Report of the “Regional Workshop on Marine Invasive Species Problems in Northwest Pacific Region”

Table of Contents

1 Background

The problem of marine invasive species (MIS) is one of the major threats to marine biological diversity, which plays a critical role in overall sustainable development and poverty eradication, and is essential to our planet, human well-being and to the livelihood and cultural integrity of people. Marine invasive species have serious negative impacts on marine biodiversity, including damage to ecosystems, change of ecosystem functions, and cause of genetic changes in coastal organisms. It also has impacts on economy. For many years, the international society has been making efforts to control this problem. The Convention on Biological Diversity states that each Contracting Party shall, as far as possible and as appropriate, prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species. The Agenda 21 called on the International Maritime Organization (IMO) and other international bodies to take action to address the transfer of harmful organisms by ships. The WSSD in 2002, in its Johannesburg Plan of Implementation, urges all countries to strengthen national, regional and international efforts to control invasive alien species, encourage the development of effective work programme on invasive alien species at all levels, and urges nations to accelerate the development of measures to address invasive alien species in ballast water. In the outcome document of “Rio+20”, “the future we want”, it is stated that “We note the significant threat alien invasive species pose to marine ecosystems and resources and commit to implement measures to prevent the introduction of, and manage the adverse environmental impacts of alien invasive species, including, as appropriate, those adopted in the framework of the IMO”.

With the support and cooperation from all members of the Northwest Pacific Action Plan (NOWPAP), the Data and Information Network Regional Activity Center (DINRAC) of NOWPAP carried out a joint research on MIS and its potential damage in Northwest Pacific region in 2009, which produced national reports by China, Japan, Republic of Korea and Russia, and a regional overview. The regional overview concluded that there is insufficient information about MIS at both national and international levels. There is a strong need to strengthen the data exchange and communication among relevant countries to share available information and to discuss future activities in this field.

Under this situation, with assistance from the partners, namely, the A.V. Zhirmunsky Institute of Marine Biology of the Far-East Branch of Russian Academy of Science, Japan Agency for Marine-Earth Science and Technology, and East Sea Fisheries Research Institute of Korea National Fisheries Research & Development Institute, DINRAC started to apply for financial support from the Asian-Pacific Network for Global Change Research (APN) under its CAPaBLE Programme to convene a regional workshop on MIS problems in the Northwest Pacific Region to promote exchange of information on MIS problems among officials and experts from NOWPAP member states, exchange of experiences on the prevention and control of MIS among

officials and experts from NOWPAP member states, analysis of the needs for policies and measures on MIS and recommendations for NOWPAP member states, which also meets the objectives of the CAPaBLE Programme, which aims at providing researchers (young and aspiring scientists in particular) and decision‐makers with opportunities for capacity development in the area of global change.

In order to facilitate the invitation of prominent and experienced experts from China, Japan, Korea and Russia, since July 2012, DINRAC started to seek support from the Regional Coordination Unit (RCU) of NOWPAP, A.V. Zhirmunsky Institute of Marine Biology of the Far-East Branch of Russian Academy of Science, Japan Agency for Marine-Earth Science and Technology, East Sea Fisheries Research Institute of Korea National Fisheries Research & Development Institute had provided professional support, the Ministry of Environmental Protection of China, Japan Oceanographic Data Center, Chinese Research Academy of Environmental Science, the Marine Ecology Research Center of the First Institute of Oceanography of State Oceanic Administration of China and other research institutes to improve the agenda of the workshop and help invite experts from the four countries. These organizations and institutes have been working on MIS problems for many years and have contacts with prominent experts in this field.

With technical support from the organizations, the Final Agenda of the workshop included three major topics: Session 1: Current situation of MIS problems in NOWPAP member states, Session 2: Impacts of the MIS on Ecosystems and Environment in NOWPAP Member Countries, and Session 3: Current policies and measures on preventing and controlling MIS problems in the NOWPAP member states and future needs for policies, measures and regional cooperation (Annex 1: Agenda of the Workshop). About 20 prominent experts were invited from 17 organizations in the four countries and more than 20 relevant local researchers in Qingdao City were also invited (Annex 2: List of Participants).

2 Holding the Workshop

During October 23-24, 2012, the Regional Workshop on marine invasive species (MIS) Problems in Northwest Pacific Region was held in Qingdao, China. Representatives from the Division of Marine Environment of the Department of Pollution Prevention and Control of the Ministry of Environmental Protection of China, Division of Biological Safety of the Department of Nature and Ecology Conservation of the Ministry of Environmental Protection of China, NOWPAP RCU, Shandong Maritime Safety Administration of China made opening remarks at the workshop, and 13 presentations were made by the experts, followed by discussions (Annex 3: Opening Remarks and Presentations made at the Workshop).

With financial support from the Asian-Pacific Network for Global Change Research (APN) and human resource support from the First Institute of Oceanography of State

Oceanic Administration of China, DINRAC tried its best to provide appropriate accommodation, food and other meeting support for the participants, who showed satisfaction with the organization of the workshop.

3 Outcome of the Workshop

Through nearly two days' discussion, participants to the workshop made the following major conclusions (Annex 4: Conclusion of the Workshop):

Participants to the workshop stressed that that the problem of MIS is one of the major threats to marine ecosystem, including the Northwest Pacific area, and this workshop is very necessary for the Northwest Pacific region to brings together relevant officials and experts to exchange information and experiences on the prevention and control of MIS.

Participants noted that the problem of MIS is of international concern, and that the Convention on Biological Diversity states that each Contracting Party shall, as far as possible and as appropriate, prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species.

Participants noted that the Agenda 21 called on the International Maritime Organization (IMO) and other international bodies to take action to address the transfer of harmful organisms by ships.

Participants noted that the World Summit on Sustainable Development in 2002, in its Johannesburg Plan of Implementation, urges all countries to strengthen national, regional and international efforts to control invasive alien species, encourage the development of effective work programme on invasive alien species at all levels, and urges nations to accelerate the development of measures to address invasive alien species.

Participants noted that, in the outcome document of "Rio+20", "the future we want", it is stated that "We note the significant threat of alien invasive species pose to marine ecosystems and resources and commit to implement measures to prevent the introduction of, and manage the adverse environmental impacts of alien invasive species, including, as appropriate, those adopted in the framework of the IMO".

In the Northwest Pacific region, there are already a lot of research and information on the current situation of MIS, such as the origins, pathways, categories, distribution and impacts of MIS, but they are still inadequate for policy-making and management. There is insufficient reliable research and statistics of the origins, pathways, categories, distribution and impacts of MIS.

Countries in the Northwest Pacific region have made many efforts to prevent and

control MIS, including legislations, putting management responsibilities on governmental organizations, implementation of international rules and guidelines, development of technologies, etc. However, due to limited knowledge and understanding of MIS, and also due to the extreme difficulty to fully investigate and control this problem, the measures are still inadequate in terms of legislation, management system and concrete actions. Participants acknowledged that, through this workshop, they shared many information, experiences and knowledge on MIS in the Northwest Pacific region, and their understanding of the issue of MIS was improved, which will benefit their future international cooperation on MIS.

Participants recommended that more investigation of and research on MIS are needed, and countries in the Northwest Pacific region need to provide resources to strengthen the investigation and researches on this issue, and to develop regional cooperation on data-sharing in the framework of NOWPAP, and close cooperation with other international organizations.

Participants stressed that, since it is very difficult to eliminate MIS after their invasion, prevention measures are very important and indispensable, including strict inspection and environmental impact assessment.

Participants recommended that a rapid entry into force of the IMO Ballast Water Convention is essential to prevent further spread of MIS. There is a need to strengthen regional cooperation through participation in international organizations, including FAO, UNEP and PICES, etc.

Participants recommended that current national legislation and management systems for MIS need to be improved to further prevent and control MIS, including control of pathways that lead to the introduction and spread of MIS, routine monitoring to detect and rapid response to eradicate or control MIS before they spread, and long-term response to mitigate the impacts of MIS.

Through this workshop, it can be said that the understanding of the issue of MIS among the researchers and government officials of NOWPAP member states was improved, the awareness on the necessity and ways to prevent and control MIS among NOWPAP member states was increased, and the awareness on the need for regional cooperation among NOWPAP member states to prevent and control MIS was also increased.

Regional Workshop on Marine Invasive Species Problems in Northwest Pacific Region
Qingdao, the People's Republic of China, 23-24 October 2012

Annex 1: Agenda of the Workshop

Agenda **of the Regional Workshop on Marine Invasive Species Problems in the Northwest Pacific**	
22 October, 2012 Arrival of Participants	
18:00-20:00	**Buffet Dinner**
Day 1: 23 October 2012	
Opening Session Moderator: Mr. Hongbo SHANG, *Director of NOWPAP DINRAC*	
8:30-9:00	**Registration**
9:00-9:10	**Introduction to the workshop** -Mr. Hongbo SHANG
9:10-9:30	**Opening Remarks** -Mr. Yi LI, *Deputy Director of the Marine Division of the Ministry of Environmental Protection of China* -Mr. Jie WANG, *Director of the Bio-safety Management Division of the Ministry of Environmental Protection of China* -Mr. Xiaofeng PENG, *Senior Engineer, Shandong Maritime Safety Administration* -Dr. Sangjin LEE, *NOWPAP Scientific Affairs Officer*
9:30-9:40	**Group Photo**
Session 1: Current situation of MIS problems in NOWPAP member states Moderator: Dr. Kun LEI, *Director of River and Coastal Environmental Research Center, Institute of Water Environment, Chinese Research Academy of Environmental Sciences*	
9:40-10:15	**Introduced marine and brackish organisms in Japanese coastal waters, and the processes for their introduction** - Mr. Michio Otani, Osaka Museum of Natural History (30 min) **Discussion** (5 min)
10:15-10:50	**Current situation of the MIS in Korea** - Dr. SOOK SHIN, Sahmyook University (30 min) **Discussion** (5 min)

10:50-11:05	Tea Break
11:05-11:40	**Marine invasive species in the Russian Far East: an overview** - Dr. Konstantin Lutaenko, A.V. Zhirmunsky Institute of Marine Biology, FEB Russian Academy of Sciences (30 min) **Discussion** (5 min)
11:40-12:15	**Invasive species in China seas and its impacts** -Prof. Lijun Wang, National Marine Environmental Monitoring Center (30 min) **Discussion** (5 min)
12:15-12:30	**Summary of Session 1**
12:30-14:00	**Buffet Lunch**
Session 2: Impacts of the MIS on Ecosystems and Environment in NOWPAP Member Countries Moderator: Dr. Konstantin Lutaenko, *Senior Research Scientist and Head of the International Cooperation Department of the Institute of Marine Biology, Far East Branch of the Russian Academy of Sciences, President of Russian Far East Malacological Society*	
14:00-14:35	**Impacts, Risk Analysis, and Management of Marine Invasive Species in Korea** -Dr. Keun-Hyung Choi, Korea Institute of Ocean Science and Technology (30 min) **Discussion** (5 min)
14:35-15:10	**Pros and Cons of Invasive Cordgrass Spartina spp. Introduced into China from UK and USA over 30 Years Ago** -Dr. Changyong WANG, Nanjing Institute of Environmental Sciences, MEP (30 min) **Discussion** (5 min)
15:10-15:45	**The influences of invasive alien species Spartina alterniflora on ecosystem of Chinese coastal wetland** -Dr. Caiyun ZHAO, Chinese Research Academy of Environmental Sciences (30 min) **Discussion** (5 min)
15:45-16:10	**Tea Break**
16:10-16:45	**China's Response to Marine Invasive Species from the Legal Perspective and Challenges Review** -Dr. Jiayu BAI, Law&Politics School, Ocean University of China (30 min) **Discussion** (5 min)

16:45-17:20	**Basic Surveys for International Convention for the control and management of ship's Ballast Water and Sediments** - Mr. Takafumi YOSHIDA, NOWPAP CEARAC (30 min) **Discussion** (5 min)
17:20-17:40	**Summary of Session 2**
18:00-20:00	**Dinner**
Day 2: October 24, 2012	
Session 3: Current policies and measures on preventing and controlling MIS problems in the NOWPAP member states and future needs for policies, measures and regional cooperation Moderator: Dr. Sangjin LEE, *NOWPAP Scientific Affairs Officer*	
9:00-9:35	**Ballast Water Management - An Approach to Combat Marine Invasive Species** - Dr. Nahui ZHANG, Environmental Engineering Institute, Dalian Maritime University (30 min) **Discussion** (5 min)
9:35-10:10	**Aquaculture and MIS in China: Status, management and policy** -Dr. Yamin WANG, College of Ocean, Shandong University at Weihai (30 min) **Discussion** (5 min)
10:10-10:30	**Tea Break**
10:30-11:05	**Current policies, measures and the challenges in Korea** - Dr. Jae-Young Lee, Marine Ecology Division, Ministry of Land, Transport and Maritime Affairs (30 min) **Discussion** (5 min)
11:05-11:40	**Current policies and measures on preventing and controlling MIS problems in Russia** - Dr. Olga SEMENIKHINA, Far-Eastern Marine Research, Design and Technology institute (30 min) **Discussion** (5 min)
11:40-12:00	**Summary of Session 3**
12:00-12:30	**Conclusion of the Workshop**
12:30-14:00	**Buffet Lunch**

Regional Workshop on Marine Invasive Species Problems in Northwest Pacific Region
Qingdao, the People's Republic of China, 23-24 October 2012

Annex 2: List of Participants

Experts of P. R. China

Mr. Yi LI
Deputy Director
Department of Pollution Prevention and Control, MEP
No.115 Xizhimennei Nanxiaojie, Beijing 100035, China
Tel: 86-10-66555274
Fax: 86-10-66556236
E-mail: marine@sepa.gov.cn

Mr. Jie WANG
Director
Department of Nature and Ecology Conservation, MEP
No.115 Xizhimennei Nanxiaojie, Beijing 100035, China
Tel: 86-10-66556325
Fax: 86-10-66556329
E-mail: wang.jie@mep.gov.cn

Mr. Xiaofeng PENG
Senior Engineer,
Shandong Maritime Safety Administration
No. 21 Wuxiao Road, Qingdao 266002, China
Tel: 86-532-86671126
E-mail: sdytpxf@yahoo.com.cn

Ms. Xiaoman XU
Senior Engineer,
Liaoning Maritime Safety Administration
No. 25 Changjiang Road, Dalian 116001, China
Tel: 86-411-82625031
E-mail: Xuxiaoman@lnmsa.gov.cn

Dr. Kun LEI
River and Coastal Environmental Research Center
Institute of Water Environment
Chinese Research Academy of Environmental Sciences
No. 8 Dayangfang, Chaoyang District, Beijing China
Tel: 86-10-8491-5305
Fax: 86-10-8491-5305
E-mail: leikun@craes.org.cn

Dr. Changyong WANG
Nanjing Institute of Environmental Sciences, MEP

No.8 Jiangwangmiao St, Nanjing 210042, China
Tel: 86-10-6650-3750 86-25-8528-7223
Fax: 86-25-885411611
E-mail: wcy@nies.org

Ms. Caiyun ZHAO
Chinese Research Academy of Environmental Sciences
No.8, Anwai Dayangfang Chaoyang District, Beijing 100012, China
Tel: 86-10-84931225
Fax: 86-10-84931225
E-mail: zhaocy@craes.org.cn

Dr. Nahui ZHANG
Environmental Engineering Institute
Dalian Maritime University
1 Linghai Road, Dalian, Liaoning, 116026, China
Tel: +86-15998689200
Fax: +86-411-84727681
E-mail: zhangnahui@gmail.com

Dr. Lijun WANG
National Marine Environmental Monitoring Center
1 Linghai Road, Dalian, Liaoning, 116026, China
Tel: +86-411-84782532
Fax: +86-411-84782532
E-mail: ljwang@nmemc.gov.cn

Dr. Yamin WANG
College of Ocean, Shandong University at Weihai
180 Wen Hua Xi Lu ,Weihai 264209, China
Tel: +86-15098149780
E-mail: wangyamin@sdu.edu.cn

Dr. Jiayu BAI
Law&Politics School, Ocean University of China
No. 238 Songling Rd., Laoshan District, Qingdao
Tel: +86-13730960930
E-mail: gracefulgl@hotmail.com

Dr. Qingjia MENG
River and Coastal Environmental Research Center
Chinese Research Academy of Environmental Sciences
No. 8 Dayangfang, Chaoyang District, Beijing China

Tel: 86-10-84915305
Fax: 86-10-84915305
Email: mengqj@craes.org.cn

Experts of Republic of Korea

Dr. Keun-Hyung Choi
Korea Institute of Ocean Science and Technology
1270 Haean-ro Ansan Gyeonggi-do KOREA
Tel: 82-31-400-7813
Fax: 82-31-400-6925
Email: keunhchoi@kiost.ac

Dr. Jae-Young Lee
Deputy Director
Marine Ecology Division, Ministry of Land, Transport and Maritime Affairs
2F, K-Water, 188 Jungang-Ro, Gwachen-City, Gyeonggi-Do, Korea 427-100
Tel: 82–02–504-5648
Fax: 82-02–503–7303
Email: jylee0403@korea.kr

Dr. SOOK SHIN
Professor, Sahmyook University
Hwarangro 815, Nowon-gu, Seoul, Korea
Tel: 82–2-3399-1717
Fax: 82-2-3399-1729
Email: shins@syu.ac.kr

Experts of Japan

Mr. MICHIO OTANI
Visiting Researcher
Osaka Museum of Natural History
Rokujo Midori-machi 3-9-10, Nara City
Tel: 81-742-48-8552
Fax: 81-742-48-8552
Email: Michio-otani@h5.dion.ne.jp

Dr. Takafumi YOSHIDA
Senior Researcher
Special Monitoring and Coastal Environmental Assessment Regional Activity Centre (CEARAC)
5-5 Ushijimashin-machi, Toyama 930-0856, Japan

Tel: 81-76-445-1571
Fax: 81-76-445-1581
E-mail: yoshida@npec.or.jp

Experts of Russian Federation

Dr. Konstantin LUTAENKO
A.V. Zhirmunsky Institute of Marine Biology
FEB Russian Academy of Science
Palchevsky Street, 17, Vladivostok 690059, Russia
Tel.: 7-423-2317111
Fax: 7-423-2310900
E-mail: lutaenko@mail.ru

Dr. Olga SEMENIKHINA
Far-Eastern Marine Research, Design and Technology institute
Fontannaya Street 40, VLADIVOSTOK 690091, Russia
Tel.: 7- (904) 6296423
Fax: 7- (423) 2401458
E-mail: oja@list.ru

NOWPAP of UNEP

Dr. Sang-Jin LEE
Scientific Affair Officer
NOWPAP Regional Coordinating Unit
152-1 Haean-ro, Gijang-up, Gijang-gun, Busan, 619-705, Republic of Korea
Tel: 82-51-720-3002
Fax: 82-51-720-3009
E-mail: sangjin.lee@nowpap.org

DINRAC

Mr. Hongbo SHANG
Director, DINRAC
Policy Research Center for Environment and Economy
Ministry of Environmental Protection (MEP)
Building C, No. 1 Yuhuinanlu, Chaoyang District
Beijing 100029, People's Republic of China
Tel: 86-10-8466-5309
Fax: 86-10-8463-0849
E-mail: shang.hongbo@prcee.org

Ms. Tong AN
Senior Engineer, DINRAC
Policy Research Center for Environment and Economy
Ministry of Environmental Protection (MEP)
Building C, No. 1 Yuhuinanlu, Chaoyang District
Beijing 100029, People's Republic of China
Tel: 86-10-8466-5309
Fax: 86-10-8463-0849
E-mail: an@mep.gov.cn

Ms. Wenwen HOU
Assistant, DINRAC
Policy Research Center for Environment and Economy
Ministry of Environmental Protection (MEP)
Building C, No. 1 Yuhuinanlu, Chaoyang District
Beijing 100029, People's Republic of China
Tel: 86-10-8466-5309
Fax: 86-10-8463-0849
E-mail: hou.wenwen@prcee.org

Researchers of P. R. China

Ms. Luyan XU
The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-15264297763
E-mail: xuluyan0720@126.com
Mr. Xinzi LIE
The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-15253257196
E-mail: qdqylxg@sina.com

Ms. Chen CHEN
The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-18006489842
E-mail: changething@yahoo.cn

Ms. Yingfei SONG

The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-15020078269
E-mail: 1344991043@qq.com

Ms. Xiao LUAN
The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-13869866243
E-mail: 422388032@qq.com

Ms. Wenwen WAN
The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-15981702920
E-mail: wanwenwen879@sina.com

Ms. Hongyan BAI
The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-15866860131
E-mail: hongyanbai@163.com

Mr. Junfei LI
The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-18763006035
E-mail:tianshizhiming08@126.com

Mr. Lijie GAO
The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-13581991042
E-mail:seaangelbaby@sohu.com

Mr. Guorui GAO
The First Institute of Oceanography, SOA

No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-15192543897
E-mail:gaoguoruily@163.com

Mr. Shuai ZHANG
Law&Politics School, Ocean University of China
No. 238 Songling Rd., Laoshan District, Qingdao
Tel: +86-15964910255
E-mail: yeah250812@gmail.com

Mr. Peng DING
Law&Politics School, Ocean University of China
No. 238 Songling Rd., Laoshan District, Qingdao
Tel: +86-15275217507
E-mail: 632213247@qq.com

Ms. Lingli WANG
The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-13345017647
E-mail:785994494@qq.com

Mr. Yijiang HUANG
The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-13573893865

Mr. Kepeng LIANG
The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-15166390760

Mr. Jinhu TIAN
The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-18661846698

Ms. Yanyan YUE

The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-18678469006

Ms. Chun WANG
The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-18661656095

Ms. Lin LI
The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-18906429679

Ms. Qian LI
The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-13954290602

Mr. Shuai WANG
The First Institute of Oceanography, SOA
No. 6, Xianxialing Road, Laoshan District
Qingdao, 266061, People's Republic of China
Tel: 86-13854206061

Regional Workshop on Marine Invasive Species Problems in Northwest Pacific Region
Qingdao, the People's Republic of China, 23-24 October 2012

Annex 3: Opening Remarks and Presentations made at the Workshop

Table of Contents

Welcome Remarks and Introduction of the Workshop by DINRAC Director

Distinguished experts, dear friends from Japan, Korea, Russia and China,

It is the honor of the Data and Information Network Regional Activity Center of Northwest Pacific Action Plan, hereafter I call it DINRAC, to have you all here today at this important workshop. On behalf of DINRAC, I would like to extend my sincere appreciation to you all for your participation to this workshop.

