MARS Newsletter No 6 Autumn 2003

MARS

The European Marine Research Stations Network

www.marsnetwork.org

Incorporating BIOMARE Newsletter No 4

www.biomareweb.org

Introduction ....from the MARS president

As this is the last newsletter to which I will contribute as president of MARS, it is perhaps a good moment to reflect on the developments over the past few years. The keyword is internationalisation, especially in the European context. We may expect that in ten years' time the European landscape will have changed dramatically and that the European Research Area (ERA) will have shaped the ways we are doing research, perhaps even to the extent that a European Research Council will be functional. Beyond co-operation in research, international networking and joint programmes in outreach and education will be crucial as backbones of the ERA.

The European marine research stations have done relatively well in showing themselves during the exciting but also threatening changes that are occurring in Europe. And of course, marine stations in Western Europe were well prepared and have had numerous collaborations since the MAST programmes of the European Union and before. But we will have to go further, and we will also have to link up with our colleagues from Central and Eastern Europe; the latter, especially, still face difficult times in which they can use help.

The Conference of Directors on 25-26 November 2003 in Amsterdam is progressing well and we have a number of excellent keynote speakers addressing a number of topics on which discussion is warranted - topics such as: what is our role in future research, on what should we concentrate, how are we convincing the public and the politicians that marine stations are a scientific and cultural asset for Europe, what is our role in education; and so on. Concerted action, knowing what the priorities of our colleagues in different countries are, dialogue with funding agencies and end users of our science - all this needs debate and reflection.

Carlo Heip
President of MARS

Editorial

This is the 6th newsletter from the MARS network, and also incorporates the 4th newsletter from the BIOMARE network.

This newsletter includes the minutes of the last executive committee meeting, and a report from one of the successful MARS travel award applicants, Piotr Kuklinski from the Institute of Oceanology, Poland, who spent one month in Marseille working on the ecology of bryozoans.

The BIOMARE project (website: www.biomareweb.org) was funded until November 2002 and produced three newsletters, incorporating popular articles on marine biodiversity issues, projects and initiatives from around Europe. We have continued this theme in this MARS newsletter and have articles from the Canary Islands to the high Arctic, from Malta, the Netherlands and Crete, and one on deep-sea corals.

The next edition of both newsletters will be incorporated into the EC 6th Framework MARBEF Network of Excellence currently under negotiation. We are very happy to accept articles on marine biodiversity for the next edition.

The Editors

Contents

This newsletter was compiled by:
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MARS meeting

Minutes of the European Marine Research Stations Network (MARS) Executive Committee meeting, Barcelona, March 2nd, 2003

This meeting was organised by MARS in the building of the Consejo Superior de Investigaciones Scientificas in Barcelona, Spain, following the meetings of the MARBEF Network of Excellence and MARBENA.

Present: Erik Bonsdorff, Friedrich Buchholz, Anastasios Eleftheriou, Jean-Pierre Feral, Stephen Hawkins, Carlo Heip.
Apologies: Giorgio Bernardi, Herman Hummel.
Absent: Krysztof E Skora.

The agenda containing 11 points was accepted.

1. Remarks on the previous meeting's minutes (19 March, 2002, Amsterdam: Executive Committee) and approval of the minutes.

MARS teaching activities

These are still at a very low level. They should be encouraged and better advertised on the web. No news from the summer school in Naples on molecular biology, or from the summer school on modelling proposed by Yerseke. A summer school is planned for July 2003, in Poland (H Hummel).

MARS membership

The problem of Associated Members should be presented at the next general assembly, where a ruling should be made.

Reminder

Membership includes:

- **Regular members:** Regular members are laboratories, institutes, or university departments primarily devoted to fundamental marine science and possessing coastal research facilities. Only directors, or their delegates, from regular members have voting rights at general and director meetings.

- **Co-opted members:** The Executive Board can co-opt members for specific purposes. One of the co-opted members shall be the Executive Secretary to be proposed by UNESCO Venice. Co-opted members can be appointed on the basis of being:
  - Editor of the MARS Newsletter
  - Co-ordinators of major MARS-related scientific projects
  - Responsible for other duties strongly related to MARS.

Co-opted members have, once invited, the same rights and duties as the regular members of the steering committee.

Membership subscriptions are:

- €150 for labs with less than 20 total personnel
- €250 for labs with between 20-50 total personnel
- €500 for labs with more than 50 total personnel.

Membership subscriptions:

The fee for 2001 and 2002 is due, as well as the fee for 2003.

Secretariat

Same situation. No money from UNESCO. There was no candidate for this position. H Hummel still acts as executive secretary.

Honorary MARS Fellows

The Executive has invited Honorary MARS Fellows. Professor Otto Kinne was nominated and has accepted, becoming the first MARS Honorary Fellow.

Newsletter

Publication of the MARS newsletter on the web is successful. The issues are downloadable from the MARS website:
http://www.marsnetwork.org/newsletters.php

External relationships

ESF/ESF Marine Board. Since the departure of Laurent d'Ozouville the relationship with the Marine Board has been quiet, but was recently revived through discussions with John Marks and Niamh Connolly. The EUROCORES mechanism remains a viable option to develop common projects from the MARS laboratories.

Census of Marine Life (CoML) is an international programme for research to assess and explain the diversity, distribution and abundance of marine organisms throughout the world's oceans. The main field projects should occur in 2005-2007. Analysis and integration of information should be completed in 2008-2010. CoML has recently established a European committee, with Carlo Heip as acting chair. The definitive composition of Euro-CoML will be established in autumn 2003. Meanwhile, Dr Ulf Lie of Bergen, Norway, has accepted the position of first chairman of the Euro-CoML committee).

The National Association of Marine Laboratories (NAML) (http://www.naml.org) will be invited to send a representative to the Conference of Directors. MARS is on the NAML mailing list and receives the messages sent to the NAML membership (now over one hundred marine and limnological laboratories in the US and Canada).

The next scientific committee meeting of **DIVERSITAS** (www.icsu.org/DIVERSITAS/) will be held in Paris on 12-13 April, 2004. The place of marine biodiversity in the DIVERSITAS Science Plan is still weak and needs improvement in preparation for the next SSC meeting in 2004. Two initiatives in the 6th framework programme are coming from the members of the DIVERSITAS SSC.

A good link now exists with the **International Association of Biological Oceanography** (IABO) (http://www.olympus.net/IAPSO/) through the new president, Dr Annelies Pierot-Bults from the University of Amsterdam in the Netherlands.

Euroconference

Held 11-15 May 2003 in Moermond Castle, Renesse, The Netherlands: "Biodiversity of Coastal Marine Ecosystems: A Functional Approach to Coastal Marine Biodiversity."

MARS travel awards

The MARS travel award laureates have reported on their grants. These reports can be found on the website:
http://www.marsnetwork.org/newsletters.php

The minutes were approved.

2. Conference of Directors 2003

Preparing the future of marine research stations in Europe. Planned for two days (25-26 November) in Amsterdam. Potential topics include:

- Progress since the last meeting in Venice
- Future of MARS
- Prospects and opportunities of marine stations in Europe.

Proposals for invited speakers and fields of discussion were issued.

3. Elections - new members

New members for the Executive Committee have to be elected. The electoral committee consists of: A Eleftheriou, J-P Feral & C Heip. New mandate: 2004-2007.

4. Financial situation

Table: Accumulated Balance in euro

Accumulated Balance, 01/01/1999	24,115.29	travel/accommodation/symposia	-22,331.29
contributions received	33,050.67	printed matter	-6,556.74
interest	524.55	other costs	-4,052.12
other income	12,688.81	bank costs	-647.02
	70,379.32	-	-3,3587.17
Balance 06/02/03	**34,364.36**		

The financial report was approved. Problem in getting contributions from French laboratories. The treasurer, J-P Feral, will try to open a MARS account in France.

Other financial points:

- Secretariat: a maximum of €16,000 per year is decided.
- The VLIZ (Flemish Institute of Sea Research) is now responsible for the MARS web page (€2,000 per year)
- Advertisements in the *Parliamentary Journal* (magazine of the EU community): €4,554
- The associated membership category is being abandoned, as it has not worked in practice. Interested laboratories should become new members if they have coastal facilities.

5. EU framework programme: MARBEF

MARBEF is now on the short list of the Network of Excellence, thanks to the structuring role of MARS. (Meanwhile, MARBEF has entered the phase of contract negotiations with the EC).

6. ESF

There is a proposal to have an observatory mandate in the Marine Board. This is to be discussed again. (Meanwhile, contact was made with Dr John Marks who mentioned that observatory status was not in use by the Marine Board. MARS will be invited as a guest organisation to the meetings of the Marine Board for the open agenda points).

