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**New electronic journal “*Aquatic Invasions*”: an important
part of the developing European early warning system on
aquatic invasive species**

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New electronic journal “*Aquatic Invasions*”: an important part of the developing European early warning system on aquatic invasive species

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Abstract

Aquatic Invasions is an electronic open-access journal focusing on biological invasions in European inland and coastal waters and potential donor areas of aquatic invasive species for Europe. The journal, established in 2006 as an initiative of the European Research Network on Aquatic Invasive Species (ERNAIS), with start-up funding from the EC FP6 Integrated Project ALARM, provides the opportunity for timely publication of first records of biological invaders for consideration in risk assessments and early warning systems. Also, the journal provides the opportunity to publish technical reports on new technologies in management of invasive species and proceedings of relevant international meetings. In 2007, four issues of the second volume of *Aquatic Invasions* with 62 research articles and short communications were released and freely available at the journal website. These papers included 820 new geo-referenced records of invasive alien species in European inland and coastal waters, with 168 records from field surveys in 2007. *Aquatic Invasions* is a part of the developing European early warning system on aquatic invasive species, with an important service of protection of author rights on primary geo-referenced records on introduced species and biological monitoring and surveys. *Aquatic Invasions* can be considered as an essential component of the novel information technology for transfer of essential information on invasive alien species on the level of decision-making (currently developing within the EC FP6 Integrated Project ALARM).

Background

Serious challenges posed by massive human-mediated introductions of invasive alien species (IAS) resulted in the strengthening of international cooperation in research, information exchange and management of IAS, specifically in frameworks of different international group activities related to aquatic invasions in Europe and adjacent areas. The Working Group on Aquatic Invasive Species of the International Association of Theoretical and Applied Limnology (SIL WGAIS), the International Council for the Exploration of the Sea (ICES) Working Group on Ballast and Other Ship Vectors (ICES WGBOSV) and the Baltic Marine Biologists (BMB) Working Group on Non-indigenous Marine and Estuarine Organisms (ICES WG NEMO) are among the most efficient international bodies in terms of the facilitation of international cooperation on aquatic IAS at different levels (Olenin *et al.* 2002, Panov *et al.* 2002, Panov 2004, Panov and Gollasch 2004, Panov 2005, Gollasch 2007). On the Pan-European level, these

* Other members of the Editorial team of “*Aquatic Invasions*” are listed at the journal homepage at <http://www.aquaticinvasions.ru>

activities resulted in the establishment of the European Research Network on Aquatic Invasive Species (ERNAIS, <http://www.zin.ru/rbic/projects/ernais/>) in 2001, whose role in the development of the European Information Network on Invasive Species has been further recognized in the European Strategy on Invasive Alien Species (Genovesi and Shine 2004). In 2005 ERNAIS initiated the establishment of the European electronic journal of applied research of invasive species in aquatic ecosystems with early warning functions *Aquatic Invasions* (ISSN: 1818-5487, DOI: 10.3391/ai, <http://www.aquaticinvasions.ru>), which was financially supported by the European Commission Sixth Framework Programme for Research and Technological Development (EC FP6) through the Integrated Project ALARM (Settele et al. 2005, Panov and Gollasch 2006). In this ALARM Deliverable we report on the results of the implementation of this ERNAIS initiative in 2006-2007.

Early warning functions of *Aquatic Invasions*

The concept of the ERNAIS e-journal *Aquatic Invasions* as an essential part of the developing European early warning system on aquatic invasive species was first presented in the Editorial paper of the first issue of *Aquatic Invasions* published in February 2006 (Panov and Gollasch 2006). As we initially suggested, the ERNAIS e-journal *Aquatic Invasions* is already playing an important specific role in the development of a network of Internet-based databases on IAS, by protecting the authors' rights on primary geo-referenced data of IAS records from monitoring and biological survey efforts and biology of invasive species, thus facilitating the flow of essential information needed for decision-making processes (Figure 1). Currently we are working on the development of an online risk assessment toolkit with early warning functions, which may serve as interactive transmitter of primary information on IAS from data providers upwards to the level of decision-making, and *Aquatic Invasions* will play an important role as essential component of this novel information technology on invasive alien species (Panov et al. 2008).