The problem of marine invasive species is one of the major threats to marine bio-diversity. Meanwhile, the costs of cleaning and controlling invasive species are huge. For many years, the international society has been making efforts to control this problem. The Convention on Biological Diversity states that each Contracting Party shall, as far as possible and as appropriate, prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species. The Agenda 21 called on the International Maritime Organization (IMO) and other international bodies to take action to address the transfer of harmful organisms by ships. The WSSD in 2002, in its Johannesburg Plan of Implementation, urges all countries to strengthen national, regional and international efforts to control invasive alien species, encourage the development of effective work programme on invasive alien species at all levels, and urges nations to accelerate the development of measures to address invasive alien species in ballast water.

In the outcome document of “Rio+20”, “the future we want”, it is stated that “We note the significant threat alien invasive species pose to marine ecosystems and resources and commit to implement measures to prevent the introduction of, and manage the adverse environmental impacts of alien invasive species, including, as appropriate, those adopted in the framework of the IMO”.

With the support of NOWPAP member states, DINRAC initiated a joint research on marine invasive species and its potential damage in Northwest

Pacific region in 2009. You may find this report at the corner of this meeting room and also on our website. One of the conclusions of this joint research claimed that, the problems related to the marine invasive species in the NOWPAP region are among the most important issues with regard to biodiversity changes and management. However, there is insufficient information about this problem at both national and international levels, and there is a strong need to strengthen the data exchange and communication among relevant countries to share available information and to discuss future activities in this field.

As a following effort on the problem of marine invasive species, DINRAC successfully secured financial support from the Asian-Pacific Network for Global Change Research (APN) under its CAPaBLE Programme to convene this workshop. The CAPaBLE Programme aims at providing researchers (young and aspiring scientists in particular) and decision‐makers with opportunities for capacity development in the area of global change. As an APN-funded activity and a DINRAC event, this workshop aims to promote the exchange of information and experiences on the prevention and control of marine invasive species, analysis of the needs for policies and measures, and recommendations for NOWPAP member states, thus to promote the understanding of MIS problems by experts and policy-makers, and to facilitate and science-policy linkages.

As you may see from the Agenda, this workshop has 3 major topics and will last for one and a half days. Experts will make presentations under different sessions, and time for discussion was allocated for each presentation. We wish this arrangement would, to a certain extent, satisfy your needs.

During the preparation of this workshop, the Regional Coordination Unit of NOWPAP, A.V. Zhirmunsky Institute of Marine Biology of the Far-East Branch of Russian Academy of Science, Japan Agency for Marine-Earth Science and Technology, East Sea Fisheries Research Institute of Korea National Fisheries Research & Development Institute had provided professional support, the Ministry of Environmental Protection of China, Japan Oceanographic Data

Center, Chinese Research Academy of Environmental Science, the Marine Ecology Research Center of the First Institute of Oceanography of State Oceanic Administration and other research institutes had also provided great help. I would like to say that, without you, it will be much more difficult for us to organize such an event. Thank you all very much for the help.

Finally, I wish you all a very nice stay in Qingdao during the workshop.

Thank you!

Opening Remarks by Mr. Li Yi

Deputy Director of the Marine Division of the Ministry of Environmental Protection of China

Distinguished experts and colleagues,

Today, this Regional Workshop on Marine Invasive Species Problems in Northwest Pacific Region is being held here in Qingdao. As one of those that have been working many years on marine environmental protection, I am very glad to see that the experts from Northwest Pacific countries are gathering here to have this workshop and discuss the problem of invasion of alien marine species. Hereby, please allow me to express congratulation to the successful holding of the workshop, and welcome the experts from Japan, Korea and Russia. Meanwhile, I would like to express my appreciation to the participation of the officials and experts from Shandong Maritime Safety Administration, Liaoning Maritime Safety Administration, National Marine Environmental Monitoring Center, and Dalian Maritime University, etc.

As we all know, with the development of international trade and exchange of people, the scale and speed of the movement of species across regions and boarders are increasing, and the possibility of harmful invasion of alien species are also getting higher and higher. The invasion of alien species could damage the stability and balance of marine ecosystem, incur huge economic losses, and pose a potential threat to the stable social and economic development in coastal areas. However, our knowledge about the invasion of alien marine species is very inadequate, reliable research and statistics of the type, distribution and impacts of marine invasive species are lacking, and measures to prevent the invasion of alien marine species are also very insufficient. These are among the problems that are in urgent need of research. I noticed that thematic presentations and discussions on these issues have been arranged during this workshop. I believe that, through our exchange and discussion, we will further improve our understanding about these issues and related policies and measures, which I think will contribute to the prevention and control of marine invasive species in the Northwest Pacific area.

As I know, the Regional Coordination Unit and the Data and Information Network Regional Activity Center have made a lot efforts for this workshop. I thank you for your work. Asian-Pacific Network for Global Change Research has provided generous financial support to this workshop; I also thank them for their precious support.

Finally, I wish this workshop will have the expected results and realize its objectives.

Thank you for your attention.

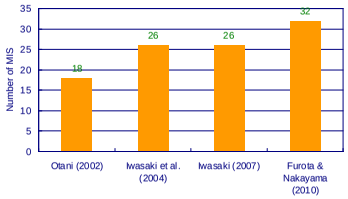
Introduced marine and brackish organisms in Japanese coastal waters, and the processes underlying their introduction

Visiting Researcher
Osaka Museum of Natural History
Michio Otani

Presentation funded by APN

- Research history of Japanese marine invasive species (MIS)
  - ➢Arakawa (1980) reported 13 MIS unintentionally introduced to Japanese coastal waters

After Arakawa (1980),



I counted 38 MIS based on Furota & Nakayama (2010) and Iwasaki (2007)

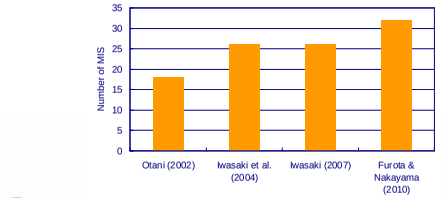
When I added Magnoliopyta newly discovered last year, Japanese MIS became 39

Change of the number of Japanese unintentionally Introduced MIS

Presentation funded by APN

- Research history of Japanese marine invasive species (MIS)
  - ➢Arakawa (1980) reported 13 MIS unintentionally introduced to Japanese coastal waters

After Arakawa (1980),



Change of the number of Japanese unintentionally Introduced MIS

Presentation funded by APN

- Current record of MIS unintentionally introduced to Japan

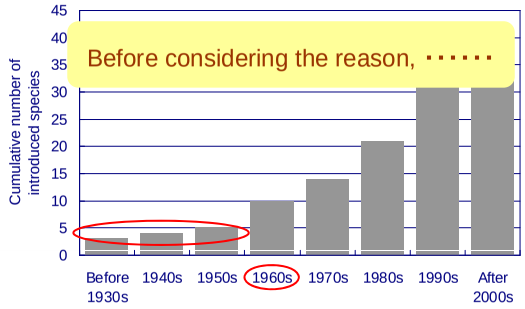
Platyhelminthes	1 *Neobenedenia girellae*		21 *Amphibalanus venustus*
	2 *Heterobotrium hirame*		22 *Amphibalanus zhujangensis*
Annelida	3 *Ficopomatus enigmaticus*		23 *Balanus glandula*
	4 *Hydroides elegans*		24 *Megabalanus coccopoma*
	5 *Hydroides dianthus*		25 *Paracerceis sculpta*
Mollusca	6 *Crepidula onyx*		26 *Carcinus aestuarii*
	7 *Euspira fortunei*		27 *Pyromaia tuberculata*
	8 *Stenothyra* sp.		28 *Rhisropanopeus harrisii*
	9 *Nassarius sinarus*		29 *Callinectes sapidus*
	10 *Trinchesia perca*	Bryozoa	30 *Bugula stolonifera*
	11 *Mytilus galloprovincialis*	Chordata	31 *Ascidiella aspersa*
	12 *Perna viridis*		32 *Polyandrocarpa zorritensis*
	13 *Xenostrobus securis*		33 *Molgula manhattensis*
	14 *Mytilopsis sallei*	Dinophyta	34 *Heterocapsa circularisquama*
	15 *Petricola cf. lithophaga*	Chlorophyta	35 *Ulva fasciata*
	16 *Mercenaria mercenaria*		36 *Ulva armoricana*
	17 *Phacosoma gibba*		37 *Ulva scandinavica*
Arthropoda	18 *Amphibalanus amphitrite*		38 *Ulva californica*
	19 *Amphibalanus improvisus*	Magnoliophyta	39 *Spartina alterniflora*
	20 *Amphibalanus eburneus*		

(Species in red letters may have not been established)

Presentation funded by APN

- Current record of MIS unintentionally introduced to Japan

- Temporal changes of the number of MIS in Japanese waters

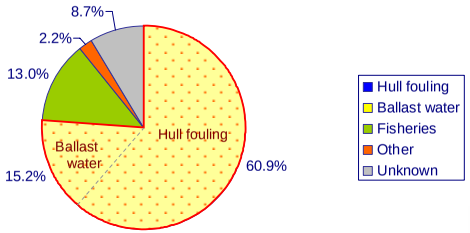


Cumulative number of MIS that were newly recorded in Japanese waters every decade

Presentation funded by APN

- What is the vector most responsible for the introduction of Japanese MIS?

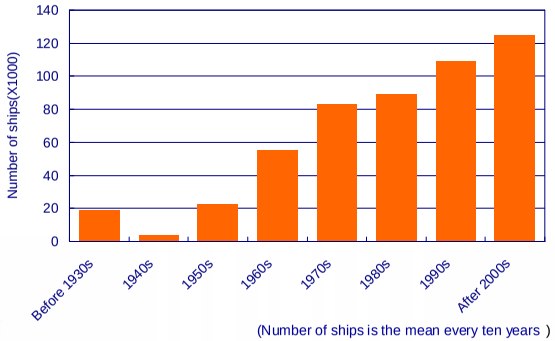
Ship accounts for about three-quarters



Relative importance of various vectors responsible for the introduction of MIS in Japanese waters

Presentation funded by APN

- Temporal change of the number of ocean-going ships called at Japanese ports



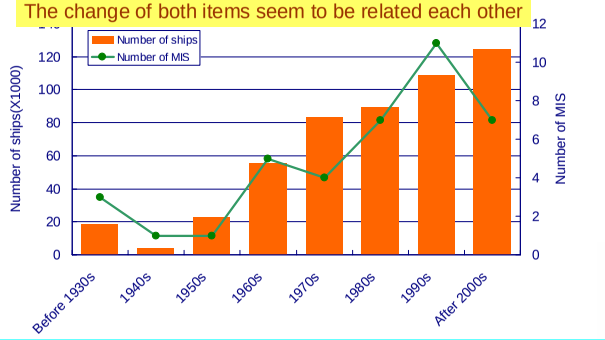
(Number of ships is the mean every ten years)

(Modified from the data of Annual port statistics, Ministry of Land Infrastructure, Transport and Tourism)

Presentation funded by APN

- Is the change of the number of MIS connected with that of ocean-going ships call at ports?

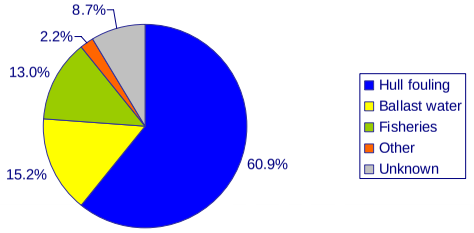
The change of both items seem to be related each other



This is supported by Spearman's rank correlation: rho=0.87 ($p<0.05$)

- Let's back to this graph again

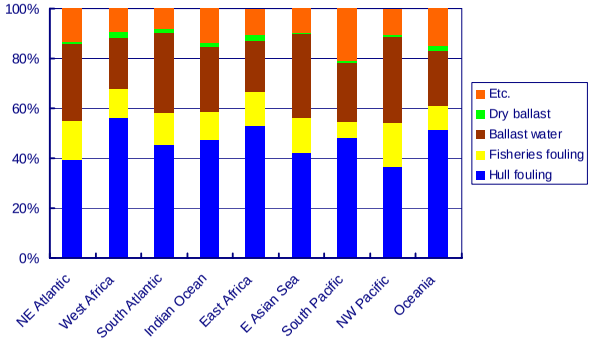
Among vectors related to a ship, which is more responsible for the introduction?



As a vector of MIS, we know the hull fouling is more responsible for the introduction than the ballast water in Japanese case.

- This tendency is not unique to Japan

Now the hull fouling is getting widespread international attention

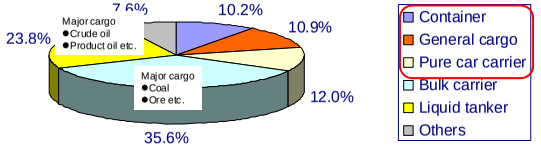


(modified from Hewitt and Campbell 2010)

- Why the hull fouling is more responsible for the introduction than the ballast water?

The answer is in ships' types and in their way of the ballast water operation

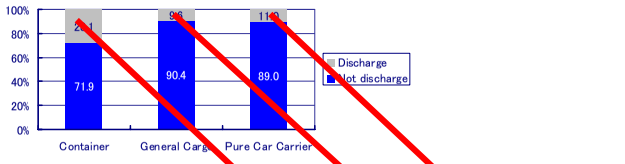
Do they discharge ballast water in Japanes ports?



These two types don't discharge ballast water in Japanese port because they don't carry much ballast water but are full load

(made from the data of the statistics manual of the seaborne shipping, the Japanese Shipowners' Association, 2011)

- Do these three discharge ballast (BW) water in Japanese ports?

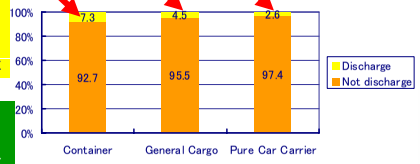


Discharge rate of BW at the port by ship type

Even if they discharge the ballast water, its amount is a little and accounts for only a small part of the ballast water kept in their tank

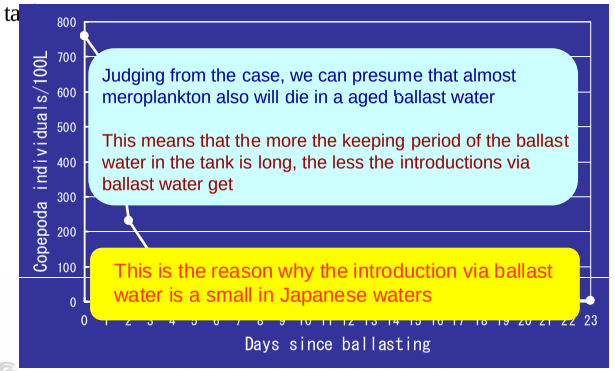
(made from the data of Ballast

This means that almost all the ballast water in their tank is kept for a long time, so that their age becomes old



Discharge rate of loaded BW by ship type

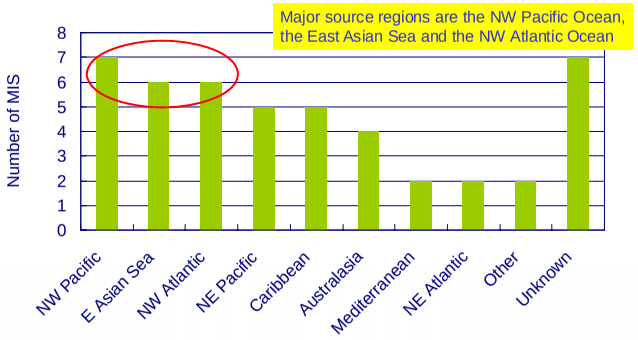
- When the age of BW becomes old, what happens in the ta



Copepoda individuals recorded in ballast water

(Modified from Gollash et al. 2000)

- Where were Japanese MIS introduced from?

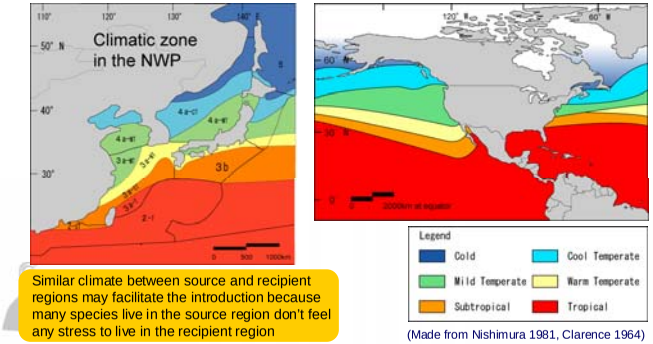


(IUCN bioregion (Kelleher et al. 1995) was used in the graph)

- What are the conditions that make the introduction of MIS possible?

There are two major conditions

1. Similarity of the sea climate



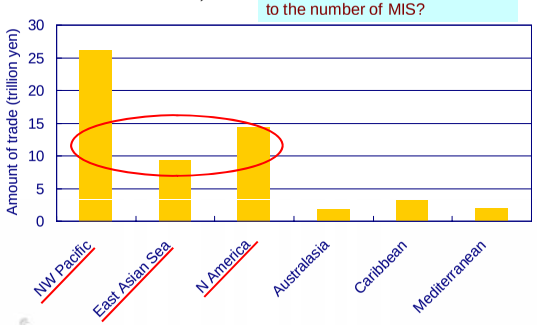
Similar climate between source and recipient regions may facilitate the introduction because many species live in the source region don't feel any stress to live in the recipient region

(Made from Nishimura 1981, Clarence 1964)

- What are the conditions that make the introduction of a MIS possible?

2. Amount of the sipping traffic (substituted by the amount of trade)

Are these amount of trade related to the number of MIS?



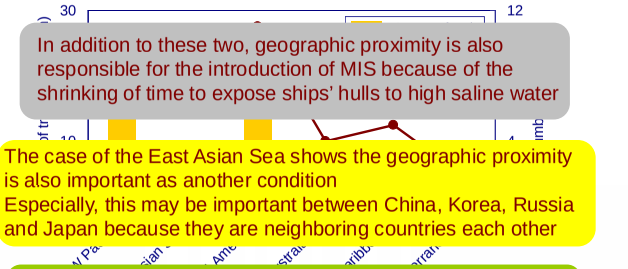
(Mean value calculated from the transport data between 2006 and 2010 of Statistics Bureau, Ministry of Internal Affairs and Communications)

Presentation funded by APN

- What are the conditions that make the introduction of a MIS possible?

2. Amount of the sipping traffic (substituted by the amount of trade)

It seems that these two items are related each other



In addition to these two, geographic proximity is also responsible for the introduction of MIS because of the shrinking of time to expose ships' hulls to high saline water

The case of the East Asian Sea shows the geographic proximity is also important as another condition
Especially, this may be important between China, Korea, Russia and Japan because they are neighboring countries each other

Among these countries, we should be careful that the introduction will also include secondary introduction
(This means that we act a role of stepping stone each other)

Presentation funded by APN

- Measures that we should take to prevent or to reduce the introduction of MIS

1. For the ballast water (BW)

Ballast water is about to be controlled by the Ballast Water Convention adopted at IMO in 2004, though it has not been come into effect

Considering the responsibility that Japan has discharged a large amount of ballast water all over the world, Japan should ratify the convention to ensure its effectiveness as soon as possible

(millions k/t)

The Japanese ratification of the convention may urge Panama and Liberia to ratify it

The amount of exported BW from Japan

Because they are major shipping nations in the world, their ratification is important for the convention to come into effect

Presentation funded by APN

- Measures that we should take to prevent or to reduce the introduction of MIS

2. For the hull fouling

Propeller post

After part of the hull

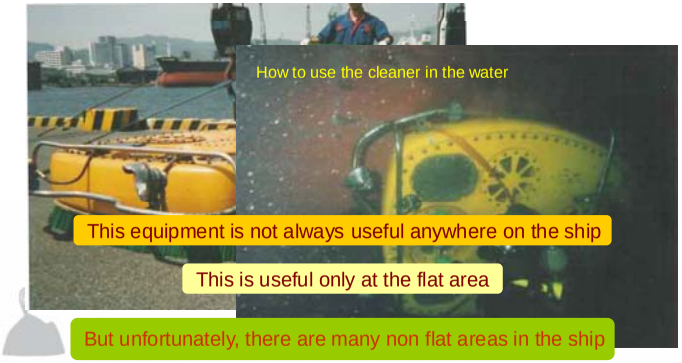
Propeller

Presentation funded by APN

- Measures that we should take to prevent or to reduce the introduction of MIS

What is the in-water cleaning?

