ICES WGITMO REPORT 2013

ICES Advisory Committee

ICES CM 2013/ACOM:30

Report of the ICES Working Group on Introduction and Transfers of Marine Organisms (WGITMO)

20 - 22 March 2013

Montreal, Canada

ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

H. C. Andersens Boulevard 44–46
DK-1553 Copenhagen V
Denmark
Telephone (+45) 33 38 67 00
Telefax (+45) 33 93 42 15
www.ices.dk
info@ices.dk

Recommended format for purposes of citation:

ICES. 2013. Report of the ICES Working Group on Introduction and Transfers of Marine Organisms (WGITMO), 20 - 22 March 2013, Montreal, Canada. ICES CM 2013/ACOM:30. 149 pp.

Contents

Executive summary

The 2013 meeting of the ICES Working Group on Introductions and Transfers of Marine Organisms (WGITMO) was held in Montreal, Canada during 20-22. March with Cynthia McKenzie as host and Henn Ojaveer as chair. The meeting was attended by 21 participants from 16 countries. The physical participants were from Belgium, Canada, Estonia, Finland, France, Germany, Lithuania, the Netherlands, Norway, Spain, Sweden, United Kingdom and United States while Greece, Italy, Portugal and United States participated over Webex and Croatia, Denmark, and Poland contributed by correspondence.

The objectives of the meeting were to update information and discuss several aspects related to the introduction of alien species. The meeting dealt in more details with the new alien species information system AquaNIS, climate impacts on alien species, the upcoming MSFD requirements re. developing monitoring programs for alien species, fouling of artificial structures by alien species, how to better address emerging ICES strategic topics (Arctic research, aquaculture) and cooperation with other ICES EG's. Importantly, the group dedicated time for addressing two OSPAR advice requests concerning alien species indicators and additional sources for alien species data and information. As usual, sufficient time was devoted to presentations of national reports and follow-up exchange of information.

The approach taken during the meeting facilitated presentations and discussions on the issues of relevance related to the Terms of References, but also on some generic and strategically important research issues relevant to bioinvasions in general. The meeting started as a half-day joint meeting with the Working Group on Ballast and Other Ship Vectors (WGBOSV) during which issues of common interest were addressed. For the next meeting, and to be able to better address ICES strategic topics, the joint meeting is planned to last one full day.

For some Terms of Reference a more detailed presentation was given during the meeting and a short overview of the information and subsequent discussion is provided in the report at the end of each section. The report is structured so that each Term of Reference is dealt with in sequential order. The main body of the report contains summaries of the presentations and discussions with the more detailed documents being contained in the Annexes.

The group progressed in each of the Term of Reference by either completing the task or clearly identifying and agreeing on the intersessional activities required to finalise the work. Intersessional work is inherently becoming an integral component of future work for WGITMO. This will be even more important during the coming years, in order to make the meeting more efficient and dedicate more time for strategic discussions which cannot be held by electronic communication means. To share the workload, several group members were asked to lead some specific tasks.

WGITMO suggests the newly established information system on Aquatic Non-Indigenous Species (AquaNIS) to be used not only in ICES whenever alien species information is required (e.g., for ecosystem overviews or regional ecosystem assessments), but also promote the database for stakeholders and policymakers, like OSPAR and HELCOM.

1 Opening of the meeting

The meeting was opened at 09:00 on March 20th, 2013 as a joint session with ICES/IOC/IMO Working Group on Ballast Water and Other Ship Vectors (WGBOSV). Sarah Bailey (Chair WGBOSV) and Henn Ojaveer (Chair WGITMO) welcomed all the participants. Cynthia McKenzie, Canada, acted as a host of the meeting. Sarah Bailey and Henn Ojaveer chaired the joint session. The session finished at 12:30 on March 20th and the WGITMO meeting started at 13:30.

2 Adoption of the agenda

The agenda was organized based on the Terms of Reference as given in ICES Resolution 2012/2/ACOM30 (see below). In addition, a few invited presentations on a specific topic and/or of generic interest, which, amongst others, might assist in defining ToR's for the coming years, were accommodated into the agenda which was adopted without changes (Annex 2).

3 WGITMO Terms of Reference

2012/2/ACOM30 The **ICES Working Group on Introduction and Transfers of Marine Organisms** (WGITMO), chaired by Henn Ojaveer, Estonia, will meet in Montreal, Canada, from 20–22 March 2013, with a back to back meeting with the ICES/IOC/IMO Working Group on Ballast and Other Ship Vectors (WGBOSV) to:

a) Synthesize and evaluate national reports using the adopted format for reporting and contributions to the database that includes species, locations (latitude and longitude), status of invasions as appropriate, region of origin, status of eradication efforts, and habitat, and develop an annual summary table of new occurrences/introductions of aquatic non-indigenous species.

b) Continue verifying selected datasets of the newly developing database on marine and other aquatic organisms in European waters with the ultimate goal to make it available online. This activity will mostly be carried out intersessionally and take several years.

c) Continue identification and evaluation of climate change impacts on the establishment and spread of non-indigenous species. This activity will mostly be carried out intersessionally and take several years (ToR of joint interest with WGBOSV).

d) Investigate and report on non-native species issues associated with artificial structures in marine environment (ToR of joint interest with WGBOSV).

e) Continue work to address MSFD D2, incl. by developing generic criteria and proposing guidance for alien species monitoring approaches to assist EC member states in designing their national alien species monitoring programs.

f) Coordinate reporting of nonindigenous pathogens affecting mariculture with the relevant ICES expert group(s) and establish a mechanisms for annually exchanging relevant information.

g) Produce the draft alien species alert report on *Ensis directus*.

h) **Support to the technical specification and application of OSPAR common indicators under D2**

Request for the quality assurance/ response to specific questions to support the work of the identification and prioritisation of common indicators to support the regional implementation of the biodiversity aspects of MSFD in the North East Atlantic. BDC 2012 have requested the submission of first set of common indicators to be presented to BDC 2013 (noting that the relevant ICES groups will meet late February early March 2013). At this time (i.e. first quarter 2013), ICES would be requested to undertake an independent peer review of the technical specifications and proposed operational implementation of the indicators that will be presented. The review should consider, from the perspective of producing a set of common indicators for the OSPAR Region: 1) whether the indicators put forwards are appropriate to implement at a regional scale; 2) whether the set of indicators is sufficient as a set to understand GES; 3) identify any gaps; 4) identify where there are difficulties in the operationalization of the indicators, with proposals for how to overcome these. Based on the outcomes of OSPAR request 2013-4 (below) (regarding maximising efficiencies for monitoring of biodiversity), 5) identify where there are opportunities to cluster indicators that can benefit from shared monitoring/ data collection. **OSPAR request 2013-3**

i) **Provide advice on maximising the use of available sources of data for monitoring of biodiversity**

The purpose of this request is to seek ICES advice on the potential sources of data and information that may be available to support the monitoring and assessment of biodiversity in relation to commitments under MSFD so as to maximise efficiencies in the use of available resources, for example where efficiencies could be made to identify where there are monitoring programmes or data sources that can deliver multiple indicators, which may relate to different Descriptors, (e.g. The Data Collection Framework could be used to implement D3 and D1 indicators), or where with a small additional effort existing monitoring could be amplified to deliver a broader set of data. Advice would be sought as to 1) the quality of these potential data sources and how they could be used, including but not limited to the relevance of outcomes identified in chapter 8 of the ICES MSFD D3+ report to Descriptors 1, 4 and 6. **OSPAR request 2013-4**

WGITMO will report by 15 April 2013 for the attention of ACOM.

Supporting Information

Priority:	The work of the Group is the basis for essential advice to prevent future unintentional movements of invasive and/or deleterious aquatic species including disease agents and parasites with the legitimate trade in species required for aquaculture, table market, ornamental trade, fishing and other purposes and to assess the potential of species moved intentionally to become a nuisance in the area of introduction. The work of this Group supports the core role of ICES in relation to planned introductions and transfers of organisms.
Scientific justification and relation to action plan:	a) We have been developing a simple excel database on new introductions or expanding introductions and will be requesting that ICES adopt the data and maintain the database for the Working Group and ICES countries to access. b) The group will contribute to MSFD Descriptor 2 issues, incl. providing

	guidance and generic suggestions for designing future alien species monitoring programs. c) We are planning to actively contribute in verification of selected datasets of the newly developing database on marine and other aquatic organisms in European waters. This will be essentially important for WGITMO to contribute as a group into this database building. d) We plan to identify and evaluate climate change impacts on the establishment and spread of alien spoecies; this activity will result in scientific publication. e) We'll start coordinating reporting on pathogens affecting mariculture and involve relevant ICES expert group(s). f) We'll investigate and report increasingly important issue of various artificial structures for alien species spread and invasions. g) We'll produce next alien speciaaleret report (on *Ensis directus*). h) OSPAR request 3/2013 relevant for the MSFD implementation i) OSPAR request 4/2013 relevant for the MSFD implementation
Resource requirements:	None required other than those provided by ICES Secretariat and national members
Participants:	WGITMO nominated members and invited experts from, e.g., Australia and Mediterranean Sea countries that are not members of ICES.
Secretariat facilities:	Meeting room providen by the host

4 Progress in relation to Terms of Reference

The sections below provide information on the progress made by each of the Term of Reference, amended by more important discussion items as well as relevant conclusions/suggestions as emerged from the group discussions.

4.1 Term of Reference a)

Synthesize and evaluate national reports using the adopted format for reporting and contributions to the database that includes species, locations (latitude and longitude), status of invasions from other ICES member countries as appropriate, status of eradication efforts, and habitat, and develop an annual summary table of new occurrences/introductions of aquatic invasive species in Member Countries (ToR lead Henn Ojaveer).

This Term of Reference was addressed by all meeting participants who provided information for their country according to the items of the reporting outline. This was done either via a short verbal report or in the form of more substantial presentation. In addition, several countries which were physically not represented at the meeting (Croatia, Denmark, Greece, Italy, Poland and Portugal) submitted their written contributions. The following sub-sections provide condensed highlights of all national reports received. For details please see Annex 3 (national reports) and Annex 4 (detailed summary information on new invasions and range expansions of already existing alien species as reported by countries).

4.1.1 Belgium

During 2012 no new introduced species were recorded. All introduced species that were reported during previous years are still present and seem to be well-established and thriving.

4.1.2 Canada

Fisheries and Oceans Canada is currently developing regulations that would help address Aquatic Invasive Species and is also revising the National Code on Introductions and Transfers of Aquatic Organisms. This year was discovery of three new species to Canada; *Ascidiella aspersa,* (European sea squirt), *Heterosiphonia japonica,* and *Diadumene lineate,* striped anemone. Other species that have already invaded Canadian waters continue to spread, including European Green Crab, Vase Tunicate, *Codium fragile*, (oyster thief), Golden Star Tunicate, *Styela clava* (clubbed tunicate), *Diplosoma listerianum* and *Botrylloides violaceus*.

4.1.3 Croatia

Planktonic polychaetes *Phalocrophorus pictus* and *Pontodora pelagica*, chaetognatha *Sagitta galerita* and two fish species *Caranx rhonchus* and *Holacanthus ciliaris* were reported in the Croatian eastern Adriatic waters for the first time. Presence of Dinophyta *Akashiwo sanguinea* in the Eastern Adriatic Sea was confirmed with finding of this species in Port of Ploče.

4.1.4 Denmark

Hemigrapsus takanoi Asakura & Watanabe, 2005 and *H. sanguineus* (De Haan, 1835) have been identified in the Danish Wadden Sea. The invasion history and ecological impacts of *Marenzelleria viridis* (Verrill, 1873) has been studied in Odense Fjord. Denmark acceded the Ballast Water Convention in September 2012.

4.1.5 Estonia

In 2012 a new polychaete species was caught in the Pärnu Bay area (NE Gulf of Riga) and established itself in the new environment. According to the preliminary analyses, the species belongs to the genera *Laonome* and it seems that the species is not previously known to science. Currently, the taxonomists and ecologists are working on the material to prepare a scientific report on the morphology and ecology of the species. Alien species monitoring, started in 2010, was continued in 2012 with substantial field works in two port areas – ports of Muuga and Sillamäe (Gulf of Finland). In addition, annual-scale population dynamics of eleven alien species was monitored. The mud crab *Rhithropanopeus harrisii* was found to be colonized the whole Pärnu Bay while in other targeted study areas at the Estonian coast (Väinameri Archipelago, Gulf of Finland) the species was not found. The cladoceran *Evadne anonyx* has colonized the whole Gulf of Riga already in 2001 but its abundance has remained very low during 2001-2012. While the round goby *Neogobius melanostomus* was still found to be expanding its distribution area and increasing in population abundance, the status of other alien species has remained largely unchanged compared to previous years. Substantial progress was achieved for developing AquaNIS information system within the EU FP7 project VECTORS.

4.1.6 Finland

One new alien species was found in Finnish waters in 2012: the Hydromedusa *Maeotias marginata* in the Archipelago Sea, northern Baltic Sea. The mud crab *Rhithropanopeus harrisii* was found to still increase in abundance in the Archipelago Sea. Sampling protocol for port monitoring was developed under HELCOM and tested in two Finnish ports in late summer 2012. Ports seem to be hot spots for alien species as they hosted most of the alien species of the corresponding sea areas. Finnish national strategy on invasive species was accepted by the parliament during spring 2012. The

ratification of the IMO's BWM Convention by Finland was delayed and will take place during 2013.

4.1.7 France

France has been active in the work to develop common biodiversity indicators for non-indigenous species for the Marine Strategy Framework Directive, both nationally and within the NIS expert group of the Intersessional Correspondence Group on the Coordination of Biodiversity Assessment and Monitoring (ICG-COBAM) from the OSPAR convention.

Two new species of crustaceans and one ascidian, present due to anthropogenic vectors, have been identified and described in the Channel and Atlantic coastline. Through the use of molecular tools, one algae species has been identified and further work on the distribution of cryptic species of *Ciona* is underway. In the Mediterranean, several new fish species have been observed due to range expansions.

Funded under the FP7 ERA-NET scheme, BiodivERsA is a network of national funding organizations promoting pan-European research that offers innovative opportunities for the conservation and sustainable management of biodiversity. The 2012-2013 call was for proposals on invasive species and biological invasions. For this call a total of 7M€ has been provisionally reserved by the participating partner organizations. Several French-led consortiums have submitted proposals. The evaluation of proposals and final ranking will take place in May 2013 (http://www.biodiversa.org/367).

4.1.8 Germany

A recent publication should be mentioned. According to Buschbaum 2012, an inventory in the Dutch-German-Danish Wadden Sea revealed a total of 66 nonnative (alien) taxa including 17 tentative cryptogenics in the brackish-marine macrobenthos until 2010, which is close to average compared with similar inventories from other coasts.

4.1.9 Greece

In 2012 four new marine alien species were reported from the Greek Seas. These are the fish *Champsodon nudivittis* and *Terapon theraps* (from Rhodes Isl. and Thermaikos Gulf respectively), the mollusk *Murchisonella columna* (from Thermaikos Gulf, N. Aegean Sea) and the alga *Caulerpa taxifolia* var. *distichophylla* (from Rhodes Isl., S. Aegean Sea). In addition, 13 species have expanded their distribution in Greek waters, some of them exhibiting invasive behaviour (*Caulerpa racemosa* var. *cylindracea*, *Womersleyella setacea*).

4.1.10 Italy

Five new species of invertebrate NIS have been recorded in Italian marine waters. Information on already established alien species, including genetics of HAB forming microalgae, ecology of macroalgae, and new locations of invertebrate NIS is given.

4.1.11 Lithuania

No new intentional NIS introductions in 2012 recorded. Two new species recorded, their NIS status is not fully certain. Implementation of the EU Marine Strategy Framework Directive (in particular Articles 8, 9 and 10) required, *inter alia*, to assess non-indigenous species in Lithuanian marine waters.

4.1.12 Norway

First observation in Norway of the red algae *Gracilaria vermiculophylla* at "Nøtterøy", SE Norway. Assumed sustainable fishery (targeting mature males) of the red king crab *Paralithodes camtschaticus* E of North Cape (E 26)resulted in unexpected reduction, both in crab size and population density. The non-regulating culling fishery W. of North Cape (E 26) seems to reduce but not prevent westward spreading of the king crab.

4.1.13 Poland (by correspondence)

Rangia cuneata (G.B.Sowerby I, 1831) (Mollusca: Bivalvia) was recorded in 2012 for the first time in the Vistula Lagoon, in Poland (Warzocha *et al*. unpublished data).

4.1.14 Portugal

A list of 97 aquatic non-indigenous species (NIS) is registered for the Portuguese estuarine and coastal aquatic systems, 16 of which were new additions to the 2012 report. The inventory of NIS did not include fish species and freshwater species. Portugal has a law on introduction of exotic species, published in 1999, which is currently under revision (since 2009). Although the current law does not include a list of marine species the revision document included marine species and refers to IMO and ICES criteria for ballast water management. A first characterization report was delivered in the aim of the implementation of the Marine Strategy Framework Directive. The illegal fishing of *Ruditapes philippinarum* is a major problem in the Tagus estuary and authorities wants to develop specific regulation for this activity.

4.1.15 Spain

The Royal Decree 1628/2011, of November 14, regulating the List and Catalogue of alien invasive species is still under revision.

Five new NIS species have been reported from Spain: *Marginella glabella* (in the inner fishing port of Málaga harbour (southern Spain, Mediterranean coast)), *Dyspanopeus sayi* (from Alfacs Bay, Ebro Delta, NE Spain, Mediterranean coast (40°40'N 0°40'E)), *Phyllorhiza punctata* (from Far del Fangar, Ebro Delta, NE Spain, Mediterranean coast (40º46'N 0º47'E)), *Arcuatula senhousia* (from Bidasoa Estuary, bordering Spain and France, Bay of Biscay, N Spain, Atlantic coast (43°20.5"N 1°46"W)) and *Gadus morhua* (off the south coast of Mallorca, Balearic Islands, Mediterranean Sea (39°15'37''N 02°38'43''E)). In addition, new reports of previous sightings are also indicated.

4.1.16 Sweden

The microalgae *Fibrocapsa japonica*, that is potentially harmful to fish, was sighted for the first time in Swedish waters in 2012. A colony of adult sea anemones, *Edwardsiella lineata* was found for the first time. Larval stages, parasitic in comb jellies, have been found before.

4.1.17 United Kingdom

The predatory shrimp *Dikerogammarus haemobaphes*, a conspecific of the so-called 'killer shrimp' *D. villosus*, was found in the River Severn and then later confirmed for several water bodies across England.

Measures to prevent the spread of *D. villosus* continue, complemented by a revised edition of the detailed identification guide for *D. villosus* published by the Freshwater

Biological Association, but the species has appeared at a few new locations in the County of Norfolk.

During 2012, two reports assessing pathways of non-native aquatic invasions were produced for the UK Department of Environment, Food and Rural Affairs, which is also expanding its campaign "Check, Clean, Dry" to enlist recreational users of water bodies to help control the spread of aquatic invasive non-native species.

Initiatives to eradicate invasive carpet sea-squirt (*Didemnum vexillum*) continue in Wales.

No new species of non-native fish have been reported.

Infectious agents have been reported in 2012, i.e. the parasite *Marteilia* sp. in edible mussels (*Mytilus edulis*), whitespot syndrome virus (WSSV) in the invasive freshwater crayfish (*Procambarus clarkii*), Gaffkaemia (a disease introduced with American lobsters) in three populations of native European lobsters (*Homarus gammarus*), Spring viraemia of carp virus in fishery comprised of a lake complex, an exotic-listed shellfish parasite (*Bonamia exitiosa*) in native oysters, and an uncharacterised herpes virus (closely related to goldfish herpesvirus, CyHV-2) in specimens said to be the feet-cleaning fish *Garra rufa,* which subsequently were shown, using molecular genetic analysis not to be *G. rufa.*

The Environment Agency, UK (England & Wales) began consideration in 2012 of a proposal to authorise a localised fishery for the invasive Chinese mitten crab (*Eriochier sinensis*) in part of the River Thames estuary.

4.1.18 United States

The important news for the Northwest Atlantic was that no new invasions of non-native species were reported in 2012. Several species identified in previous reports are showing major range expansions, including the alga *Heterosiphonia japonica,* the bryozoan *Tricellaria inopinata,* and the shrimps *Palaemon elegans and Palaemon macrodactylus*. Some of these species may have been present earlier than first reported given their abundance based on the recent sightings, but more studies need to be done to confirm this and/or that multiple introductions occurred. The alga *Gracilaria vermiculophylla* has been reported as present in multiple locations based on preserved specimens. One warm water species, the tubeworm *Hydroides elegans* has persisted for a second year in a lagoon (Eel Pond) on Cape Cod (Woods Hole), Massachusetts. Summer 2013 field work is planned to determine if this southern serpulid has survived for a third year in New England. Finally, the European sea anemone *Sagartia elegans* may have disappeared from the only location where it was found in a marina in Salem, Massachusetts.

4.2 Term of Reference b)

Continue verifying selected datasets of the newly developing database on marine and other aquatic organisms in European waters with the ultimate goal to make it available online. This activity will mostly be carried out intersessionally and take several years (ToR lead Sergej Olenin).

Summary

AquaNIS is an online information system on the aquatic Non-Indigenous Species (NIS), and species which might be considered as NIS, i.e. cryptogenic species. The system stores and disseminates information on NIS introduction histories, recipient regions, taxonomy, biological traits, impacts, and other relevant documented data.

AquaNIS is developed as part of the EU funded project VECTORS (Vectors of Change in Oceans and Seas Marine Life, Impact on Economic Sectors, FP7/2007-2013). In addition to the data gathered within VECTORS, AquaNIS inherited and incorporated multiple NIS data collections from the earlier projects where the developers of this information system have participated, such as: EU Concerted Action "Testing Monitoring Systems for Risk Assessment of Harmful Introductions by Ships to European Waters"; EU FP6 and FP7 projects ALARM, DAISIE, IMPASSE, MEECE; European Census of Marine Life (2009-2010), Baltic Sea Alien Species Database as well as ICES WGITMO and WGBOSV.

AquaNIS seeks to ensure the long-term maintenance and reliability of the database by continuous update and scientific validation of its data. Currently, the system contains data on more than 1200 NIS introduced to marine, brackish and coastal freshwater of Europe and neighbouring regions, but may be extended to include data on marine organism introductions to the East coast of North America and other parts of the World.

WGITMO suggests the newly established information system on Aquatic Non-Indigenous Species (AquaNIS), which is still in many aspects under development, to be used not only in ICES whenever alien species information is required (e.g., for ecosystem overviews or regional ecosystem assessments), but also promote the database for stakeholders and policymakers, like OSPAR and HELCOM.

AquaNIS, its aims and origin

AquaNIS is an online information system on the aquatic Non-Indigenous Species (NIS), and species which might be considered as NIS, i.e. cryptogenic species. The system stores and disseminates information on NIS introduction histories, recipient regions, taxonomy, biological traits, impacts, and other relevant documented data (Figure 4.2.1).

The system is freely available online at **www.corpi.ku.lt/databases/aquanis**.

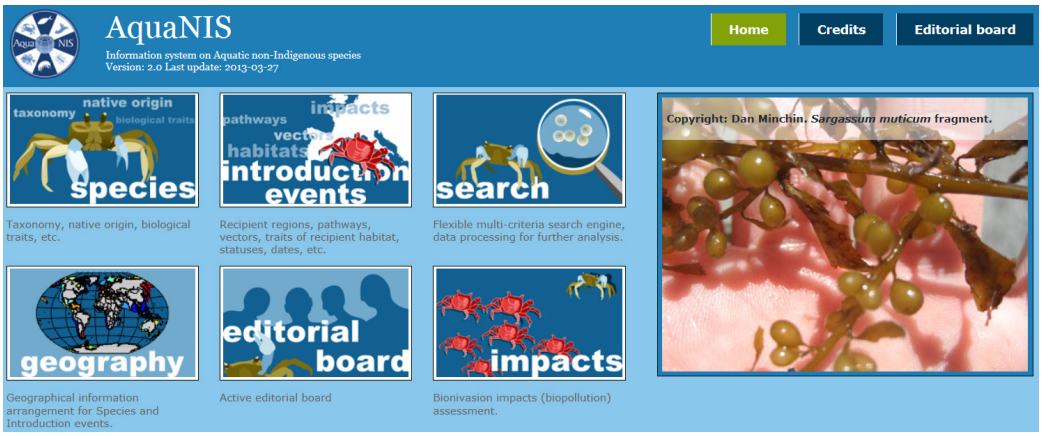

Figure 4.2.1. Front page of AquaNIS. Version 2.0. Assessed at 2013-03-27

AquaNIS is developed as part of the EU funded project VECTORS (Vectors of Change in Oceans and Seas Marine Life, Impact on Economic Sectors, FP7/2007-2013). In addition to the data gathered within VECTORS, AquaNIS inherited and incorporated multiple NIS data collections from the earlier projects where the developers of this information system have participated, such as:

- EU Concerted Action "Testing Monitoring Systems for Risk Assessment of Harmful Introductions by Ships to European Waters" (1997-1999)

- EU FP6 Integrated Project ALARM "Assessing Large-scale environmental risks with tested methods" (2004-2009)
- EU FP6 project DAISIE "Delivering Alien Species Inventory for Europe" (2005-2008)
- EU FP6 project IMPASSE "Environmental impacts of invasive alien species in aquaculture" (2006-2008)
- EU FP7 project MEECE "Marine Ecosystem Evolution in a Changing Environment" (2008-2012)
- European Census of Marine Life (2009-2010)
- Baltic Sea Alien Species Database (1997-2012)
- ICES WGITMO and WGBOSV

AquaNIS seeks to ensure the long-term maintenance and reliability of the database by continuous update and scientific validation of its data. The experience gained in the above projects, especially in DAISIE, IMPASSE and the Baltic Sea Alien Species Database was used to develop AquaNIS. It differs substantially from existing NIS information sources in its organizational principles, structure, functionality, and output potential for end-users. The system is designed to assemble, store and disseminate comprehensive data on NIS, and in addition provides users with meaningful information for evaluating progress towards NIS management.

Structure of AquaNIS

AquaNIS has flexible, easily extendible structure, where new data blocks and functional modules may be included as necessary. Presently all data is organized in four interrelated data blocks: INTRODUCTION EVENTS, SPECIES, GEOGRAPHY and IMPACTS (Figure 4.2.2). Data within blocks are grouped according to attributes (Development traits, Pathways and vectors, etc.).

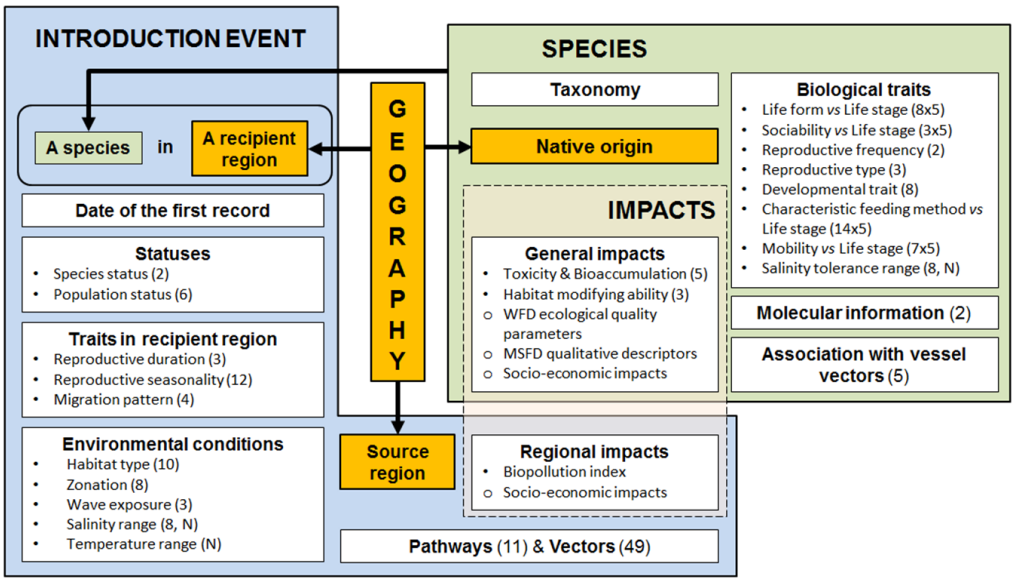

Figure 4.2.2. Present structure of AquaNIS: two main (INTRODUCTION EVENTS and SPECIES), one supporting (GEOGRAPHY) and one composite (IMPACTS) data blocks and attributes within them. Numbers in brackets indicate how many predefined values (arranged in drop-down menu) are included in each attribute; "N" means that numerical values are entered; "x" indicates a matrix of possible choices. Attributes indicated by open bullet points are under development.

The INTRODUCTION EVENTS data block contains records of introduction events. The latter is defined as a species introduction into a recipient region. Here, the recipi-

ent region is a country or a country area within a Large Marine Ecosystem (LME, *sensu* Sherman and Duda, 1999) or LME sub-region. The date of the first record indicates when a species presence was noticed in a region according to a different level of certainty (year, decade or century) (Figure 4.2.3).

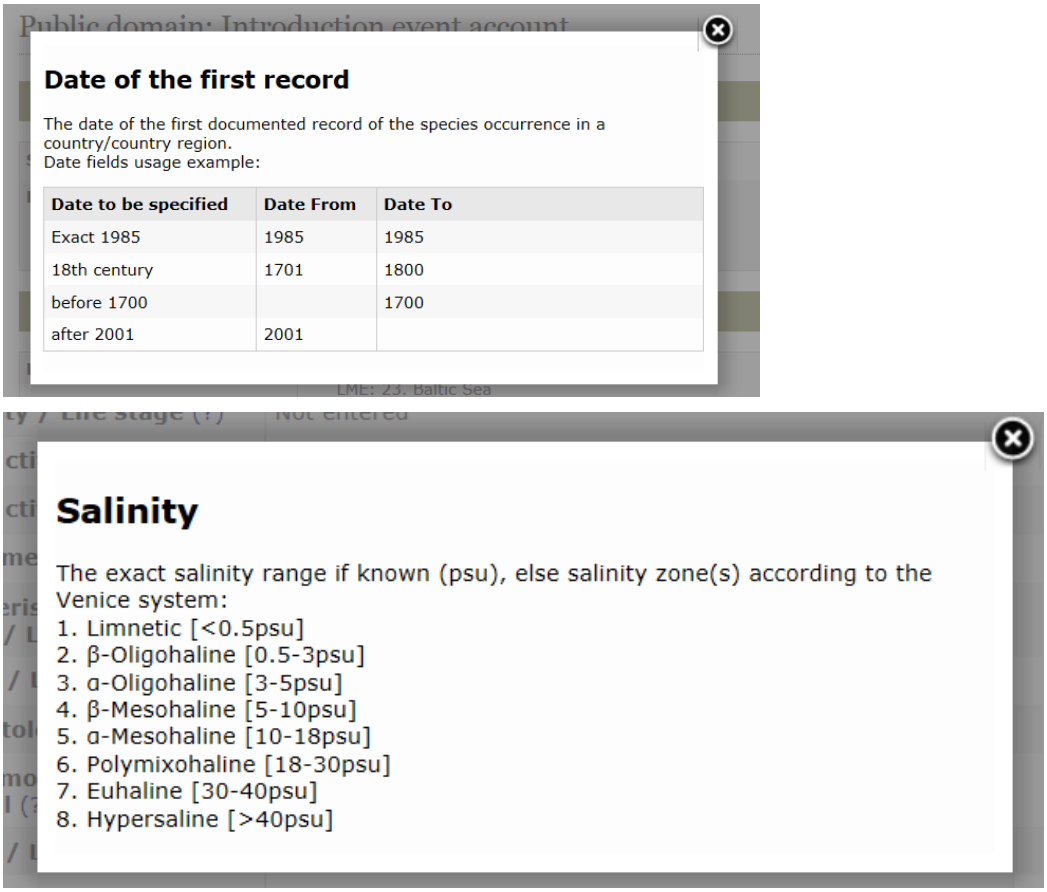

Figure 4.2.3. Above: explanation on how to enter the date of the first record with different level of certainty. Below: explanation on how to enter salinity data. These and other values used in different attributes are briefly explained in pop-up notes in all data blocks of AquaNIS.

"Species status" refers to either a species being non-indigenous or cryptogenic defined as:

- Non-indigenous species (synonyms: alien, exotic, non-native, introduced) are species, subspecies or lower taxa introduced intentionally or accidentally by a human-mediated vector outside of their natural range (past or present) and outside of their natural dispersal potential.
- Cryptogenic species are such species which cannot be reliably demonstrated as being either non-indigenous or indigenous (*sensu* Carlton 1996).

While registering an introduction event, information on the population status is provided and classified according to three levels of certainty, Low, Medium and High (Minchin *et al*. 2009; Olenin and Minchin 2012). Following the introduction the population status may change over time, the NIS may spread to other localities within the recipient region and appear at different level of abundance. Recent information on the population status should be updated.

The system requires indicating the pathway(s) and vector(s) for each NIS introduction, where:

- A pathway is the route a NIS takes to enter or spread through a nonnative ecosystem (e.g. vessels). Each pathway may have a number of vectors.
- A vector is a transfer mechanism and is the physical means by which species are transported from one geographic region to another. More than one vector within a pathway may be involved in a transfer of species.

In total there are 11 pathways and 49 related vectors which a user may select from a drop down menu. The variety of pathways and vectors included in AquaNIS is based on extensive literature reviews (Minchin *et al*. 2009; Olenin and Minchin 2012). It is also important to indicate the level of certainty assigned to a particular pathway or vector (Table 4.2.1.).

Table 4.2.1. Levels of certainty for Pathways and Vectors in AquaNIS

Level	Criteria
Direct evidence	The species was actually found associated with the specific vector(s) of a pathway at the time of introduction to a particular locality within a country/country region.
Very likely	The species appears for the first time in a locality where a single pathway/vector(s) is known to operate and where there is no other explanation that can be argued for its presence except by this likely pathway/vector(s).
Possible	The species cannot be convincingly ascribed to a single pathway, but is known to be introduced by this pathway(s) elsewhere.
Unknown	Invasion of a given alien species cannot be clearly explained.

The INTRODUCTION EVENTS data block contains also information on the source region, i.e. the area the species was introduced from to the recipient country/country region. Depending on the information availability may be ascribed to a particular locality (e.g. port), a country, a LME or a larger Ocean region. It is important to note that in many cases the source area will be not the same as the area of native origin which is defined in the SPECIES block of the database. Other data included in this data block covers traits of a NIS in the recipient region and environmental conditions, such as "Reproductive duration" (3 predefined values), "Reproductive seasonality" (in months of a year), "Migration pattern" (4), "Habitat type" (10), "Wave exposure" (3), "Salinity" and "Temperature" range in the recipient region.

The SPECIES data block provides general information for each NIS, including its taxonomy, biological traits (such as reproductive type, characteristic feeding method, mobility, etc.), native origin and availability of molecular information (Figure 4.2.1). Taxonomy is based on the updated accounts in major global organism-specific databases such as FishBase (www.fishbase.org) and WoRMS (www.marinespecies.org). Native origin refers to a region where a species originates from. It can be indicated according to its biogeographical range at different levels of scale from ocean to a LME/country. That also contains data on a NIS association with "Vessel" vectors (Table 4.2.2).

Table 4.2.2. A NIS association with "Vessel" vectors, i.e. the actual evidence of a NIS being found in samples in a particular vector from any world region. Requires reference to a peer-reviewed study, report or personal communication

Anchor and anchor chains	Organisms found on anchors, anchor chain or within attached sediments, including anchor chain lockers.
Ballast water	Ballast water means water with its suspended matter taken on board a ship to control trim, list, draught, stability or stresses of the ship.
Biofouling	Biofouling means the accumulation of aquatic organisms such as micro-organisms, plants, and animals on surfaces and structures immersed in or exposed to the aquatic environment. Biofouling can include microfouling and macrofouling. Macrofouling means large, distinct multicellular organisms visible to the human eye such as barnacles, tubeworms, or fronds of algae. Microfouling means microscopic organisms including bacteria and diatoms and the slimy substances that they produce. Biofouling comprised of only microfouling is commonly referred to as a slime layer.
Sea chest	The sea chests are cavities (an opening with protection grid) at the bottom side of the ships' hull (an opening for pumping in and out water for, e.g., ballasting, firefighting) where aquatic organisms may settle and be transported.
Tank sediments	Matter settled out of ballast water within a ship.

The GEOGRAPHY data block provides information on the native origin of a NIS with a hierarchy of region scales ranging from oceans to LME's (or country, if known). Recipient and source regions have a finer tuned scale of sub-regions of LME's, countries and localities (Figure 4.2.3). Additional sea regions, not covered by the LME system (NOAA 2012), are included to complete geographical coverage of marine and coastal regions (Figure 4.2.4). All countries are linked to relevant LMEs or LME Sub-regions. This provides combinations "country + LME" or "country + LME sub-region" for different coasts and for a country that borders different seas, e.g.: "Germany within the LME 23 Baltic Sea", "Italy within the Adriatic Sea, a sub-region of LME 26 Mediterranean Sea". The arrangement enables entering and retrieving information at different user defined geographic scales.

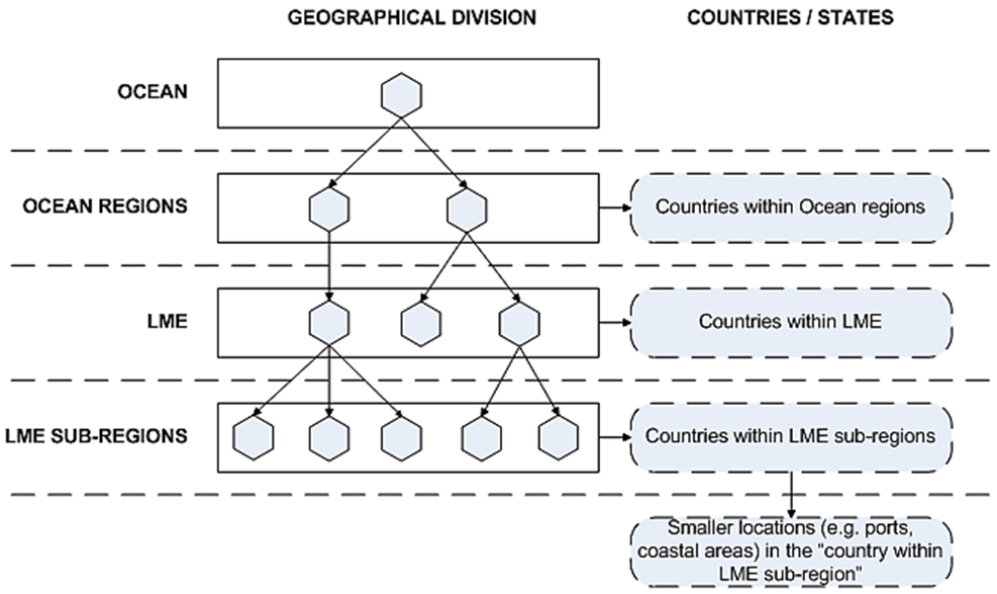

Figure 4.2.4. The principal scheme of the GEOGRAPHY data block. LME – Large Marine Ecosystem (NOAA 2012). LME sub-region – a relatively large, geographically well-defined sea area within an LME, e.g. Adriatic Sea within the LME 26 Mediterranean Sea. The list of countries is adopted from the UN Population Division's quinquennial estimates and projections (United Nations, 2012).

IMPACTS data block. This is a composite data block which includes information at two levels related to NIS impacts: one contains the global level (various environmental and socio-economic effects documented in the peer-reviewed literature from any world location) and the other one is the introduction event based on region-specific knowledge (such as BPL index, *sensu* Olenin *et al*., 2007). This data block is especially important for bioinvasion management and risk assessments.

Data input and output functions

Entries throughout AquaNIS are supported by explanations of terms and guidance is provided for data input throughout logically separated data attributes. Drop down values, designed to reduce possible human error, enable rapid entry. Also free text fields may be used to store references and comments. Since data may be entered and modified by different data suppliers all changes are stored in a separate "track-changes" table. Although, AquaNIS contains more than forty attributes, but not all of these are likely to be equally saturated with data. The system provides an opportunity to check data completeness for each attribute separating between "unknown" and "not entered" data. Such check is recommended before making any analysis.

The search function retrieves listings or matrices using interrelated data tables of any combinations of attributes, for example, biological traits, introduction date, pathways, regions, habitat type, etc. Listings and matrices can be exported and downloaded to Excel files. This function greatly facilitates the dimension of the database for specific needs (e.g. Primer, MatLab, etc)

Data providers and data quality

Data on NIS is provided by contributors who are the registered AquaNIS users. The privileges of a data provider are to use:

- information stored in the "Species" data block, such as NIS taxonomy, biological traits, native origin;
- information stored in the "Introduction event" data block for the Large Marine Ecosystem(s) (LME) they are enabled to use;
- technical services, such as search and comparison functions, export to Excel, provided by AquaNIS;
- opportunity to relate data within AquaNIS with bioinvasion impact (biopollution index) assessments using BINPAS (www.corpi.ku.lt/binpas).

In order to manage the information system effectively and to protect each contributor's right to use his/her data before it is generally released to the public, the contributors should comply with following conditions:

- each contributor is free to distribute (within and without AquaNIS) his/her own data;
- each group of contributors, responsible for a particular LME, may, on agreement, release their data for public use after notifying the Editorial Board;
- permission is required for use of data which belong to other contributors. Data is not to be used and released without written approval by the contributing author. If there is doubt about the actual contributor of the data then all the possible authors should be consulted.

The Development Team is responsible for the designing and maintaining of AquaNIS. Currently the team consists of:

- Sergej Olenin (coordinator; CORPI, Lithuania),
- Aleksas Narščius (database manager; CORPI, Lithuania),
- Bella Galil (Israel Oceanographic and Limnological Research, Haifa, Israel),
- Stephan Gollasch (GoConsult, Hamburg, Germany),
- Agnese Marchini (Dep. of Earth and Env. Sciences, University of Pavia, Pavia, Italy),
- Dan Minchin (Marine Organism Investigations, Ballina, Killaloe, Co Clare, Ireland),
- Anna Occhipinti-Ambrogi (Dep. of Earth and Env. Sciences, University of Pavia, Pavia, Italy),
- Henn Ojaveer (Estonian Marine Institute, University of Tartu, Pärnu, Estonia)
- Anastasija Zaiko (CORPI, Lithuania).

The AquaNIS Editorial Board is responsible for gathering, editing, and validating data. New members that have a special knowledge of a region/country or of a particular taxonomic group(s) will be invited by the chief editor to become contributors and/or Editorial Board members, following general agreement of the Editorial Board. Currently the Editorial Board includes: S. Olenin (chief editor), D. Minchin, A. Zaiko, B. Galil, S. Gollasch, A. Occhipinti-Ambrogi, M. Lehtiniemi and H. Ojaveer.

Recent data availability and perspectives

AquaNIS seeks to ensure the long-term maintenance and reliability of the database by continuous update and scientific validation of its data, making it useful for research and practical for management. The Database developers and Editorial board believe that the content will be of value in relation to the management of the EU Water Framework Directive, The Marine Strategy Framework Directive, Risk Assessment measures for different pathways, especially shipping and aquaculture.

AquaNIS is intended as a living database, all entered data is checked as far as is possible to current taxonomic status and references are supplied to qualify each of the datasets. All of the submitted data is to the best of the Editorial Board knowledge accurate. However, the Editorial Board does not accept any legal responsibility as to how the information derived from this database is interpreted or used.

Currently, the system contains data on more than 1200 NIS introduced to marine, brackish and coastal freshwater of Europe and neighbouring regions, but may be extended to include data on marine organism introductions to the East coast of North America and other parts of the World. At present the Baltic Sea dataset is opened for public access. The rest will be gradually opened for free access in modules according to each state of completion.

Literature cited

Carlton J.T., 1996. Biological invasions and cryptogenic species. Ecology, 77(6), pp. 1653-1655.

NOAA, 2012. Large Marine Ecosystems of the World (online). <http://www.lme.noaa.gov> (accessed 20.09.12).

Olenin, S., Minchin, D., Daunys, D., 2007. Assessment of biopollution in aquatic ecosystems. Marine Pollution Bulletin, 55(7-9), pp. 379-394.

Minchin, D., Gollasch, S., Cohen, A.N., Hewitt, C., Olenin, S. 2009. Characterizing vectors of marine invasions, In: Rilov, G. and Crooks, J. (Eds.), Biological Invasions in marine ecosystems: Ecological, management and geographic perspectives. Ecological Studies 204, Springer, Heidelberg, Germany, 109-115

Olenin S and Minchin D (2011) Biological Introductions to the Systems: Macroorganisms. In: Wolanski E and McLusky DS (eds.) Treatise on Estuarine and Coastal Science, Vol 8, pp. 149–183

Sherman K., Duda A.M., 1999. An ecosystem approach to global assessment and management of coastal waters. Marine Ecology Progress Series 190, pp. 271-287

United Nations, 2012. UN Population Division's quinquennial estimates and projections, Department of Economic and Social Affairs (online). <http://www.un.org/esa/population/> (accessed 20.09.12).

4.3 Term of Reference c)

Continue identification and evaluation of climate change impacts on the establishment and spread of non-indigenous species. This activity will mostly be carried out intersessionally and take several years (ToR of joint interest with WGBOSV; ToR lead Judith Pederson).

Addressing of this Terms of Reference should be based on, amongst other resources, the recent overview on climate impacts on alien species in the recent ICES Cooperative Research Report (Pederson *et al*., 2011). It includes both related literature review and original information submitted to WGITMO in national reports by the following major sections:

- Colonization impacts
- Climate change in the North Atlantic
- Impacts of climate change on NIS
- Assigning confidence levels of climate change affecting biota:
  - ✓ High confidence (e.g., the oyster *Crassostrea gigas*)
  - ✓ Medium confidence (the green alga *Codium fragile*, the clam *Ruditapes philippinarum*, the snail *Crepidula fornicata*, the ascidian *Styela clava*)

- ✓ Low confidence (the crab *Eriocheir sinensis*, the algae *Asparagopsis armata*, *Sargassum muticum*, and *Undaria pinnatifida*, and the salt marsh grass *Spartina anglica*)
- Community- and regional level impacts
- Predicted impacts
- Future directions

There are several additional potential approaches on how to summarise and analyse climate impacts on alien species. For example, one approach is to base the analysis on a unified framework of biological invasions as described by Blackburn *et al*. (2011). Blackburn *et al*.'s model is shown in Figure 4.3.1**.** The framework (based upon extensive earlier literature describing the "invasion process") consists of identifying various stages and barriers in the progression of invasions, relative to potential management strategies. Under this approach, an analysis would ask how *each stage and barrier* may be influenced given climate change scenarios. For example, at the "Transport" stage (Figure 4.3.1.), there may be instances when temperature increases will either reduce successful dispersal (because passage conditions are too warm for survival for certain species) or increase dispersal (because conditions are now warm enough) -- and thus reduce or increase potential invasions.

Another approach, not mutually exclusive with a stage-based analysis, and under development by WGITMO, is to consider how climate change may, for example, alter the abundance of already-present species (whether native or introduced), and how these changes could, in turn, influence the number of future invasions through competitive or predatory processes.

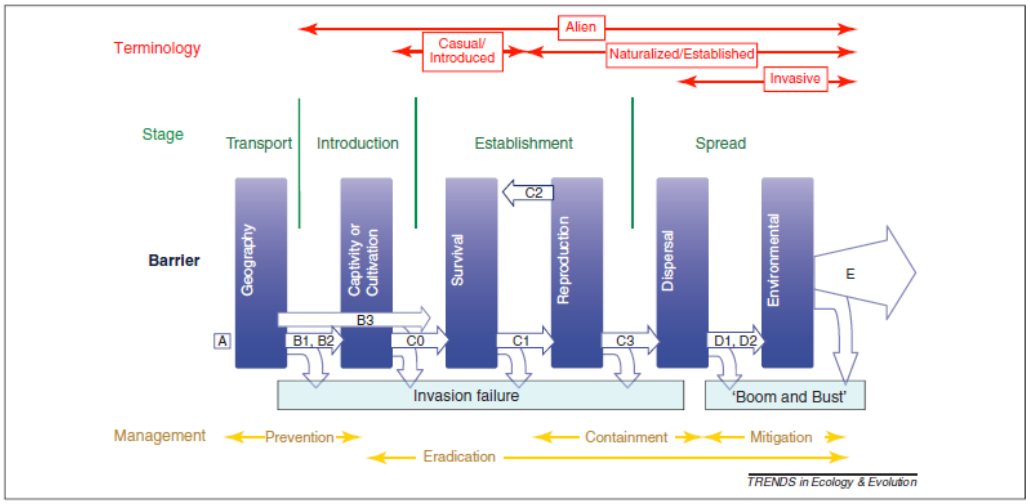

Figure 1. The proposed unified framework for biological invasions. The proposed framework recognises that the invasion process can be divided into a series of stages, that in each stage there are barriers that need to be overcome for a species or population to pass on to the next stage, that species are referred to by different terms in the terminology depending on where in the invasion process they have reached, and that different management interventions apply at different stages. Different parts of this framework emphasise views of invasions that focus on individual, population, process, or species. The unfilled block arrows describe the movement of species along the invasion framework with respect to the barriers, and the alphanumeric codes associated with the arrows relate to the categorisation of species with respect to the invasion pathway given in Table 1 (main text).