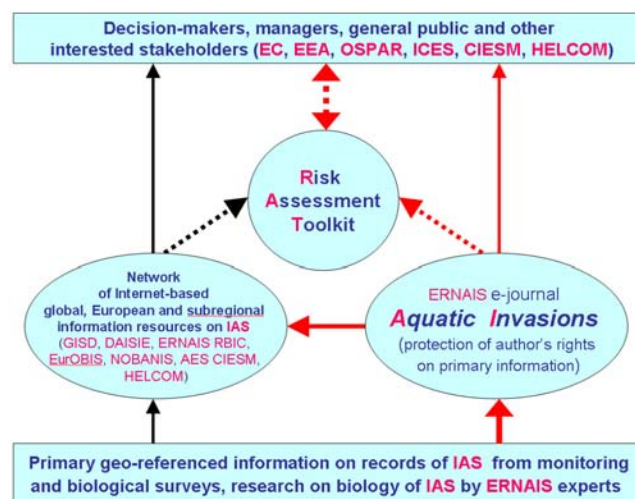


Figure 1. Role of e-journal *Aquatic Invasions* in the developing European early warning system on invasive alien species (IAS), modified from Panov and Gollasch (2006). GISD – Global Invasive Species Database (<http://www.issg.org/database/>), DAISIE - EC FP6 Strategic Targeted Research Project “Delivering Alien Invasive Species Inventories for Europe” information resources (<http://www.europe-aliens.org>), ERNAIS – European Research Network on Aquatic Invasive Species (<http://www.zin.ru/rbic/projects/ernais/>), RBIC – Regional Biological Invasions Centre information system (<http://www.zin.ru/rbic/>), EurOBIS - The European Ocean Biogeographic Information System (<http://www.marbef.org/data/eurobis.php>), ICES – International Council for the Exploration of the Sea (<http://www.ices.dk>), NOBANIS – North European and Baltic Network on Invasive Alien Species (<http://www.nobanis.org/>); AES CIESM – Atlas of Exotic Species of the International Commission for the Scientific Exploration of the Mediterranean Sea (<http://www.ciesm.org/online/atlas/>), EC – European Commission (<http://ec.europa.eu/>), EEA – European Environment Agency (<http://www.eea.europa.eu/>), OSPAR - OSPAR Commission for the Protection of the Marine Environment of the North-East Atlantic (<http://www.ospar.org/>), HELCOM – Baltic Marine Environment Protection Commission (<http://www.helcom.fi/>), Risk Assessment Toolkit – online risk assessment instrument with early warning functions currently under development in frameworks of EC FP6 Integrated Project ALARM (Panov et al. 2008)

The first issue of *Aquatic Invasions* was published in February 2006, and by December 2006 four issues of the first volume of *Aquatic Invasions* were freely available online, including 55 research articles and short communications with 667 new geo-referenced records of aquatic alien species in European inland and coastal waters. This first volume contained 59 records of alien species found during field surveys of European waters in 2006. In 2007, 62 published research articles and short communications in 4 regular issues of the second volume of “Aquatic Invasions” included 820 new geo-referenced records of alien species in European inland and coastal waters, with 168 records of alien species found during field surveys of European waters in 2007. Selected records of invasive aquatic species during 2006-2007, from inland and coastal waters respectively, are shown in Figures 2-3.