The cost for the in-water cleaning is about 38,000 US$



This equipment is not always useful anywhere on the ship

This is useful only at the flat area

But unfortunately, there are many non flat areas in the ship

- Measures that we should take to prevent or to reduce the introduction of MIS

Typical area where this equipment is not work well is the niche area such as bow thruster, rope guard and so on

Among them, the most well known area is the sea chest

The sea chest is installed on ships to allow the ship to take in water for cooling purposes and ballast water

Sea chest

- Measures that we should take to prevent or to reduce the introduction of MIS

How has IMO worked on the hull fouling issue

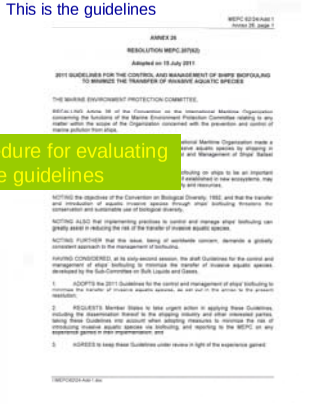
- After the adoption of the Ballast Water Convention, under the tide of opinion, the argument for the prevention or the reduction of biofouling on the hull began at MEPC（Marine Environment Protection Committee) which is one of the committee of IMO in 2006
- Three years later (in 2009), to develop the guidelines for the control and management of ships' biofouling, based on the work in the correspondence group, the discussion of the issue began officially at BLG (sub-committee on Bulk Liquids and Gases) 13
- After several discussions, the guidelines were adopted at MEPC62 in 2011

The name is "Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species"

- Measures that we should take to prevent or to reduce the introduction of MIS

2. The case of the Hull fouling

This is the guidelines



In the guidelines, practical guidance were provided. They are:

1) Biofouling management plan and record book
2) Antifouling system
3) In-water inspection
4) Design and construction
5) Dissemination of information
6) Training and education

But we have no procedure for evaluating the enforcement of the guidelines

Prospects for the future

Draft procedure for evaluation of the guidelines submitted by Australia, the Netherlands and New Zealand at BLG16/5/1 will be argued at BLG17 in 2013

- Conclusions
  - There are 39 unintentionally introduced MIS in Japanese waters
  - The number of MIS in Japan tends to be increased still now
  - Many MIS were introduced to Japan by hull fouling from nearby countries which have a similar climate and a frequent shipping traffic with Japan
  - To reduce the introduction via hull fouling, voluntary guidelines were adopted at MEPC in 2011
  - To make the guidelines effective, draft procedure for evaluation of the guidelines is supposed to be argued at BLG17 in 2013
    (I hope BLG17 will hold active discussions to apply the guidelines reconciling various conflicting interests)

Thank you very much for listening my presentation

Presentation funded by APN

Current situation of the MIS in Korea

Sook Shin
Dept. of Life Science
Sahmyook University
Seoul, Korea
NOWPAP DINRAC, OCT. 23, 2012

삼육대학교 SAHMYOOK UNIVERSITY

Presentation funded by APN

Contents

Presentation funded by APN

Cause of MIS inflow

1. Import of live marine organisms
2. High dependence on ocean trade (70%)

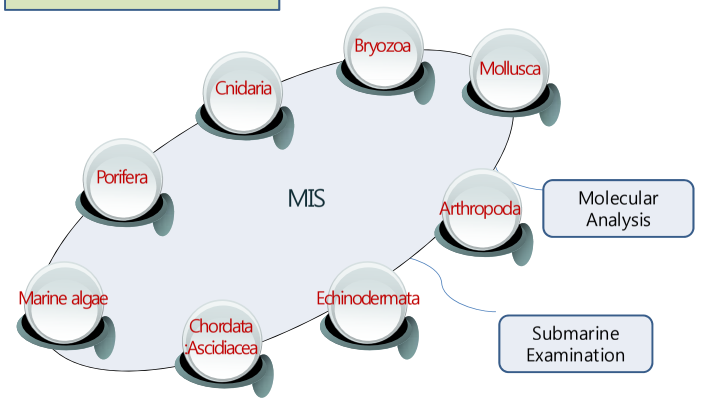
Major cause

- Non-intentional inflow by ships

: fouling (36%), ballast water (20%), fouling + ballast water (44%)

Presentation funded by APN

Major taxa of research



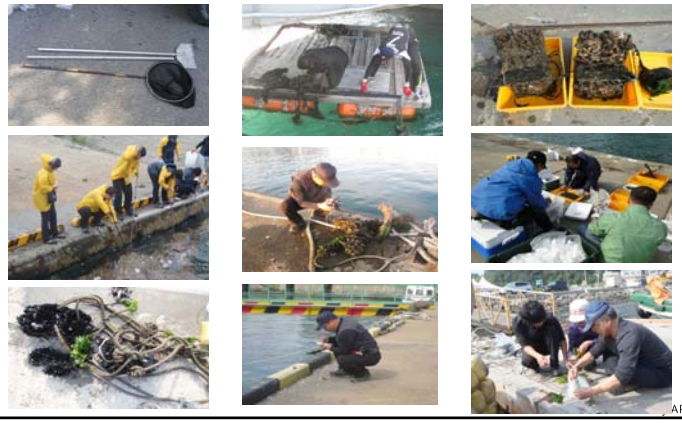
Presentation funded by APN

1. Monitoring of Major and Adjacent Harbors

- Monitoring sites :
  Major ports (12)
  + Adjacent harbors (11)
- Periods : Jun. to Aug.
  Oct. to Feb.

Presentation funded by APN

Collection	Photos and Record	Fixation



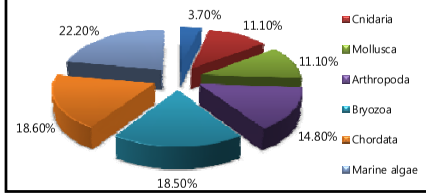
APN

MIS in Korea → 27

Taxa	No. of Species
Porifera	1
Cnidaria (Hydroida)	3
Mollusca	3
Arthropoda (Cirripedia)	4
Bryozoa	5
Chordata(Ascidiacea)	5
Marine algae	6
계	27

Seven Most outstanding MIS

Taxa	Species
Mollusca	*Mytilus galloprovinciallis*
Arthropoda (Cirripedia)	*Balanus amphitrite*
	Balanus perforatus
Chordata (Ascidiacea)	*Ciona intestinalis*
	Styela plicata
Marine algae	*Ulva armoricana*
	Ulva fasciata
계	7



Balanus perforatus

Presentation funded by APN

MIS from 10 major ports

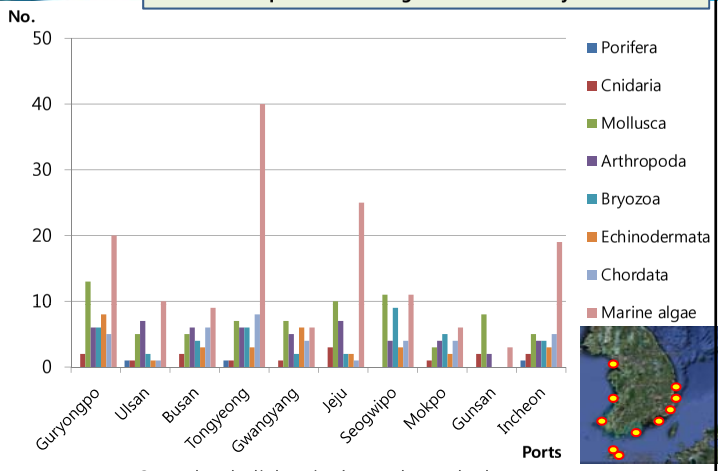
Taxa	Species	Guryongpo	Ulsan	Busan	Tongyeong	Gwangyang	Jeju	Seogwipo	Mokpo	Gunsan	Incheon	Total
Porifera	*Halichondria bowerbanki*		☆●		○☆●						☆●	1
Cnidaria: Hydroida	*Tubularia mesembryanthemum*	○☆●	○☆	○☆	○	☆			☆		○☆●	3
	Obelia dichotoma	☆●	○☆●	☆●	●	☆	●		☆●	☆		
	Bougainvillia ramosa		○	○	○	●					☆	
Mollusca	*Mytilus galloprovincialis*	○☆●	○☆●	○☆●	○☆●	○☆●			☆●	☆●	○☆●	3
	Crepidula onyx	○☆●		○	○	○☆			☆			
	Xenostrobus securis											
Arthropoda	*Balanus amphitrite*	○☆●	○☆●	○☆●	○☆●		☆●	○☆●	☆●		○☆●	4
	Balanus perforatus	○☆●	○☆●	○☆●								
	Balanus eburneus	○☆●	○☆●		○☆●							
	Balanus improvisus		○☆●		☆●	○☆●	☆		☆●			
Bryozoa	*Bugula californica*		○		○☆●	○☆		☆●	☆●		○	5
	Bugula neritina	○☆●	○●	○☆	○☆●	☆●		○☆●				
	Tricellaria occidentalis	○☆●	○☆●	○☆●	○☆●	☆	○☆	○☆●	☆●		☆●	
	Schizoporella unicornis	○☆●	○		☆●		○☆	○☆				
	Celleporaria brunnea	○	○	○	○		○☆	○☆●				
Chordata: Ascidiacea	*Ciona intestinalis*	○☆●	☆	○☆●	○☆●	○☆●		☆●	☆●		○☆●	5
	Styela plicata	○☆	○●	○☆●	○☆●	○☆●	○	○☆●	☆			
	Clavelina lepadiformis	●		○				☆●				
	Molgula manhattensis			●					☆●	☆	☆●	
	Ascidiella aspersa	●		●	●	●			●		●	
Marine algae	*Ulva armoricana*	●	○☆●		☆●	○☆	○☆●		☆		○☆●	6
	Ulva fasciata		○☆●	○☆●	○☆●	○	☆●	○				
	Ulva flexousa	○☆●	○		○●		○	○	☆●		○☆●	
	Ulva procera				○		○				○☆●	
	Antithamnion kylinii			☆●								
	Antithamnionella ternifolia	●										
2009		13	15	12	14	8	7	8	-	-	8	
2010		13	11	11	12	11	7	9	13	3	10	27
2011		16	12	11	16	7	4	8	10	1	12	

2009 : ○ 2010 : ☆ 2011 : ●

The quantity of MIS was proportional to big ports.

Presentation funded by APN

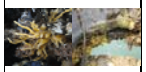
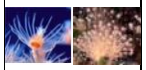
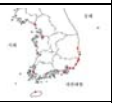
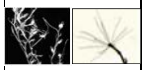
No. of species according to taxa in 10 major harbors



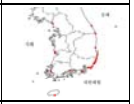
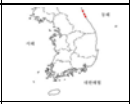
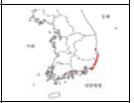
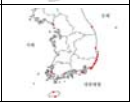
Compared to other kinds, marine algae was the most abundant.

Presentation funded by APN

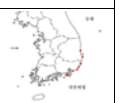
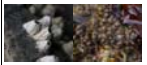
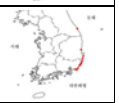
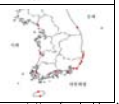
27 MIS in Korea

Taxa	Species	Photos	Situation	Status
Porifera (1)	*Halichondria bowerbanki*		Europe. No records about invasion damage in Korea.	
Cnidaria: Hydroida (3)	*Tubularia mesembryanthemum*		Mediterranean Sea, West Europe. Attached to hard substratum or vessels at about 30m depth of water.	
	Obelia dichotoma		North Atlantic (UK). Broadly distributed and invaded in the world.	
	Bougainvillia ramosa		Europe, North-west Atlantic, Broadly invaded in subtropical zone. And also found in Korea and Japan.	

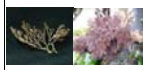
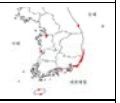
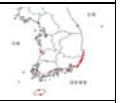
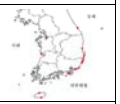
Presentation funded by APN

Taxa	Species	Photos	Situation	Status
Mollusca (3)	*Mytilus galloprovincialis* <Most outstanding MIS>		Mediterranean Sea, Black Sea, Adriatic Sea. Removal of native species in competition. Dominant species in many regions as result of rapid growth.	
	Xenostrobus securis		Australia. Color is dark brown and glossy. Similar shape with freshwater mussels, *Limnopema fortunei*.	
	Crepidula onyx		Southern California, Chile, Market value decrease due to attachment to shells of marine farming products like an abalone.	
	Balanus amphitrite <Most outstanding MIS>		Attached to bottom of ships and dock of harbor. Corrosion occurred when attached to ship. Caused decrease in speed of ship.	

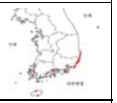
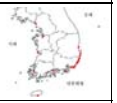
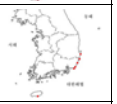
Presentation funded by APN

Taxa	Species	Photos	Situation	Status
Arthropoda: Cirripedia (4)	*Balanus eburneus*		North Atlantic, Caribbean Sea - Northern South America. Competition with native species for habitat.	
	Balanus perforatus <Most outstanding MIS>		West Europe, Northwest Africa, Black Sea, Mediterranean Sea. Competition with *Thais bronni* or oyster for habitat.	
	Balanus improvisus		Eastern North America. Attached to rocks, woods, bottom of ships, and shells of mussel, etc.	
	Bugula californica		California. Attached to bottom of ships and fish farming structures.	

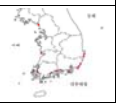
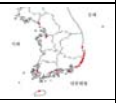
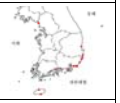
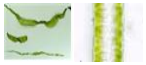
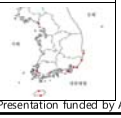
Presentation funded by APN

Taxa	Species	Photos	Situation	Status
Bryozoa (5)	*Bugula neritina*		Mediterranean Sea. Commonly found in bottom of ships. Decrease in speed and increase in consumption of excessive fuels due to resistance of vessels.	
	Tricellaria occidentalis		California. Attached to several fishing gears especially buoys of fishing farm, bottom of vessels, fishing net, and anchor.	
	Schizoporella unicornis		Atlantic (UK). Sticking to entire type of inanimate object like buoys of fishing farm, basket, ground of vessel, anchor, octopus fishing jar, and tire for collision avoidance in dock.	
	Celleporaria brunnea		Queen Charlotte Is. Invade into North-eastern Pacific through ballast water.	

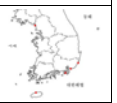
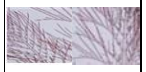
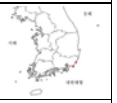
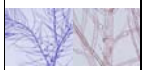
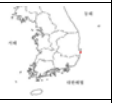
Presentation funded by APN

Taxa	Species	Photos	Situation	Status(10)
Chordata: Ascidiacea (5)	*Styela plicata* <Most outstanding MIS>		East America, Gulf of Mexico, West Indies. Pollution indicator species. Sticking to oyster farming facilities, farming raft, fishing net, bottom of ships, and dock of harbors.	
	Ciona intestinalis <Most outstanding MIS>		Atlantic Ocean. Inhabit in bottom of vessels and oyster farming facilities, etc. In case of farm, attached to take a possession of living organisms or interrupting their development.	
	Clavelina lepadiformis		Atlantic ocean, North Sea, Mediterranean Sea. Invaded by fouling. Damage due to invasion appeared to be minimal.	
	Mogula manhattensis		Atlantic ocean. Introduced by ballast water. Generally covered by mud like a dust.	

Presentation funded by APN

Taxa	Species	Photos	Situation	Status
Chordata: Ascidiacea (5)	*Ascidiella aspersa*		Atlantic (UK). Irregular bumps on body surface.	
Marine algae (6)	*Ulva armoricana* <Most outstanding MIS>		Atlantic (France). Blooming of green tides occurred in France Brittany coast of Atlantic. Increasing possibility of damage.	
	Ulva fasciata <Most outstanding MIS>		Mediterranean Sea. Attached to bedrock, cement wall, and rope, etc. If breeding increase a lot, there will be possibility to have an algae outbreak.	
	Ulva flexusa		Mediterranean Sea, Adriatic Sea. Attached to bedrock, rope, and hull, etc. Possibility to have an algae outbreak.	

Presentation funded by APN

Taxa	Species	Photos	Situation	Status
Marine algae (6)	*Ulva procera*		Coast of Sweden. Very dangerous invasive species in the coast of Northeast Asia.	
	Anithamnion kylinii		California. Introduced through fouling of ships. Reported for the first time in Northeast Asia.	
	Antithamnionella ternifolia		Chile, Cape Horn. Similar to native species, *A. spirographidis*, but different shape in whole branch of twig.	
27 MIS (7 most outstanding MIS)				

Presentation funded by APN

MIS in Korea
: 18 species (April, 2010)

•Porifera	*Halichondria bowerbanki*
•Mollusca	*Mitilus galloprovincialis*
	Crepidula (Crepidula) onyx
•Arthropoda (Crripedia)	*Balanus amphitrite*
	Balanus eburneus
	Balanus perforatus
	Balanus improvisus
•Buyozoa	*Bugula californica*
	Bugula neritina
	Tricellaria occidentalis
	Schizoporella unicornis
•Chordata (Ascidiacea)	*Styela plicata*
	Ciona intestinalis
	Clacelina lepadiformis
•Marine algae	*Ulva armoricana*
	Ulva fasciata
	Ulva flexousa
	Ulva procera

(7 most outstanding MIS)

Presentation funded by APN

2. Plates affixa experiments

Sites of experiments

Donghae

Guryongpo

Busan

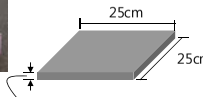
Tongyoung

Incheon

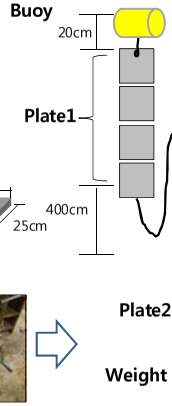
Presentation funded by APN

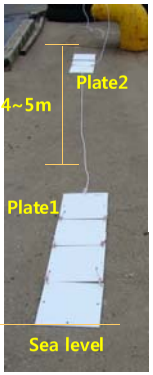
Preparation of plates affixa for attachment of organisms

- Cross type



- Linear type



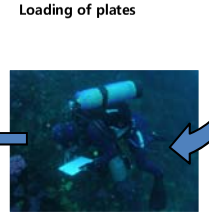


Presentation funded by APN

Procedures of study

Manufacture of plates affixa

Loading of plates

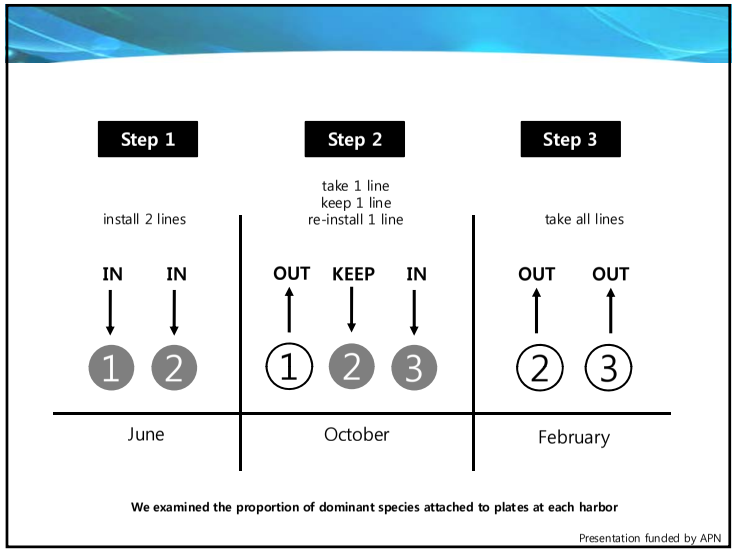


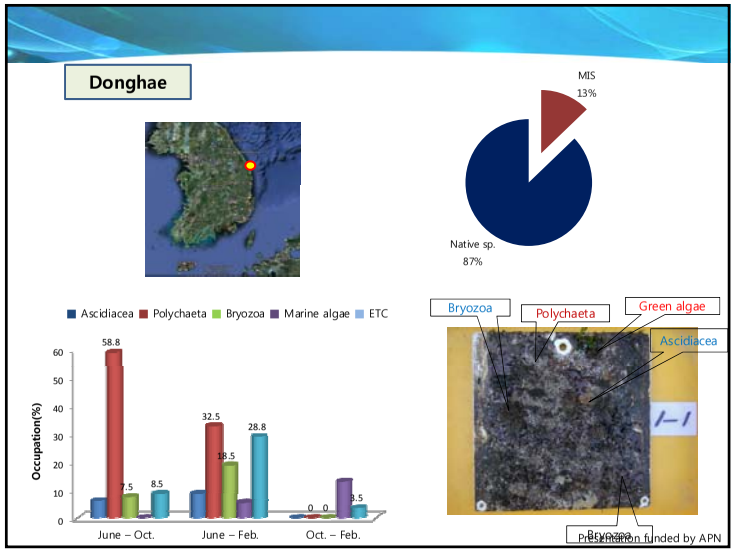
Investigation of quay wall in harbor

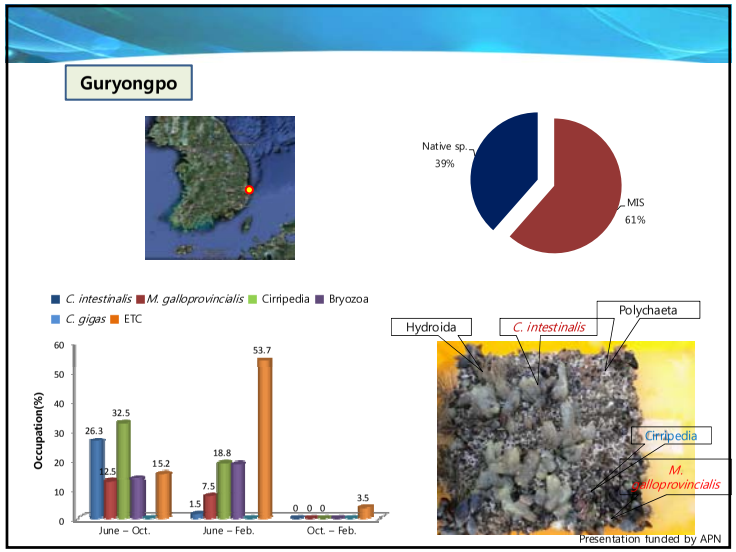
Treatment of specimens

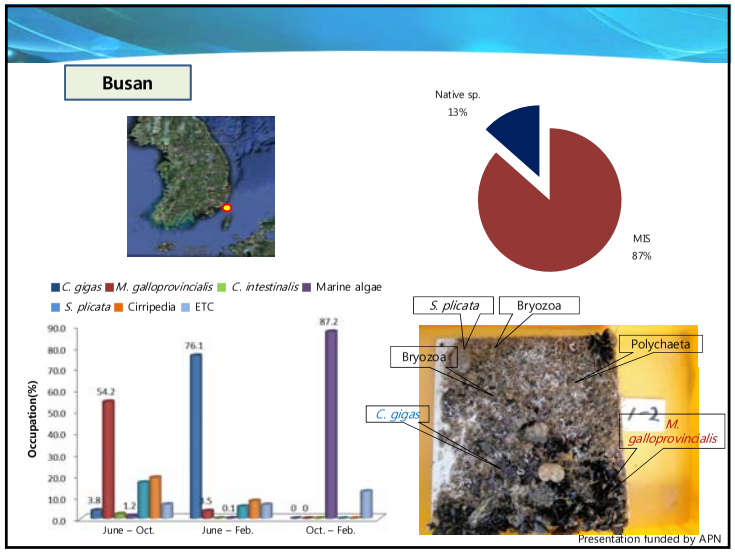
Analysis of data

Presentation funded by APN

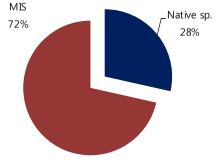

Step 1
Step 2
Step 3
install 2 lines
take 1 line
keep 1 line
re-install 1 line
take all lines
IN
IN
OUT
KEEP
IN
OUT
OUT
1
2
1
2
3
2
3
June
October
February
We examined the proportion of dominant species attached to plates at each harbor
Presentation funded by APN