Figure 4.3.1. A unified framework for biological invasions (from Blackburn *et al*. 2011).

Important considerations in identifying and evaluating climate change impacts on the transport, release, establishment, and spread of non-indigenous species include appreciation of the number of potential variables involved. For example, under either of the above approaches, it may be, under certain circumstances, difficult to disentangle climate-driven impacts from multiple human-mediated impacts, such as changes in marine management practices, water quality changes due to nutrient in-

puts, or port and harbour developments. Due consideration should be paid to these variables that may confound correlation with climate change with other causations.

It is further important to bear in mind, that in addition to temperature, climate variability and change may cause changes in other marine abiotic physico-chemical properties, such as salinity, currents, oxygen content and ocean acidification. Recognizing this, it was agreed that the present analysis should focus on temperature effects, using changing thermal conditions as an *example* of climate change. Other climate-driven impacts on marine alien species invasions could and should be studied in future.

There is accumulating evidence that although global warming is a dominating tendency in various seas, some regions have become colder during past decades (due, for example, to increased coastal upwelling as a result of warming of adjacent land masses; Snyder *et al*., 2003) or there might be periodic short-term colder periods (Canning-Clode *et al*., 2011) within the generic temperature increase. These patterns should be taken into account while synthesizing climate impacts on alien species.

It was agreed that final draft manuscript on climate impacts on alien species will be produced intersessionally and results presented at WGITMO 2014 meeting. Further steps in investigating other climate-induced impacts will be discussed and agreed upon at the next year's meeting.

Literature cited

Blackburn, T. M., P. Pysek, S. Bacher, J. T. Carlton, R. P. Duncan, V. Jarosik, J. R. U. Wilson, and D. M. Richardson. 2011. A proposed unified framework for biological invasions. Trends in Ecology and Evolution 26: 333-339.

Canning-Clode, J., A. E. Fowler, J. E. Byers, J. T. Carlton, and G. M. Ruiz. 2011. 'Caribbean Creep' chills out: climate change and marine invasive species. PLoS ONE 6(12): e29657 [5 pages].

Pederson, J., N. Mieszkowska, J. T. Carlton, S. Gollasch, A. Jelmert, D. Minchin, A. Occhipinti-Ambrogi, and I. Wallentinus. 2011. Climate change and non-native species in the North Atlantic, pp. 174-190, in: P. C. Reid and L. Valdes, editors, ICES Status Report on Climate Change in the North Atlantic. ICES Cooperative Research Report No. 310, 262 pp.

Snyder, M. A., L. C. Sloan, N. S. Diffenbaugh, and J. L. Bell. 2003. Future climate change and upwelling in the California Current, Geophys. Res. Lett., 30(15), 1823, doi:10.1029/2003GL017647.

4.4 Term of Reference d)

Investigate and report on non-native species issues associated with artificial structures in marine environment (ToR of joint interest with WGBOSV; ToR lead Francis Kerckhof).

Non-native species issues associated with artificial structures in the marine environment (presentation given by **Francis Kerckhof**)

The number and different types of artificial hard substrates installed into marine environment is continuously increasing. All of them are directly associated with different types of human activities (maritime transport, coastal defence, aquaculture and energy production/transfer) and include, amongst others, coastal defences, artificial reefs, pipes, shipwrecks, anchored buoys, mooring blocks, commercial ships, leisure crafts, floating pontoons, fish cages and drifting buoys. While some of these activities extend back in time for centuries (like shipping, harbours and coastal defence), (renewable) energy production is a relatively more recent activity with clear intensification during recent decades extending also further off shore. The associated non-

native organisms may include the following species in the North Sea: *Crassostrea gigas*, *Balanus amphitrite*, *Undaria pinnatifida*, *Caprella mutica*, *Styela clava*, *Hemigrapsus sanguineus*, *Crepidula fornicata*, *Elminius modestus* and *Patella vulgata*. Some of the hard substrates migth create completely a new habitat in the marine ecosystem. For instance, wind turbine pilings create 3 different zones for epifouling organisms in the intertidal zone: i) intertidal + splash zone (*Telmatogeton japonicus*); ii) low intertidal – shallow subtidal: (*Barnacles – Jassa – Mytilus* zone); and iii) an extensive subtidal zone. In particular, the number of non-indigenous species proved to be high in the intertidal zone, a habitat that until recently did not exist in the Southern North Sea. Importantly, wind turbines are often found in sandy environments and these artificial hard structures can act as a stepping stones for non-indigenous biota. One of the ongoing processes in several formerly sandy and muddy areas is 'oysterification', incl. by the Pacific oyster *Crassostrea gigas* in the North Sea. Oil and gas platforms are also important artifical hard substrates, also colonised by many introduced species. After these structures will not be used anymore, pragmatic question arises as to whether to start decommissioning these structures or not. Aquaculture installations include several devices and can be a target of substantial biofouling by a variety of introduced species. One of the most recent artificial hard substrates to be created in the coastal waters of Belgium is an 'energy island'. The issue of artifical substrates is not only relevant to introduced species, but also contributes to the overall change of marine biodiversity. Thus, in conclusion, increased availability of artificial hard substrate promotes: i) spreading of southern species, ii) establishing of introduced species; iii) strengthening of the strategic position of the populations and stepping stone effect.

Assessing the risk of transporting non-native species to Scotland via biofouling on vessels (by **Lyndsay Brown).**

A Scottish Government funded research project investing the biofouling present on vessels that dock in Scottish ports was conducted by Marine Scotland Science between 2009-2012. The aim of the project was to survey vessels in dry dock, collect samples of biofouling from niche areas and to use these data to assess the risk that particular vessels and particular vessel routes have of introducing non-native species into Scottish waters. Three dry docks in Scotland were visited during the project, Dales dry docks in Aberdeen and Leith on the east coast and Garvel Clyde dry dock in Greenock on the west coast. Six dive surveys were also conducted in Aberdeen and Peterhead harbours but these were not continued with due to logistical issues. A walk-round of each vessel was conducted before sampling to identify areas of fouling and to assign a fouling rank according to Floerl *et al*. (2005). This was not always possible due to various factors such as one half of the vessel having already been washed down prior to re-painting and not being able to walk round the whole vessel due to dock equipment and other work being carried out. Samples were collected using paint scrappers, preserved in formalin and stored in tubs. Questionnaires were also filled out for each vessel which provided information on voyage history, types of anti-fouling paint used and maintenance work. Formalin was rinsed off and samples would then be sorted into groups and identified using relevant literature. Identifications were quality checked by experts from the UK and Belgium. 29 dry docked vessels were surveyed in total, samples were collected from 24 and 5 were found to have no fouling apart from a very light layer of biofilm around the hulls which was not sampled. The majority of vessel types surveyed were supply vessels servicing the oil industry in the North Sea followed by safety/standby vessels. A smaller number of tugs and Western Isles ferries were also sampled. All vessels sampled had been operating within the North Sea apart from one vessel that had been in the Southern

Ocean for roughly 5 months before returning to the North Sea 4 months before docking. A wide range of organisms were collected and non-native species previously recorded in the UK were identified. No new non-native species were observed. The majority of fouling consisted of barnacles and mussels. Non-native species of barnacle identified were *Balanus amphitrite* from the vessel that had previously been in the Southern Ocean and *Austominius modestus*. Other non-native species observed were the amphipods *Caprella mutica* and *Jassa marmorata*. Other common species present in the fouling included *Mytilus edulis*, *Conchoderma auritum*, *Lepas anatifera*, *Nereis pelagica, Lepidonotus squamatus*, *idotea pelagica* and a range of encrusting bryozoans (*Electra pilosa*,*Conopeum reticulum*, *Lichenopora verrucaria, Membranipora membranacea* and *Cryptosula pallasiana*). Algae was also collected but no further identification was made. In order to fully assess the risk of introductions of new non-native species it is likely that a wider range of vessels would be required and would involve work targeting international vessels. Final data analyses and write-up are in progress and a manuscript should be ready to send for peer review shortly.

Discussion

Biofouling of artificial structures appears to be a truly global issue. Several types of artificial hard-substrate installations have been created for decades both in ICES and non-ICES waters, such as oil/gas platforms, pipelines, port facilities and wind turbines. Movable structures (e.g. oil platforms) can certainly act as vectors, while non-mobile structures (e.g. wind turbines) may facilitate invasions through 'stepping stone' transfers or when structures are decommissioned. Several important questions, which need further attention, were identified:

- Most likely, the artificial hard structures are generally not covered with any specific material (e.g., paint) which reduce/prevent biofouling. Therefore, the question arises how fouling can be reduced and whether there are good substances which reduce biofouling. This is perhaps a technology issue to develop suitable anti-fouling coating materials.
- There is also a role for national governments to play in this process as technical solutions need to be taken and finding ways and options on how governments and industry can/should work together is important.
- What is the local/sub-regional/regional impact of these installations on marine ecosystems and their components? Is it just biodiversity change or also related to system productivity and therefore also provision of ecosystem goods and services?
- What happens when these hard structure installations are not needed anymore? Will these be retained at sea or decommissioned? If decommissioned, who pays for decommissioning?
- Management baselines need to be identified. These require pre-installation investigations on marine ecosystems and their impacted sub-components (like taxonomic composition, biodiversity, productivity, etc.). If such studies are lacking, the baseline studies need to carry out as soon as possible and baselines to be established soon. Another option would be to use expert knowledge from other non-impacted/reference areas.

Because the expertise available for the meeting was relatively limited, but because alien species biofouling of artificial structures is an important and global issue, joint PICES/ICES/CIESM Theme Session for ICES ASC 2014 should be proposed. Also, the suggestion was to continue dealing with this issue at WGITMO 2014 meeting and try to get attendance of wider group of experts.

4.5 Term of Reference e)

Continue work to address MSFD D2, incl. by developing generic criteria and proposing guidance for alien species monitoring approaches to assist EC member states in designing their national alien species monitoring programs (ToR lead Maiju Lehtiniemi).

HELCOM port biological sampling guidelines (**Maiju Lehtiniemi**).

HELCOM ALIENS2- project "Study on biological survey protocols and target species selection" aimed at creating a harmonized protocol for sampling in ports, producing a target species list for the Baltic Sea and developing an online tool for decision making in order to grant A-4 exemptions under the Ballast Water Management Convention (BWM Convection).

The ALIENS 2 project started in December 2011 and ended in the end of 2012. The project concentrated on three major themes 1) survey protocol, 2) target species selection and 3) establishing the structure for data collection and designing a decision support tool. The sampling protocol was developed and tested in three ports (2 in Finland, 1 in Estonia) during 2012 and modified based on the experiences and comments gathered. Sampling includes pathogens, phyto- and zooplankton, benthos, mobile epifauna and biofouling. In addition, statistics on port activities and data on abiotic factors is collected. The data gathered is uploaded to a database, which serves as a platform for the developed decision making tool. To be able to make proper risk assessments for determining low and high risk routes in ship traffic in the Baltic Sea a target species list was compiled. This list was made based on existing lists of observed non-indigenous species in the Baltic Sea and the potential species that could be introduced in the future. These lists were modified based on the information from other countries' target species lists, databases and literature. A preliminary target species list of 39 invasive non-indigenous species was made to be further developed and used in the decision making tool for granting exemptions.

Canadian example on monitoring of alien species (by **Cynthia McKenzie**).

The Canadian government through programs delivered by the Department of Fisheries and Oceans and its Aquatic Invasive Species Programme (AIS Research, Risk Assessments and Monitoring) has been the lead department in monitoring aquatic invasive species in Canada since 2005. The presentation outlined the monitoring priorities 1) early detection, 2) prevention and 3) rapid response and standardized methodologies for this monitoring program in Atlantic Canada. Successful monitoring programs in the Atlantic Zone (Newfoundland, the Maritimes (Nova Scotia and New Brunswick), the Gulf (parts of New Brunswick and Prince Edward Island) and Quebec) have documented AIS early species detections, distributions and spread and identified many habitat types impacted

The methods and protocols used for monitoring of AIS, and conducting targeted species and ecosystem assessments has been standardized between Regions to enable direct comparisons and data exchange and inclusion into the national AIS database. Data gathered from surveys and monitoring has immediate AIS management implications as it is used by the fishing and aquaculture industries and provincial and federal fisheries management.

Targeted Early Detection and Monitoring Biofouling AIS and Their Spread in High Risk Ecosystems (1) Targeted Monitoring in areas identified as: (a) "at-risk" by new invasions, based on the type of ecosystem, or vulnerability based existing risk factors for AIS introduction, and (b) AIS infested areas with potential for spread. The collection of biological and ecological data present opportunities to learn more about the

ecology and impact of invasions, as well as understanding the temporal and spatial dynamics of biofouling. Environmental parameters (temperature, salinity, oxygen) are monitored. (2) A Collector Comparison Study was initiated to test the efficacy of several designs of monitoring collectors currently in use. One new monitoring collector, as well as two genetic (biotechnological) screening tools will be piloted in locations free of tunicate infestations and with new/low tunicate infestations. Data generated will determine the best collector type and/or method to detect new/low and high tunicate infestations. (3) A database on recreational and fishing boat (vectors to better monitor) was initiated within the Atlantic zone.

Early Detection and Monitoring of the European Green crab: Population Densities and Biodiversity The methods used for the monitoring of green crab were standardized between regions to enable direct comparisons and data exchange. Spatial and temporal variations will be assessed at different scales. The program includes three elements to accurately determine population density and spread of the invasive green crab: (1) Trapping of adult and juvenile crabs using standardized traps. The trapping standard will be Fukui fish traps (12 mm mesh) currently being used by all regions in the zone. Analysis and measurements of the specimens was standardized and data templates provided. Environmental data was collected, analysed and collated during monitoring at each site. By-catch was recorded to provide information on biodiversity in areas of green crab invasion. (2) Beach seines and coastal surveys were used when possible to sample green crabs in inshore and beach areas.(3) Green crab population densities are assessed and estimated using a standard mark recapture method where possible.

Part C: Rapid Response and Assessments Three project activities are conducted based on type of response and time required: (1) Targeted Species Assessments/Confirmations. Short-term investigations (< 1 day) are conducted in response to calls reporting new invasions, or to confirm specific requests to inform a management question or process. A variety of techniques are employed (underwater camera and viewers, snorkeling, diving, scraping of fouling surfaces, quadrate, genetic tools and benthic sampling), and environmental parameters. (2) Species Assessment/Follow-up Monitoring. AIS invasions can be short-lived or persistent, so it is important to provide follow-up in areas where a new species is confirmed, to determine if its establishment has been successful over the course of an annual cycle or beyond. These studies involve repeating techniques used in Part (1), with additional sampling and monitoring of the ecosystem in time and space. (3) Targeted Ecosystem Assessment. These longer-term (2-4 day) assessments involving a large, multi-agency team of investigators are conducted in high-risk ports and in response to detection of high risk species (eg. *Ciona intestinalis*) to provide baseline physical, ecological and multi-trophic level community data. These data is used to evaluate the impact by invasive and potential recovery of infested ecosystems. Information derived from any of the three levels of sampling may be used as input to Risk Assessments for the AIS, and if warranted, the development of a further Rapid Response Plan.

Estonian example on monitoring of alien species **(b**y **Henn Ojaveer**).

Although marine and fisheries monitoring has been in place in the country for decades already (some of the datasets originate from the early 1950s), and these have allowed to create a long-term perspective on several marine alien species in the country, the specifically dedicated and governmentally funded alien species monitoring program started in 2010. The overarching strategy of the aliens monitoring program is to combine and summarise alien species data and information from all possible

different sources, by incl. dedicated specific alien species sampling, data obtained from other types of marine and fisheries monitoring, and from research surveys and fundamental research programs. The alien species monitoring consists of three major sub-components: 1) monitoring of high risk areas of primary invasions; 2) tracking long-term performance of selected most important alien species and 3) evaluation of ecological and socioeconomic impacts caused by alien species. As a new activity, HELCOM port monitoring guidelines were tested and further developed in the largest port in the country – Port of Tallinn in 2012. The applied methodology generally follows HELCOM monitoring guidelines and targets mesozooplantkon, macrozoobenthos and fish (Anon. 2013). Importantly, all data and annual reports are freely available, though unfortunately written in Estonian only.

Monitoring of high risk areas of primary invasions – vicinity of ports – has been conducted in Port of Tallinn (since 2010) and Port of Sillamäe (since 2012), both located in the Gulf of Finland. Several stations were sampled in port vicinity and also in more distant localities called also as reference sites. Long-term datasets describing abundance/biomass dynamics of the following eleven alien species have been established: the cirriped *Balanus improvisus,* the gibel carp *Carassius gibelio*, cladocerans *Cercopagis pengoi* and *Evadne anonyx*, the zebra mussel *Dreissena polymorpha*, the Chinese mitten crab *Eriocheir sinensis*, the amphipod *Gammarus tigrinus*, the polychaete *Marenzelleria neglecta*, the soft-shelled clam *Mya arenaria*, the round goby *Neogobius melanostomus* and the mud snail *Potamopyrgus antipodarum*. While fish and macrozoobenthos have been, with exception of the Chinese mitten crab and round goby, sampled in several stations generally once per year, data on parthenogenetically reproducing cladocerans have been considered representative with sampling frequnecy of twice per month (Ojaveer *et al*. 2011). Impacts caused by alien species have been obtained from dedicated research, mainly carried out through various fundamental research projects. The HELCOM port sampling is planned to be continued in coming years.

Discussion

In the previous WGITMO meeting (2012) the on-going monitoring programs that may give data on NIS were summarized and reviewed. Information was received from several ICES and non-ICES countries like Belgium, Canada, Finland, France, Estonia, Germany, Italy, Israel, Lithuania, The Netherlands, Spain, Sweden and UK. The compilation showed that data on presence/absence and on abundance/biomass are more often available while hot-spot areas for primary invasions – ports – neither invasion impacts are weakly or not monitored in most countries.

NIS monitoring should most importantly give data and information for early detection to design and execute eradication actions of invasive alien species. In addition, monitoring should give data for the EU MSFD reporting purposes for D2 (NIS) but also for biodiversity (D1) and food webs (D4) and also for IMO Ballast Water Management Convention (e.g. granting of exemptions). The monitoring should cover habitats and methods needed to detect a variety of NIS from different taxonomic groups and also take into account life cycle-related aspects (seasonal aspects and methods).

For MSFD, NIS data on distribution (presence/absence data, which could be partly obtained through rapid assessments), on abundance/biomass (NIS counts from community samples and individual measurements), on the ratio of NIS *vs*. native species (species counts of the whole community) and on impacts are needed. The problem is how to monitor impacts? The impacts NIS cause include changes in predator-prey relationships, in species dominance, in reproductive input and in habitats among others. These changes, in turn, cause changes in the communities. To be able to moni-

tor these changes it would optimal to have monitoring of the community in place already before the introduction. This is not always the case but monitoring of the community even after the introduction would help to follow the changes that the new NIS may cause.

For BWMC, NIS data for granting exemptions from the ballast water treatment are needed. In this context there is a need to know if harmful species are present in the source and/or destination harbors on the specific routes where ships may be exempted. For this purpose the data on presence/absence (rapid assessments could be used) and on abundance of invasive NIS, at least on a rough scale is needed.

Monitoring of NIS is also relevant for the EU Biodiversity Strategy and EU Strategy on Invasive Species.

Monitoring efforts and resources should be allocated between natural habitats (littoral, open sea, bottoms) for spread and changes in abundance and hot spot areas for new introductions: 1) harbours, ports, marinas, 2) structures (wind mills, mariculture sites, oil platforms, fish processing plants, piers etc.), 3) water intake pipes (industry) and 4) warm water discharge areas (e.g. nuclear power plants).

Identifying baselines is increasingly important in marine management as these are required to set management targets. This is essentially important for alien species invasions, as amongst others, helps to evaluate ecological impacts caused by NIS. If pre-invasion studies are unavailable (which is the case for several areas), the baseline should be set to the current situation and success of further management actions should be assessed against this baseline. Of utmost importance is to store the monitoring samples to the extent possible, as this allows to perform specific re-analysis of samples in case new alien species is introduced and/or check the stored samples for the existence of alien species which presence was previously unknown.

Communication with public seems to be essentially important both in terms of acquiring new information on presence and distribution of NIS, but also making them aware of any established NIS collection devices and gears (such as settling plates, fish and crab traps) at locations where easy access by wide public is possible and therefore these might be at risk to be potentially stolen and/or destroyed. Of specific interest for reporting purposes on NIS are boat owners, commercial/leisure fishers and port/marina managers.

It was agreed to do further work intersessionally and write scientific paper (with tentative title "Advancing monitoring of marine alien species", lead author Maiju Lehtiniemi) summarizing suggestions and designing generic guidance for NIS monitoring. The manuscript could have a following outline:

- Introduction
- Early detection and eradication
- Requirements of international policies, directives and legislative acts (incl. EU MSFD, IMO BWMC, EU Biodiversity Strategy and EU Strategy on Invasive Species)
- Monitoring categories:
    a. High-risk areas of new invasions (e.g. ports)
    b. Presence-absence monitoring
    c. Tracking spatio-temporal distribution of existing NIS
    d. Impacts (ecologial, socio-economic)

e. Public involvement/observations (fishers, boat owners, environmental groups etc.)

- Methodology

  a. Life-history considerations

  b. Species-specific approach

  c. Habitat representativeness (natural *vs*. man-made substrates/habitats; including most vulnerable habitats for invasions)

  d. Specific sampling methodologies (e.g., settling plates, molecular approaches, investigating marine/coastal debris/litter)

- Potential for cooperation with ongoing monitoring programs

  a. Marine biological/environmental monitoring (incl. consider adding new stations within the ongoing programs or taking additional samples from the already sampled stations)

  b. Fisheries data collection (incl. consider adding new stations within the ongoing programs or taking additional samples from the already sampled stations)

- Data format, reporting and database management

Literature cited

Anon 2013. Operational monitoring of Estonian coastal sea. Estonian Marine Institute, University of Tartu. Final report, Tallinn (in Estonian).

Ojaveer, H.; Kotta, J.; Põllumäe, A.; Põllupüü, M.; Jaanus, A.; Vetemaa, M. (2011). Alien species in a brackish water temperate ecosystem: annual-scale dynamics in response to environmental variability. Environmental Research, 111(7), 933 - 942

4.6 Term of Reference f)

Coordinate reporting of nonindigenous pathogens affecting mariculture with the relevant ICES expert group(s) and establish a mechanism for annually exchanging relevant information (ToR lead Cynthia McKenzie)

Mariculture/Aquaculture Introduction and Transfer Protocols in Canada **(by Cynthia H McKenzie and Geoff Perry**)

The Canadian National Code on Introductions and Transfers of Aquatic Organisms protects freshwater and marine ecosystems while encouraging responsible use of aquatic resources. The process is consistently adopted across federal, provincial and territorial jurisdictions in the country. The legislative basis for this regulation is based on the Health of Animals Act and the Fisheries Act in coastal provinces and territories and provincial legislation in inland provinces. The Canadian Council of Fisheries and Aquaculture Ministers approved the code in 2003 and is undergoing a review in 2013. The process is used to evaluate and minimize risk of (1) harmful alterations to natural aquatic ecosystems; (2) deleterious genetic changes in indigenous fish populations; and (30 potential introduction and spread of pathogens and parasites that might accompany aquatic organisms being moved.

The Introduction and Transfer Code regulates release or transfer of aquatic organisms to fish rearing facilities or fish habitat. The responsibility is shared between two federal departments: DFO (Department of Fisheries and Oceans) – ecological and genetic risks and CFIA (Canadian Food Inspection Agency) - prevents introduction and

spread of disease. The Minister (DFO) may issue an I&T license if the release or transfer of the fish would be in keeping with the proper management and control of fisheries; the fish do not have any disease or disease agent that may be harmful to the protection and conservation of fish; and the release or transfer of the fish will not have an adverse effect on the stock size of fish or the genetic characteristics

Fisheries Act Fishery (General) regulations prohibits "transfer of any live fish to any fish rearing facility or to release live fish into any fish habitat" unless authorized by a license. Fish Health Protection regulations permit salmonid movements between provinces to producers for suppliers possessing a Fish Health Certificate. Fisheries Act section 78 - a person who contravenes the Act or regulations commits an offense.

Health of Animals Act and associated regulations controls imports and certifies exports and will apply to domestic movements in 2014. This prevents importation and spread of disease in accordance with international OIE standards. Each province and territory has an I&T Committee comprised of federal/provincial regulators, scientists, veterinarians, and other subject matter experts and is application-based. The I&T process does not apply to the following activities as these are covered by other legislative or policy frameworks live fish for food trade, aquarium and water garden trade, aquatic invasive species, "unintentional" movements of aquatic organisms, movements of genetically modified organisms. Federal regulations governing the possession and transport of AIS are currently being developed as they have been identified as a gap in the I&T process.

Discussion

It was discussed and agreed that information and data availability on nonindigenous pathogens affecting mariculture is relatively poor. While WGITMO national report requires submission of information on alien pathogens, it can be very rarely found in the report. The obvious reason for this is simply lack of information nationally. For instance, it is known that in the US, pathogens are checked/recorded in Massachusetts while other states have different requirements. Therefore, it was suggested to identify and explore other data sources unavailable currently to ITMO. The following other ICES expert groups were identified which could potentially hold relevant information: Working Group on Harmful Algal Bloom Dynamics (WHHABD), Working Group on Aquaculture (WGAQUA) and Working Group on Parasites and Diseases of Marine Organisms (WGPDMO). It was stressed, that transfer and interactions of both ways, i.e., transfer of pathogens from mariculture to the marine ecosystem and *vice versa* should be taken into account and explored with suggesting additional data collection requirements and monitoring programs, if needed.

Therefore, WGITMO has suggested the following request:

For initiating periodic reporting of nonindigenous parasites, pathogens and other disease agents affecting mariculture and advance related research, request WGHABD, WGAQUA and WGPDMO to provide WGITMO any information on availability of potentially relevant data/information sources (incl. location of datasets), and on current monitoring/reporting practices in ICES area and elsewhere.

4.7 Term of Reference g)

Produce the draft alien species alert report on Ensis directus (ToR lead Francis Kerckhof)

ITMO agreed to prepare an Alien Species Alert report regarding Ensis directus which may be published by ICES in the Cooperative Research Report (CRR) series. This planned report will follow the structure of the previously published Alien Species

Alert reports, which addressed Rapana venosa (published in 2004, CRR 264), Paralithodes camtschaticus (2005, CRR 277), Undaria pinnatifida (2007, CRR 283) and Crassostrea gigas (2009, CRR 299). Francis Kerckhof (Belgium) volunteered to prepare the first draft of this report and Stephan Gollasch (Germany) agreed to contribute as co-author. Due to time constraints no draft was yet prepared, but this work will be initiated intersessionally so that at the next ITMO meeting the report may be finalised. The report will cover the following aspects:

1) INTRODUCTION
2) SPECIES IDENTIFICATION
3) BIOLOGY IN THE NATIVE RANGE
4) NON-NATIVE DISTRIBUTION
5) PROSPECTS FOR FURTHER INVASIONS
6) IMPACTS

4.8 Term of Reference h)

Support to the technical specification and application of OSPAR common indicators under D2

Request for the quality assurance/ response to specific questions to support the work of the identification and prioritisation of common indicators to support the regional implementation of the biodiversity aspects of MSFD in the North East Atlantic. BDC 2012 have requested the submission of first set of common indicators to be presented to BDC 2013 (noting that the relevant ICES groups will meet late February early March 2013). At this time (i.e. first quarter 2013), ICES would be requested to undertake an independent peer review of the technical specifications and proposed operational implementation of the indicators that will be presented. The review should consider, from the perspective of producing a set of common indicators for the OSPAR Region: 1) whether the indicators put forwards are appropriate to implement at a regional scale; 2) whether the set of indicators is sufficient as a set to understand GES; 3) identify any gaps; 4) identify where there are difficulties in the operationalization of the indicators, with proposals for how to overcome these. Based on the outcomes of OSPAR request 2013-4 (below) (regarding maximising efficiencies for monitoring of biodiversity), 5) identify where there are opportunities to cluster indicators that can benefit from shared monitoring/ data collection. ***OSPAR request 2013-3***

WGITMO addressed two OSPAR indicators, NIS-1 (Pathways management measures) and NIS-2 (Rate of new introductions of NIS (per defined period)), by applying the methodology developed by ICES Working Group on Biodiversity Science (WGBIODIV) ICES CM 2013/SSGEF:02 at its 2013 meeting. The characteristics used to evaluate the performance of the two NIS indicators by OSPAR were: Existing and ongoing data (no. 2); Metrics should be tangible (3); Quantitative vs. qualitative (4); Relevant spatial coverage (5); Reflects changes in ecosystem component that are caused by variation in any specified manageable pressures (6); Relevant to MSFD management objectives (7); Relevant to management measures (8); Comprehensible (9); Established indicator (10); Cost-effectiveness (11); Early warning (12); Theoretically sound (13); metrics relevance to MSFD indicator (14) and Cross-application (15). Similar to WGBIODIV, and due to the participants expertise, the analytical evaluation exercise was undertaken as a case study covering the North Sea only. Evaluation of both NIS indicators was performed by three experts. The mean overall assessment scores obtained were 40% (range 23-46) for NIS-1 and 56% (range 50-61) for NIS-2. The mean scores given to both NIS indicators against the criterion on 'relevant spatial

coverage' was 50%. WGITMO also assessed whether NIS indicators can be readily operationalized based on indicator's performance against criteria 2, 3, 4, 5, 10 and 11. The mean score of 50% was obtained for NIS-1 and 58% for NIS-2. Like WGBIODIV, WGITMO als applied the benchmark threshold of 0.767 to identify high-performing operationalized indicators. It appeared that none of the proposed two NIS indicators did not meet the benchmark threshold of 77% for neither overall, operational nor spatial coverage criteria (see Table 4.8.1 below).

Indicator	Overall	Operational	Spatial coverage	Meets all three benchmarks
NIS-1				
NIS-2				

Table 4.8.1. Evaluation of the overall performance of the OSPAR NIS indicators against criteria 2 to 15, against the six criteria related to operationalization of the indicators and the one criterion related to spatial coverage of the indicators. Green cells show where indicators meet the benchmark thresholds and red cells show where indicators do not meet the benchmark thresholds.

Performance of each two NIS indicators was further investigated against each of the six operationalization criteria individually. The values shown in table 4.8.2. represent mean scores for each indicator-criterion given by the three experts expressed as a percentage of the total score possible. It appears that the both proposed NIS indicators are performing well in terms two criteria (existing data and metrics tangible), but fail in the rest four criteria.

Indicator	Criteria					
	Existing data	Metrics tangible	Quantitative vs. qualitative	Spatial coverage	Cost effectiveness	Established indicator
NIS-1	83	100	67	50	0	0
NIS-2	100	100	67	50	17	17

Table 4.8.2. Performance of the two OSPAR NIS indicators against each of the individual criteria related to operationalization. Red cells indicate poorest scores (≤ 50%); amber cells indicate intermediate scores but still below the single criterion benchmark threshold of 77%; green cells indicate high performance of an indicator with a score exceeding the benchmark threshold of 77%.

WGITMO has carefully investigated the two proposed alien species indicators within the OSPAR common set of biodiversity indicators and have several comments and suggestions on these. Several of the comments are based on the MSFD TG2 report (Olenin *et al*. 2010), the EU MSFD (EU 2008) and EU MSFD GES decision (EU 2010).

Major comments:

- ✓ WGITMO highly supports OSPAR efforts to identify and develop NIS indicators. However, before these can be fully operational, major improvements and amendments are required.
- ✓ It is suggested to make it explicit and clear that the purpose is to manage and monitor NIS introduced by man, i.e., to deal with anthropogenic invasions, and not with range expansion species, which may spread by natural means, e.g. by ocean currents.
- ✓ The generic approach taken by OSPAR that 'as soon as NIS arrives, nothing can be done' needs substantial revision. Amongst others, it is not fully in accordance with the approach of the MSFD Descriptor 2 'Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems' and it D2 Criterion 2.2 ' Environmental impact of invasive

non-indigenous species ' . Thus the approach taken that if vector management is efficient, then everything is OK, needs to be fundamentally revised. The reason is that the pressure (i.e., NIS in the environment) still remains and there is a need to routinely monitor the resulting pressure on environment, ecosystem services, uses of the sea and human health. It is suggested here that impacts indicators should also be developed.

- ✓ WGITMO agrees that prevention is the most effective option to manage biological invasions, however it is by far not the only option (see Lodge at al. 2006; Olenin *et al*. 2011). The indicators proposed by OSPAR do not provide necessary information to support managerial decisions on other bioinvasion management options, such as invasive species control, confinement, mitigation, etc.
- ✓ The proposed NIS-1 indicator needs substantial and major further development, incl. its technical description. Only after then it can be subjected to an independent peer-review by ICES WGITMO. As it stands now, WGITMO feels unable to provide almost any comments as the provided technical description is very poor and incomplete.
- ✓ Before deciding on invasion pathways and vectors to be focussed on by different OSPAR countries, critical analysis needs to be carried out taking into account the importance of different pathways and associated vectors (see Olenin *et al*. 2010; 2011) to be prioritized and only after the pragmatic decisions to be made. The importance of different pathawys and vectors might significantly differ between different countries and therefore, this should be in mind while designing sampling, analysis and assessments. While at the pan-European level, shipping, marine and inland corridors, and aquaculture are the three most important pathways for NIS invasions (Katsanevakis *et al*. 2013), this is certainly not the case even for all major European regional seas.

Other comments

- ✓ Certainty level of a pathway and/or vector responsible for an alien species invasion needs to be taken into account (can be found in Olenin *et al* 2010). This is essentially important and should form a basis for the assessment of efficiency of vector management.
- ✓ During the alien species monitoring and assessment process, annual variation in species presence/absence needs to be considered. Moreover, this can be confounded by other effecst/factors not directly related to alien species invasion pathways. This aspect is essentially important for less abundant alien species.
- ✓ One option to deal with pathway/vector uncertainty is to identify and choose a georgaphical place (port, aquaculture, marina) to be assessed for NIS and relate the findings to the suggested main typical invasion vector related to the area.
- ✓ Sampling methodology should be adopted to the organism groups (e.g., plankton, macrozoobenthos, fish) to be monitored. As it remains unclear from the document on what organism groups/ taxa/species/ are planned to be monitored, the proposed methodology (number of locations, sampling frequency) cannot be commented. However, the sampling frequency of once per year is undoubtedly insufficient to obtain representative information for several organism groups, but essentially for planktonic organisms with a reproduction cycle in a range of days to tens of days.

- ✓ WGITMO suggests instead of identifying monitoring locations per invasion vector, which might prove impossible, rather to focus on monitoring of zones at risk – i.e., taking 'entry points principle'.
- ✓ One option on how to deal with the invasion pathways and habitats to be monitored is to prepare pahtway/habitat matrix and leave countries to make the selection based on their priorities and capabilities. Another option would be to develop a decision-tree on which pathway/vector and when to be addressed. If financies are limiting, then one site/vector can will be monitored/assessed in one year and the another vector/site in the second year.
- ✓ Species identification might pose serious problems, essentially for smaller organisms like microzooplankton or meiobenthos. The suggestion here is that the collected samples can be analysed centrally in a laboratory holding required taxonomic expertise. This also allows to process more samples and therefore sample more habitats.
- ✓ The proposed site selection - 2 sites per countries - might be insufficient. The site selection should country-specific and rather depend on the analysis of the presence and importance of different pathways/vectors and only after then site selection should be performed. Therefore, this shouldn't be regulated in the document.
- ✓ To assess impacts caused by NIS, distribution/abundance/biomass data are also needed. For this purpose, certainly more sites than two are needed to be monitored.
- ✓ The target setting should perhaps be redefined as 3-yr period might not work and longer assessment period is more appropriate (e.g., 6 years as stated in EU MSFD).

Literature cited

EU, 2008b. Directive of the European Parliament and the Council Establishing a Framework for Community Action in the Field of Marine Environmental Policy (Marine Strategy Framework Directive). European Commission. Directive 2008/ 56/EC, OJ L 164.

EU, 2010. Decision on Criteria and Methodological Standards on Good Environmental

Status of Marine Waters. Decision 2010/477/EU, OJ L 232. European Commission.

Katsanevakis, S., Zenetos, A., Belchior and C., Cardoso, A.C. 2013. Invading European Seas: Assessing pathways of introduction of marine aliens. Ocean and Coastal Management, http://dx.doi.org/10.1016/j.ocecoaman.2013.02.024

Lodge, D.M., Williams, S., MacIsaac, H.J., Hayes, K.R., *et al*., 2006. Biological invasions: recommendations for US policy and management. Ecological Applications 16 (6), 2035–2054.

Olenin, S., Alemany, F., Cardoso, A.C., Gollasch, S., Goulletquer, P.,Lehtiniemi, M., McCollin, T., Minchin, D., Miossec, L., Occhipinti A., Ojaveer, H., Jensen, K.R., Stankiewicz, M., Wallentinus, I., Aleksandrov, B. (2010). Marine Strategy Framework Directive - Task Group 2 Report. Nonindigenous species. European Communities. EUR 24342 EN. ISBN 978-92-79-15655-7. ISSN 1018-5593. DOI 10.2788/87092. Luxembourg: Office for Official Publications of the European Communities. 44 pp.

Olenin S., Elliott M., Bysveen I., Culverhouse P., Daunys D., Dubelaar G.B.J., Gollasch S., Goulletquer P., Jelmert A., Kantor Y., Mézeth K.B., Minchin D., Occhipinti Ambrogi A., Olenina I., Vandekerkhove J. 2011. Recommendations on methods for the detection and control of biological pollution in marine coastal waters. Marine Pollution Bulletin, 62 (12): 2598-2604

4.9 Term of Reference i)

Provide advice on maximising the use of available sources of data for monitoring of biodiversity

The purpose of this request is to seek ICES advice on the potential sources of data and information that may be available to support the monitoring and assessment of biodiversity in relation to commitments under MSFD so as to maximise efficiencies in the use of available resources, for example where efficiencies could be made to identify where there are monitoring programmes or data sources that can deliver multiple indicators, which may relate to different Descriptors, (e.g. The Data Collection Framework could be used to implement D3 and D1 indicators), or where with a small additional effort existing monitoring could be amplified to deliver a broader set of data. Advice would be sought as to 1) the quality of these potential data sources and how they could be used, including but not limited to the relevance of outcomes identified in chapter 8 of the ICES MSFD D3+ report to Descriptors 1, 4 and 6. OSPAR request 2013-4

While WGITMO members are not familiar with details on ongoing monitoring projects and programs in the OSPAR region, and therefore, cannot propose any operational suggestions on how to gather data on alien species from the ongoing monitoring activities, WGITMO can suggest two information sources to consult with. These may provide additional and previously unavailable information on alien species:

i) WGITMO 2012 report summarising ongoing monitoring activities (on presence/absence monitoring, port monitoring, abundance/biomass monitoring and impacts monitoring) in ICES and several non-ICES countries which may provide information on NIS. The details can be found in WGITMO 2012 report (pages 10-23 and Annex 5 on pages 172-250). The summary of findings to address this ToR is given below (copied from the ICES WGITMO 2012 report)

The information concerning the present monitoring programs and surveys, where non-indigenous species (NIS) could be observed, was collected from experts taking part in WGITMO meetings. The information was collected from the countries via an excel-sheet during autumn 2011/winter 2012. The information requested was on monitoring programs where information could be obtained on 1) presence/absence, 2) distribution or 3) abundance/biomass of NIS, and 4) if there exists monitoring in ports or 5) on ecological and socioeconomic impacts NIS cause.

The detailed information on existing monitoring programs in OSPAR region was received via excel sheets from Belgium, France, UK, Spain and Sweden. Additional information in text format was received from France, Germany, The Netherlands, Spain, Sweden and UK. Denmark reported that no monitoring programs occur where NIS could be detected.

In many countries the monitoring activities are scattered under different institutes making it difficult to obtain all information concerning ongoing programmes, and thus the reported monitoring activities here may give an underestimate of the real situation. The detailed country-information by different monitoring types (on presence/absence; distribution and abundance/biomass; port monitoring; ecological impact; socioeconomic impacts) is given in Annex 5 of WGITMO 2012 report.

Presence/absence of NIS

Presence or absence of NIS could be detected in many of the routinely ongoing biological monitoring programs. Many countries report that phytoplankton, zooplank-

ton, macrophytes and fish are monitored and NIS could be detected in those monitoring surveys if looked for. As an example, information on offshore benthic invertebrate species and assemblages can be obtained through scientific surveys aimed at monitoring fish stocks (e.g: International Bottom Trawl Survey, national beam trawl groundfish surveys) over wide geographic areas. More than half of all alien species in European seas are benthic invertebrates (Olenin *et al*., 2010).

UK (Scottish) monitoring programs include phyto- (started 1997) and zooplankton (1997) and invertebrates. Settling fauna was monitored at marinas along the Scottish coasts in 2009. This included ascidians, bryozoans, molluscs, barnacles, anemones, hydroids, sponges and polychates. Presence/absence could be specifically detected for *Crepidula fomicata, Styela clava, Sargassum muticum* and *Crassostrea gigas* on the western and eastern coasts of Scotland. These monitoring programs have started 2010 and 2011, respectively on different coasts. Also crustaceans *Caprella mutica* and *Eriocheir sinensis;* ascidians *Perophora japonica* and *Styela clava* and green algae *Codium* could be detected in Scottish monitorings, conducted from 2006 to 2009. In Wales (UK) macrophytes are monitored annually by divers. This monitoring started in 2008 in 12 locations, mainly in marinas.

The monitoring programs of **Belgium** in the North Sea can detect NIS from various taxonomic groups. These groups are zooplankton, benthos (epibenthos, hyperbenthos, macrobenthos, meiobenthos), jellyfish (with special focus on *Mnemiopsis leidyi*), demersal and pelagic fish, seabirds and mammals. The oldest samplings have started 1978 (demersal fish and epibenthos), while more benthos monitoring programs were started 1997 and during the late 2000's the rest of the groups were included in the sampling schemes. The only ecxeption being macrophytes, which are not monitored in Belgium. Samples are taken at least twice a year, pelagic samples are collected every month (jellyfish, zooplankton, fish).

Swedish monitoring programs include phyto- and zooplankton, macrophyte, benthic invertebrate and fish sampling. Samplings are conducted both in the coastal and open sea stations. Benthic invertebrate monitoring has started 1978, zooplankton 1979, open sea fish trawling in 1970's, phytoplankton samling 1983, coastal fish monitoring 1991(nets), 2001 trawling and macrophytes 1993. Sampling frequency varies from several times a year (plankton) to once-twice a year (benthos, macrophytes, fish).

Distribution and abundance/biomass of NIS

In **Belgium** NIS distribution and abundance could be studied for benthos (epibenthos, hyperbenthos, macrobenthos, meiobenthos), jellyfish (especially *Mnemiopsis leidyi*), demersal and pelagic fish, seabirds and mammals. All the taxonomic groups that reported for presence/absence monitoring (phyto-, zooplankton, benthos, fish) may also give information on NIS distribution and abundance/biomass in **Sweden**. The only exception being macrophytes that are only photographed and thus give information on distribution but not on biomass. *Port monitoring*

Port monitoring is not known to exist in Sweden and Germany.

Ecological and socioeconomical impact monitoring

Ecological impacts of NIS are not reported to be monitored in **Sweden** and **UK**. Ecological impacts are monitored in **Belgium** since mid 2000's for fish, benthos and jellyfish. Socioeconomic impacts are not monitored in any of the countries who reported their monitoring activities.

ii) Information system on Aquatic Non-Indigenous Species in Europe (AquaNIS). The data block relevant to OSPAR area is unfortunately under construction as yet and will be hopefully opened in 2014. The Baltic Sea component (incl. the Kattegat and Skagerrak) is already opened and can be consulted at www.corpi.ku.lt/databases/aquanis.

4.10 Other discussion items and any other business

There were several strategically important generic discussion items and/or presentations which did not directly qualify to under any of the Terms of References. These are briefly summarised below.

4.10.1 Forecasting the ecological impacts of aquatic invasions: A major challenge for risk assessment (by Anthony Ricciardi).

Non-native species are being introduced to large aquatic ecosystems at increasing rates worldwide. Studies of their impacts are generally rare. Most of these introduced species are thought to have only minor ecological effects, whereas others are known to have substantially altered water quality, contaminant cycling, food webs, and native biodiversity. Predictive information is lacking for the vast majority of known invaders, and there exist very few general models or even 'rules of thumb' to forecast the impacts of invasions; consequently, managers lack risk assessment methods to prioritize invasion threats. A major challenge to developing such methods is the context-dependent variation generated by the influence of site-specific physical and biological factors that affect the invader's local abundance and performance. Moreover, interactions among introduced species can produce synergistic effects that are extremely difficult to predict; such interactions are becoming documented more frequently in freshwater and marine systems.

Nevertheless, a burgeoning number of case studies have revealed some intriguing patterns that may guide management efforts. A promising approach toward developing empirical rules is to test hypotheses that incorporate characteristics of both the invader and the invaded system. This approach has found that those invaders that displace native species are more likely to belong to genera not already present in the system, suggesting that risk assessments should consider an invader's taxonomic relationship to resident species in the target community. Furthermore, statistical synthesis of data from multiple invaded sites can generate predictive models for species with extensive invasion histories. Meta-analyses of the impacts of certain species, such as the zebra mussel (*Dreissena polymorpha*) and the common carp (*Cyprinus carpio*), have revealed predictable patterns that are robust across geographic regions. Unfortunately, there are insufficient data available to construct predictive models for most invaders – including those deemed to be major threats. This problem underscores the need for coordinated management of large databases that include, *inter alia*, standardized quantitative information on the ecological impacts of introduced aquatic species.

4.10.2 Molecular identification of UK populations of *Didemnum vexillum* (by Lyndsay Brown).

Didemnum vexillum, or the carpet seasquirt, is a highly invasive non-native tunicate. The first population was identified in Holyhead Marina in Wales in 2008 and subsequently in Largs Yacht Haven, on the west coast of Scotland in 2009. There are also populations along the south east coast of England. During a *D. vexillum* identification workshop in Bangor, Wales in 2011 run by John Bishop (Plymouth Marine Laborato-

ry) and Rohan Holt (Countryside Council for Wales) participants had the opportunity to examine samples from various locations. It was discussed how the morphology of samples from Kent (on the South east coast) were different from samples from all other locations and how it would be interesting to perform some genetic analyses on these samples to investigate whether or not they were a different species of *Didemnum*. Marine Scotland Science (MSS) volunteered to carry out this work. Samples were collected, preserved in ethanol and sent to MSS for investigation from seven locations in the UK (Largs, Fairlie, Hunterston, Holyhead, Gosport, Darthaven and Kent). This project is still in progress and to date DNA has been extracted and PCR amplification has been carried out using forward and reverse primers targeting the *coI* gene (mitochondrial encoded gene). These PCR products have been sequenced and on-going work will involve sequence identifying and alignment with *coI* sequences of *Didemnum vexillum* via NCBI BLAST.

4.10.3 Possible MSC certification of a NIS in Spain and its repercussions (by Gemma Quilez-Badia).

A Clams and Cockle Fishery from Ria de Arousa (NW Spain) has been recommended for a Marine Stewardship Council (MSC) certificate. Four species are included in this fishery, among which there is the NIS Manila clam, *Ruditapes philippinarum*. The MSC certificate is supposed to be granted only when certain environmental standards are fulfilled. These standards are allegedly there to "maintain the integrity of ecosystems… allow for the maintenance of the structure, productivity, function and diversity of the ecosystem (including habitat and associated dependent and ecologically related species)… maintains natural functional relationships among species and should not lead to trophic cascades or ecosystem state changes." Ultimately, the MSC's fishery certification program and seafood ecolabel is supposed to recognize and reward sustainable fishing. But by recommending the certification of a well-documented environmentally harmful invasive species, the MSC will end up harming the environment as well as risking its credibility.

4.10.4 Potential cooperation with ICES Study Group on Integrated Morphological and Molecular Taxonomy (SGIMT)

SGIMT has expressed interest to cooperate with WGITMO. The WGBOSV/WGITMO joint meeting discussed potential cooperation with SGIMT and concluded that both groups are interested in cooperation with SGIMT. Maiju Lehtiniemi will act as a contact point between the groups and will compile a list of needs of WGITMO for genetic approaches, which will be presented for SGIMT for discussion.

4.10.5 Election of chair for 2014-2016

There were no other nominations than Henn Ojaveer for the post of WGITMO chair for the next 3-years period (i.e., 2014-2016). He was unanimously re-elected for the second term. Henn thanked the group for re-electing him as a chair.

5 Closing of the meeting

The meeting was closed at 17:00 on March 22th, 2013. The chair thanked the group for all their input and participation during the meeting and intersessionally. The chair also thanked Cynthia McKenzie for hosting the meeting.