The EUROCORES programme may be an alternative for organising marine biodiversity research if MARBEF fails.

7. MARS awards

One award of €2,000 for Young Scientists was made in 2002 to: Piotr Kuklinski from Institute of Oceanology, Polish Academy of Sciences, Sopot, Poland, who is working on bryozoan taxonomy and ecology. The receiving MARS Institution is the Centre d'Oceanologie de Marseille, UMR CNRS 6540 DIMAR, Station Marine d'Endoume, Marseille, France **(see page 4)**. Other awards will be made in 2003.

This award scheme is for young scientists (max. 35 years old) of regular members (full-paying institutes). The announcement is on the MARS web page. The deadline for applications was 1 October 2003.

8. Summer schools

- Previously planned for July 2003 (postponed to May 2004): **Baltic Summer Course,** "On adaptive strategies and biodiversity among intertidal and coastal marine organisms." Organised under the colours of Gdansk University (Poland) in cooperation with Herman Hummel from NIOO-CEME, the Netherlands. Contact: Dr Adam Sokolowski.

MARS provides three grants for attending this summer school. More information and application forms are available from the MARS website, or send an e-mail to Dr Herman Hummel.

Other summer schools:

- **Helgoland** (Fred Buchholz), 2004: Shelf seas ecology (sediments and rocks)
- **Endoume/Marseille** (Jean-Pierre Feral), 2005: Model organisms
- **Naples** (Giorgo Bernardi): will be contacted by J-P Feral.

9. BIOMARE

Final results on the concerted action for "large-scale long-term MARine BIOdiversity research in Europe." (Co-ordinators: Carlo Heip & Herman Hummel, NIOO-CEMO, Yerseke, the Netherlands).

BIOMARE followed from a MARS initiative. Within theme 4 ("Energy, Environment and Sustainable Development") of the EC 5th Framework Programme, the Concerted Action BIOMARE was aimed at establishing the infrastructure and conditions required for marine biodiversity research at a European scale. BIOMARE lasted two years from November 2000 until October 2002. It included 26 participating European institutes.

The objectives of the Concerted Action were to achieve a European consensus on:

i) a network of reference sites for long-term, large-scale marine biodiversity research in Europe;

ii) the establishment of internationally agreed measures and indicators for biodiversity; and

iii) the creation of facilities for, and the co-ordination of, marine biodiversity research, by running workshops, improving training and mobility, and setting up a website - this would include an overview of current research in, and existing infrastructure for, marine biodiversity research in Europe, and would create a database for authenticated data, including socio-economic data such as the impact of fisheries and tourism.

Three work-packages were set in motion, consisting of a series of evaluations, recommendations, regional meetings and joint workshops. The methodology was similar in all three work-packages and followed a sequence of inventories and reviews made by WP leaders in consultation with all members; regional meetings and two general workshops to discuss drafts and recommendations; and reports and implementation.

The inventories, meetings and reports focused on:

i) expanding the existing networks of marine biodiversity research organisations. Many MARS members have been involved in the BIOMARE actions, and in turn several BIOMARE participants joined MARS;

ii) recommending reference sites for marine biodiversity research. A set of 30 Reference stations and 80 Focal sites have been selected. The stations will be described in a booklet [Warwick (R.M.), Emblow (C.), Feral (J.-P.), Hummel (H.), van Avesaath (P.) & Heip (C.) (in press, 2003): "BIOMARE European Marine Biodiversity Research Sites" **(see page 11)**];

iii) establishing methodologies, protocols, and indicators of marine biodiversity in Europe. A scheme on the priority indicators of marine biodiversity has been selected, and will be printed in a booklet [Feral (J.-P.), Fourt (M.), Perez (T.), Warwick (R.M.), Emblow (C.), Hummel (H.), van Avesaath (P.) & Heip (C.) (in press, 2003): "BIOMARE European Marine Biodiversity Indicators" **(see page 11)**];

iv) publishing an annotated check-list of long-term data-sets, species-diversity lists, and associated publications. All the data-lists are available through the internet: http://www.biomareweb.org;

v) initiating Euroconferences on marine biodiversity. A conference was organised in May 2001, and the following one was held from 11-15 May 2003 in Renesse, the Netherlands (see above);

vi) establishing a website for dissemination of information on European marine biodiversity to scientists, administrators and the public at large (http://www.biomareweb.org);

vii) indicating data available to end-users, suitable for integration with socio-economic questions.

This Concerted Action enhanced research on marine biodiversity in Europe through the establishment of a network of marine institutes and an agreed set of reference stations and indicators. This will enable comparisons to be made between sites and trends in long-term surveys to follow. It will enhance the integration of research throughout Europe, to the benefit of students, research scientists and managers dealing with socio-economic questions, and it will increase awareness among the public.

Further information about this project can be found at http://www.biomareweb.org.

10. Field station in Portugal

University of Aveiro: Henrique Queiroga asked in a letter to MARS to support the creation of a marine research station.

11. Any other business

Five groups will be invited to prepare a document on the MARS strategy concerning:

- Pelagial in shelf sea ecosystem (F Buchholz)
- Model organisms (A Picard)
- Genomics (J-P Feral)
- Transition to deep sea (D Billet)
- Long-term ecological observations (S Hawkins)

A sixth group may discuss land-ocean exchanges.

The next meeting of the MARS Executive Committee will be held on Saturday, 28 February, 2004.

Jean-Pierre Feral, Banyuls-sur-mer
July 2003

MARBEF news

The MARBEF (Marine Biodiversity and Ecosystem Function) Network of Excellence being funded under the European Union 6th Framework Programme is currently under negotiations. The negotiations are running smoothly and a tentative date and place for a first general assembly has been proposed for the 17-19 March in Ostend, Belgium.

On behalf of all the MARBEF members, we would like to thank Carlo Heip and his team in Yerseke for all the hard work in developing this proposal.

Bryozoan taxonomy and ecology

A report from the MARS travel award winner, 2002

Piotr Kuklinski
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Between 26th May and 27th June, 2003, I undertook a planned visit to the Station Marine d'Endoume (SME) in Marseille, France. I was hosted by Jean George Harmelin and Thierry Perez. I usd the first days of my visit to accustom and acclimatise myself to northern Europe's unfriendly environment - in summer, Marseille is a very hot place!

At the beginning, as is usual during such visits, I was introduced as a newcomer to all the important facilities (library, internet connection, laboratories, places to eat and drink, *etc*). Also, at the beginning of my stay, we discussed the plan and my expectations of the visit. A 'check-up' or test dive was made to make my planned underwater work in France officially possible.

The first dives were devoted to collecting red coral. This work was part of the work of Dr Joakim Garrabou and his PhD student within the Oriol project. The main objective of this work is to determine the growth ratio of the individuals inhabiting the inner and outer parts of caves. I very much enjoyed being part of this project.

The other project I was involved in was long-term observation of the Gorgonian population in the Marseille region. Gorgonian length and vitality level were measured underwater. Numbers of individuals per square metre were counted. Most of my dives in Marseille were devoted to this work.

Together with Jean George Harmelin, I visited Port-Cross National Park. It is the only French (as I was informed) underwater national reserve. One of the diving sessions was used to describe the bottom morphology of the site being investigated by my host. The other dive (after working hours) was purely for pleasure! I wholeheartedly recommend this site for diving - it is fantastic.

One sunny day in the middle of my visit I prepared a seminar for the station staff. The talk was an overview of the work I am doing in my everyday professional life, which is simply studying the ecology of bryozoans in waters surrounding Svalbard Archipelago. The staff of the station constitutes some excellent ecologists, so they had a few questions. The discussion was stimulating…

I noticed a few differences between research done at my home institute and the French Marine Station. The biggest difference was the distance from the station to fantastic wild sites - this was very short, so work could be conducted on a daily basis.

SCUBA diving was the main tool used in the research conducted by the staff at the station. This was very surprising when compared to the Polish reality, where very few use this excellent technique to carry out research. In addition, clear water and easy access to the good spots is incomparable to both Polish and Arctic sites, where my home lab is carrying out investigations. Probably the biggest similarity between both places (at least to my mind) is the very low level of research subsidy, which probably is true for all of marine science.

Besides the observations mentioned above, I fulfilled some of the main aims of my visit. First of all, I made a lot of friends, too many to list! Honestly, I was very warmly introduced to all the station activities – including a session with the PhD students' association. Even the station's carpenter, who did not speak English, invited me for a glass of wine most days. Many thanks to all of you! I have brought home lots of literature (the station's library is full of old books which in Poland we cannot even dream about). Discussions with the staff about my PhD project to some degree influenced my thinking.