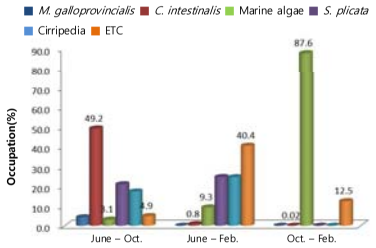

Donghae
MIS
13%
Native sp.
87%
Ascidiacea Polychaeta Bryozoa Marine algae ETC
Occupation(%)
58.8
7.5
8.5
32.5
28.8
18.5
0
0
3.5
June – Oct.
June – Feb.
Oct. – Feb.
Bryozoa
Polychaeta
Green algae
Ascidiacea
1-1
Bryozoa
Presentation funded by APN

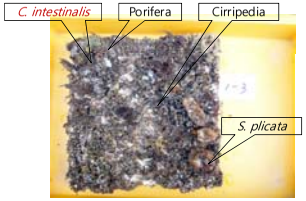

Guryongpo
Native sp.
39%
MIS
61%
C. intestinalis M. galloprovincialis Cirripedia Bryozoa
C. gigas ETC
Occupation(%)
26.3
12.5
32.5
15.2
1.5
7.5
18.8
53.7
0
0
0
3.5
June – Oct.
June – Feb.
Oct. – Feb.
Hydroida
C. intestinalis
Polychaeta
Cirripedia
M. galloprovincialis
Presentation funded by APN


Busan
Native sp.
13%
MIS
87%
C. gigas M. galloprovincialis C. intestinalis Marine algae
S. plicata Cirripedia ETC
Occupation(%)
3.8
54.2
1.2
76.1
3.5
0.1
0
0
87.2
June – Oct.
June – Feb.
Oct. – Feb.
S. plicata
Bryozoa
Bryozoa
Polychaeta
C. gigas
1-2
M. galloprovincialis
Presentation funded by APN

Tongyoung

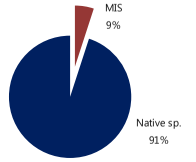


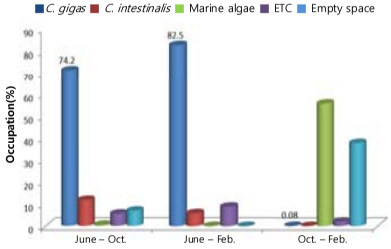


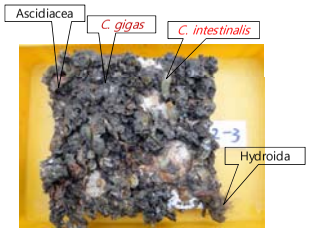


Presentation funded by APN

Incheon

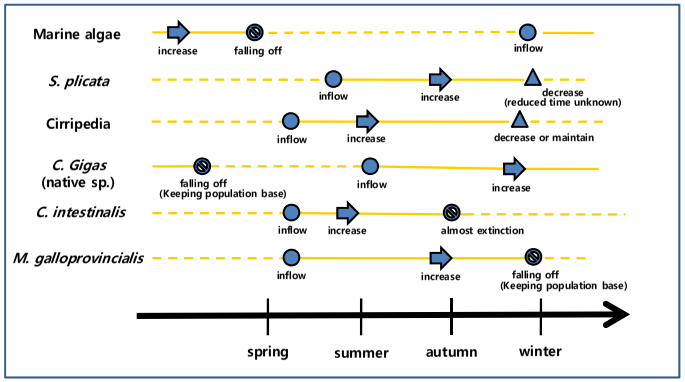






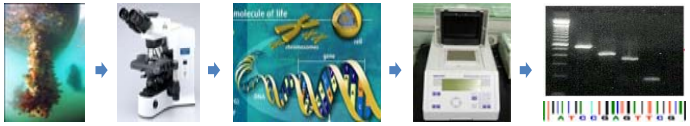
Presentation funded by APN

Seasonal change of the MIS on Plates



Presentation funded by APN

3. Molecular Analysis of MIS



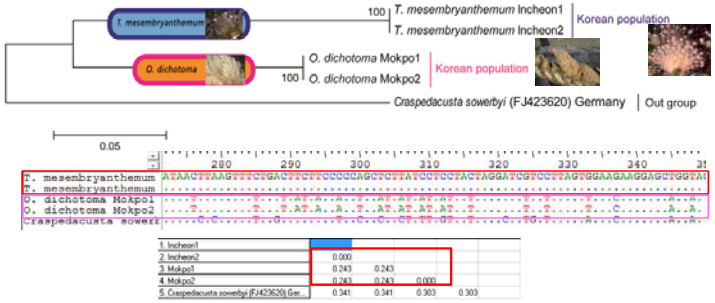
Collection → identification → DNA extraction → DNA amplification → DNA sequencing

gene	Taxa	Species
mt-COI	Cnidaria, Hydroida	*T. mesembryanthemum, O. dichotoma O. dichotoma*
	Mollusca	*M. galloprovincialis, C. onyx*
	Arthropoda, Cirripedia	*B. perforatus, B. amphitrite*
	Bryozoa	*B. neritina, B. californica , C. brunnea, S. unicornis*
	Chordata, Ascidiacea	*C. intestinalis, S. plicata*
ITS1		*M. galloprovincialis , B. perforatus, B. amphitrite,*
ITS2		*B. perforatus, B. amphitrite, C. intestinalis*
18S rRNA	Chordata, Ascidiacea	*C. intestinalis, S. plicata M. manhattensis, A. aspersa*
plastid *rbc*L	Marine algae	*U. armoricana, U. fasciata, U. flexuosa, U. procera, A. kylinii*

Presentation funded by APN

Results of Molecular Analysis

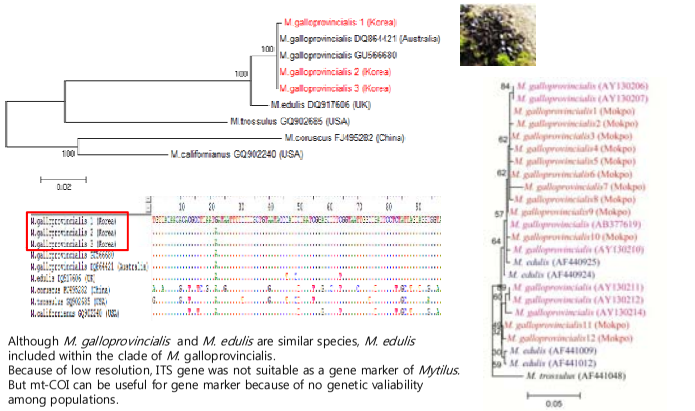
Cnidaria Hydroida: *Tubularia mesembryanthemum, Obelia dichotoma* – mt-COI



No genetic variability among Koran population. Mt-COI gene was useful to identify hydroid MIS.

Presentation funded by APN

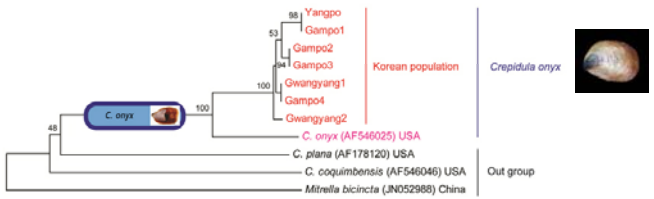
Mollusca Pelecypoda: *Mytilus galloprovincialis* – mt-COI, ITS1



Although *M. galloprovincialis* and *M. edulis* are similar species, *M. edulis* included within the clade of *M.* galloprovincialis.
Because of low resolution, ITS gene was not suitable as a gene marker of *Mytilus*. But mt-COI can be useful for gene marker because of no genetic valiability among populations.

Presentation funded by APN

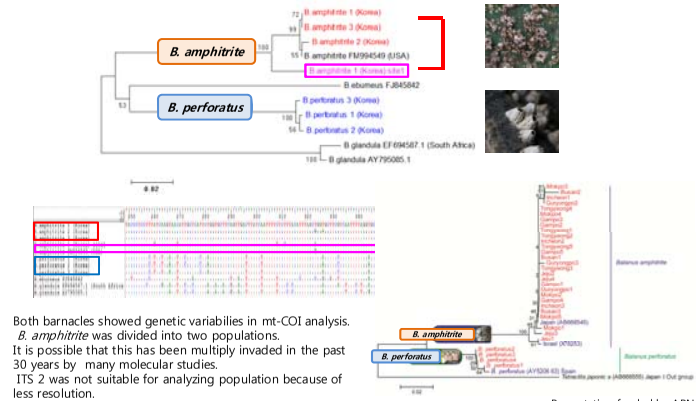
Mollusca Gastropoda : *Crepidula onyx* – mt-COI



There was genetic variability. Intraspecies variation was less than 1.2% in Korean populations
But between Korea and the US was about 4.7% - 5.3%. Interspecies variation was 13-16%.

Presentation funded by APN

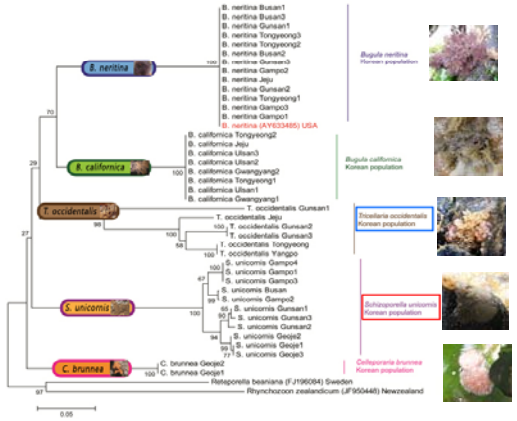
Arthropoda Cirripedia : *Balanus amphitrite, B. perforatus* – mt-COI, ITS2



Both barnacles showed genetic variabilies in mt-COI analysis.
B. amphitrite was divided into two populations.
It is possible that this has been multiply invaded in the past 30 years by many molecular studies.
ITS 2 was not suitable for analyzing population because of less resolution.

Presentation funded by APN

Bryozoa: *Bugula neritina* , *Bugula californica* , *Tricellaria occidentalis* , *Schizoporella unicornis* , *Celleporaria brunnea* – mt-COI

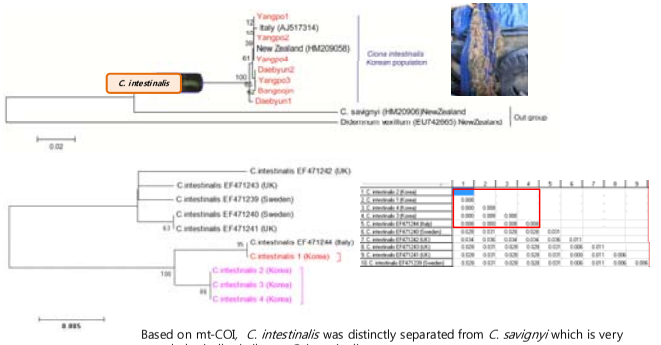


There were no genetic differences in 3 species such as *Bugula neritina, B californica*, and *Celleporaria brunnea*

But
T occidentalis and *S. uniconis* had more than 2 existing populations. So, we need additional research.

Presentation funded by APN

Chordata Ascidiacea : *Ciona intestinalis* – mt-COI, ITS2

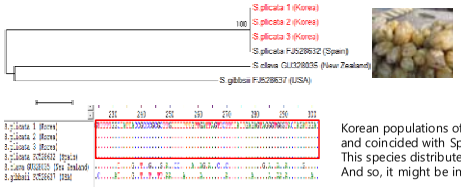


Based on mt-COI, *C. intestinalis* was distinctly separated from *C. savignyi* which is very morphologically similar to *C. intestinalis* .

IST 2 confirmed two Korean populations
Italian and Korean populations were closely related.

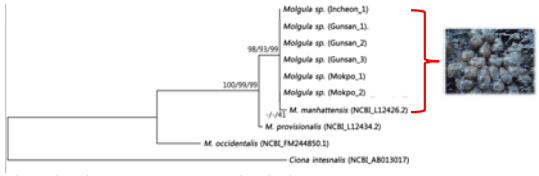
Presentation funded by APN

Chordata Ascidiacea : *Styela plicata* – mt-COI gene



Korean populations of *S. plicata* has no genetic differences. and coincided with Spain.
This species distributed in the central part of Atlantic.
And so, it might be introduced from Spain.

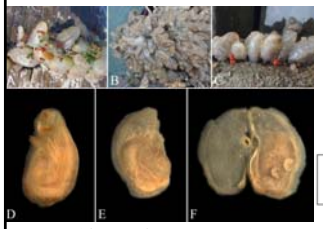
Chordata Ascidiacea : *Molgula manhattensis* – 18S rRNA



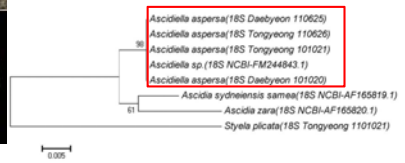
The similarity between our specimens and Genbank 's was 99%.

Presentation funded by APN

Chordata Ascidiacea : *Ascidiella aspersa* – 18S rRNA



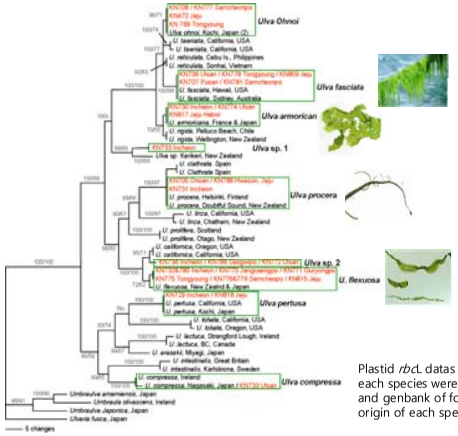
A-C. External features of *A. aspersa*, D. right view, E. left view, F. sagittal view.



Intraspecies variation 0 %

Presentation funded by APN

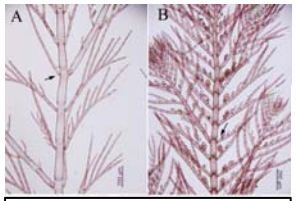
Marine algae : genus *Ulva* – plastid *rbc*L gene



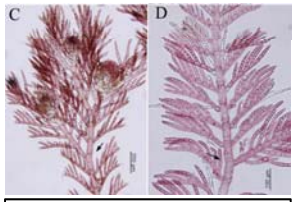
Plastid *rbc*L datas showed that all the sequences of each species were equal between Korean specimens and genbank of foreign country that might be the origin of each species.

Presentation funded by APN

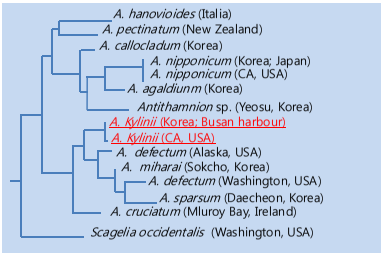
Marine algae Rhodophyceae : *Antithamnion kylinii* – plastid *rbc*L gene



A-B: *Antithamnion kylinii* (MIS)



C-D. *Antithamnion sprasum* (native sp.)



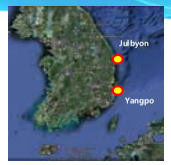
Busan in 2011.

rbcL sequences of Korean specimens to US were have 1 base pair difference.
And so, there were very likely to inflow from American pacific to South Korea.

Presentation funded by APN

4. Predator of MIS (Natural enemy)

Unlike land invasive species, it is very difficult to discover and remove MIS due to quick spread by the vessel and an ocean current.

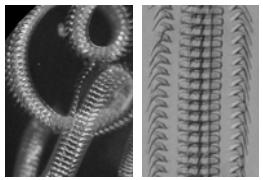


Mollusca Gastrododa

Thais bronni **(native sp. ; predator)**

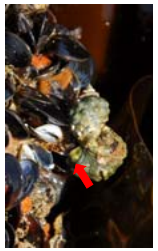
→ *Mytilus galloprovincialis* **(MIS; prey)**

Biological control method

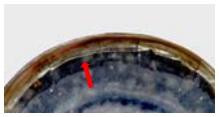


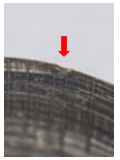
Gastropods usually predate bivalves by making a hole with radula.
Holes in a center of shell were rarely seen in *M. galloprovincialis*.

Presentation funded by APN



M. galloprovincialis and *T. bronni*





Thais bronni usually attached to marginal area rather than shell surface of *M. galloprovincialis*.

Presentation funded by APN

Jukbyon, Nogok

Jukbyon

T. bronni drilled mainly marginal area where the adductor muscle of *M. galloprovincialis* was located by avoiding byssus.

Biological control method

Presentation funded by APN

Summary

1. Twenty seven MIS were identified from the inside of 12 major and 11 adjacent harbors in Korea.
2. At the beginning of plates affixa submerged, the MIS were predominantly found to attach on plates, and as the time goes by the ratio of native species increased and was shown to change like the wharf wall of harbors.
3. Molecular analysis was done to make sure of the MIS. Mt-COI for animal MIS and plastid *rbc*L gene for marine algae were found to be valuable markers of species identification.
4. *T. bronni*, a native species of Gasropoda, Mollusca, was found to be a natural enemy of *M. galloprovincialis,* one of the most outstanding MIS. Biological control method is available to get rid of MIS.

Presentation funded by APN

Marine invasive species in the Russian Far East: an overview

Konstantin A. Lutaenko

A.V. Zhirmunsky Institute of Marine Biology
FEB RAS

Presentation funded by APN

⟹ Biological invasions in marine environment represent a serious ecological and economic menace leading to biodiversity loss, ecosystem unbalancing, fishery and tourism impairment; they are lesser known aspect of global change.

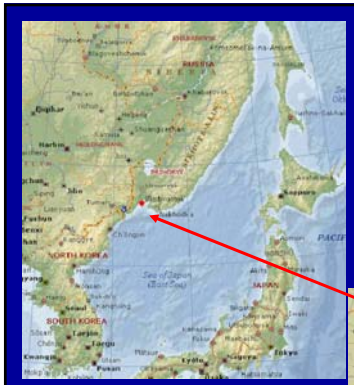
⟹ We are witnessing rapidly growing interest in the phenomenon of biological invasions as a result of an increasing number of unintentional invasions of marine organisms due to the release of ballast water through international shipping activities, and of increasing aquaculture purposes and for open sea fisheries enhancement.

⟹ Bioinvasions create so-called "novel" (or "emerging") ecosystems containing new combinations of species that arise through human action, environmental change, and the impacts of the deliberate and inadvertent introductions of species from other regions.

Presentation funded by APN

NOWPAP region and the southern part of the Russian Far East

Presentation funded by APN



The Russian Federation's part of the NOWPAP region is located in the North-West Pacific between the Asia coast, the Japanese Islands and the Sakhalin Island. It is situated between 34°26' and 51°41' N and between 127°20' and 142°15' E

Arrow points Peter the Great Bay

Peter the Great Bay is the most studied area with regard to marine invasive species in the Russian Far East

Presentation funded by APN

Pathways (vectors and routes) of introduction of MIS in the Russian NOWPAP region

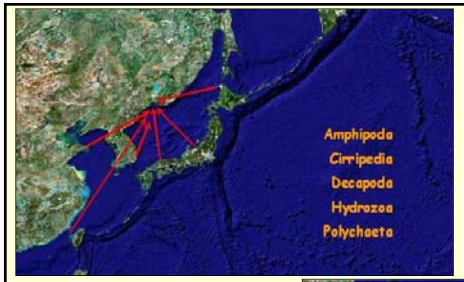
Shipping and ballast waters +

Aquaculture -

Intentional introductions -

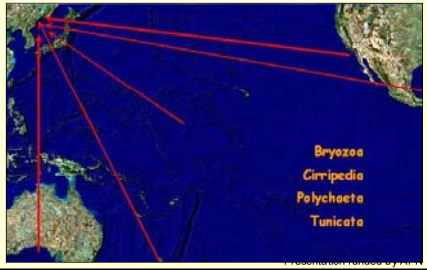
Climatic changes +

Presentation funded by APN



Asian vectors of introductions of MIS into the Russian part of the NOWPAP region (http://www.imb.dvo.ru/files/ballast.pps).

Trans-Pacific vectors of introductions of MIS into the Russian part of the NOWPAP region (http://www.imb.dvo.ru/files/ballast.pps).

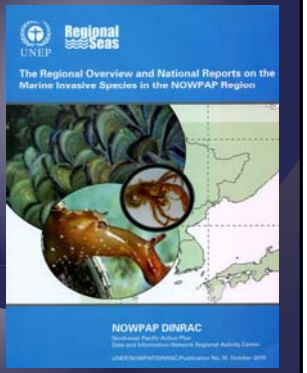


Presentation funded by APN

In Peter the Great Bay, about 16000 ships enter ports and harbours every year, and among them about 8000 ships operate on international lines (Zvyagintsev, 2007). A majority of ships (more than 10000) go into the **Vladivostok Port**. Such an intensive traffic favours introductions of alien species through fouling communities and release of ballast waters.