Annex 1. List of participants

Name	Address	Phone/Fax	Email
Henn Ojaveer (Chair)	Estonian Marine Institute University of Tartu 2a Lootsi EE-80012 Parnu Estonia	Phone +372 443 4456 mobile: +372 5158328	henn.ojaveer@ut.ee
Ana Amorim (Webex participation)	Universidade de Lisboa Centro de Oceanografia Campo Grande, 1749-016 Lisbon Portugal	Phone +351 217500156 Fax +351 21750009	ajamorim@fc.ul.pt
Sarah Bailey	Fisheries and Oceans Canada, Great Lakes Laboratory for Fisheries and Aquatic Sciences 867 Lakeshore Road Burlington, ON L7R 4A6 Canada	Phone +1 905 336 6425 Fax +1 905 336 6437	Sarah.Bailey@dfo-mpo.gc.ca
Lyndsay Brown	Marine Scotland - Science Scottish Government, Marine Laboratory, PO Box 101 375 Victoria Road Aberdeen AB11 9DB UK	Phone +44 (0)1224 295506 Fax +44 (0)1224 295511	Lyndsay.Brown@scotland.gsi.gov.uk
James T. Carlton (Webex participation)	Williams College - Mystic Seaport P. O. Box 6000, 75 Greenmanville Avenue Mystic, Connecticut 06355 USA	Phone +1 860 572 5359, Fax +1 860 572 5329	jcarlton@williams.edu
Paula Chainho (Webex participation)	Universidade de Lisboa Centro de Oceanografia Edificio C5, Campo Grande Lisbon , Portugal	Phone +351 217500000 Fax +351 21750009	pmchainho@fc.ul.pt
Amelia Curd	IFREMER Centre de Brest BP 70 - F-29280 Plouzané France	Phone +33 (0) 298224260	Amelia.curd@ifremer.fr
Anders Jelmert	Institute of Marine Research Flødevigen Marine Research Station 4817 His Norway	Phone +47 3705 9052 Fax +47 3705 9001	anders.jelmert@imr.no
Stefan Kacan	Federal Maritime and Hydrographic Agency P.O. 30122 D-20359 Hamburg Germany	Phone +49 40 3190 7480 Fax +49 40 3190 5000	Stefan.Kacan@bsh.de
Francis Kerckhof	Royal Belgian Institute of Natural Sciences, Management Unit of the North Sea Mathematical Models (MUMM) 3de en 23ste Linieregimentsplein B-8400 Oostende Belgium	Phone + 32 59 24 20 56 Fax + 32 59 70 49 35	f.kerckhof@mumm.ac.be

Name	Address	Phone/Fax	Email
Maiju Lehtiniemi	Finnish Environment Institute (SYKE) P.O. Box 140 Mechelininkatu 34a 00251 Helsinki, Finland	Phone +358 Fax +358	maiju.lehtiniemi@ymparisto.fi
Cynthia McKenzie	Fisheries and Oceans Canada Northwest Atlantic Fisheries Center P.O. Box 5667 St John s NL A1C 5X1, Canada		Cynthia.McKenzie@dfo-mpo.gc.ca
Anna Occhipinti-Ambrogi (Webex participation)	Universita degli Studi di Pavia Dipartimento di Ecologia del Territorio Via S. Epifanio 14, I 27100 Pavia, Italy	Phone +39 0382 984876 Fax +39 0382 304610	occhipin@unipv.it
Sergej Olenin	Coastal Research and Planning Institute Klaipeda University H. Manto str. 84, Klaipeda, 92294 Lithuania	Phone +8 46 398 847 Fax +8 46 398 845	sergej@corpi.ku.lt
Judith Pederson	MIT Sea Grant College Program E38-300 Cambridge MA 02139 United States	Phone +1 617 252 1741	jpederso@mit.edu
Gemma Quílez-Badia	WWF Mediterranean Programme Office Carrer Canuda, 37 3er 08002 Barcelona SPAIN	Phone +34 933056252 Fax +34 932788030	gquilez@atw-wwf.org
Anthony Ricciardi	Redpath Museum & McGill School of Environment, McGill University, Canada	Phone: 514 398 4089 Fax 514 398 3185	tony.ricciardi@mcgill.ca
Nathalie Simard	Fisheries and Oceans Canada Institut Maurice-Lamontagne P.O. Box 1000 Mont-Joli QC G5H 3Z4 Canada	Phone +1 418 775 0682	Nathalie.Simard@dfo-mpo.gc.ca
Andrea Sneekes	Wageningen IMARES Wageningen Imares P.O. Box 57 NL-1780 AB Den Helder Netherlands	Phone +31 317 487141 Fax +31 317 487371	andrea.sneekes@wur
Lauri Urho	Finnish Game and Fisheries Research Institute P.O. Box 2, FI-00791 Helsinki, Finland	Phone +358 205 751 258 Fax +358 205 751 201	lauri.urho@rktl.fi
Argyro Zenetos (Webex participation)	Hellenic Centre for Marine Research PO Box 712 Attica, Greece	Phone +30 210 985 6701 Fax +30 210 981 1713	zenetos@hcmr.gr
Malin Werner	Swedish University of Agricultural Sciences Department of Aquatic Resources Institute of Marine Research S-453 30 Lysekil Sweden	Phone +46 (0) 10-478 4057 Mobile +46 (0) 76-12 68 048	Malin.Werner@slu.se

Annex 2. Meeting agenda

AGENDA

ICES WORKING GROUP ON INTRODUCTION AND TRANSFERS OF MARINE ORGANISMS

20-22th March, 2013

INTERCONTINENTAL MONTREAL (Saint Laurent Room)

360, St Antoine Ouest

Montréal, Québec, H2Y 3X4

WEDNESDAY 20th MARCH

JOINT MEETING WITH WGBOSV

09:00 Opening of the joint meeting

Welcoming remarks from Chairs (Sarah Bailey and Henn Ojaveer) and Cynthia McKenzie (Meeting Host)

Introduction of participants

09:15 ToR d) Investigate and report on non-native species issues associated with artificial structures in marine environment. *ToR lead: Francis Kerckhof.*

- Presentation – Francis Kerckhof

10:30-11:00 Coffee break

- **ToR c)** Continue identification and evaluation of climate change impacts on the establishment and spread of non-indigenous species. This activity will mostly be carried out intersessionally and take several years. *ToR lead: Judy Pederson*
-
- Location of next meeting and joint 2014 ToR's
- Any Other Business
- Wrapping up

12:30 End of joint meeting

12:30-13:30 Lunch break

Review of Terms of Reference and Agenda

Forecasting the ecological impacts of aquatic invasions. **Tony Ricciardi**

ToR b) Continue verifying selected datasets of the newly developing database on marine and other aquatic organisms in European waters with the ultimate goal to make it available online. *ToR lead : Sergej Olenin*

- Presentation on AquaNIS database. **Sergej Olenin**

15:00-15:30 Coffee break

ToR b) continued

ToR h) Support to the technical specification and application of OSPAR common indicators under D2. *ToR lead: Henn Ojaveer*

ToR i) Provide advice on maximising the use of available sources of data for monitoring of biodiversity. *ToR lead: Henn Ojaveer*

17:00 Close of the day

THURSDAY 21th MARCH

09:00 ICES updates. **Henn Ojaveer**

ToR a) Synthesize and evaluate national reports using the adopted format for reporting and contributions to the database that includes species, locations (latitude and longitude), status of invasions as appropriate, region of origin, status of eradication efforts, and habitat, and develop an annual summary table of new occurrences/introductions of aquatic non-indigenous species. *ToR lead : Henn Ojaveer.*

Highlights from national reports

Belgium	Francis Kerckhof
Canada	Nathalie Simard
Finland	Lauri Urho
France	Amelia Curd
Germany	Stefan Kacan
Lithuania	Sergej Olenin

10:30-11:00 Coffee break

Netherlands	Andrea Sneekes
Norway	Anders Jelmert
Spain	Gemma Quilez-Badia
Sweden	Malin Werner
United Kingdom	Lyndsay Brown

United States	Judith Pederson
Estonia	Henn Ojaveer

12:30-13:30 Lunch

Presentation: Non-native species work at Marine Scotland Science. **Lyndsay Brown**

ToR h) and **ToR i)** continued

15:00 – 15:30 Coffee break

ToR h) and **ToR i)** continued

ToR e) Continue work to address MSFD D2, incl. by developing generic criteria and proposing guidance for alien species monitoring approaches to assist EC member states in designing their national alien species monitoring programs. *ToR lead: Maiju Lehtiniemi*

- HELCOM port sampling guidelines. **Maiju Lehtiniemi**
- Canadian example **Cynthia McKenzie**
- Estonian example **Henn Ojaveer**

17:00 Close of the day

FRIDAY 22th MARCH

09:00 ToR f) Coordinate reporting of nonindigenous pathogens affecting mariculture with the relevant ICES expert group(s) and establish a mechanisms for annually exchanging relevant information. *ToR lead: Cynthia McKenzie*

- Current regulations for I&T in Canada directed at preventing the spread of AIS particularly through aquaculture. **Cynthia McKenzie**

10:30 – 11:00 Coffee break

ToR g) Produce the draft alien species alert report on *Ensis directus*. *ToR lead: Francis Kerckhof*

12:30-13:30 Lunch

Presentation: Possible MSC certification of a NIS in Spain and its repercussions. **Gemma Quilez-Badia**.

Finalising ToR's e), h), i)

15:00 – 15:30 Coffee break

- Election of the chair
- WGITMO ToR's for 2014
- Any Other Business
    - Theme session proposal for ICES ASC 2014
    - Requests to ICES other EG's (e.g., WGAQUA, SGIMT)
    - Update on 5-yr report
    - WGITMO new website
    - Update on the MSFD D2 manuscript
    - Cooperation with PICES

17:00 Close of the meeting

Annex 3. National reports

3.1 Belgium

Prepared by Francis Kerckhof with assistance of Lies Vansteenbrugge, Institute for Agricultural and Fisheries Research, Animal Sciences Unit – Fisheries, Belgium

Highlights

During 2012 no new introduced species were recorded.

All introduced species that were reported during previous years are still present and seem to be well-established and thriving.

1. Laws and regulations

There is no new legislation to report.

2. Intentional introductions

There is no information available on intentional introductions if any.

3. Unintentional introductions:

During 2012 no new introduced species were recorded.

During 2011 several colonies of the bryozoan *Fenestrulina delicia* Winston, Hayward & Craig, 2000 were discovered on stones of the scour protection of one of the windmills of the C-Power windmill park, collected on January 31st 2011. During 2012, the species has been found again on the stones of the scour protection of the same wind park which means that this species is her to stay. A paper on recent discoveries of F. delicia in Western Europe is in preparation (De Blauwe *et al*. in prep.).

During 2012 the colonial encrusting tunicate Diplosoma listerianum has been found on the sites of both operational wind parks off the Belgian coast. The colonies were covering rather large surfaces on the stones of the scour protection and were also present in the fouling community on the pilings. This cryptogenic species was until now only known from one sighting in the marina of Zeebrugge (unpublished record).

In December 2012 a fresh but empty specimen of Ruditapes philippinarum was found on the beach of De Panne. This is the second finding of a beached specimen. Ruditapes philippinarum is well established along the French Normandy cost and in the Oosterschelde in the Netherlands and apparently spreading.

All introduced species that were reported during previous years are still present and seem to be well-established and thriving. Noteworthy was the find of a carapax of the *Callinectes sapidus* on the beach of De Panne on the 8th of October 2011 indicating that this species is still present

4. Pathogens

No information

5. Meetings

CONFERENCE

On 20-22 November 2013 a conference on Non-indigenous species in the North-East Atlantic will be organized in Oostende. The conference is Open for scientists, policy makers/advisors, academics and stakeholders and will deal with various aspects related to introduced species

website: www.ilvo.vlaanderen.be/NISconference2013

émail adress: NIS@ilvo.vlaanderen.be

6. Research projects:

In January 2011, the research project 'MEMO: *Mnemiopsis* Ecology and Modeling: Observation of an invasive comb jelly in the North Sea' started. The MEMO project, framed in Interreg IV A '2 Seas', is a cross-border cooperation between ILVO (Institute for agricultural and fisheries research, Belgium), IFREMER (Institut français de recherche pour l'exploitation de la mer, France), ULCO-LOG (Université du Littoral Côte d'Opale-Laboratoire d'Océanologie et de Géosciences, France), CEFAS (Centre for Environment, Fisheries and Aquaculture Science, Great-Britain) and Deltares (the Netherlands). It consists of three main activities. The first activity will monitor the spatial and temporal distribution of *Mnemiopsis leidyi* in the 2 seas region. A habitat model based on biological and environmental parameters will be made. The second activity focuses on the biology, physiology and feeding behavior of *Mnemiopsis leidyi*. Using prey-predator interactions, a life cycle model will be constructed. The third activity will develop an applied integrated plankton ecosystem model to predict ecological and socio-economical impacts. This project ends in 2013 with a closing workshop.

7. References and bibliography

De Blauwe H. 2008. *Fenestrulina delicia* Winston, Hayward & Craig, 2000, een nieuw mosdiertje (Cheilostomata, Bryozoa) in Europa. - De Strandvlo 28(4): 154-157

De Blauwe H. 2009. Mosdiertjes van de Zuidelijke Bocht van de Noordzee. Determinatiewerk voor België en Nederland. Uitgave Vlaams Instituut voor de Zee, Oostende: 464pp

De Blauwe H. etal. in prep. Recent discoveries of the introduced Fenestrulina delicia in Western Europe.

Kerckhof, F., Haelters, J., Gollasch, S. 2007. Alien species in the marine and brackish ecosystem: the situation in Belgian waters. *Aquatic Invasions 2(3)*: 243-257.

Kerckhof F.; Degraer S.; Norro A.; Rumes B. 2011. Offshore intertidal hard substrata: a new habitat promoting non-indigenous species in the Southern North Sea: an exploratory study, in: Degraer, S. *et al*. (Ed.) (2011). Offshore wind farms in the Belgian part of the North Sea: Selected findings from the baseline and targeted monitoring. pp. 27-37 In: Degraer, S. *et al*. (Ed.) (2011). Offshore wind farms in the Belgian part of the North Sea: Selected findings from the baseline and targeted monitoring. Royal Belgian Institute of Natural Sciences. Management Unit of the North Sea Mathematical Models. Marine Ecosystem Management Unit: Brussels. 157 pp

Vandepitte, L.; De Pooter, D.; Lescrauwaet, A.-K.; Fockedey, N.; Mees, J. (Ed.) (2012). Nietinheemse soorten van het Belgisch deel van de Noordzee en aanpalende estuaria. VLIZ Special Publication, 59. Vlaams Instituut voor de Zee (VLIZ): Oostende. ISBN 978-90-817451-9-2. 371 pp. VLIZ Special Publication 59. Available at:

http://www.vliz.be/imisdocs/publications/237837.pdf

Vansteenbrugge, L. etal. in prep. Mnemiopsis leidyi (A. Agassiz 1865) distribution and population dynamics in the Belgian Part of the North Sea and the Westerschelde estuary.

3.2 Canada

Overview:

Fisheries and Oceans Canada is currently developing regulations that would help address Aquatic Invasive Species and is also revising the National Code on Introductions and Transfers of Aquatic Organisms. This year was discovery of three new species to Canada; *Ascidiella aspersa,* (European sea squirt), *Heterosiphonia japonica,* and *Diadumene lineate,* striped anemone. Other species that have already invaded Canadian waters continue to spread, including European Green Crab, Vase Tunicate, *Codium fragile*, (oyster thief), Golden Star Tunicate, *Styela clava* (clubbed tunicate), *Diplosoma listerianum* and *Botrylloides violaceus*.

1. **Regulations**:

Fisheries and Oceans Canada is developing a regulatory proposal to manage and control Aquatic Invasive Species (AIS) in Canada.

While the proposed regulations are still in the developmental stage, these are expected to include:

1. a **list of species** affected by the regulations;
2. a **prohibition structure** to avoid the introduction and spread of AIS by restricting activities such as importation, transport and possession of live AIS in various locations;
3. a **permitting scheme** to authorize specific low risk activities related to AIS in Canada (i.e. science); and
4. **authorities for control and eradication** activities.

The initial list of species to be included in the proposed regulations is yet to be determined. More information can be found at the following website; http://isdm-gdsi.gc.ca/ais-eae/index-eng.asp

Fisheries and Oceans Canada, along with the provinces and territories, currently manage disease, genetic, and ecological risks associated with aquatic animal movements through a variety of federal, provincial, and territorial regulations under the National Code on Introductions and Transfers of Aquatic Organisms. However, the Code is currently undergoing renewal to account for regulatory changes and lessons learned in the nearly 10 years since it has been implemented. In particular, the renewed Code will account for the Canadian Food Inspection Agency's new regulatory role in managing disease risks through the National Aquatic Animal Health Program under the Health of Animals Regulations. In the summer 2012, the Canadian Council of Fisheries and Aquaculture Ministers officially approved the formation of an Introductions and Transfers Renewal Task Group. The existing Code will apply until it is renewed. Public consultations are expected to take place in early 2013.

There are new requirements for all aquatic animals (finfish, molluscs and crustaceans) imported into Canada under the *Health of Animals Regulations*.

As of December 10, 2012, a Canadian Food Inspection Agency (CFIA) permit is required for any species listed in Schedule III of the *Health of Animals Regulations*. Without this permit, a shipment could be refused entry into Canada. More information can be found at the following website; http://www.inspection.gc.ca/animals/aquatic-animals/imports/eng/1299156741470/1320599337624.

2. Intentional Introductions:

Synthesis of introductions is provided in appendix 1, at the time of submission of the report information was not available for Newfoundland, Quebec freshwater and Ontario.

3. Unintentional Introductions:

New Sightings

In 2012 there was discovery of three new species to Canada. *Ascidiella aspersa,* (European sea squirt), native to Europe, was detected for the first time in Nova Scotia (3 locations in Lunenburg Bay). Four specimens of the invasive red alga *Heterosiphonia japonica* were collected from Mahone Bay, Nova Scotia, Canada, in August 2012.

The identity of these specimens was confirmed using molecular and anatomical evidence (Savoie and Saunders 2013). *Diadumene lineate,* striped anemone, was detected in the Bay of Fundy, a first record in Canada.

Previous Sightings

The attached excel spreadsheet provides as complete an overview as possible at the time of publication and does not represent all datapoints collected during the 2012 sampling season. Canada has a database that is updated on an ongoing basis, based on regional staff capacity.

Records included here represent persistent AIS, or AIS that have been detected in the area in previous years, or species that are undergoing range expansion within the Canadian Atlantic zone. Range expansion has been identified for European Green Crab, Vase Tunicate, *Codium fragile*, (oyster thief), Golden Star Tunicate, *Styela clava* (clubbed tunicate), *Diplosoma listerianum* and *Botrylloides violaceus*.

Some specific examples include;

European Green Crab

Continues to spread of green crab into northeastern New Brunswick and was detected for a second year at Chandler, Gaspe Peninsula, Quebec. Green crab continue to spread in Newfoundland in Placentia Bay and along the western coast of the province. At Chandler juvenile crabs were detected on detection plates. Subsequent diving and Fukui cages did not detect any additional individuals.

Vase Tunicate, *Ciona intestinalis*, is now established on the eastern shore of Nova Scotia, in Chedabucto Bay, Cape Breton, along the south and southwest shores of mainland Nova Scotia and in SW New Brunswick. It was also detected in Newfoundland for the first time in 2012, on the Burin Pennisula in Placentia Bay. Vase tunicate (L'ascidie jaune) has been observed in Cap-aux-Meules in limited numbers since 2006. In 2012, the infestation grew, in order to prevent further spread mitigation measures were taken in collaboration with the province of Quebec.

Oyster thief seaweed, *Codium fragile*, was found for the first time in Newfoundland attached to the substrate at one location on the Burin Penninsula, Placentia Bay. Several specimens were found washed up on the beach at three locations following an hurricane in the area in September.

Golden Star Tunicate, is now present in most Bays and harbours along the south, and south west coast of mainland Nova Scotia, as well as in coastal Cape Breton and the Bras D'Or lakes. The species was noted on Pictou, on the north shore in 2012. It is well established in SW New Brunswick and continues to spread into the NE of the province. Golden Star Tunicate was detected for the first time on Gaspesie, Quebec

on collector plates. In addition it was observed for the first time at an aquaculture site on the Magdalen Islands, having previously only been observed at marinas and docks.

Botrylloides violaceus, continued to spread to new locations in Nova Scotia. It is not yet widespread in SW New Brunswick, however it continues to spread in NE New Brunswick. *Botrylloides violaceus* was observed for the first time in the Northern Gulf of the Saint Lawrence. In the last two years the species has increased in abundance at the Havre-Aubert marina and now outnumbers Golden Star Tunicate that was present there first.

Styela clava (clubbed tunicate), was detected for the first time in Nova Scotia in Halifax harbour (Bedford Insitute of Oceanography Jetty, Wright's Cove, Dartmouth Yacht Club) and in Lunenburg Bay (Fisheries Museum public wharf).

Diplosoma listerianum (compound seasquirt), was detected for the first time in Nova Scotia in Lunenburg Bay (Fisheries Museum public wharf). In October 2008, the first official documented sighting of the invasive tunicate *Diplosoma listerianum* Milne-Edwards, 1841 in the Magdalen Islands in the Gulf of St. Lawrence was recorded. In 2011 presence was confirmed using molecular techniques but presence was not confirmed in 2012 using the same techniques. A publication on the first observation of *Diplosoma listerianum* in Canada is currently in preparation.

Species of concern

Didemnum vexillum is considered a threat to Atlantic Canada as it is present in nearby US waters. Canada conducted a Rapid Assessment for *Didemnum vexillum* in the southwestern Bay of Fundy in October 2012. No *Didemnum vexillum* was detected.

4. Pathogens

None reported.

5. Meetings

Past year

Canadian Aquatic Invasive Species Network Annual General Meeting. Montreal, Québec, Canada. May 1-4, 2012.

Canadian Science Advisory Sector Meetings

Risk Assessment for ship-mediated introductions of aquatic non-indigenous species to the Atlantic and Pacific coasts, Burlington, ON, March 6-7, 2012.

National risk assessment of Zebra Mussel, Quagga Mussel and Dark Falsemussel. Winnipeg, Manitoba, Canada. March 27-28, 2012

Future meetings

18th International Conference on Aquatic Invasive Species. Niagara Falls, Ontario, Canada, April 21-25, 2013.

Eighth International Conference on Marine Bioinvasions. Vancouver, British Columbia, Canada. August 20-22, 2013.

6. References and bibliography

DiBacco, Claudio; Humphrey, Donald B.; Nasmith, Leslie E.; et al. 2012. Ballast water transport of non-indigenous zooplankton to Canadian ports. ICES Journal of Marine Science: 69 (3): 483-491. DOI: 10.1093/icesjms/fsr133

DFO (Locke A, Frey M, Therriault T, Mandrak N, eds.) (2012) Proceedings of a Workshop on the Canadian Aquatic Invasive Species Rapid Response Framework; 9-10 June, 2009. DFO Canadian Science Advisory Secretariat Proceedings Series 2012/016: 70 p. http://www.dfo-mpo.gc.ca/csas-sccs/Publications/Pro-Cr/2012/2012_016-eng.html

Kanary, L., Locke, A.; Watmough, J. et al. 2011. Predicting larval dispersal of the vase tunicate Ciona intestinalis in a Prince Edward Island estuary using a matrix population model. Aquatic Invasions: 6 (4) Special Issue: 491-506. DOI: 10.3391/ai.2011.6.4.14

Kestrup, A.M. and S.E. Foster. 2012. Aquatic Invasive Species research funded by Fisheries and Oceans Canada 2005-2010. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2999E. online: http://www.dfo-mpo.gc.ca/Library/346439.pdf Aussi disponible en français: http://www.dfo-mpo.gc.ca/Library/346440.pdf

Landry T, Locke A (2012) Aquatic invasive species. *In:* Benoît HP, Gagné JA, Ouellet P, Savenkoff C, Bourassa M-N (eds.) Gulf of St. Lawrence Integrated Management (GOSLIM) Area state-of-the-ocean report 2011. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2986: 31-36.

Locke, A., M.A. Frey, T.W. Therriault, and N.E. Mandrak . 2012. Proceedings of a Workshop on the Canadian Aquatic Invasive Species Rapid Response Framework; June 9-10, 2009. Proceedings 2012/016

Rossong, M.A., Quijon, P.A.; Snelgrove, P.V.R. .; Barrett, T.J.; McKenzie, C.H.; Locke, A. 2012. Regional differences in foraging behaviour of invasive green crab (Carcinus maenas) populations in Atlantic Canada. Biological Invasions: 14 (3): 659-669. DOI: 10.1007/s10530-011-0107-7

Sargent, P.S, Wells, T., Matheson, K., McKenzie, C.H., and Deibel, D. 2013. First record of vase tunicate, Ciona intestinalis (Linnaeus, 1767) in coastal Newfoundland waters BioInvasions Records (2013) Volume 2, Issue 2: in press

Savoie, A. M. and Saunders, G. W., 2013. First record of the invasive red alga Heterosiphonia japonica (Ceramiales, Rhodophyta) in Canada. BioInvasions Records (2013) Volume 2, Issue 1: 27–32

Simard, Nathalie, Pereira Selma, Estrada Rafael and Nadeau Madeleine (In revision). Situation state of marine invasive species in Quebec. Can. Manuscr. Rep. Fish. Aquat. Sci. xxxx : viii + 61p.

Simard, Nathalie; Plourde, Stephane; Gilbert, Michel; et al. 2011. Net efficacy of open ocean ballast water exchange on plankton communities. Journal of Plankton Research: 33 (9) 1378-1395. DOI: 10.1093/plankt/fbr038

Vercaemer, Benedikte; Sephton, Dawn; Nicolas, Jean M.; et al.: 2011. Ciona intestinalis environmental control points: field and laboratory investigations. Aquatic Invasions: 6 (4) Special Issue: 477-490. DOI: 10.3391/ai.2011.6.4.13

Wong, Melisa C.; Vercaemer, Benedikte. 2012. Effects of invasive colonial tunicates and a native sponge on the growth, survival, and light attenuation of eelgrass (Zostera marina). Aquatic Invasions: 7(3): 315-326. DOI: 10.3391/ai.2012.7.3.003

Appendix 3.2.1 : Intentional transfers in Canada

Species		Total number/weight of organisms approved for movement in 2012:			
		Aquaculture[1]	Enhancement/ Stocking	Research	Other (Specify)
British Columbia	Amphipod - Marine (Adults)			11,755	
	Amphipod - Freshwater (Juveniles)			5,610	
	Anemone -Fish Eating (*Urticina piscivora*)				3 (Release)
	Anemone -Green Burrowing (*Anthopleura artemisia*)				3 (Release)
	Anemone -Green Surf (*Anthopleura xanthogrammica*)				5 (Release)
	Anemone - Strawberry (*Corynactis californica*)				19 (Release)
	Anemone -Stubby Rose (*Urticina coriacea*)				6 (Release)
	Anemone -Pink-tipped (*Anthopleura elegantissima*)				39 (Release)
	Anemone -White Spotted (*Cribinopsis albopunctata*)				3 (Release)
	Blennies – Var. spp.				18 (Release)
	Burbot (*Lota lota*) Juvenile			210,000	
	Burbot (*L. lota*) (Eggs)			Eggs from 30 Fish	
	Carp – Koi (*Cyprinus carpio*) (Adults & Juveniles)				34,658 (Resale/ Private Pond)
	Catfish - Brown Bullhead(*Ameiurus nebulosus*)				3 (Education)
	Char – Arctic (*Salvelins alpinus)* (Eggs)	21,000			

	Char - Lake (*Salvelinus namaycush*) (Eggs)		25,000		
	Char – Lake (*S. namaycush*) (Juvenile)		14,000		
	Chiton - Pink-lined (*Tonicella lineate)*				1 (Release)
	Chiton - Black Katy (*Katharina tunicata*)				3 (Release)
	Chiton – Hairy (*Mopalia kennerleyi*)				3 (Release)
British Columbia	Chiton - Gumboot (*Cryptochiton stelleri*)				1 (Release)
	Chiton - Smooth Mopalia (*Mopalia vespertina*)				1 (Release)
	Chiton - Various				3 (Release)
	Clam - Butter (*Saxidomus gigante*) (Adult)			60	
	Clam - Geoduck (*Panopea generosa*) (Adult)	2,290			1 (Release)
	Clam - Geoduck (*Panopea generosa*) (Juvenile)	3,259,000		1,200	
	Clam - Manila (*Venerupis philippinarum*) (Adult)			1,500 lbs	
	Clam - Manila (*Venerupis philippinarum*) (Juvenile)	63,400,000[2] + 50 bags			
	Clam - Pacific Ugly (*Entodesma navicula*)				1 (Release)
	Clam - Nuttall's Cockle (*Clinocardium nuttallii*)				10 (Release)
	Clingfish (*Gobiesocidae*)				6 (Release)
	Crab - Brown Box (*Lopholithodes foraminatus*)				3 (Release)

	Crab - Dungeness (*Metacarcinus magister*)				1 (Release)
	Crab - European Green (*Carcinus maenas*) (Adult)			800	
	Crab - Furry Hermit (Pagurus hirsutiusculus)				1 (Release)
	Crab – Graceful (*Metacarcinus gracilis*)				11 (Release)
	Crab - Green Shore (*Hemigrapsus oregonensis*)				1 (Release)
	Crab - Heart (*Phyllolithodes papillosus*)				2 (Release)
	Crab - Hermit (*Paguroidea*)				26 (Release)
	Crab - Kelp (*Epialtidae*)				3 (Release)
	Crab - Longhorn Decorator (*Chorilia longipes*)				7 (Release)
British Columbia	Crab - Moss (*Loxorhynchus crispatus*)				25 (Release)
	Crab - Porcelain (*Porcellanidae*)				9 (Release)
	Crab - Puget Sound King (*Lopholithodes mandtii*)				1 (Release)
	Crab - Pygmy Rock (*Glebocarcinus oregonensis*)				3 (Release)
	Crab - Red Rock (*Cancer productus*)				8 (Release)
	Crab - Sharpnose (Scyra acutifrons)				2 (Release)
	Crab - Shore (*Carcinus maenas*)				15 (Release)
	Crayfish - Signal Adult (*Pacifastacus leniusculus*)			130	
	Dace – Nooksack (*Rhinichthys sp.*)			110	
	Dogfish - Pacific Adult (*Squalus*			20	

	suckleyi)				
	Dorid – Yellow (Dorididae)				4 (Release)
	Dogwinkle – File (*Nucella lima*)				1 (Release)
	Flounder – Starry (*Platichthys stellatus*)				1 (Release)
	Goby - Black Eyed (*Rhinogobiops nicholsii*)				5 (Release)
	Goldfish – Adult (*Carassius auratus auratus*)			100	
	Grayling - Arctic Adult (*Thymallus arcticus*)			12	
	Greenling – Kelp (*Hexagrammos decagrammus*)				11 (Release)
	Greenling – Lingcod (*Ophiodon elongatus*)				1 (Release)
	Gunnel – Crescent (*Pholis laeta*)				4 (Release)
	Gunnel – Penpoint (*Apodichthys flavidus*)				1 (Release)
	Gunnel – Various (*Pholidae*)				22 (Release)
	Hagfish - Pacific Adult (*Eptatretus stoutii*)			160	
British Columbia	Lamprey - Pacific (*Lampetra tridentate*) (Adult)			300	
	Lamprey - Pacific (*Lampetra tridentate*) (Juvenile)			500	
	Lamprey - Sea (*Petromyzon marinus*) (Adult)			450	
	Lancelet - Florida (*Branchiostoma floridae*) (Adult)			600	
	Limpet - Duncecap (*Acmaea mitra*)				18 (Release)
	Limpet – Keyhole (Diodora aspera)				3 (Release)

	Limpet - Shield (*Lottia pelta*)				2 (Release)
	Limpet – Various spp.				3 (Release)
	Mackerel (*Scomber australiasicus*)				4 (Release)
	Midge - Freshwater Eggs Unidentified spp.			2,480	
	Minnow - Pike (Ptychocheilus oregonensis) (Juvenile)			20	
	Minnow - Fathead (*Pimephales promelas*) (Juvenile)			14,900	
	Mosquito Fish – (*Gambusia holbrooki*) (Adult)			150	
	Mussel - California (*Mytilus californianus*) (Adult)			1,450 + 2,500 kg + 12 bags	
	Mussel - Gallo (*Mytilus galloprovincialis*) (Adult)			700	
	Mussel – Gallo (*M. galloprovincialis*) (Juvenile)	53,400,000[2]			
	Mussel – Various spp.			175 sacks	
	Mysids – Unidentified spp. (Eggs)			5,625	
	Nudibranch – Giant (*Denronotus iris*)				8 (Release)
	Nudibranch – Opalescent (*Hermissenda crassicornis*)				10 (Release)
British Columbia	Nudibranch – Orangepeel (*Tochuina tetraquetra*)				1 (Release)
	Nudibranch - Shaggy Mouse (*Aeolidia papillosa*)				4 (Release)

	Nudibranch - Pink (*Tritonia diomedea*)			100	
	Nudibranch - Sea Lemon (Doridiidae)				6 (Release)
	Nudibranch - White and Orange Tipped (*Janolus fuscus*)				1 (Release)
	Octopus - Pacific Giant (*Enteroctopus dofleini*)				2 (Release) 1 (Education)
	Oyster - Olympia (*Ostreola conchaphila*) (Adult)			200	
	Oyster - Pacific (*Crassostrea* gigas) (Juvenile)	215,400,000[2] + 11,500 bags		40,500	
	Oyster - Pacific (*C.* gigas) (Adult)			850	15 (Release)
	Midshipman – Plainfin (*Porichthys notatus*)			200	
	Perch – Kelp (*Brachyistius frenatus*)				4 (Release)
	Perch – Pile (*Rhacochilus vacca*)				3 (Release)
	Spotted Ratfish (*Hydrolagus colliei*)				2 (Release)
	Perch -Shiner (*Cymatogaster aggregata*)				34 (Release)
	Perch - Striped Surf (*Embiotoca lateralis*)				42 (Release)
	Prickleback – Snakeskin (*Lumpenus sagittal*)				5 (Release)
	Rockfish – Black (*Sebastes melanops*)				20 (Release)
	Rockfish – Canary (*Sebastes pinniger*)				1 (Release)
	Rockfish – China (*Sebastes nebulosus*)				1 (Release)
	Rockfish – Copper (*Sebastes caurinus*)				10 (Release)
	Rockfish – Quillback (*Sebastes maliger*)				3 (Release)

	(Adult)				
	Rockfish – Vermillion (*Sebastes miniatus*)				1 (Release)
British Columbia	Rockfish – Yellowtail (*Seabastes flavidus*)				1 (Release)
	Sablefish (*Anoplopoma fimbria*) (Adult)	1,583			1 (Release)
	Sablefish (*A. fimbria*) (Juvenile)	775,000			
	Salmon - Atlantic[3] (*Salmo salar*) (Adult)	24,000		3,500	
	Salmon - Atlantic[3] (*S. salar*) (Juvenile)	9,485,000			
	Salmon - Atlantic[3] (*S.* salar) (Eggs/Milt)			80,000	
	Salmon - Chinook[3] (*Oncorhynchus tshawytscha*) (Adult)			1,000	
	Salmon - Chinook[3] (*O. tshawytscha*) (Juvenile)			800	
	Salmon - Chinook[3] (*O. tshawytscha)* Eggs/Milt		226,000	4,000	
	Salmon - Chum[3] (*Oncorhynchus keta*) (Adult)			1,000	
	Salmon - Coho[3] (*Oncorhynchus kisutch*) (Adult)			1,740	
	Salmon - Coho[3] (*O.kisutch*) (Juvenile)				100,000 (Education)
	Salmon - Coho[3] (*O. kisutch*) (Eggs/Milt)	1,000,000			
	Salmon – Kokanee (*Oncorhynchus nerka*) (Juvenile)		8,659,100		
	Salmon – Kokanee (*O.* nerka) (Eggs/Milt)				5,100 (Education)
	Salmon - Pink[3] (*Oncorhynchus*			11,000	

	gorbuscha) (Adult)				
	Salmon - Pink[3] (*O. gorbuscha*) (Eggs/Milt)			10,000	
	Salmon – Sockeye (*Oncorhynchus nerka*) (Adult)			1,000	
	Salmon – Sockeye (*O. nerka*) (Juvenile)	10,000	7,850,000	3,250	
	Salmon - Sockeye (*O. nerka*) (Eggs/Milt)		1,250,000	Eggs/Milt from 160 fish	
British Columbia	Sanddab – Pacific (*Citharichthys sordidus*)				1 (Release)
	Sanddab – Speckled (*Citharichthys stigmaeus*)				10 (Release)
	Sand Dollar – Pacific (*Dendraster excentricus*)				2 (Release)
	Sand Dollar – (Various spp.) (Adult)			100	
	Scallop - Giant Rock (*Crassadoma gigantean*)				6 (Release)
	Scallop – Swimming (*Chlamys hastata*)				5 (Release)
	Sculpin – Buffalo (*Enophrys bison*)				4 (Release)
	Sculpin – Cabezon (*Scorpaenichthys marmoratus*)				1 (Release)
	Sculpin – Coralline (*Artedius corallines*)				1 (Release)
	Sculpin – Fluffy (*Oligocottus snyderi*)				4 (Release)
	Sculpin – Grunt (*Rhamphocottus richardsoni*)				2 (Release)
	Sculpin – Longfin (*Jordania zonope*)				2 (Release)
	Sculpin - Prickly (*Cottus asper*)				14 (Education)

	(Adult)				
	Sculpin - Red Irish Lord (*Hemilepidotus hemilepidotus*)				2 (Release)
	Sculpin – Sailfin (*Nautichthys oculofasciatus*)				2 (Release)
	Sculpin - Slimy (*Cottus cognatus*) (Adult)			60	
	Sculpin – Snubnose (*Orthonopias triacis*)				3 (Release)
	Sculpin – Staghorn (*Leptocottus armatus*)				5 (Release)
	Sculpin – Threadfin (*Icelinus filamentosus*)				1 (Release)
	Sculpin – Tidepool (*Oligocottus maculosus*)				9 (Release)
	Sculpin – Various spp.				4 (Release)
British Columbia	Sea Cucumber - Giant Red (*Parastichopus californicus)* (Adult)	850		90	66 (Release)
	Sea Cucumber - Giant Red (*P. californicus*) (Juvenile)		40	370	
	Sea Pen – Orange (*Ptilosarcus gurneyi*)				5 (Release)
	Sea Star – Bat (*Patiria miniata*)				28 (Release)
	Sea Star - Blood (*Henricia leviuscula*)				5 (Release)
	Sea Star - Giant Pink (*Pisaster brevispinus*)				4 (Release)
	Sea Star - Leather (*Dermasterias imbricata*)				9 (Release)
	Sea Star - Mottled (*Evasterias troshelii*)				1 (Release)

	Sea Star - Ochre (*Pisaster ochraceus*)				26 (Release)
	Sea Star – Rainbow (*Orthasterias koehleri*)				2 (Release)
	Sea Star - Sand Star (*Luidia foliolata*)				1 (Release)
	Sea Star - Six Rayed (*Leptasterias hexactis*)				2 (Release)
	Sea Star - Spiny Pink (*Pisaster brevispinus*)				6 (Release)
	Sea Star - Morning Sunrise (*Solaster dawsoni*)				5 (Release)
	Sea Star – Sunflower (*Pycnopodia helianthoides*)				31 (Release)
	Sea Star - Vermillion (*Mediaster aequalis*)				14 (Release)
	Shrimp – Coonstripe (*Pandalus danae*)				1 (Release)
	Shrimp - Stout (*Heptacarpus brevirostris*)				1 (Release)
	Snail - Black Turban (*Tegula funebralis*)				29 (Release)
	Snail - Channeled Topsnail (*Calliostoma canaliculatum*)				1 (Release)
	Snail - Dusky Turban (*Tegulo pulligo*)				4 (Release)
	Snail - Leafy Hornmouth (*Ceratostoma foliatum*)				10 (Release)
British Columbia	Snail - Red Turban (*Astrae gibberosa*)				98 (Release)
	Sponge - Orange				22 (Release)
	Sponge – Various spp.				1 (Release)
	Stickleback – Threespine (*Gasterosteus aculeatus*) (Adult)			1,070	14 (Education)

	Stickleback – Threespine (*G. aculeatus* (Eggs)			13,000 + 260 egg clutches	
	Sturgeon - White (*Acipenser transmontanus*) (Adult)		20	15	
	Sturgeon - White (*A. transmontanus*) (Juvenile)		555,000		9 (Education)
	Sturgeon - White (*A. transmontanus*) (Eggs/Milt)		8,100,000	6,000 + < 100 ml	
	Brown Bullhead (*Ameirus nebulosus*) (Adult)				3 (Education)
	Crappie (*Pomoxis spp.*) (Adult)				3 (Education)
	Largemouth Bass (*Micropterus salmoides*)				3 (Education)
	Sunfish – Pumpkinseed (*Leponis* gibbosus) (Adult)				3 (Education)
	Tilapia (*Oreochromis niloticus*) (Adult)	2,500			944,500 lbs (Resale/ Table Market)
	Tilapia (*O.* niloticus) (Juvenile)	202,200			
	Topsmelt (*Atherinops affinis*) (Eggs)			3,835	
	Trout - Bull (*Salvelinus* confluentes) (Adult)			55	
	Trout - Cutthroat[3] (*Oncorhynchus* clarkii) (Adult)		160		
	Trout - Cutthroat[3] (*O.* clarkia) (Juvenile)		31,550		
	Trout - Cutthroat[3] (*O. clarkii*) (Eggs)			15,000	
	Trout - Eastern Brook (*Salvelinus fontinalis*)		515,500		

	Trout - Lake (*Salvelinus namaycush*) (Eggs/Milt)			Eggs (8 fish) & Milt (6 fish)	
	Trout - Rainbow[3] (*Oncorhynchus mykiss*) (Adult)			2,650	
British Columbia	Trout - Rainbow[3] (*O. mykiss*) (Juvenile)	28,500	5,080,827	45,216	40 (Education)
	Trout - Rainbow[3] (*O. mykiss*) (Eggs)	1,130,000		58,010	
	Trout - Steelhead[3] (*O. mykiss*) (Adult)		230	1,000	
	Trout - Steelhead[3] (*O. mykiss*) (Juvenile)		58,000		
	Trout - Westslope Cutthroat (*Oncorhynchus clarkii lewisi*) (Juvenile)		18,000	150	
	Tubeworm				1 cluster (Release)
	Tunicate - Lightbulb (*Clavelina lepadiformis*)				3 (Release)
	Tunicate – Stalked (*Styela montereyensis*)				3 (Release)
	Urchin - Green Sea (*Strongylocentrotus droebachiensis*) (Adult)				5 (Release)
	Urchin - Purple Sea (*Strongylocentrotus purpuratus*) (Adult)			20	40 (Release)
	Urchin - Red (*Strongylocentrotus franciscanus*)				13 (Release)
	Warbonnet – Mosshead (*Chirolophis nugator*)				1 (Release)
	Whelk - Dire (*Searlesia dira*)				17 (Release)
	Whelk – Various spp.				4 (Release)
	Wolf Eel (*Anarrhichthys*	400			1 (Release)

	ocellatus) (Adult)				
	Wolf Eel (*A. ocellatus*) Juvenile			13,465	
	[1] Total does not include routine movements covered in aquaculture conditions of licence. [2] Totals are estimates only. Amounts indicated are based solely on information provided in applications, as blanket licenses for import of shellfish for aquaculture do not specify amount permitted. [3] Numbers indicated for these species do not include transfers to labs for research purposes covered under blanket licenses, as numbers are not specified in those cases				

3.3 Croatia

Prepared by Josip Mikuš and Marijana Pećarević, University of Dubrovnik, Dubrovnik, Croatia.

Overview:

Highlights of the National Report

Planktonic polychaetes *Phalocrophorus pictus* and *Pontodora pelagica*, chaetognatha *Sagitta galerita* and two fish species *Caranx rhonchus* and *Holacanthus ciliaris* were reported in the Croatian eastern Adriatic waters for the first time. Presence of Dinophyta *Akashiwo sanguinea* in the Eastern Adriatic Sea was confirmed with finding of this species in Port of Ploče.

Content:

1. Regulations:

The fundamental act regulating nature protection is the Nature Protection Act (Official Gazette NN 70/05, 139/08, 57/11). The consolidated text of the Act is available on web pages: http://www.dzzp.hr/eng/regulations/k/laws-and-regulations-702.html.

New Nature Protection Act is in the procedure in Croatian Parliament.

Proposal of the National Strategy on Invasive Alien Species in Croatia is still in preparation.

2. Intentional:

Synthesis of introductions – No data available.

3. Unintentional:

New Sightings

Invertebrates

Dinophyta *Akashiwo sanguinea* (K. Hirasaka) G.Hansen & Ø.Moestrup, 2000 is often found in samples from the Southern and Middle Eastern Adriatic (Carić *et al*., 2011) and was found in Port of Ploče as well (Čalić, personal communication).

Polychaetes *Phalocrophorus pictus* Greef, 1879 and *Pontodora pelagica* Greef, 1879 were found in plankton samples from the eastern part of the Southern Adriatic Sea during the investigated period 1993-2011 (Batistić & Garić, 2012).

An occurence of *Sagitta galerita* Dallot, 1971 was recorded in the Croatian waters of the Southern Adriatic (Batistić & Garić, 2012).

Vertebrates

Caranx rhonchus Geoffroy Saint-Hilaire, 1817 is a common predatory fish in the eastern Atlantic and in 2011 it was recorded for the first time in the southern part of the Eastern Adriatic Sea in Mali Ston Bay (Kožul & Antolović, 2013).

Holacanthus ciliaris (Linnaeus, 1758) was found for the first time in the Adriatic Sea, Trogir Bay, in 2011 (Dulčić, personal communication). So far, this is the only record in the Eastern Adriatic Sea.

Species lists (x,y coordinates) (see database format)

Previous Sightings - No data available.

Not Seen Species Yet - No data available.

4. Pathogens

Sightings/records – No data available.

General information - No data available.

5. Meetings

No new data

6. References and bibliography

Batistić, M., Garić, R. 2012. Newly recorded zooplankton species in the Adriatic Sea from 1993-2011: indicators of the hydroclimatic changes in the Eastern Mediterranean. p. 23-23. In: *International workshop: Molecular tools for monitoring marine invasive species, Lecce, 12-14 September 2012*. Italian National Interuniversity Consortium for Marine Sciences, Pisa.

Carić, M. Jasprica, N., Čalić, M., Batistić, M. 2011. Phytoplankton response to high salinity and nutrient limitation in the eastern Adriatic marine lakes. *Scientia Marina*, 75: 493-505.

Kožul, V., Antolović N. 2013. Occurrence of the false scad, *Caranx rhonchus* Geoffroy Saint-Hilaire, 1817 in the Adriatic Sea. *Journal of Applied Ichthyology*. DOI: 10.1111/jai.12086.

3.4 Denmark

Prepared by Kathe R. Jensen, Zoological Museum, Universitetsparken 15, DK-2100 Copenhagen Ø, Denmark; e-mail: krjensen@snm.ku.dk

Highlights:

Hemigrapsus takanoi Asakura & Watanabe, 2005 and *H. sanguineus* (De Haan, 1835) have been identified in the Danish Wadden Sea.

The invasion history and ecological impacts of *Marenzelleria viridis* (Verrill, 1873) has been studied in Odense Fjord.

Denmark acceded the Ballast Water Convention in September 2012.

Regulations:

Denmark acceded the Convention on Management of Ballast Water and Sediments on 11 September 2012, and in collaboration with OSPAR and HELCOM is developing guidelines and protocols for the implementation of the regulations of the convention. Danish participation is through the Nature Agency (Naturstyrelsen). A report on selection of Target Species Lists to be used in port surveys has been prepared (Jensen, 2013).

Intentional introductions:

None reported

Import and export of live marine species

Fisheries statisics for 2011 (the most recent available) can be downloaded from http://naturerhverv.fvm.dk/fiskeristatistik.aspx?ID=46763

There are no official statistics on import and export of live fish or other organisms for aquariums.

Unintentional introductions:

Invertebrates:

The two small crabs *Hemigrapsus takanoi* Asakura & Watanabe, 2005 and *H. sanguineus* (De Haan, 1835) have been found in the Danish Wadden Sea. The first record was from Rømø in 2011 (Buschbaum *et al*., 2012). Subsequently they have also been recorded from oyster banks near Mandø (Klaus Melbye, Vadehavscentret, pers. comm., including pictures). The crabs appear to be associated with empty shells of *Crassostrea gigas*.

A few new records of Chinese mitten crab, *Eriocheir sinensis* H. Milne Edwards, 1853, were spectacular enough to make it into news reports. One was caught on 19 September 2012 in a freshwater stream, Vindinge Å, eastern Funen (http://www.dr.dk/P4/Fyn/Nyheder/Nyborg/2012/09/19/144253.htm). The second one was caught in an eel-trap in Karrebæk Fjord, western Sjælland on 13 October 2012 (http://www.tv2east.dk/artikler/kinesisk-krabbe-fanget-i-karrebæksminde). Both reports included pictures, unfortunately only from the dorsal side, but judging from the size of the "mittens" both were probably males. There may have been other captures of smaller specimens, which have not been reported.

One Scandinavian study has elucidated the influence of ice winters on the Pacific cupped oyster, *Crassostrea gigas* (Thunberg, 1793) (Strand *et al*., 2012). Another study investigated interactions between cultured mussels and *C. gigas* (Eschweiler & Christensen, 2011).

Population genetics of the American razor clam, *Ensis directus* (Conrad, 1843) *(=E. americanus)*, including specimens from Denmark, has shown high variability in the introduced range (Vierna *et al*., 2012). Also, the cytogenetics of this species has been studies (González-Tizón *et al*., 2013).

