Newsletter No 2 Summer 2002

BIOMARE

Implementation of large-scale long-term MARine BIOdiversity research in Europe

www.biomareweb.org

A concerted action to establish the infrastructure and conditions required for marine biodiversity research at a European scale.
Contract number: EVR1-CT2000-20002

Progress and meetings

Palma de Mallorca Workshop

The first BIOMARE workshop was held at Instituto Mediterraneo de Estudios Avanzados (IMEDEA), Palma de Mallorca, Spain, in November 2001. The main aim was to report and adjust the first drafts on the selection of reference sites for long-term, large-scale marine biodiversity research (Work Package 1) and biodiversity indicators (Work Package 2). More than 190 stations were proposed as reference sites, and the criteria for the selection of these stations were adjusted. It was decided to install a committee of independent researchers to judge on the selection of primary (intensive) sites. A protocol for biodiversity indicators was further worked out during the workshop. To refine and develop the set of indicators for marine biodiversity, it was decided to organise four *ad hoc* working groups, communicating through an email conference.

Marine Biodiversity Picnic

A public marine biodiversity picnic was held in Gdynia, Poland, on 16th June. The event attracted over 2,000 visitors in six hours. The Polish BIOMARE reference sites were promoted along with other aspects of marine biodiversity.

The Polish marine biodiversity picnic attracted much local attention

Contents

Regional meetings

The meetings of the Mediterranean and North Sea/Baltic regions were organised in parallel in Heraklion, Crete, Greece (March 2002). The meeting for the Atlantic/Arctic Region was organised in Horta, Azores, Portugal (April 2002).

During the regional meetings, the selection of the independent committee on the 35 Primary Reference Sites was evaluated. Major agreement existed on the choices made. For the remaining 150 reference sites it was decided to send a list of evaluation criteria to the proposers and to give them the opportunity for self-evaluation of their sites. Those whose site had not been chosen as a primary site, and felt treated unfairly, could start an appeal procedure.

The protocol on biodiversity indicators was clarified. However, an underlining description of procedures still needs to be added, which is noted as a key action for the coming period.

The regional meeting in the Azores was held in the old whaling station near Horta on Faial, hosted by the University of the Azores.

Steering committee meeting

A third steering committee meeting was organised in April 2002 during the regional meeting in Horta, Azores, to discuss progress, to prepare the actions for the regional meeting and to decide on the second workshop, which will be held in Tromsö, northern Norway, at the beginning of September 2002.

Full reports and the dates of forthcoming meetings are available on the website www.biomareweb.org

Dissemination

BIOMARE website

Promotion of the project has been achieved through the website, at BIOMARE regional meetings and through the Marine-B listserver (see below).

The website, at www.biomareweb.org, has been updated regularly. It includes details of the project objectives, work packages, project participants and the first newsletter, with links to key marine biodiversity and biodiversity websites.

The website now also includes databases on researchers, managers and institutes involved in marine biodiversity issues, and large-scale, long-term marine biodiversity datasets in Europe.

A brochure on BIOMARE has been produced, outlining the project aims and preliminary results. If you wish to receive a copy, it is available from Chris Emblow, EcoServe, Unit B19, KCR Industrial Estate, Kimmage, Dublin 12, Ireland.

Marine-B listserver

To facilitate communication of the 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 the mail is distributed to the people who have signed on to 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 be useful if you wish to get further information about listservers and the running of the list.
If you have any problems, please email Chris Emblow (cemblow@ecoserve.ie).

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 four articles - two from the Baltic, one from the southern North Sea and one from the western Mediterranean.

We are still looking for articles for the final edition of the BIOMARE newsletter, so please contact Chris Emblow (cemblow@ecoserve.ie) if you wish to submit an article on marine biodiversity issues in your region.

Idotea metallica in the German Bight: an indicator of a warming trend in the North Sea

Lars Gutow
Biologische Anstalt Helgoland - AWI

The marine isopod *Idotea metallica* exhibits a strictly neustonic life-style. The species is associated with surface drifting objects such as macroalgae, wood, plastic bottles or remains of fishing nets. Due to their resistance to natural decay, abiotic substrates in particular represent a suitable vehicle for dispersal by large-scale water currents, sometimes resulting in a cosmopolitan distribution.

Permanent populations of *I. metallica* occur predominantly in subtropical waters of the Mediterranean and the east coast of North America. The species ranges from North America over the entire North Atlantic area. It is carried by the Gulf Stream to western European waters, from Scandinavia down to the Iberian peninsula.

Apart from a few records from the Dutch and Norwegian coasts, the species had never been found in the North Sea proper. In 1994, however, we encountered *I. metallica* for the first time off the island of Helgoland (German Bight). This was in the course of a long-term survey programme (begun in 1988) on the isopod fauna associated with surface drifting objects. A slight increase in population density in 1995 was followed by the species' complete disappearance from the area after the severe winter of 1995/96. Since 1998, however, *I. metallica* has re-appeared in higher numbers than ever before, with a relatively stable proportion of 1-2% of the total *Idotea* fauna found on drift material.

