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International Cooperation in Aquatic Invasive Species Research, Information Exchange and Management in Europe

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Introduction

During the last decades invasion rates of alien species into European inland and coastal waters increased significantly. A number of alien species arrived in Europe from other parts of the world with ships ballast water and as hull fouling. Breaking of natural barriers between water basins by construction of canals in the 19th and 20th centuries resulted in the spread of hundreds of alien species. Headlong intentional introductions also contributed to the number of invaders, including invasive and pathogenic organisms. Currently several hundred species are considered as alien in the Mediterranean Sea (Galil, 2000; Galil and Zenetos, 2002). It is believed that about 100 aquatic invaders occur in the Baltic Sea, with 56 species first recorded during 1950-2002 (Baltic Alien Species Database, 2001). In the Black Sea, 59 species are considered as exotic, including 49 species introduced during the last 50 years (Zaitsev and Öztürk, 2001). In many cases introductions of invasive species have caused significant losses in marine, estuarine and inland waters' biodiversity as well as economic losses in Europe.

The Atlantic ctenophore *Mnemiopsis leidyi* is considered as one of most harmful aquatic invasive species in Europe. In the early 1980s this comb jelly was introduced with ballast water into the Black Sea, and by late 1990s it spread to the Mediterranean and Caspian seas. Invasion of *Mnemiopsis* resulted in a drastic decline in the anchovy fishery in the Ponto-Caspian region with huge economic losses, estimated in hundreds of million of US dollars per year. Currently the unique biodiversity of the Caspian Sea is at serious risk (Regional Biological Invasions Center, 2001a; Caspian Environment Programme, 2002). In 1984 the tropical green alga *Caulerpa taxifolia* was first found in the Mediterranean Sea, most likely as a result of an unintended aquarium release, and currently it is spreading across the Mediterranean, negatively affecting native biodiversity.

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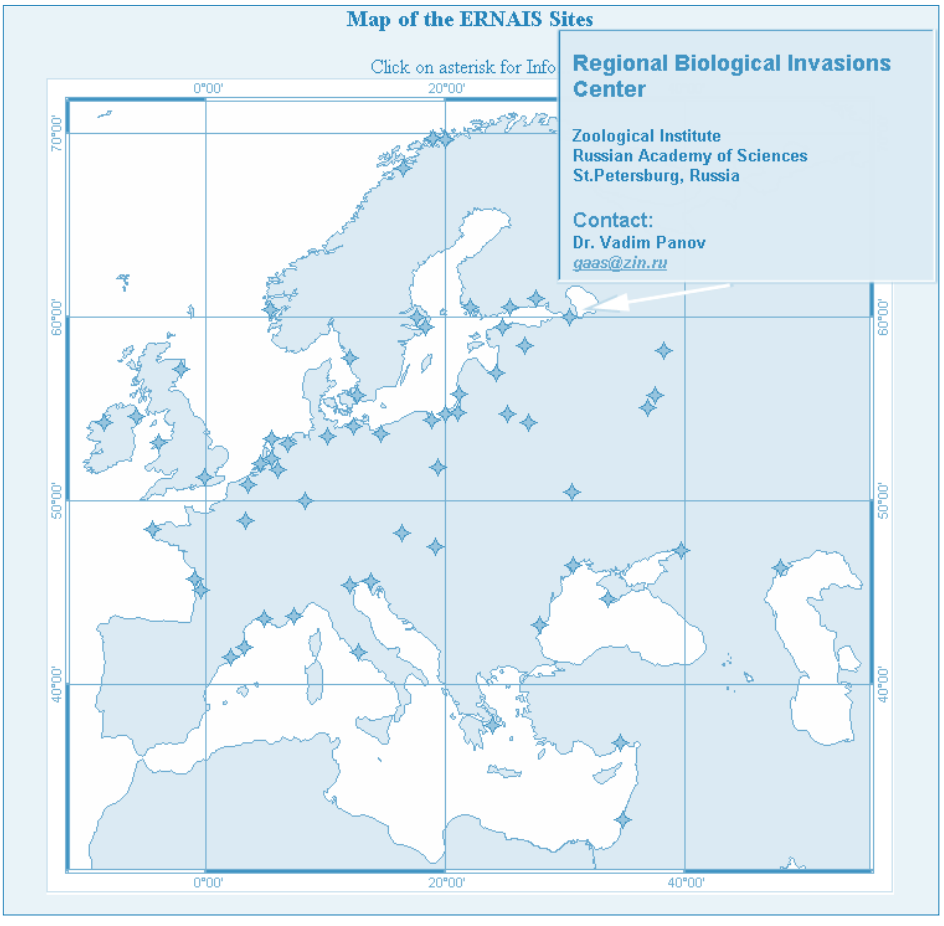