Collected samples at Port-Cross and in the vicinity of the station probably will not result in a publication (the sampling effort was too small) but will give me an idea about the biodiversity and processes taking place on the Mediterranean boulders. No doubt the visit was my first step to unravelling the bryozoan taxonomy of the Mediterranean Sea. One sunny day I will come back - so the skills I gained during this visit will be used.

I would like to thank my host Jean George Harmelin, Thierry Perez and all the friendly staff of the station for the time and effort they put into my visit. I promise not to "waste" it.

Sending MARS Institution:

Institute of Oceanology
Polish Academy of Sciences
ul. Postancow Warszawy 55
81-712 Sopot, POLAND

Receiving MARS Institution:

Centre d'Océanologie de Marseille
UMR CNRS 6540 DIMAR
Station Marine d'Endoume
Rue de la batterie des lions

Marine Biodiversity in Europe

This newsletter aims to publish a series of articles highlighting regional marine biodiversity issues in and around Europe. In this edition we present articles from the Canary Islands, Malta, Crete, the Netherlands and the Russian Arctic. We also have a short article on coral reefs and fish.

We are always looking for short articles to publish in the next newsletter. They can be as short as half a page or up to about three pages. The articles should cover topics such as:

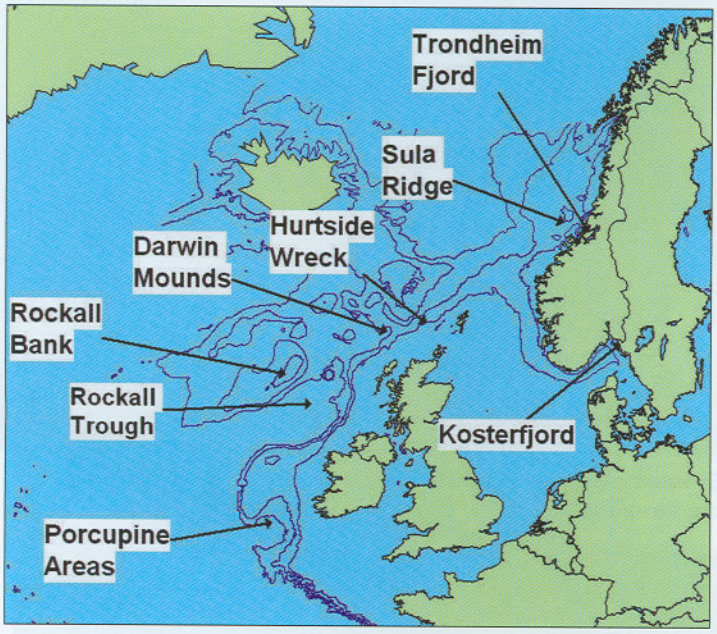
- Marine biodiversity projects; research cruises; local, national, European or international initiatives, etc
- Local or regional marine biodiversity issues (exotic species' invasions, nature conservation or management issues, etc)
- Undergraduate and post-graduate projects and work
- Marine biodiversity conferences and meetings.

Articles should be written in a popular style and we encourage the use of full-colour maps and photographs. All articles and the newsletters will be archived on the MARS or BIOMARE websites.

If you would like to contribute or have comments about the newsletter, please contact Chris Emblow at e-mail: cemblow@ecoserve.ie

A guide to the fish associated with deep-water coral reefs

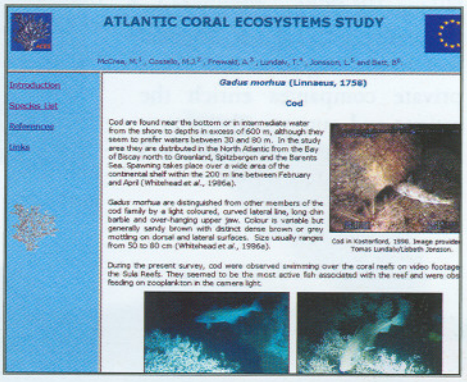
McCrea, M.,[1] Costello, M.J.,[2] Freiwald, A.,[3] Lundalv, T.,[4] and Jonsson, L.[4]
[1] Ecological Consultancy Services Ltd, B19, K.C.R. Industrial Estate, Kimmage, Dublin 12, Ireland
[2] Huntsman Marine Science Centre, 1 Lower Campus Road, St Andrews, New Brunswick, E5B 2L7, Canada
[3] Institut für Paläontologie, Universität Erlangen, Loewenichstr, 28 91054 Erlangen
[4] Tjarno Marine Biological Station, Sweden



The rate of discovery of cold-water coral reefs, *Lophelia pertusa*, in the eastern Atlantic has been remarkable, resulting largely from the increased use of underwater video in deepwater surveys. These reefs form a major three-dimensional habitat in deeper waters where little other 'cover' for fish is available. Present data indicates that reefs occur from northern Norway to south-west Ireland. However, *Lophelia* is recorded throughout the eastern Atlantic continental margin, down to south-west Africa, in the western Atlantic, and Indian and Pacific oceans; it is likely that new reefs will continue to be discovered in many areas. Thus, not only is this a significant habitat on a local scale, but it may also occur over a very wide geographic area.

The recently completed EU 5th Framework-funded Atlantic Coral Ecosystem Study (ACES) examined the association of fish species with *Lophelia* in the north-east Atlantic, including the Trondheim Fjörd and Sula Ridge in Norway; Kosterfjörd in Sweden; the Darwin Mounds to the west of Scotland; and the Rockall Bank, Rockall Trough and Porcupine Seabight off Ireland. The fish fauna associated with a shipwreck west of Shetland was also studied. Video and still camera footage of the deepwater coral reefs was examined and fish associated with the corals were identified, counted, and their behaviour and habitat noted.

In total, data were collected from 11 study sites in eight locations, comprising, in total, 52 hours of video and 15 rolls of still photograph film. Video and still photographs were variously collected using a remotely operated vehicle (ROV), a bed-hop camera, and the SOC camera systems WASP (wide angle survey photography vehicle), SHRIMP (seabed high resolution imaging platform) and Bathysnap (time-lapse camera mooring). It was possible to identify 90% of the fish observed to species level, and 6.6% to genus or family level; only 3.6% were not identifiable. In total, 25 species of fish from 17 families were recorded; most of these species are of commercial importance. A guide to the fish recorded during the study is available on the EcoServe website at www.ecoserve.ie/projects/aces.



Canaries, for an alive coast!

An educational and research initiative to enhance the sustainable use of the Canarian coasts

Ricardo Haroun Tabraue and Yaiza Fernández-Palacios Vallejo
Mediateca Guiniguada. Camino de Salvago s/n. Campus de Tafira – 35017. Las Palmas de Gran Canaria, Spain
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Canarias por una Costa Viva

Sampling sea grasses. New data for the Canarian list of endangered species will be generated.

The aim of this project is to promote awareness of the biological and socio-economic values of the Canarian coastline among coastal users. Other underlying objectives include designing best practices for management and sustainable use of the littoral resources. The working team has two complementary divisions: research and education, which incorporate a large social facet. This is a new and fresh approach to littoral issues, at least in Spain.

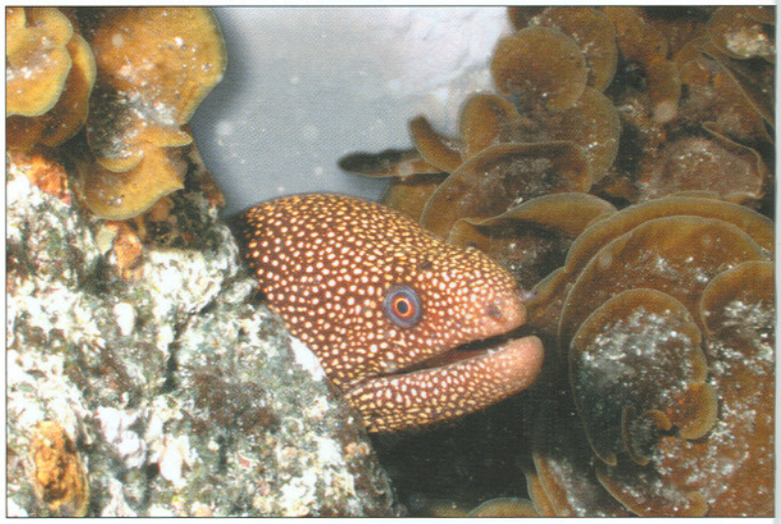
"Canarias, por una Costa Viva" is fully supported by the Spanish Ministry of Environment and is run by the University of Las Palmas de Gran Canaria in conjunction with WWF-ADENA. Collaboration with the Canarian Institute of Marine Sciences, the University of La Laguna, Regional and Insular Agencies and some private companies enrich the actions and outputs. The project started in August 2002 and will end in November 2004.