A comprehensive data-set on sea-surface temperatures measured daily at Helgoland since the early 1960s has revealed that the last decade of the 20th century was characterised by extraordinarily mild winter temperatures. Whether this temperature anomaly is a first sign of a long-term global warming trend or just a temporary phenomenon caused by the North Atlantic Oscillation (NAO) has not yet been determined. However, the simultaneous occurrence of the warm-adapted *I. metallica* and mild winter temperatures appears to be more than purely accidental.

Since drift material could only be collected from spring to autumn, laboratory experiments were performed in order to reveal the species' status in winter. The question was whether *I. metallica* was able to survive winter periods in the North Sea under typical and slightly warmer temperature conditions. The answer was: no.

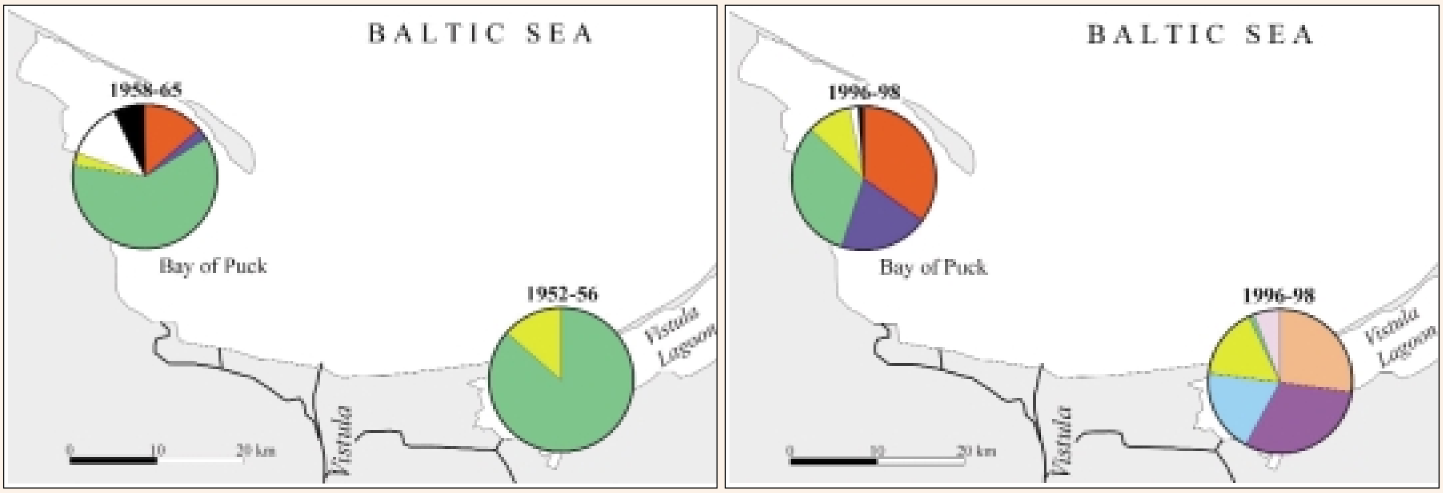
Experimental populations reared under such winter temperatures were not able to produce offspring and died out within about six months. The lower temperature limit for reproduction was determined as 13°C. Since the period with water temperatures below 13°C lasts for about eight months in the German Bight, animals cannot survive until spring to be able to establish a new population.

Consequently, summer populations found in the German Bight must derive from specimens newly introduced into the North Sea every year. Presumably, specimens of *I. metallica* may have always been there but in numbers too low to be easily detected. However, as the North Sea warmed up, it resulted in an extended reproductive period for *I. metallica*, allowing the population to become more prolific and thus more conspicuous. Its recent conspicuous and regular occurrence accordingly makes *I. metallica* a potentially suitable and sensitive indicator of ecologically relevant warming trends in the North Sea.

The marine isopod *Idotea metallica*

Changes in the diversity of the populations of gammarid crustaceans in the southern Baltic offshore waters

Krzysztof Ja d ewski
Laboratory for Polar Biology and Oceanobiology, University of Lodz, Poland



The changes in gammarid crustaceans in the southern Baltic from 1952-1998. Red: ***Gammarus salinus,*** **Black:** ***Gammarus locusta,*** **Blue:** ***Gammarus oceanicus,*** **Purple:** ***Gammarus tigrinus,*** **Green:** ***Gammarus zaddachi,*** **Orange:** ***Obesogammarus crassus,*** **Yellow:** ***Gammarus duebeni,*** **Light Blue:** ***Pontogammarus robustoides,*** **White:** ***Gammarus inaequicauda,*** **Pale Purple:** ***Dikerogammarus haemobaphes.***

Gammarid crustaceans are common inhabitants of European shallow brackish waters. In the impoverished Baltic Sea fauna they constitute a major component of the near-shore macrofaunal communities, especially in the phytal zone.