Figure 1. Interactive map of the European Research Network on Aquatic Invasive Species (ERNAIS) sites, http://www.zin.ru/projects/invasions/gaas/ernais_m.htm

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During the last two decades several invasive species have been introduced into the Baltic Sea with ballast water of ships, including the Ponto-Caspian cladoceran *Cercopagis pengoi* and the North American polychaete *Marenzelleria viridis*, both considered as harmful alien species in the Baltic (Leppäkoski et al., 2002a). Biodiversity of inland waters of Europe is also under serious risk caused by alien species introductions, the most harmful of those being the Ponto-Caspian zebra mussel *Dreissena polymorpha*. Other successful recent invaders are the Ponto-Caspian amphipods *Dikerogammarus villosus* and *Pontogammarus robustoides*, the North American signal crayfish *Pacifastacus leniusculus,* the red swamp crayfish *Procambarus clarkii,* and the Baikalian zebra amphipod *Gmelinoides fasciatus* (Leppäkoski et al., 2002b).

The problem of alien species invasions is transboundary in nature, and strong international response is needed to combat it. This paper provides a brief outline of present European cooperation in aquatic invasive species research, information exchange and management.

International and Regional Working Groups

European scientists are actively involved in several international and regional working groups, dealing with aquatic invasive species issues. In the beginning of the 1970s the International Council for the Exploration of the Sea (ICES) established the Working Group on Introductions and Transfers of Marine Organisms (WGITMO) expressing its concern about species movements around the world. Ballast water mediated transportation and release of exotic species has been a frequent topic of review and the ICES/IOC (Intergovernmental Oceanographic Commission)/IMO (International Maritime Organization) Study Group on Ballast Water and Other Ship Vectors (SGBOSV) was established by ICES Council Resolution in 1996. WGITMO focuses on intentional introductions for e.g. aquaculture purposes within ICES Member Countries, but the SGBOSV is a global working group dealing with ship-mediated introductions. At their annual meeting in 2002 both groups noted the increase of species invasions and unwanted impacts caused by invaders. In 1998, the International Association of Theoretical and Applied Limnology (SIL) established the Working Group on Aquatic Invasive Species (WGAIS). The development of an information system on invasive species on a worldwide basis is one of the main objectives of WGAIS, along with providing an expert forum for development of strategies to combat further introductions (Regional Biological Invasions Center, 2001b).

Regional working groups include Baltic Marine Biologists (BMB) Working Group on Non-indigenous Estuarine and Marine Organisms (WG NEMO), established in 1994 (Baltic Alien Species Database, 2001), and the UNDP Caspian Environment Programme (CEP) Regional Invasive Species Advisory Group (RISAG), which

was established in 2001 (Regional Biological Invasions Center, 2001b; Caspian Environment Programme, 2002). Facilitation of international networking in invasive species research, information exchange and management on the regional level are among the goals of both groups. Members of these working groups have been actively involved in several international projects and initiatives regarding aquatic invasive species, which are briefly described below.