Research

The objectives of the research division are to:

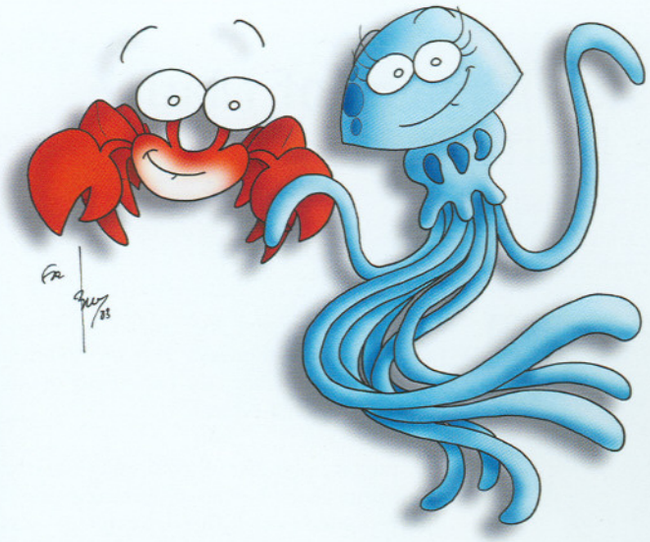
- Analyse the characteristics and environmental quality of the Canarian marine biological communities.
- Determine the conservation status of selected marine species and ecosystems.
- Analyse the relationship between the human population and the natural environment, as well as the pressures it supports.
- Study ecological processes in intertidal and shallow subtidal ecosystems.

The research activities are carried out with sampling every six months in over 100 sites around the coastlines of the overall Canary Islands. Marine biodiversity and water and sediment quality are measured following standard research protocols. Sampled areas include: rocky intertidal areas, brown algae forests, sea-urchin barren grounds and seagrass meadows. Sampling sites are in both pristine and anthropogenically stressed areas in order to assess the effects of the different pressures (pollution, shell-fishing activity, urban development, marinas, *etc*).



***Gymnothorax miliaris*. Databases are used to keep and manage the sampling results.**

At the end of the project, an assessment of the environmental quality of coastal areas in the Canary Islands will be produced. Littoral environmental quality bioindicators and inputs to the Canarian list of endangered species are only some of the results which will contribute to the generation of tools for ICZM in the Canary Islands.



Project mascots Menuda and Chinijo (the local words for a small girl and boy).

The display panels at the exhibition are colourful and attractive to visitors.

Education

The education division works to:

- Raise public awareness of the environmental and natural values of the Canarian coastline.
- Support the education of the Canarian population and visitors on the sustainable use of the natural resources.
- Enhance public participation in diverse coastal activities.
- Develop a full range of educational tools for diverse social groups (schools, handicapped collectives, silver-age groups, *etc*).

These objectives are mainly achieved through three different types of actions: an exhibition, the design of educational materials, and activities with social groups.

The exhibition created by *"Canarias, por una Costa Viva"* includes display panels, models and an aquarium, which provide explanatory details not only about the tides, biodiversity and different coastal landscapes, but also about the traditional and modern activities developed on the coast and the conservation and management issues related to them. The exhibition will be on display in the principal cities and villages within the seven islands. It will be the focal point for different educational activities carried out by *"Canarias, por una Costa Viva"* staff. Two pets, **Menuda** (a jellyfish) and **Chinijo** (a crab), introduce the visitors to the coast. It's great fun to watch children's faces during their visit!

Guided trips to the seashore are some of the activities run by the project.

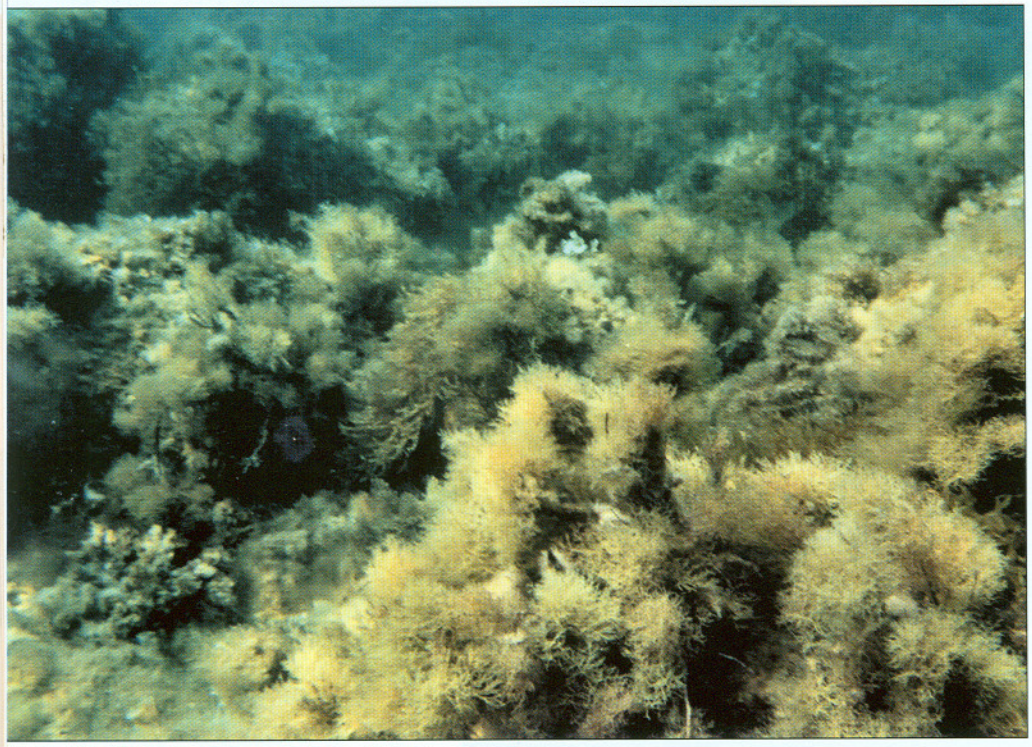
Educational materials have been designed for students from primary-school level to university, and there is accompanying material for teachers. The contents refer to the natural values of the Canarian littoral and are complemented by visits to the exhibition and guided trips to the intertidal area.

Activities with social groups are based on a volunteering network which will conduct joint activities such as talks, cleaning of beaches, snorkelling, littoral walks or collaborations with the research sampling activities. The aim is to strengthen the relationship of different social groups with the natural environment and to create a common objective: the protection of the coast.

A pilot study aimed at the establishment of Marine Protected Areas in the Maltese Islands

Konrad Pirotta & Patrick J Schembri

Marine Ecology Research Group, Department of Biology, University of Malta, Msida MSD06, Malta
(Contact: Prof Patrick J Schembri, e-mail: patrick.j.schembri@um.edu.mt)



'Forests' of photophilic algae growing on bedrock and boulders in shallow water (3m). The dominant species in this image are *Cystoseira ercegovicii, Padina pavonica, Dictyota linearis* and *Sargassum vulgare*, but many different assemblages dominated by other species occur in the study area.

The Maltese Islands at the centre of the Mediterranean have a coastline of ca 190km and a submerged area (to a depth of 100m) of approximately 1,940km^2. They are densely populated and are now visited by over a million tourists every year. Human pressure on the environment has increased tremendously over the past four decades and, today, no part of the local environment is totally free from the effects of human activities. At sea, although it is difficult to ascertain the extent of human impact, one can claim with an appreciable degree of certainty that divers have probably trekked the entire seabed from the mean sea-level to a depth of about 65m, while bottom trawling, dumping of dredge spoil, major coastal projects and day-to-day uses of coastal resources and those of the sea adjacent to the coast, have all taken their toll.

Although protection of the coastal sea may be largely seen as a domestic issue, conservation of the marine environment at large now has an international dimension; this is especially true for the Mediterranean region where regional agreements concerning marine protection have existed since 1975 in the form of the Mediterranean Action Plan (MAP) adopted by the Mediterranean countries and the (then) EEC, followed by the Barcelona Convention in 1976, administered by the United Nations Environment Programme (UNEP).