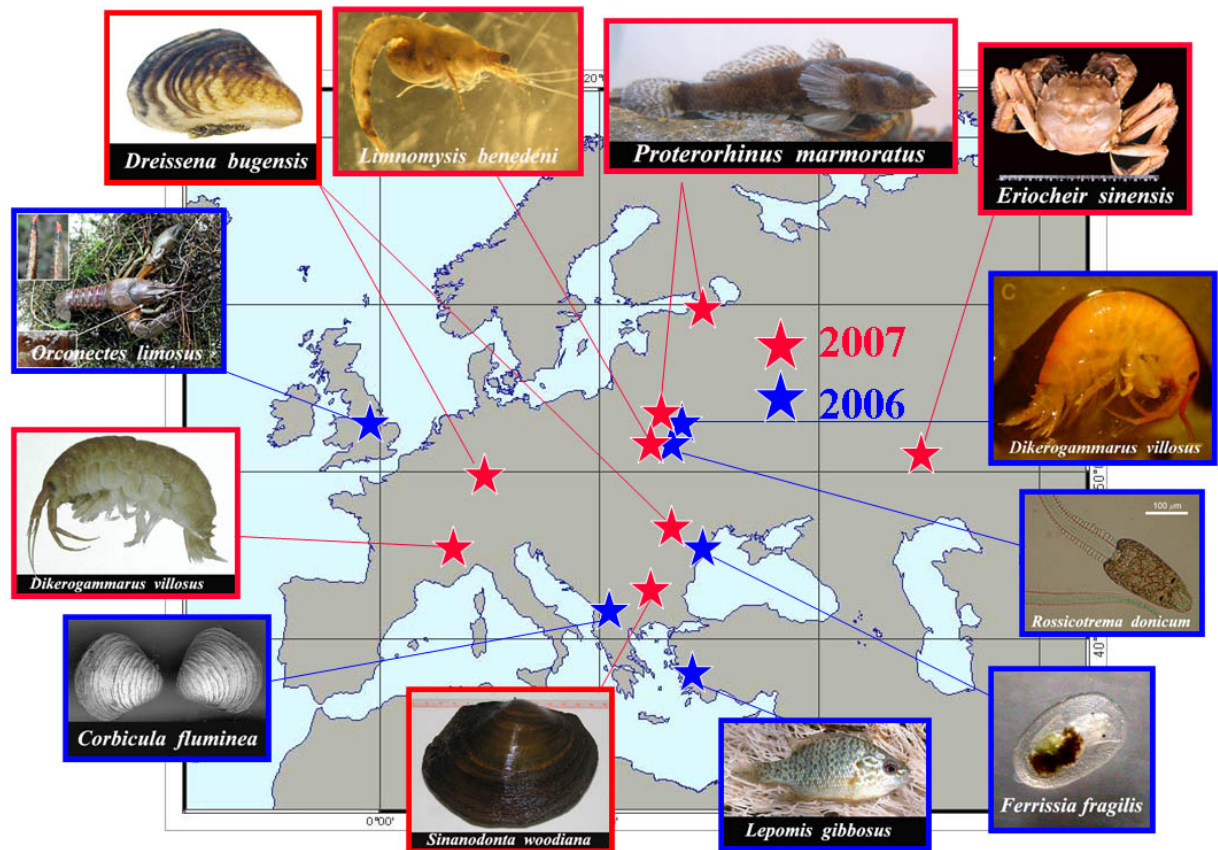


Figure 2. Selected new geo-referenced records of invasive alien species in European inland waters in 2006-2007, published in the second volume of *Aquatic Invasions*: 1 – the spiny-cheek crayfish, *Orconectes limosus* in UK (Holdich and Black 2007), 2 – the Ponto-Caspian amphipod *Dikerogammarus villosus* (“killer shrimp”) in Lac du Bourget, France (Grabowski et al. 2007), 3 – the Quagga mussels *Dreissena bugensis* in the Main River, Germany (van der Velde and Platvoet 2007), 4 – the Quagga mussels *Dreissena bugensis* in Ukraine (Son 2007), 5 – the tubenose goby *Proterorhinus marmoratus* from the River Pripyat, Belarus (Rizevsky et al. 2007), 6 – the tubenose goby *Proterorhinus marmoratus* from the Neva River estuary, Russia (Antsulevich 2007), 7 - the Ponto-Caspian amphipod *Dikerogammarus villosus* in the Dnieper River, Belarus (Mastitsky and Makarevich 2007), 8 – the North American freshwater limpet *Ferrissia fragilis* in Ukraine (Son 2007), 9 – the parasite trematode *Rossicotrema donicum* from Lake Lukomskoe, Belarus (Mastitsky 2007), 10 – the Ponto-Caspian mysid *Limnomysis benedeni* from the River Pripyat, Belarus (Semenchenko et al. 2007), 11 – the Chinese mitten crab, *Eriocheir sinensis* from the Volga River, Russia (Shakirova et al. 2007), 12 – the Asian clams *Corbicula fluminea* and *C. fluminalis* in Serbia (Paunović et al. 2007), 13 – the Asian clam *Sinanodonta woodiana* from Eastern Romania (Popa et al. 2007), 14 – the North American sunfish *Lepomis gibbosus* in Turkey (Özcan 2007)