Nordic Risk Assessment Project

A preliminary risk assessment of alien species in Nordic coastal waters, conducted in 1997-1998 in the framework of the Nordic Council of Ministers' project "Risk Assessment for Marine Alien Species in the Nordic Area", provided a first international attempt to assess the environmental risks related to alien invasions into the Nordic coastal waters (Gollasch and Leppäkoski, 1999). Through literature review a semi-quantitative model (low – medium – high risk) was developed and applied to five representative port regions in Nordic countries, including the Baltic Sea, the Kattegat, the Skagerrak and the North Sea. Desk studies reviewed physical, chemical, and biological peculiarities and invasion status of selected harbours in the Bergen area (Norway), Stenungsund area (Sweden), Klaipeda (Lithuania), Turku/Ebo (Finland), and St. Petersburg (Russia), and elucidated the main transport routes for ballast water imported to and from these ports.

EU Concerted Action Project

During 1998-2000 a study entitled "Testing Monitoring Systems for Risk Assessment of Harmful Introductions by Ships to European Waters" was funded by the European Union and involved six European countries: Finland, Germany, Ireland, Sweden, United Kingdom (England and Scotland), Lithuania and the International Maritime Organization (IMO). One of the key objectives of this EU Concerted Action Project was to compare and harmonize various sampling methods of ballast water and to study their effectiveness for sampling. Other objectives included: state of the art of ballast water studies, case histories of selected introduced species, development of public awareness material, assessing European waters as potential donor area and documentation of European studies on introduced species in the past (Rosenthal et al., 1998).

EU MARTOB Project

Assessing potential treatment options for ballast water is the main goal of the new European Community funded project entitled "On-board treatment of ballast water and application of low sulphur fuels" (2001-2004), involving partner organizations from eight European countries: Denmark, Finland, France, Greece, The Netherlands, Norway, Sweden, and UK. Specific objectives of MARTOB, regarding ballast water management, include: to investigate methodologies and technologies for preventing the introduction of non-indigenous species through ships' ballast water; to develop design tools and treatment equipment to be used in the further development of ballast water treatment techniques; to assess the effectiveness, safety, and environmental and economic aspects of current and newly developed methods; to develop cost effective, safe, environmentally friendly onboard ballast water treatment methods which have a minimum impact on ship operations; to produce guidelines for crew training and criteria for selecting an appropriate ballast water management method (MARTOB, 2001).

Cooperation in Information Exchange

The development of an INTERNET-based information resources on aquatic invasive species is considered as one of the most important mechanisms of information exchange. The recent Conference of the Parties of the Convention on Biological Diversity agreed that a clearing-house mechanism will be useful to facilitate scientific and technical cooperation on invasive species issues, and notified the Global Invasive Species Programme as an international thematic focal point for alien species under the clearing-house mechanism, and calls on Parties, countries and relevant organizations to contribute to the creation and maintenance of the global information network, in particular to ensure effective international cooperation and expertise sharing (CBD COP6 Decision VI/23, 2002). Currently relevant European international organizations and working groups are actively working on the development of information resources regarding aquatic invasive species. These resources may provide comprehensive information for management of aquatic invasive species in Europe, as well as for scientific and educational purposes.

CIESM Atlas of Exotic Species

At present the International Commission for the Scientific Exploration of the Mediterranean Sea (CIESM) Atlas of Exotic Species is one of the most comprehensive Internet-based atlases of aquatic alien species in the world. At present the CIESM Atlas of Exotic Species includes detailed description of 125 alien species of mollusks, 55 species of alien crustaceans and 91 alien fish species that invaded the Mediterranean Sea. Individual species pages present illustrations, diagnostic features, biological information, references and a distribution map (CIESM, 1999).

Baltic Sea Alien Species Database

An Internet Database on aquatic alien species in the Baltic Sea area was developed as an initiative of the Baltic Marine Biologists' Working Group on Non-indigenous Estuarine and Marine Organisms in 1997; in 2000 a new concept of the online Database appeared with support received from the Baltic Marine Environment Protection Commission (HELCOM). This regional project

encourages the exchange of data within the Baltic Sea area, providing a competent system regarding biological invasions, vectors of introduction, spread of alien species and their impacts on environment and economy (Baltic Sea Alien Species Database, 2001; Olenin et al., 2002).