The zebra mussel, *Dreissena polymorpha* (Pallas, 1771) is still only found in freshwater in Denmark. However, local authorities and consultants have plans to use this species to "clean" lakes for noxious/ toxic phytoplankton by culturing mussels on lines (http://www.sn.dk/Muslinger-skal-rense-Haraldsted-Soe/Ringsted/artikel/223644?rss, accessed on 31 January 2013), thus presumably increasing the existing population.

The identity of the Japanese oyster drill, *Ocinebrellus inornatus* (Récluz, 1851), in the western Limfjord has been confirmed by molecular analysis (Lützen *et al*., 2012).

The New Zealand mud-snail, *Potamopyrgus antipodarum* (J.E. Gray, 1843), from Roskilde Fjord has been used in a laboratory study on effects of metal oxide nanoparticles (Pang *et al*., 2012).

The mudworm *Marenzelleria viridis* (Verrill, 1873), now officially called "svovlorm" (sulphur worm) in Danish continues to spread and increase in abundance in Danish waters, and must now be considered truly invasive. Several studies have been carried out on impacts on native species and ecosystem functions (Kristensen *et al*., 2011; Delefosse & Kristensen, 2012; Delefosse *et al*., 2012). A student report from Roskilde University studied physiological responses to salinity and sulphate in specimens collected in Isefjord and Roskilde Fjord (Nielsen *et al*., 2012). For actual records see National Data Reports sheet.

Studies on population dynamics and impacts of the American comb-jelly *Mnemiopsis leidyi* (A. Agassiz, 1865) are also continuing in Danish waters (Jaspers *et al*., 2011; Schaber *et al*., 2011a,b; Dinasquet *et al*., 2012; Riisgård *et al*., 2012a,b). Most recently specimens identified as *Beroe ovata* Mayer, 1912, have been reported from Kerteminde Fjord (Riisgård, pers. comm.). Identification has not yet been confirmed by molecular methods.

The orange-striped sea anemone, *Diadumene lineata* (Verrill, 1869) may have been wiped out by cold winter temperatures and ice formation during early 2011. After having been fairly common in the original – and only – locality, it was not found at any time during spring, summer or fall of 2011 (Olsen & Tendal, 2012).

Fish

The round goby, *Neogobius melanostomus* Pallas, 1811 continues to spread in Danish waters. Several student projects are in progress. Some results were presented at the national meeting of marine scientists in January 2013 (see below).

Macroalgae:

Several studies on ecological aspects (temperature, salinity, grazing) of the invasive *Gracilaria vermiculophylla* (Ohmi) Papenfuss, 1967 have been published (Höffle *et al*., 2011; Nejrup & Pedersen, 2012; Nejrup *et al*., 2012).

Higher plants:

Adaptations of *Spartina anglica* C.E. Hubbard, 1968 root and rhizome metabolism indicate that it may be better adapted to changes associated with sea leve rise than native seagrasses (Holmer *et al*., 2009; Winkel *et al*., 2011).

Species not yet seen:

The red-gilled mudworm, *Marenzelleria neglecta* Sikorski & Bick, 2004 has not yet been detected in Danish waters, though it is very common in the Baltic Sea (Norkko *et al*., 2012).

Meetings

Second Jelly-Day, 10 October 2011, DTU-Aqua, Charlottenlund had 45 participants from 10 European countries. There were 17 presentations, mostly on *Mnemiopsis leidyi*.

Danish Society of Marine Biology (Dsfmb), 31 January 2012, two presentations on the invasion, biology and ecology of *Marenzelleria viridis* in Danish waters (E. Kristensen and M. Delefosse).

Third Symposium on marine bioinvasions in Denmark, 14 September 2012, NERI, Risø, Roskilde. Ten presentations. Abstracts available at http://cis.danbif.dk/cooperation/fol195769/symposium-om-marine-invasioner-i-danmark-149-2012/Symposium_marine_invasioner_program_og_abstract-book.pdf).

17th National Meeting of Marine Scientists, 21-23 January 2013, Roskilde University, Roskilde. One session had 5 presentations about invasive species, and several posters were also presented on this topic.

Acknowledgements

I would like to thank Klaus Melbye, director of the Wadden Sea Center, for information about *Hemigrapsus* spp., and prof. H.U. Riisgård for information about the possible occurrence of *Beroe ovata* in the Belt Sea.

References

Buschbaum, C., Lackschewitz, D. and Reise, K. 2012. Nonnative macrobenthos in the Wadden Sea ecosystem. Ocean & Coastal Management 68: 89-101.

Delefosse, M. and Kristensen, E. 2012. Burial of *Zostera marina* seeds in sediment inhabited by three polychaetes: Laboratory and field studies. Journal of Sea Research 71: 41-49.

Delefosse, M., Banta, G.T., Canal-Vergés, P., Penha-Lopes, G., Quintana, C.O., Valdemarsen, T. and Kristensen, E. 2012. Macrobenthic community response to the *Marenzelleria viridis* (Polychaeta) invasion in a Danish estuary. Marine Ecology Progress Series 461: 83-94.

Dinasquet, J., Titelman, J., Møller, L.F., Setälä, O., Granhag, L., Andersen, T., Båmstedt, U., Haraldsson, M., Hosia, A., Katajisto, T., Kragh, T., Kuparinen, J., Schrøter, M.-L., Søndergaard, M., Tiselius, P. and Riemann, L. 2012. Cascading effects of the ctenophore *Mnemiopsis leidyi* on the planktonic food web in a nutrient-limited estuarine system. Marine Ecology Progress Series 460: 49-61.

Eschweiler, N. and Christensen, H.T. 2011. Trade-off between increased survival and reduced growth for blue mussels living on Pacific oyster reefs. Journal of Experimental Marine Biology and Ecology 403: 90-95.

González-Tizón, A.M., Rojo, V., Vierna, J., Jensen, K.T., Egea, E. and Martinez-Lage, A. 2013. Cytogenetic characterisation of the razor shells *Ensis directus* (Conrad, 1843) and *E. minor* (Chenu, 1843) (Mollusca: Bivalvia). Helgoland Marine Research 67: 73-82.

Höffle, H., Thomsen, M.S. and Holmer, M. H. 2011. High mortality of *Zostera marina* under high temperature regimes but minor effects of the invasive macroalgae *Gracilaria vermiculophylla*. Estuarine, Coastal and Shelf Science 92: 35-46.

Holmer, M., Gribsholt, B. and Kristensen, E. 2002. Effects of sea level rise on growth of *Spartina anglica* and oxygen dynamics in rhizosphere and salt marsh sediments. Marine Ecology Progress Series 225: 197-204.

Jaspers, C., Møller, L.F. and Kiørboe, T. 2011. Salinity gradient of the Baltic Sea limits the reproduction and population expansion of the newly invaded comb jelly *Mnemiopsis leidyi*. PLoS ONE 6(8): e24065.

Jensen, K.R. 2013. Selection of target species for risk assessment of Danish ports in connection with the International Convention for the Control and Management of Ships' Ballast Water and Sediments. Unpublished report to the Danish Nature Agency, submitted 3 January 2013. (pdfs available on request from the author: krjensen@snm.ku.dk)

Kristensen, E., Hansen, T., Delefosse, M., Banta, G.T. and Quintana, C.O. 2011. Contrasting effects of the polychaetes *Marenzelleria viridis* and *Nereis diversicolor* on benthic metabolism and solute transport in sandy coastal sediment. Marine Ecology Progress Series 425: 125-139.

Lützen, J., Faasse, M., Gittenberger, A., Glenner, H. and Hoffmann, E. 2012. The Japanese oyster drill *Ocinebrellus inornatus* (Récluz, 1851) (Mollusca, Gastropoda, Muricidae), introduced to the Limfjord, Denmark. Aquatic Invasions 7(2): 181-191.

Nejrup, L.B. and Pedersen, M.F. 2012. The effect of temporal variability in salinity on the invasive red alga *Gracilaria vermiculophylla*. European Journal of Phycology 47(3): 254-263.

Nejrup, L.B., Pedersen, M.F. and Vinzent, J. 2012. Grazer avoidance may explain the invasiveness of the red alga *Gracilaria vermiculophylla* in Scandinavian waters. Marine Biology 159: 1703-1712.

Norkko, J., Reed, D.C., Timmermann, K., Norkko, A., Gustafsson, B.G., Bonsdorff, E., Slomp, C.P., Carstensen, J. and Conley, D.J. 2012. A welcome can of worms? Hypoxia mitigation by an invasive species. Global Change Biology 18: 422-434.

Nyberg, C.D., Thomsen, M.S. and Wallentinus, I. 2009. Flora and fauna associated with the introduced red alga *Gracilaria vermiculophylla*. European Journal of Phycology 44(3): 395-403.

Olsen, K. and Tendal, O.S. 2012. Første fund af orangestribet søanemone, *Diadumene lineata* (Verrill, 1869) (Anthozoa: Actiniaria), i Danmark. [First record of Orange-striped sea anemone, *Diadumene lineata* (Verrill, 1869) (Anthozoa: Actiniaria), in Denmark.] Flora og Fauna 118(1): 1-6.

Pang, C., Selck, H., Misra, S.K., Berhanu, D., Dybowska, A., Valsami-Jones, E. and Forbes, V.E. 2012. Effects of sediment-associated copper to the deposit-feeding snail, *Potamopyrgus antipodarum*: A comparison of Cu added in aqueous form or as nano- and micro-CuO particles. Aquatic Toxicology 106-107: 114-122.

Riisgård, H. U., Andersen, P. and Hoffmann, E. 2012. From fish to jellyfish in the eutrophicated Limfjorden (Denmark). Estuaries and Coasts 35(3): 701-713.

Riisgård, H. U., Jaspers, C., Serre, S. and Lundgreen, K. 2012. Occurrence, inter-annual variability and zooplankton-predation impact of the invasive ctenophore *Mnemiopsis leidyi* and the native jellyfish *Aurelia aurita* in Limfjorden (Denmark) in 2010 and 2011. BioInvasions Records 1(3): 145-159.

Schaber, M., Haslob, H., Huwer, B., Harjes, A., Hinrichsen, H.-H., Köster, F.W., Storr-Paulsen, M., Schmidt, J.O. and Voss, R. 2011. The invasive ctenophore *Mnemiopsis leidyi* in the central Baltic Sea: seasonal phenology and hydrographic influence on spatio-temporal distribution patterns. Journal of Plankton Research 33(7): 1053-1065.

Schaber, M., Haslob, H., Huwer, B., Harjes, A., Hinrichsen, H.-H., Storr-Paulsen, M., Schmidt, J.O., Voss, R., Neumann, V. and Köster, F.W. 2011. Spatio-temporal overlap of the alien invasive ctenophore *Mnemiopsis leidyi* and ichthyoplankton in the Bornholm Basin (Baltic Sea). Biological Invasions 13: 2647-2660.

Strand, Å., Blanda, E., Bodvin, T., Davids, J.K., Jensen, L.F., Holm-Hansen, T.H., Jelmert, A., Lindegarth, S., Mortensen, S., Moy, F.E., Nielsen, P., Norling, P., Nyberg, C., Christensen, H.T., Vismann, B., Holm, M.W., Hansen, B.W. and Dolmer, P. 2012. Impact of an icy winter on the Pacific oyster (*Crassostrea gigas* Thunberg, 1793) populations in Scandinavia. Aquatic Invasions 7(3): 433-440.

Svenningsen, N.B., Heisterkamp, I.M., Sigby-Clausen, M., Larsen, L.H., Nielsen, L.P., Stief, P. and Schramm, A. 2012. Shell biofilm nitrification and gut denitrification contribute to emission of nitrous oxide by the invasive freshwater mussel *Dreissena polymorpha* (zebra mussel). Applied Environmental Microbiology 78(12): 4505-4509.

Vierna, J., Jensen, K.T., González-Tizón, A.M. and Martinez-Lage, A. 2012. Population genetic analysis of *Ensis directus* unveils high genetic variation in the introduced range and reveals a new species from the NW Atlantic. Marine Biology 159: 2209-2227.

Winkel, A., Colmer, T.D. and Pedersen, O. 2011. Leaf gas films of *Spartina anlica* enhance rhizome and root oxygen during tidal submergence. Plant, Cell and Environment 34: 2083-2092.

Unpublished student report

Nielsen, K.T., Børgesen, L.F., Samuelsen, L., Nielsen, A.S., Karling, N.D., Christensen, L. and Andersen, M.M. 2012. En undersøgelse af fysiologisk tolerance mellem marine børsteorme. A study of physiological tolerance in the native *Nereis diversicolor* and the invasive *Marenzelleria viridis*. Student report Roslilde University (RUC) under supervision of G.T. Banta. Roskilde University, 52pp. (available at: http://rudar.ruc.dk/bitstream/1800/8217/1/Samlet%20rapport.pdf; last accessed on 19 February 2013).

3.5 Estonia

Compiled by Henn Ojaveer with assistance of Jonne Kotta, Estonian Marine Institute, University of Tartu

Overview

In 2012 a new polychaete species was caught in the Pärnu Bay area (NE Gulf of Riga) and established itself in the new environment. According to the preliminary analyses, the species belongs to the genera *Laonome* and it seems that the species is not previously known to science. Currently, the taxonomists and ecologists are working on the material to prepare a scientific report on the morphology and ecology of the species. Alien species monitoring, started in 2010, was continued in 2012 with substantial field works in two port areas – ports of Muuga and Sillamäe (Gulf of Finland). In addition, annual-scale population dynamics of eleven alien species was monitored. The mud crab *Rhithropanopeus harrisii* was found to be colonized the whole Pärnu Bay while in other targeted study areas at the Estonian coast (Väinameri Archipelago, Gulf of Finland) the species was not found. The cladoceran *Evadne anonyx* has colonized the whole Gulf of Riga already in 2001 but its abundance has remained very low during 2001-2012. While the round goby *Neogobius melanostomus* was still found to be expanding its distribution area and increasing in population abundance, the status of other alien species has remained largely unchanged compared to previous years. Substantial progress was achieved for developing AquaNIS information system within the EU FP7 project VECTORS.

1. Regulations: An update on new regulations and policies (including, aquaculture and vector management)

No news to report.

2. Intentional introductions

Official data on fish releases of Estonia for 2011 and 2012 (in thousands)

Species/year	2011	2012
Salmon (Salmo salar)	108.9	242.6
Sea trout (Salmo trutta trutta)	162.3	119.0

3. Unintentional introductions

In summer 2012 a new polychaete species was caught in the Pärnu Bay area. The same species was regularly observed at very high densities till the end of sampling season (November). The species currently inhabit about 5 km^2 sea area close to the Pärnu rivermouth. All this suggests that the species has formed a permanent population in the study area. According to the preliminary analyses the species belongs to the genera *Laonome* and it seems that the species is not previously known to science. Currently, the taxonomists and ecologists are working on the material to prepare a scientific report on the morphology and ecology of the species.

Cercopagis pengoi invaded the Gulf of Riga in 1992. It is known, that the species prefers warm water environment, preferably sheltered from winds. One of the largest density values was recorded for the alien predatory cladoceran *C. pengoi* in the zooplankton long-term monitoring area in the NE Gulf of Riga in 2011 (Figure 1, Anon. 2013). At the same time, in Tallinn and Muuga bays (southern Gulf of Finland), *C. pengoi* density has been extremely low during the past few years (Figure 2, Anon. 2013).

The other alien cladoceran – *Evadne anonyx* – was first found in the Baltic Sea in 1999 (Põllupüü *et al*. 2008). The species has been present in several sampling stations (the samples were taken during the commercial fish hydroacoustic surveys late July) all over the Gulf of Riga since the first year of observations in 2001, however, with very low abundances - annual mean below 30 ind/m^{-3}. For details on finding locations in 2001 and 2012, please see the data report.

Abundance of larvae of the polychaete *Marenzelleria neglecta* reached very high annual mean value in NE Gulf of Riga in 2012 being historically the second highest (ca. 51 thousand ind/m^2, Figure 1). At the same time, density of *M. neglecta* larvae reached historically the highest value in Tallinn and Muuga bays – 12 638 ind/m^2; Figure 2). As evidenced by the results from the national alien species monitoring programme (started in 2010), this species was commonly present in zoobenthic communities in Muuga Bay (Gulf of Finland), which hosts the largest port in Estonia. The samples taken both from the harbour area as well as adjacent localities confirm that *M. neglecta* was the most frequently found alien species in these areas (with co-domination in a few localities), with the other zoobenthic alien species being *Potamopyrgus antipodarum*, *Balanus improvisus* and *Mya arenaria* (Anon. 2012). The status of other recent benthic invertebrate invaders *Paramysis intermedia*, *Gammarus tigrinus*, *Chelicorophium curvispinum* and *Pontogammarus robustoides* has remained relatively the same as in previous years.

The Harris mud crab *Rhithropanopeus harrisii* was first found in Estonian waters in 2011. Seven individuals were found in pike-perch artificial spawning substrata, consisting of linen small mesh-sized gillnets, in northern coast of Pärnu Bay (NE Gulf of Riga) when collecting them out of the sea in August. Artificial spawning substrata have been provided to pike-perch in the same area annually since the end of the 1980s. Further investigations in 2012 evidenced that the species has colonised whole Pärnu Bay and already occurring outside the area in the NE Gulf of Riga (Figure 3; Kotta and Ojaveer 2012).

Catch index of the Chinese mitten crab *Eriocheir sinensis* has been monitored in gillnet fishing nets in Muuga Bay (Gulf of Finland) since 1991. While until 2002, the species was relatively rarely found, significantly elevated catch index level was recorded since then. However, no crabs were found in the bay during the past two years (Figure 4; Anon 2012).

The round goby *Neogobius melanostomus* continues to increase in population abundance in the Gulf of Finland. The center of the distribution area is Muuga Bay where the species has increased exponentially since 2005 to until 2010, and this increase has slowed down during a few past years. In 2012, the fish constituted already 92% in terms of biomass in experimental catches with gillnets nets of mesh size of 36-44mm (Figure 5, Anon 2013). In addition, the species is also spreading spatially and have colonized several localities around the Estonian coast (Figure 6).

The gibel carp *Carassius gibelio* was introduced to fish ponds in Estonia during the mid 1950s and first found in the sea in 1985 (Vetemaa *et al*. 1985). Out of the routinely investigated coastal fish monitoring stations, this alien fish is most abundant at the southern coast of Saaremaa (Kõiguste) in the northern Gulf of Riga (Figure 7). However, gibel carp occurs in several coastal fish monitoring sites at low abundances and is therefore considered as a common species in coastal fish communities.

4. Pathogens

Nothing to report.

5. Meetings

Several EU FP7 VECTORS project meetings were attended to further develop the information system of the Aquatic Non-Indigenous Species in Europe (AquaNIS).

6. References and bibliography

Anon 2013. Operational monitoring of Estonian coastal sea. Estonian Marine Institute, University of Tartu. Final report, Tallinn (in Estonian).

Bulleri, F., Mant, R., Bulleri, F., Kotta, J., Rilov, G., Crowe, T. 2012. The effects of exotic seaweeds on native benthic assemblages: variability between trophic levels and influence of background environmental and biological conditions. Environmental Evidence 1:08.

Katajisto, T.; Kotta, J.; Lehtiniemi, M.; Malavin, S. A.; Panov, V. E. (2013). Palaemon elegans Rathke, 1837 (Caridea: Palaemonoidea: Palaemonidae) established in the Gulf of Finland, the north-eastern Baltic Sea. Bioinvasions Records (in press).

Kotta, J.; Kuprijanov, I. (2012). The first finding of the palaemonid shrimp Palaemon elegans Rathke, 1837 in the Estonian coastal sea. Estonian Journal of Ecology, 61(2), 148 - 153.

Kotta, J. and Ojaveer, H. 2012. Rapid establishment of the alien crab *Rhithropanopeus harrisii* (Gould) in the Gulf of Riga. Estonian Jouran of Ecology 61,4, 293-298.

Kotta, J.; Torn, K.; Reisalu, G.; Veber, T. (2013). Relationships between mechanical disturbance and biomass of the invasive amphipod Gammarus tigrinus within a charophyte dominated macrophyte community. Marine Ecology (in press).

Rilov, G. Mant, R., Lyons, D., Bulleri, F., Benedetti-Cecchi, L., Kotta, J., Queiros, A., Chatzinikolaou, E., Crowe, T., Guy-Haim, T. 2012. How strong is the effect of invasive ecosystem engineers on the distribution patterns of local species, the local and regional biodiversity and ecosystem functions? A Systematic Review Protocol. Environmental Evidence 1:10.

Olenin, S., Aleksas Narščius, Dan Minchin, Bella Galil, Stephan Gollasch, Anna Occhipinti-Ambrogi, Henn Ojaveer and Anastasija Zaiko Making non-indigenous species databases practical for management and useful for research: an aquatic perspective. Biological Conservation (under review).

Põllupüü, M., Simm, M. and Ojaveer, H. Phenological trends among cladocerans: a response to climate change and bioinvasions. MEPS (under review).

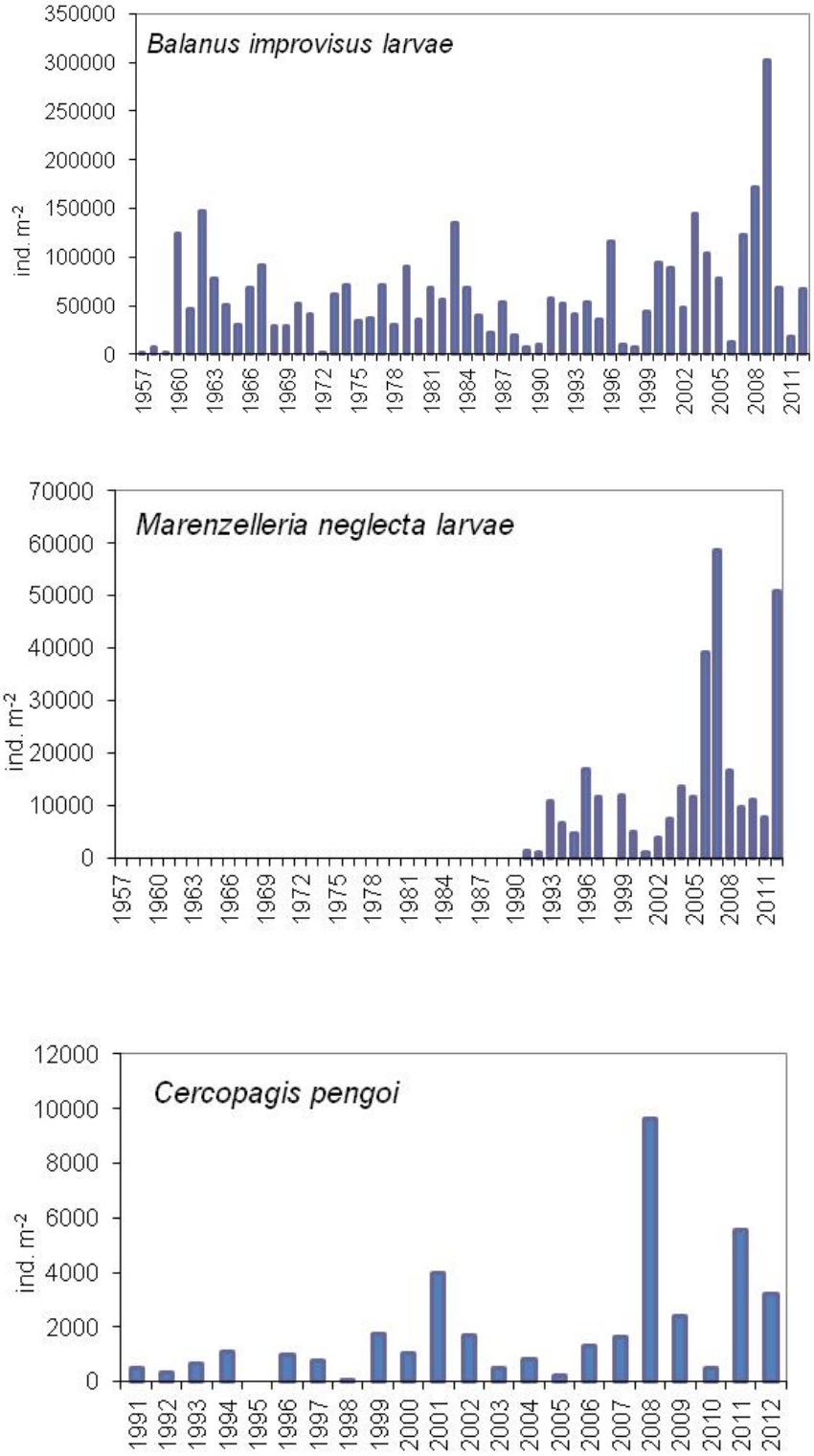

Figure 1. Long-term abundance dynamics of *Balanus improvisus* larvae, *Marenzelleria neglecta* larvae and *Cercopagis pengoi* in the NE Gulf of Riga (Baltic Sea). Anon 2013.

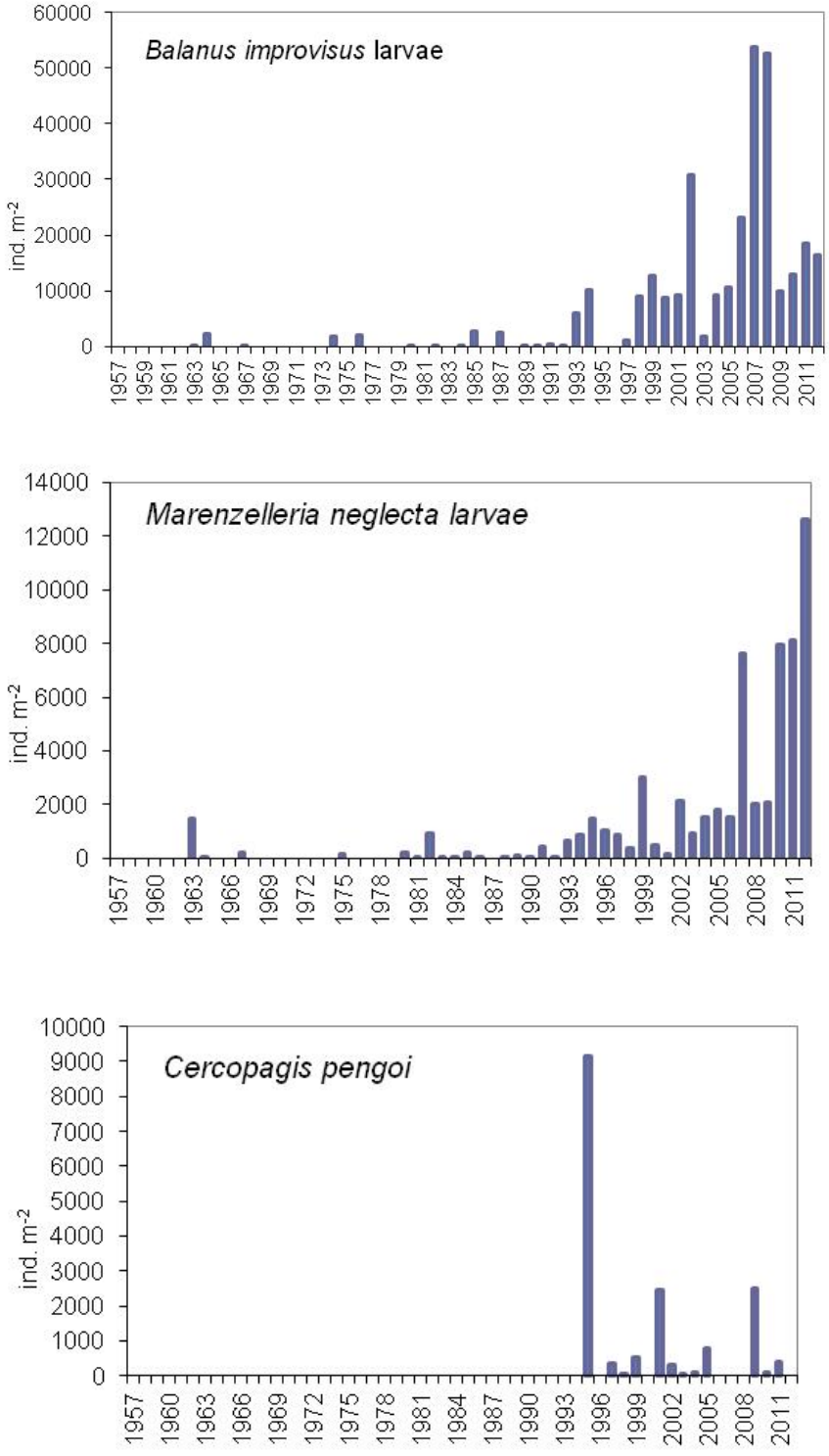

Figure 2. Long-term abundance dynamics of *Balanus improvisus* larvae, *Marenzelleria neglecta* larvae and *Cercopagis pengoi* in Tallinn and Muuga Bays (Gulf of Finland, Baltic Sea). Anon 2013.

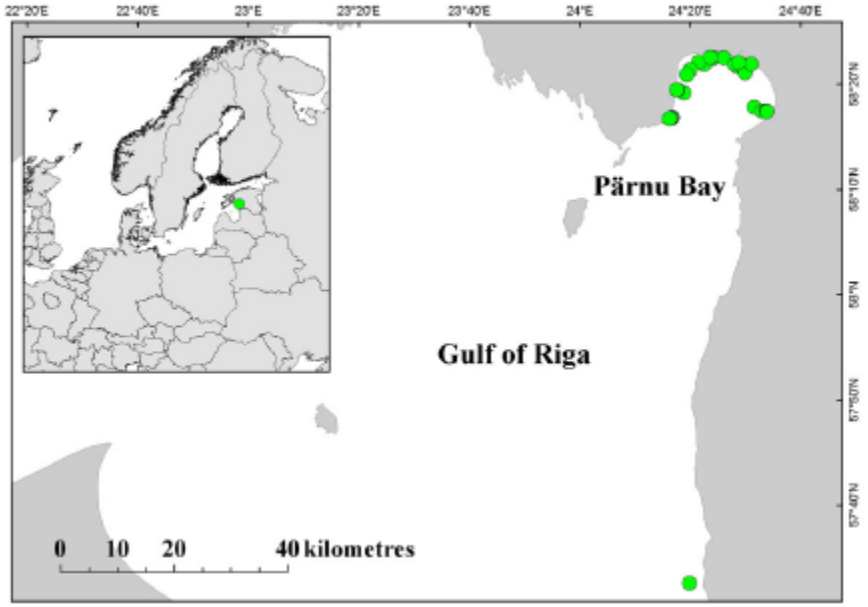

Figure 4. Locations where the mud crab *Rhithropanopeus harrisii* was found in the Estonain coastal sea in the Gulf of Riga (Kotta and Ojaveer 2012).

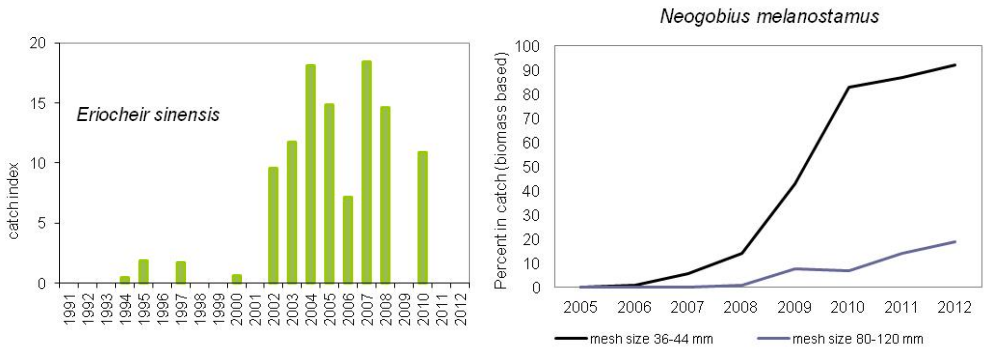

Figure 5. Catch index of the Chinese mitten crab *Eriocheir sinensis* (upper panel) and percent contribution of the round goby *Neogobius melanostomus* (lower panel) in experimental gillnet catches in Muuga Bay (Gulf of Finland, Baltic Sea) (Anon 2013).

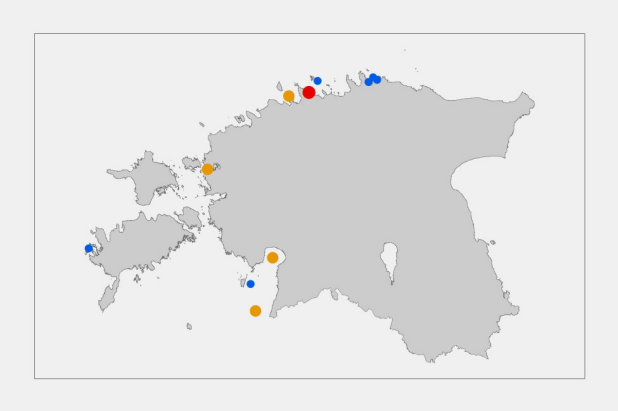

Figure 6. Findings of the round goby *Neogobius melanostomus* in Estonain coastal sea. Red: very abundant and dominating in fish community (Port of Muuga); Orange: widely distributed and common (Tallinna ja Haapsalu bays and NE Gulf of Riga); Blue: present in low abundance (west coast of Saaremaa Island and mid Gulf of Riga). Anon. 2013.

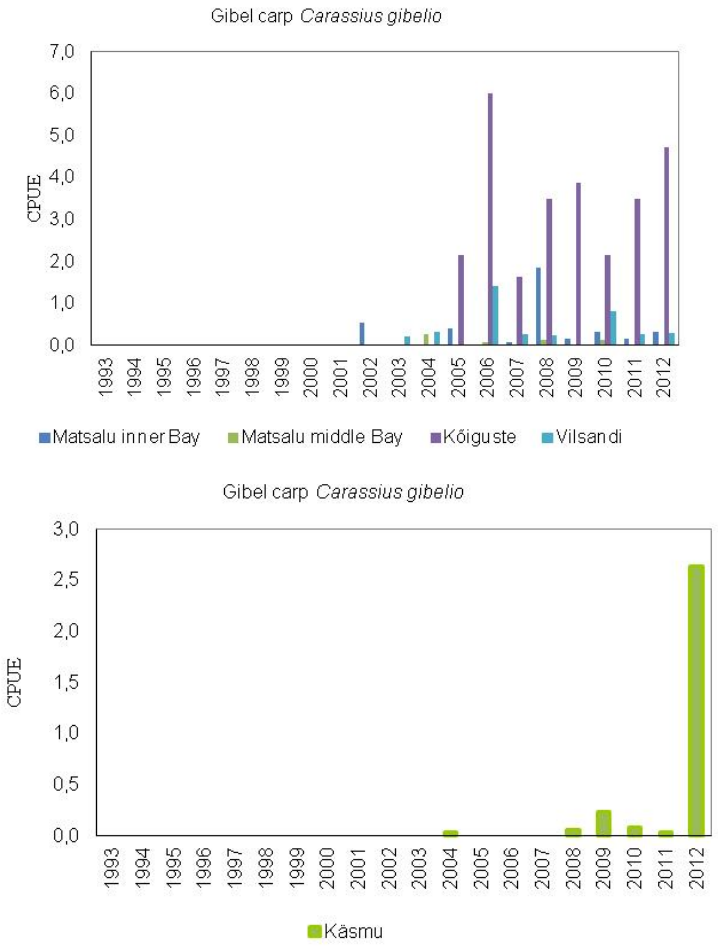

Figure 7. Catch per unit effort (CPUE) of gibel carp *Carassius gibelio* in various locations in Estonian coatsal sea: Matsalu Bay (West-Estonian Archipelago Sea), Kõiguste (southern coast of Saaremaa in the Gulf of Riga), Vilsandi (west coast of Saaremaa Island) and Käsmu (southern coast of the middle Gulf of Finland). Anon 2013.

3.6 Finland

Compiled by Maiju Lehtiniem, Finnish Environment Institute, Finland; and Lauri Urho, Finnish Game and Fisheries Research Institute, Finland.

Overview

One new alien species was found in Finnish waters in 2012: the Hydromedusa *Maeotias marginata* in the Archipelago Sea, northern Baltic Sea. The mud crab *Rhithropanopeus harrisii* was found to still increase in abundance in the Archipelago Sea. Sampling protocol for port monitoring was developed under HELCOM and tested in two Finnish ports in late summer 2012. Ports seem to be hot spots for alien species as they hosted most of the alien species of the corresponding sea areas. Finnish national strategy on invasive species was accepted by the parliament during spring 2012. The ratification of the IMO's BWM Convention by Finland was delayed and will take place during 2013.

1. Regulations: An update on new regulations and policies (including, aquaculture and vector management)

The National Strategy on Invasive Species (coordinated by the Ministry of Agriculture and Forestry) was accepted by the parliament in spring 2012. The strategy listed all harmful and potentially harmful alien species in Finland (and species that could come to Finland) as well as suggested the most important management options and authorities responsible for the management.

Finland is going to ratify the International Maritime Organization's International Convention for the Control and Management of Ships' Ballast Water and Sediments (the BWM Convention) during 2013.

Sampling protocol for port monitoring was developed under HELCOM ALIENS 2 to prepare and create unified approaches for the exemption-procedures of BWMC in the Baltic Sea when the Convention will enter into force. The sampling protocol was tested in two Finnish ports (Turku and Naantali ports) in late summer 2012. Ports seem to be hot spots for alien species as they hosted most of the alien species of the corresponding sea areas.

A scheme (parameters, stations/areas, frequency, methods) for alien species monitoring will be developed in Finland during 2013 in order to fulfill the requirements of the MSFD descriptor 2. This national monitoring will also take into account the planned port monitoring, which serves in addition to the BWMC also MSFD.

2. Intentional introductions

Deliberate releases into the Baltic Sea were (including rivers draining into the Baltic) for fisheries and fish stock enhancement purposes in 2012 as follows (some values are underestimates):

0.6 million newly hatched and 1.6 million older salmon (*Salmo salar*), and

0.3 million newly hatched and 1.1 million older sea trout (*Salmo trutta* m. *trutta*),

something around 26 million newly hatched and 10.4 million older whitefish (*Coregonus lavaretus*).

Salmonids, mostly Rainbow trout (*Oncorhynchus mykiss*) were imported from Denmark and Sweden for cultivation. Eel were imported from England via

Sweden and sturgeons (*Acipenser naccarii*), (*Acipenser naccarii x A.baerii*) from Spain.

3. Unintentional introductions

One new alien species was found in Finnish waters in 2012, the Hydromedusa *Maeotias marginata* in the Archipelago Sea, northern Baltic Sea (vonNumers 2012). One specimen was observed in shallow littoral in August.

In addition there were changes in species abundance and distribution in established alien species.

Turku and Naantali ports were revealed to host several alien species, which were found in samplings done simultaneously with several methods in order to cover plankton, benthos, fish, mobile and sessile epifauna. The observed alien species in the ports were:

Acartia tonsa
Amphibalanus improvisus
Boccardiella ligerica
Cercopagis pengoi
Cordylophora caspia
Gammarus tigrinus
Marenzelleria spp.
Mytilopsis leucophaeata
Neogobius melanostomus
Palaemon elegans
Rhithropanopeus harrisii
Victorella pavida

Invertebrates:

The crustacean *Palaemon elegans* was observed the first time in the Gulf of Finland, in 2003. 2010-2011 littoral samples were collected along the Finnish southern coastline and *P. elegans* was observed in several localities from the eastern Gulf of Finland to the Archipelago Sea. Based on these results it is clear that the species has well established in the Gulf of Finland (Katajisto *et al*. 2013).

The crustacean, mud crab *Rhithropanopeus harrisii* was observed for the first time in 2009 in Naantali area in the Archipelago Sea (northern Baltic Sea) after that it has increased rapidly in abundance as well as in distribution in the Archipelago Sea (Fowler *et al*. 2013). Fishermen often report of fishes (mainly perch but also roach and pike-perch) that have stomachs full of mud crabs.

Fish:

The round goby, *Neogobius melanostomus*, were observed again in two totally new areas, all near ports. The species seemed to have established a population also quite far in the northern Baltic Sea, near the port of Raahe. In Helsinki area, were the round goby was first found in 2009, the distribution areas has extended locally from less than 1 km^2 in 2009 to 3 km^2 in 2010, 29 km^2 in 2011 and 41 km^2 in 2012.

4. Species Not Yet Observed:

The Amur sleeper, *Perccottus glenii*, has not been observed in Finnish waters, although it is known to occur in the Russian side of the Gulf of Finland. The American comb jelly, *Mnemiopsis leidyi,* has not been observed (genetically confirmed) in Finnish waters. *Pontogammarus robustoides* (Sars) has not been observed in Finnish waters although it has been recorded for the first time in the Estonian coastal sea in Narva Bay, eastern Gulf of Finland, in 2006 and thereafter. *Paramysis intermedia* (Czerniavsky) has not been recorded either although is present in the eastern Gulf of Finland.

5. Research projects:

- A project to develop alien species monitoring in coastal areas of Finland has been funded by the Ministry of Environment (2011-2013).
- A research project to increase knowledge on invasive alien species (IAS) in Finland - distribution, dispersal, risk management, pathways for entry (HAVINA) is funded by the Ministry of Agriculture and Forestry, Finland (2012-2013).

6. Meetings

Riikka Puntila presented a poster titled "Rapid spread of the invasive round goby (Neogibius *melanostomus*) in the coast of Helsinki, Finland, Northern Baltic Sea" by Puntila, R. & Urho, L in the Benthic Ecology Meeting, Norfolk, VA. 21.-.24.3.2012

7. References and bibliography

Katajisto Tarja, Jonne Kotta, Maiju Lehtiniemi, Stanislaw A. Malavin and Vadim E. Panov: *Palaemon elegans* Rathke, 1837 (Caridea: Palaemonoidea: Palaemonidae) established in the Gulf of Finland. Aquatic Invasions (in press).

Fowler Amy E., Tiia Forsström, Mikael von Numers, Outi Vesakoski 2013: The North American mud crab *Rhithropanopeus harrisii* (Gould, 1841) in newly colonized Northern Baltic Sea: distribution and ecology. Aquatic Invasions (in press).

von Numers Mikael 2013: The first record of *Maeotias marginata* (Modeer, 1791) (Cnidaria, Hydrozoa) from Finland, northern Baltic Sea. BioInvasions Records Volume 2.

Hosia, A., Granhag, L., Katajisto, T. & Lehtiniemi, M. 2012: Experimental feeding rates of gelatinous predators *Aurelia aurita* and *Mnemiopsis leidyi* at low northern Baltic Sea salinity. Boreal Env. Res. 17: 473–483.

Urho Lauri, Maiju Lehtiniemi, Riikka Puntila, Reetta Ljungberg, Anna Pikkarainen, Tarja Katajisto, Jussi T. Pennanen, Erkki Leppäkoski 2012: Delivering a survey program, risk assessment and early warning system on (invasive) alien species in Finnish brackish waters / Merialueemme vieraslajien seurannan, varhaisvaroitusjärjestelmän (VVJ) ja riskinarvioinnin kehittäminen (in Finnish). Työraportteja, nro 30, 2012. 25 p. http://www.rktl.fi/julkaisut/j/626.html

Lehtiniemi M 2012: Ecological roulette in the Baltic Sea/Ekologista rulettia Itämerellä (in Finnish). Ympäristö: 26 (2): 4-9

Hyytiäinen Kari, Maiju Lehtiniemi 2012: Risks from alien species affect also power plants/Vieraslajien riski koskettaa voimaloitakin (in Finnish, Vieraskynä). Helsingin Sanomat 27.5.2012: A 2

3.7 France

France National Report 2012

ICES Working Group on Introductions and Transfers of Marine Organisms

Compiled by Amelia Curd (IFREMER) with contributions from Guy Bachelet (CNRS – University Bordeaux 1), Jacques Bertrand (IFREMER), Anthony Doré (MNHN-Concarneau), Jean-Claude Dauvin (CNRS - University of Caen), Cyrille François (IFREMER), Patrice Francour (University of Nice Sophia Antipolis), Sophie Girard (IFREMER), Philippe Goulletquer (IFREMER), Samuel Iglesias (MNHN-Concarneau), Laurence Miossec (IFREMER), Pierre-Guy Sauriau (CNRS – University of la Rochelle), Frédérique Viard (Station Biologique de Roscoff).

Overview:

France has been active in the work to develop common biodiversity indicators for non-indigenous species for the Marine Strategy Framework Directive, both nationally and within the NIS expert group of the Intersessional Correspondence Group on the Coordination of Biodiversity Assessment and Monitoring (ICG-COBAM) from the OSPAR convention.

Two new species of crustaceans and one ascidian, present due to anthropogenic vectors, have been identified and described in the Channel and Atlantic coastline. Through the use of molecular tools, an opisthobranch mollusk and five algae species havez been identified and further work on the distribution of cryptic species of *Ciona* is underway. In the Mediterranean, several new fish species have been observed due to range expansions.

Funded under the FP7 ERA-NET scheme, BiodivERsA is a network of national funding organizations promoting pan-European research that offers innovative opportunities for the conservation and sustainable management of biodiversity. The 2012-2013 call was for proposals on invasive species and biological invasions. For this call a total of 7M€ has been provisionally reserved by the participating partner organizations. Several French-led consortiums have submitted proposals. The evaluation of proposals and final ranking will take place in May 2013 (http://www.biodiversa.org/367).

1. Regulations:

A memorandum was published by the French Ministry of Ecology on the 17th of December 2012 transposing the good ecological status of French waters as defined in the Marine Strategy Framework Directive (MSFD) into French law. There are two noteworthy points for WGITMO:

-The criteria 2.2.1 "Ratio between invasive non-indigenous species and native species in some well-studied taxonomic groups that may provide a measure of change in species composition" from the Commission Decision of the 1st of September 2010 (L 232/14) is not considered relevant if France due to the paucity of data necessary to determine such a ratio.

-French waters are divided between four MSFD sub-regions (Greater North Sea, Celtic Seas, Bay of Biscay and the Iberian coast and Western Mediterranean Sea). Four inter-regional directorates (DIRM – Direction Inter-Régionale de la Mer) are responsible for setting the environmental targets and associated indicators for the North Sea Eastern Channel, Western Channel North Atlantic, South Atlantic and Mediterranean French Waters. The diversity of the French coastline and available data has led to there being some heterogeneity in the targets set depending on the MSFD sub-region. As an example, only the Mediterranean DIRM specifically mentions reducing the risk of introduction of NIS due to ballast waters.

More information on the transposing of MSFD into French law can be found here: http://wwz.ifremer.fr/dcsmm/Le-Plan-d-Action-pour-le-Milieu-Marin

The Commission Decision 2010/221/EU approving national measures for limiting the impact of certain diseases in aquaculture animals and wild aquatic animals in accordance with article 43 of Council Directive 2006/88/EC has been transposed into French law. The French Ministry of Agriculture, Food, Fisheries, Rural Affairs and Spatial Planning published on the 14th May 2012 a memorandum outlining the procedure to follow in order to restrict the movement of *Crassostrea gigas* due to oyster spat mass mortality events. A total of 30 prefectural decrees were issued between May and July 2012, temporarily suspending the movement of Pacific oysters for periods spanning from 9 to 42 days.

2. Intentional:

Invertebrates

French customs import and export statistics for Pacific oysters *Crassostrea gigas* and the European flat oyster *Ostrea edulis* can be found on the FranceAgriMer website (http://www.franceagrimer.fr/content/download/17494/136874/file/BIL_MER_CE_2011.pdf). Information on the imports of non-native species of live crustaceans and bivalve mollusks other than oysters are available, although the nomenclature used by customs is too imprecise to isolate individual species.

Algae

Cultures of *Undaria* in Brittany were the primary vector of release in the wild. Following non-authorized trials and projects to expand cultures in Brittany, governmental agencies requested an expert opinion on the conditions for expanding cultures (see WGITMO national French report 2012 for further details about the context of this expertise). The expertise was supervised by IFREMER with a panel of experts. The report is available at the IFREMER institutional repository (ARCHIMER; http://archimer.ifremer.fr/doc/00086/19740/17380.pdf).

Briefly, considering 1) the Regulation (EU) No 304/2011 of the European Parliament and of the Council of 9 March 2011 amending Council Regulation (EC) No 708/2007 concerning use of alien and locally absent species in aquaculture, 2) the documented fast escape of *Undaria* from farms into the wild and 3) the lack of knowledge of ecological consequences of the establishment of *Undaria* in the wild, the expert panel recommended to limit the expansion of cultures and to allow such an expansion only in areas where the species is already cultivated.

3. Unintentional:

New Sightings

Fish

Along the French Mediterranean coast, citizen science observation programs have been set up to report sightings of two Lessepsian species: the rabbitfish *Siganus spp.* http://www.unice.fr/ecomers/images/stories/ECOMERS/Actualits/Siganus/Fiche_Siganus_version_7.pdf, and the bluespotted cornetfish *Fistularia commersonii* (http://www.portcrosparcnational.fr/documentation/pdf/Fistularia_commersonii%202.pdf).

The Regional Activity Centre for Specially Protected Areas published a report in 2011 entitled "Non-native species in the Mediterranean: What, when, how and why?" http://www.rac-spa.org/sites/default/files/doc_alien/nis_en_r.pdf .

In October 2011 three specimens belonging to the bastard grunt *Pomadasys incisus* (Bowdich, 1825), were caught in the French Ligurian Sea for the first time. This subtropical species, which naturally entered the Mediterranean Sea through the Straits of Gibraltar in the first half of the nineteenth century, and is currently colonizing the whole Mediterranean coast except the Adriatic Sea, was until now unknown for this region (Bodilis ., 2013).