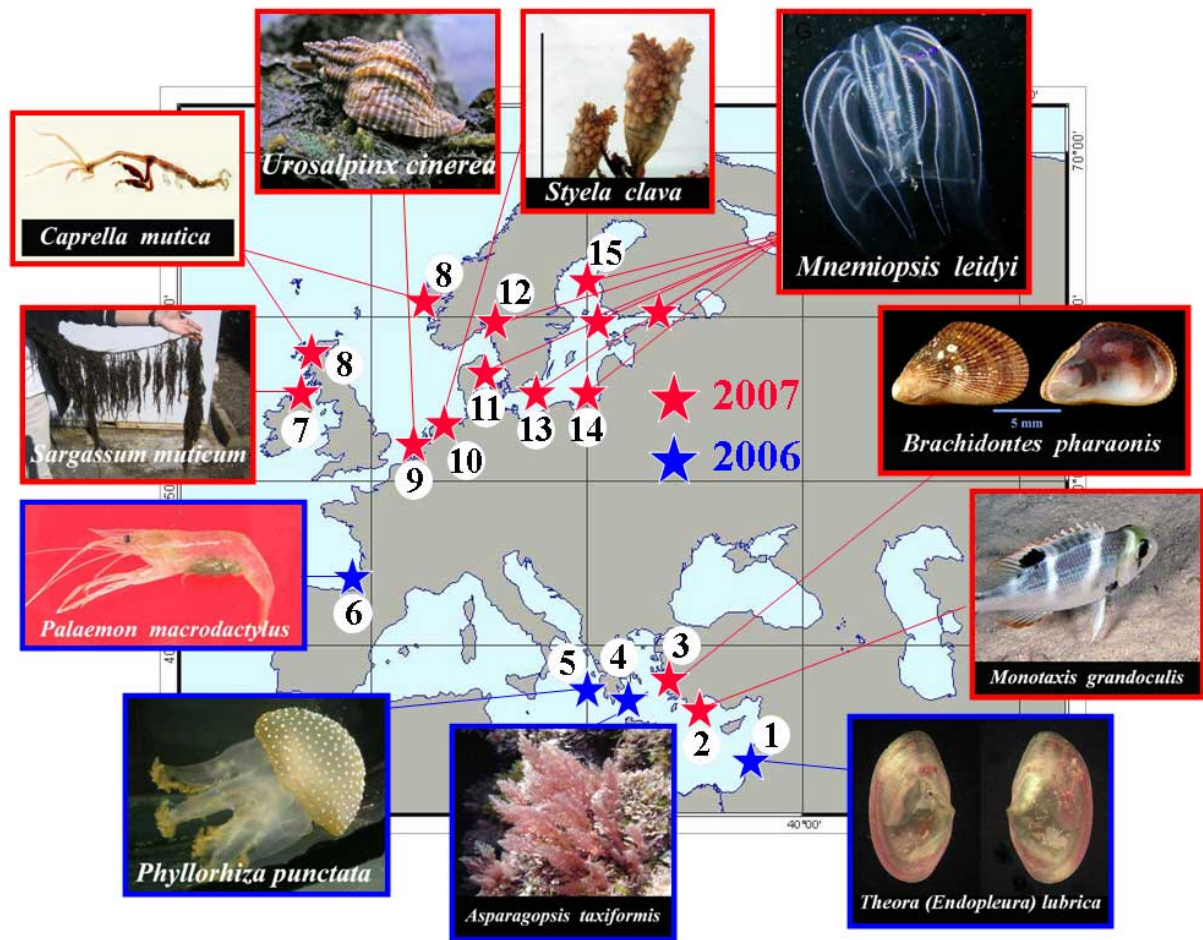


Figure 3. Selected new geo-referenced records of invasive alien species in European coastal waters in 2006-2007, published in the second volume of *Aquatic Invasions*: 1 – the Asian bivalve *Theora (Endopleura) lubrica* from Mediterranean coast of Israel (Bogi and Galil 2007), 2 – the Indo-Pacific humnose big-eye bream, *Monotaxis grandoculis* in the Mediterranean Sea (Bilecenoglu 2007), 3 - the Red Sea mussel *Brachidontes pharaonis* from the Turkish coasts (Doğan et al. 2007), 4 - the red alga *Asparagopsis taxiformis* in Greece (Tsiamis and Panayotidis 2007), 5 - the tropical scyphomedusa *Phyllorhiza punctata* in the Central Mediterranean Sea (Abed-Navandi and Kikinger 2007), 6 - the oriental shrimp *Palaemon macrodactylus* in Gironde Estuary, France (Beguer et al. 2007), 7 – the Pacific alga *Sargassum muticum* on the west coast of Scotland (Harries et al. 2007), 8 – the Asian amphipod *Caprella mutica* in coastal waters of UK and Norway (Cook et al. 2007), 9 - the American oyster drill, *Urosalpinx cinerea* in The Netherlands (Faase and Ligthart 2007), 10 – the Asian tunicate *Styela clava* from the central German Bight (Krone et al. 2007), 11 – the North-American ctenophore *Mnemiopsis leidy* in Danish waters (Tendal et al. 2007), 12 – *Mnemiopsis leidy* in the Oslofjorden, Norway (Oliveira 2007), 13 - *Mnemiopsis leidy* in south-western Baltic Sea (Kube et al. 2007), 14 - *Mnemiopsis leidy* in the Gulf of Gdańsk, southern Baltic Sea (Janas and Zgrundo 2007), 15 - *Mnemiopsis leidy* in the north-eastern Baltic Sea (Lehtiniemi et al. 2007)