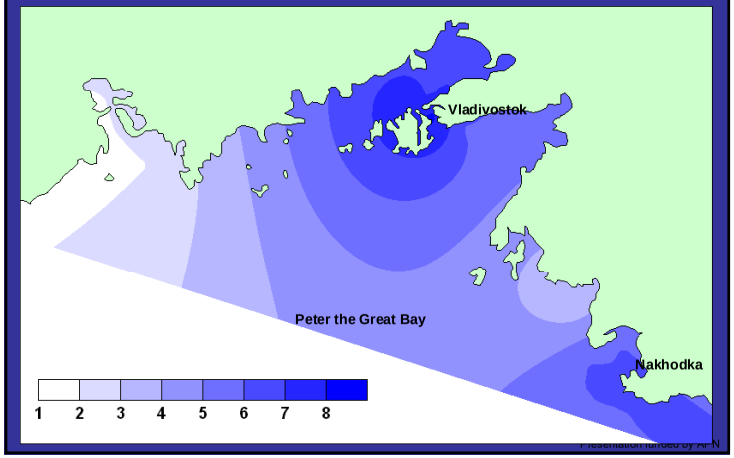
Presentation funded by APN

In Russian waters of NOWPAP area, 37 species MIS were known by 2010 (The Regional Overview and National Reports…, 2010) but this number may increase up to 66 (Zvyagintsev et al., 2011).



Presentation funded by APN

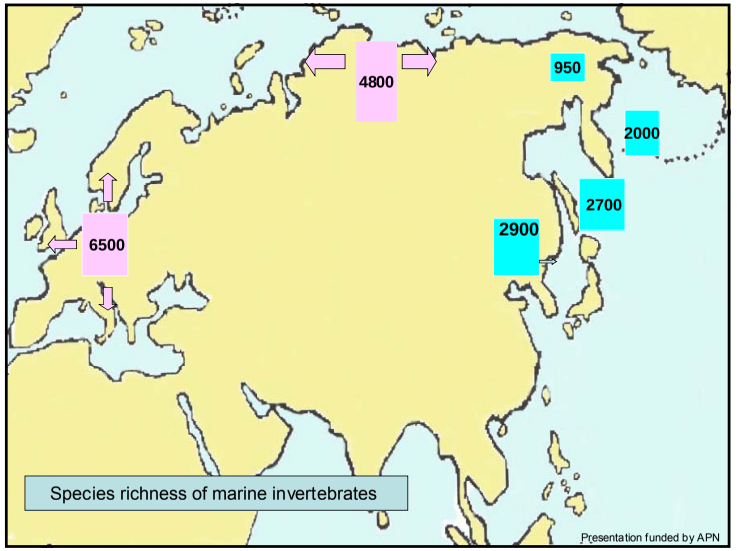
More than 60 introduced species have been presently recorded for the Russian Far East seas. In Peter the Great Bay 51 species have been identified as non indigenous; 17 of them are fouling species.



By its biological diversity, Peter the Great Bay can be considered among the richest and most productive regions of Russia

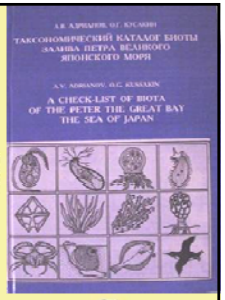
- in the number of species of marine organisms, the bay significantly exceeds similar water areas in Russian Far-Eastern Seas;
- the bay is inhabited by more then 3800 species of microorganisms, fungi, plants and animals belonging to 1855 genera, more than 840 families, 104 classes and 52 phyla;
- among the species inhabiting Peter the Great Bay, 68 species of fish and more than 40 species of invertebrates and plants are commercially important.

Presentation funded by APN



52 phyla; 104 classes; 840 families; 1855 genera; 3800 species

Cyanophyles – 130
Rodophyles – 147
Dinophyles – 183
Phaeophyles – 72
Diatomophyles – 331
Chlorophyles – 76
Ciliophora – 157
Fungi – 68
Cnidaria – 96
Plathelminthes – 222
Nemathelminthes – 178
Annelida – 277
Mollusca – 330
Crustacea – 620
Echinodermata – 74
Chordata - 332



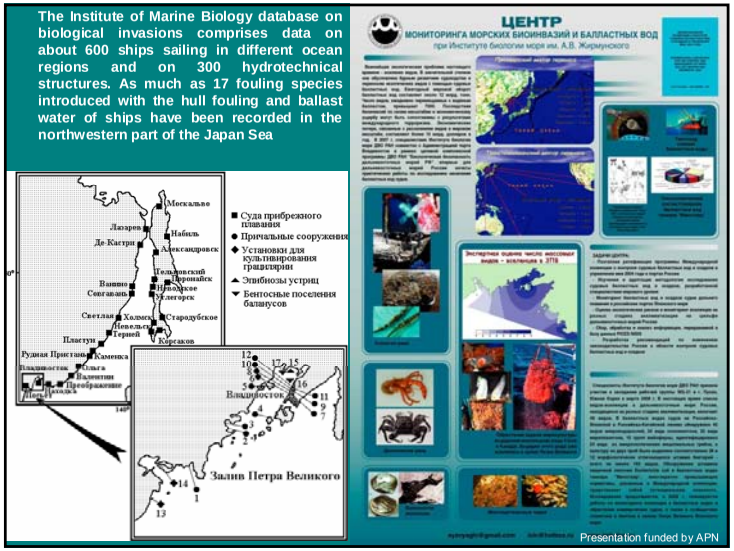
Peter the Great Bay

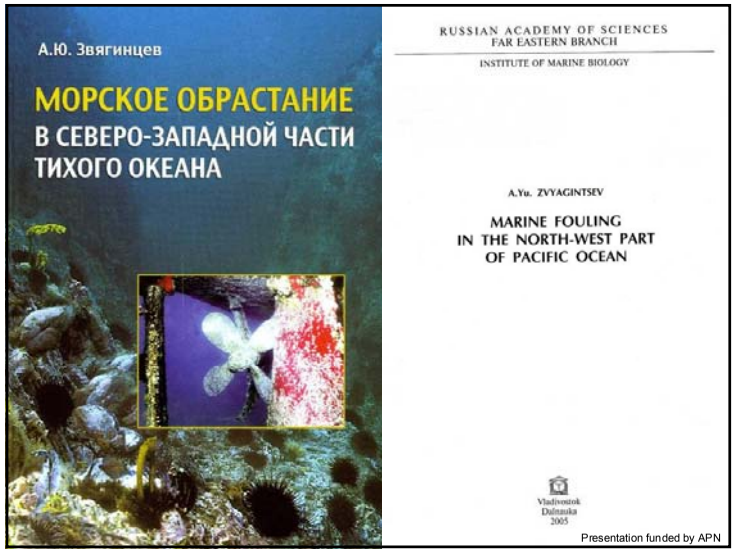
Among the species inhabiting Peter the Great Bay, 68 species of fish and more than 40 species of invertebrates and algae are commercially important

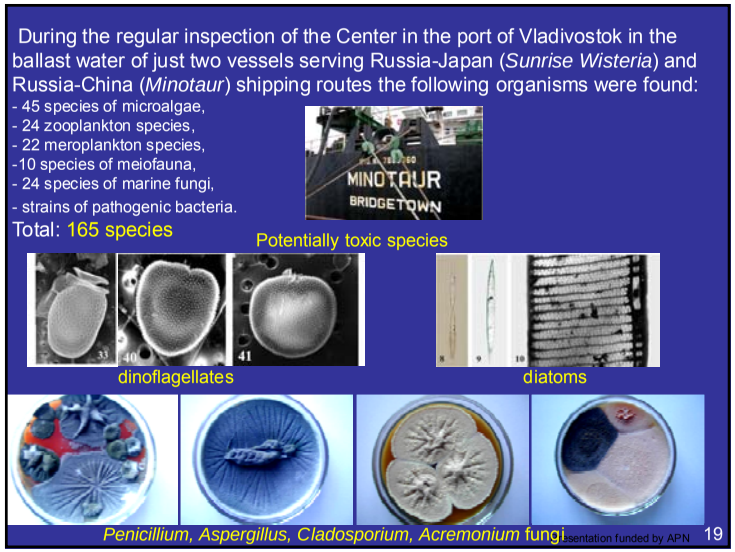
Presentation funded by APN

17 subtropical species of marine invertebrates (hydroids, barnacles, amphipods, polychaetes, bryozoans, and ascidians) have been introduced to Peter the Great Bay in the last decade, and are now at different stages of acclimatization. All the above-listed animals constitute fouling communities of hydrotechnical structures

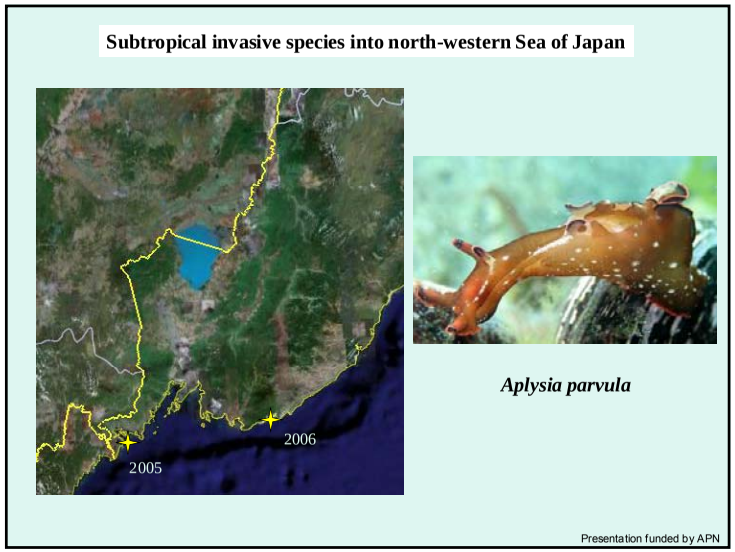
The Institute of Marine Biology database on biological invasions comprises data on about 600 ships sailing in different ocean regions and on 300 hydrotechnical structures. As much as 17 fouling species introduced with the hull fouling and ballast water of ships have been recorded in the northwestern part of the Japan Sea




А.Ю. Звягинцев
МОРСКОЕ ОБРАСТАНИЕ
В СЕВЕРО-ЗАПАДНОЙ ЧАСТИ
ТИХОГО ОКЕАНА
RUSSIAN ACADEMY OF SCIENCES
FAR EASTERN BRANCH
INSTITUTE OF MARINE BIOLOGY
A.Yu. ZVYAGINTSEV
MARINE FOULING
IN THE NORTH-WEST PART
OF PACIFIC OCEAN
Vladivostok
Dalnauka
2005
Presentation funded by APN


During the regular inspection of the Center in the port of Vladivostok in the ballast water of just two vessels serving Russia-Japan (Sunrise Wisteria) and Russia-China (Minotaur) shipping routes the following organisms were found:
- 45 species of microalgae,
- 24 zooplankton species,
- 22 meroplankton species,
-10 species of meiofauna,
- 24 species of marine fungi,
- strains of pathogenic bacteria.
Total: 165 species
MINOTAUR
BRIDGETOWN
Potentially toxic species
dinoflagellates
diatoms
Penicillium, Aspergillus, Cladosporium, Acremonium fungi
sentation funded by APN
19


MINOTAUR
BRIDGETOWN
Stomatopoda,
псевдозоэа
Brachyura,
мегалопа
Larvae in ballast water
Presentation funded by APN
20


Subtropical invasive species into north-western Sea of Japan
2006
2005
Aplysia parvula
Presentation funded by APN

Subtropical and tropical species of the Opisthobranchia in Peter the Great Bay

Presentation funded by APN

Abalone *Haliotis discus* found in Peter the Great Bay (Rakov, Arhipov, 2004)

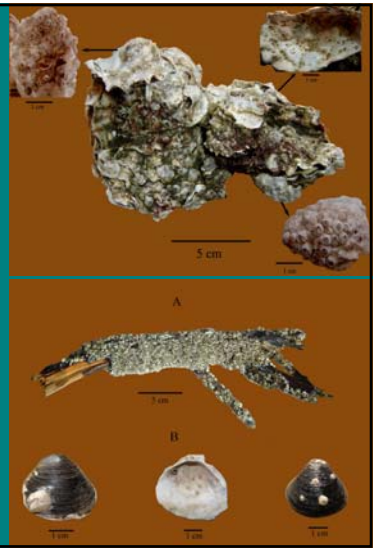
Presentation funded by APN

Amphibalanus improvisus, a barnacle, was recorded for the first time in the fouling of hydrotechnical constructions of Peter the Great Bay in 1969 (Zevina, Gorin, 1971)

Balanus amphitrite is a subtidal widely distributed tropical-subtropical species. According to Zevina and Gorin (1975), this species occurred in the fouling of buoys in Nakhodka, Strelok, and Amursky bays only in warm years. In Peter the Great Bay, Zvyagintsev (2003) found *B. amphitrite* in the fouling of 46% of the examined active vessels.

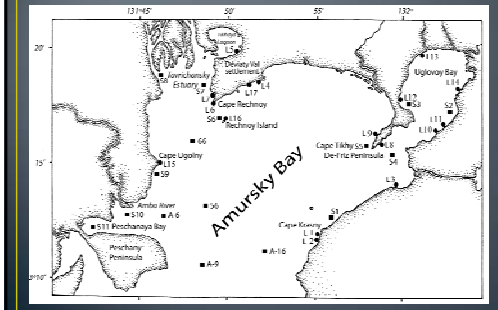
Presentation funded by APN

Invasive species of barnacle *Amphibalanus improvisus* in Amursky Bay



Presentation funded by APN

A successful naturalization of the invasive barnacle *Amphibalanus improvisus* led to displacement of indigenous cirripeds from dominating macrobenthic species of the local fauna (Ovsyannikova, 2008)



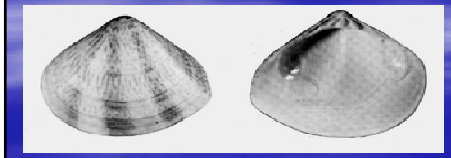
Distribution of *Amphibalanus improvisus* in Amursky Bay

Presentation funded by APN

New immigrants – alien species of bivalve mollusks in north-western Sea of Japan/East Sea

Mytilus galloprovinciallis (Mytilidae)

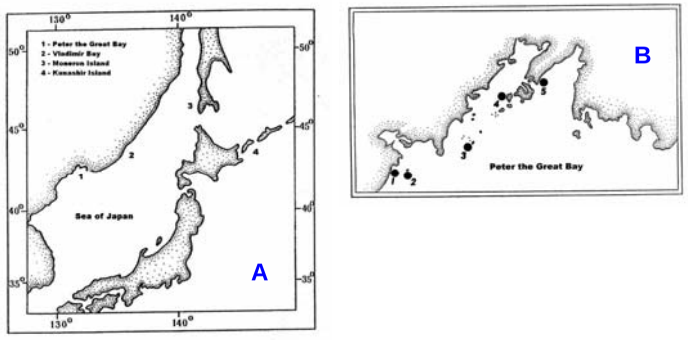
introduced in 1970s



Gomphina aequilatera (Veneridae)

introduced in 1990s

Presentation funded by APN



Regional (A) and local (B) distributions of *Mytilus galloprovinciallis* in the Russian Far Eastern seas

Presentation funded by APN

Economic impact

The mussel *M. galloprovinciallis* which became an abundant component of biofouling in Peter the Great Bay in the 1990s (Ivanova, Lutaenko, 1998) may damage aquaculture installations but, at the same time, this mussel and its hybrids with local allied species *Mytilus trossulus* are perspective object of aquaculture

Presentation funded by APN

Polychaetes (Polychaeta)

- ***Polydora limicola.*** In fouling of HTC in Vladivostok, Nakhodka, Nevelsk, Kholmsk, Korsakov, and Uglegorsk.
- ***Hydroides elegans.*** It dominates the fouling in Peter the Great Bay, and its biomass increases toward the innermost part of the bay.
- ***Pseudopotamilla occelata.*** The greatest quantitative indices for the population density of this species were registered in the fouling in western Sakhalin; it was found also along the coasts of Primorye and the southern Kurile Islands on rocky coast.
- ***Perinereis aibuhitensis.***

Presentation funded by APN

Polychaetes

Pseudopotamilla occelata found in Peter the Great Bay (Zvyagintsev et al., 2009)

Presentation funded by APN

PLANKTON

In Amursky Bay, long-term studies of the species composition of phytoplankton carried out during the period from 1991 to 2006 revealed a total of 357 species of planktonic microalgae from eight divisions: Cyanophyta (8 species), Chrysophyta (8), Bacillariophyta (157), Cryptophyta (5), Dinophyta (143), Raphidophyta (3), Euglenophyta (11), and Chlorophyta (22 species); some of them can be invasive species but it is diffucult to prove as there was no long-term monitoring in the area (Orlova et al., 2009).

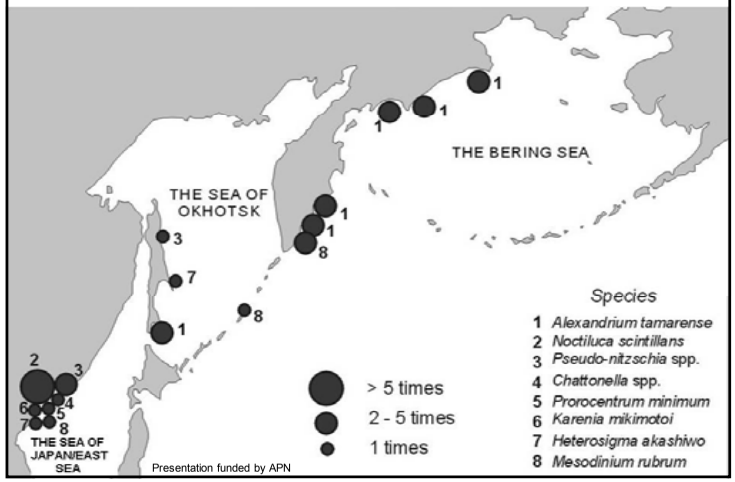
Presentation funded by APN

New records or invasive species?

- Appearance of the dinoflagellate ***Scrippsiella spinifera*** in Possjet Bay in 1999 might be related to the introduction with warm waters from the coast of Japan (Selina et al., 2009)
- A dinoflagellate ***Gyrodinium instriatum***, new for Russian waters of Russia and found in Peter the Great Bay, probably, penetrated to the bay with ballast waters (Orlova et al., 2003)
- A diatom ***Cerataulina dentata*** was recorded for the first time in Peter the Great and previously was known in tropical-subtropical regions (Stonik, Orlova, 1998)
- A copepod crustacean, ***Pseudocalanus inopinus*** was found in ballast waters of the *Timber Star* motorship (Russia-Japan shipping lines) which is rare or occasional component of plankton communuties of Peter the Great Bay and a marker of the arrival of tropical warm waters (Zvyagintsev and Selifonova (2008)

Presentation funded by APN

Harmful algal blooms in the Russian Far East seas in 1980-2005



Presentation funded by APN

Institute of Marine Biology Research Center

Far East Centre of Monitoring of HABs (Harmful Algal Bloom) and Biotoxins

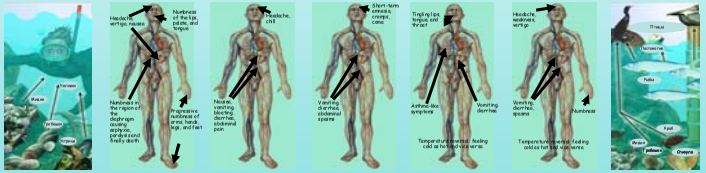
Presentation funded by APN 28

Microalgal toxins and their impact on human health

Types of poisoning	Producers	Major toxins
Paralytic shellfish poisoning (PSP)	*Alexandrium catenella, A. cohorticula, A. fundyense, A. fraterculus, A. kei, A. minutum, A. tamarense, A. andersonii, A. ostenfeldii, A. tamiyavanichii, Gymnodinium catenatum, Pyrodinium bahamense var. compressus*	Saxitoxins (STXs)
Diarrhetic shellfish poisoning (DSP)	*Coolia sp., Dinophysis acuta, D. caudate, D. fortii, D. norvegica, D. mitra, D. rotundata, D. sacculus, D. fortii, D. miles, D. norvegica, D. tripos, Prorocentrum lima, P. arenarium, P. belizeanum, P. cassubicum, P. concavum, P. faustiae, P. hoffmannianum, P. maculosum, Protoceratium reticulatum, Phalacroma rotundatum*	Okadaic acid, dinophysis toxins (DTXs), yessotoxins (YTXs) and pectenotoxins (PTXs)
Amnesic shellfish poisoning (ASP)	*Pseudo-nitzschia australis, P. delicatissima, P. fraudulenta, P. multiseries, P. multistriata, P. pseudodelicatissima, P. pungens, P. seriata, P. turgidula*	Domoic acid
Neurotoxic shellfish poisoning (NSP)	*Karenia brevis, K. brevisulkata, K. papilionacea, K. selliformis, K. bicuneiformis, K. concordia*	Brevetoxins (PbTXs)
Ciguatera fish poisoning (CFP)	*Gambierdiscus toxicus, Linguladinium polyedrum, Prorocentrum lima, P. concavum, P. hoffmannianum, P. mexicanum, P. rhathytum, Ostreopsis lenticularis, O. ovata, O. siamensis, Akashiwo sanguinea*	Ciguatoxins (CTXs), maitotoxins (MTXs), palytoxin, gambierol
Azaspiracid shellfish poisoning (AZP)	*Protoperidinium crassipes*	Azaspiracids (AZAs)
Fish kills	*Chaetoceros convolutus, Chattonella marina, Cochlodinium polykrikoides, Fibrocapsa japonica, Heterosigma akashiwo, Karenia mikimotoi, K. brevisulkata, Karlodinium micrum, Pfiesteria piscicida, Prorocentrum arabianum, P.minimum, P.rocentrum micans*	

Scheme of toxin transfer — Symptoms of poisoning — Scheme of toxin transfer

PSP DSP ASP NSP CFP



Presentation funded by APN 31

30 species are bloom-forming

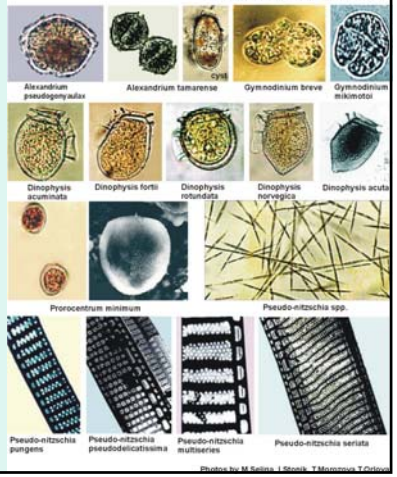
24 species are known to be harmful

Toxic plankton can be subdivided into three categories:

DSP – diarrhetic shellfish poisoning
ASP amnesic shellfish poisoning,
PSP – paralytic shellfish poisoning

Harmful Microalgae in Russia

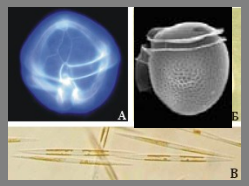
Species found in Far Eastern Seas of Russia and known to be toxic elsewhere



Presentation funded by APN

Annual and seasonal long-time monitoring of phytoplankton, including toxic microalgae

Among 200 species of microalgae responsible for blooms about 50 species produce toxins. In Peter the Great Bay, 25 potentially toxic species have been found.