Invertebrates

Tunicata

As part of the Interreg Marinexus project and the AXA Research Fund program MAAC, the styelid unitary ascidian *Asterocarpa humilis* has been found on the coast of NW France (Brittany) from St-Malo to Quiberon and the south coast of England from Falmouth to Brighton, and also in north Wales. The species is common in several places in Brittany. These are the first records of this species in the Northern Hemisphere which were confirmed based on morphological and molecular (barcoding) identification. The results of these identifications and surveys are reported in Bishop . (2013). GPS data are available in the paper.

Crustacea

The non-native amphipod *Grandidierella japonica* (Stephensen, 1938) is reported for the first time on the Atlantic coast of mainland Europe, specifically from Marennes-Oléron Bay, France (Jourde ., 2012). Likely vectors for this introduction include commercial shellfish transplants and ballast waters. A native of Japan, this species had previously only been reported twice outside the Pacific region; in both cases from British coastal waters. Adults of both sexes, females carrying eggs, and juveniles were collected in Marennes-Oléron Bay, which suggests the species has become established. GPS data are available in the paper. Since Jourde *et al*. (2012) was published Water Framework Directive grab samples from the Seudre river have been analysed. *G. japonica* is shown to be present in very high densities (up to 80 individuals per 0,1m² grab). Samples from the same site in 2007 did not contain the *Grandidierella* genus, nor did they contain similar genera such as *Microdeutopus* sp. (P-G Sauriau 2013, pers. comm.,12 Feb.).

The presence of the demersal Asian copepod *Pseudodiaptomus marinus* was reported for the first time in the southern bight of the North Sea, in twelve different sites in both Calais harbour and the coastal waters off Gravelines, France. This is the first record of *P. marinus* in the Atlantic Ocean sector and the North Sea area (Brylinski ., 2012). The very low number of collected individuals (0.2 to 4.0 ind.m-3) and the capture of only two ovigerous females and of a few numbers of copepodid CV stages suggest that the species survives and actually reproduces in both sites but does not manage to develop an abundant population. The presence of *P. marinus* in Calais harbour and coastal waters of the southern North Sea supports recent observations of other Asian species in the same area and suggests a passive transport via ship's ballast waters.

Mollusca

A paper by Hanson, Hiraldo and Valdés (2013) has confirmed the presence of an opisthobranch mollusk with a large non-indigenous range, *Haminoea japonica*, in the North of France. Two specimens were collected in 2003 and identified with a DNA barcoding approach. This species is a vector for a parasite that causes the human skin disease cercarial dermatitis, and may have negative effects on populations of native species.

Algae

A paper by Mineur . (2012) reports the occurrence of four red macroalgae species new to Europe, identified with a DNA barcoding approach. *Gracilaria chorda*, *Chondracanthus* sp. and *Solieria* sp. were found in the Gulf of Morbihan in Brittany; *Solieria* sp. was also observed in the Mediterranean Thau lagoon. GPS data are available in the paper.

The presence of the introduced alga *Polysiphonia morrowii* Harvey was highlighted for the first time in the Northern Atlantic. This species originally from the Northwest Pacific Ocean has already been reported as introduced in Chile and New Zealand. It has been found along the coast of NW France (Brittany) from St-Malo to Quiberon. These observations were confirmed based on morphological and molecular (barcoding) identification. The first results of these observations are reported in Geoffroy, Le Gall & Destombe (2012). GPS data are available in the paper. This work was carried out as part of the PhD thesis of Alexandre Geoffroy (co-supervised by C. Destombes and L. Le Gall). The thesis (in French) is available on the Station Biologique of Roscoff website.

IFREMER is coordinating a new citizen-science program where the public is asked to report harmful algal blooms. A network of scientific and non-governmental French organizations is then responsible of the ensuing sampling and analysis. The objective is to crowdsource in order to cover a larger area of observation and to help the scientific community be more reactive and efficient in their HAB sampling process. The project, called PHENOMER (an acronym of 'visible phenomena at sea' in French), will be launched in the spring of 2013, in the pilot region of Brittany. It fulfills the role of a monitoring watch program for the potential appearance of exotic microalgae species.

Previous Sightings

Fish

A short communication by Bodilis *et al*. (2012) summarises the occurrence of an Atlantic species, *Pisodonophis semicintus*, along the Mediterranean coast. Dr. Samuel Iglesias from the Natural History Museum of Concarneau is compiling an identification and classification guide for the Chondrichthyans and Actinopterygians of the North-Eastern Atlantic and Mediterranean (Iglésias, 2012). This is a natural classification based on collection specimens, with DNA barcodes and standardized photographs. The date and GPS data are available for each specimen captured. There are a number of new and uncommon fish records within the French EEZ listed in this guide

(http://www.mnhn.fr/iccanam/GBAccueil.htm).

In the French Caribbean island of Martinique, the local environmental authorities (DEAL – Direction de l'Environnement, de l'Aménagement et du Logement en Martinique) are studying the possibility of commercially harvesting the red lionfish *Pterois volitans*. However before launching this initiative a study on the contamination of the red lionfish by chlordecone, an insecticide frequently used in banana plantations, will be led to see if the red lionfish flesh meets health and safety standards. The observation of this species around Martinique is followed and mapped by the Observatoire de l'eau de la Martinique: http://www.observatoire-eau-martinique.fr/news/le-poisson-lion-un-fauve-a-la-conquete-de-nos-recifs

Invertebrates

Tunicata

The taxa known as *Ciona intestinalis* is composed of at least 4 cryptic species (Zhan *et al*. 2010). Two of these cryptic species, named Type A and Type B, have been shown to occur in sympatry in Brittany where they can hybridize (Nyddam & Harrison 2010). Type B is native from the Northern Atlantic (incl. Brittany) whereas type A is supposed to be of Pacific origin and recently introduced into Europe. As part of the Marinexus programme and the ANR project HySea (coord. F. Viard), a thesis work (Sarah Bouchemousse supervised by F. Viard) has started in 2012 to study selected invasive tunicates established in Brittany, in particular *Ciona intestinalis* type A. In 2012, two surveys and genetic analyses were carried out to monitor the presence and examine the introgression between the two *Ciona* species. Results show that *Ciona intestinalis* type A is common, and in some localities dominant over type B, in Brittany. Surveys and analyses are pursued.

Mollusca

A single specimen of the veined Rapa whelk *Rapana venosa* was caught in southern Brittany (rivière de Saint-Philibert – 47.5746; -2.9990) on the 6th of June 2012, near Quiberon bay where this species was first observed in 1997. Although egg masses

have been found in the past, sightings remain extremely sporadic, with only 16 individuals reported since 1997.

Crustacea

Since its first sighting in 2008 on the central part of the western coast of northern Cotentin, the marbled crab *Pachygrapsus marmoratus* has been regularly sampled in the sites where it was first reported along the north coast of France (Dauvin, 2012). The presence of ovigerous females and juveniles confirmed the presence of a reproductive population in the English Channel. However, the absence of this species in other sites around the Cotentin suggests that the species may have good abilities to colonize new areas, considering the larval dispersal with its long planktonic larval phase, but failed in this particular case, probably due to non-favourable conditions.

A PhD at the university of Lille 1, entitled "*Introduction of the crabs of the genus* Hemigrapsus *on the coast of the Eastern English Channel : consequences on the population dynamics of native species and on the trophic network"* was started in October 2010. This study contributes towards both identifying the factors responsible for the success of the invasion (competition, typology of colonized sites) and analyzing the functioning of the impacted ecosystems (food webs, predation pressure).

Ctenophora

The INTERREG IVA 2 Seas programme project MEMO (*Mnemiopsis leidyi*: Ecological Modelling and Observation) launched a call to all citizens of the study area to report any observations of the species (http://www.ilvo.vlaanderen.be/Portals/55/Documents/Observe_affiche_EN.pdf).

In October 2012 a dedicated sampling programme aboard the French R/V Thalia was carried out. *Mnemiopsis* specimens were found in Dunkerque harbor and in vast numbers in the estuarine waters of the Westerschelde, Oosterschelde, and Lake Grevelingen, with thousands of individuals per plankton tow. Once back in marine waters, densities rapidly decreased again. In UK waters, (the mouth of the Thames and in the vicinity of Dover and Dungeness), densities of gelatinous and other zooplankton were surprisingly low, and not a single *Mnemiopsis* was observed. More information is available in the MEMO Newsletter 4 (http://www.ilvo.vlaanderen.be/memo/EN/Communication/Publications/tabid/5331/Default.aspx).

Porifera

In 1996 a sponge was found in a well studied area in the Ria of Etel, Brittany, France, that had never been recorded there before. This sponge was later described as a new species and genus, first by Perez *et al*. (2006), who concluded that it is probably an invasive species, and then by Henkel & Janussen (2011) who revised the taxonomy and nomenclature for the species now known as *Celtodoryx ciocalyptoides.* This sponge rates today among the dominant benthic megafauna in the shallow waters of the Gulf of Morbihan and Dutch inshore waters. The paper by Henkel & Janussen (2011) concludes that *Celtodoryx ciocalyptoides* was introduced to the North East Atlantic from the North West Pacific with aquaculture of the Pacific oyster *Crassostrea gigas* as the probable vector. This is probably the first case recorded so far of a sponge species being transferred from one ocean to another by human activity.

Not Seen Species Yet

Invertebrates

The French overseas territory of Saint-Pierre et Miquelon (SPM) has been exchanging with the Canadian AIS Zonal Monitoring Program since 2010, and some of the monitored species have been detected on a local level. In 2013 AIS surveillance in SPM will gain momentum, with anticipated collaborations and further information exchange with Canada's four Atlantic Provinces. A meeting was held at the Bedford Institute of Oceanography on the 12-13th February 2013 to discuss AIS monitoring programmes and database linkages. The ARDA (Association de Recherche et Développement pour l'Aquaculture) and IFREMER have developed a protocol to monitor the green crab *Carcinus maenas.* Although currently absent from SPM waters, Fukui traps will be set in selected sites in the spring of 2013 in order to detect their potential arrival. A second protocol to monitor biofouling involves immersing 10cm² PVC collector plates in selected sites in order to survey the colonization of the following invasive species: the leathery sea squirt *Styela clava*, the vase tunicate *Ciona intestinalis (specific Type undetermined),* the star ascidian *Botryllus schlosseri,* and the colonial sea squirt *Botrylloides violaceus.* The green macroalgae *Codium fragile* is also present in SPM waters. As there is regular ferry service between SPM and Fortune, Newfoundland, AIS surveys are recommended to determine if these species have been introduced to Fortune Bay (Sargent ., 2013). In time SPM should integrate the Canadian AIS Zonal Monitoring Program as part of the development of Franco-Canadian regional cooperation.

General Information

As part of the Marinexus programme, samples from ballast tanks (water and tank walls) and from the hull of a ferry sailing across the English Channel were obtained at several time periods. For ballast waters, meroplankton (benthic invertebrate larvae) was composed of bivalves, gastropods, polychaetes and cirripeds. Molecular barcoding applied to 12 bivalve larvae showed that all were local species (Mya sp., Lutraria sp. and Hiatella sp.). Foulers on ballast tank walls were also examined. Among them, specimens of the vase tunicate *Ciona intestinalis* were analyzed by means of molecular tools: one individual (out of eight) belonged to type A (the introduced one; see paragraph '*Ciona intestinalis*'). Visual surveys and sampling on the hull were also carried out by diving before and 6 months after winter careening on dry dock. Before careening, 19 taxa were recorded belonging to diverse phyla (brown and green seaweeds, cnidarians, mollusks, annelids, echinoderms, etc.) - including introduced species such as the barnacle *Elminius modestus*. A brown alga from the genus *Scytosiphon* was also observed. According to morphological criteria, the latter species may be *Scytosiphon doytii*, an introduced species from Pacific (identification to be confirmed). Mussels (*Mytilus* sp.), bivalves *Hiatella* sp. and the hydroid *Sarsia eximia* were the most abundant sessile animals, mainly located in 'refugia niches' such as the propellers and stern tube. After the careening, no invertebrates have been found, even on the "refugia niches" previously identified, showing the efficiency of the dry dock careening. However, the algal community was already well-developed at every part of the hull exposed to light. Altogether, this study exemplifies the potential role of cruise ferries in transporting a large diversity of taxa, including introduced ones, as foulers on the hull and within ballast tanks (Comtet, Roby, Fanfard, Leveque & Viard, unpublished data). Ballast water results were presented by T. Comtet at the International Workshop "Molecular tools for monitoring marine invasive species" (Lecce, Sept. 2012).

4. Pathogens

General information

In an attempt to understand the molecular mechanisms involved in disease resistance, a study by Morga . (2012) compared the molecular response of haemocytes from two populations (resistant and wild) to the parasite *Bonamia ostreae*. This is the first study to investigate resistance of a marine bivalve to an infection with an obligate intracellular parasite. It has not only generated new data concerning the flat oyster genome but has also contributed to a better understanding of the molecular basis involved in the resistance to *B. ostreae* infection. Further functional studies are now required to better characterize how these mechanisms allow the host to resist to *B. ostreae*.

Within the Interreg IVB SEAFARE framework a PhD was defended by Estelle Harrang at the University of La Rochelle in July 2012 entitled: "Benefits of molecular and cellular information for the characterisation of the resistance of the European flat oyster to B. ostreae, and for the detection of natural selection signatures".

5. Meetings

Past year (2012)

Organizational workshop of the Global Invasive Alien Species Information Partnership for users and providers (London 9-10 July 2012)

http://www.cbd.int/doc/?meeting=5099

A plenary meeting of the Marinexus project was held 21-22 May 2012 in Roscoff, France to present the new results of the project.

"Molecular tools for monitoring marine invasive species in European seas" was held in September 12-14th 2012, in Lecce, Italy. This workshop was organized within the 2011-2014 European Community project VECTORS ("Vectors of Change in Oceans and Seas- marine Life, Impact on Economic Sectors") (http://www.marine-vectors.eu).

A national seminar addressing the development of the monitoring programme for the Good Environmental Status Descriptor 2 "non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystem" of the Marine Strategy Framework Directive was held in Paris on the 16th of October 2012.

Meetings in 2013

The Invasive Species Centre is hosting the 18th International Conference on Aquatic Invasive Species that will be held in Niagara Falls, Ontario, Canada, April 21-25, 2013.

The next International Conference on Marine Bioinvasions will be 20-22 August 2013. It will be held at and sponsored by The Biodiversity Research Centre at the University of British Columbia in Vancouver, Canada.

6. References and bibliography

Bishop, J., Roby, C., Yunnie, A., Wood, C., Leveque, L., Turon, X. & Viard, F., 2013. The Southern Hemisphere ascidian *Asterocarpa humilis* is widely established in NW France and Great Britain. *Biological Invasions* 15 (2): 253-260.

Bodilis, P., Crocetta., F., Langeneck, J., & Francour, P., 2013. The spread of an Atlantic fish species, *Pomadasys incisus* (Bowdich, 1825) (Osteichthyes: Haemulidae), within the Mediterranean Sea with new additional records from the French Mediterranean coast, Italian Journal of Zoology, DOI:10.1080/11250003.2012.730555

Bodilis P, Cheminée A, Miniconi R, Arceo H, Francour P, 2012. Occurrences of the Atlantic species,*Pisodonophis semicinctu*s (Osteichthyes: Ophichthidae), along the Mediterranean coast. *Journal of Applied Ichthyology* 28(4): 652-654.Boudouresque, C-F., 2012. Les invasions et transferts biologiques, avec une attention spéciale au milieu marin. GIS Posidonie publ., Marseille. 248p. ISBN 2-905540-32-X.

Brylinski, J-M., Antajan, E., Raud, T., and Vincent D., 2012. First record of the Asian copepod *Pseudodiaptomus marinus* Sato, 1913 (Copepoda: Calanoida: Pseudodiaptomidae) in the southern Bight of the North Sea along the North coast of France. *Aquatic Invasions* 7(4): 577-584.

Dauvin, J-C., 2012. Establishment of a population of marbled crab *Pachygrapsus marmoratus* (Crustacea: Brachyura: Grapsoidea) on the coast of northern Cotentin, Normandy, on the western English Channel. *Marine Biodiversity Records* 5: e56 doi:10.1017/S1755267212000334

Geoffroy A., 2012: "Diversité génétique et délimitation d'espèces par des approches conjointes de barcoding et de génétique des populations: application à l'identification d'espèces d'algues marines nouvellement cultivées" Thèse de doctorat de l'Université Pierre et marie Curie, Spécialité Diversité du Vivant. 175pp.

Geoffroy, A., Le Gall, L. & Destombe, C., 2012. Cryptic introduction of the red alga *Polysiphonia morrowii* Harvey (Rhodomelaceae, Rhodophyta) in the North Atlantic Ocean highlighted by a DNA barcoding approach. *Aquatic Botany* 100: 67– 71.

Hanson D., Hirano Y., Valdés A., 2013. Population genetics of Haminoea (Haloa) japonica Pilsbry, 1895, a widespread non-indigenous sea slug (Mollusca: Opisthobranchia) in North America and Europe. *Biological Invasions* 15 (2): 395-406.

Henkel, D., and Janussen, D., 2011. Redescription and new records of *Celtodoryx ciocalyptoides* (Demospongiae: Poecilosclerida)—a sponge invader in the north east Atlantic Ocean of Asian origin? *Journal of the Marine Biological Association of the United Kingdom* 91(02): 347-355.

Iglésias S.P., 2012. - Actinopterygians from the North-eastern Atlantic and the Mediterranean (A natural classification based on collection specimens, with DNA barcodes and standardized photographs), Volume I (plates), version 08, 01 April 2012. 245p. http://www.mnhn.fr/iccanam.

Iglésias S.P., 2012. - Chondrichthyans from the North-eastern Atlantic and the Mediterranean (A natural classification based on collection specimens, with DNA barcodes and standardized photographs). (plates & text). Provisional version 06, 01 April 2012. 83p. http://www.mnhn.fr/mnhn/iccanam

Jourde, J., Sauriau, P-G., Guenneteau, S., and Caillot, E., 2013. First record of *Grandidiriella japonica* Stephensen, 1938 (Amphipoda : Aoridae) from mainland Europe. *BioInvasions Records* 2(1): 51-55.

Lefebvre, F., Wielgoss, S., Nagasawa, K. and Moravec, F., 2012. On the origin of *Anguillicoloides crassus*, the invasive nematode of anguillid eels. *Aquatic Invasions* 7(4): 443-453.

Quigley, D. T. G., Herdson, D., and Flannery, K., 2013. Occurrence of the kuruma prawn *Marsupenaeus japonicus* (Spence Bate, 1888) in the Celtic Sea, English Channel and North-West France. *BioInvasions Records* 2(1): 51-55.

Mineur F., Le Roux A., Stegenga H., Verlaque M., Maggs C.A., 2012. Four new exotic red seaweeds on European shores. *Biological Invasions* 14(8): 1635-1641.

Morga, B., Renault, T., Faury N. and Arzul, I., 2012. New insights in flat oyster Ostrea edulis resistance against the parasite Bonamia ostreae. *Fish & Shellfish Immunology* 32(6): 958-968.

Perez, T., Perrin, B., Carteron, S., Vacelet, J., Boury-esnault, N., 2006. *Celtodoryx girardae gen. nov. sp. nov., a new sponge species (Poecilosclerida: Demospongiae)invading the Gulf of Morbihan (North East Atlantic, France).* Cahiers de Biologie Marine 47 : 205-214

Sargent, P. S., Wells, T., Matheson, K., McKenzie, C. H., and Deibel, D., 2013. First record of vase tunicate, *Ciona intestinalis* (Linnaeus, 1767) in coastal Newfoundland waters. BioInvasions Records 2(2): *in press*

3.8 Germany

Prepared by S. Gollasch, GoConsult, Germany; and S. Kacan, Federal Maritime and Hydrographic Agency, Germany.

Highlights of the National Report

A recent publication should be mentioned. According to Buschbaum 2012, an inventory in the Dutch-German-Danish Wadden Sea revealed a total of 66 nonnative (alien) taxa including 17 tentative cryptogenics in the brackish-marine macrobenthos until 2010, which is close to average compared with similar inventories from other coasts.

Content:

1. Regulations:

1.1 Platform for Information Exchange on Neobiota

The issue neobiota in the marine environment including the coastal areas and the harbours attracts growing interest worldwide. In the meantime it is taken on by international fora like IMO, OSPAR, HELCOM. European regulations like the EU Water Framework Directive and the EU Marine Strategy Framework Directive include provisions for neobiota and since the Wadden Sea has been placed on the list of UNESCO's World Heritage Sites neobiota receive growing attention. Recognizing that against the background of the varied fora and regulations in Germany different authorities are busy with the subject and that the information exchange between these bodies could be enhanced, a "Platform for Information Exchange on Neobiota" has been established in the framework of the "Federal and States Marine Montitoring Programme" the national body that takes care of the duties arising from national and international obligations. Involved in the group are representatives from different federal agencies, federal state agencies and research facilities.

1.2 Trilateral Wadden Sea Plan

Two major issues, relevant to alien species, are noted (1) seed mussel imports and (2) pleasure boating.

1.2.1 Seed mussel imports

During recent consultations in the framework of the Trilateral Wadden Sea Plan it was noted that seed mussel imports are addressed differently by the three countries so that no harmonized procedure exists. The species involved are *Crassostrea gigas* and the native *Mytilus edulis*. Whether or not the ICES Code of Practice is followed in the exporting countries is unknown. After arrival in Germany, it is recommended to

place the oysters for two hours into freshwater as a risk reducing measure to treat potential fouling organisms. However, this measure is not controlled.

It was reported from the Netherlands that seed mussel imports are permitted with some reservations. In Denmark seed mussel imports are not regulated as in NL and DE. In Germany two federal states are affected, i.e. Lower Saxony and Schleswig-Holstein. Due to the Wadden Sea status as UNESCO World Heritage Site the import of seed mussels into the protected parts of the Wadden Sea in Schleswig-Holstein are prohibited. In Lower Saxony the same rule applies, however, it is known that (illegal) seed mussel imports occur.

According to the Common Wadden Sea Secretariat (CWSS)[1] offshore wind-parks are screened for neobiota as these installation represent a rare hard-bottom habitat in the region.

1.2.2 Pleasure boating

Pleasure boating was identified as species introduction vector, especially for secondary spread. The management of this vector was not yet agreed in the Trilateral Wadden Sea Plan.

1.3 Good Environmental Status

As reported last year, one of the 12 identifiers of Good Environmental Status (GES) are alien species. There are discussions at national and HELCOM as well as OSPAR level how to use alien species to qualify the status. A trend indicator (rate of new invasions) and an impact indicator (invasiveness) are discussed. One of the key issues is to identify where to draw the "bottom line", i.e. what is currently the number of alien species so that future newly found aliens are new introductions and not overlooked already earlier introduced species. This is important should in the future the new situation need to be compared to today´s situation to identify trends and to answer questions like "Does vector management reduce the arrival of new alien species?"

1.4 Alien species monitoring programs

German coastal waters are monitored quite well in comparison to other Baltic Sea countries including studies targeting alien species in ports and the taxonomic expertise to process these samples is well available. Almost all regular monitoring activities are also made aware to report on the occurrence of alien species. Comparing all known Baltic Sea alien species records internationally, the German coastal waters have the highest numbers (Fig. 1 in German National Report of WGBOSV 2012). It is questionable if this reflects the real situation or if this may be a result of "the more you look, the more you find". This gives an interesting perspective regarding the EU qualifiers for GES. Does Germany have a worster status when looking at alien species due to the higher number of these species, or are simply more species found due to targeted monitoring and awareness rising in regular monitoring studies?

Another interesting aspects in this regard is how new alien species found in e.g. the Baltic are added to the alien species database. A new species may be found in Finland, but it is native to German waters. This Finnish finding could have been a result of secondary spread or an introduction. Should this species be added to the list of

[1] The Common Wadden Sea Secretariat started its work already in 1985 to successfully establish trilateral work on the protection of the Wadden Sea.

aliens in the Baltic this needs to be treated with care that this does not become a new entry for the entire Baltic Sea!

1.5 Summary of German coastal monitoring activities

A comprehensive summary of German coastal monitoring activities is available online at: http://www.blmp-online.de/Seiten/Berichte.html

The Federal and State Monitoring Programme (Bund-Länder Meßprogramm) is also responsible for the preparation of Germany´s marine strategies including a guide to implementing the Marine Strategy Framework Directive (MSFD) for the initial assessment, determination of good environmental status and establishment of environmental targets in the German North and Baltic Seas and The Water Framework Directive (WFD).

The BSH (Federal Maritime and Hydrographic Agency of Germany) issues various status reports of the North and Baltic Seas as the Marine Environment Reporting System (MURSYS) http://www.bsh.de/en/Marine_data/Observations/MURSYS_reporting_system/index.jsp

which is published in form of reports providing information on physical and chemical parameters (weather, sea surface temperatures, water levels, current conditions, nutrient concentrations, oxygen situation) and biological parameters (occurrence of algae and toxic algae, blue mussel stocks, fish stocks etc.) in the North and Baltic Seas.

2. Intentional:

No major changes since last year's National Report. The species which were reported earlier include Sturgeons, salmonid species, rainbow trouts, carps, *Crassostrea gigas*, *Homarus americanus* and the red alga *Palmaria palmata*.

Seed mussels (*Crassostrea gigas*) were imported to the northern Wadden Sea from Ireland, United Kingdom and the Netherlands (Oosterschelde) (see above).

3. Unintentional:

New Sightings

The most up-to-date list of alien species in German coastal waters can be found at www.aquatic-aliens.de/species-directory.htm. This is a private initiative of Stefan Nehring and the hompage is updated frequently.

On 2 November 2011, a very dense, well established population of G3 *Claviceps purpurea* was found on the common cord-grass *Spartina anglica* C.E. Hubbard at two localities on the German North Sea coast in the Wadden Sea (Cäciliengroden and Hooksiel). It is most likely that G3 *C. purpurea* has a North American origin and entered German coastal waters by floating sclerotia from Irish, British, or Benelux waters, where it was previously found. However, introduction via ships' ballast water coming from their native or introduced ranges is also plausible. Furthermore imports of G3 sclerotia via seed mussels collected from wild subtidal banks in Irish, British and Dutch coastal waters and released into the German Wadden Sea can currently not be excluded. Risks from this highly toxic fungus for human, grazing animals and the marine environment have been identified but not yet quantified in terms of impact (Nehring *et al*. 2012).

4. Pathogens

No new records.

5. Meetings

The European NEOBIOTA group met in Pontevedra (Spain) in September 2012 and the agenda items discussed at the meeting considerably contributed to the development of this report.

6. References and bibliography

Please consult the 2013 report of WGBOSV for references.

A project funded by the German Federal Agency for Nature Conservation (Bundesamt für Naturschutz, BfN) is underway to identify a summary of black, grey and white listed alien species which do not yet occur in German waters, but are known from neighbor countries or nearby areas. The species of greatest concern are included in the black lists.

Another project, funded by the Alfred-Wegener-Institute, addresses alien species monitoring in selected German ports (commercial ports and marinas) in the North and Baltic Seas. The study focusses on benthos and fouling organisms. As an initial result, it seems that there is a tendency that primary introductions of alien species prevail in artificial, man-made habitats.

A recent publication should be mentioned, too. According to Buschbaum 2012, an inventory in the Dutch-German-Danish Wadden Sea revealed a total of 66 nonnative (alien) taxa including 17 tentative cryptogenics in the brackish-marine macrobenthos until 2010, which is close to average compared with similar inventories from other coasts. Because of the Wadden Sea is known as the largest sedimentary tidal flats in the world, most aliens encountered where artificial or natural hard substratum was put in the ecosystem. (A related Discussion we had yesterday.) So, the in the paper presented qualitative rapid assessments focusing on port localities had substantially improved knowledge on introduced species in the Wadden Sea. This publication is uploaded to the share point.

3.9 Greece

Prepared by: Argyro Zenetos and Kostas Tsiamis, Hellenic Centre for Marine Research

Overview

In 2012 four new marine alien species were reported from the Greek Seas. These are the fish *Champsodon nudivittis* and *Terapon theraps* (from Rhodes Isl. and Thermaikos Gulf respectively), the mollusk *Murchisonella columna* (from Thermaikos Gulf, N. Aegean Sea) and the alga *Caulerpa taxifolia* var. *distichophylla* (from Rhodes Isl., S. Aegean Sea). In addition, 13 species have expanded their distribution in Greek waters, some of them exhibiting invasive behaviour (*Caulerpa racemosa* var. *cylindracea*, *Womersleyella setacea*).

Content

1. Regulations: An update on new regulations and policies (including, aquaculture and vector management)

2. Intentional:

Synthesis of introductions

Add websites for more details rather than summarizing the amounts etc., e.g. amounts , live imports and exports (to the extent possible). The amount seems to be difficult to obtain in some countries.

3. Unintentional

New Sightings-New species to the Greek Alien biota

Fish

***Champsodon nudivittis* (Ogilby, 1895)**

On 12 May 2012, two individuals of *Champsodon nudivittis* were captured by a local shrimp pot at a depth of 150 m, offshore the Kamiros area - at the western coast of Rhodes Island, Aegean Sea (36°23'50,35"N, 27°52'35,86"S) (Kalogirou & Corsini-Foka, 2012).

***Terapon theraps* (Cuvier, 1829)**

This fish was captured alive by gillnets in September 2008, from 20 m depth, in Thermaikos Gulf (N. Aegean Sea) (Minos *et al*., 2012).

Mollusca

***Murchisonella columna* (Hedley, 1907)**

Found at Cape Epanomi, in Thermaikos Gulf (N. Aegean Sea) in shallow *Zostera* meadows (0.2 m depth) (Manousis *et al*., 2012).

Algae

***Caulerpa taxifolia* var. *distichophylla* (Sonder) Verlaque, Huisman & Procaccini**

This green seaweed was collected in Ladiko Bay, Rhodos Island (S. Aegean Sea), in September 2010, from 20 m depth, on sandy bootom (Tsiamis & Louizidou, in preparation).

Literature for New Species

Kalogirou S. & Corsini-Foka M, 2012. First record of the Indo-Pacific Champsodon nudivittis (Ogilby, 1895) (Perciformes, Champsodontidae) in the Aegean waters (eastern Mediterranean Sea). BioInvasions Records 1 (3): 229–233.

Manousis T, Mpardakis., Zamora G., Silva A., Paraskevopoulos, K., Manios D. & Galinou-Mitsoudi S., 2012. New findings of Gastropods in the Hellenic seas with emphasis on their origin and distribution status. *Journal of Biological Research-Thessaloniki* 18: 249-264.

Minos G, Imsiridou A, & Economidis PS, 2012. First record of Terapon theraps (Terapontidae) in the Aegean Sea (Greece). *Cybium* 36(2): 401-402.

Previous Sightings

Mollusca

***Aplysia dactylomela* (Rang, 1828)**

Found at Amoopi, a site at the east coast of Karpathos Isl. (35°35′N, 27°8′E), in August 2010 (Kout in Nikolaidou *et al*., 2012).

***Bursatella leachi* (De Blainville, 1817)**

One live individual (95.0 mm in the animal length) was collected from rocky bottom, in 0.2 m depth, at Micro Emvolo of Thermaikos Gulf (N. Aegean Sea), while several animals of various sizes have been observed in Potamos, Epanomi (Thermaikos Gulf) on a shipwreck and on mixed bottom (Manousis *et al*., 2012).

***Chama pacifica* (Broderip, 1834)**

Reported from Fokià Bay (Kàrpathos Isl., S. Aegean Sea), in August 2011, at a depth of 1.5 m (Crocetta & Russo, 2013).

***Murex forskoehlii* (Röding, 1798)**

Only one shell (65.2 mm) collected in N. Crete (Manousis *et al*., 2012).

***Rapana venosa* (Valenciennes, 1846)**

Found at Perea, Thermaikos Gulf (N. Aegean Sea) (Manousis *et al*., 2012).

Ascidia

***Phallusia nigra* (Savigny, 1816)**

Found only once at Peristera Island (40°13′39.27′′ N, 23°45′55.94′′ E) in Chalkidiki (N. Aegean Sea) on 27 August 2008 (Koutsogianopoulos *et al*. in Thessalou-Legaki *et al*., 2012).

Crustacea

***Callinectes sapidus* (Rathbun, 1896)**

Collected on April 5 2012 with gillnets, close to the mouth of Kalamas River (39°34′38.15′′N, 20°9′17.24′′E), in the Ionian Sea, in 1 m depth (Perdikaris *et al*. in Nicolaidou *et al*., 2012).

Algae

***Acanthophora nayadiformis* (Delile) Papenfuss**

Found at S. Amvrakikos Gulf, in Western Greece, in August 2012, at 0.5m depth, on rocks (K. Tsiamis, unpublished data).

***Asparagopsis taxiformis* (Delile) Trevisan de Saint-Léon**

Found at Igoumenitsa Bay, in the Ionian Sea, in August 2012, at 0.5m depth, on rocky substrate. In addition, numerous thalli were collected from Paxoi port (Ionian Sea) and from Argostoli, Kephallonia Island (Ionian Sea), in 1 m depth, on rocky bottom, in March 2013 (K. Tsiamis, unpublished data).

***Caulerpa racemosa* var. *cylindracea* (Sonder) Verlaque, Huisman & Boudouresque**

Several pants were found in Paxoi port (Ionian Sea) and in Argostoli, Kephallonia Isl. (Ionian Sea), in 1 m depth, on rocky substrates, in March 2013 (K. Tsiamis, unpublished data). Invasive behavior was detected off Kephallonia Isl. coasts at depths between 40-70 m.

***Laurencia caduciramulosa* Masuda & Kawaguchi**

This red alga was collected near Parga, in the Ionian Sea, in September 2011, in 1 m depth, at rocky bottom (K. Tsiamis, unpublished data).

***Lophocladia lallemandii* (Montagne) F.Schmitz**

Found at Ithaki Island, in the Ionian Sea, in August 2011, at 20 cm depth, on rocks. The same time it was found near Parga, in 1 m depth, on rocks. In July 2012, another specimen was detected in Evoikos Gulf, at Aliveri, at 1 m depth, growing as epiphyte on other macroalgae (K. Tsiamis, unpublished data).

***Womersleyella setacea* (Hollenberg) R.E.Norris**

Detected in Thasos Island (N. Aegean Sea), in May 2012, at 15 m depth, exhibiting invasive behavior, covering other macroalgae (K. Tsiamis, unpublished data).

Literature for geographic expansion of Alien Species

Crocetta F. & Russo P., 2013. The alien spreading of *Chama pacifica* Broderip, 1835 (Mollusca: Bivalvia: Chamidae) in the Mediterranean Sea. *Turkish Journal of Zoology*, 37: 92-96

Manousis T, Mpardakis., Zamora G., Silva A., Paraskevopoulos, K., Manios D. & Galinou-Mitsoudi S., 2012. New findings of Gastropods in the Hellenic seas with emphasis on their origin and distribution status. *Journal of Biological Research-Thessaloniki* 18: 249-264.

Nicolaidou, A., Alongi, G., Aydogan, O., Catra, M., Cavas, L., Cevik, C., Dosi, A., Circosta, V., Giakoumi, S., Gimenez-Casalduero, F., Filiz, H., Izquierso-Munoz, A., Kalogirou, S., Konstantinidis, E., Kousteni, V., Kout, J., Legaki, A., Megalofonou, P., Ovalis, P., Paolillo, G., Paschos, I., Perdikakis, C., Poursanidis, D., Ramos-Espla, A. A., Reizopoulou, S., Sperone, E., Taskin, E., Tripepi, S. & Vazquez-Luis, M. (2012). New Mediterranean biodiversity records (June 2012). *Mediterranean Marine Science*, 13,1: 162-174

Thessalou-Legaki, M., Aydogan, O., Bekas, P., Bilge, G., Boyaci, Y., Brunelli, E., ... & Zenetos, A. (2012). New Mediterranean Biodiversity Records (December 012). *Mediterranean Marine Science*, *13*(2), 312-327.

4. Pathogens
5. Meetings
6. References and bibliography
    - High-lighting articles on Greek aliens

Salomidi, M., Katsanevakis, S., Issaris, Y., Tsiamis, K., & Katsiaras, N. 2013. Anthropogenic disturbance of coastal habitats promotes the spread of the introduced scleractinian coral Oculina patagonica in the Mediterranean Sea. *Biological Invasions*, DOI 10.1007/s10530-013-0424-0.

"*The preferential presence of a non-indigenous scleractinian coral (Oculina patagonica) on anthropogenic hard substrata was investigated in a highly disturbed coastal area, along the eastern Saronikos Gulf (Aegean Sea, Eastern Mediterranean). Although the species occurred on both natural and anthropogenic substrata at similar frequencies, its abundance was substantially higher on the latter. The species was present all along the shallow (0.5–5 m) infralittoral zone of the studied coastline, and its percent cover even exceeded 50 % at a site of anthropogenic hard substratum. The occupancy of the species declined with distance from a highly disturbed industrialized/urbanized area (Athens metropolitan coastal front and the port of Piraeus). Space availability as a result of habitat modification appears to have been an important factor enhancing the coral's abundance in this area. The ongoing degradation of the*

coastal zone, as a combined effect of coastal pollution, proliferation of artificial substrata and overgrazing seems to be paving the way to this new invasion in the Aegean Sea."

Issaris, Y., Katsanevakis, S., Salomidi, M., Tsiamis, K., Katsiaras, N., & Verriopoulos, G. (2012). Occupancy estimation of marine species: dealing with imperfect detectability. *Marine Ecology Progress Series*, *453*, 95.

"*Underwater visual surveys are frequently used in monitoring programmes of marine*

populations. Species occupancy, defined as the probability of presence in a sampling unit, is a commonly used state variable. Imperfect detectability is a serious issue in such studies and, if ignored, may lead to incorrect inferences and erroneous management decisions. In this paper, we propose a methodology and field protocol for underwater visual surveys implemented by multiple observers. This approach can be applied for an unbiased occupancy estimation of marine species by explicitly incorporating imperfect detection into the modelling process. Based on a case study carried out in a Greek coastal area (Saronikos Gulf), the benefits of the proposed approach were demonstrated. Using a sufficient number of observers, the probability of recording false absences (i.e. the probability that the target species was present in a site but not detected) was minimized and occupancy estimation was greatly improved. For the whelk Stramonita haemastoma in the case study area, single-observer occupancy estimates were negatively biased and varied significantly (between 0.64 and 0.89) depending on the observer, while with the proposed methodology, using 5 observers, the obtained occupancy estimate had the value of 0.93. The probability of false absence was high in the single-observer case (between 0.10 and 0.30), and rather low with any combination of 3 observers (<0.025), while it dropped to practically 0 with 5 observers. As demonstrated in the case of the alien green alga Codium fragile fragile, occupancy models provide a flexible framework for relating occupancy to spatial and environmental covariates, testing ecological hypotheses and producing predictive distributional maps. Overall, the presented methodology and its potential extensions could prove extremely useful in a variety of applications in the marine environment."

- Other Articles related with Greek alien species

Kalogirou S., 2013. Ecological characteristics of the invasive pufferfish *Lagocephalus sceleratus* (Gmelin, 1789) in the eastern Mediterranean Sea – a case study from Rhodes. *Mediterranean Marine Science*.

Katsanevakis S., Zenetos A., Poursanidis D., Nunes AL, Deriu I., Bogucarskis K., Cardoso AC. 2013. ELNAIS meets EASIN: distribution of marine alien species in Greece using EASIN mapping services and ELNAIS spatial data. *Mediterranean Marine Science*, 14(1): 95-98

Thessalou-Legaki, M., Aydogan, O., Bekas, P., Bilge, G., Boyaci, Y., Brunelli, E., ... & Zenetos, A., 2012. New Mediterranean Biodiversity Records (December 2012). *Mediterranean Marine Science*, 13(2), 312-327.

Tsiamis K, Panayotidis P, Salomidi M, Pavlidou A, Kleinteich J, Balanika K, Kupper FC., 2013. Macroalgal community response to re-oligotrophication in Saronikos Gulf. *Marine Ecology Progress Series*, 472:73–85 in press

Giakoumi S., Distribution patterns of the invasive *Siganus luridus* (Rüppell, 1829) and its impacts to the central Aegean Sea ecosystem, North-eastern Mediterranean. *Marine Ecology* MAE-1725

3.10 Italy[2]

Prepared by Anna Occhipinti-Ambrogi, Department of Earth and Environmental Sciences, University of Pavia, Italy.

With assistance of:

Airoldi Laura (Ravenna)
Bacci Tiziano (Roma)
Belmonte Genuario (Lecce)
Bulleri Fabio (Padova)
Caronni Sarah (Pavia)
Castriota Luca (Palermo)
Catra Marcello (Catania)
Crocetta Fabio (Napoli)
Froglia Carlo (Ancona)
Gambi Maria Cristina (Ischia)
Giangrande Adriana (Lecce)
Gravili Cinzia (Lecce)
Innocenti Gianna (Firenze)
Lodola Alice (Pavia)
Magaletti Erika (Roma)
Marchini Agnese (Pavia)
Mastrototaro Francesco (Bari)
Mazziotti Cristina (Cesenatico)
Penna Antonella (Urbino)
Rosso Antonietta (Catania)
Savini Dario (Pavia)
Tagliapietra Davide (Venezia)
Terlizzi Antonio (Lecce)
Tirelli Valentina (Trieste)
Zenetos Argyro (Athens)

Overview:

Five new species of invertebrate NIS have been recorded in Italian marine waters. Information on already established alien species, including genetics of HAB forming microalgae, ecology of macroalgae, and new locations of invertebrate NIS is given.

1. ***Regulations: An update on new regulations and policies (including, aquaculture and vector management)***

No information available

[2] **Note:** This report is the outcome of a special working group of the Italian Marine Biology Society (SIBM) on a voluntary basis. It does not reflect an official position or knowledge of the relevant Italian Government bodies. It has been prepared according with the guidelines for ICES WGITMO National Reports; it updates the Italian status of 2011.

2. *Intentional introduction*

No new intentional introductions have been reported.

3. Unintentional introduction

New Sightings

Algae & higher plants
None

Invertebrates

The Sabellid polychaete *Branchiomma bairdi* was recorded in the Sicilian coastal Lake Faro, inhabiting the hard bottom of the Lake's two seaward inlets and of the channel which connects the basin with the neighbouring lake of Ganzirri. The species, distributed in Western Atlantic (Bermuda and the Caribbeans) and Eastern Pacific (Mexico and Panama) had been recently introduced in the Eastern Mediterranean, and apparently is expanding westwards, as was the case with *B. luctuosum* (also abundant in Lake Faro, as well as in many other Italian localities). The high densities recorded, coupled with its reproductive strategy, anti-predation strategies and feeding mode, suggest that this species is a potential invader. The introduction of *B. bairdi* to Lake Faro could be associated with aquaculture, although the possibility of its introduction on the hulls of ships or in their ballast waters cannot be excluded (Giangrande *et al*., 2012).

The Asian egg-carrying copepod *Pseudodiaptomus marinus* was recorded for the first time in plankton tows in two different areas of the North Adriatic Sea, Rimini and Monfalcone (de Olazabal and Tirelli, 2012). Until now it has never been observed in the Mediterranean Sea.

The swimming crab *Charybdis japonica,* distributed from Korea and Japan to Indonesia, was recorded for the first time in the Mediterranean Sea (Froglia 2012). A single adult male specimen was caught in 2006 with gill-net at the entrance of Ancona harbour, on the middle Adriatic coast of Italy. No other specimens have been found, despite extensive surveys of the environs of the port. Unintentional transport by a merchant ship seems the most likely vector of introduction.

A new species of Ascidians, *Botrylloides pizoni*, belonging to the Botryllinae, was described in the Gulf of Taranto (South Italy). This new species was collected in mussels farms of the semi-enclosed *Mar Piccolo* in different seasons over a period of several years, which allowed information about its biology to be obtained. The new species was first recorded in 2001, and it is hard to establish with certainty whether it is native or introduced. However, it was probably really absent in the area previously, because its large zooids and the peculiar shape of the gut loop would have been noticed earlier, being very different from the local species *Botryllus schlosseri* and *Botrylloides leachii* (Brunetti and Mastrototaro, 2012).

The discovery of the Tunicate *Didemnum vexillum* in the Lagoon of Venice is the first record not only for Italy, but for the entire Mediterranean Sea (Tagliapietra *et al*., 2012). Specimens were noticed as early as 2007, but not collected until 2012, from a few stations in the central, well flushed part of the lagoon.

Previous Sightings

Algae & higher plants

The toxin-producing microbial species *Alexandrium minutum* has a wide distribution in the Mediterranean Sea and causes high biomass blooms with consequences on the environment, human health and coastal-related economic activities. Algal genetic differences and associated connectivity, to understand the geographical scale of adaptation and dispersal pathways have been studied by Casabianca *et al*. (2012). In their study, they combined *A. minutum* population genetic analyses, based on microsatellites, with indirect connectivity estimations derived from a general circulation model of the Mediterranean Sea. Their results show that four major clusters of genetically homogeneous groups can be identified, loosely corresponding to four regional seas: Adriatic, Ionian, Tyrrhenian and Catalan. They suggest that the genetic population differentiation is related to the basin scale transport patterns through successive generations of the vegetative microalgal cells, and that the residual genetic diversity within regional populations can be related with the existence of large seed banks of cysts in the benthos. However, human-mediated transport cannot be excluded as an additional source of gene mixing.

The mechanisms underpinning the coexistence of algal invaders in environmentally and biologically heterogeneous systems have been investigated by Tamburello *et al* (2012). The exotic seaweeds, *Asparagopsis taxiformis* and *Caulerpa racemosa*, exhibit a segregated distribution on Mediterranean rocky reefs. *A. taxiformis* dominates assemblages in topographically complex habitats, but is virtually absent on homogenous platforms. In contrast, *C. racemosa* achieves extensive cover in both types of habitat. By the analysis of transplant and removal experiments, the authors conclude that heterogeneity in environmental conditions can promote invader coexistence, by mitigating the effects of negative biotic interactions. An investigation of the impact of *Caulerpa racemosa* invasion on fish populations has been carried out by Terlizzi *et al*. (2011) and Felline *et al*. (2012). They show that *C. racemosa* changes the foraging habit of the native white seabream, *Diplodus sargus*. In invaded areas, they found a high frequency of occurrence of *C. racemosa* in the stomach contents (it was the most important item in term of frequency of occurrence and relative importance) of this omnivorous fish, while the alga was not detected in fish from a control area. They also found a significant accumulation of caulerpin, one of the main secondary metabolites of *C. racemosa*, in fish tissues (liver and red muscle). The observed cellular and physiological alterations included activation of some enzymatic pathways, the inhibition of others and changes in hepatosomatic index and gonadosomatic indexes. The occurrence of biochemical perturbations in fish consuming the pest alga was showed. Induced stress conditions, increased metabolic activity of detoxification and changes in the morphology of gross gonads were described.

Caronni (2011) has investigated the effects of *Caulerpa taxifolia* invasion on substrata previously colonized by the autochthonous congener *Caulerpa prolifera* in a bay of North East Sardinia. No significant changes in the density of the major taxa forming the macrobenthic community were found, independently from the presence of *Caulerpa* species. Airoldi and Bulleri (2011) analysed how the expansion of opportunistic and invasive algal forms on coastal defence infrastructures along the Italian side of the north Adriatic Sea could be influenced by the continued repair and maintenance. They quantified the response trajectories of assemblages following maintenance of breakwaters. Their results indicate that intense human disturbance can be a major determinant of the spread of opportunistic species on artificial coastal infra-

structures. Maintenance - which is an extreme disturbance - caused a significant decrease in the cover of dominant species such as mussels and oysters and enhanced the cover of opportunistic organisms such as biofilms, and weedy and invasive macroalgae. Results suggest possible management strategies to improve the ecological outcomes of artificial marine infrastructures. Optimising maintenance timing would reduce the development of weedy macroalgal species.

Invertebrates

Branchiomma luctuosum (Polychaeta: Sabellidae) was introduced from the Red Sea and recorded in Italy since 1983; at present it is one of the most abundant species along the Italian coasts; in the Gulf of Naples its large populations have overwhelmed the once abundant congeneric *B. lucullanum* (Licciano & Giangrande, 2008). Licciano *et al*. (2002) studied the reproductive biology and gametogenesis of *B. luctuosum,* giving a description of larval development and of reproduction, comparing populations from the Tyrrhenian Sea (Ischia, Naples) and Ionian Sea (Gulf of Taranto). The reproductive features of this species fits well with its role as a primary colonizer, since hermaphroditism and a short pelagic phase may produce high population densities starting from just a few individuals. Moreover, experimental work on *B. luctuosum* (Licciano *et al*., 2007) has demonstrated that it is able to accumulate cultured microbial species, thus indicating its ability in reducing the microbial concentration in its often contaminated surrounding environment.

The zooplankton composition of Lake Varano (a coastal lagoon in northern Apulia) has been studied during an year (2007 and 2008). The dominant species was the alien copepod *Acartia tonsa* (reported here for the first time, but known from a nearby lake), which occurred throughout the year. The native *Acartia clausi* was also abundant, while the presence of the other NIS, *Paracartia grani*, was seasonal (Belmonte *et al*., 2011).