CAMP-Malta

In the past decade, a number of the pilot projects implemented under the aegis of the Barcelona Convention and its protocols, and related to the conservation and rational use of the coastal zone, have been brought together and regulated under the Coastal Area Management Programmes (CAMPs). In December 1999, an agreement to implement a Coastal Area Management Programme in Malta (CAMP-Malta) was signed between the Government of Malta and UNEP. One thematic activity within this programme was the study of an 11km stretch of coastline on the northwestern coast of the island of Malta, and of the sea area off it to the 50m depth contour, covering 4.75 km^2 of seabed, with the aim of evaluating it for eventual designation as a Marine Protected Area (MPA) and to generate information upon which to base a management plan for the area. This area, known as Rdum Majjiesa, was selected as it is representative of the coastal and marine habitats present in the Maltese Islands and is relatively unaffected by human activities. Considering that at present there are no MPAs within Maltese territory, the importance of this pilot project is self-evident.

The primary objective of this study was the assessment of the biological characteristics of the proposed site. This assessment was intended to produce an inventory of the major biological complexes occurring within the site's boundaries, and to generate base maps for the use of environmental managers to draw plans for zoning, managing and protecting the site. Extensive benthic and bathymetric surveys of the study area yielded considerable data, including detailed maps (at a scale of 1:2500) of the bathymetry, submarine geophysical features, seascapes and benthic biotic assemblages of the area. As a result of these studies we are now able to make a strong case for the designation of this site as Malta's first MPA.

The most outstanding physical feature of the study area is the heterogeneity of the seabed geomorphology (seascape) and the bottom types present. The site consists essentially of two rocky shoals extending about 1km from the shore, generated from wave-cut shore-platform terraces. The seaward boundary of these shoals consists of stepped drop-offs or steep slopes. Collapse under gravity of blocks from the edges of the backing limestone escarpments on the terrestrial part of the area have resulted in aggregations of boulders along much of the coast; these boulders extend out to sea as submarine boulder fields at several locations. Bays with sandy pocket beaches and coves are also present in the area, formed at the seaward extremities of major fault systems that cross the island. The southern sector of the study area (an area known as Ras ir-Raheb) consists of vertical sea cliffs extending for about 1.9km of coastline and which give rise to continuous drop-offs below sea level; semi-submerged caves are also present in this sector.

Rich and diverse biota

Given the heterogeneous nature of the seabed it is hardly surprising that the area is characterised by an equally diverse and rich biota. Five main biotic assemblages are represented in the study area: those of **hard beds and rocks, seagrass meadows** and **fine sands** cover large areas of seabed, while those of **coarse sand** and **stones and pebbles** are more sparsely represented. Pockets of **maerl** are also present.

The Ras il-Qarraba promontory: one of the most conspicuous features in the study area. Note the boulder screes that extend underwater as boulder fields and the bays with sandy pocket beaches and seagrass meadows offshore.

Neptune Grass, *Posidonia oceanica,* dominates large areas of the seabed. Extensive meadows occur on sand as well as on bedrock overlain by a veneer of sediment. From north to south, the meadows are practically continuous, although showing different bed morphologies (so called 'ecomophoses') in different places. Although *Posidonia* efficiently colonises both hard and soft substrata, on sand it generates thick layers of matte, which, when extensive, develop an organic substratum that is colonised by a wide variety of photophilic and sciaphilic algae growing among the *Posidonia* shoots. Thick matte also produces matte walls at the edges of the meadow. In places, these walls may be over 2m high. A large variety of organisms occur within the *Posidonia* meadows, including some of conservation interest such as the bivalve *Pinna nobilis* (Noble Pen-shell), a regionally and locally protected species.

The Lesser Neptune Grass, *Cymodocea nodosa,* is also very abundant in the study area, where it occurs on sand and precedes and succeeds *Posidonia oceanica.* This seagrass forms a major association within the biocoenosis of fine sands. The *Cymodocea* beds are susceptible to extensive damage by strong waves due to their open morphology. *Cymodocea* meadows recorded during this study are some of the most extensive meadows known to date from the Maltese Islands.

Excluding bedrock colonised by *Posidonia oceanica,* hard substrata are almost completely dominated by photophilic algae. Phaeophytes are by far the most abundant macroalgae, and *Cystoseira spinosa* var. *tenuior* is the commonest and most conspicuous species. It occurs over large areas both as almost monospecific stands (in the sense that they are not accompanied by any other tall-growing, canopy-forming algae) and also accompanied by other, sub-dominant or co-dominant species. At depths greater than 13-15m, with hard beds and rocks, other photophilic and/or sciaphilic (if the light intensity is reduced) algae become dominant. Tall-growing species dominating these deeper water associations include *Dictyopteris polypodioides, Cystoseira squarrosa, Sargassum vulgare* and *Sargassum acinarium.*

Hard substrata occurring in deeper waters include drop-offs. Sciaphilic assemblages characterise these habitats, and *Flabellia petiolata, Halimeda tuna* and *Peyssonnelia* sp. are the most abundant dominants in these assemblages throughout the study area. Other rhodophytes such as *Jania* sp., a number of calcareous algae (mostly corallines) and low-growing hydroids may at times be very abundant as well, but are not conspicuous as they are overshadowed by the larger and more noticeable species. The same applies for a number of low-growing algae that occur as an 'undergrowth' beneath the other tall-growing species, where they may become covered with silt and form an algal turf. Two such examples are *Dasycladus vermicularis* and *Vidalia volubilis.*

Protection model

Given the heterogeneity of the study area and the diversity (and social and economic significance) of human activities occurring within it, applying the **Multiple Use Marine Protected Area** model seems to be the most realistic and appropriate approach to protect and manage this region. Adopting this model would allow the preservation and maintenance of biodiversity and the conservation of seascapes and adjacent landscapes on one hand, and the fulfilment of social and economic requirements and obligations on the other. One fundamental requirement of a Multiple Use Marine Protected Area is a management programme based on a multi-level protection system in which different regions within the same MPA are managed with regulations and prohibition of activities that vary from one region to another. Management plans must also include monitoring programmes.

The CAMP-Malta study, including our results and proposals for designation of our study area as an MPA and for its management and monitoring, have been submitted to the Government of Malta by UNEP and are currently being considered. Designation of this area as an MPA would signify formal acknowledgment of the special value of these waters and may discourage excessive new development and focus attention on the natural resources of the area. It would also act as a pilot for assessing the benefits of MPAs in the Maltese context, as a resource for marine research, and for refining environmental policies.

The Rdum Majjiesa area has been proposed by our group to the MARS network as a **European Marine Biodiversity Focal Site** (EMBiF), while UNEP-MAP is funding additional work on this area, mainly the formulation of a management plan, under its Med-MPA programme.

Hard-bottom benthic communities: towards a new concept in assessing and monitoring marine biodiversity

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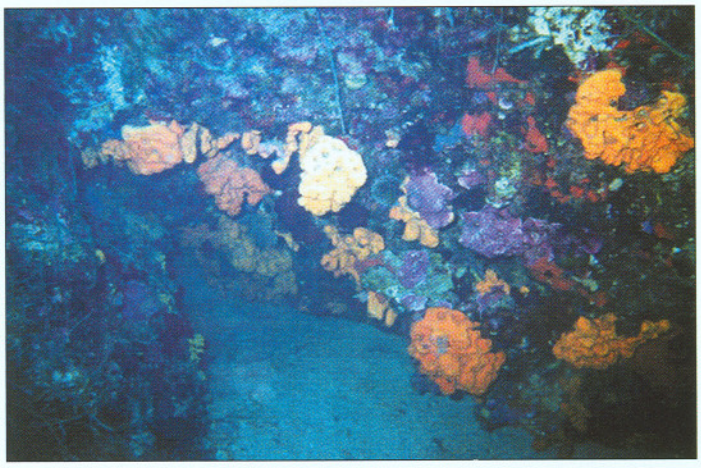

Figure 1. Hard substratum benthic communities from Greece characterised by dense growths of sponges.

Studying benthic invertebrates is considered a valuable tool for assessing the marine environment quality, since these organisms have the ability to 'integrate' and thus reflect the long-term environmental conditions to which they are subjected (Bilyard, 1987; Gray, 1980; EMaPS, 1998). Several researchers have underlined the advantages of studying hard-bottom epibenthic assemblages, as they are spatially fixed and therefore easily monitored and manipulated (Christie, 1980; Hartnoll & Hawkins, 1980; Fraschetti *et al*, 2001a). The importance of the marine rocky habitats is further strengthened by the fact that 85% of the benthic species that have been characterised as endangered by the Protocol for the Marine Biodiversity in the Mediterranean Sea occur in hard substrata (EEA, 1999).