The first two volumes of *Aquatic Invasions* included numerous contributions on first records of IAS in European regional seas and inland waters, including first records of *Neogobius melanostomus*, *Mnemiopsis leidy*, *Rapana venosa* and *Rangia cuneata* in the North Sea basin (the latter invasive species is a first record for Europe) (van Beek 2006, Faase and Bayha 2006, Hansson 2006, Kerckhof et al. 2006, Verween et al. 2006). Experts from the Baltic Sea basin reported on new records of such invasive aquatic species as Conrad’s false mussel *Mytilopsis leucophaeata* (Laine et al. 2006), the Chinese mitten crab *Eriocheir sinensis* (Panov 2006), the round goby *Neogobius melanostomus* (Ojaveer 2006), tubenose goby *Proterorhinus marmoratus* (Antsulevich 2007), the Ponto-Caspian cladoceran *Evadne anonyx* (Rodionova and Panov 2006) and Atlantic ctenophore *Mnemiopsis leidy* (Javidpour et al. 2006, Lehtiniemi et al. 2007). The latter three species were recorded in the Baltic Sea for the first time; rapid publication in *Aquatic Invasions* of the first records, in the southern and north-eastern Baltic, of the highly invasive *Mnemiopsis* less than one month after the authors completed field work, represents a sound example of the early warning service provided by this online tool for the Baltic Sea region (Figure 3). For the Mediterranean Sea, rapid publication of the first record of the needle-spined

urchin *Diadema setosum* (the manuscript was received 4 days after this species was recorded at the southern coast of Turkey on 12 August 2006, accepted within two days and posted at the journal website early September 2006) demonstrates the effectiveness of *Aquatic Invasions*, in terms of rapid response, as an early warning provider (Yokes and Galil 2006).

The effective "service" of *Aquatic Invasions* as early warning tool has been reported in 2006-2007 at several Pan-European and sub-regional international meetings*, and, as a result, the European Environment Agency recently acknowledged this early warning service provided by *Aquatic Invasions* (EEA 2007). In addition, HELCOM Maritime recommended that the services of *Aquatic Invasions* should be considered for the implementation of relevant activities within the Baltic Sea Action Plan (HELCOM MARITIME 2007).

As a separate important function, *Aquatic Invasions* is also serving several online databases on invasive species, including the information system of the EC FP6 Strategic Targeted Research Project DAISIE (<http://www.europe-aliens.org>), through the publication of the national checklists of aquatic alien species, which represent a core component of this project database (Gollasch and Nehring 2006, Alexandrov et al. 2007, Galil 2007, Kerckhof et al. 2007, Minchin 2007). Furthermore, the timely publication of verified checklists and new IAS findings may help to keep the DAISIE information system up-to-date.

Thus, one of the key benefits of e-journal *Aquatic Invasions* is the timely and readily available publication of essential primary scientific information, also needed for decision-making. A manuscript publication, including a comprehensive review process, takes on average less than one month, thereby reducing the publication time lag typical of many regular international journals. In this way *Aquatic Invasions* can facilitate the regional and Pan-European early warning systems on alien species, previously lacking. The provision of a freely accessible, early warning system for alien species is an essential tool for decision-making on potential early eradication efforts, and also for relevant decision support systems. In addition, *Aquatic Invasions* provides a publication platform for other important information on the management of invasive species including publication of technical reports on new technologies in management of invasive species and proceedings of relevant international meetings. Finally, fast but comprehensive reviewing process of submitted manuscripts is serving as effective quality insurance mechanism for information on IAS freely available for interested stakeholders via *Aquatic Invasions* information system.

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* *Aquatic Invasions* early warning services were presented at:

- the Second HELCOM/BSRP Thematic Workshop on the risks related to the ballast water mediated introductions of non-indigenous species in the Baltic Sea, April 19-21, 2006, Helsinki, Finland
- the European Environment Agency Project "Streamlining European 2010 Biodiversity Indicators" (SEBI2010) Expert Group 5 meeting 'Trends in alien invasive species', June 27-28, 2006, Athens, Greece
- the ICES/IOC/IMO WGBOSV and the ICES WGITMO meetings, March 19-23, 2007, Dubrovnik, Croatia
- the 6th Meeting of the HELCOM Maritime, 9-11 October 2007, Szczecin, Poland.

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