The decapod crustacean *Dyspanopeus sayii* is well established along the Adriatic shores: during repeated surveys carried out in 2011in Lago Fusaro, a brackish lagoon north of Naples, linked to the Tyrrhenian Sea, it was the most abundant crab species along the lagoon shores, accounting for hundreds of sighted specimens (Crocetta *et al*., 2012). A few individuals of the same species were also found in the Apulian coastal lagoon of Varano (central-southern Adriatic coast) during a monitoring survey of fish fauna performed in October 2011 (Ungaro *et al*.,2012). Its presence in another coastal lagoon, where aquaculture activities are present, strongly indicates the importance of this vector in the spread of NIS.

Two adult specimens belonging to the sub-tropical rock crab *Percnon gibbesi* have been identified in two different locations of the "Capo di Leuca" (Southern Apulia, Ionian Sea). The two records represent the first occurrence in the Apulian waters (Licchelli *et al*., 2011).

One male specimen of *Callinectes sapidus* was caught at Silvi Marina (Abruzzi – Central Adriatic Sea) by gillnet on a sandy, shallow bottom, near a small river mouth (Castriota *et al*., 2012).

The collection of decapod crustacean *Herbstia nitida* during spring 2002 in the shallow marine cave "Grotta di Ciolo", located near Capo di Leuca (southern Apulia) (39°50′ 38″ N and 18°23′11″E) was recently commented and evaluated by Denitto *et al*. (2010). The species was originally described from coastal waters of the Gulf of Guinea: : it is dubious if this small species has been overlooked until recently in the Medi-

terranean or it has been introduced. The native congeneric *H. condyliata,* typical of cave environment, was also present in the same cave.

The nudibranch mollusc *Polycera hedgpethi* has been found in the lagoon of Venice for 3 consecutive years from 2009. It is the northern most record until now. The specimens have been found attached to the Bryozoans *Bugula neritina* and *Tricellaria inopinata* (Keppel, 2012). After the first record in Italy in 1986 from Lake Fusaro (Naples), this species appears now as established in Italy.

The Bryozoan *Electra tenella,* known from Sicily (Ionian sector) is expanding in two areas of the Tyrrhenian Sea (Livorno harbour and Messina Straits area) (Rosso, 2012).

The finding of the Bryozoan *Tricellaria inopinata* in the harbours of La Spezia and Olbia represents the first record of the species in the Ligurian Sea and in the western-central Tyrrhenian Sea, respectively (Lodola *et al*., 2012). The pathway of introduction is very likely is the transfer of molluscs from the northern Adriatic (namely the Lagoon of Venice).

Fish

No information

Not Seen Species Yet

Two individuals of the spotted halfbeak *Hemiramphus far* were caught along the eastern coast of Algeria, at Collo (37°00'N 6°33'E), on December 2010 (Kara, 2012). Despite its relatively early introduction into the Levant basin, *H. far* has not penetrated the western basin until 2003. It was recorded recently in Tunisia (Charfi-Cheikhrouha, 2004) while it can already be found in Libyan fish markets.

The first occurrence in the Central Mediterranean of the silverstripe blaasop *Lagocephalus sceleratus was* recorded in the southern gulf of Gabes, Tunisia (Jribi and Bradai, 2012). *Lagocephalus sceleratus* has shown a rapid expansion throughout the eastern Mediterranean Sea since its first appearance, reaching to the northern most parts of the Aegean Sea. This new occurrence of this dangerous species, since it contains tetrodotoxin (TTX) that may be a source for food poisoning, suggests a successful adaptation of the species and a westerly movement into the Mediterranean Sea.

Vagrant species

We list in this section a few species that have been recorded in Italy, which we do not include in the Italian list of NIS, since they are probably vagrant species, that enter the Mediterranean Sea through the Gibraltar Strait, probably without a direct human intervention. These species of large size, belonging to the fish, cephalopod mollusc and decapod crustacean fauna, are sometimes called vagrant species.

The diamondback squid (*Thysanoteuthis rhombus*) is a rare epipelagic inhabitant of tropical and subtropical waters. It was first described in the Mediterranean Sea from the Strait of Messina, and from other scattered stations. An adult male specimen was found on the beach of Bosa, Sardinia (Meloni *et al*., 2012).

Several specimens of the royal spiny lobster, *Panulirus regius* were captured in the coastal waters north of Leghorn (Ligurian Sea). A drift of larvae within the Atlantic water mass would explain the present captures as well as those occurred along the French coasts many years before (Froglia *et al*., 2012).

Two specimens of the opah *Lampris guttatus* (Actinopterygii: Lampriformes: Lampridae) were caught from both the Tyrrhenian and the Ionian coasts of Calabria

(Sperone *et al*., 2011). A specimen of the subtropical trachychthyid fish *Gephyroberyx darwinii* has been collected in the southern Tyrrhenian Sea off Sicily (Andaloro *et al*., 2011). It is an Atlantic immigrant, caught for the first time in the Mediterranean in 1961 along the Algerian coast.

The fangtooth moray *Enchelycore anatina* was sighted twice by Guidetti *et al*. (2012) along the south-eastern Apulian coast (south-eastern Italy). This represents the first record of the species in the Ionian Sea and in Italy. This species, entered via Gibraltar (i.e. from the Atlantic Ocean), was firstly reported from the eastern Mediterranean and it is expanding westwards (it was known before from the eastern side of the Adriatic Sea, Croatia) with no records until now from the western sector of the basin.

4. Pathogens

A study to compare genetic and parasitological data for the Lessepsian migrant, the bluespotted cornetfish, *Fistularia commersonii*, in the Mediterranean Sea was performed by Merella *et al*. (2010). The parasite assemblages of *F. commersonii* are mostly characterized by native generalist species, but also include two specific Indo-Pacific digeneans: the lepocreadiids *Allolepidapedon fistulariae* and *Neoallepidapedon awaiiense*. Considering that adult/juvenile fish acquire these digeneans by predating on second intermediate fish hosts, these authors suggested that *F. commersonii* colonized the Mediterranean with actively swimming individuals and not passive planktonic larvae. The inference that a few individuals of *F. commersonii* invaded the Mediterranean Sea, and an expansion followed through larval dispersal, does not fit well with the above-mentioned parasitological findings, and suggests that the genetic diversity of the species should be reconsidered.

5. Meetings and research projects

Research on alien species has been supported by funding from the Italian Ministry of University and Scientific Research (MURST COFIN and FIRB projects) and Italian Ministry of the Environment Territory and Sea (MATTM Italy–Israel Cooperation) the European Community (MARBEF NoE, IASON and SESAME projects), and the EU FP7 VECTORS.

An International Workshop on Molecular Tools for Monitoring Marine Invasive Species, has been held at the University of Lecce on 12-14 September 2012 within the EU FP7 VECTORS.

The information on the Italian situation up to the year 2012 has been checked against the paper on the state-of-art on alien species in the Mediterranean Sea published by Zenetos *et al*. (2010), that makes distinctions among the four subregions defined in the EU Marine Strategy Framework Directive: (i) the Western Mediterranean Sea (WMED); (ii) the Central Mediterranean Sea (CMED); (iii) the Adriatic Sea

(ADRIA); and (iv) the Eastern Mediterranean Sea (EMED). The updated bibliographical information retained for Italy has been quoted in this National Report.

Two reviews of interest for the knowledge on alien species have been published, including a study of alien species along the coast of the Apulian Peninsula (Gravili *et al*. 2010), and a review on the Hydrozoan species richness of the Mediterranean, comprising data and a discussion on non indigenous species (Gravili *et al*., 2013).

6. References and bibliography

Airoldi L., Bulleri F. 2011. Anthropogenic disturbance can determine the magnitude of opportunistic species responses on marine urban infrastructures. PLoS ONE, 6(8): e22985.doi:10.1371/journal.pone.0022985

Andaloro F., Falautano M., Finoia M.G., Castriota L. 2011. Second record of Gephyroberyx darwinii in the Mediterranean Sea. Marine Biodiversity Records, 5: 3pp e101 doi:10.1017/S175526721200084X.

Belmonte G., Scirocco T., Denitto F. 2011. Zooplankton composition in Lake Varano (Adriatic Sea coast, Italy). Italian Journal of Zoology, 78 (3): 370–378.

Brunetti R., Mastrototaro F. 2012. Botrylloides pizoni, a new species of Botryllinae (Ascidiacea) from the Mediterranean Sea. Zootaxa, 3258: 28–36.

Caronni S. 2011. Effects of Caulerpa taxifolia (Vahl) C. Agardh invasion on sandy bottoms and Posidonia oceanica (L.) Delile dead matte. Scientifica Acta, 5 (1): 3-9

Casabianca S., Penna A., Pecchioli E., Jordi A., Basterretxea G., Vernesi C. 2012. Population genetic structure and connectivity of the harmful dinoflagellate Alexandrium minutum in the Mediterranean Sea. Proc. R. Soc. B.. 279: 129–138.

Castriota L., Andaloro F., Costantini R., De Ascentiis A. 2012. First record of the Atlantic crab Callinectes sapidus Rathbun, 1896 (Crustacea: Brachyura: Portunidae) in Abruzzi waters, central Adriatic Sea. Acta Adriatica, 53(3): 467 – 471.

Charfi-Cheikhrouha D. 2004. Premières observations de quatre espèces de poissons allochtones à Rafraf (nord-est de la Tunisie). Bulletin de l'Institut National Scientifique et Technique d'Océanographie et de Pêche de Salammbô, 31: 115–117.

Crocetta F., Sordino P. and F. Toscano. 2012. Dyspanopeus sayi (Brachyura: Xanthoidea: Panopeidae) in Lago Fusaro (SW Italy). In: Thessalou E., Aydogan Ö., Bekas P., Bilge G., BoYaci Y.Ö., Brunelli E., Circosta V., Crocetta F., Durucan F., Erdem M., Ergolavou A., Filiz H., Fois F., Gouva E., Kapiris K., Katsanevakis S., Kljajić Z., Konstantinidis E., Konstantinou G., Koutsogiannopoulos D., Lamon S., Mačić V., Mazzete R., Meloni D., Mureddu A., Paschos I., Perdikaris C., Piras F., Poursanidis D., Ramos-Esplá A.A., Rosso A., Sordino P., Sperone E., Sterioti A., Taskin E., Toscano F., Tripepi S., Tsiakkiros L., Zenetos A. 2012. New Mediterranean Biodiversity Records (December 2012). Mediterranean Marine Science, 13 (2): 312-327.

Denitto F., Pastore M., Belmonte G. 2010. Occurrence of the Guinean species Herbstia nitida Manning & Holthuis, 1981 (Decapoda, Brachyura) in a Mediterranean submarine cave and a comparison with the congeneric H. condyliata (Fabricius, 1787). Crustaceana, 83 (8): 1017-1024.

de Olazabal A. and Tirelli V. 2011. First record of the egg-carrying calanoid copepod Pseudodiaptomus marinus in the Adriatic Sea. Marine Biodiversity Records, Vol. 4; e85 page 1 of 4.

Felline S., Caricato R., Cutignano A., Gorbi S., Lionetto M.G., Mollo E., Regoli F., Terlizzi A. 2012. Subtle effects of biological invasions: cellular and physiological responses of fish eating the exotic pest Caulerpa racemosa. PLoS ONE, 7(6): e38763. doi:10.1371/journal.pone.0038763

Froglia C. 2012. First record of Charybdis japonica (Crustacea: Decapoda: Portunidae) in the Mediterranean Sea. Marine Biodiversity Records, page 1 of 3. Marine Biological Association of the United Kingdom, doi:10.1017/S1755267212000140; Vol. 5; e33; Published online.

Froglia C., Silvestri R., Serena F. 2012. First record of Panulirus regius (Decapoda: Palinuridae) in the Italian seas, with remarks on the earlier Mediterranean records. Marine Biodiversity Records, Vol. 5, page 1 of 4. doi:10.1017/S1755267211000960; Published online.

Giangrande A., Cosentino A., Lo Presti C., Licciano M. 2012 . Sabellidae (Annelida) from the Faro coastal lake (Messina, Ionian Sea), with the first record of the invasive species Branchiomma bairdi along the Italian coast. Mediterranean Marine Science 13/2: 283 – 293.

Gravili C., Belmonte G., Cecere E., Denitto F., Giangrande A., Guidetti P., Longo C., Mastrototaro F., Moscatello S., Petrocelli A., Piraino S., Terlizzi A., Boero F. 2010. Nonindigenous species along the Apulian coast, Italy, Chemistry and Ecology, 26 (1): 121 – 142.

Gravili C., Di Camillo C.G., Piraino S., Boero F. 2013. Hydrozoan species richness in the Mediterranean Sea: past and present. Marine Ecology, 34 (Suppl. 1): 41– 62.

Guidetti P., Causio S., Licchelli C. 2012. The first record of Enchelycore anatina (Muraenidae:Pisces) in the Ionian Sea (Mediterranean Basin). Marine Biodiversity Records, 5: 3 pp. doi:10.1017/S1755267212000164; Vol. 5; e22; Published online.

Jribi I., Bradai M.N. 2012. First record of the Lessepsian migrant species Lagocephalus sceleratus (Gmelin, 1789) (Actinopterygii: Tetraodontidae) in the Central Mediterranean. BioInvasions Records, 1(1): 49-52.

Kara H.M., Rouag F., Laouira L. 2012. Westward range expansion of the lessepsian spotted halfbeak Hemiramphus far (Hemiramphidae) in the Mediterranean Sea. Marine Biodiversity Records. doi:10.1017/S1755267212000139; Vol. 5; e45; Published online.

Keppel E., Sigovini M., Tagliapietra D. 2012. A new geographical record of Polycera hedgpethi Er. Marcus, 1964 (Nudibranchia: Polyceridae) and evidence of its established presence in the Mediterranean Sea, with a review of its geographical distribution. Marine Biology Research, 8: 969-981.

Licciano M., Giangrande A., Gambi M.C. 2002. Reproduction and simultaneous hermaphroditism in Branchiomma luctuosum (Polychaeta, Sabellidae) from the Mediterranean Sea. Invertebrate Biology, 121(1): 55-65.

Licchelli C., Licchelli D., Moscatello S., Denitto F. 2011. On the occurrence of adult specimens of the crab Percnon gibbesi (H. Milne Edwards, 1853) (Decapoda, Grapsidae) in southern Apulia (Ionian Sea, Italy). Thalassia Salentina, 33:, 69-74.

Licciano M., Giangrande A. 2008.The genus Branchiomma (Polychaeta: Sabellidae) in the Mediterranean Sea, with the description of B. maerli n. sp. Scientia Marina, 72 (2): 383-391.

Licciano M., Stabili L., Giangrande A., Cavallo R.A. 2007. Bacterial accumulation by Branchiomma luctuosum (Annelida: Polychaeta): a tool for biomonitoring marine systems and restoring polluted waters. Marine Environmental Research, 63: 291–302.

Lodola A., Savini D., Occhipinti-Ambrogi A. 2012. First Record of Tricellaria inopinata in the harbour of La Spezia and Olbia, Western Mediterranean Sea (Italy). Marine Biodiversity Records. doi:10.1017/S1755267212000309; Vol. 5; e41; Published online.

Meloni D., Piras F., Lamon S., Fois F., Mureddu A., Mazzette R. 2012. Occurrence of diamondback squid (Thysanoteuthis rhombus) in NW Sardinia. In: Thessalou E., Aydogan Ö., Bekas P., Bilge G., BoYaci Y.Ö., Brunelli E., Circosta V., Crocetta F., Durucan F., Erdem M., Ergolavou A., Filiz H., Fois F., Gouva E., Kapiris K., Katsanevakis S., Kljajić Z., Konstantinidis E., Konstantinou G., Koutsogiannopoulos D., Lamon S., Mačić V., Mazzete R., Meloni D., Mureddu A., Paschos I., Perdikaris C., Piras F., Poursanidis D., Ramos-Esplá A.A., Rosso A., Sordino P., Sperone E., Sterioti A., Taskin E., Toscano F., Tripepi S., Tsiakkiros L., Zenetos A. 2012. New Mediterranean Biodiversity Records (December 2012). Mediterranean Marine Science, 13 (2): 312-327.

Merella P., Casu M., Garippa G., Pais A. 2010. Lessepsian fish migration: genetic bottlenecks and parasitological evidence. Journal of Biogeography, 37 (5): 978–980.

Rosso A. 2012. New findings of the bryozoan Electra tenella (Hincks) in the Mediterranean: are we seeing the spreading of an alien species? In: Thessalou E., Aydogan Ö., Bekas P., Bilge G., BoYaci Y.Ö., Brunelli E., Circosta V., Crocetta F., Durucan F., Erdem M., Ergolavou A., Filiz H., Fois F., Gouva E., Kapiris K., Katsanevakis S., Kljajić Z., Konstantinidis E., Kon-

stantinou G., Koutsogiannopoulos D., Lamon S., Mačić V., Mazzete R., Meloni D., Mureddu A., Paschos I., Perdikaris C., Piras F., Poursanidis D., Ramos-Esplá A.A., Rosso A., Sordino P., Sperone E., Sterioti A., Taskin E., Toscano F., Tripepi S., Tsiakkiros L., Zenetos A. 2012. New Mediterranean Biodiversity Records (December 2012). Mediterranean Marine Science, 13 (2): 312-327.

Sperone E., Circosta V., Brunelli E., Tripepi S. 2012. The opah Lampris guttatus (Actinopterygii: Lampriformes: Lampridae) in the Calabrian coasts (Southern Italy). In: Thessalou E., Aydogan Ö., Bekas P., Bilge G., BoYaci Y.Ö., Brunelli E., Circosta V., Crocetta F., Durucan F., Erdem M., Ergolavou A., Filiz H., Fois F., Gouva E., Kapiris K., Katsanevakis S., Kljajić Z., Konstantinidis E., Konstantinou G., Koutsogiannopoulos D., Lamon S., Mačić V., Mazzete R., Meloni D., Mureddu A., Paschos I., Perdikaris C., Piras F., Poursanidis D., Ramos-Esplá A.A., Rosso A., Sordino P., Sperone E., Sterioti A., Taskin E., Toscano F., Tripepi S., Tsiakkiros L., Zenetos A. 2012. New Mediterranean Biodiversity Records (December 2012). Mediterranean Marine Science, 13 (2): 312-327.

Tagliapietra D., Keppel E., Sigovini M., Lambert G. 2012. First record of the colonial ascidian Didemnum vexillum Kott, 2002 in the Mediterranean: Lagoon of Venice (Italy). BioInvasions Records 1/4: 247–254.

Tamburello L., Benedetti-Cecchi L., Masini L., Bulleri F. 2012. Habitat heterogeneity promotes the coexistence of exotic seaweeds. Oecologia DOI 10.1007/s00442-012-2510-x: 9 pp.

Terlizzi A, Felline S, Lionetto MG, Caricato R, Perfetti V., Cutignato A., Mollo E. 2011. Detrimental physiological effects of the invasive alga Caulerpa racemosa on the Mediterranean white seabream Diplodus sargus. Aquatic Biology, 12: 109–117.

Ungaro N., Pastorelli A.M., Di Festa T. 2012. Dyspanopeus sayi (Smith, 1869) – Crustacea Panopeidae – a new presence in the Varano coastal lagoon (central-southern Adriatic). Biologia Marina Mediterranea, 19 (1): 194-195.

Zenetos A., Gofas S., Verlaque M., Çinar M.E., García Raso J.E., Bianchi C.N., Morri C., Azzurro E., Bilecenoglu M., Froglia C., Siokou I., Violanti D., Sfriso A., San Martín G., Giangrande A., Ocaña O., Zingone A., Gambi M.C., Streftaris N., Katağan T., Ballesteros E., Ramos-Esplá A., Mastrototaro F. 2010. Alien species in the Mediterranean Sea by 2010. A contribution to the application of European Union's Marine Strategy Framework Directive (MSFD). Part I. Spatial distribution. Mediterranean Marine Science, 11 (2): 381-493.

3.11 Lithuania

Compiled by Sergej Olenin, Coastal Research and Planning Institute, Klaipeda University, Lithuania

Overview

No new intentional NIS introductions in 2012 recorded. Two new species recorded, their NIS status is not fully certain. Implementation of the EU Marine Strategy Framework Directive (in particular Articles 8, 9 and 10) required, *inter alia*, to assess non-indigenous species in Lithuanian marine waters.

1. Regulations: An update on new regulations and policies (including, aquaculture and vector management)

No new national regulations concerning introductions to marine environment since 2010.

Lithuania completed initial assessment for D2 non-indigenous species for the Marine Strategy Framework Directive, based on all D2 indicators proposed by EC regulation on criteria and methodological standards on good environmental status of marine

waters (2010/477/EU): accumulative number of NIS, ratio between NIS and native species and Biopollution index.

2. Intentional introductions

No intentional introductions were reported to the Lithuanian coastal waters in recent years.

3. Unintentional introductions

Streblospio shrubsolii

A new spionid polychaete, identified by morphological features as *Streblospio shrubsolii* (Buchanan, 1890) was found in 2012 at one marine biological monitoring station in the Lithuanian sector of the south-eastern Baltic, depth 41 m, soft (muddy sand) bottom. Finding was not yet confirmed by taxonomic spionid expert. The species is known from the German (Kube & Powilleit, 1997) and Polish (World Polychaeta database, 2013) Baltic waters. Most probably it should be regarded as the range expansion species, not truly NIS.

Chaetoceros cf. *lorenzianus*

The diatom *Chaetoceros* cf. *lorenzianus* Grunow 1863 was found for the first time in October 2005 in the Lithuanian coastal waters. Two year before, in November 2003, it was recorded in the Polish waters in the Gulf of Gdansk. Now the species became predominant component of autumn phytoplankton in the southern Baltic Sea (Kownacka *et al*. 2013). Identification of the species is made by morphological features. The authors indicate that the nearest known location is in the Kattegat and the Belt Sea area, approximately 500 km to the west from the Polish and Lithuanian waters. They claim the non-indigenous status of the species, based on 4 "criteria:

1) a new arrival of a conspicuous species;
2) a discontinuity in the known distribution of a species;
3) a highly localized distribution in an area adjacent to the recognized pathways (e.g., in ports, marinas, etc.);
4) recent expansion in the range of a highly localized species, where natural dispersal alone is insufficient to explain its current distribution.

Neogobius melanostomus

The round goby *Neogobius melanostomus* is still spreading further from the Klaipeda port area, both inside the Curonian Lagoon and northward along the mainland coast.

Rangia cuneata – in the area neighboring to Lithuania

The estuarine clam *Rangia cuneata* was found in 2010 in the Russian part of the Vistula Lagoon (Rudinskaya and Gusev, 2012). Identification is based on morphological features. In its native region (Gulf of Mexico) the species survives within the salinity range 0–18‰, the optimal conductions for larval development are T 18–29°C, S 6–10‰, survival range T 8–32°C, S 2–20‰ (Cain, 1973, cit. by Rudinskaya and Gusev, 2012). In Europe the species is known only from Belgium (Verween *et al*. 2006; Kerckhof *et al*. 2007). *R. cuneata* may spread into adjacent Lithuanian and Polish waters.

5. Meetings and projects

Meetings

The 1st European Conference on Research and Ecosystem-Based Management Strategies in Support of the Marine Strategy Framework Directive. Copenhagen, Denmark. May 14–16, 2012

- S. Olenin. Non-indigenous species in marine environment: setting the baseline and defining Good Environmental Status

51st Estuarine, Coastal and Shelf Science International Symposium. Klaipėda, Lithuania. September 23 – 27, 2012

- S. Olenin *et al*. Invasive alien species as an agent of change in transitional waters
- A. Zaiko *et al*. A. Zaiko et. al. Aquatic invasive species and biotic indices: a fake evidence of water quality improvement?
- A. Narščius et. al. AquaNIS – Information system on Aquatic non-indigenous species
- J. Lesutienė et. al. Ontogenetic patterns of feeding strategy and body C:N:P stoichiometry in Ponto-Caspian peracaridans from invaded environments with contrasting nutrient supply
- E. Bacevicius et. al. Biology, feeding habits and metazoan parasites of the round goby, *Neogobius melanostomus* (Pallas, 1811) in the Lithuanian coast and Curonian lagoon (South-eastern Baltic Sea)
- V. Andrašunas et. al. Habitat suitability of round goby (*Neogobius melanostomus* (Pallas, 1811) in Baltic sea Lithuanian coastal zone
- R. Strikaitytė *et al*. The role of invasive shrimp *Palaemon elegans* in the littoral nectobenthic communities of the Baltic sea and Curonian lagoon

NEOBIOTA 2012. Halting Biological Invasions in Europe: from Data to Decisions. 7th European Conference on Biological Invasions. Pontevedra, Spain. September, 12-14, 2012

- S. Olenin *et al*. Invasive alien species assessments for the European Marine Strategy Framework Directive.
- A. Narščius *et al*. Alien species databases: a tool for users or a toy for database developers?
- G. Srėbalienė *et al*. How invasive aliens species are changing Ecological Quality Status of aquatic ecosystems?
- A. Zaiko *et al*. Accommodation phase of a bioinvasion process: evidence-based criteria

Projects:

- MEECE. Marine Ecosystem Evolution in a Changing Environment. EU FP7 project (2008-2012)

Lithuanian team (KUCORPI) developed online Bioinvasion impact / biopollution assessment system (BINPAS). <http://www.corpi.ku.lt/databases/index.php/binpas/>. An experimental work has been competed to determine the parameters of refiltration effect in benthic-pelagic linkage caused by the invasive zebra mussel *Dreissena polymorpha*; the loads of non-organic C and Ca compounds stored in zebra mussel tissues

were estimate to be used in modeling and balance calculations. The bioinvasion impact threshold defined on the basis of biopollution assessment of the invasive dinoflagellate *Prorocentrum minimum* was used to feed the biogeochemical model.

- VECTORS. Vectors of Change in Oceans and Seas Marine Life, Impact on Economic Sectors (2011-2015)

The project addresses a complex array of vectors effecting marine life, biodiversity, sectorial interests, and uses of regional seas. The Lithuanian team (KUCORPI) is developing AquaNIS, an information system on aquatic non-indigenous species of Europe and neighboring areas.

- DEVOTES. Development of innovative tools for understanding marine biodiversity and assessing good environmental status (2012-2016)

The project aims at improving understanding of human activities impacts (cumulative, synergistic, antagonistic) and variations due to climate change on marine biodiversity, using long-term series (pelagic and benthic). A major aim is to test the indicators proposed by the EC, and develop new ones for assessment at species, habitats and ecosystems level, for the status classification of marine waters, integrating the indicators into a unified assessment of the biodiversity and the cost-effective implementation of the indicators (i.e. by defining monitoring and assessment strategies). KUCORPI team is mostly involved in development of NIS indicators.

- INSIST – Invasive species adaptation and its impact on aquatic ecosystems of varying complexity (2012 -2014). Research council of Lithuania. Contact person: Dr. J. Lesutienė <jurate@corpi.ku.lt>
- IANUS – Study of invasive species adaptation mechanisms by synthesis of new methods (2012 -2014). Dr. R. Paškauskas <ricardas.paskauskas@botanika.lt>
- DREISENA - The role of invasive zebra mussel on functioning of aquatic ecosystems and water quality (2012 -2014). Prof. A. Razinkovas-Baziukas <art@corpi.ku.lt>

6. References and bibliography

Cited literature

Rudinskaya, Gusev, 2012. Invasion of the North American bivalve mollusk *Rangia cuneata* to the Vistula Lagoon, Baltic Sea. Russian Journal of Biological Invasions.

Kownacka, J., Edler, L., Gromisza, S., Łotockac,M., Olenina I., Ostrowskac, M., Piwosza, K. 2013. Non-indigenous species *Chaetoceros* cf. *lorenzianus* Grunow 1863 – A new, predominant component of autumn phytoplankton in the southern Baltic Sea. Estuarine, Coastal and Shelf Science. 119, 101–111

Factors controlling the distribution of Marenzelleria cf. viridis, Pygospio elegans and Streblospio shrubsoli (Polychaeta: Spionidae) in the southern Baltic Sea, with …

Kube, J., Powilleit, M. 1997 Factors controlling the distribution of *Marenzelleria* cf. *viridis*, *Pygospio elegans* and *Streblospio shrubsoli* (Polychaeta: Spionidae) in the southern Baltic Sea, with special attention for the response to an event of hypoxia. Aquatic Ecology, 31(2): 187-198

Read, G.; Fauchald, K. 2012. *Streblospio shrubsoli* [auctt.]. In: Read, G.; Fauchald, K. (2012). World Polychaeta database. Accessed through: Read, G.; Fauchald, K. (2012). World Polychaeta database at http://www.marinespecies.org/polychaeta/aphia.php?p=taxdetails&id=334883 on 2013-03-22

Verween A., Kerckhof F., Vincx M., Degraer S. 2006. First European record of the invasive brackish water clam *Rangia cuneata* (G.B. Sowerby I, 1831) (Mollusca: Bivalvia). Aquatic Invasions. 1(4): 198–203.

Kerckhof, F.; Haelters, J.; Gollasch, S. 2007. Alien species in the marine and brackish ecosystem: the situation in Belgian waters. Aquatic Invasions 2(3): 243-257

Information systems

KUCORPI developed BINPAS (Bioinvasion Impact / Biopollution Assessment System available at www.corpi.ku.lt/databases/binpas. The bioinvasion impact assessment methodology is based on estimation of the abundance and distribution range of alien species and the magnitude of their impacts on native communities, habitats and ecosystem functioning, all aggregated in a hybrid ranking "Biopollution Level" index (BPL).

KUCORPI develops AquaNIS an online information system on the aquatic Non-Indigenous Species (NIS), and species which might be considered as NIS (i.e. cryptogenic species), mainly focused on Europe and neighboring regions. The system is available at www.corpi.ku.lt/databases/aquanis. The system stores and disseminates information on NIS introduction histories, recipient regions, taxonomy, biological traits, impacts, and other relevant documented data.

Publications (since the 2012 national report)

Berezina, N.A.; Petryashev, V.V.; Razinkovas, A.; Lesutienė, J. 2011. Alien Malacostracan Crustaceans in the Eastern Baltic Sea: Pathways and Consequences. In: Galil B. S., Clark, P. F., Carlton, J. T. (Eds.), In the Wrong Place - Alien Marine Crustaceans: Distribution, Biology and Impacts. Series: Invading Nature - Springer Series in Invasion Ecology, 6: 301-322

Chuševė, R., Mastitsky, S., Zaiko, A. 2012. First report of endosymbionts in *Dreissena polymorpha* from the brackish Curonian Lagoon, SE Baltic Sea. Oceanologia, 54, 4: 701-713.

Kownacka, J., Edler, L., Gromisza, S., Łotockac, M., Olenina I., Ostrowskac, M., Piwosza, K. 2013. Non-indigenous species *Chaetoceros* cf. *lorenzianus* Grunow 1863 – A new, predominant component of autumn phytoplankton in the southern Baltic Sea. Estuarine, Coastal and Shelf Science. 119, 101–111

Olenin, S. and Minchin, D. 2011. Biological Introductions to the Systems: Macroorganisms. In: Wolanski E and McLusky DS (eds.) Treatise on Estuarine and Coastal Science, 8: 149–183

Olenin, S., Zaiko, A., Lehtiniemi, M. 2012. Biopollution level index. HELCOM Core Indicator Report. Online. [2013-03-21], http://www.helcom.fi/BSAP_assessment/ifs/ifs2012/en_GB/Biopollution/

Zaiko, A.; Daunys, D. 2012. Density effects on the clearance rate of the zebra mussel *Dreissena polymorpha*: flume study results. Hydrobiologia, 680, Page(s): 79-89

3.12 Norway

Prepared by Anders Jelmert, IMR, with contributions from A.-L. Agnalt, V. Husa and J. Sundet, IMR.

Summary:

First observation in Norway of the red algae *Gracilaria vermiculophylla* at "Nøtterøy", SE Norway.

Assumed sustainable fishery (targeting mature males) of the red king crab *Paralithodes camtschaticus* E of North Cape (E 26)resulted in unexpected reduction, both in crab size and population density. The non-regulating culling fishery W. of North Cape (E 26) seems to reduce but not prevent westward spreding of the king crab.

1. Regulations: Law of biodiversity / bylaws has been "in the tube" since 2009.

Finalised 2011 and 2012

- Chapter IV on Alien species
- General prohibition against releasing NIS, unless special permit is granted after RA.

2. Intentional:

No new alien species (*proper)* have intentionally being introduced has been reported. There is quite widespread translocation of several wrasse species in the aquaculture industry (employed for biological de-lousing of salmon). Eventual regional differences in the genetically structure of the populations of the various wrasse species have not been completed.

3. Unintentional:

New sightings

The red algar *Gracillaria vermiculophylla* was observed at "Nøtterøy. First observation in Norway. The 3 sighting sites were close to marinas.

Gracillaria vermiculophylla	N 59 14.06 E 10 25.49 N 59 15.06 E 10 25.81 N 59 9.02 E 10 25.49
Husa et al., 2012	

General information:

An assumed sustainable fishery (targeting mature males) of the red king crab *Paralithodes camtschaticus* E of North Cape (E 26) resulted in unexpected reduction, both in crab size and population density. The non-regulating culling fishery W. of North Cape (E 26) seems to reduce but not prevent westward spreading of the king crab.

Proposed mechanism: The smaller remaining males are not able to defend vulnerable females (mates during molting) from predators (incl. cannibals) Hjelset *et al*., (2012)

Further information on the previously reported hybrid of **Lobster hybrid H. americanus(fe) x H. homarus (m):**

2010: Some 10700 larvae hatched

2013: 83 surviving hybrids

- Size range 5-15 cm total length
- Approx 60% have deformities / physical abberations
- Will be kept until eventual fertility can be determined

Contact: Ann-Lisbet Agnalt, IMR Ann-lisbeth.agnalt@imr.no

Previous Sightings.

An observation of a rather "large" (by Norwegian standards) population of Slipper limpet *Crepidula fornicate* at "Ula": N 59 1.134 E 10 10.892

Crepidula fornicata	N 59 1.134 E 10 10.892
Husa et al. 2012	

Range expansions:

Few observations in 2012 of Mnemiopsis leidyi, (But information of new observations in 2013) .

Snow Crab: *Chionoecetes opilio.* First observed in Russian sector 1996, 2004 in Norw. EEZ. Slowly increasing in Norwegian waters, but the large expansion/ pop. increase in Russian waters. Northward and eastward expansion.

Prefer colder water (typ 3 C) than red king crab. N & E distribution, may even retract if the Arctic gets warmer. May populate Svalbard/Spitzbergen. Contact. Jan.h.sundet@imr.no

Erradication programmes:

Crassostrea gigas: eradication as part of action plan for one municipality (Oslo and Akershus). Not formally, but *de facto* in some areas in Arendal municipality

Homarus americanus: Not formally established or regularily funded (!),

but suspect specimen are collected by fishermen and are genetically analysed at IMR.

Not Seen Species Yet:

No observations of *Didemnum vexillum*, in rapid coastal surveys (Swedish border to Telemark County (58 59N, 11 4E, to 59 0N, 9 5E). Contact V. Husa, IMR.

4. Pathogens

A male American lobster caught outside Bergen. Exoskeleton with signs of shell infections. Work in progress on etiology.

5. Meetings

47th EMBS symposium, Arendal, 3-7 September, 2012

Arctic Frontiers, Tromsø, Jan 19-24, 2013

6. References and bibliography

Hjelset, Ann Merete; Nilssen, Einar Magnus; Sundet, Jan Henry. Reduced size composition and fecundity related to fishery and invasion history in the introduced red king crab (Paralithodes camtschaticus) in Norwegian waters. Fisheries Research 2012; Volum 121. ISSN 0165-7836.s 73 - 80.s doi: 10.1016/j.fishres.2012.01.010.

Husa V, Agnalt A-L, Heggøy E, Svendsen R, Bysveen I, Holmern T, Sjøtun K, Rokkan Iversen K, Steen H, Jelmert A, Farestveit E, Petersen H., 2012

Rapid Coastal Surveys in Norwegian Waters. Poster *47th European Mar. Biol. Symposium,* Arendal, Norway, 3-7 September 2012

3.13 Poland

Prepared by Aldona Dobrzycka-Krahel and Anna Szaniawska, Department of Experimental Ecology of Marine Organisms, Institute of Oceanography, University of Gdańsk, Poland

Overview:

Highlights of the National Report:

- ***Rangia cuneata*** (G.B.Sowerby I, 1831) (Mollusca: Bivalvia) was recorded in 2012 for the first time in the Vistula Lagoon, in Poland (Warzocha *et al*. unpublished data).

1. Regulations:

New regulations on alien species in Poland:

- ● On 17.08.2012 the President of Poland signed law amending nature conservation act and hunting law. Some of the amended regulations refer to alien species. Responsibility for issuing permits for keeping, breeding, offering for sale and trading invasive aliens species was transferred from the General Director for Environmental Protection to regional directors. The General Director will only be responsible for permissions for import of invasive alien species to Poland. It will be possible to issue permissions without obtaining opinion of the State Council for Nature Conservation (which was required before). The applicant will not have to provide an opinion from a veterinarian that the animal will be kept in conditions adequate for its biological needs (again, such opinion was required before). These conditions will be defined in the issued permission and the new regulation makes it possible to control whether the applicant fulfils them. Results of these controls will have to be reported every year to the General Directorate (this new law is in force from 30 September 2012).
- ● The new decree of the Minister of environment, issued on 9 September 2011, is coming into force. It imposes restrictions on 52 invasive alien species of plants and animals. Import, keeping, breeding and selling these species requires obtaining permission from the General Director for Environmental Protection. Breaking the law is subject to a fine or jail. Negligence leading to escape of animals listed in the decree may result in similar consequences. The aim of the new regulation is to reduce the risk of introduction of the most invasive alien species that are either absent, or still restricted in their range in Poland (it is in force from April 2012).

2. Intentional:

In 2012 deliberate releases of salmon (*Salmo salar*), sea trout (*Salmo trutta morpha trutta*) and whitefish (*Coregonus lavaretus*) were conducted (information from Inland Fisheries Institute, Olsztyn, Poland).

3. Unintentional:

New Sighting

Rangia cuneata (G.B. Sowerby I, 1831) (Bivalvia; Mactridae) was recorded in 2012 for the first time in the Vistula Lagoon, in Poland (Warzocha *et al*. unpublished data).

This species inhabits low salinity estuarine habitats. It is considered to be native to the Gulf of Mexico and Atlantic coast of North America, where it is predominantly found in estuaries. *R .cuneata* is most commonly found in areas with salinities from 5 – 15 PSU (Swingle and Bland 1974). Along the Mexican Gulf coast, they form the basis for an economically important clam fishery (Wakida-Kusunoke and MacKenzie 2004). *R. cuneata* should be considered as hazardous biofouling species (Verween at al. 2006). This species was previously reported for the first time in the Vistula Lagoon in September 2010, but in Russian Federation; probably the invasion of this species into the Vistula Lagoon took place at least 2-3 years earlier, in 2007-2008. In 2010-2011 *R. cuneata* colonized and occupied sufficiently large areas to the Kaliningrad sea channel. The most likely invasion way of *R. cuneata* in the Vistula Lagoon is connected with the ballast water of ships, including dredging ships, which came from areas where the clams are already naturalized (Rudinskaya and Gusev 2012). First European record of this invasive brackish water clam has been noted in the harbour of Antwerp, Belgium in 2005 (Verween *et al*. 2006).

Previous Sightings

Ponto-Caspian gammarids: ***Pontogammarus robustoides, Obesogammarus crassus, Dikerogammarus haemobaphes, Dikerogammarus villosus*** (Crustacea, Amphipoda) were in 2010 found for the first time in the Gulf of Gdańsk. Later studies (from 2011-2012) documented the presence and establish populations by these species in the Gulf of Gdańsk (Dobrzycka-Krahel *et al*. unpublished data).

4. Pathogens

No new records of pathogens are known.

5. Meetings:

'International symposium on aquatic plants', 27 to 31 August 2012 in Poznań, Poland

The conference looked at wetland and aquatic ecosystems, with particular attention paid to botanical species composition. Session topics included: biology, ecology and distribution of aquatic plants; aquatic plants in biomonitoring; nature conservation of aquatic vegetation; invasive species, management and control; environmental management in relation to aquatic plant cover; aquatic vegetation and environmental relationships; hydrobotanical systems in waste water treatment.

'Sturgeon Conference 2012', 27 November 2012 in Warsaw, Poland

Sturgeon farmers, producers, scientists and organizations representatives from all over the world gathered in one place during the International Sturgeon Conference. Problems concerned sturgeon production sector were main issues discussed during the conference program.

'Carp Conference', 15-17 February 2012 in Paprotnia, Poland

Nowadays many of carp farmers problems are very important. Fish diseases, predators, EU funds – those are only some issues in which carp farmers should find common position. In the conference participated carp farmers, associations and governmental representatives, veterinary services, university and institutes representatives.

6. References and bibliography:

Dobrzycka-Krahel A., Majkowski W., Melzer M., unpublished data.

Information from Inland Fisheries Institute, Olsztyn, Poland

Rudinskaya L.V., Gusev A.A., 2012. Invasion of the North American Wedge Clam *Rangia cuneata* (G.B. Sowerby I, 1831) (Bivalvia: Mactridae) in the Vistula Lagoon of the Baltic Sea. Russian Journal of Biological Invasions, Vol.3, No 3: 220-229.

Swingle H.A., Bland D.G., 1974. Distribution of the estuarine clam *Rangia cuneata* Gray in coastal waters of Alabama. Alabama Marine Resource Bulletin 10: 9-16.

Verween A., Kerckhof F., Vincx M., Degraer S., 2006. First European record of the invasive brackish water clam *Rangia cuneata* (G.B. Sowerby I, 1831) (Mollusca: Bivalvia). Aquatic Invasions Vol.1, Issue 4: 198-203.

Wakida-Kusunoke A.T., McKenzie C.L., 2004. *Rangia* and Marsch clams, *Rangia cuneata*, *R. flexuosa* and *Polymesoda caroliniana*, in Eastern Mexico: Distribution, biology and ecology, and historical fisheries. Marine Fisheries Review 66(3): 13-20.

Warzocha J., Wodzinowski T., Drgas A., Witalis B., unpublished data.

3.14 Portugal

Compiled by Paula Chainho, Centro de Oceanografia, Faculdade de Ciências da Universidade de Lisboa, Portugal. This report was compiled with contributions from Ana Amorim, Joana Micael, Ana Cristina Costa and Miriam Guerra.

Overview

A list of 97 aquatic non-indigenous species (NIS) is registered for the Portuguese estuarine and coastal aquatic systems, 16 of which were new additions to the 2012 report. The inventory of NIS did not include fish species and freshwater species. Portugal has a law on introduction of exotic species, published in 1999, which is currently under revision (since 2009). Although the current law does not include a list of marine species the revision document included marine species and refers to IMO and ICES criteria for ballast water management. A first characterization report was delivered in the aim of the implementation of the Marine Strategy Framework Directive. The illegal fishing of *Ruditapes philippinarum* is a major problem in the Tagus estuary and authorities wants to develop specific regulation for this activity.

1. Regulations: An update on new regulations and policies (including, aquaculture and vector management)

No new regulations were published since the 2012 report.

In order to accomplish the requirements of the EU Marine Strategy Framework Directive (2008/56/EC) IPMA (Portuguese Institute of the Sea and Atmosphere) delivered a first characterization report, which included information about the state of non-indigenous species (NIS) in EEZ marine waters of mainland Portugal. The main conclusions were as follows:

1) Main vectors of NIS introductions are ballast water, fouling and aquaculture.

2) Most NIS are native from the Pacific (53%) and Indo-Pacific (29%).

3) Small number of NIS recorded: 39.

4) Low ratio between NIS and native species: <5% for micro and macroalgae, arthropods and molluscs and between 5% and 11% (probable) for cnidarians and chordates.

5) Little information on NIS abundance.

6) No records of adverse effects of NIS, except for *Gymnodinium catenatum* which is monitored by IPMA's expert group on phytoplankton since 1987.

7) The following species show potential for expansion:

- The microalgae *Ostreopsis ovata* (monitored by IPMA since 2011)
- The Japanese oyster drill gastropod *Ocenebra inornata*
- The Southern Hemisphere ascidian *Corella eumyota*

2. Intentional introductions

Information available for introductions in Portuguese estuarine and coastal waters is insufficient to separate between intentional and unintentional introductions.

3. Unintentional introductions

A list of 97 aquatic non-indigenous species (NIS) is registered for the Portuguese estuarine and coastal aquatic systems. New additions to the 2012 report are listed in Table 1. New additions for Portuguese mainland and Azores and Madeira islands were considered separately. Species for which there were corrections/changes on the possible introduction vectors, year of first record, current population status at locations where the species were registered and references were also included. Possible introduction vectors were indicated based on the life cycle of the introduced species and the presence of known introduction vectors at locations where it was registered. The inventory of NIS did not include fish species and freshwater species.

Table 1. List of new NIS registered in Portuguese waters

Taxa	Year of first record	Location of first record	Possible introduction vector	Invasion Status	References
Papenfussiella kuromo (Yendo) Inagaki	1990	Azores (S. Miguel)	Unknown	Unknown	Tittley *et al*. 2009
Aglaothamnion cordatum (Børgesen) Feldmann-Mazoyer	2011	Azores (Pico, Graciosa)	Fouling	Unknown	Wallenstein, 2011
Antithamnion densum (Suhr) M.A. Howe	2011	Azores (Pico)	Unknown	Unknown	Wallenstein, 2011
Antithamnion diminuatum Wollaston	1994	Azores	Ballast water; Fouling	Established	Athanasiadis & Tittley, 1994
Antithamnion nipponicum Yamada et Inagaki	1994	Azores (Faial)	Unknown	Established	Athanasiadis & Tittley, 1994
Antithamnionella boergesenii (Cormaci & G. Furnari) Athanasiadis, 1996	2007	Azores (Pico)	Ballast water; Fouling	Unknown	Leon-Cisneros *et al*. 2012
Antithamnionella ternifolia (J.D. Hooker &	1987	Azores (S. Miguel)	Ballast water; Fouling	Unknown	Castro & Viegas, 1987

Ceramium codii (H. Richards) Mazoyer	2011	Azores (Santa Maria, S. Miguel, Graciosa Pico, S. Jorge)	Fouling	Unknown	Wallenstein, 2011
Grateloupia filicina (J.V. Lamouroux) C. Agardh	1914	Azores (S. Miguel)	Aquaculture	Established	Gain, 1914
Grallatoria reptans M.A. Howe	2011	Azores (S. Miguel)	Unknown	Unknown	Wallenstein, 2011
Hypnea flagelliformis Greville ex J. Agardh	2011	Azores (S. Miguel, Pico)	Fouling	Unknown	Wallenstein, 2011
Hypnea spinella (C. Agardh) Kützing	1990	Azores (Flores)	Fouling	Unknown	Neto & Azevedo 1990
Laurencia brongniartii J. Agardh	2011	Azores (Graciosa, Pico, S. Jorge)	Unknown	Unknown	Wallenstein, 2011
Laurencia chondrioides Børgesen	2011	Azores (Terceira, Graciosa, Pico, S. Jorge)	Unknown	Unknown	Wallenstein, 2011
Laurencia majuscula (Harvey) A.H.S. Lucas	2011	Azores (S. Miguel, Graciosa Pico, S. Jorge)	Unknown	Unknown	Wallenstein, 2011
Neosiphonia sphaerocarpa (Børgesen) M.-S. Kim & I.K. Lee	2011	Azores (S. Miguel, Terceira, Pico)	Fouling	Unknown	Wallenstein, 2011
Pleonosporium caribaeum (Børgesen) R.E. Norris	2011	Azores (S. Miguel, Pico)	Fouling	Unknown	Wallenstein, 2011
Pterosiphonia pinnulata (Kützing) Maggs & Hommersand	2011	Azores (Santa Maria, S. Miguel, Terceira, Graciosa)	Unknown	Unknown	Wallenstein, 2011
Symphyocladia marchantioides (Harvey) Falkenberg	1971	Azores (Santa Maria, S. Miguel and Graciosa)	Unknown	Established	Ardré, 1974
Codium effusum (Rafinesque) Delle Chiaje	2007	Azores (Pico)	Unknown	Unknown	León-Cisneros *et al*. 2012
Codium fragile subsp. *atlanticum* (A.D. Cotton) P.C. Silva	1994	Azores (S. Miguel, Flores)	Fouling	Established	Tittley & Neto, 2005
Endarachne binghamiae J. Agardh	1985	Azores (S. Miguel, Terceira)	Fouling	Established	Yoneshigue, 1985
Caprella scaura Templeton, 1836	2012	Portuguese coast	Fouling	Unknown	Ros & Guerra-García, 2012

5. Meetings and projects

Meetings

2012. P. Chainho, A. Amorim, J. Castro, A. Costa, J.L. Costa, T. Cruz, D. Sobral, A. Fernandes, R. Melo, J. Semedo, T. Silva, M. Sousa, P. Torres, V. Veloso & M.J. Costa. Introduced marine non-indigenous species in Portuguese estuaries and coastal areas: who, where and how?. 7th European Conference on Biological Invasions (NEOBIOTA), Pontevedra, Spain.

2012. L. Garaulet, P. Chainho, J.L. Costa, M. Gaspar & M.J. Costa. Distribution, abundance and growth of the Manila clam *Ruditapes philippinarum* in the Tagus estuary (Portugal). 7th European Conference on Biological Invasions (NEOBIOTA), Pontevedra, Spain.