In Greece, whereas rocky shores represent the largest part of the extensive coastline (16,000km, including the islands), scientific knowledge of the indigenous hard-bottom benthic communities is still in a rather impoverished state. Although there are several phytobenthic studies (Chryssovergis & Panayotidis, 1995; Haritonidis, 1978; Lazaridou, 1994; Orfanidis *et al*, 2001), seldom are they efficiently replicated in space and time. As regards zoobenthic communities, plenty of information exists on soft-bottom fauna composition (Simboura & Nikolaidou 1994, 2001; Pancucci, 1996; Zenetos, 1993; Zenetos *et al*, 1991; Koutsoubas *et al*, 1992; Karakassis & Eleftheriou, 1997; Arvanitidis, 2000), but very little is known about hard-bottom species and assemblages (but see Koukouras *et al*, 1995, 1996; Vafidis *et al*, 1997; Antoniadou & Chintiroglou, 2001).

Due to the logistic difficulties that are inherent in rocky sublittoral sampling (*e.g.* laborious, costly, time-consuming) there is comparatively little information on the ecology and dynamics of these particular ecosystems. At the same time, Marine Protected Areas are being continuously established along the Mediterranean rocky shores (Fraschetti *et al*, 2001a). As a result, there is an increasing need for a new concept in assessing and monitoring the biodiversity status of rocky coastal areas.

Developing rapid bio-assessment techniques is becoming a major common goal in the field of marine biology. Recent approaches give priority to surrogate or key species (Ward *et al*, 1998; EEC, 2000) to obtain a fast but efficient tool for biodiversity conservation and management action. Various visual census techniques are developed and widely used by many marine biologists around Europe (Garrabou *et al*, 1998; Roberts *et al*, 1998; Fraschetti *et al*, 2001b; Pagola-Carte *et al*, 2002; Terlizzi *et al*, 2002). Such methods can provide us with the capability of effective qualitative and quantitative sampling over large areas with low effort and within short periods of time. At the same time, their non-destructive character renders them invaluable tools, especially when it comes to the biological assessment of marine protected areas or rare and endangered species.

In this preliminary study, both destructive and non-destructive (photographic) sampling was performed on phytobenthic populations of the Saronikos Gulf, in order to compare and inter-calibrate these two methods. Three sampling stations were chosen in the upper sublittoral zone between 0.5 and 1m - one situated in a degraded area near the sewage discharge of the Attica treatment plant, while the other two were at putatively unimpacted sites. An Ecological Evaluation Index (EEI) developed by Orfanidis *et al* (2001) was applied to data collected by each method. The analyses showed that the 'anticipated' loss in taxonomic information by the photographic method did not correspond to loss of ecological quality information, and that identification to genera level can be as informative as identification to functional form group, when it comes to the ecological assessment of a marine ecosystem.

Further studies are imperative in order to verify the method's robustness to greater temporal and spatial variability. In addition, there is a need to integrate zoobenthic data, starting by testing whether invertebrate species regarded as bioindicators in the Western Mediterranean (*e.g.* Ballesteros, 1982; Bellan *et al*, 1994; Perez *et al*, 2000) show similar responses and can thus be used in the Aegean Sea. Besides, this study is expected to bring in a considerable amount of new information concerning the hard-bottom benthic fauna and thereupon the marine biodiversity of Greek waters.

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BIOMARE project results

The BIOMARE project concluded successfully a while ago. The project can be called a success in many ways. BIOMARE resulted in a network of enthusiastic researchers that were (are!) motivated to integrate marine biodiversity research, and related knowledge and information, on a pan-European scale. There were several regional meetings and workshops, and although the discussions weren't always easy, the atmosphere always remained open and stimulating. Most certainly, the hospitality of the local organisers contributed to this, and we would like to thank them again for the organisation of both the scientific as well as the social parts of the events.

Two books available

The results of BIOMARE have been disseminated at several important occasions already (more information is available on the website www.biomareweb.org) and the project has resulted in the production of two books and a CD:

1) European Marine Biodiversity Research Sites. Richard M Warwick, Chris Emblow, Jean-Pierre Féral, Herman Hummel, Pim van Avesaath, Carlo Heip. Netherlands Institute of Ecology - Centre for Estuarine and Marine Ecology, Yerseke, The Netherlands, 2003

2) European Marine Biodiversity Indicators. Jean-Pierre Féral, Maïa Fourt, Thierry Perez, Richard M Warwick, Chris Emblow, Carlo Heip, Pim van Avesaath, Herman Hummel. Netherlands Institute of Ecology - Centre for Estuarine and Marine Ecology, Yerseke, The Netherlands, 2003

If you would like to obtain a copy of either or both books, please fill in the order form (available on the BIOMARE website). The cost of the two books and CD set is €30 (to cover the mailing costs).

Although the project has finished, the BIOMARE initiative has not ceased. It will be adopted by the Network of Excellence 'Marine Biodiversity and Ecosystem Functioning' which is planned to start early next year.

Carlo Heip, Pim van Avesaath and Herman Hummel

Unravelling the relationship between biological diversity and ecosystem processes on the mudflats of a large European estuary

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Keywords – *estuaries, mudflats, biodiversity, biogeochemical cycles, ecosystem function, land use, impacts, microphytobenthos*

Valuable natural real estate

In the new discipline of environmental economics, conventional accounting techniques are used to calculate the value of natural systems to humankind. Ecosystem functions such as food production and water regulation, and natural capital stocks, are given an economic value. This approach, although controversial, gives a ranking of ecosystems which may be useful for conservation purposes. The results of a global analysis by Costanza *et al* (1997) showed that marine systems have a higher economic value than terrestrial systems, due to their larger surface area (Figure 1). Within the marine realm, the coastal zone was ranked more important than the open oceans, and estuaries were the second most important type of coastal ecosystem. Indeed, with a total value of $22,832 per hectare, estuaries are the most valuable ecosystem on the planet.

Hotspot of activity at land-water boundary

Estuaries are rated with such a high monetary value because of the wealth of diverse processes which occur in these systems. At the top of the list of these 'ecosystem services' to humans is nutrient cycling. A large amount of dissolved materials, including industrial and human waste materials, are carried into the estuary from the surrounding catchment area. Biogeochemical processes within the water and sediments of an estuary can rapidly capture and process a large fraction of the incoming material. Complex organic molecules are degraded to simpler, inorganic forms which may be released as gases such as CO_2 or N_2, or transported to the open sea in the form of plant nutrients such as nitrate.

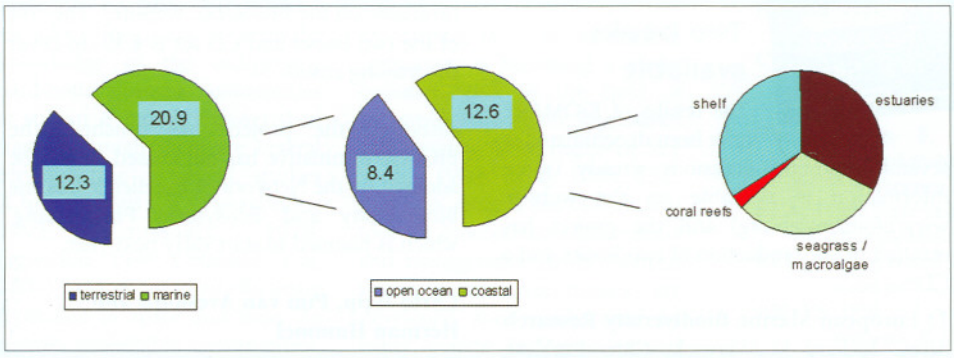

Figure 1. Total global flow value (1994 US $ yr-1 x 109).

A well-stocked larder

The diversity and abundance of microbial life within estuaries provide an important food source for commercially important species, particularly shellfish. Many species of birds depend on the rich food supply of estuarine mudflats and marshes for refuelling during migration, and shallow areas of estuaries are of great importance for the juvenile stages of fish species such as the herring and sole.

Microscopic life – unseen, but powering the ecosystem

Many ecosystem services within estuaries are enhanced or modified by the presence of biofilms. These are thin layers of microscopic cells which colonise intertidal or subtidal sediment surfaces. The majority of the cells in a biofilm are photosynthetic – *i.e.* they use special pigments to capture the energy of sunlight for growth, just like land plants. Over a half of the primary production in estuaries is due to these microphytobenthic algae. The most common group of cells are the diatoms, a diverse algal group which can be found in all aquatic habitats. At certain times of the year, the diatom biofilms become thick enough to be visible to our eyes as a brown film on the sediment surface. Not surprisingly, such 'blooms' of microphytobenthos are often accompanied by large flocks of birds which feed either on the algae directly (*e.g.* the shelduck, *Tadorna tadorna*) or on the animal grazers (*e.g.* the avocet *Recurvirostra avosetta*). Different waders have different techniques for sieving animal morsels from the soft matrix of algae and sediment.