Regional Biological Invasions Center Information System

Since the beginning of 2001, the web site of the Regional Biological Invasions Center (RBIC), provides access to the Internet-based information resources on aquatic invasive species research and management in Europe and worldwide. The development of the Geographic Information System "INVADER" as international database on the Internet is one of the RBIC priorities (Regional Biological Invasions Center, 2001c). On-line geo-referenced distribution maps of selected species, along with detailed descriptions of their taxonomy, invasion histories and biology, are available at the RBIC Illustrated Database of the Aquatic Invasive Species of Europe, linked to the Baltic Sea Alien Species Database and the Global Invasive Species Database (Regional Biological Invasions Center, 2001a). The RBIC web site is also supporting web pages of some international working groups and networks, including the developing European Research Network on Aquatic Invasive Species (Regional Biological Invasions Center, 2001b).

European Research Network on Aquatic Invasive Species (ERNAIS)

The idea to develop an European information exchange network on aquatic invasive species was discussed for the first time in 1999 at the 16th Baltic Marine Biologist Meeting in Klaipeda, Lithuania. In 2001, SIL WGAIS and BMB WG NEMO initiated a broad discussion of the ERNAIS concept. As a result, a first directory of European experts in the area of aquatic invasions was developed, which currently includes 76 scientists and managers from 26 countries (Regional Biological Invasions Center, 2001b; Fig.1). Main objectives of ERNAIS include: facilitation of international cooperation in research, scientific information exchange and management of aquatic invasive species in Europe and worldwide; development of the on-line information system on aquatic invasive species as part of the Global Invasive Species Information Network; creation of a network to exchange information on port and ballast water studies. In the future the ERNAIS may serve as part of the developing Global Invasive Species Information Network. This potential service of ERNAIS has been recently recognized at the international workshop on development of the Nordic/Baltic Invasive Species Information Network, held during 21-23 May, 2002 in Tallinn, Estonia (Report of the Workshop, 2002). Also, ERNAIS may serve as a main European framework of on-line scientific information exchange, relevant to aquatic invasive species, and provide essential information and expertise needed for management of aquatic invasive species on the European level.

New Book on Aquatic Invaders

A book entitled "Invasive Aquatic Species of Europe. Distribution, Impacts and Management" was published in August, 2002 (Leppäkoski et al. 2002b). This book is the first attempt to provide an overall picture of aquatic species invasions in Europe. Altogether 100 scientists from 24 countries joined to synthesize the available information on bioinvasions. Geographically that initiative ranges from Irish waters in the west to Volga River and the Caspian Sea in the east, and from Mediterranean in the south up to the Arctic coast of Europe in the north. The book tends to represent the array of all major European aquatic systems: fully saline seas, enclosed brackish water bodies, coastal lagoons, freshwater lakes and major river systems.

The idea of this volume originates from activities of the Baltic Marine Biologists'(BMB), Working Group on non-indigenous species. The book benefited from co-operation with similar working groups of the International Maritime Organization (IMO), the International Council for the Exploration of the Sea (ICES), and the Nordic Council of Ministers (more details, order form and material to download at http://www.ku.lt/nemo/EuroAquaInvaders.htm).