Number of cysts of *A. tamarense* varies from 100 to 60 000 per g of the bottom sediment.

Dinophysis **(ocadaic acid) – DSP (50), diarrhoeic shellfish poisoning – acute gastroenteritis)**
Pseudo-nitzschia **(domoic acid) – ASP (80), anmesia shellfish poisoning) (up to 760 ng/ml)** ***Alexandrium*** **(saxitoxin) – PSP (1100) (**paralytic shellfish poisoning)

Presentation funded by APN

Annual and seasonal long-time monitoring of fish fauna in Peter the Great Bay

Ichthyofauna of the Russian waters of the Sea of Japan/East Sea includes 365 species, 316 of which occur in Peter the Great Bay. 114 species are southern migrants.

17 species of tropical and subtropical fishes, new for the Russian waters, have been recorded in the Bay for the last decade (13 species for the 2001-2007) because of the warming of surface waters

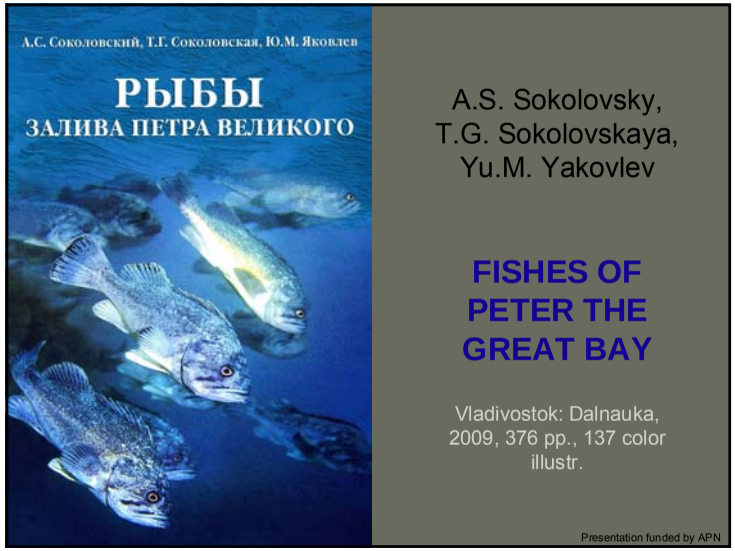
1. *Coryphaena equisetis* (dorado)
2. *Brama japonica* (Japanese bream)
3. *Micracanthus striatus* (striated micracanth)
4. *Girella punctata* (spotted girella)
5. *Pictiblennius yatabei* (Yatabe blenniform fish)
6. *Chirolophis saitone* (Saito blenniform fish)
7. *Hyperogliphe japonica* (Japanese gyperogliph)
8. *Hexagrammos otakii* (Japanese greenling)
9. *Liparis punctulatus* (striped sea-snail)
10. *Histrio histrio* (frogfish)
11. *Sphaeroides pachygaster* (ball fish)
12. *Seriola dumerili* (greater amberfish)
13. *Parupeneus spilurus* (Japanese goat-fish)

Some warm-water species – garfish, half-beaks, thread herring, Japanese anchovy, mullet – extend their area of distribution and have been involved into fishery process in Peter the Great Bay

At the same time, some cold-water species valuable for fishery – walleye pollock, Pacific herring, saffron cod, plaices – often migrate from Peter the Great Bay to north for reproduction

All these species are at the first stages of acclimatization, still there are no stable populations naturalized into local communities

Presentation funded by APN



A.S. Sokolovsky,
T.G. Sokolovskaya,
Yu.M. Yakovlev

FISHES OF PETER THE GREAT BAY

Vladivostok: Dalnauka, 2009, 376 pp., 137 color illustr.

Presentation funded by APN

Presentation funded by APN

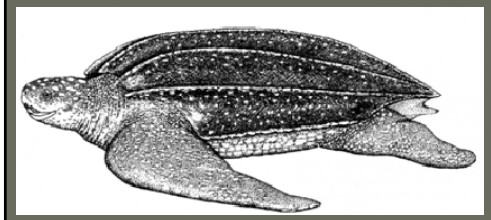
Jellyfish (Scyphozoa)

Rhopilema esculentum, a jellyfish was first recorded along the coast of Primorye in 1999 and became an object of commercial harvesting in 2001 (Borodin et al., 2003). Its natural distributional range is located in tropical and subtropical waters – South China, Yellow and East China seas. Borodin et al. (2003) explain its appearance in Peter the Great Bay by intensification of warm Tsushima and East Korean currents.

Presentation funded by APN

Sea reptiles (Chelonia and Serpentes)

Yellowbelly sea snake ***Pelamis platura*** - records in Peter the Grewt Bay in 1873 and 2007



Leatherback turtle ***Dermochelys coriacea*** (1936, 1972, 1979, 1984)

Seasonal migrants

Presentation funded by APN

POTENTIAL (EXPECTED) MARINE INVASIVE SPECIES

Sokolovsky et al. (2004) predict appearance of more subtropical fish species in Peter the Great Bay with global warming and intensification of warm currunts in the Sea of Japan/East Sea.

Zvyagintsev et al. (2009) believe that ascidian *Polyandrocarpa zorritensis*, barnacle *Balanus glandula*, polychaetes of the genus *Polydora* and bivalve mollusk *Perna viridis* are potential marine benthic invasive species into Peter the Great Bay. These species were introduced into the coastal waters of Japan (Otani, 2004).

Potential invasive species of mollusks due to migrations induced by global warming and current system modifications (Lutaenko, 1999)

Presentation funded by APN

Possible new inhabitants (invasive species) – bivalve mollusks in different parts of the Sea of Japan in course of global warming (after Lutaenko, 1999; with corrections)

Species	Southern Sakhalin	Peter the Great Bay	Middle Primorye
Anadara brougthonii	+	*	+
A. inaequivalvis	+	+	-
A. kagoshimensis	?	+	-
Trapezium liratum	+	*	-
Meretrix lusoria	-	+	-

Presentation funded by APN

Talmi Lagoon, Russian – Korean border

Storm gravelly deposits with abundant shells of regionally extinct *Anadara inaequivalvis*

Presentation funded by APN

Thank you

Presentation funded by APN

The invasive species in China seas and its impacts

Wang Lijun

National Marine Environmental Monitoring Center
State Oceanic Administration of China

Presentation funded by APN

National Marine Environmental Monitoring Center

Presentation funded by APN

Contents

Presentation funded by APN

1.Non-indigenous species in China seas

There are about 126 species introduced intentionally and unintentionally in China seas.Among which there are 9 species bacteria(viruses),7 species algae,8 species plants,7 species coelenterate,1 species polychaete,17 species molluscs,8 species crustacean,4 species bryozoan,2 species echinoderms,4 species urochordata,45 species fishes, 4 species birds,and 8 species mammals.

Presentation funded by APN

2.The main ways for marine alien species introduction

2.1 Introduction for marine aquaculture

As the country with the biggest mariculture industry in the world, China has introduced some 41 species of alien marine organisms for the purpose of mariculture until 2007.

Presentation funded by APN

Introduction for marine aquaculture

- According inadequate statistic until 2007, there were
- 5 species of alga
- 13 species of shellfish
- 7 species of crustaceans
- 1 species of sea urchin,
- 15 species of fishes,

being introduced in recent years.

Presentation funded by APN

Tab. Species introduced for marine aquaculture in China

Species	Introduction date	Source regions	Recipient regions
Scophthalmus maximus	1992	EU	Shan dong,Liao ning
Sciaenops ocellatus	1991	U.S.A	China coast
Salmo gairdnerri	1983	U.S.A	All China
Anguilla anguilla	1990	EU	South China coast
Fugu rubripes	1991	Japan	North China coast
Orehromis mossambica	1957	vietnam	China coast
Orehromis niloticus	1978	Sudan	China coast
Orehromis aureus	1983	U.S.A	China coast
Morone saxatilis	1990s	U.S.A	South China coast
Lates calcarifer	1990s	Australia	South China coast
Penaeus japonicus	1993	Japan	North China coast
Penaeusvannamei	1988	Ecuador	China coast
Argopecten irradian	1982	U.S.A	North China coast
Patinopecten yessoensis	1980s	Japan	North China coast
Crassostren gigas	1980s	Japan	China coast
Haliotis rufescens	1980s	U.S.A	
Haliotis fulgens	1980s	U.S.A	
Panopea abrupta	1990s	U.S.A	North China coast
Mercernaria mercernaria	1990s	U.S.A	North China coast
Pecten maxima	1990s	EU	
Strongylocentratus intermedius	1989	Japan	North China coast
Laminaria japonica	1930	Japan	naturalization
Undaria Pinnatifida	1950s	Japan	naturalization
Macrocystis pyritera	1980s	U.S.A	
Eucheuma dmakusaensis	1984		Guang dong

Presentation funded by APN

Some kinds of the introduced species were widely cultured

Argopecten irradians

***Pecsem yessoensis* Jay**

***Penaeus japonicus* (Bate)**

Penseus vannamei

Presentation funded by APN

Some kinds of the introduced species were widely cultured

Strongylocentrorus intermedius

Oncorhynchus mykiss

Scophthalmus maximus(Linnaeus)

Scophthalmus maximus(Linnaeus)

Presentation funded by APN

2.The main ways for marine alien species introduction

2.2 Introduction for aquaria

Many aquaria have been built over Chinese mainland, in which 51 marine ornamental animals and plants were imported and exhibited.

Presentation funded by APN

Introduction for aquaria

- 7 species of coelenterata
- 2 species of shellfish
- 1 species of crustacean
- 1 species of echinoderms
- 26 species of fishes
- 6 species of birds
- 8 species of mammals

Presentation funded by APN

2.The main ways for marine alien species introduction

2.3 Introduction for ballast water

In recent years,sixteen cryptogenic HAB species have been found in China coast sea areas.Perhaps they were introduced by ballast water.

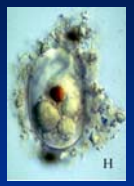
Chattonella marina
Gonyaulax polygramma Stein
Gonyaulax polyedra Stein

Karenia mikimotoi
Phaeocystis sp.
Alexandrium tamarense
Alexandrium catenella
Gymnodinium catenatum
Cochlodinium sp.

Presentation funded by APN

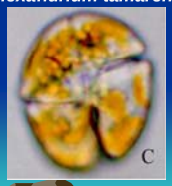
Some kinds of the introduced species from ballast water

Alexandrium catenella



Alexandrium tamarense

Gymnodinium catenatum



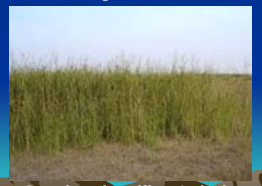
Karenia mikimotoi

Presentation funded by APN

2.The main ways for marine alien species introduction ---other ways

Salicornia bigelovii Torr

Sonneratia apetala



Spartina alterniflora Loisel

Mytilopsis sallei Recluz

Presentation funded by APN

3.The invasive species in China seas

- *Spartina alterniflora* Loisel
- Crepidula onyx
- *Mytilopsis sallei* Recluz
- Some HAB species
- Some pathogens species

Presentation funded by APN

4.The problems caused by the invasive species

4.1 economic and ecological damages.
4.2 Genetic pollution
4.3 Marine aquaculture disease

Presentation funded by APN

Impacts and Distribution of *Mytilosis sallei*

Mytilopsis sallei., looks like small mussel, were found in some semi-closed bays and shallow water in southeast China coastal. They have strong spread ability, and even can grow in very polluted sea water. They came from tropic sea near south America, now have be common benthod species.

Presentation funded by APN

Impacts and Distribution of *Mytilosis sallei*

- *Mytilosis sallei* was found in Taiwan in 1977,found in Hongkong in 1980,and firstly found in Xiamen ,Fujian province in 1990.
- It often clings to and cover with marine aquaculture establishments such as piscicultural cages,breeding rafts and ropes etc.According to monitoring,the density can reach to 5740~34360 indi./m^2,so it seriously impacts the local marine aquaculture.Moreover, *Mytilosis sallei* can exclude the native species such as *Balanus sp.*,*Crassostrea sp.*etc,and makes local biodiversity loss.

Presentation funded by APN

Impacts and Distribution of *Crepidula onyx*

- *Crepidula onyx* was found in Kongkong in 1979.Now it has spread to Guangdong coast(figure5,6).It is a dominant species of the fouling organisms,and often adheres to the shell of *Perna viridis* cultured and to piscicultural cages.The density can reach to 11~994 indi./m^2.
- Guangdong,Hongkong

Presentation funded by APN

Impacts and Distribution of *Spartina alterniflora*

- *Spartina alterniflora* was introduced to protect beach from England and U.S.A in 1979
- Its impacts
  (1)destroying the habitat of inshore organisms ,so as to impact beach breeding;
  (2)jamming the navigation way,thereby barring ships in and out;
  (3)impacting seawater exchanging,then causing the degradation of seawater quality,further inducing red tide;
  (4)threating the native coast ecosystem,thus bringing on the disappearing of mangrove.
- From north China to south China coasts

Presentation funded by APN

Impacts of some HAB

- There are many HABs are found in China, including *Alexandrium catenella*、*A. colorticula*、*A.tamarense*、*Amphidinium carterae*、*A. Klebsii*、*Dinophysis fortii*、*D.acuminata*、*D.acuta*、*D.caudata*、*D.rotunda*、*Guinardia flaccida*、*Gymnodinium breve*、*G.rhomboides*、*Prorocentrum micans*、*P.mininum*、*Protogonyaulax tamarensis*, of which many were transport from other seas.

Presentation funded by APN

Genetic impacts

- *Strongylocentratus intermedius* lives natively in north Japan,north Korea and the Pacific coast of Russia.This species was introduced to north China for marine aquaculture by Dalian Fishery College in 1989,and it is cultured in large scale in Liaoning and Shandong province north China now.But there are several native sea urchin species,such as *Strongylocentrolus nudus and Hemicentrolus pulcherrimus*,which have high phylogenetic relationships with *S. intermedius* in north China.These native species with high quality are very important sea urchin fishery resources in north China. However,there exists “genetic pollution” risk due to introducing *S. intermedius*.In order to assess this possible genetic impact,several experiments in laboratory were conducted to test whether there exists genetic hybridization between the native sea urchin species and the introduced species.

Presentation funded by APN

Genetic impacts

- hybridization experiments between *Strongylocentratus intermedius and Strongylocentrolus nudus Hemicentrolus*

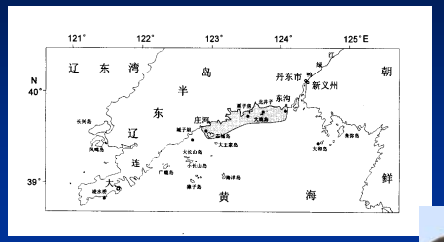
Strongylocentrolus nudus

Strongylocentratus intermedius

Hemicentrolus pulcherrimus

Presentation funded by APN

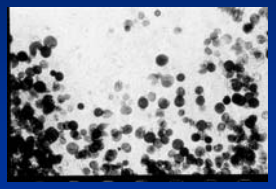
Marine aquaculture disease



Presentation funded by APN

Dormant spores cultivated by FTM medium

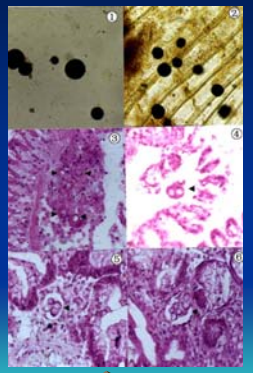
Densities of spores amounts to one million per gram tissue



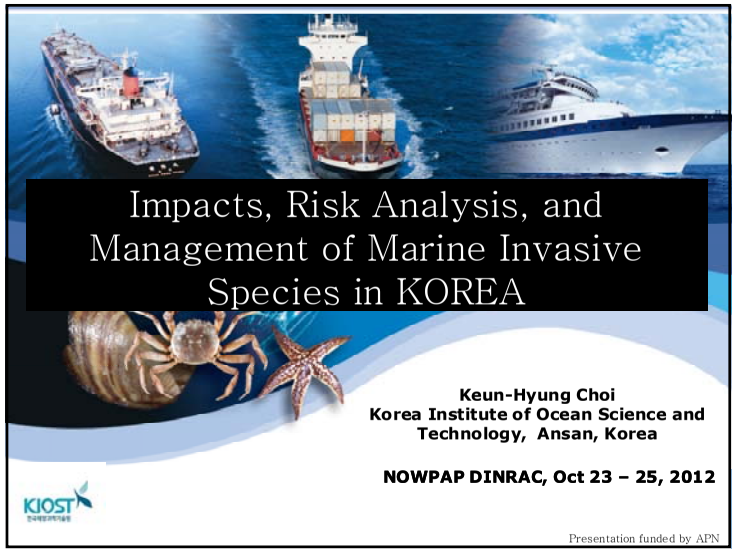
Presentation funded by APN

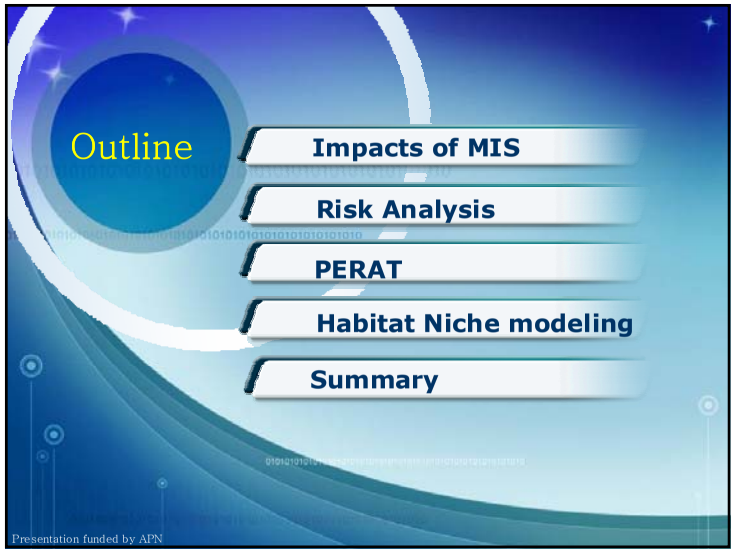
Shape and distribution of Perkinsus in *Ruditapes philippinarum*

① Dormant spores cultivated by FTM medium;
② Dormant spores of gill cultivated by FTM medium;
③One cell nourishing spores of gill;
④ Double cell nourishing spores of gill ;
⑤Four cell nourishing spores of digestive gland;
⑥ Eight cell nourishing spores of digestive gland



Presentation funded by APN





MIS Impact Studies

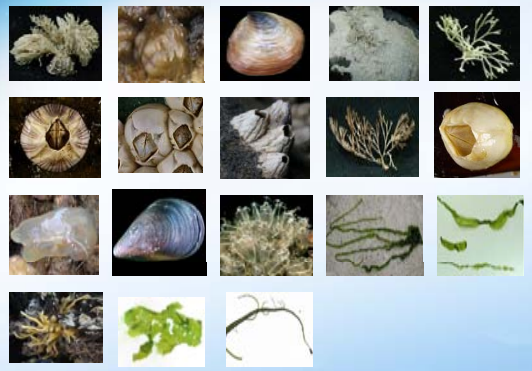
- Park and Kang 2010 as a part of Westpac/IOC analysis
  - based on literature review
- MLTM (2010) – benthic survey rather than an impact study
- PERAT(Port Environmental Risk Assessment Technology) started in 2007
  - focused on ballast water management

MIS Impact report

Group of organisms	Species	First recorded (year)	Location of 1st record	Verification of the first record	Vector	Current distribution	Native range	Origin (introduced from)	Impact (Yes/No)
Microalgae	*Noctiluca scintillans*	1970s	Inchon	unknown	Ballast	Coast	Europe	Shipping	Y
Sea anemone	*Anthopleura kurogane*	1980s	unknown	Song (1984)	Shipping	Coast	Asia	unknown	unknown
Polychaete	*Hydroides ezoensis*	1980s	unknown	Paik (1975)	Ballast	Ports	Southern Asia	unknown	Y
Crustacean	*Acartia clausi*	1980s	Inchon	unknown	Ballast	Coast	Asia	unknown	unknown
	Acarcia hongi	1990s	Namhae	unknown	Ballast	Ports	Asia	unknown Japan by shipping	unknown
Barnacle	*Balanus albicostatus*	1970s	Inchon	Kim and Kim (1980)	Ballast	Estuaries	Southern Asia	unknown	unknown
	Balanus trigonus	1970s	Busan	Kim and Kim (1980)	Ballast	Southern coast	Southern Asia	Japan by shipping	unknown
Sea star	*Asterias amurensis*	1960s	Kangwon	Rho and Kim (1966)	Ballast	Coast	North Pacific	Italy during Korean war	Y
Mussel	*Mytilus galloprovincialis*	1960s	Busan	Je (1991)	Ballast	Coast	Europe	unknown	Y
Ascidian	*Ciona intestinalis*	1965s	Busan	Rho (1968)	Ballast	Coast	Asia	unknown	Y
Bryozoa	*Bugula californica*	1980s	unknown	Rho and Song (1980)	Ballast	Southern coast	Southern Asia	USA and China for	unknown
Fish	*Sciaenops ocellatus*	1990s	Tongyong	unknown	Aquaculture	Southern coast	North America	aquaculture	Y

Kang and Kim 2010 in Chavanich, S., L. Tan, et al., Eds. (2010). Report on the current status of marine non-indigenous species in the Western Pacific Region. Intergovernmental Oceanographic Commission Sub-Commission for the Western Pacific(IOC/WESTPAC). Bangkok, Thailand.