Diatoms – key players in coastal ecology

Intertidal benthic diatom communities are highly diverse, both with respect to their taxonomic composition as well as to the spectrum of growth forms present. To date, most studies on estuarine and marine microphytobenthos have focused on the epipelon, which comprises motile pennate diatoms capable of vertical migration in the upper layers of the sediment. They often represent the bulk of the autotrophic biomass and primary production, and play a major role in sediment stabilisation through their overproduction of photosynthetic sugars.

These substances are excreted and act as a kind of glue which binds sediment particles together. However, far less is known about the biology of the epipsammon, which consists of small species that are attached to sand grains, and the tychoplanktonic component (cells which can grow both in the water and on the sediment). These groups are dominant in sandy and very silty sediments respectively.

Taxonomic diversity in estuarine benthic microphytobenthos is high: excluding imported planktonic and riverine taxa, about 200 taxa were observed in a study of the Westerschelde estuary (The Netherlands). Individual samples contain between 27 and 59 taxa. Due to the inaccessible nature of mudflats, many habitats in this estuary have not yet been sampled, so the true number of benthic diatom species in the Westerschelde estuary is almost certainly higher.

Biodiversity and ecosystem function

From a functional point of view, it is intriguing that despite their local co-occurrence, the diversity and dynamics of epipelon, epipsammon and tychoplankton appear to be regulated by different processes. Epipelic communities are less diverse than epipsammic communities, and show distinct seasonal succession patterns, with a pronounced spring bloom followed by a summer decline. Epipsammic communities are highly even (*i.e.* biomass is rather evenly distributed over the species present) and have a remarkably stable species composition throughout the year. Like the epipsammon, the enigmatic tychoplankton displays a stable composition throughout the year.

Very little is known about the exact life strategies of epipelic, epipsammic and tychoplanktonic diatoms, but it can be expected that they display great variation in photosynthetic, trophic, survival and reproductive strategies, and hence offer great prospects for studying evolutionary adaptations for survival in the highly dynamic benthic environment. The roles of the different microphytobenthic functional groups in the ecology of the Schelde estuary are now under investigation by scientists from the Netherlands Institute of Ecology, the University of Ghent, and the Technical University of Delft.

With funding from the European Union and from both Dutch and Flemish Academies of Sciences, our primary goal is to quantify the biomass and primary production of microphytobenthic algae throughout the estuary at different times of year, as these parameters are critical to many ecosystem services such as nutrient exchange and sediment stabilisation. Estimates of the concentration of benthic microalgae can now be made from the air, using hyperspectral sensors which are sensitive to the wavelengths reflected by algal pigments. Airborne surveys accurately reveal the location of the most productive intertidal areas, and these sites are investigated further by ground teams. Another optical technique, chlorophyll fluorescence, is used to monitor microalgal photosynthesis in real time. Samples of the sediment surface are then collected and analysed in the laboratory for nutrient concentrations and physical properties. At each collection site, microalgal species are identified using a combination of classical taxonomy (microscopy, isolation into culture) and molecular biological techniques (DNA extraction and sequencing). By comparing the functional data with biodiversity indicators, the 'keystone' species for estuarine ecosystem vitality can be identified.

New insights into estuarine processes

With one of the largest wading bird populations in western Europe, and several rare habitat types such as freshwater tidal marshes, the Schelde estuary is a site of international recognition and importance. The estuary is also a site of heavy industry, and is an important commercial shipping transport route, thus coastal zone managers must constantly balance the demands of many conflicting interest groups. Better knowledge of benthic microalgal processes, and the contribution of individual species to these processes, will increase our understanding of the Schelde and other estuarine ecosystems. In the long term, our results may enable predictions to be made as to the functional response of estuaries to climate change, to loss of biodiversity, or to changes in land and water management practices.

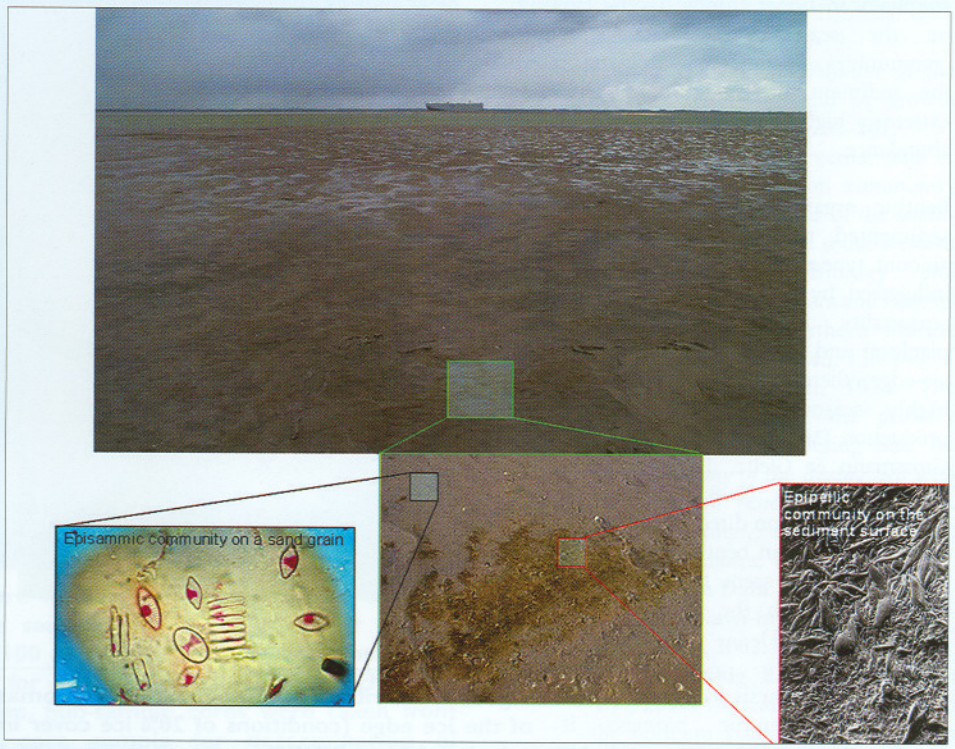

Figure 2. A bloom of microscopic diatoms colours the surface of a mudflat in the Schelde estuary in the Netherlands.

Life at the Edge

Benthic communities at the Barents Sea ice-edge in a changing climate (BASICC)

A Norwegian-Russian Co-operative Project

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The survey vessel RV *Ivan Petrov* in the marginal ice zone in the north-eastern Barents Sea.

Sea-ice is a dominant feature of Arctic ecosystems, which are also characterised by simplicity in upper trophic layers. However, on the sea-floor, there are complex communities of benthic animals living on or in the sediment. In some areas, these are extremely high in biomass and/or numerical abundance.

Benthic organisms rely entirely on sedimented material for food, the amount, type and availability of which is influenced by many factors including seasonality, ice-cover, grazing by plankton and bottom currents. At the ice-edge, there is a very intense and highly seasonal surge of primary production (McRoy & Goering, 1974; Grossmann & Gleitz, 1997, Hegseth, 1997; Makarevich, 1998; Zernova *et al*, 2000). Although no direct link is as yet proven, patterns in benthic biomass in the Barents Sea seem to show some relationship with the extent of ice coverage (Figure 1).

A working hypothesis may therefore be made that benthic biomass is significantly affected by ice cover. If this is the case, climate-driven changes in the extent of ice cover are likely to cause a series of changes to the sea-floor biota and other animals feeding off them, including fish and certain marine mammals.

Financed by the Research Council of Norway, a joint Russian-Norwegian expedition to the Barents Sea was carried out in August 2003. A total of 49 stations were sampled (Figure 2). The main objectives were to investigate the benthic faunal communities and energy flow at the ice edge, in seasonally ice-covered areas and in permanently ice-free areas.

Quantitative samples of benthic fauna were taken, for analysis of community composition. An inter-disciplinary approach was used to relate biological phenomena with physical and chemical characteristics of the sediments and overlying water masses. In addition, core samples were taken for analysis of sedimentation rates and bioturbation.

To trace the relative influence of food arising from ice algae compared with phytoplankton in open waters, samples were taken of bottom-living organisms, zooplankton, phytoplankton and ice-bound material. Using stable isotopes, the aim is to trace and compare different food sources and to relate this to the composition and biomass of the benthic faunal communities in the area.