Cooperation Between European and North American Scientists

Although North America is one of the most important donor areas of aquatic invasive species for Europe (Leppäkoski et al. 2002b), European coastal and inland waters are an important source of invasive species for North America and worldwide. Several aquatic species, originating from Europe, are considered as invasive both in Northern Europe and North America. These species include several Ponto-Caspian species, such as the zebra mussel *Dreissena polymorpha*, the fishhook waterflea *Cercopagis pengoi*, and round goby *Neogobius melanostomus*. Other Eurasian species, considered as invasive in both Europe and North America, include the spiny water flea *Bythotrephes longimanus* and ruffe *Gymnocephalus cernuus.* Currently the development of effective cooperation between European and North American scientists in research and information exchange is recognized by both sides. During the last 5 years, several international meetings regarding aquatic invasive species have been organized as cooperative efforts by European and North American scientists, particularly SIL'98 Workshop "Aquatic Invasive Species - Developing a Scientific Information Exchange" (August 11, 1998, Dublin, Ireland, SIL Working Group of Aquatic Invasive Species being one of the results of this event), the ASLO 2000 Pre-Conference Workshop "Invasions of European and North American Ecosystems by Ponto-Caspian Species" (June 2-3, 2000, Copenhagen, Denmark), U.S.-Russia Invasive Species Workshop (August 27-31, 2001 Borok, Russia), and International Workshop on Development of Nordic/Baltic Invasive Species Informational Network (May 21-23, 2002, Tallinn, Estonia) (Regional

Biological Invasions Center, 2001b). At the last event it was agreed that existing European information resources on aquatic alien species such as the Baltic Sea Alien Species Database and the Regional Biological Invasions Center Information System should be linked to main North American databases on aquatic invasive alien species such as the Smithsonian Marine Invasions Database and USGS Non-indigenous Aquatic Species Database (Report of the Workshop, 2002).

About the Authors

Vadim Panov is Senior Scientist at the Zoological Institute of the Russian Academy of Sciences, and Coordinator of the Regional Biological Invasions Center web site. His research interests include biology and ecosystem impacts of aquatic alien species. Currently he is involved in several international working groups, focusing on invasive species: SIL Working Group on Aquatic Invasive Species (Chairperson since 2001), Global Invasive Species Programme (GISP) Information Management Working Group, Caspian Environment Programme Regional Invasive Species Advisory Group and others, http://www.zin.ru/projects/invasions/gaas/panov.htm

Stephan Gollasch was involved in the first European ship sampling programme on ballast water, tank sediments and ship hull fouling (1992-1996). His PhD is world-wide the first thesis based on ship sampling. Due to the international aspect of biological invasions Dr. Gollasch became a member of several international working groups: International Council for the Exploration of the Sea (ICES) Working Group on Introductions and Transfers of Marine Organisms (WGITMO), Study Group on Ballast Water and Other Ship Vectors (SGBOSV), International Maritime Organization (IMO) (Marine Environment Protection Committee (MEPC)) and convener of the Baltic Marine Biologists (BMB) (Working Group on Non-Indigenous Estuarine and Marine Organisms (NEMO)). Since 2001 he is the chairman of the WGITMO and SGBOSV. Co-Editor for an international book (2002) on invasive aquatic species of Europe. Today he is involved in a project assessing several ballast water treatment options, http://www.gollaschconsulting.de

Erkki Leppäkoski is professor of ecology and environmental research at Åbo Akademi University, Finland. He has been involved in aquatic invasion biology of the Baltic and other European brackish-water seas since the early 1980s. Initiator and chairman of the Baltic Marine Biologists' Working Group on Nonindigenous Estuarine and Marine Organisms; member of the ICES Working Group on the same issues, Chief Editor for an international book (2002) on invasive aquatic species of Europe, http://www.abo.fi/fak/mnf/biol/eco/Personsidor/erkki_leppakoski.htm

Sergej Olenin is professor at the Coastal Research and Planning Institute, Klaipeda University, Lithuania, http://www.corpi.ku.lt/. Since 1980 he is involved in marine environmental research, mainly benthic ecology studies. Current research areas in the field of biology of invasions include biogeographical and ecological aspects of aquatic species introductions, mechanism of species transfer in ballast tanks and development of information system on bioinvasions. Initiator and first convener of the Baltic Marine Biologists' Working Group on Nonindigenous Estuarine and Marine Organisms (1994-1999); Co-Editor for an international book (2002) on invasive aquatic species of Europe, Coordinator of the BMB/HELCOM Baltic Sea Alien Species Database Project, http://www.ku.lt/nemo/s_olen.htm