2012. L. Garaulet, P. Chainho, J.L. Costa, G. Silva, C. Azeda, J.P. Medeiros, M. Gaspar, M.J. Costa & I. Caçador. Comparative analysis of the population structure of the Manila clam *Ruditapes philippinarum* with its native relative *Ruditapes decussatus* and the macrobenthic community in Seixal Bay (Portugal). XVII Simposio Ibérico de Estudios de Biología Marina (SIEBM), San Sebastián, Spain.

2012. A. Amorim, V. Veloso, M.L. Dâmaso-Rodrigues, M.M. Angélico, A. Fernandes, J.L. Costa, P. Chainho, M.J. Costa. Assessing the risk of HA translocation through ballast water exchange between the Azores archipelago and mainland Portugal. The 15th International Conference on Harmful Algae, Changwon, Gyeongnam, República da Coreia.

2013. Chainho, P. Does introduction of non-indigenous species increase marine biodiversity? Seminar BioIsle, Marine Biodiversity, Ponta Delgada, Azores, Portugal.

2013. Costa, A. & J. Micael. Azores susceptibility to Marine Bio-Invasions in the Portuguese Context. Workshop Marine Bio-Invasions held in Horta, Azores, Portugal.

Projects:

- Azores: Stop-over for Marine Alien Species? – ASMAS (M2.1.2/I/032/2011). In the Azores, studies on marine species introductions or invasions are rather recent. However, some alien species have already been identified. This project aims to study the occurrence of main marine alien species in the Azores and its invasion pathways (hull fouling and ballast water), evaluate the existence of environmental conditions that favour or difficult the establishment of potential invaders and promote monitoring and mitigation protocols. Sampling surveys on maritime traffic routes will be conducted at commercial and marina harbours of São Miguel and Santa Maria Islands, and neighbouring areas, for several different taxonomic groups, namely phytoplankton, zooplankton, macroalgae and invertebrates on soft and hard substrates. Also, some selected ship ballast water tanks arriving to the mentioned harbours will be sampled to assess the importance of this introduction vector. Proposals on the definition of priority areas and species will be done with the aim of supporting managers and decision makers on the allocation of resources to prevent and/or mitigate the invaders impacts. Also, it is intended to evaluate the exploitation potential of main identified marine alien species, to allow an alternative approach to address this problem. This project is also expected to increase the cooperation between the scientific community, administration representatives of different sectors and civil society, through cooperative actions and participation, meetings organization and through leaflet factsheets distribution to raise public awareness of the problem.
- Canning-Clode J. (2012-2015). Exploring fouling invasions in Portuguese waters: roles of artificial substrates and metal pollution. Postdoctoral FCT grant.

- Non-indigenous species (NIS) invasions occur on a global scale and can generate significant ecological, evolutionary, economic and social consequences. One of the major transfer mechanisms (vectors) for the redistribution of marine species around the world is shipping, primarily through ballast water and hull fouling. Estuarine are particularly vulnerable to invasions due to their use as harbors and ports, and are also often highly polluted due to years of human-induced degradation. In addition, the number of artificial structures such as docks and pilings is becoming increasingly frequent within bays and estuaries, representing a crucial source of space for newly established species. At IMAR-DOP and Centre of Oceanography at the University of Lisbon and also in close collaboration with the Smithsonian Environmental Research Centre, I propose to make a pioneer contribution to marine invasions in Portugal. I will investigate whether artificial substrates facilitate marine invasions and will examine if marine invasive species are more tolerant to metal pollutants than native species.
- Presado, P.V. 2013. Spatial distribution, abundance and size structure of the populations of non-indigenous species *Blackfordia virginica* (Mayer, 1910) and *Corbicula fluminea* (Müller, 1774) in the Mira estuary. University of Évora.
- Coelho. A.F. (ongoing). Spatial distribution and abundance of the non indigenous species *Eriocheir sinensis* in the Tagus estuary. Master thesis. University of Évora.

Future Projects:

- *Ruditapes philippinarum* – this species was registered in the Tagus estuary in 2000 and its populations have increased greatly along the last 6 years. It is currently the dominant bivalve species in some areas of the Tagus estuary, mainly shallow bays with extensive intertidal areas. The increase in abundance of the Manila clam was simultaneous to a strong reduction of the native congeneric species *Ruditapes decussatus*. The Manila clam occurs in areas identified as below microbiological standards, requiring long term depuration before consumption. Illegal fishing is a major problem since although it is legal to harvest this species since 2011, there is no specific regulation. Management of harvesting for this species are major issues that will be addressed in the aim of a project which application for funding was delivered in March 2013.
- *Blackfordia virginica* – this species was registered only in the Guadiana and Mira estuaries, but large blooms occur in the Mira estuary during Summer. Since high densities were measured in the water column a considerable impact over fish species is expected to occur. The lack of specific studies and management actions for this species indicate the need for developing a specific research project in the Mira estuary. The status of the Mira population is currently being monitored every 3 months and an experiment on vertical migrations was conducted in 2012.

6. References and bibliography

Athanasiadis A. & I. Tittley. 1994. Antithamnioid algae (Rhodophyta, Ceramiaceae) newly recorded from the Azores. *Phycologia* 33: 77-80.

Ardré F, C.F. Boudouresque, & J. Cabioch. 1974. Présence remarquable du Symphocladia marchantioides (Harvey) Falkenberg (Rhodomélacé es, Céramiales) aux Açores. Bull. de Soc. Phycologique de Fr. 19:178–182.

Castro, M. L. & M.C. Viegas. 1987. Estudo dos povoamentos de algas fotófilas da ilha de S. Miguel (Açores). *Arquipélago, Life and Marine Sciences*, 4: 7-30

Gain. L. 1914. Algues provenant des campagnes de "1'Hirondelle" 11" (191 1-1 912). *Bulletin de l'Institute Ocianograjique* 279: 1-23.

León-Cisneros, K., I. Tittley, M.R. Terra, E.M. Nogueira & A.I. Neto 2012. The marine algal (seaweed) flora of the Azores: 4, further additions. *Arquipelago*. Life and Marine Sciences 29: 25-32.

Neto A.I. & J.N. Azevedo 1990. Contribuição para o estudo dos padrões de zonação litoral da ilha das Flores. *Flores/89. Relatório Preliminar. Relatórios e Comunicações do Departamento de Biologia.* 18: 89-102.

Ros, M. & J.M. Guerra-García, The role of touristic harbors in the distribution of invasive caprellids (Crustacea: Amphipoda) in the Iberian Peninsula and Northern Africa.Neobiota 2012, Pontevedra, Spain.

Tittley I. & A.I. Neto. 2005. The marine algal (seaweed) flora of the Azores: additions and amendments. *Botanica Marina* 48: 248–255.

Tittley, I., A.I. Neto & M.I. Parente 2009. The marine algal (seaweed) flora of the Azores: additions and amendments 3. *Botanica Marina* 52: 7-14.

Wallenstein, F.M. 2011. Rocky Shore Macroalgae Communities of the Azores (Portugal) and the British Isles: a Comparison for the Development of Ecological Quality Assessment Tools. PhD Thesis Heriot Watt University.

Yoneshigue Y. 1985. Taxonomie et ecologie des algues marines dans la région de Cabo Frio (Rio de Janiero, Bresil). PhD Thesis University D'Aix-Marseille II.

3.15 Spain

Prepared by Gemma Quilez-Badia, WWF Mediterranean Programme Office, Spain.

Overview:

The Royal Decree 1628/2011, of November 14, regulating the List and Catalogue of alien invasive species is still under revision.

Five new NIS species have been reported from Spain: *Marginella glabella* (in the inner fishing port of Málaga harbour (southern Spain, Mediterranean coast)), *Dyspanopeus sayi* (from Alfacs Bay, Ebro Delta, NE Spain, Mediterranean coast (40°40'N 0°40'E)), *Phyllorhiza punctata* (from Far del Fangar, Ebro Delta, NE Spain, Mediterranean coast (40°46'N 0°47'E)), *Arcuatula senhousia* (from Bidasoa Estuary, bordering Spain and France, Bay of Biscay, N Spain, Atlantic coast (43°20.5"N 1°46"W)) and *Gadus morhua* (off the south coast of Mallorca, Balearic Islands, Mediterranean Sea (39°15'37''N 02°38'43''E)). In addition, new reports of previous sightings are also indicated.

Content:

1. Regulations: An update on new regulations and policies (including, aquaculture and vector management)

Royal Decree 1628/2011, of November 14, regulating the List and Catalogue of alien invasive species is still under revision.

On March 3 the Secretary of State for the Environment announced in the Senate that, at the end, the different autonomous communities will probably have to be the ones to develop a list of potentially invasive species in their region, which would eliminate the general list that was previously included in the Royal Decree.

2. Intentional:

3. Unintentional:

New Sightings (see "SPAIN National Data Report 2013")

Marginella glabella (Linnaeus, 1758), the Shiny Marginella, was reported by Luque *et al* (2012). An established population of the gastropod *M. glabella*, native to the West African Atlantic coasts of Morocco to Senegal and also present in the Canary Islands was found in the inner fishing port of Málaga harbour (southern Spain, Mediterranean coast) (36º42'N 4º25'W). In spite of its presumably scarce self-dispersal ability due to its direct development, it should be considered an invasive species since it is potentially able to spread out from the area currently occupied and preys voraciously on autochthonous gastropods (Luque *et al*., 2012). It is suggested that this species was introduced during the 1990s as by-catch of Málaga-based trawlers, which at that time were fishing on the Atlantic coast off Morocco and the Canary–Saharian bank.

Dyspanopeus sayi (Smith, 1869), the Say's Mud Crab, was found in November 2005, September 2006, and August 2010 from Alfacs Bay (40°40'N 0°40'E) (Ebro Delta, Tarragona, NE Spain, Mediterranean coast) (Schubart *et al* 2012). Originally endemic to the Atlantic coast of North America, *D. sayi* was involuntarily introduced into Britain (Ingle 1980, Clark 1986), France and the Netherlands (Vaz *et al*. 2007), and into the Adriatic (Froglia and Speranza 1993, Mizzan 1995, Florio *et al*. 2008) and Black Sea (Micu *et al*. 2010) within the last thirty years. This is the first record of this species from the western Mediterranean Sea. Occurrences of ovigerous females at different localities of the delta and in different years provide evidence that the population is well established (Schubart *et al* 2012). *Dyspanopeus sayi* is a molluscivorous crab, its main prey organisms being bivalve molluscs and barnacles. In the Adriatic Sea, *D. sayi* has exterminated prey species like *Mytilus galloprovincialis*, *Mytilaster lineatus*, *Ostrea edulis* and *Crassostrea gigas* in a very small locally restricted area (Mizzan 1998). Alfacs Bay is very important for the economy of the region due to its fish and shellfish farming and aquaculture, thus, biological and ecological studies are necessary as soon as possible in order to assess the real impact that *Dyspanopeus sayi* can have on the Ebro Delta system (Schubart *et al* 2012). The authors indicate commercial and non-commercial vessels and/or movements and exchanges of aquaculture as possible introduction vectors for this species.

Phyllorhiza punctata (von Lendenfeld, 1884), the Australian spotted jellyfish, was reported for the first time in Spain in 2010 from Far del Fangar (40º46'N 0º47'E) (Ebro Delta, NE Spain, Mediterranean coast) (Andreu *et al*., 2012). *P. punctata* is indigenous to the tropical western Pacific Ocean (Graham *et al*. 2003) and may have been transported via vessels arriving from tropical western Atlantic ports (8% of the Gibraltar inbound vessels originate in Caribbean, Gulf of Mexico and Central American ports) (CIESM 2002), or in the fouling as the sessile polyp stages on ship hulls or drilling rigs (Larson and Arneson 1990; Bolton and Graham 2004). In the Gulf of Mexico it has severely impacted fisheries by significantly reducing the shrimp harvest and by predating on pelagic fish eggs and bivalve larvae, causing several million dollars loss

(Graham *et al*. 2003; Johnson *et al*. 2005). As it is not stinger, it should not affect human health, however, it could still have negative impacts on tourism, such as what happened in 2011 in Mar Menor (SE Spain, Mediterranean coast) when several beaches had to be closed due to unusual high densities which even reached the international press (i.e. www.couriermail.com.au/news/world/australian-spotted-jellyfish-phyllorhiza-punctata-invade-spanish-beaches/story-e6freoox-1226099789817).

Six specimens of ***Arcuatula senhousia*** (Benson in Cantor, 1842), the Asian date mussel, were found for the first time in October 2006 in Spain, i.e. in Bidasoa Estuary, bordering Spain and France (43°20.5"N 1°46"W) (Bay of Biscay, N Spain, Atlantic coast) (Bachelet *et al*., 2009). In the Bay of Biscay, *M. senhousia* appeared to be adapted to a variety of habitats (intertidal/shallow subtidal, muds with or without *Zostera noltii*/fine gravels/oyster reef) and be able to tolerate low salinities, which may explain its invasive success (Bachelet *et al*., 2009). Due to the presence of ports in the locations where *M. senhousia* was discovered, the species might have been transported as fouling on ship's hulls (Bachelet *et al*., 2009). In other invaded areas, M. senhousia has been shown to have a detrimental, although localised, effect on seagrass growth (Reusch & Williams, 1998; Allen & Williams, 2003) and infaunal assemblages (Creese *et al*., 1997; Crooks, 2001; Mistri, 2003). It thus appears necessary to survey the newly colonized sites in the Bay of Biscay to assess the potential impact of *M. senhousia*, as well as the sites not colonized until now in north-western Europe, where it can be predicted a secondary dispersal within the next years (Bachelet *et al*., 2009).

A single mature female cod ***Gadus morhua*** (Linnaeus, 1758) was captured approximately 9 nautical miles off the south coast of Mallorca Island (39°15′37′′N 02°38′43′′E) (Balearic Islands, Mediterranean Sea) on June 24 2009 by a bottom trawler between 63 and 110 m depth (Morey *et al*., 2012). This is the first documented occurrence of the species in the Mediterranean. Temperature is a crucial factor in determining the distribution of cod (Mieszkowska *et al*. 2009). Adult cod can occur in temperatures ranging from −1 to 20°C (Mieszkowska *et al*. 2009). Sea surface temperatures off the Balearic Islands range from 13 to 15°C during winter to >25°C during summer. However, below the 50 m depth thermocline, the water temperature is constant at 13 to 15°C, within the range for the species. Ocean warming is predicted to lead to a northward shift in the distribution of cod, especially at the southern limits of its distribution (Mieszkowska *et al*. 2009). However, this cod was found ca. 2000 km from NW Spain waters, where it is considered sporadic (Bañon *et al*. 2010) and represents its southernmost occurrences along European coasts (Morey *et al*., 2012).

Previous Sightings (see "SPAIN National Data Report 2013")

The algae ***Caulerpa racemosa*** **var.** ***cylindracea*** (Sonder) Verlaque, Huisman and Boudouresque, 2003 was found in December 2008 in Vilanova and Sitges (i.e. from 41°12'N 41°13'N to 1°43'E 1°48'E), NE Spain, Mediterranean coast (Weitzman *et al*., 2009). It had previously been recorded from the Balearic Islands, (Aranda *et al* 1999; Ballesteros *et al*., 1999; Verlaque *et al*. 2000; Pena Martin *et al*. 2003), all the three provinces of Valencia (Aranda *et al*., 1999 , Guillen *et al*., 2010) and Murcia (Ruiz Fernandez *et al*., 2006; Ruiz *et al*., 2011).

Stable populations of the bivalve ***Fulvia fragilis*** (Forsskål in Niebuhr, 1775) were reported from several locations in Ebro Delta (40°43'N 0°50'E) (NE Spain, Mediterranean coast) since 1993 to 2009 (Lopez Soriano *et al*., 2009). It had been previously reported from Valencia (E Spain, Mediterranean coast), where it was found in 1991 (Gofas and Zenetos, 2003; Tamayo-Goya 2008). Thus, showing a northwards spread.

The Black-pygmy mussel ***Limnoperna securis*** (Lamarck, 1819) has recently been reported from Fluvià River (NE Spain, Mediterranean coast) (42º12'N 03º06'E) where it was found in 2007 (Barbieri *et al*., 2011), from Nervión estuary (Bay of Biscay, N Spain, Atantic coast) (02º56'W 43º15'N) in 2010 (Adarraga and Martínez, 2012) and from Ria of Pontevedra (NW Spain, Atlantic coast) (42º26'N 8º39'W) in 2012 (Guerra *et al*., 2013). It had previously been reported from Ria de Vigo (NW Spain, Atlantic coast) (42º20'29''N 8º36'49''W) in 2002 (Garci *et al*., 2007; Santaclara *et al*., 2007; Pascual *et al*., 2010). It has, therefore, been reported from both the northern Atlantic coast and the Mediterranean coast of Spain.

The polychaete ***Branchiomma luctuosum*** (Grube, 1869) was found in 2009 from Cases D´Alcanar port (Tarragona) to Santa Pola port (Alicante) (i.e. Cases d´Alcanar (40º33,1'N 0º31,9'E), Benicarló (40º24,9'N 0º26,0'E), Peñiscola (40º21,4'N 0º24,3'E), Burriana (39º51,8'N 0º04,3'W) and Santa Pola (38º11,4'N; 0º33,5'W) (all in E Spain), Mediterranean coast) (El Haddad *et al*., 2012). It had previously been reported from the Port of Valencia (Mediterranean coast) in 2005 (El Haddad *et al*., 2007). It has, therefore, spread both northwards and southwards.

A single adult female of the American blue crab ***Callinectes sapidus*** (Rathbun, 1896) was caught on 3 November 2012 in Tancada Lagoon, Ebro Delta (40°38'24''N, 0°44'23.9''W) (NE Spain, Mediteranean coast) and a single adult male was caught on 4 January 2013 using trammel net off Eucaliptus Beach, Ebro Delta (40°37'48''N, 0°45'0''W) (NE Spain, Mediterranean coast) (Castejón and Guerao, 2013). It had previously been reported from the Guadalquivir estuary - SW Spain (Atlantic coast), where it appeared before 2002 (WWF/ADENA, 2002) - and from Gijón (N Spain, Atlantic coast) in 2004 (Cabal *et al*., 2006). It has, therefore, been reported from all the different Spanish coasts (i.e. north Atlantic coast, south Atlantic coast and Mediterranean coast).

The first record of the oriental shrimp, ***Palaemon macrodactylus*** (Rathbun, 1902), in the Mediterranean was reported by Torres *et al*. (2012). Eight larvae were found in summer 2005 and 2010 in plankton samples off the Balearic Islands (western Mediterranean) (38º40.20'N 3º49.20'E). Two mature females had previously been caught in the Guadalquivir Estuary (36º46'N 6º22'E) in January 1999 (Cuesta *et al*., 2004; González-Ortegón *et al*., 2007.

Fistularia commersonii (Rüppell, 1838), the Bluespotted cornetfish, was found in 2007 in Palamós (NE Spain, Mediterranean coast) (41°50'N 3°07'E), and in 2010 in Blanes (NE Spain, Mediterranean coast) (41°40'N 2°47'E) (Andreu *et al*., 2012). It had previously been reported in 2007 from the Alboran Sea (SE Spain, Mediterranean coast), i.e. in Berenguel Bay (Almuñécar, Granada) (36º43´16.3N 3º44´14.3''W) and in Herradura Bay (Almuñécar, Granada) (36º43´29''5N 3º44´15.3''W) (Sánchez-Tocino *et al*., 2007).

4. Pathogens

No new pathogens have been reported

5. Meetings

6. References and bibliography

Adarraga, I. and Martínez, J., 2012. First record of the invasive brackish water mytilid *Limnoperna securis* (Lamarck, 1819) in the Bay of Biscay. *Aquatic Invasions*, 7 (2): 171–180.

Andreu, J., Pino, J., Basnou, C., Guardiola, M. and Ordóñez, J.L., 2012. Les espècies exòtiques de Catalunya. Resum del projecte EXOCAT 2012. Available at: http://www20.gencat.cat/docs/DAR/MN_Medi_natural/MN10_Fauna_salvatge_autoctona/Fauna_invasora_medi_natural/EXOCAT_2012_def.pdf

Bachelet G., Blanchet H., Cottet M., Dang C., de Montaudouin X., de Moura Queiros A., Gouillieux B., Lavesque N., 2009. A round-the-world tour almost completed: first records of the invasive mussel *Musculista senhousia* in the North-east Atlantic (southern Bay of Biscay), *Marine Biodiversity Records*, 2 (e119), 1-4.

Barbieri M, Maltagliati F, di Giuseppe G, Cossu P, Lardicci C, Castelli A., 2011. New records of the pygmy mussel *Xenostrobus securis* (Bivalvia: Mytilidae) in brackish water biotopes of the western Mediterranean provide evidence of its invasive potential. *Marine Biodiversity Records*, 4: e48.

Castejón, D. and Guerao, G., 2013. A new record of the American blue crab, *Callinectes sapidus* Rathbun, 1896 (Decapoda: Brachyura: Portunidae), from the Mediterranean coast of the Iberian Peninsula. *BioInvasions Records*, 2 (*in press*)

El Haddad, M., Tasso, V., Gilabert, J.A. & Assadi, C. (2012). The use of georeferenced underwater TV devices for the study of the exotic invasive species *Branchiomma luctuosum* (Polychaeta, Sabellidae) in ports from Eastern Iberian coast (Western Mediterranean Sea, Spain). *BioInvasions Records*, 1 (4): 277–281.

Guerra, A., Pascual, S., Garcia, M.E., Roura, A., Mucientes, G. and González, A.F., 2013. The black-pygmy mussel *Limnoperna securis* in Galician Rias (north-eastern Atlantic): new records and first evidence of larval stages predation by copepods. *Marine Biodiversity Records*, 6: e15.

López Soriano, J., Quiñonero Salgado, S.; Tarruella, A. (2009). Presencia de poblaciones estables de un inmigrante lessepsiano, *Fulvia fragilis* (Forsskål, 1775) en el Delta del Ebro. *Spira*, 3: 53-58.

Luque, A.A., Barrajon, A., Remon, J.M., Moreno, D. & Moro, L., 2012. *Marginella glabella* (Mollusca: Gastropoda: Marginellidae): a new alien species from tropical West Africa established in southern Mediterranean Spain through a new introduction pathway. *Marine Biodiversity Records*, 5: e17. doi: http://dx.doi.org/10.1017/S175526721200 0012.

Morey, G., Morales-Nin, B., Riera, F., Grau, A., Geffen, A.J., Pérez-Mayol, S., Chang, M.-Y-., Grau, A.M., 2012. Atlantic cod *Gadus morhua* in the Mediterranean: a surprising immigrant. *Mar Ecol Prog Ser*, 467: 277–280. doi: 10.3354/meps09936

Schubart, C.D., Guerao, G. & Abelló, P., 2012. First record and evidence of an established population of the North America mud crab *Dyspanopeus sayi* (Brachyira: Heterotremata: Panopeidae) in the western Mediterranean. *Scientia Marina*, 76 (1): 79-85.

Torres, A.P., Dos Santos, A., Cuesta, J.A., Carbonell, A., Massutí, E., Alemany, F. & Reglero, P. (2012) First record of *Palaemon macrodactylus* Rathbun, 1902 (Decapoda, Palaemonidae) in the western Mediterranean. *Mediterranean Marine Science*, 13: 278-282.

Weitzmann, B., Garcia, M., Cebrian, E., and Ballesteros, E., 2009. Les invasions biològiques en el medi marí: exemples i impactes a la mediterrània occidental. *L'Atzavara*, 18: 39-49.

3.16 Sweden

Prepared by Malin Werner, Swedish University of Agricultural Sciences, Dep. of Aquatic Resources, Institute of Marine Research, Lysekil, Sweden.

Contributions were received from Inger Wallentinus (University of Gothenburg), Kennet Lundin (Gothenburg Natural History Museum), Kerstin Mo (Swedish University of Agricultural Sciences), Ann-Britt Florin (Swedish University of Agricultural Sciences), Jan Albertsson (Umeå University), Åsa Strand (University of Gothenburg), Sture Nellbring (County Administrative Board of Stockholm), Lena Granhag (Chalmers University of Technology). Lene Friis Möller (University of Gothenburg), Vidar Öresland (Swedish University of Agricultural Sciences), Lennart Edsman (Swedish University of Agricultural Sciences), Malin Mohlin (SMHI).

Overview:

The microalgae *Fibrocapsa japonica*, that is potentially harmful to fish, was sighted for the first time in Swedish waters in 2012.

A colony of adult sea anemones, *Edwardsiella lineata* was found for the first time. Larval stages, parasitic in comb jellies, have been found before.

1. Regulations:

For several years a regulation clarifying ownership of oysters, including the introduced *Crassostrera gigas* has been anticipated, but the issue has still not been solved.

Sweden has been part of the work to develop indicators for D2 non-indigenous species for the Marine Strategy Framework Directive, earlier within HELCOM but mostly within OSPAR during 2012.

2. Intentional:

Not investigated.

3. Unintentional:

a) New Sightings

Fibrocapsa japonica

This species was found in plankton samples from Skagerrak and Kattegat in autumn 2012 (Malin Mohlin, SMHI, pers. comm.). *Fibrocapsa japonica* belongs to the class Raphidophyceae. In Japan *F. japonica* has caused fish deaths many times, but the mechanisms behind the deaths are still not fully understood (e.g. de Boer . 2012). The species is destroyed when fixating samples, and thus the sample needs to be examined fresh, to be able to identify the algae.

b) Previous Sightings

A colony of adult sea anemones of *Edwardsiella lineata** were photographed at Väderöarna (the weather islands) in March 2012. The larval stage of this anemone live as an endoparasite in the comb jelly *Mnemiopsis leidyi* and has earlier been identified by DNA-sequencing by Swedish researchers (Selander . 2010). But this was the first adult colony reported in Swedish waters (Lundin & Malmberg 2012). The colony consists of adult individuals that all bud off from a first specimen that leaves the comb jelly for a bottom dwelling life stage.

Conrad's false mussel, *Mytilopsis leucophaeata*, found in 2011 in the Biotest Basin, southern Bothnian Sea , was also observed in surrounding waters in 2011, and

showed a drastic increase in 2012 (Mo . in prep). In the Biotest Basin, heated by cooling water from Forsmark nuclear power plant, numerous adult mussels were observed on stones and equipment in 2012. However, only juvenile specimens have been observed outside the Biotest Basin, so far.

The comb jelly *Euplokamis dunlapae* that was first found in the Gullmar fjord, southern Skagerrak in 2011, occurred in 2012 in about the same abundance and area as in 2011 (Lene Friis Möller pers. comm.)

The results from the monitoring programs for the Bothnian Sea and the Bothnian Bay on the northern part of the Swedish east coast are not ready for 2012 yet. Jan Albertsson, Umeå University, reported that until 2011 *Cercopagis pengoi* has been found every year since 2006, but scarcely. In 2006 and 2007 the abundance was a little higher but lower after that. *Marenzelleria* spp. is established in all investigated areas in the Bothnian Sea, in offshore areas in the northernmost parts of the Bothnian Bay, and a few near the coast. Up to 2010, the abundance had decreased in most areas for a few years, but again increased in 2011. The species concept of *Marenzelleria* spp. is being investigated molecularly in a research project. On the west coast of Sweden *Marenzelleria viridis** is reported all along the coast in brackish waters.

Studies have been made on settlement preferences of and on the Pacific oyster *Crassostrea gigas* that had high recruitment on the north part of the Swedish west coast in 2011. Preliminary results showed that Blue mussels, *Mytilus edulis*, and Pacific oyster settled more in areas where there were already shells available (Åsa Strand pers. comm.)

The Japanese skeleton shrimp *Caprella mutica**, that was found in large numbers in fishing nets in summer 2011 at the Lovén centre at Tjärnö, south west of Strömstad were not as common in 2012.

Monitoring of the Chinese mitten crab, *Eriocheir sinensis**, in Göta älv (Göta river) was initiated by the Natural History Museum in Gothenburg in cooperation with University of Gothenburg. None were found in October-November in four sampling stations along Göta älv (Vänersborg, Lilla Edet, Nödinge and Nya varvet in Gothenburg). Invasion history in Lake Vänern is described in a publication by Drotz *et al* (2012).

Information about species marked with * are collected from the coming yearly publication for 2012 from the Natural History Museum in Gothenburg, communicated by K. Lundin.

The round goby, *Neogobius melanostomus*, is continually reported by recreational anglers in Gothenburg and Visby and by fishermen in Karlskrona suggesting that the populations in these areas are established. In a project using fykenets in Visby harbor several hundreds of gobies were caught during the summer of 2012 (sightings reported in www.artportalen.se; Ann-Britt Florin, SLU Aqua pers. comm.). The status for the round goby in Karlshamn where a single individual was reported in 2009 is unknown. In 2012 the species was also reported in Klintehamn – south of Visby (sighting reported in www.artportalen.se; Ann-Britt Florin, SLU Aqua pers comm.). This might suggest a range expansion from Visby but it could also be a new primary introduction by shipping.

4. Pathogens

No new pathogens were reported in Sweden in 2012, but monitoring programs to look for them are absent. High mortality of *Tinca tinca* (Tench) in Mönsterås archipelago, east coast of Sweden, was reported in May 2012 by the public and a bacteria

never recorded in Sweden before was detected in the dead fish (Vidar Öresland, SLU, pers.comm.). More information may be found in the coming report from the ICES working group on Pathology and Diseases of Marine Organisms, who met in Padova, Italy, 5–9 March 2013.

5. Meetings

a) 2012

The Swedish Agency for Water and Marine Management (SwAM) held a workshop on introduced species and genetic variants in November 2012 to discuss monitoring issues and to initiate/build on a national network of interested parties.

The Scandinavian network on Pacific oysters held a workshop in Arendal, Norway 19-20 April 2012.

b) Future meetings:

Scandinavian Network on Oyster Knowledge and management (SNOK) are planning a workshop in Copenhagen the 28-29 of May 2013.

"Environmental monitoring and detection of invasive species - current challenges" a workshop planned for August by the Swedish University of Agricultural Sciences/ Global Alliance University Challenges. 4-6 September, Uppsala, Sweden.

6. Miscellaneous information:

a) Important information website will be moved

The useful information-website www.frammandearter.se that has been run by the three regional Information Offices for the Swedish coast is planned to be transferred to the website of the Swedish Agency for Water and Marine Management. The details are not clear yet, but the website has not received any more funding and will not be updated after April 2013.

b) Interesting findings in freshwater:

In November 2012, thirteen "Marmorkrebs" (*Procambarus fallax* f. *virginalis*) were found in Märsta river, north of Stockholm (Lennart Edsman, Swedish University of Agricultural Sciences, pers. comm.). Marmorkrebs reproduces itself by parthenogenesis and a population can in principle start from only one individual. It is believes that all parthogenetic individuals originate from the aquaria trade. In a recent publication the known findings in Europe are listed (Chucholl . 2012) Researchers at SLU (Lennart Edsman and Patrik Boman) will investigate the possibility to eradicate the species in this area.

c) In a new Ph.D. thesis the chemical defence and the protective traits of the algae *Bonnemaisonia hamifera* is investigated by Swantje Enge. The algae have a double advantage to many native species, because it contains toxins and are thus not grazed extensively upon by herbivores. At the same time the grazers use the algae as protection against predators and can graze more efficiently on algae around the introduced algae that in this way benefit from decreased competition (Enge, 2012, Enge . 2013). Also the settlement of propagules of native algae species can be prevented by *B. hamifera* (Svenson . 2012)

7. References and bibliography

Abbas, A., Josefson, M., Nylund G.M., Pavia, H., Abrahamsson, K. (2012) Chemical images of marine bio-active compounds by surface enhanced Raman spectroscopy and transposed orthogonal partial least squares (T-OPLS). Analytica Chimica Acta 237: 37-44.

de Boer M. K., Claire Boerée C., Sjollema S.B., de Vries T., Rijnsdorp A.D. Bumaa A.G.J. (2012) The toxic effect of the marine raphidophyte *Fibrocapsa japonica* on larvae of the common flatfish sole (*Solea solea*). Harmful Algae 17: 92–101.

Chucholl C., Morawetz K.,, Groß H., (2012) The clones are coming – strong increase in Marmorkrebs [*Procambarus fallax* (Hagen, 1870) f. *virginalis*] records from Europe. Aquatic Invasions 7 (4): 511–519.

Drotz, M. K., Brodin, T., Berggren, M. (2012) Distribution patterns of the Chinese mitten crab (*Eriocheir sinensis* H. Milne Edwards, 1853) in Lake Vänern, Sweden. Aquatic Invasions, 7(2): 243-249.

Enge, S. (2012), Seaweed Invasions and Novel Chemical Defences. Ph.D. thesis. University of Gothenburg.

Enge, S., Nylund, G. M., Harder, T., Pavia. H. (2012) An exotic chemical weapon explains low herbivore damage in an invasive alga. Ecology 93 (12): 2736-2745.

Enge, S., Nylund, G.M., Pavia, H. (2013) Native generalist herbivores promote invasion of a chemically defended seaweed via refuge-mediated apparent competition. Ecology Letters 16 (4): 487-492.

Granhag, L., Majaneva S., Friis Møller, L. (2012) First recordings of the ctenophore *Euplokamis* sp. (Ctenophora, Cydippida) in Swedish coastal waters and molecular identification of this genus. Aquatic Invasions: 7 (4): 455-463.

Lundin K., Azurduy Högström C. (2013) Faunistiskt nytt 2012 - marina evertebrater. Göteborgs Naturhistoriska Museum Årstryck 2013 (not published yet. Information received from K. Lundin).

Lundin, K., Malmberg, K. (2012) Havsanemoner – om nya och sällan sedda arter vid den svenska västkusten. Fauna och Flora 107(4): 6-9.

Roleda, M.Y., Nyberg, C.D., Wulff, A. (2012) UVR defense mechanisms in eurytopic and invasive *Gracilaria vermiculophylla* (Gracilariales, Rhodophyta). Physiologia Plantarum 146: 205-216.

Selander, E., Fagerberg, T., Wohlrab, S., Pavia, H. (2012) Fight and flight in dinoflagellates? Kinetics of simultaneous grazer-induced responses in *Alexandrium tamarense.* Limnology and Oceanography 57 (1): 58-64.

Selander, E., Friis Møller, L., Sundberg, P. , Tiselius, P. (2010) Parasitic anemone infects the invasive ctenophore *Mnemiopsis leidyi* in the North East Atlantic. Biological Invasions 12(5): 1003-1009.

Svensson, J. R., Nylund, G. M., Cervin, G., Toth G., Pavia, H. (2013) Novel chemical weapon of an exotic macroalga inhibits recruitment of native competitors in the invaded range. Journal of Ecology 101(1) :140-148.

webpage: www.artportalen.se

3.17 United Kingdom

Compiled by Gordon H. Copp (Centre for Environment, Fisheries & Aquaculture Science - Lowestoft) and Paul Stebbing (Cefas-Weymouth), with contributions from Lyndsay Brown (Marine Scotland-Science), Elizabeth Cook (Scottish Association for Marine Science — SAMS), Gabrielle Wyn (Countryside Commission for Wales –

CCW), Rohan Holt (CCW), Catherine Collins (Marine Scotland Science – MSS) and David Donnan (Scottish Natural Heritage – SNH).

Highlights of National Report

The predatory shrimp *Dikerogammarus haemobaphes*, a conspecific of the so-called 'killer shrimp' *D. villosus*, was found in the River Severn and then later confirmed for several water bodies across England.

Measures to prevent the spread of *D. villosus* continue, complemented by a revised edition of the detailed identification guide for *D. villosus* published by the Freshwater Biological Association, but the species has appeared at a few new locations in the County of Norfolk.

During 2012, two reports assessing pathways of non-native aquatic invasions were produced for the UK Department of Environment, Food and Rural Affairs, which is also expanding its campaign "Check, Clean, Dry" to enlist recreational users of water bodies to help control the spread of aquatic invasive non-native species.

Initiatives to eradicate invasive carpet sea-squirt (*Didemnum vexillum*) continue in Wales.

No new species of non-native fish have been reported.

Infectious agents have been reported in 2012, i.e. the parasite *Marteilia* sp. in edible mussels (*Mytilus edulis*), whitespot syndrome virus (WSSV) in the invasive freshwater crayfish (*Procambarus clarkii*), Gaffkaemia (a disease introduced with American lobsters) in three populations of native European lobsters (*Homarus gammarus*), Spring viraemia of carp virus in fishery comprised of a lake complex, an exotic-listed shellfish parasite (*Bonamia exitiosa*) in native oysters, and an uncharacterised herpes virus (closely related to goldfish herpesvirus, CyHV-2) in specimens said to be the feet-cleaning fish *Garra rufa,* which subsequently were shown, using molecular genetic analysis not to be *G. rufa.*

The Environment Agency, UK (England & Wales) began consideration in 2012 of a proposal to authorise a localised fishery for the invasive Chinese mitten crab (*Eriochier sinensis*) in part of the River Thames estuary.

National reports:

Overview

A document published in July 2012 by the Centre for Ecology & Hydrology, "Non-Native Species in Great Britain: establishment, detection and reporting to inform effective decision making" reports that nearly 2000 non-native species have established in Great Britain, with about 600 arriving in the six decades since 1950. Two months later, i.e. September 2012, the predatory shrimp *Dikerogammarus haemobaphes*, a conspecific of the so-called 'killer shrimp' *D. villosus* was found in the River Severn and then later confirmed for several water bodies across England. Advice on the response to *D. haemobaphes* is being provided by The Killer Shrimp Task Group, which comprises representatives from Natural England, Defra, the Welsh Government, SEPA, CCW, and the Broads Authority.

Measures to prevent the spread of *D. villosus* continue, but the species has appeared at a few new locations, e.g. the River Bure and Wroxham Broad, both in the County of Norfolk. In March 2012, the Freshwater Biological Association published a revised edition of its detailed identification guide for *D. villosus.*

During 2012, the UK Department of Environment, Food and Rural Affairs published two reports that address marine pathways of aquatic species invasions in the UK: "Modelling the risk of introduction and spread of non-indigenous species in the UK and Ireland" (Pearce *et al*. 2012) and "Review of invasion pathways and provisional pathway management plan for non-native ponto-caspian species of potential invasion risk to Great Britain" (Godard *et al*. 2012).

The campaign aimed at recreational users of water bodies, entitled "Check, Clean, Dry", to stop the spread of aquatic invasive non-native species, has continue to expand since its launch in March 2011.

Regulations

No new regulations were introduced in 2012.

Intentional introductions

Fish

Summaries of imports of salmonid eggs into the UK can be found in Finfish News for England and Wales (http://www.cefas.co.uk/publications/finfish-news.aspx) and Marine Scotland Science publications for Scotland (http://www.scotland.gov.uk/Topics/marine/science/Publications/publicationslatest/FishFarmProductionSurveys). UK export statistics are also presented in these publications.

Invertebrates

Deliberate releases of Pacific oysters for cultivation, mainly from UK hatcheries, continue at a similar level to that in previous years. Stock for on growing was imported from Guernsey (only). Movement restrictions to prevent the spread of a new and highly pathogenic strain of oyster herpes virus (OsHV-1 µvar) remain in place.

Imports of non-native species of live bivalve molluscs and crustaceans for human consumption continue. There were further reports of Canadian/American lobsters being captured in pots set in the wild.

A paper has been published providing information on reports of American lobsters in UK waters (Stebbing *et al*. 2012a).

Unintentional introductions

New sightings –

The predatory shrimp of Ponto-Caspian origin, *Dikerogammarus haemobaphes*, was first reported for the UK in September 2012, having been found in the River Severn and then later confirmed for several water bodies across England.

Previous sightings –

Invertebrates

A few new sightings of the predatory ("killer") shrimp *Dikerogammarus villosus* were reported in 2012. The locations suggest that the measures taken to impede the spread of the species have been largely successful but that human translocations of the species appear to account for the new locations. Further information on these measures is available at: https://secure.fera.defra.gov.uk/nonnativespecies/alerts/index.cfm?id=3

The Countryside Council for Wales has just completed their third winter of treatment of Holyhead Marina (4th year into the project) to eradicate the ascidian *Didemnum vexillum*. This wave of treatment began in the winter of 2011–2012 by re-treating all the floating pontoons and mooring chains in the marina in one go, and this time calcium hypochlorite was used in all treatments including in the chain wraps. Results were promising and during the summer of 2012 only a small handful of hand-sized *D. vex* colonies were located - having originally been found on ≈ 30–50% of all surfaces. These small outbreaks were treated in the autumn and during the 2012–2013 winter by deploying bags and wraps on colonised and adjacent structures and surveys post treatment have located no further outbreaks. The team also treated several vessels' hulls - the largest of which was a 150 tonne ex fishing boat. The plan is now to re-survey the marina in the late spring as the water temperature rises. A side project to develop a decontamination berth was also running while the eradication was in progress. Initial trails were encouraging, the principles involved in treating boats worked well, but a storm destroyed the in-water part of the equipment this winter. A small experiment to trial a self-cleaning rotating pontoon float was also completed. This seemed to work well but now requires development to scale up to a commercially viable size. Currently there are no new actions on *Didemnum* to report from Scotland.

Fish

No new species of non-native fish have been reported for either marine or inland waters during 2013.

Species not yet reported or observed

Pathogens –

Sightings/records

A fishery has been designated for Spring Viraemia of Carp virus. Operations were undertaken to remove the existing stock from the upper and lower lakes. Water was pumped from the lakes to an adjacent field that had been recently harvested and harrowed. The water soaked away quickly and the surrounding ditches showed no signs of seepage. Quicklime was applied to the drained lakes and the treated silt removed and spread on to agricultural land. The fishery is currently dry and will be left fallow until at least 2012.

Samples were taken from a foot spa experiencing significant losses in *Garra Rufa.* An uncharacterised herpes virus was detected by PCR closely related to goldfish herpesvirus (CyHV-2). Molecular genetic analysis also indicated the species was not *Garra rufa.* Further work will be conducted in order to identify the range of fish species imported into the UK as *Garra rufa*.

Following the identification of the exotic listed shellfish parasite *Bonamia exitiosa* in native oysters in the Fal estuary a surveillance programme covering all shellfish production areas where native oysters are cultivated commenced. The results of this programme of sampling will be available in the next quarterly report.

Edible mussels (*Mytilus edulis*) were obtained from the Torpoint/Cremyll Ferry area of the Tamar estuary. This followed publication of a report indicating that the parasite *Marteilia* sp. was present in the mussels. The mussels were wild stocks, which were naturally settled in the area. The mussels were difficult to find as the population in the area is low. There is no known commercial harvesting of mussels, nor any aquaculture in the estuary histological examination indicated that 2/150 of the mussels

appeared to be clearly infected with *Marteilia* sp., 3/150 showed indicative signs of early infection, and 2/150 were suspicious.

A sample of freshwater crayfish (*Procambarus clarkii*), seized from a shipment under the Prohibition of keeping of live fish (crayfish) order 1996 at Manchester BIP tested positive for whitespot syndrome virus (WSSV).

A study presenting information on the establishment of Gaffkaemia, a disease introduced with American lobsters, in UK waters has shown that the pathogen is found in three native lobster populations (Stebbing *et al*. 2012c).

General information

The "Check, Clean, Dry" campaign, launched in March 2011 to stop the spread of aquatic invasive non-native species, is continuing. The campaign aims to reduce the spread of non-native invasive species between waters via boats, equipment, clothing and footwear during angling and water sport activity. Hosted by the GB Non-native Species Secreatariat (GBNNSS) on behalf of UK Defra, the campaign has wide support, including water user groups and conservation organisations, with species to be watched for that include the invasive zebra (*Dreissena polymorpha*) and quagga (*D. rostriformis*) mussels. (https://secure.fera.defra.gov.uk/nonnativespecies/checkcleandry/index.cfm).

The GBNNSS is continuing to develop Invasive Species Action Plans (ISAPs), complemented by a species recording and database portal, a project search function, etc. Further information is available at: https://secure.fera.defra.gov.uk/nonnativespecies/home/index.cfm

Risk assessments are available on a range of species, including Japanese skeleton shrimp (*Caprella mutica*), Pacific oyster (*Crassostrea gigas*), slipper limpet (*Crepidula fornicata*), carpet sea-squirt (*Didemnum vexillum*), killer shrimp (*Dikerogammarus villosus*), zebra mussel (*Dreissena polymorpha*), Chinese mitten crab (*Eriocheir sinensis*), rapa whelk (*Rapana venosa*), Manilla clam (*Ruditapes philippinarum*)

The Environment Agency, UK (England & Wales) are considering authorising a localised fishery for the invasive Chinese mitten crab (*Eriochier sinensis*) in part of the River Thames estuary. Chinese mitten crab (CMC) are believed to have been present in England for many decades and there are now established populations in many rivers, most notably the Thames. CMC has been formally risk assessed under recognised, national non-native risk assessment procedures (the GB Non-native species risk assessment scheme) and has been classified as a high risk species. In view of this designation, concerns have been expressed about the merits of allowing any exploitation of the species; in particular, there are concerns that this might lead to efforts to maliciously transfer to the species to new areas (with the hope of establishing other fisheries in the future). There are also concerns that a CMC fishery might impact on other important species (e.g. by-catch of European eel). Arguments for permitting a small fishery include: exerting some downward pressure on the CMC population, an existing legal trade in the species (imports from other EU countries), that natural spread is the main route by which CMC have extended their range (not malicious transfer) and that a small, well-regulated legal fishery would be preferable to the existing illegal exploitation. Some recent work has been conducted to assess alternative capture techniques (with the aim of minimising eel by-catch) and it appears likely that a short-term, tightly-regulated fishery will now be allowed on a trial basis. A paper reviewing the issues surrounding the possible establishment of a CMC fishery was prepared for policy makers and to aid decisions; this report has subsequently been

used to inform on-going deliberations relating to the development of generic policy guidance on the exploitation of non-native species in general.

The Scottish Government funded project 'Assessing the risk of transporting non-native species to Scotland via biofouling on vessels' conducted by Marine Scotland Science has now been completed. A draft manuscript is currently being prepared and should be ready for submission for peer review shortly. During this project no new non-native species were detected.

The application for LIFE+ funding from the EU for this project was submitted last year but has not been successful. Since there was a vast amount of work put in to developing the partnership and putting the bid together there is hope that some of the work will still be carried out. The project steering group led by CCW will meet later this year to discuss what options are available for taking the work forward. The aims of the project currently remain the same - The main aim of this project is to protect marine biodiversity by managing the key pathways by which marine alien species are introduced and spread. It is a transnational project involving the UK and Ireland because of their shared marine pathways. The main pathways have been identified as recreational boating, aquaculture and fisheries, shipping and ship-recycling and off-shore energy. The project will last five years in order to have the positive, long-term impact required. Overall this project expects to raise the profile of marine alien species with key stakeholders significantly and so reduce the risk of introducing and spreading them. By demonstrating the use of an Early Warning System the project will enable a rapid response to new introduction and spread. If an invasive alien species (IAS) becomes established, a suite of cost-effective and sustainable approaches to control or potential eradication, will also be demonstrated, which could also be applied elsewhere in Europe.

A collaborative project between Cefas, Defra, Marine Scotland Science, Invasive Species Ireland and the Non-Native Species Secretariat has been put together to carry out work to identify the highest risk vectors/pathways for the introduction and subsequent spread of marine invasive species in GB and to recognise 'hot spot' areas or nodes that are at most risk of invasion. The study will also include a case study of the invasive tunicate *Didemnum vexillum* to validate the tool and to aid in the management of this species. The report from this collaborative project has been published (Pearce *et al*. 2012).

Marine Scotland Science is progressing with the genetic study of *Didemnum* populations in the UK. Samples have been collected from seven sites (Largs, Fairlie Pier, Hunterston, Darthaven, Gosport, Holyhead and Kent). DNA has been isolated and the PCR products obtained will be processed for molecular sequencing. Results should be available shortly. MSS contact – Lyndsay Brown Lyndsay.brown@scotland.gsi.gov.uk

A study on colonisation of offshore marine renewable energy structures is being undertaken at the Scottish Association for Marine Science (SAMS), in collaboration with the Northern Lighthouse Board. A network of 43 navigation buoys throughout Scotland was used to study epibenthic communities typical of artificial structures in tidal and wave exposed areas proposed for marine renewable energy generation. The presence and abundance of non-native species have been assessed to determine the importance of these off-shore artificial habitats for the maintenance of marine non-native populations. Many non-native species were identified in different geographical regions. Most notably large numbers of *Caprella mutica*, a non-native amphipod, were found on many navigation buoys. A PhD has started recently with joint super-

vision from SAMS and the Environmental Research Institute in Thurso (Northern Scotland), and working closely with Pelamis (a wave renewables company). Non-native and native species associated with the Pelamis structure and with vessels and service hubs associated with the offshore renewables industry will be studied. SAMS/SUPERGEN Ph.D. student Adrian Macleod has recently submitted his thesis and will shortly publish the findings of his work assessing the potential of offshore renewable energy devices in Scotland to act as refuges for non-native species.

The final report on the Scottish Aquaculture Research Forum (SARF) funded project that ran from Feb - July 2012, reviewing existing published guidance on the recognition and eradication of marine invasive and non-native species, has been prepared by the Scottish Association for Marine Science (SAMS) (Cook *et al*. 2012) and is now available. The report has provided recommendations for the production and dissemination of guidance material for the monitoring and eradication for invasive non-native species. It also noted that common eradication/control methods may not be easily transferable to the Scottish aquaculture industry so recommends that future work examines the practicalities and effectiveness of using existing measures (and other novel methods) at both fin- and shellfish sites to eradicate invasive non-native species.

http://www.sarf.org.uk/cms-assets/documents/91976-5284.sarf087.pdf

Report contact – Elizabeth Cook Elizabeth.Cook@sams.ac.uk

Other news from SAMS - In 2012, baseline data has been collected by SAMS/ ERI Thurso – UHI Ph.D. Student Chris Nall in the North of Scotland, including Orkney and Shetland. This data is currently being written up and will be published shortly. Review papers published in the last year include assessments of how the increase in artificial structures (Mineur *et al*. 2012) and on how aquaculture developments (Callaway *et al*. 2012) will impact on the spread of non-native species.