The identification of Baltic species of the genus *Gammarus* was possible thanks to papers by Segerstråle (1947, 1950, 1959) and Kinne (1954). At the time of publication, five species *(Gammarus duebeni, G. locusta, G. oceanicus, G. salinus* and *G. zaddachi)* were recorded from the Baltic Sea, whilst a sixth species *(G. inaequicauda)* was later added by Jażdżewski (1970).

In Lithuanian waters, in the oligohaline Curonian Lagoon, two alien Ponto-Caspian gammarid species, *Pontogammarus robustoides* and *Obesogammarus crassus,* were recorded in the 1960s by Gasjunas (1972). These species were intentionally introduced in 1960 to the Kaunas Dam reservoir on the Neman River, which empties into the Curonian Lagoon. Jażdżewski (1975) recorded *Chaetogammarus ischnus*, another Ponto-Caspian gammarid, in the mouth of the Vistula River, although it is thought to have already invaded the Vistula in the 1920s (Jarocki & Demianowicz 1931).

Jażdżewski (1976) discovered the Atlantic-boreal species, *Chaetogammarus stoerensis*, in the southern Baltic. Bulnheim (1976) also recorded another alien gammarid, *Gammarus tigrinus*, which is of North American origin, in the Schlei estuary. It had entered the Baltic Sea basin from the middle course of Werra River in Germany in the 1950s.

New alien gammarids

In the last decade, further records of new alien gammarid species in Baltic offshore oligohaline waters have appeared in several papers: Gruszka (1995, 1999) records the occurrence of *G. tigrinus* and *P. robustoides* in the Szczecin Lagoon, and Konopacka (1998), Jażdżewski & Konopacka (2000) and Konopacka & Jażdżewski (in press) note the occurrence of these two species and *Dikerogammarus haemobaphes* and *Obesogammarus crassus* in the Vistula Lagoon and old brackish arms of the Vistula. Müller *et al.* (in press) records *Dikerogammarus villosus,* the latest Ponto-Caspian immigrant, in the Szczecin Lagoon. As a result, in the Baltic proper and its offshore lagoons and estuarine waters, we now have seven species of *Gammarus,* two species of *Chaetogammarus,* two species of *Dikerogammarus* and one species each of *Pontogammarus* and *Obesogammarus.*

Changes in Polish waters

In the Polish waters of the Baltic Sea, gammarid populations were comprehensively studied by Jażdżewski (1971, 1973) in the Bay of Puck, with some less detailed data available from the Vistula Lagoon in papers by Zmudzinski (1957) and Jażdżewski (1975). We therefore have information on the relations between particular gammarid species in these two basins from the 1960s (Bay of Puck) and the 1950s (Vistula Lagoon), with quite recent studies from the Bay of Puck by Jeczmien & Szaniawska (2000), Morawski (unpubl.) and Stos (unpubl.) and in the Vistula Lagoon by Jażdżewski *et al.* (in press). This has allowed us to compare the present composition of gammarid populations in the Bay of Puck and in the Vistula Lagoon with that occurring several decades ago. In the Bay of Puck we still have only native species, but due to the eutrophication of this basin two gammarids of more oxyphilous nature, *G. locusta* and *G. inaequicauda,* have evidently given way to the more resistant *G. zaddachi, G. salinus* and *G. oceanicus* (see Figure).

Declines in native species

In the oligohaline waters of the Vistula Lagoon, native *G. zaddachi* is now outcompeted by a much more eurytopic *G. duebeni* and by alien immigrants of the last decade, especially *G. tigrinus, P. robustoides* and *O. crassus.* The freshwater oligohaline species *Dikerogammarus haemobaphes* occurs in the Vistula Lagoon only in its westernmost, least saline parts.

The data presented in the Figure is a summary of the many samples collected along the whole shoreline of the study area and so do not reflect the local diversity of gammarid populations connected with different ecological conditions (especially salinity) at particular stations.

References page 5 →

References

Bulnheim, H-P., 1976. *Gammarus tigrinus*, new element in the fauna of the Baltic estuary of Schlei. *Schr. Naturw. Ver. Schlesw.-Holst.*, **6**: 79-84 (in German).

Gasjunas, I., 1972. Enrichment of fodder basis of water bodies of Lithuania by acclimatized crustaceans-like organisms from the Caspian Seas complex. In: J.Virbickas (ed.), *On the breeding of fish and crustaceans-like organisms in the water bodies of Lithuania. Vilnius P.* Virbickas (ed.), 57-68 (in Russian).

Gruszka, P., 1995. *Gammarus tigrinus* Sexton, 1939 (Crustacea: Amphipoda) - a new species for Polish fauna in the Oder estuary. In: *Przyrodnicze aspekty badania wod estuarium Odry i wod jeziornych wojewodztwa szczecinskiego. Mat. Konf. 7, Uniw. Szczecin*, p44 (in Polish).