References

Baltic Sea Alien Species Database. 2001. Alien Species Directory (Olenin, S. and E. Leppäkoski, eds). http://www.ku.lt/nemo/mainnemo.htm

Caspian Environment Programme. 2002. *Mnemiopsis leidyi* in the Caspian Sea. http://caspianenvironment.org/mnemiopsis/index.htm

CIESM. 1999. Atlas of Exotic Species in the Mediterranean Sea. http://www.ciesm.org/atlas/index.html

Galil, B.S. 2000. A sea under siege – alien species in the Mediterranean. *Biological Invasions* 2: 177-186.

Galil, B.S. and Zenetos, A. 2002. A sea change – exotics in the eastern Mediterranean Sea. In: Leppäkoski, E., S. Gollasch and S. Olenin (eds) 2002. Invasive Aquatic Species of Europe. Distribution, Impacts and Management. Kluwer Academic Publishers, Dordrecht, pp. 325-336.

Gollasch, S. and Leppäkoski, E. (eds) 1999. Initial risk assessment of alien species in Nordic coastal waters. Nordic Council of Ministers, Copenhagen. Nord 1999:8, 244 pp.

Leppäkoski, E., Gollasch, S., Gruszka, P., Ojaveer, H., Olenin, S. and Panov, V. 2002a. The Baltic—a sea of invaders. *Canadian Journal of Fisheries and Aquatic Sciences*, 59: 1175-1188.

Leppäkoski, E., Gollasch, S. and Olenin, S. (eds) 2002b. Invasive Aquatic Species of Europe. Distribution, Impacts and Management. Kluwer Academic Publishers, Dordrecht. 583 pp.

MARTOB. 2001. On Board Treatment of Ballast Water (Technologies Development and Applications) and Application of Low-sulphur Marine Fuel. http://www.marinetech.ncl.ac.uk/research/martob/index.htm

Olenin, S., Leppäkoski, E. and Daunys, D. 2002. Internet database on alien species in the Baltic Sea. In: Leppäkoski, E., S. Gollasch and S. Olenin (eds) 2002. Invasive Aquatic Species of Europe. Distribution, Impacts and Management. Kluwer Academic Publishers, Dordrecht, pp. 525-528.

Regional Biological Invasions Center. 2001a. Group on Aquatic Alien Species: Aquatic Invasive Species in Europe. http://www.zin.ru/projects/invasions/gaas/aa_idb.htm

Regional Biological Invasions Center. 2001b. Group on Aquatic Alien Species: International Networking. http://www.zin.ru/projects/invasions/gaas/aa_netw.htm

Regional Biological Invasions Center. 2001c. Group on Aquatic Alien Species: Projects. http://www.zin.ru/projects/invasions/gaas/aa_proj.htm

Report of the Workshop on the Development of a Nordic/Baltic Invasive Species Informational Network. 2002. Tallinn, Estonia, 21-23 May, 2002. http://www.us-reo.dk/IS_Database.htm

Rosenthal, H., Gollasch, S., Laing, I., Leppäkoski, E., Macdonald, E., Minchin, D., Nauke, M., Olenin, S., Utting, S., Voigt, M. and Wallentinus, I. 1998. Testing Monitoring Systems for Risk Assessment of Harmful Introductions by Ships to European Waters. In: Barthel, K. G., Barth, H., Bohle-Carbonell, M., Fragakis, C., Lipiatou, E, Martin, P., Ollier, G. and Weydert, M. (eds): 3rd European Marine Science and Technology Conference, Lisbon, 23-27 May 1998, Project Synopses Vol. II, Strategic Marine Research, 919-928 (EUR 18220 EN).

Zaitsev Yu. and Öztürk B. (eds) Exotic species in the Aegean, Marmara, Black, Azov and Caspian Seas. Published by Turkish Marine Research Foundation, Istanbul, Turkey, 2001, 267 pp.