The research vessel used was RV *Ivan Petrov*, of VNIIOCEANGEOLOGIYA in Arkhangelsk, Russia. Good working relationships were formed, and our sincere thanks go to the captain and crew, as well as cruise leader Boris Vahnstein and his team for unfailing and ever-smiling, round-the-clock operation of sampling equipment.

Through this project, existing co-operation between institutes were strengthened and expanded to include new participants. The

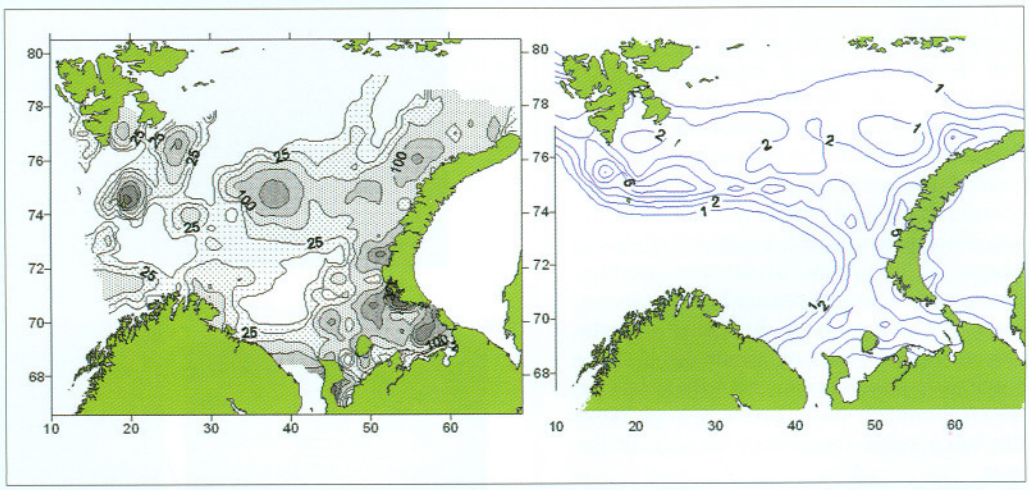


Figure 1. Distribution of (a) zoobenthos biomass (g/m²) and (b) average monthly duration of the ice edge (conditions of 20% ice cover in spring/summer) in the Barents Sea. Data calculated from PINRO zoobenthos survey in 1968-1970 and Shlitzer (2002), respectively. Figure courtesy of Stanislav Denisenko, Zoological Institute, St. Petersburg.

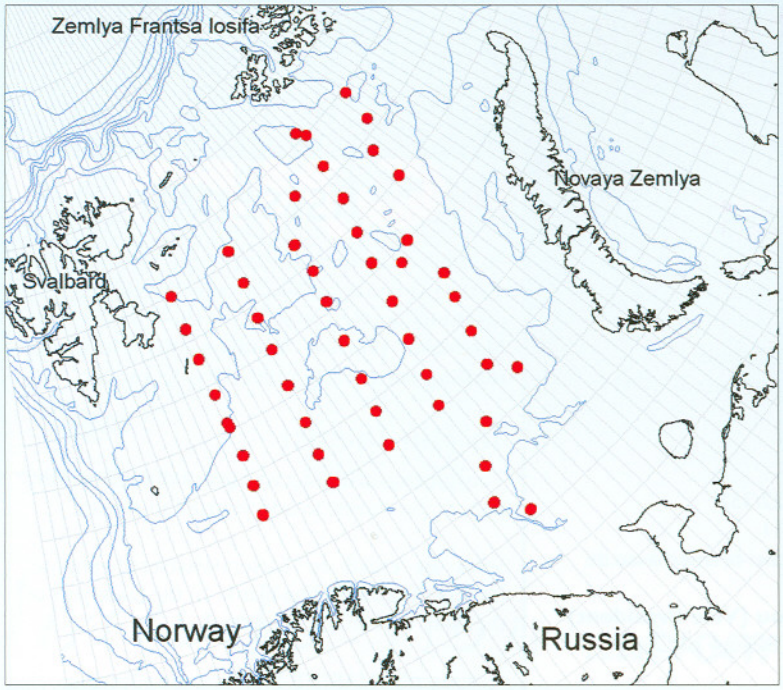


Figure 2. The location of sampling stations in the Barents Sea examined during the BASICC cruise in August 2003.

project runs until 2005 and will contribute to the 6th Framework Network of Excellence MARBEF (Marine Biodiversity and Ecosystem Functioning) which is currently under negotiations with the EU. MARBEF is coordinated by Prof Carlo Heip. Through these national and international initiatives we hope to promote the importance of Arctic biodiversity as a significant and unique component of European biodiversity and to highlight the work that is being carried out in this region.

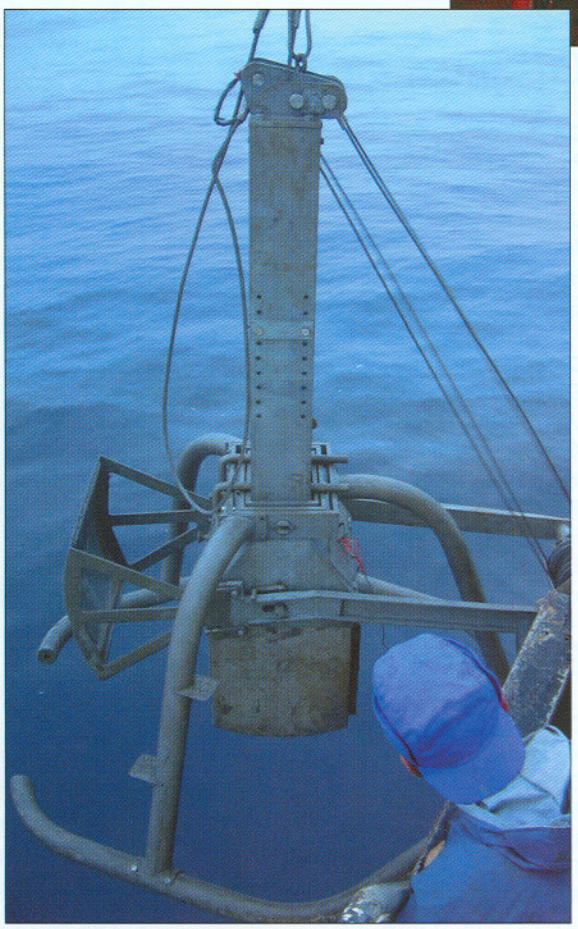
Cruise participants:

Norway: Sabine Cochrane (project leader, Akvaplan-niva, Tromsø), Chris Emblow (EcoServe Ltd, Dublin), Kanchan Maiti (University of South Carolina) and Håvard Dahle (University of Oslo).

Russia: Stanislav Denisenko (Russian coordinator), Vadislav, Andrey Voronkov (all Zoological Institute, St Petersburg) and Alexander Frolov (Murmansk Marine Biological Institute).

Participating institutes:

Akvaplan-niva (Michael Carroll, Salve Dahle); Bates College, USA (Will Ambrose); University of Troms (Paul Wassman); and the Norwegian Polar Institute (Stig Falk-Petersen).



A box core was used to take sediment samples from the seabed. The depth of water ranged between 100 and 450m. Surface sediment will be analysed for a range of physical and chemical parameters. Sub-sample cores were taken from the box core sample for determination of sedimentation rates and bioturbation depths.

A modified van Veen grab was used for sampling the benthic fauna. Five replicate samples were taken at each of the 49 stations.

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MARS listserver

To facilitate communication of the MARS project aims to as broad an audience as possible, and to disseminate the results of the project, the **Marine-B (Marine Biodiversity) electronic mailing list** is being utilised by the project.

To join the list

This process will generate a piece of mail inviting you, as the owner, to add yourself to the list.

Send an email to listserv@listserv.heanet.ie, leaving the subject line blank. In the main part of the mail, type in the command:-

subscribe MARINE-B <firstname surname>

Make sure that you do not add a signature at the end of the mail. You will then receive a message saying you are subscribed to the list.

To send mail to the list

When you want to send mail to the list, you just enter MARINE-B@listserv.heanet.ie in the 'To:' field and your mail message is distributed to the people who have signed onto the list.

If you wish to check the list archives, go to:-

http://listserv.heanet.ie/marine-b.html

The website (http://www.lsoft.com/) may also be useful if you wish to get further information about listservers and the running of the list. If you have any problems, please e-mail Chris Emblow (cemblow@ecoserve.ie).

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