Gruszk,a P., 1999. The River Odra Estuary as a Gateway for Alien Species Immigration to the Baltic Sea Basin. *Acta hydrochim. hydrobiol.*, **27**: 374-382.

Jarocki, J. & Demianowicz, A., 1931. On the occurrence of a Ponto-Caspian amphipod *Chaetogammarus tenellus* (G.O. Sars) in the Vistula River. *Bull. Int. Acad. Pol. Sci. Lettr.* (Cl. Math. Nat. BII): 513-530 (in German).

Jażdżewski, K., 1970. *Gammarus inaequicauda* Stock in the Baltic Sea (Amphipoda, Gammaridea). *Crustaceana*, **19**: 216-217.

Jażdżewski, K., 1971. Ecology of Crustacea Malacostraca in the Bay of Puck. *Acta biol. med. Soc. sci. Gedan.*, **16**: 9-77 (in Polish).

Jażdżewski K., 1973. Ecology of gammarids in the Bay of Puck. Oikos, suppl. **15**: 121-126.

Jażdżewski K., 1975. Morphology, taxonomy and distribution in Poland of the gammarids of the genera *Gammarus* Fabr. and *Chaetogammarus* Mart. (Crustacea, Amphipoda). *Acta Univ. Lodz., Lodz*: 185pp (in Polish).

Jażdżewski K., 1976. Notes on the occurrence and ecology of *Chaetogammarus stoerensis* (Reid, 1938) and *Corophium multisetosum* (Stock, 1952) (Amphipoda) in the Baltic Sea. *Crustaceana*, Leiden, **30 (1)**: 33-38.

Jażdżewski K. & Konopacka A., 2000. Immigration history and present distribution of alien crustaceans in Polish waters. In: *The biodiversity crisis and Crustacea. Proceedings of the 4th Int. Crustacean Congr., Brill, Leiden*, J.C. von Vaupel Klein & F.R.Schram (eds.), Vol. 2, *Crustacean Issues*, 12: 55-64.

Jażdżewski K., Konopacka A. & Grabowski M. (in press). Four Ponto-Caspian and one American gammarid species (Crustacea, Amphipoda) invading Polish waters. *Beaufortia.*

Jeczmien W. & Szaniawska A., 2000. Changes in species composition of the genus *Gammarus* Fabr. in Puck Bay. *Oceanologia*, **42 (1)**: 71-87.

Kinne O., 1954. The species of *Gammarus* in the Gulf of Kiel. *Zool. Jb. Syst.*, **82**: 405-424 (in German).

Konopacka, A., 1998. *Dikerogammarus haemobaphes* (Eichwald, 1841) (Crustacea, Amphipoda), a new species in Polish fauna and two other rare amphipods in the Vistula River. *Przegl. Zool.*, **42 (3-4)**: 211-218 (in Polish).

Konopacka, A. & Jażdżewski, K. (in press). *Obesogammarus crassus* (G.O. Sars, 1894) - one more Ponto-Caspian species in Polish waters. *Przegl. Zool.* (in Polish).

Müller, O., Zettler, M.L. & Gruszka, P. (in press). Distribution and status of *Dikerogammarus villosus* Sovinsky (Crustacea, Amphipoda) in the middle and the upper part of the River Oder and the adjacent waterways. *Lauterbornia* (in German).

Segerstråle, S.G., 1947. New observations on the distribution and morphology of the amphipod *Gammarus zaddachi* Sexton, with notes on related species. *J. Mar. Biol. Ass. U.K.*, **27**: 219-244.

Segerstråle, S.G., 1950. The amphipods on the coasts of Finland - some facts and problems. *Comment. biol., Soc. Sci. Fenn.*, **10 (14)**: 1-28.

Segerstråle, S.G., 1959. Synopsis of Data on the Crustaceans *Gammarus locusta, Gammarus oceanicus, Pontoporeia affinis* and *Corophium volutator* (Amphipoda Gammaridea). *Comment. biol., Soc. Sci. Fenn.*, **20 (5)**: 3-23.

Zmudzinski, L., 1957. Zoobenthos of Vistula Lagoon. *Pr. Morsk. Inst. Ryb.*, **9**: 453-500 (in Polish).

Mass mortality of marine invertebrates in the NW Mediterranean (Summer 1999)

Thierry Perez & Joaquim Garrabou

Centre d Oc anologie de Marseille, UMR 6540 DIMAR, Station Marine d Endoume, Rue de la batterie des lions, 13007 Marseille, France

Temperature stress has been recognised as a main factor in the development of marine diseases that seem to be increasing around the world (Peters, 1993; Harvell *et al.*, 1999). Among the most severe events recorded, a mass mortality occurred in the NW Mediterranean in summer 1999 (Perez *et al.*, 2000; Cerrano *et al.*, 2000). The area affected stretches from Elba Island in Italy to the Bay of Marseilles in France. All other NW Mediterranean regions appeared to have been spared by this event. However, cases of mortality, apparently similar to those described here, were reported to us in August and September 1999 in Tunisia, Greece, Morocco, Cyprus and Turkey. A possible link between these observations and the event recorded in France and Italy has not yet been established.