Most outstanding MIS in Korea



Data source: MLTM 2010 report

MIS	Vector	Impacts (1-5)	Origin	Status
Halichondria bowerbanki	BW	1	Europe	Newly invaded
Mytilus galloprovincialis	BW/aquaculture	5 (outcompete native species)	Europe	Widely distributed
Crepidula onyx Sowerby	aquaculture	2	South America, CA south	
Balanus eamphritrite	Hull fouling	3	Unknown	Widely distributed in ports and bays
Balanus eburneus	Hull fouling	1	North America, Caribbean	
Balanus perforatus	Hull fouling	3 (competition with native species)		Spread on the East coast
Balanus improvisus	Hull fouling	3(aquaculture, clogging pipes)		Widely distributed in ports and bays
Bugula californica	BW	1(aquaculture)	CA	
Bugula neritina Linné	Hull fouling	2(aquaculture)	Mediterranean	Southern coast, Jeju
Tricellaria occidentalis	Hull fouling	1(aquaculture, navigation)	CA	Southern coast, Jeju
Schizoporella unicornis	BW	2(aquaculture, navigation)	Britain	Southern coast, Jeju

Data source: MLTM 2010 report

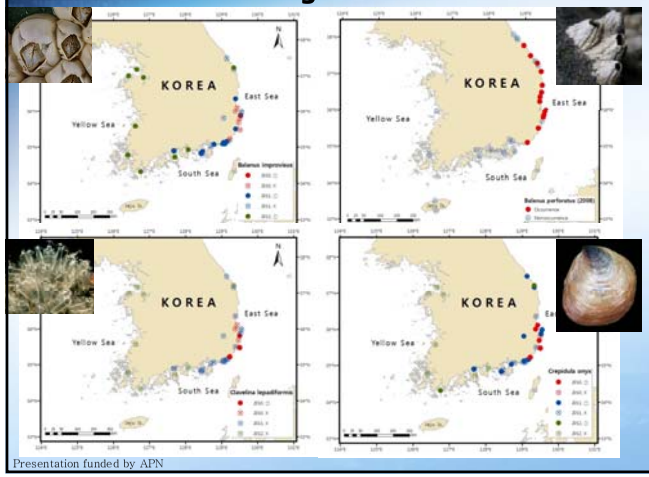
MIS	Vector	Impacts (1-5)	Origin	Status
Styela plicata	BW/hull fouling	3(aquaculture)	East coast of US, Caribbean Sea	widespread
Ciona intestinalis	BW/hull fouling	3(aquaculture)	Atlantic coasts	
Clavelina lepadiformis	BW/hull fouling	1	Atlantic coasts, Mediterranean Norway~Spain	
Ulva armoricana	Hull fouling/fishery import	2(green tide)	France	South, West coast
Ulva fasciata	Hull fouling/fishery import	2(green tide)	Mediterranean	South coast, Jeju
Ulva flexuosa	Hull fouling	1(green tide)	Mediterranean	South, West coast
Ulva procera	Hull fouling	1(green tide)	Sweden	Tongyoung, Incheon-limited distribution

* **Nearly all of impact studies are anecdotal or of literature review, and no systematic study has been conducted**

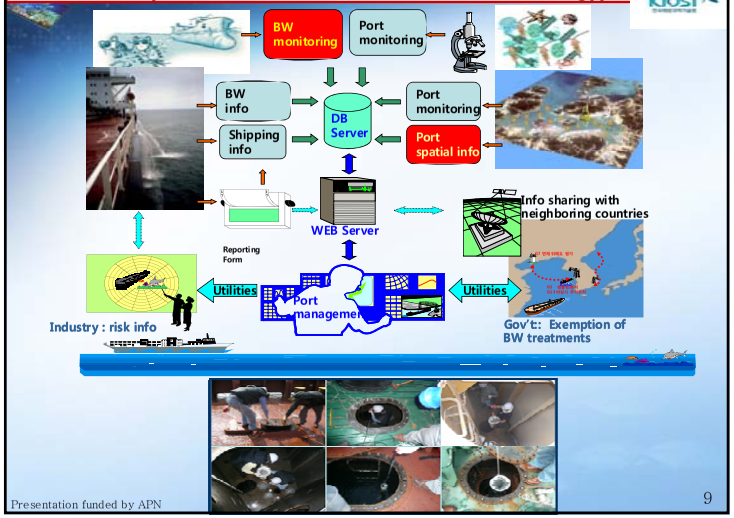
Data source: MLTM 2010 report

Species Interactions

Species interaction limits Range extension?



PERAT (Port Environmental Risk Assessment Technology)



PERAT - started in 2007, focused on ballast water management

IMO Approach

ROR (relative overall risk)

$= (C1 + [C2 \times R1_{w4}] + C3 + [C4 \times R2_{w5}]) / 4$ Eq1

$= (C1 + [C2 \times R1_{w4}] + [C3 \times C4 \times R2_{w5}]) / 3$ Eq2

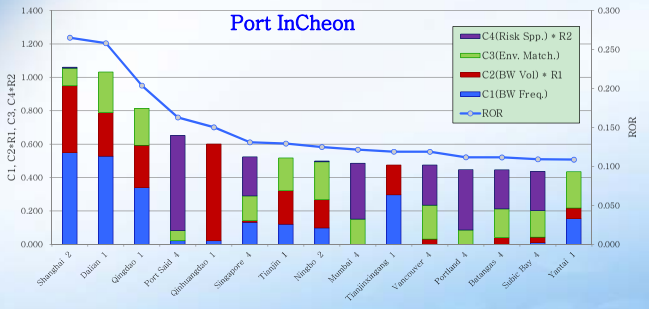
C1=proportional discharge frequency
C2=proportional discharge volume
C3=environmental matching
C4=relative risk species threat
R1= effects on C2 by BW tank size
R2= effects on C4 via duration of BW

R1 기록상의 최대탱크부피	<100	100-500	500-1000	>1000
W4 C2에 적용될 위해가중계수	0.4	0.6	0.8	1

R2 기록상의 최소탱크저장시간	<5	5-10	10-20	20-50	>50
W5 C4에 적용될 위해가중계수	1	0.8	0.6	0.4	0.2

Improvement on ROR

- Modified ROR = (C1 + C2*R1+ C3 + C4*R2) / 4



- Results – all 4 parameters have relatively even effects

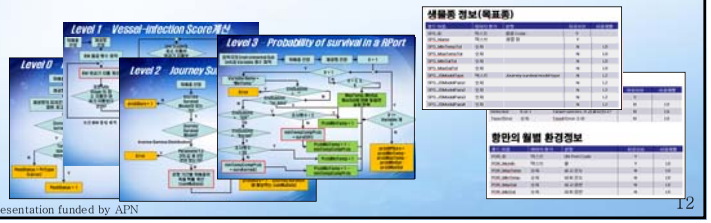
Species-specific risk analysis

- Synopsis
  - one of three IMO risk analyses applied to ports of similar environmental settings
  - useful for assessments among neighboring countries

- Method

$$Risk_{species} = p(\omega) \cdot p(\varphi) \cdot p(\psi) \cdot p(\upsilon)$$

p(ω) : presence in the port of origin (Level 0)
p(φ) : Entrainment (Level 1)
p(ψ) : Survival during transport (Level 2)
p(υ) : Survival in receiving port (Level 3)



Port Monitoring

Port Baseline Surveys under Risk Assessment

Biological monitoring
- Diatoms
- Dinoflagellates
- Zooplankton
- Larvae
- Benthos
- Invasive species

Environmental monitoring
- Temperature
- Salinity
- Dissolved oxygen
- Nutrients
- Suspended solids
- Chl-a

1. Information of potential threat species
2. List up of normally occurring species
3. Listing of new invasive species

Potential threatners

Phytoplankton

•Potential risky species

Bacillariophyceae	Character	Distribution	Frequency
Asterionellopsis glacialis	Red tide species	E, W, S	18
Chaetoceros affinis	Red tide species	E, W, S	6
Chaetoceros compressus	Red tide species	E, W, S	18
Chaetoceros curvisetus	Red tide species	E, W, S	6
Chaetoceros didymus	Red tide species	E, W, S	9
Chaetoceros lorenzianus	Red tide species	E, W, S	6
Chaetoceros socialis	Red tide species	E, W, S	6
Cylindrotheca closterium	Red tide species	E, W, S, J, K	11
Dactyliosolen fragilissimus	Red tide species	E, W, S, J, K	17
Detonula confervacea	Red tide species	E, W, S, J, K	11
Guinardia delicatula	Red tide species	E, W, S	6
Leptocylindrus danicus	Red tide species	E, W, S, J, K	18
Leptocylindrus minimus	Toxic[DA]	E, W, S	9
Nitzschia longissima	Toxic[DA]	E, W, S, J, K	11
Pseudo-nitzschia pungens	Red tide species	E, W, S, J, K	6
Rhizosolenia setigera	Red tide species	E, W, S, J, K	17
Skeletonema costatum	Red tide species	E, W, S	7
Dinophyceae			
Alexandrium sp.	Toxic[PSP]	E, W, S	7
Ceratium furca	Red tide species	E, W, S	7
Ceratium fusus	Red tide species	E, W, S, J, K	6
Ceratium tripos	Red tide species	E, W, S, J, K	6
Dinophysis acuminata	Red tide species	E, W, S, J, K	5
Euglenophyceae			
Eutreptiella gymnastica	Red tide species	E, W, S, J, K	6

Distribution of potential risky species at ports from February 2007 to August 2009

Ports	Taxa	Spring	Summer	Autumn	Winter
Pusan	Diatoms	36	40	46	51
	Dinoflagellates	9	11	6	4
	Euglenoides	2	2	1	0
Ports	Taxa	Spring	Summer	Autumn	Winter
Ulsan	Diatoms	40	44	33	36
	Dinoflagellates	7	13	4	6
	Euglenoides	1	1	1	1
Ports	Taxa	Spring	Summer	Autumn	Winter
Incheon	Diatoms	29	34	19	27
	Dinoflagellates	4	8	4	2
	Euglenoides	1	2	0	0
Ports	Taxa	Spring	Summer	Autumn	Winter
Gwangyang	Diatoms	59	46	57	44
	Dinoflagellates	6	10	3	4
	Euglenoides	2	1	1	1

Potential threatners

Phytoplankton

- Nativity

	Bacillariophyceae	Dinophyceae	Chrysophyceae	Chlorophyceae	Euglenophyceae	Cryptophyceae	종계
주목종	169	44	6	13	1	1	233
기타목적종	7	1	1	–	–	–	9
목표목종	–	–	–	–	–	–	–
종계	176	45	6	13	1	1	242

- Harmfulness

Bacillariophyceae	Character
Pseudo-nitzschia delicatissima complex	Toxic(ASP)
Pseudo-nitzschia multistriata	Toxic(ASP)
Pseudo-nitzschia pungens	Toxic(ASP)
Dinophyceae	
Alexandrium sp.	Toxic(PSP)
Alexandrium tamarens	Toxic(PSP)
Dinophysis acuminata	Toxic(DSP)
Karenia mikimotoi	Toxic(DSP)

Species of high survival upon transport : 59 spp including
***Skeletonema* sp.,**
Thalassiosira rotula,
Heterocapsa triquetra,
Prorocentrum minimum,
Heterosigma akashiwo

Potential threatners

Zooplankton

Potential risky species or taxon based on literature (Inner and outer ports)

[Inner port]

Zooplankton	Character	Pusan				Ulsan				Incheon				Gwangyang			
		N	F	M	A	N	F	M	A	N	F	M	A	N	F	M	A
Ctenophore larvae	Strong invasive, Omnivorous	*				*								*			
Thaliacean larvae	Strong invasive, Omnivorous	*			*	*											
Hydromedusae	Strong predator	*		*	*	*	*	*				*	*	*	*	*	*
Noctiluca scintillans	Red-tide species	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Acartia omorii	Eurythermal and euryhaline Potentially strong transfer ability by dormant eggs	*	*	*	*	*	*	*		*					*	*	*
Acartia hongi	Stenohaline, Potentially international or intra-coastal transfer									*	*	*	*				*

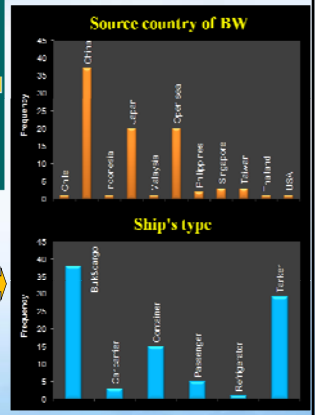
[Outer port]

Zooplankton	Character	Pusan				Ulsan				Incheon				Gwangyang			
		N	F	M	A	N	F	M	A	N	F	M	A	N	F	M	A
Ctenophore larvae	Strong invasive, Omnivorous					*								*			
Thaliacean larvae	Strong invasive, Omnivorous	*		*	*	*											
Hydromedusae	Strong predator	*	*	*	*	*	*	*			*	*	*	*	*	*	*
Noctiluca scintillans	Red-tide species	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Acartia omorii	Eurythermal and euryhaline Potentially strong transfer ability by dormant eggs		*	*	*		*	*							*	*	
Acartia hongi	Stenohaline, Potentially international or intra-coastal transfer			*						*	*	*	*			*	

*** Indicates occurrence of the species N: November, F: February, M: May, A: August**

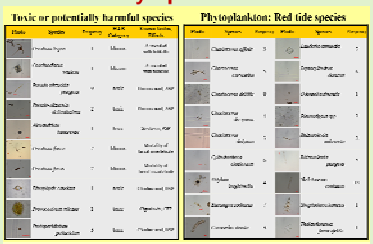
Ballast Water Monitoring

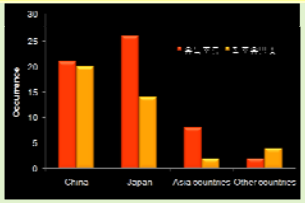
2007-2010년
우리나라 주요 7개항
해양항만청, 항만공사, 세관과 사전협의
총 268척 선박에 조사 시도
91척에서 평형수 시료 확보



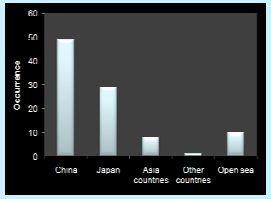
Potential harmful plankton

Phytoplankton

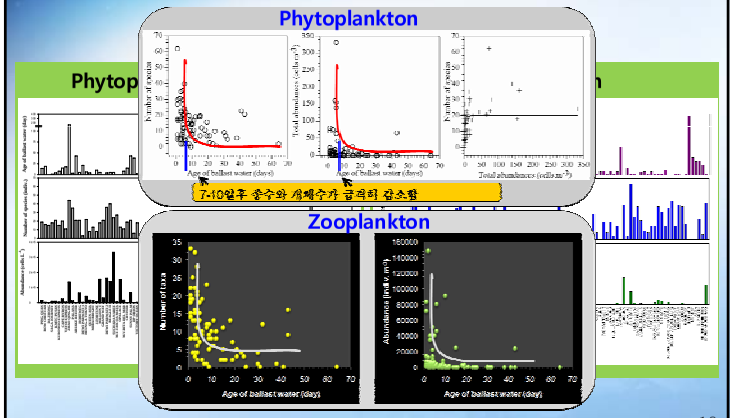




Zooplankton



Taxa and abundance pattern in BW tanks during voyage



Survivalship in receiving ports : response to temperature

	Si	DIP	DIN
ROYAL DIAMOND	6.23	0.00	0.00
BALTIC SAPPHIRE	25.89	1.97	16.57
CS CRANE	22.66	1.06	14.93
온산만 주변수	10.15	0.52	11.74

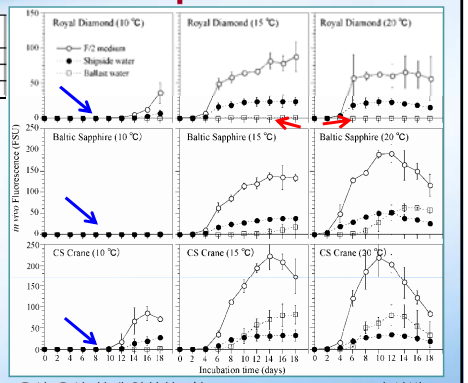
➢Royal Diamond= Ballast water 에서 낮은 영양염검출
-식물플랑크톤의 성장제한.

➢ Baltic 과 CS Crane은 평형수의 영양염이 주변수 보다 높았음. 15-20도의 온도 조건에서 빠르게 증식 가능함

➢모든 실험구에서 f/2배지의 풍부한 영양염 조건에서 성장가능.

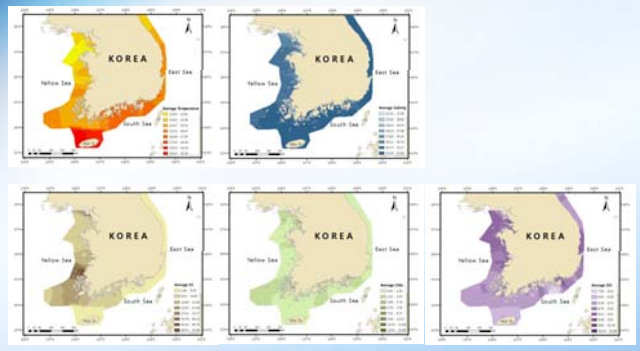
➢저온에서는 성장둔화

➢상기 3선박의 평형수에서 유입되는 종은 방출후 4-10일의 광조건에 노출되면 잠재적으로 성장이 가능하다고 판단됨.

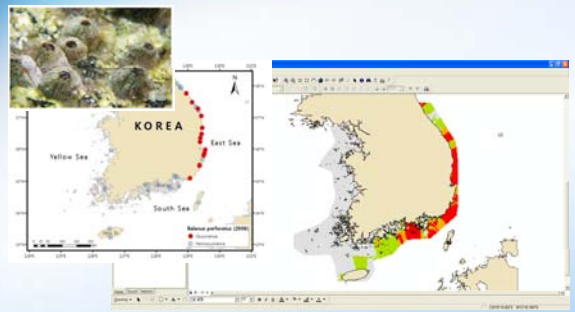


울산(온산)항에 입항한 3척(Royal, Baltic, CS Crane)의 선박을 대상으로 식물플랑크톤 적응 능력평가 (광 조건 60 μmol m^{-2} S^{-1})

Environmental Conditions (2004-2010)



Genetic Algorithm for Rule-set Prediction (GARP)



Atlas of NIS in the N. Pacific

Grandidierella japonica

Summary

- There must be species interactions, which may determine invasional success, and ecological approach is urgently needed to understand full impacts of MIS
- Regional cooperation of information sharing is essential for stemming spreading as well as introductions of MIS
  - qualitative information is not enough
- Distribution pattern of MIS backs up BW/hull fouling is a major route for their introductions.

Acknowledgements

- Drs. Hee-Dong Jeong, Kyungsoon Shin and other numerous colleagues involved in the projects
- Picture sources : MLTM, SERC and others
- Fundings from Ministry of Land, Transport and Maritime Affairs (K.S. Shin) and National Research Foundation (K.H. Choi)

Regional Workshop on MIS in Northwest Pacific Region,
Beijing 23-24 October, 2012

Pros and Cons of Invasive Cordgrass *Spartina Spp.* Introduced into China from UK and USA over 30 Years Ago

WANG CHANGYONG

Nanjing Institute of Environmental Sciences
Under Ministry of Environmental Protection of China

Presentation funded by APN

环 境 保 护 部
南京环境科学研究所

1. Introduction of *Spartina anglica and S. alterniflora* into China

***Spartina anglica*, commonly called English cordgrass, is an invasive, perennial salt marsh grass.**

***Spartina anglica* was deliberately introduced into China from UK by Prof. Chung Chung Hsin of Nanjing University in July 1963.**

The first English cordgrass plantation, about 40 hectares, was created in the coastal mudflat of Yancheng city, Jiangsu province of China in 1965.

Presentation funded by APN

环 境 保 护 部
南京环境科学研究所

***Spartina alterniflora*, also called smooth cordgrass, was introduced by Prof. Chung. C.H. into Fujian province of China from USA in 1979.**

The two cordgrass were successively planted in coastal salt flats of 10 provinces, such as Liaoning, Hebei, Zhejiang, Shandong, Fujian, Guangxi, Guangdong.

The primary purpose of introducing the two *Spartina* species is to reclaim arable land from the sea and mitigate the attack of strong storm to seawall

Presentation funded by APN

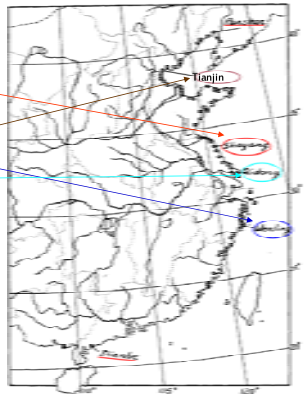
环 境 保 护 部
南京环境科学研究所

2. Distribution of *Spartina anglica and S. alterniflora* in China

The earliest center of Spartina anglica distribution is Sheyang County(33° 40'N), Jiangsu.

Three others are Wenling County (north of 28° N), Tianjin(39° N) and Qidong County(32° N) north of Yangze estuary.