Scottish Natural Heritage (SNH) intends to bid for funds to conduct a survey of high risk locations of *Crassostrea gigas* in Scotland. They intend to cover locations in the Forth (east coast) and along the west coast. This follows recent records of *C. gigas* in Solway and the Berwickshire coast. MSS intend to liaise with SNH regarding this survey and discussions will be held soon.

Contact – David Donnan David.Donnan@snh.gov.uk

In 2012, Cefas published a literature review and risk assessment for Defra of non-native species invasion pathways with a view to the preparation of a 'Pathway Management Plan' (PMP) for organisms of Ponto-Caspian origin that pose a potential risk of invading Great Britain (Godard *et al*. 2012).

Cefas also published 2 reports reviewing methods of controlling invasive species of crayfish and *Dikerogammarus villosus* (Stebbing *et al*. 2012b; Stebbing *et al*. 2012d). Further work is continuing on developing methods of controlling invasive crayfish.

A new version of the Fish Invasiveness Scoring Kit (FISK) was published in 2012, following a complete revision of the questions to make v2 of this screening tool applicable to virtually all climatic zones (Lawson *et al*. 2012). The user interface was also revamped, and the new version has already been applied in Australia (Vilizzi & Copp 2012), with the output from applications in Iberia, Finland, Turkey and four Balkans countries due to appear in 2013.

Meetings

Past year (2012)

Canadian Conference for Fisheries Research (Moncton, Canada; 5–7 January 2012)

National Invasive Species Forum (Ottawa, Canada; 28 February – 1 March 2012)

6th Annual Invasive Species Ireland Forum (Glasnevin, Ireland; 3 May 2012)

6th World Fisheries Congress (Edinburgh, Scotland; 7–11 May 2012)

International Conference on Ecology & Conservation of Freshwater Fish (Vila Nova de Cerveira, Portugal; 28 May – 2 June 2012)

European Pond Conservation Network 5th Workshop (Luxembourg; 4–8 June 2012)

142nd Annual Meeting of the American Fisheries Society (St. Paul, Minnesota, USA; 19–23 August 2012)

International Symposium on Aquatic Plants - "Plants in hydrosystems: from functional ecology to weed research (Poznan, Poland; 27–31 August 2012)

1st International Conference on Integrative Sciences and Sustainable Development of Rivers (Lyon, France; 26–28 June 2012)

NEOBIOTA 2012 (Pontevedra, Spain; 12–14 September 2012)

Meetings in 2013

The following meetings are either focused on non-native species or will have non-native species sessions as part of their programme:

Canadian Conference for Fisheries Research (Windsor, Canada; 3–5 January 2013)(http://www.uwindsor.ca/glier/ccffr/)

International Conference on Aquatic Alien Species (Niagara Falls, Canada; 21–25 April 2013) (http://www.icais.org/)

British Ecological Society Symposium on Non-native Species Management (University of Worcester; 25 March 2013)

Freshwater Invasives – Networking for Strategy (Galway, Ireland; 8–11 April 2013) (www.finsconference.ie)

International Conference on Marine Bioinvasions (University of British Columbia, Canada; 20–22 August, 2013)

Invasion of alien species in Holarctic. Borok-4 (Borok, Russia; 22–28 September 2013)

References

Godard, M.J., Davison, P.I., Copp, G.H. & Stebbing, P. 2012. Review of invasion pathways and provisional pathway management plan for non-native Ponto-Caspian species of potential invasion risk to Great Britain. Research Report (Contract code C5524) to Defra, Protected Species and Non-native Species Policy Group, Bristol. 50 pp.

Callaway, R., Shinn, A.P., Bron, J.E., Burnell, G., Cook, E.J., Cumlish, M., Culloty, S., Davidson, K., Ellis, R.P., Flynn, K.J., Fox, C., Green, D.M., Grenfell, S.E., Hayes, G., Hughes, A., Johnston, E., Lupatsch, I., Malham, S., Mendzil, A.F., Nickell, T., Pickerel, T., Rowley, A.F., Stanley, M., Tocher, D.R., Turnbull, J.F., Webb, G., Wooton, E. & Sheilds, R. 2012. Review of climate change impacts on marine aquaculture in the UK and Ireland. *Aquatic Conservation: Marine and Freshwater Ecosystems* **22**, 389–421.

Cook, E.J., Davidson, K., Fox, C. & Black, K. 2012. Monitoring and eradication of invasive and non-native species in aquaculture units. Report by Scottish Association for Marine Science to the Scottish Aquaculture Research Forum. Tender Ref: SARF087. 39pp. (ISBN: 978-1-907266-52-2)

Lawson, L.L., Vilizzi, L., Hill, J.E., Hardin, S. & Copp, G.H. 2012. Revisions of the Fish Invasiveness Scoring Kit (FISK) for its application in warmer climatic zones, with particular reference to peninsular Florida. *Risk Analysis* (doi: 10.1111/j.1539-6924.2012.01896.x)

Mineur, F, Cook, E.J., Minchin, D., Bohn, K., MacLeod, A. & Maggs, C.A. 2012. Changing coasts: marine aliens and artificial structures. *Oceanography and Marine Biology: An Annual Review* **50**, 187–232.

Pearce, F., Peeler, E. & Stebbing. 2012. Modelling the risk of the introduction and spread of non-indigenous species in the UK and Ireland. Cefas project code E5405W.

Stebbing, P., Johnson, P., Delahunty, A., Clark, P., McCollin, T., Hale C. & Clark, S. 2012a. Reports of American lobsters, *Homarus americanus* (H. Milne Edwards, 1837), in British waters. *BioInvasions Records* **1**, 17–23.

Stebbing, P.D., Longshaw, M., Taylor, N., Norman, R., Lintott, R., Pearce, F. & Scott, A. 2012b. Review of methods for the control of invasive crayfish in Great Britain. Cefas Contract - Final Report C5471.

Stebbing, P.D., Pond, M.J., Peeler, E., Small, H.J., Greenwood, S.J. & Verner-Jeffreys, D. 2012c. Limited prevalance of gaffkaemia *(Aerococcus viridans* var. *homari)* isolated from wild-caught European lobsters *Homarus gammarus* in England and Wales. *Diseases of Aquatic Organisms* **100**, 159–167.

Stebbing, P., Irving, S., Stentiford G. & Mitchard N. 2012d. A review of potential methods to control and eradicate the invasive gammarid, *Dikerogammarus villosus* from UK waters. Cefas contract report C5525.

Vilizzi, L. & Copp, G.H. 2012. Application of FISK, an invasive-ness screening tool for non-native freshwater fishes, in the Murray-Darling Basin (south-eastern Australia). *Risk Analysis* (10.1111/j.1539-6924.2012.01860.x)

3.18 United States

Prepared by Paul Fofonoff and Judith Pederson with contribution from James Carlton.

Overview:

The important news for the Northwest Atlantic was that no new invasions of non-native species were reported in 2012. Several species identified in previous reports are showing major range expansions, including the alga *Heterosiphonia japonica,* the bryozoan *Tricellaria inopinata,* and the shrimps *Palaemon elegans and Palaemon macrodactylus*. Some of these species may have been present earlier than first reported given their abundance based on the recent sightings, but more studies need to be done to confirm this and/or that multiple introductions occurred. The alga *Gracilaria vermiculophylla* has been reported as present in multiple locations based on preserved specimens. One warm water species, the tubeworm *Hydroides elegans* has persisted for a second year in a lagoon (Eel Pond) on Cape Cod (Woods Hole), Massachusetts. Summer 2013 field work is planned to determine if this southern serpulid has survived for a third year in New England. Finally, the European sea anemone *Sagartia elegans* may have disappeared from the only location where it was found in a marina in Salem, Massachusetts.

Content:

Regulations: An update on new regulations and policies (including, aquaculture and vector management)

US Coast Guard release (http://www.uscg.mil/hq/cg5/cg522/cg5224/antifoul.asp)

On August 21, 2012, the United States ratified the International Convention on the Control of Harmful Anti-Fouling Systems on Ships, 2001 (Anti-Fouling Convention). The instrument of ratification was deposited with the International Maritime Organization, and the Anti-Fouling Convention entered into force for the United States on November 21, 2012.

Coast Guard News Release

U.S. Coast Guard issues standard for living organisms in ships' discharged ballast water

The U.S. Coast Guard announced [that] the final rule for standards for living organisms in ships' ballast water discharged into waters of the United States is scheduled for publication March 23 [2012] in the Federal Register. A public inspection copy of the final rule is available online (http://www.archives.gov/federal-register/public-inspection) and select the option "View the Special Filing Document List."

The Coast Guard is amending its regulations on ballast water management by establishing a standard for the allowable concentration of living organisms in ballast water discharged from ships in waters of the United States. The Coast Guard is also amending its regulations for engineering equipment by establishing an approval process for ballast water management systems.

"These new regulations will aid in controlling the introduction and spread of nonindigenous species from ships' ballast water," said Jeffrey Lantz, director of the Coast Guard's Office of Commercial Regulations and Standards. "This final rule establishes a ballast water discharge standard that is protective of the marine environment and is also consistent with the discharge standard adopted by the International Maritime Organization in 2004."

The numerical limits set by the discharge standard in this final rule are supported by reports from the National Academy of Sciences and the U.S. Environmental Protection Agency Science Advisory Board in 2011 as the most stringent that vessels can practicably implement and that the Coast Guard can enforce at this time.

The final rule is effective 90 days after publication in the Federal Register, which is available through the new Federal Digital System at http://www.gpo.gov/fdsys/.

US Environmental Protection Agency

The U.S. Environmental Protection Agency's Vessel General Permit, which will also regulate ballast water in the U.S., is likely to be issued soon. It was originally scheduled to be finalized in mid-March and be effective in late December 2013.

2. Intentional:

No intentional introductions have been reported.

3. Unintentional:

New Sightings
There were no new sightings reported for 2012.

Previous Sightings

Range expansions

Algae

Two red seaweeds, native to the Northwest Pacific, have shown significant range expansions in US Atlantic waters in recent years. *Gracilaria vermiculophylla* was first identified in the northwest Atlantic in 2000 in North Carolina, but it may have been long overlooked due to its similarity to native species. It has been collected from Rhode Island (Saunders 2009) to Georgia (Byers *et al* (2012). In South Carolina and Georgia it is abundant on mudflats which formerly had little seaweed biomass (Byers *et al*., 2012).

A recent paper (Nettleton *et al*. 2013) identified the presence of *G. vermiculophylla* at 24 sites in New England (Long Island Sound to the Canadian border). It has been found from Stamford, Connecticut to Greenland, New Hampshire but was not detected at any sites in Maine. Using molecular screening techniques to test historical samples from Massachusetts indicated five sites with *G. vermiculophylla*.

Two scientists (C Yarish, University of Connecticut and S. Lindell, Marine Biological Laboratory) have initiated an aquaculture project in Waquoit Bay, Massachusetts as part of an effort to reduce nitrogen with native seaweeds and oysters (http://www.mbl.edu/blog/oysters-and-seaweed-better-together-3/). Molecular testing confirmed that *G. vermiculophylla* was not present in Waquoit Bay. Using cultivars from the native *Gracilaria tikvahiae* growing in Waquoit Bay was an extra measure of safety that the researchers employed to eliminate accidental introduction from outside the area. The algae have many uses as food, fertilizer, fuel, and a source of agar potentially making it an economically viable option for reducing nutrients in coastal ponds.

In the Northwest Atlantic, *Heterosiphonia japonica* was first discovered off Rhode Island in 2008, and has extended its range into the Gulf of Maine. Specimens were collected in Massachusetts (Sandwich, 2010,; Plymouth, 2011; Gloucester, 2012,) (Savoie and Saunders 2013) and Appledore Island (Maine) in 2012 (Science Daily, 2012).

Heterosiphonia japonica has been identified as a nuisance algal to beach goers during the summer months. *Heterosiphonia* is one of a number of seaweeds (including the also non-native *Neosiphonia harveyi*) that grow prolifically and are washed ashore by storms and surf. Communities have rallied to seek solutions, but are unlikely to address the proximal cause, namely excessive nutrients from coastal development that often promotes excessive algal growth in nearshore waters.

A Northwest Pacific brown alga, *Colpemenia peregrina* was first identified in Nova Scotia Canada; its type location is Brittany, France. This alga, referred to as the oyster thief effects shellfish culture, although no impacts to aquaculture are reported in the Northwest Atlantic.

Colpemenia peregrina was misidentified throughout the range because it is very similar to the native *Leathesia marina* (=*difformis*), which is found from North Carolina to

Newfoundland. Molecular sequencing was used to identify collected and archived specimens from Newfoundland to Delaware confirming it was not present in most locations prior to 2005 but was present at sites in Nova Scotia in 1960, 1970s, andearly 1980s. Its current range is from Nova Scotia to Massachusetts and appears to be spreading rapidly.

Invertebrates

The Indo-Pacific serpulid polychaete *Hydroides elegans* was discovered in Eel Pond, Woods Hole, Massachusetts in 2011. They were expected to die out during the winter of 2011-2012, but the colony-forming tubeworms survived for a second summer. Whether they remain present, for a third year, after a cold winter of 12-13 will be determined by summer 2013 field work (James T. Carlton, personal communication 2013).

Penaeus monodon (Tiger Shrimp), a large Indo-Pacific shrimp, once widely reared in aquaculture, continues to appear in shrimp catches from North Carolina to Texas, possibly straying from abandoned shrimp farms in the Caribbean (Pam Fuller, personal communication). More than 20 specimens have been reported in 2012, mostly as single specimens (USGS Nonindigenous Aquatic Species Program 2011). Officials in Louisiana have stopped counting reports of the shrimps, because of the frequency of records, and the lack of personnel to process the data. There is no evidence of reproduction or overwinter survival. However, the continued occurrence of these shrimps raises the possibility of eventual establishment, competition with native commercial shrimps, or transmission of parasites and diseases (Alexander-Bloch 2012).

The prawn (shrimp) *Palaemon elegans* is native to Europe but has been recently spreading into new regions. The first report of the species' expansion in Europe occurred in the Vistula River delta in Poland. It has subsequently been reported in the Baltic Sea in many locations, replacing native shrimp. Efficient reproductive strategies, high tolerance to wide ranges in salinity and temperature and opportunistic feeding behavior may all contribute to *P. elegans* out-competing native species.

The first discovery of *P. elegans* in the western Atlantic was in Salem, Massachusetts on July 30, 2010 at Hawthorne Cove Marina. The discovery occurred during a rapid assessment survey of New England marinas and cobble shores. Since the initial discovery the species has maintained a viable population in Salem Sound and has been found further north in salt marshes and near docks in Gloucester, MA and as far north as Kennebunk, Maine. In August, 2012, high school interns working with MIT Sea Grant found the shrimp, including many egg-bearing females in shallow intertidal pools on Lovells Island in Boston Harbor. It has since been reported in other locations along the Massachusetts south shore including Scituate, Marshfield and Barnstable, at Sandwich at the eastern end of the Cape Cod Canal in Massachusetts, and most recently at Bourne at the western end of the Canal, at the head of Buzzards Bay, in southern New England.

The Asian Shrimp *Palaemon macrodactylus* is native to the water of Japan, Korea, and north China. Populations introduced by ballast water occur on the Pacific coast of North America (since the 1950s), in Europe (since the 1990s) and Australia and Argentina (both in the 2000s). The first populations in the northeast US were recorded in New York in 2001. It now occurs from the Gulf of Maine to Chesapeake Bay. The first report of this species in New England was made in 2010 when it was discovered in the Mystic River Estuary in Mystic CT; retrospective studies revealed it had been present there since 2003. It now occurs in estuaries throughout southern New Eng-

land, such as Narragansett Bay and the Niantic River (J. Carlton, pers. comm.). It was also found in Boston Harbor in 2012 (C. McIntyre, identified by J. Carlton).

Competition with the native shrimps (*Palaemonetes pugio, P.vulgaris, P. intermedius*) is possible, but is not yet documented (Warkentine and Rachlin 2012). In 2010, re-sampling of the area in which it was first collected in 2001, in the East River, New York, indicates that the relative abundance of this shrimp has increased, from 4 to 15 % of the palaemonid shrimp population.

One small (29 mm), clawless specimen of the Chinese mitten crab *Eriocheir sinensis* was found in June, 2012, in a fishway on the Mianus River, in westernmost Connecticut not far from the Hudson River (Darrick Sparks, personal communication, USGS Nonindigenous Aquatic Species Program 2012). This crab could have been accidentally transported from the Hudson River, where there is an established population (Schmidt *et al*. 2009). We know of no further reports of Chinese mitten crabs.

Dreissena polymorpha (zebra mussel) was first reported in waters adjacent to Chesapeake Bay in 2008, as a single specimen in a powerplant intake at Conowingo Dam, on the Susquehanna River. In December 2012, about 20 mussels were found attached to concrete blocks anchoring buoys off Havre de Grace, Maryland at the mouth of the Susquehanna, and the head of Chesapeake Bay (King 2012). Zebra mussels appear to be established in tidal waters in the uppermost reaches of Chesapeake Bay, though at very low density.

The bryozoan *Tricellaria inopinata* has a disjointed global distribution, and has been reported in Japan (where it may be native), New Zealand, Australia, and the Pacific Coast of North America, as well as the Mediterranean and several locations in Europe. In September 2010 *T. inopinata* was discovered in the western Atlantic Ocean on floating docks in Eel Pond, Woods Hole, Massachusetts. It was abundant throughout the pond and has since been established and surviving in Eel Pond; its biology is described by Johnson *et al*. (2012). It has also been observed in Gloucester and Boston Harbor, Massachusetts.

Fishes

Lionfishes (*Pterois* sp., predominantly *P. volitans*) have colonized the whole Caribbean, and the Atlantic Coast of the US from North Carolina to the tip of Florida, with some occurrences in the Gulf of Mexico, west to Texas, and Veracruz, Mexico (Santander-Monsalvo 2012). No major range expansions have been reported in US waters in 2012 (USGS Nonindigenous Aquatic Species Program 2013), but populations, predatory impacts, and the variety of habitats colonized, all appear to be increasing. In the Florida Keys, where lionfish were first seen in 2009, abundance and biomass increased sixfold from 2010 to 2011, on natural and artificial reef habitats (Ruttenberg *et al*. 2012). In the Loxahatchee River estuary, on the Atlantic coast of Florida, where habitat included docks, artificial reefs, seagrasses, mangroves and sand, tagged lionfish showed strong site fidelity, rarely moving more than 20 m between captures (Jud and Layman 2012).

Observations in the Turks and Caicos Islands suggest that young lionfish are more likely to utilize shallow-water habitats, such as seagrass beds and mangroves, and move to deep reef habitats as they age (Claydon *et al*. 2012). Côté and Green *et al*. (2012) modeled the effect of climate change on lionfish populations and distribution. They predict that ocean warming may slow the rate of dispersal of lionfish, by decreasing the time spent in the plankton, but may increase local impacts, with more retention of young fish, and increased prey consumption. However, they consider

climate change impacts to be small, relative to the present rapid population increases. A handbook on lionfish management has been published, which summarizes *Pterois* sp. biology, and discusses monitoring, removal efforts, encouragement of fisheries, and public education (Morris *et al*. 2012),

Species Not Seen Yet and or No Longer Observed

Although the Chinese mitten crab, *Eriocheir sinensis* has been reported in the Chesapeake and Delaware Bay and Hudson River, it has not been reported in any of the New England states (Maine to Connecticut) except for a clawless juvenile crab in the Mianus River in Connecticut, near the Hudson.

Sagartia elegans, an anemone from the U.K. was reported in Hawthorne Cover, Salem, Massachusetts in 2000 and continued to be observed during intensive searches during surveys in 2003, 2007 and 2010 and years in between by (L. Harris and B. Warren, pers. comm.). However, it was not reported anywhere else except at this one location. In 2011 and 2012, a graduate student who conducted several dive surveys could not find it anywhere in the vicinity, including surrounding areas. Observations over the next few years will be required to determine if it has become extinct in North America.

4. Pathogens

No new pathogens have been reported.

5. Meetings

The next International Conference on Marine Bioinvasions will be held 20-22 August 2013 (Tuesday-Thursday) at The Biodiversity Research Centre at the University of British Columbia (UBC) in Vancouver, Canada. Sponsors include UBC, NOAA, CAISN, and PICES.

The conference title is:

Biological Invasions in Changing Waters: Envelopes, Estuaries, and Evolution

Meeting themes are:

*Defining the environmental niche space of invaders using empirical and theoretical tools

*Evaluating the success of invaders in transitionary waters such as estuaries and waters that are changing as a result of anthropogenic activities

*Determining invaders' responses to changing waters during transport

*Evaluating vectors for invaders and modes of transport

*Examining management, rapid response, the eradication of invaders and efforts to restore ecosystems

6. References and bibliography

Alexander-Bloch, B. 3/27/2012. Menacing tiger shrimp are prowling the waters of the Gulf. Times-Picayune, New Orleans LA (online).http://www.nola.com/environment/index.ssf/2012/05/menacing_tiger_shrimp_are_prow.html

Byers, J. E., P. E. Gribben, C. Yeager, and E. E. Sotka. 2012. Impacts of an abundant introduced ecosystem engineer within mudflats of the southeastern US coast. Biological Invasions 14 (4): 2587-2600

Grammer, G. L., W. T. Slack, M. S. Peterson, and M. A. Dugo. 2012. Nile tilapia *Oreochromis niloticus* (Linnaeus, 1758) establishment in temperate Mississippi, USA: multi-year survival confirmed by otolith ages. Aquatic Invasions **7** (3): 367–376

Green, C. C., W. E. Kelso, M. D. Kaller, K. M. Gautreaux, and D. G. Kelly. 2012. Potential for naturalization of nonindigenous tilapia *Oreochromis* sp. in coastal Louisiana marshes based on integrating thermal tolerance and field data. Wetlands **32**:717-723.

Johnson, C. H., J. E. Winston, and R. M. Woollacott. 2012. Western Atlantic introduction and persistence of the marine bryozoan *Tricellaria inopinata*. Aquatic Invasions **7**(3): 295–303

Jud, Z. R. and C. A. Layman. 2012. Site fidelity and movement patterns of invasive lionfish, *Pterois* spp., in a Florida estuary. Journal of Experimental Marine Biology and Ecology **414-415**:69-74.

King, K. 12/17/2012. More Zebra Mussels found in Upper Chesapeake Bay. Maryland Department of Natural Resources. http://news.maryland.gov/dnr/2012/12/17/more-zebra-mussels-found-in-upper-chesapeake-bay/

Lowe, M. R., W. Wu, M. S. Peterson, N. J. Brown-Peterson, W. T. Slack, and P. J. Schofield. 2012. Survival, growth and reproduction of non-native Nile Tilapia II: Fundamental niche projections and invasion potential in the northern Gulf of Mexico. PLOS One **7**: e41580.

Marshall, B. 5/6/2009. Section of Plaquemines waterways to be poisoned to kill foreign fish. Times-Picayune, New Orleans LA. http://www.nola.com/news/index.ssf/2009/05/section_of_plaquemines_waterwa.html

Morris, J. A., Jr. (Ed.). 2012. Invasive lionfish: a guide to control and management. Gulf and Caribbean Fisheries Institute, Marathon, Florida.

Nettleton, J. C., A. C Mathieson, C.Thornber, C. D. Neefus and C. Yarish 2013. Introduction of *Gracilaria vermiculophylla* (Rhodophyta, Gracilariales) to New England: Estimated arrival times and current distribution. Rhodora. Published online.

http://rhodorajournal.org/doi/abs/10.3119/12-07

Ruttenberg, B. I., P. J. Schofield, A. Acosta, M. W. Feeley, J. Blondeau, S. G. Smith, and J. S. Ault. 2012. Rapid invasion of Indo-Pacific lionfishes (*Pterois volitans* and *Pterois miles*) in the Florida \Keys, USA: Evidence from multiple pre- and post-invasion data sets. Bulletin of Marine Science **88**:1051-1059. http://lionfish.gcfi.org/manual/

Savoie, A. M. and G. W. Saunders. 2013. First record of the invasive red alga *Heterosiphonia japonica* (Ceramiales, Rhodophyta) in Canada. BioInvasions Records **2**:27-32.

Science Daily. 9/13/2012. Devastating red alga discovered creeping north to Maine. Science Daily. http://www.sciencedaily.com/releases/2012/09/120913122842.htm

Warkentine, B. E. and J. W. Rachlin. 2012. *Palaemon macrodactylus* Rathbun 1902 (Oriental Shrimp) in New York: status revisited. Northeastern Naturalist **19**:173-180.

Annex 4. List of new species and range expansions of alien species as reported in National Reports

Country	Date	Genus	Species	Namer and date	Taxon	Location name	Lat	Lon	Population status	Region of 1st record	Date of 1st record	Likely vector	likely impacts	References
Croatia	2011	*Akashiwo*	*sanguinea*	(K. Hirasaka) G.Hansen & Ø.Moestrup, 2000	Algae (Dinophyta)	Middle and Southern Adriatic	43°42′N	15°52′E	Spreading	Middle Adriatic	2000	unknown		Carić *et al*. 2011
Croatia	2011	*Phalacrophorus*	*pictus*	Greef, 1879	Annelida (Polychaeta)	Southern Adriatic	42°27′N	17°53′E	First record	Southern Adriatic	2011	unknown (climate change)		Batistić & Garić, 2012
Croatia	2011	*Pontodora*	*pelagica*	Greef, 1879	Annelida (Polychaeta)	Southern Adriatic	42°27′N	17°53′E	First record	Southern Adriatic	2011	unknown (climate change)		Batistić & Garić, 2012
Croatia	2011	*Sagitta*	*galerita*	Dallot, 1971	Chaetognatha	Southern Adriatic	42°27′N	17°53′E	First record	Southern Adriatic	2011	unknown (climate change)		Batistić & Garić, 2012
Croatia	2011	*Caranx*	*rhonchus*	Geoffroy Saint-Hilaire, 1817	Pisces	Southern Adriatic	42°52′N	17°41′E	First record	Southern Adriatic	2011	unknown		Kožul & Antolović, 2013
Croatia	2011	*Holacanthus*	*ciliaris*	(Linnaeus, 1758)	Pisces	Middle Adriatic	43°31′N	16°15′E	First record	Middle Adriatic	2011	shipping		Dulčić (unpublished data)
Denmark	2008-2010	*Marenzelleria*	*viridis*	(Verrill, 1873)	Annelida, Polychaeta	Odense Fjord, Inner Fjord	55º 28'N	10º 29'E	100-200 ind. m^{-2}; max. 1200 ind. m^{-2}	Ringkøbing Fjord (North Sea coast)	1990	Ballast water/ secondary dispersal	competition; modification of biogeochemical processes in sediment	Delefosse *et al*., 2012
Denmark	March 2008	*Marenzelleria*	*viridis*	(Verrill, 1873)	Annelida, Polychaeta	Bregnør Bay, Odense Fjord	55.48118ºN	10.61002ºE		Ringkøbing Fjord (North Sea coast)	1990	Ballast water/ secondary dispersal	competition; modification of biogeochemical processes in sediment	Kristensen *et al*., 2011
Denmark	2008-2010	*Diadumene*	*lineata*	(Verrill, 1869)	Cnidaria, Anthozoa	Bovet Bugt, Læsø	57º 18'6.12''N	11º 10'22.48''E	local	Bovet Bugt, Læsø	2008	unknown; possibly fouling	no serious impacts	Olsen & Tendal, 2012
Estonia	July 2012	*Rhithropanopeus*	*harrisii*	Gould, 1841	crab	Gulf of Riga, Baltic Sea	57,545	24,32333	established	Estonia: Pärnu Bay	Baltic Sea: 1936	unknown	competition, food-prey, predation	Kotta and Ojaveer 2012

Country	Date	Genus	Species	Namer and date	Taxon	Location name	Lat	Lon	Population status	Region of 1st record	Date of 1st record	Likely vector	likely impacts	References
Estonia	2012	*Rhithropanopeus*	*harrisii*	Gould, 1841	crab	Pärnu Bay (Gulf of Riga, Baltic Sea)			established	Estonia: Pärnu Bay	Baltic Sea: 1936	unknown	competition, food-prey, predation	Kotta and Ojaveer 2012; Jonne Kotta, unpubl.
Estonia	July 2001	*Evadne*	*anonyx*	Sars 1897	cladoceran	Gulf of Riga, Baltic Sea	57°09,6'	23°39,2'	established	Baltic Sea: Gulf of Riga	Baltic Sea: 1999	ballast water		Marilyn Kalaus, unpubl.
Estonia	July 2001	*Evadne*	*anonyx*	Sars 1897	cladoceran	Gulf of Riga, Baltic Sea	57°47,9'	22°17,8'	established	Baltic Sea: Gulf of Riga	Baltic Sea: 2000	ballast water		Marilyn Kalaus, unpubl.
Estonia	July 2001	*Evadne*	*anonyx*	Sars 1897	cladoceran	Gulf of Riga, Baltic Sea	57°57'	22°52,7'	established	Baltic Sea: Gulf of Riga	Baltic Sea: 2001	ballast water		Marilyn Kalaus, unpubl.
Estonia	July 2001	*Evadne*	*anonyx*	Sars 1897	cladoceran	Gulf of Riga, Baltic Sea	57°37,2'	23°19,2'	established	Baltic Sea: Gulf of Riga	Baltic Sea: 2002	ballast water		Marilyn Kalaus, unpubl.
Estonia	July 2001	*Evadne*	*anonyx*	Sars 1897	cladoceran	Gulf of Riga, Baltic Sea	58°14,7'	23°30,4'	established	Baltic Sea: Gulf of Riga	Baltic Sea: 2003	ballast water		Marilyn Kalaus, unpubl.
Estonia	July 2001	*Evadne*	*anonyx*	Sars 1897	cladoceran	Gulf of Riga, Baltic Sea	58°01,4'	23°28'	established	Baltic Sea: Gulf of Riga	Baltic Sea: 2004	ballast water		Marilyn Kalaus, unpubl.
Estonia	July 2001	*Evadne*	*anonyx*	Sars 1897	cladoceran	Gulf of Riga, Baltic Sea	57°45,8'	24°05,9'	established	Baltic Sea: Gulf of Riga	Baltic Sea: 2005	ballast water		Marilyn Kalaus, unpubl.
Estonia	July 2001	*Evadne*	*anonyx*	Sars 1897	cladoceran	Gulf of Riga, Baltic Sea	57°35'	23°36,8'	established	Baltic Sea: Gulf of Riga	Baltic Sea: 2006	ballast water		Marilyn Kalaus, unpubl.
Estonia	July 2001	*Evadne*	*anonyx*	Sars 1897	cladoceran	Gulf of Riga, Baltic Sea	57°36,5'	24°11,9'	established	Baltic Sea: Gulf of Riga	Baltic Sea: 2007	ballast water		Marilyn Kalaus, unpubl.
Estonia	July 2001	*Evadne*	*anonyx*	Sars 1897	cladoceran	Gulf of Riga, Baltic Sea	57°15,9'	24°12,3'	established	Baltic Sea: Gulf of Riga	Baltic Sea: 2008	ballast water		Marilyn Kalaus, unpubl.
France	06.06.11	*Rapana*	*venosa*	Valenciennes, 1846	Gastropoda	Anse de la Malconche	46,0094	-1,2647	one specimen	Bay of Quiberon	1997	oyster batches		n/a
France	04.06.12	*Rapana*	*venosa*	Valenciennes, 1846	Gastropoda	Rivière de Saint-Philibert	47,5746	-2,9990	one specimen	Bay of Quiberon	1997	oyster batches		n/a
France	12.08.12	*Grandidierella*	*japonica*	Stephensen, 1938	Amphipoda	Bellevue	45,9390	-1,2180	70 specimens	Eastern coast of Oléron island	08.11.10	oyster batches		Jourde *et al*. 2012.

Country	Date	Genus	Species	Namer and date	Taxon	Location name	Lat	Lon	Population status	Region of 1st record	Date of 1st record	Likely vector	likely impacts	References
France	07.09.11	*Asterocarpa*	*humilis*	Heller, 1878	Ascidia	Bas Sablons marina, Saint Malo	48,6392	2,0269	15	Camaret-sur-mer marina	2005			Bishop *et al.*, 2012
France	18.08.10	*Asterocarpa*	*humilis*	Heller, 1878	Ascidia	Perros Guirrec marina	48,8047	3,4417		Camaret-sur-mer marina	2005			Bishop *et al.*, 2012
France	18.08.10	*Asterocarpa*	*humilis*	Heller, 1878	Ascidia	Trébeurden marina	48,7697	3,5864	7	Camaret-sur-mer marina	2005			Bishop *et al.*, 2012
France	15.09.11	*Asterocarpa*	*humilis*	Heller, 1878	Ascidia	Astan, Morlaix area, CTD profiler offshore	48,7486	3,9611	3	Camaret-sur-mer marina	2005			Bishop *et al.*, 2012
France	02.03.10	*Asterocarpa*	*humilis*	Heller, 1878	Ascidia	Roscoff Harbour	48,7486	3,9611	1	Camaret-sur-mer marina	2005			Bishop *et al.*, 2012
France	29.04.11	*Asterocarpa*	*humilis*	Heller, 1878	Ascidia	Penzé estuary, natural habitat	48,6744	3,9358		Camaret-sur-mer marina	2005			Bishop *et al.*, 2012
France	12.08.10	*Asterocarpa*	*humilis*	Heller, 1878	Ascidia	Penzé estuary, oyster farm	48,6666	3,9411	2	Camaret-sur-mer marina	2005			Bishop *et al.*, 2012
France	08.02.10	*Asterocarpa*	*humilis*	Heller, 1878	Ascidia	Aber Wrac'h marina	48,5968	4,5608	13	Camaret-sur-mer marina	2005			Bishop *et al.*, 2012
France	17.08.10	*Asterocarpa*	*humilis*	Heller, 1878	Ascidia	Château marina, Brest	48,3792	4,4900		Camaret-sur-mer marina	2005			Bishop *et al.*, 2012
France	07.12.09	*Asterocarpa*	*humilis*	Heller, 1878	Ascidia	Moulin blanc marina, Brest	48,3928	4,4308		Camaret-sur-mer marina	2005			Bishop *et al.*, 2012
France	01.09.05	*Asterocarpa*	*humilis*	Heller, 1878	Ascidia	Camaret-sur-mer marina	48,2800	4,5956	10	Camaret-sur-mer marina	2005			Bishop *et al.*, 2012
France	19.08.10	*Asterocarpa*	*humilis*	Heller, 1878	Ascidia	Crozon Morgat marina	48,2239	4,4950		Camaret-sur-mer marina	2005			Bishop *et al.*, 2012

Country	Date	Genus	Species	Namer and date	Taxon	Location name	Lat	Lon	Population status	Region of 1st record	Date of 1st record	Likely vector	likely impacts	References
France	01.03.11	*Asterocarpa*	*humilis*	Heller, 1878	Ascidia	Quiberon marina	47,4883	3,1022		Camaret-sur-mer marina	2005			Bishop *et al*., 2012
France	21.01.10	*Pseudodiaptomus*	*marinus*	Sato, 1913	Copepoda	Calais	50,9692	1,8533	six specimens	southern Bight of the North Sea	21.01.10	ballast water discharge		Brylinski *et al*. 2012.
France	16.01.11	*Pseudodiaptomus*	*marinus*	Sato, 1913	Copepoda	Gravelines	50,0208	2,1519	twelve specimens	southern Bight of the North Sea	21.01.10	ballast water discharge		Brylinski *et al*. 2012.
France	18.06.96	*Celtodoryx*	*ciocalyptoides*	Perez, 2006	Porifera	Ria of Etel	47,6856	3,2191				oyster batches		Henkel & Janussen., 2011.
France	20.06.10	*Gracilaria*	*chorda*	Ohmi, 1958	Rhodophyta	Bailleron island, gulf of Morbihan	47,5777	2,7487		Bailleron island, gulf of Morbihan	20.06.10	oyster batches		Mineur *et al*. 2012
France	25.05.09	*Chondracanthus*	*sp.*	Delaroche, 1811	Rhodophyta	Toulindac, gulf of Morbihan	47,5980	2,8697		Toulindac, gulf of Morbihan	25.05.09	oyster batches		Mineur *et al*. 2012
France	18.07.05	*Solieria*	*sp.*	J. Agardh, 1842	Rhodophyta	Péchit, gulf of Morbihan	47,5958	2,7293		Péchit, gulf of Morbihan	18.07.05	oyster batches		Mineur *et al*. 2012
France	27.08.05	*Solieria*	*sp.*	J. Agardh, 1842	Rhodophyta	Passage Berder, gulf of Morbihan	47,5824	2,8902		Péchit, gulf of Morbihan	18.07.05	oyster batches		Mineur *et al*. 2012
France	31.08.08	*Solieria*	*sp.*	J. Agardh, 1842	Rhodophyta	Toulindac, gulf of Morbihan	47,5980	2,8697		Péchit, gulf of Morbihan	18.07.05	oyster batches		Mineur *et al*. 2012
France	13.08.10	*Solieria*	*sp.*	J. Agardh, 1842	Rhodophyta	Port Jakez, Gulf of Morbihan	47,5990	2,8617		Péchit, gulf of Morbihan	18.07.05	oyster batches		Mineur *et al*. 2012
France	17.05.11	*Solieria*	*sp.*	J. Agardh, 1842	Rhodophyta	Mèze/bouzigues, Thau lagoon	43,4416	3,6343		Péchit, gulf of Morbihan	18.07.05	oyster batches		Mineur *et al*. 2012
France	25.06.03	*Haminoea*	*japonica*	Pilsbry, 1895	Opistobranchia	Pléneuf-Val-André	48,5666	2,5666	two specimens	Pléneuf-Val-André	25.06.03	oyster batches		Hanson, Hirano and Valdès., 2013
France	02.06.80	*Pisodonophis*	*semicintus*	Richardson, 1848	Actinopterygii	Cassis	43,2151	5,5371		Cassis	02.06.80			Bodilis *et al*., 2012

Country	Date	Genus	Species	Namer and date	Taxon	Location name	Lat	Lon	Population status	Region of 1st record	Date of 1st record	Likely vector	likely impacts	References
Greece	12.05.2012	*Champsodon*	*nudivittis*	(Ogilby, 1895)	osteichthyes	Kamiros area , Rhodes isl		36°23'50,35 "N	27°52'35,86"E	Aegean Sea		Suez/spreading		Kalogirou & Corsini-Foka, 2012
Greece	10.09.2008	*Terapon*	*theraps*	Cuvier, 1829	osteichthyes	Thermaikos Gulf, Northern Aegean Sea				Aegean Sea		shipping?		Minos *et al*., 2012
Greece	not specified	*Murchisonella*	*columna*	(Hedley, 1907)	mollusca	Cape Epanomi, Thermaikos				Aegean Sea		shipping?		Manousis *et al*., 2012
Greece	1.09.2010	*Caulerpa*	taxifolia var. distichophylla	(Sonder) Verlaque, Huisman & Procaccini	algae	Ladiko Bay, Rhodos		36°19'25,98 "N	28°12'49,28"E	Aegean Sea	September 2010			Tsiamis & Louizidou, in preparation
Greece	1.08.2010	*Aplysia*	*dactylomela*	Rang, 1828	mollusca	Amoopi, Karpathos isl		35°35′N	27°8′E	Aegean Sea	aug.10	Suez/spreading		Kout in Nikolaidou *et al*., 2012
Greece	not specified	*Bursatella*	*leachi*	De Blainville, 1817	mollusca	Micro Emvolo of E Thermaikos Gulf				Aegean Sea		Suez/spreading		Manousis *et al*., 2012
Greece	1.08.2011	*Chama*	*pacifica*	Broderip, 1834	mollusca	Fokià Bay (Kàrpathos Island)				Aegean Sea	aug.11	Suez/spreading		Crocetta & Russo, 2013
Greece	not specified	*Murex*	*forskoehlii*	Roeding, 1798	mollusca	N Crete.				Aegean Sea		Suez/spreading		Manousis *et al*., 2012
Greece	not specified	*Rapana*	*venosa*	(Valenciennes, 1846)	mollusca	Perea, Thessaloniki				Aegean Sea		shipping		Manousis *et al*., 2012
Greece	27.08.2008	*Phallusia*	*nigra*	Savigny, 1816	ascidia	Peristera Island		40°13′39.27 ′′ N	23°45′55.94′′ E	Aegean Sea	27.aug.08	Suez/spreading		Koutsogianopoulos *et al*., 2012 in Thessalou-Legaki *et al*., 2012

Country	Date	Genus	Species	Namer and date	Taxon	Location name	Lat	Lon	Population status	Region of 1st record	Date of 1st record	Likely vector	likely impacts	References
Greece	5.04.2012	*Callinectes*	*sapidus*	Rathbun, 1896	decapoda	mouth of Kalamas River, NW Greece		39°34’38.15’’N	20°9’17.24’’E	Ionian Sea	5.apr.12	Suez/spreading		Perdikaris *et al*. in Thessalou-Legaki *et al*., 2012
Italy	2004	Branchiomma	bairdi	(McIntosh, 1885)	Polychaeta, Sabellidae	Faro Lake (Messina)	38°16’07’’N	15°38’13’’E	high densities	Faro Lake, Sicily	2007-2010	aquaculture/shipping		Giangrande *et al*, 2012.
Italy	2007	Pseudodiaptomus	marinus	Sato, 1913	Crustacea Copepoda, Pseudodiaptomidae	Rimini, Monfalcone (North Adriatic)	44°17.55'N	12°42.12'E	A few specimens	North Adriatic sea	2007-2009	aquaculture/shipping		de Olazabal and Tirelli, 2012
Italy	2006	Charybdis	japonica	(A. Milne-Edwards, 1861)	Crustacea, Decapoda	Ancona	43°37'31”N	13°29'35”	single specimen	Ancona, Adriatic Sea	2006	shipping		Froglia, 2012
Italy	2001	Botrylloides	pizoni	Brunetti & Mastrototaro, 2012	Tunicata, Didemnidae	Taranto	40°25'80"N	17°11'30"E	abundant	Mar Piccolo, Taranto	2001			Brunetti & Mastrototaro, 2012
Italy	2007	Didemnum	vexillum	Kott, 2002	Tunicata, Styelidae	Venice lagoon	45°26'13" N	012°21'14" E	abundant	Venice lagoon	2007	shipping		Tagliapietra *et al*, 2012
Sweden	November 2012	*Fibrocapsa*	*japonica*	Toriumi & Takano, 1973	algae	Åstol	57º 55,18 N	11º 35,60 E	very common	Skagerrak	November 2013	shipping		
Sweden	November 2011	*Mytilopsis*	*leucophaeata*	Conrad, 1831	Mollusca, fam. Dreissenidae	Asphällafjärden	60º24’N	18º12’E	3 juvenile specimens (1-2mm)	Outside Forsmark, south-western Bothnian Sea	2011			Adill *et al*. 2011.
Sweden	October 2012	*Mytilopsis*	*leucophaeata*	Conrad, 1831	Mollusca, fam. Dreissenidae	Asphällafjärden	60º24’N	18º12’E	About 200 juvenile specimens (1-2mm)/m^2	Outside Forsmark, south-western Bothnian Sea	2011			
Sweden	October 2012	*Mytilopsis*	*leucophaeata*	Conrad, 1831	Mollusca, fam. Dreissenidae	Plume area outside Forsmark nuclear power plant	60º26’N	18º13’E	About 70 juvenile specimens (1-2mm,)/m^2	Outside Forsmark, south-western Bothnian Sea	2011			

Country	Date	Genus	Species	Namer and date	Taxon	Location name	Lat	Lon	Population status	Region of 1st record	Date of 1st record	Likely vector	likely impacts	References
Sweden	November 2011	*Mytilopsis*	*leucophaeata*	Conrad, 1831	Mollusca, fam. Dreissenidae	Biotest Basin	60º26'N	18º12'E	Numerous adult specimens observed on stones and equpments (≤16 mm,)	Outside Forsmark, south-western Bothnian Sea	2011			
Sweden	10.07.2012	*Neogobius*	*melanostomus*	Pallas, 1814	Fish	Klintehamn, the harbour, Gotland	57,388531	18,18903	Abundantly found by recreational fishermen	S Baltic proper; Blekinge	2008 July	shipping	competition with benthic species, also food to predatory fish & seabird	
US	2010-2012	Heterosiphonia	japonica		red alga	Massachusetts, New Hampshire, Maine, Rhode Island	41.76767, 41.93361, 42.59798, 42.9892582	70.56046, 70.56046; 70.65501 70.614493	abundant	Point Judith, Rhode Island	2009	shipping	competes with other algae, nuisance on beaches	Savoie and Saunders 2013; Science Daily 9/13/2012
US	2010-2012	Tricellaria	inopinata		bryozoan	Massahcusetts	42º 35' N , 41.76, 41.5264977	71.05 W, 7.56046, 70;673087		Woods Hole, Massachusetts	2010	recreational boats?	competes with other fouling organisms	in press
US	2012	Palaemon	elegans		shrimp	Massahcusetts	42.3584308 N	71.0597732 W	abundant	Salem, Massachusetts	2010	shipping	preys on amphipods, carries fish pathogens	pers.comm.
US	2012	Palaemon	macrodactylus		shrimp	Massahcusetts	42.3584308 N ,	71.0597732 W	rare	New York, New York	2001	shipping?	predator	pers.comm.

Annex 5 Proposed Terms of Reference for 2014

2013/x/ACOMxx The **ICES Working Group on Introduction and Transfers of Marine Organisms** (WGITMO), chaired by Henn Ojaveer, Estonia, will meet in Klaipeda, Lithuania, from 19-21 March 2014, with a back to back meeting with the ICES/IOC/IMO Working Group on Ballast and Other Ship Vectors (WGBOSV) to:

a) Synthesize and evaluate national reports using the adopted format for reporting and contributions to the database that includes species, locations (latitude and longitude), status of invasions as appropriate, region of origin, status of eradication efforts, and habitat, and develop an annual summary table of new occurrences/introductions of aquatic non-indigenous species.

b) Continue verifying selected datasets of the newly developing database on marine and other aquatic organisms in European waters by making other components of the database available online, in addition to the Baltic Sea which is already available. This activity will mostly be carried out intersessionally and take several years.

c) Continue addressing EU MSFD D2 on further developing alien species indicators, incl. evaluating of ecological impacts caused by alien species.

d) Continue identification and evaluation of climate change impacts on the establishment and spread of non-indigenous species. Produce draft manuscript on temperature effects on non-indigenous species and develop further research agenda. This activity will mostly be carried out intersessionally and take several years.

e) Investigate and report on new developments in non-native species issues associated with biofouling (e.g. artificial structures in the marine environment and recreational boating) (joint Term of Reference with WGBOSV).

f) Investigate and report on new developments in non-native species issues into and through the Arctic region (joint Term of Reference with WGBOSV).

g) Collaborate with ICES Study Group on Integrated Morphological and Molecular Taxonomy (SGIMT) regarding identification, early detection and monitoring of non-native species, as appropriate (joint Term of Reference with WGBOSV).

h) Finalise the draft alien species alert report on *Ensis directus*.

WGITMO will report by 14 April 2014 for the attention of ACOM.

Supporting Information

Priority:	The work of the Group is the basis for essential advice to prevent future unintentional movements of invasive and/or deleterious aquatic species including disease agents and parasites with the legitimate trade in species required for aquaculture, table market, ornamental trade, fishing and other purposes and to assess the potential of species moved intentionally to become a nuisance in the area of introduction. The work of this Group supports the core role of ICES in relation to planned introductions and transfers of organisms.
Scientific justification and relation to action plan:	a) We have been developing a simple excel database on new introductions or expanding introductions and will be requesting that ICES adopt the data and maintain the database for the Working Group and ICES countries to access. b) The group will continuously contribute to the MSFD Descriptor 2 issues, incl. further developing alien species indicators, especially those related to ecological impacts. c) The group will continue contribute with new data and data verifications to the AquaNIS database with the aim to make the database operational and usefurl alien species assessments in European seas. d) We plan to continue identification and evaluation of climate change impacts on the establishment and spread of alien spoecies. By the next meeting, temperature change aspects will be anaylsed and summarised, and discussions will be continued on how to deal with other climate-induced factors than temperature. e) We'll continue coordinating reporting on pathogens and other disease agents affecting mariculture and involve relevant ICES expert group(s). f) We'll continue investigations on increasingly important issue of various artificial structures for alien species spread and invasions.
Resource requirements:	None required other than those provided by ICES Secretariat and national members
Participants:	WGITMO nominated members and invited experts from, e.g., Australia and Mediterranean Sea countries that are not members of ICES.
Secretariat facilities:	Meeting room providen by the host
Financial:	None required
Linkages to advisory committees:	WGITMO reports to ACOM
Linkages to other committees or groups:	WGHABD, WGBOSV, WGBIODIV, WGAQUA, SGIMT, WGPDMO
Linkages to other organizations:	WGITMO urges ICES to encourage and support a continued dialogue with PICES, CIESM, IMO, HELCOM, OSPAR and EIFAC.