The incidence and the virulence of this mortality event were surveyed by SCUBA diving between September 1999 and March 2000, both by scientists and by recreational divers under the supervision of scientists. In general, each survey was carried out from the surface to a maximum depth of 60m. The species affected were noted as well as their degree of necrosis and some environmental parameters: depth range, type of substratum and orientation to the main currents. Surveys were conducted with the help of amateur divers previously trained, their observations being submitted to quality control whenever considered necessary. Interviews with diving-club officers also allowed gathering of information on the date of first appearance of mortality signs for different species and localities.

The species affected

All species affected dwell in rocky habitats and several of them are prominent components of the infralittoral and circalittoral communities (photophylic algae assemblages, coralligenous and semi-obscure caves). This event appears to be the largest mass mortality event ever recorded in the Mediterranean with respect to (i) the large geographic area concerned, (ii) the great diversity of taxa affected - sponges, cnidarians, bivalves, ascidians and bryozoans - and (iii) the high mortality rates observed. Twenty-eight species of marine invertebrates were observed to have been involved in the 1999 mass mortality event. The most affected taxa were sponges and cnidarians. Among sponges, the keratose species (with spongin fibre skeletons) were the most damaged. Commercial sponges from the genera *Spongia* and *Hippospongia* were dramatically affected in most of the area concerned, with mortality rates reaching 75% in some places (Perez, 2001).

Among cnidarians, the gorgonians suffered spectacular and extensive damage. In the most affected species, the gorgonians *Paramuricea clavata* and *Eunicella singularis*, the mortality rate reached 90% in some sites (Sartoretto *et al.*, in prep). Extensive injuries of the red coral *Corallium rubrum* and numerous cases of bleaching of the scleractinian *Cladocora caespitosa*, resulting in the total or partial death of colonies, were also observed in shallow waters (above 30m) (Perez *et al.*, 2000; Garrabou *et al.*, 2001). Abnormal recent death among bivalve molluscs *(Lima lima* and *Neopycnodonte cochlear)* and solitary tunicates *(Microcosmus* spp., *Pyura dura* and *Halocynthia papillosa)* was indicated by empty valves and tunics still attached to the substrate or accumulated on the bottom. Finally, it was noted that fouling rate showed a significant increase on three branched bryozoan species *(e.g. Adeonella calveti, Myriapora truncata, Pentapora fascialis, Turbicellepora avicularis).*

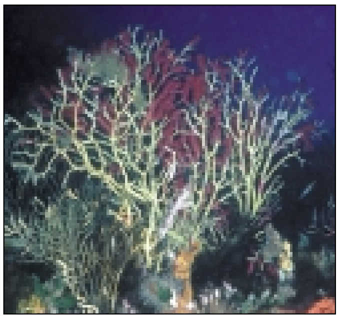
Causes of mortality

There is to date no clear explanation of the cause(s) of this mortality event. However, there is clear evidence that this mass mortality took place under an unusual environmental context characterised by high and stable water column temperatures (Romano *et al.*, 2000; Perez *et al.*, 2000; Cerrano *et al.*, 2000). Indeed, the thermal structure of the water column was remarkable, displaying a general warming of 2-3°C in the surface (above thermocline) water layers, while the thermocline went down to 40m (Romano *et al.*, 2000; Cerrano *et al.*, 2000). In such conditions, the impacted invertebrates were probably exposed to temperatures near to or beyond their thermal tolerance, the exposure time having lethal consequences either directly, leading to physiological stress, and/or indirectly by triggering the virulence of pathogens (Perez *et al.*, 2000; Perez, 2001). The hypothesis that temperature played a key role in this event is supported by the remarkable decrease in the rate of injuries with depth (no signs of mortality having been recorded below 45m), and by changes in the levels of expression of heat-shock proteins in sponges (Garrabou *et al.*, 2001; Perez, 2001; Sartoretto *et al.*, in prep.).

Recovery not certain

The recovery of impacted populations may be uncertain since most of the affected species are characterised by slow dynamics: low growth, recruitment and death rates. For instance, it will take decades for gorgonian or sponge populations to fully recover, and worse, this might fail in cases of new outbreaks occurring in the area. This catastrophic scenario is not unlikely since many biological indicators point to a global warming of the NW Mediterranean (species migration and distribution, life-history shifts and increases of disturbance rates) (see for example Francour *et al.*, 1994). Moreover, climatic models foresee a significant increment of temperature and significant changes in extreme climatic events frequency for the next decades in the NW Mediterranean area (Parry *et al.*, 2000). Since the Mediterranean harbours 4 to 18% of total marine biodiversity over only 0.82% of oceanic surface (Bianchi & Morri, 2000), potential effects of global change in that particular area could have dramatic consequences for the conservation of marine diversity as a whole. These threats warrant a concerted effort to help understand past and future effects of global change on marine Mediterranean biodiversity.

J.G. Harmelin

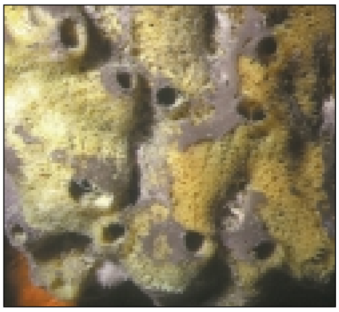


Paramuricea clavata was one of the species most affected. Here injuries are important, the necrosis rate is higher than 70%.

J.G. Harmelin

Eunicella singularis has been severely affected. Several weeks after the break-up, the bare axial skeleton is colonised by macroscopic pioneer taxa such as hydroids, bryozoans, serpulid polychaetes and algae.

J.G. Harmelin



The commercial species *Spongia officinalis*. The first sign of mortality was a white bacterial veil on the epidermis. Soon after, the areas under the bacterial layer appeared rotten and death occurred within two days. Skeletons of dead specimens remained attached to the rocks and were eventually detached by storms.

J.G. Harmelin

Numerous cases of bleaching of the scleractinian coral *Cladocora caespitosa*, resulting in the total or partial death of colonies, were observed.

Some references

Bianchi, N. & Morri, C. (2000). Marine biodiversity of the Mediterranean Sea: situation, problems and prospects for future research. *Mar. Pollut. Bull.* 40, 367-376.

Cerrano, C., Bavestrello, G., Bianchi, C.N., Cattaneo-Vietti, R., Bava, S., Morganti, C., Morri, C., Picco, P., Sara, G., Schiaparelli, S., Siccardi, A. & Sponga, F. (2000). A Catastrophic Mass-mortality Episode of Gorgonians and Other Organisms in the Ligurian Sea (North-western Mediterranean), Summer 1999. *Ecology Letters 3,* 284-293.

Garrabou, J., Perez, T., Sartoretto, S., & Harmelin, J.G. (2001). Mass mortality event in red coral (Corallium rubrum, Cnidaria, Anthozoa, Octocorallia) population in the Provence region (France, NW Mediterranean). *Mar. Ecol. Prog. Ser. 217,* 263-272.

Francour, P., Boudouresque, C.F., Harmelin, J.G., Harmelin-Vivien, M.L., & Quignard, J.P. (1994). Are the Mediterranean waters becoming warmer? Information from biological indicators. *Mar. Pollut. Bull.,* 28(9): 523-526.

Harvell, C.D., Kim, K., Burkholder, J.M., Colwell, R.R., Epstein, P.R., Grimes, D.J., Hofmann, E.E., Lipp, E.K., Osterhaus, A.D.M.E., Overstreet, R.M., Porter, J.W., Smith, G.W., & Vasta, G.R. (1999). Emerging marine diseases - Climate links and anthropogenic factors. *Science 285,* 1505-1510.

Parry, M.L. (Ed.) (2000). Assessment of potential effects and adaptations for climate change in Europe: the Europe ACACIA project. Jackson Environment Institute, University of East Anglia, Norwich. 320 pages.

Perez, T. (2001). Qualité de l'environnement marin littoral: étude des spongiaires pour la bioévaluation des peuplements de substrats durs. Doctorate thesis, Université de la Méditerranée, Centre d'Océanologie de Marseille. 229 pages.

Perez, T., Garrabou, J., Sartoretto, S., Harmelin, J.G., Francour, P., & Vacelet, J. (2000). Mortalité massive d'invertébrés marins: un événement sans précédent en Méditerranée nord-occidentale (Mass mortality of marine invertebrates: an unprecedented event in the NW Mediterranean). C. R. Acad. Sci. Paris, III 323, 853-865.

Peters, E.C. (1993). Disease of other invertebrate phyla: Porifera, Cnidaria, Ctenophora, Annelida, Echinodermata. In: Pathobiology of Marine and Estuarine Organisms. (Eds: Couch, John A. & Fournie, John W.), CRC Press, Boca Raton, 393-449.

Romano, J.C., Bensoussan, N., Younes, W.A.N., & Arlhac, D. (2000). Anomalies thermiques dans les eaux du golfe de Marseille durant l'été 1999. Une explication partielle de la mortalité d'invertébrés fixés. C. R. Acad. Sci. Paris, III 323, 415-427.

Invasion of round goby *(Neogobius melanostomus)* from the Ponto-Caspian to the Baltic

Mariusz R. Sapota
University of Gda~sk, Institute of Oceanography, Dept. of Marine Biology and Ecology, Al. M. Pilsudskiego 46, 81-378 Gdynia, Poland

There are currently over a hundred species known to have been introduced into the Baltic by man. The round goby (Neogobius melanostomus) is a relatively newly introduced species, having invaded from the Ponto-Caspian region.

The first round gobies were caught in the Gulf of Gdańsk, and in the Great Lakes in North America, in 1999, indicating the start of an invasion.

In June 1990, despite the origin and the route of transport being unknown (it is now surmised that the route of transport was in ships' ballast water), the first round gobies were caught in the vicinity of port in Hel, on the tip of the Hel peninsula. In the same year, more round gobies were caught near Hel and Gdynia harbours. Over the next few years, the colonisation of new regions and an increase in round goby numbers occurred and, from 1999, the round goby became one of the more dominant species in the shallow water zone in the west part of the Gulf of Gdańsk.

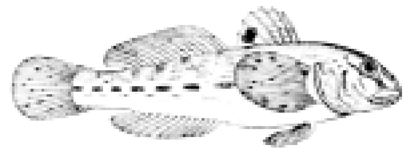
Currently, three geographically separated groups of round gobies exist in the Gulf of Gdańsk and its vicinity. The largest occupies the shallow waters of the west part of the Gulf of Gdańsk; it is stable and well established. The second one, on the west border of the Gulf of Gdańsk, is small and slowly growing. The third one, in the Vistula Lagoon, started to grow rapidly in 2001. The new groups originate from the population inhabiting the west part of the Gulf of Gdańsk and the discrete distribution suggests that transport in ballast waters was also the way the new groups became established.

Why invasion is a success

A number of biological features of the round goby support its invasion success, the most important being its high tolerance of a range of environmental factors and its effective spawning strategy.

Round gobies typically occur in shallow waters (from less than one to about 20m depth) and they always occur near bottom. Hard seabed habitats are preferred; however, the invasion of the generally sandy-bottomed Gulf of Gdańsk started near the harbour regions, where the concrete piers provided refuge for the fish.

In the Gulf of Gdańsk, the round goby can grow up to 25cm in length. However, the majority of individuals are between 8 and 18cm in length, making them one of the biggest fish in the area. Their life-span is rather short, three to four years, with the females living about three years and the males one year longer and reaching a larger size.



The round goby *Neogobius melanostomus*

The spread in the distribution of the round goby in the Gulf of Gdańsk over the last decade can be clearly seen.

In the Gulf of Gdańsk, they generally spawn from the beginning of May to the end of September, although this is prolonged during warmer years. The male to female ratio is approximately three or two to one in contrast to native populations where the sex ratio is more or less equal. Round gobies are multi-spawners; that is, females spawn more than once during the spawning season. In the Gulf of Gdańsk, spawning takes place two to four times a year. Round gobies lay their eggs in nests guarded by males. The nest substratum must be solid, and all hard objects found on the seabed are used to form the basis for round goby nests, including stones, rocks, wood, roots of vascular plants or even dumped waste. In the Gulf of Gdańsk, where places suitable for nests are limited, the density of nests is much higher than in other regions.

Adaptable

Round gobies can live in marine, brackish and freshwater conditions. On that scale, the Baltic can be included in the brackish-water category. Theoretically, they can also live in full oceanic salinity, but no such population exists. The range of round goby migration is short, mostly hundreds of metres distance; however, longer migrations of up to several kilometres do take place in late autumn and early spring when they migrate to and from deeper water.

Round gobies typically eat bivalves (mainly blue mussel), which constitute about 60% of their diet in the Gulf of Gdańsk. The arthropods (chiefly Idotea) are also an important food resource, particularly for the young and smaller individuals and in places with smaller quantities of bivalves. Round goby may also be food for predatory fish, but in the shallow water ecosystem of the Gulf of Gdańsk there are almost no fish predators, though the round goby is a very important food source for cormorants, constituting about 60% of fish eaten by this species of bird.

Further invasions?

The populations of round goby in the Gulf of Gdańsk could provide the springboard for the establishment of new populations in the Baltic region. Maybe an invasion is now in its starting phase and a new population is becoming established.

BIOMARE participants

Project members

Netherlands Institute of Ecology (NIE), Centre for Estuarine and Coastal Ecology
(General Coordinator)
Prof. Dr. C.H.R. Heip, Prof. Dr. H. Hummel, Dr. P. van Avesaath (scientific management assistant), email: heip@cemo.nioo.knaw.nl; hummel@cemo.nioo.knaw.nl

Centre for Coastal and Marine Sciences, Plymouth Marine Laboratory (PML)
(Work Package 1 leader)
Dr. R.M. Warwick, email: r.warwick@pml.ac.uk

Observatoire Oceanologique de Banyuls, (OOB) (Work Package 2 leader)
Dr. J.-P. Féral, email: feral@obs-banyuls.fr

Ecological Consultancy Services Ltd (EcoServe) (Work Package 3 leader)
Dr. M.J. Costello & C.S. Emblow, email: mcostello@ecoserve.ie; cemblow@ecoserve.ie

University of the Azores, Department of Oceanography and Fisheries (IMAR)
(Regional coordinator Atlantic and Arctic)
Dr. R.S. Santos, email: ricardo@dop.uac.pt

Akvaplan-Niva AS and University Studies on Svalbard (AN/UNIS)
(Regional coordinator Atlantic and Arctic)
Dr Sabine Cochrane, Dr. T.H. Pearson & Prof. Dr. B. Gulliksen, email: akvaplan@akvaplan.niva.no

Institute of Marine Biology of Crete (IMBC)
(Regional coordinator Mediterranean and Black Sea)
Prof. Dr. A. Eleftheriou, email: telef@imbc.gr; Dr. Christos Arvanitidis, email: arvanitidis@imbc.gr

Instituto Mediterraneo de Estudios Avanzados (IMEDEA)
(Regional coordinator Mediterranean and Black Sea)
Prof. Dr. C.M. Duarte, D. Jaumé, email: cduarte@clust.uib.es; vieadjul@clust.uib.es

Institute of Oceanology PAS (IO)
(Regional coordinator Baltic and North Sea)
Dr. J.M. Weslawski, email: weslaw@iopan.gda.pl

Alfred-Wegener-Institute for Polar and Marine Research (AWI)
(Regional coordinator Baltic and North Sea)
Prof. Dr. F. Buchholz, email: fbuchholz@awi-bremerhaven.de

Stazione Zoologica Anton Dohrn (SZAD)
Dr. Valerio Zupo, email: vzupo@alpha.szn.it

Marine Biological Station, National Institute of Biology (MBS)
Prof. Dr. A. Malej, email: malej@posta.nib.si

Centre d'Océanologie de Marseille (COM)
Dr. J. Vacelet, email: jvacelet@com.univ-mrs.fr

National Institute of Oceanography (NIO) Israel Oceanographic and Limnological Research (IOLR)
Dr. B.S. Galil, email: galil@ocean.org.il

Institute of Marine Sciences, Middle East Technical University (IMS)
Dr. A.E. Kideys, email: kideys@ims.metu.edu.tr

CNRS/GDR 1117, Marine Chemistry and Ecotoxicology (CNRS)
Dr. C. Amiard-Triquet, email: amiard@sante.univ-nantes.fr

University Gent, Marine Biology Section, Zoology Institute (UG)
Prof. Dr. M. Vincx, email: magda.vincx@rug.ac.be

Institute of Estuarine Studies, The University of Hull
Dr. J.-P. Ducrotoy, email: j.p.ducrotroy@hull.ac.uk

Abo Akademi University (AAU), Department of Biology, Environmental and Marine Biology
Prof. Dr. E. Bonsdorff, email: erik.bonsdorff@abo.fi

Tvärminne Zoological Station, University of Helsinki (TZS)
Dr. E. Sandberg-Kilpi, email: eva.sandberg@helsinki.fi

Klaipeda University, Coastal Research and Planning Institute (CORPI)
Dr. S. Olenin, email: serg@samc.ku.lt

Associate members

Marine Biological Association of the United Kingdom (MBA)
Prof. Steve Hawkins, email: sjha@mba.ac.uk

Sinop Fisheries Faculty, Turkey
Prof. Dr. Levent Bat, email: leventbat@hotmail.com

Estonian Marine Institute
Dr. Henn Ojaveer, email: henn@sea.ee

Baltic Sea Research Institute Warnemuende
Dr. Doris Schiedek & Dr. Michael Zettler, Seestrasse 15, D-181119 Rostock, Germany, email: doris.schiedek@io-warnemuende.de

Institute of Oceanology, Bulgarian Academy of Sciences
Dr. Moncheva & Prof. Dr. Prodanova, PO Box 152, 9000 Varna, Bulgaria

University College Dublin, Department of Zoology
Dr. Tasman Crowe, Dept of Zoology, UCD, Belfield, Dublin 4, Ireland, email: tasman.crowe@ucd.ie

German Centre for Marine Biodiversity
Dr. Wulf Greve, c/o DESY Geb.3, Notkestr. 85, D-22607 Hamburg, Germany, email: wgreve@meeresforschung.de

After BIOMARE

The BIOMARE concerted action has brought together European expertise in marine biodiversity, and linked marine biodiversity knowledge on a larger scale and identified gaps in knowledge.

A follow-up project, MARBENA, will allow further development and implementation of this marine biodiversity knowledge base. A further aim should be to establish a strong and functional network of excellence that will not only focus on scientists but also on those who will use and benefit from this knowledge such as decision-makers (politicians, civil servants, NGO leaders, planners, funding bodies, communicators, *etc.*) and other shareholders of marine biodiversity information.