S. *anglica* distribution extended in the past to approximately 90 cities and counties along Chinese coast. Its distribution sites are found in every province along the coastline from Dandong, at the mouth of the Yalu River to Hepu, Guangxi



Source: Chung C.H. 2003

Presentation funded by APN

环 境 保 护 部
南京环境科学研究所

East China contains more than four-fifths of the total S. *anglica* distribution. Jiangsu ranks highest, Zhejian being next. North China has far fewer areas and South China has the least.

The record of its highest plantation area in China reached ever up to about 33, 000 hectares in 1983. Since introduction of *Spartina alterniflora*, its distribution area started to decrease.

Spartina anglica distribution in China

Source: Chung C.H. 2003

County	Hectares (ha)
Jiangsu	18,700–22,000
Zhejian	6,900–8,400
Shandong	3,000
Fujian	1,000
Hebei	970
Guangxi	153
Liaoning	70
Guangdong	10

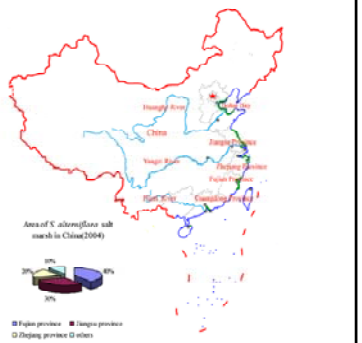
Jiangsu was especially noticed. The chronological increase of S. *anglica* as surveyed was: 110 ha in 1966, 270 in 1973, 10,000 in 1978, 33,000 in 1983.

S. alterniflora is now distributed in nine of the 14 coastal provinces in East and South China, spanning from the subtropics to the temperate zone. (Source: Liu et al. 2007; Wang et al., 2008).

Mainly distributed in the salt flats of Fujian(40% in plantation area) and Jiangsu(30%), Zhejiang(20%)

The current distribution area of *S. alterniflora* in China is approximately 46,000-53,000 hectares.

Dr. Zhao will give detailed information in terms of its distribution in the provinces where it was planted.



Distribution of Spartina alterniflora salt marsh in China. The green block represents S. alterniflora salt marsh

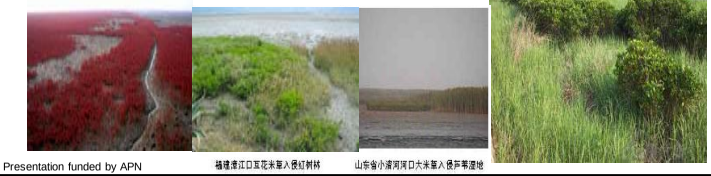
Source: Wan et al., 2009

3. Potential Ecological Risks resulting from *Spartina spp.* in China

3.1 Invade into the habitats of native plants in salt marshes and then replace them

- Reduce and eventually replace distribution of native marsh grass (e.g. *Suaede salsa*, *S. mariqueter*, reed) in Jiangsu, Shangdong and Zhejiang provinces and Shanghai, resulting in their disappearance from original habitats (Zuo and Liu, 2007, Tian et al. 2009, Li et al. 2009, Li et al. 2005)
- Invade into the habitat of mangroves in Guangxi (Li et al. 2009).
- Invade into Dayu Island Nature Reserve in Xiamen, Fujian province, southeast China (Zhu, et al. 2008).

Main causes: *S. alterniflora* has a greater competitive ability than native salt marsh plants.

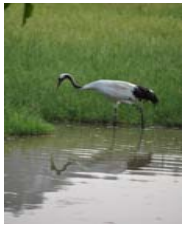


植被滩江口互花米草入侵红树林　　山东省小清河河口大米草入侵芦苇湿地

3.2 Decrease availability of native salt marsh habitats to migrant and shorebirds

- Lower numbers of red crown crane in *S. alterniflora* community of Yancheng Nature Reserve in Jiangsu province than the mudflats (Zuo and Liu, 2007)
- A decrease in species and number of waterfowls (e.g. White Egrets) in *S. alterniflora* stand in Yellow Sea delta, Shandong province and Fujian province (Tian et al. 2009, Yu et al. 2010).
- Most shorebirds (songbirds and breeding birds, waterbirds and migrants) preferred to select mudflats or native plant community (reed, *S. mariqueter*) in Yangtze River estuary, rather than *S. alterniflora* meadow (Li et al. 2009, Gan et al. 2009).

Main causes: (1) Dense and *S. alterniflora* stands which is difficult to make access to native birds; (2) Changes in food components in S. alterniflora community.



3.3 Effects of S. alterniflora on macrobenthic species

- Lower invertebrate species in *S. alterniflora* stand but higher individuals than that in adjacent mudflats in Yellow Sea delta, Shandong province (Tian et al. 2009)
- The mean density between *S. alterniflora* and *S. mariqueter* stand displayed no significant difference for 25 macrobenthic invertebrates sampled from Shanghai Congming Island, but abundance is lower for 4 out of 25 species in *S. alterniflora stand and is higher for 1 species* (Chen et al. 2005).
- The biodiversity index (e.g. Shannon index) and richness of macrobenthic species in the salt marsh of *S. alterniflora* were less than those in the mudflat in Jiangsu coast in every season. However, total individuals of the macrobenthic species was higher (Zhou et al. 2007).

3.4 Effects of *S. alterniflora* expansion along costal areas on local aquaculture

- Rapid colonization of *S. alterniflora* compete with shellfish (e.g. oyster and several clams) for habitat room in costal mudflats of Fujian and Jiangsu provinces, resulting in a great loss of aquaculture production (Shang et al. 2008, Wan et al. 2009, Tian et al. 2009)
- Local fishermen thinks *S. alterniflora* may decrease the production of kelps and nori through competing with them for nutrients (Liu et al. 2002, Gao, 1996).

Fig. 6 – Shellfish migrated to the mudflat outside of *S. alterniflora* marsh in Yancheng City, China. Photograph: P. Zuo.

4. Ecological Benefits and Utilization Practices of *Spartina spp.* in China

4.1 Buffering against storm tide

In the past 26 years, *Spartina spp.* proved itself to be an excellent guard along the coast. For example, In 1990, when the 5th typhoon with huge wave of 6.27m came to Ouhai county of Zhejiang province, The seawall, in the front of which no macrophytes were distributed, was completely destroyed, while the one with *spartina* meadow was intact and only sprays of waves reached the dike; Another example from Wenzhou city, Zhejiang province showed *Spartina spp.* community can effectively prevent seawall from attack of strong typhoon (Lu and Wu, 1996)

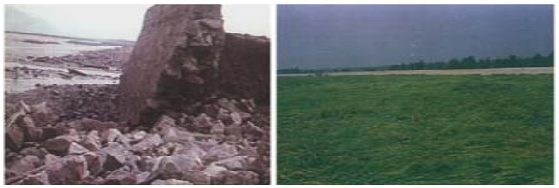


Fig. 2 – The sea dike without *S. alterniflora* vegetation in front was crushed (left) and the sea dike with *S. alterniflora* vegetation in front was saved (right) in Dongtang district of Wenzhou City, China when the 17th strong typhoon attacked the whole seashore in 1994. Photographs: L. Min.

4.2 Accelerating accretion and reclamation

In a report by Chung et al (2004), his study results showed that *S. alterniflora* meadow in Dongtai county, Jiangsu province brought out a greater accretion than the mudflat: 52.1cm vs 10.5cm, resulting in about 10,000ha. of newly formed land reclaimed from the smooth cordgrass accretion. In Zhejiang province, there are several similar example reports.

4.3 Providing important food source for salt marsh animals and saving as effective assimilator of Carbon dioxide (CO2) and as a agent of soil improvement

- Net primary production of *S. alterniflora* was estimated to be 3,412g(dry weight)/m2/yr and hence its organic detritus *can* supported sustainable development of offshore marine fish resources (Wan et al. 2009).
- A study showed that the total net primary production of the *S. alterniflora* salt marsh in China increased from 18,186 tons in 1981 to 1,706,126 ton in 2004 and CO2 fixed by the *S. alterniflora* vegetation per year increased from 29,619 ton to 2,778,707 tons (Wan et al. 2009).
- *S. alterniflora* can increase organic matter in soil. After enclosing *S. alterniflora* meadows, The *S. alterniflora* marsh can be used for farmland.

4.4 Some good practices from utilization of *S. alterniflora* in China

- Use *Spartina spp.* as green manure to increase crop production (by 33% for rice, 29% for cotton in Zhejiang)
- Use *Spartina spp.* as fodders for sheep, as feed for chicken, pig and fish or for grazing sheep, hence reducing production costs and rapid increasing body of the domestic animals.
- Use *Spartina spp.* for fuel and paper-making material.
- The extracts from *Spartina spp.* have been developed as health-care products and drinks (e.g. beer and soft beverages)
- Use *Spartina spp.* to address the issues of pollutants (heavy metals, N, P) discharged from terrestrial and marine culture.

5. Current control of Spartina spp. in China.

(1) Hand removal

Although hand removal of *Spartina spp.* can be an effective technique, its widespread use is severely limited by practicality.

(2) Removal by machinery

This technique appears to control *Spartina* infestations by reducing seed production and weakening the plant by depleting root and rhizome energy reserves

(3) Herbicide

Use wide spectrum herbicide-glyphsate and BC-08 (developed by China) to kill *Spartina spp.* but this method also produced negative effects on other organisms and environment. Hence this method was not recommended in China

(4) Biological Control

The most promising biocontrol agent appears to be a *Homopteran* plant hopper (*Prokelesia marginata*) that feeds on the vascular fluids of *Spartina* species and proved to be effective biological agent for *Spartina* species in USA.

6. Management of *Spartina spp.* by Chinese Ministry of Environmental Protection (MEP)

(1) MEP has developed a regulation of invasive alien species and plan to issue it in this year

This regulation emphasized the necessity and procedures for risk assessment, monitoring, regular investigation, information collection, control and removal of invasive alien species which have been or will be introduced into natural ecosystems.

(2) MEP has issued a national invasive alien species list two times, including *Spartina* species, to provide guide for their investigation in natural ecosystem, especially in nature reserves.

(3) MEP funded related domestic organizations to conduct scientific researches into effects of *Spartina* species on local biodiversity.

(4) MEP conducted publicity activity and training workshops for the environmental protection authorities at provincial level to increase their awareness of and update knowledge for the risks associated with invasive alien species.

Thanks for Your Attention !

The influences of invasive alien species *Spartina alterniflora* on biodiversity in Chinese coastal wetland

Reporter：Caiyun Zhao

Chinese Research Academy of Environmental Sciences

Presentation funded by APN

- **The distribution of *Spartina alterniflora* in China.**
- **The influences of invasive alien species *Spartina alterniflora* on biodiversity**

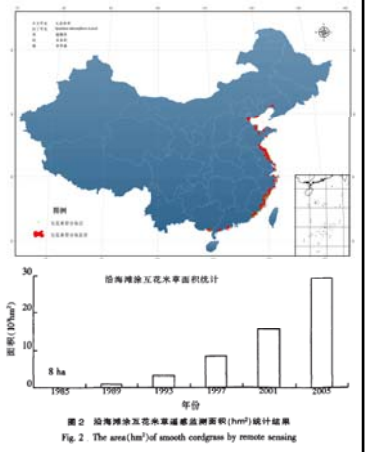
Presentation funded by APN

1、 The distribution of *Spartina alterniflora* in China

Presentation funded by APN

The distribution of *Spartina alterniflora* in China

The *Spartina alterniflora* spread from the Yingkou, Liaoning Province to Beihai, Guangxi Province in China. And the areas of *Spartina alterniflora* increased from 8 hm^2 in 1985 to 34178 hm^2 in 2005.



Zhang et al. 2010

Presentation funded by APN

The distribution of *Spartina alterniflora* in China

Tab.3 The area and proportion of *S. alterniflora* in tidal flats of China

地区 Region	互花米草种群 *S. alterniflora* population	
	面积 Area（hm^2）	比例 Proportion（%）
辽宁 Liaoning	0	0.00%
河北 Hebei	241	0.70%
天津 Tianjin	570	1.67%
山东 Shandong	564	1.65%
江苏 Jiangsu	17842	52.20%
上海 Shanghai	5336	15.61%
浙江 Zhejiang	5092	14.90%
福建 Fujian	3932	11.50%
广东 Guangdong	349	1.02%
广西 Guangxi	251	0.74%
全国 Total	34178	100.00%

Zhang et Lu, 2010

Presentation funded by APN

The distribution of *Spartina alterniflora* in north China

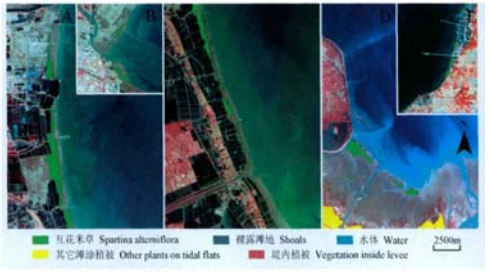


图 5 北方两省一市互花米草种群的空间分布图。A：大港区；B：北塘口；C：黄骅市；D：黄河三角洲；E：莱州湾

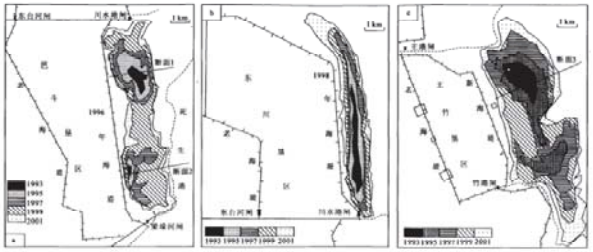
The *Spartina alterniflora* mainly distributed in Dagang in Tianjin, and mainly distributed in Huangye county in Hebei province, and mainly distributed in Dongying in Shandong province.

Zhang et Lu, 2010

Presentation funded by APN

The distribution of *Spartina alterniflora* in Jiangsu

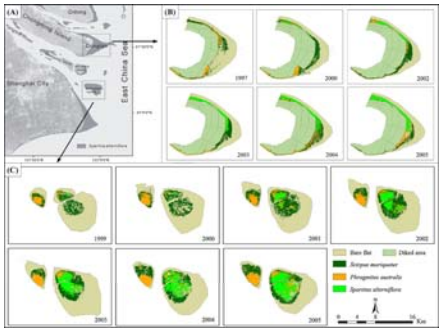
More than half area of *Spartina alterniflora* in China distributed in Jiangsu province, after it was cultivated in 1982. *Spartina alterniflora* spread from Sheyang to Dongtai.



Zhang et al., 2005

Presentatic

The distribution of *Spartina alterniflora* in Shanghai



Spartina alterniflora was first found in 1995 in Shanhai, and it distributed in the ChaomingDao and Jiuduansha, and the total areas were 5336hm^2.

Distribution of *Spartina alterniflora* (A) and its range expansion in Dongtan (B) and Jiuduansha (C) marshlands, the Yangtze River estuary, China. (Li et al. 2009)

Presentation funded by APN

The distribution of *Spartina alterniflora* in Zhejiang

In 1993, the *Spartina alterniflora* was introduced in Zhejiang province. It spread from hangzhou bay to aojiang, and after twenty years, the area of its increased to 5092hm^2. And the most *Spartina alterniflora* distributed in Leqing county, and almost occupied 77% in the all province.

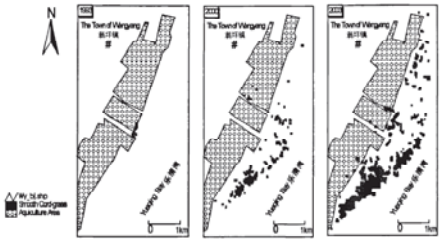


图1 鹤坪镇互花米草历年变化

Fig. 1 Changing *Spartina alterniflora* along the Wengyang Coast

Liu and Li, 2007

Presentation funded by APN

The distribution of *Spartina alterniflora* in Fujian

In 1979, *Spartina alterniflora* was introduced in Luoyuan coast, in Fujian province. And this site is the first introduce sites in China.

Most *Spartina alterniflora* distribute in Luoyuan coast, Sandou coast and Funing coast in Fujian province.

The areas of *spartina alterniflora* increased to 3856.3 hm^2 in 2006, in Luoyuan coast Fujian Province.

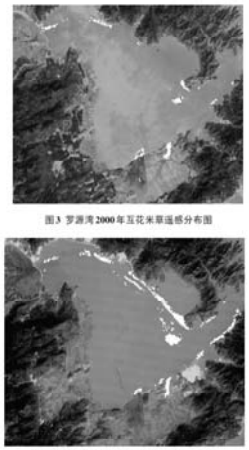


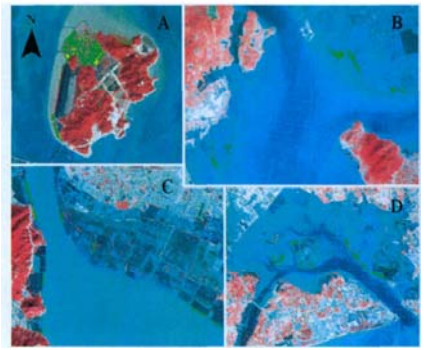
图3 罗源湾2000年互花米草遥感分布图

图4 罗源湾2006年互花米草遥感分布图

Pan et al. 2009

Presentation funded by APN

The distribution of *Spartina alterniflora* in Guangdong

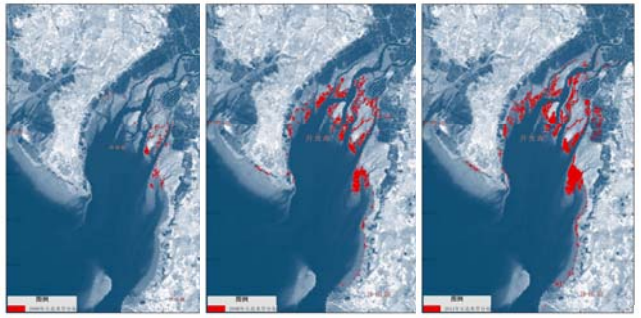


The areas of *Spartina alterniflora* in Guangdong province is 349hm^2, and mainly distributed in Qiaodao.

Zhang and Lu, 2010

Presentation funded by APN

The distribution of *Spartina alterniflora* in Guangxi



1999年、2008年、2011年广西丹兜海互花米草分布

In 1979, *Spartina alterniflora* was introduced in Guangxi province, up to 2011, the area increased to 357.2hm^2 , and mainly distributed in Dandouhai.

Presentation funded by APN

Conclusion

Up to now, *Spartina alterniflora* distributed in most of the coastline in China, and rapidly spread in some region.

2、The influences of invasive alien species *Spartina alterniflora* on biodiversity

- The influences of invasive alien species *Spartina alterniflora* on microorganism
- The influences of invasive alien species *Spartina alterniflora* on macrobenthonic invertebrates
- The influences of invasive alien species *Spartina alterniflora* on plant

The impacts of *Spartina alterniflora* on the microorganism

The soil microbial biomass in inter-tidal zone increased more with the growth of *S. alterniflora* comparing with the barren tidal flat. The community components may be more complicated in *Spartina* salt marshes with the dominant components activities in microbial physiological function group.

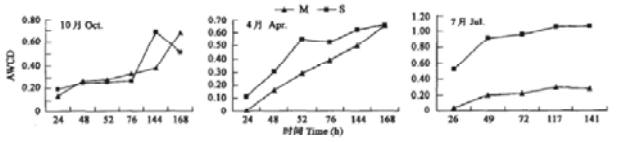


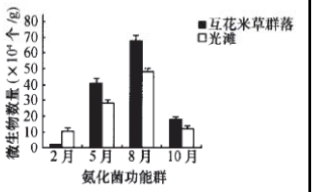
图 2 互花米草盐沼(S)及光滩(M)土壤微生物 CLPP 反应 AWCD 值变化比较

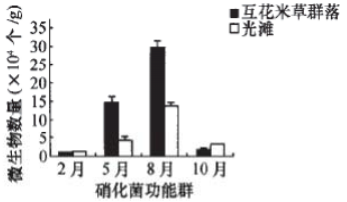
Fig. 2 AWCD of soil microbial community level physiological profiles in different sampling seasons in *Spartina* salt marshes (S) and mudflat (M)

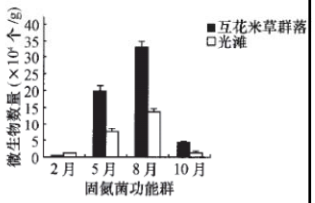
Zhou et al., 2005

The impacts of *Spartina alterniflora* on the microorganism

Microbial functional groups related to nitrogen-cycle were more higher in *spartina* salt than in mudflat except for in February.



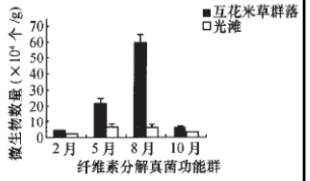


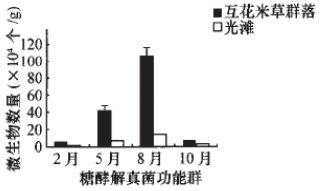


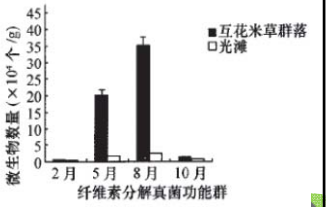
Zhou et al., 2007

The impacts of *Spartina alterniflora* on the microorganism

Microbial functional groups related to carbon-cycle were more higher in *spartina* salt than in mudflat in all season.

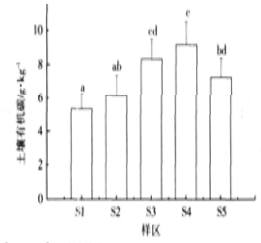






The impacts of *Spartina alterniflora* on the microorganism

Spartina alterniflora can increase the concentration of soil organic carbon as well as the soil microbial activities.



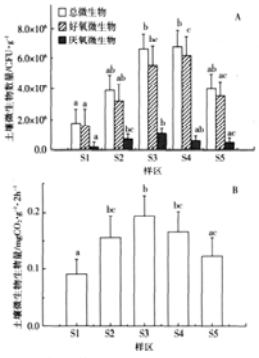


图 3 九段沙土壤微生物数量（图 A）和微生物生物量（图 B）的分布特征

Figure 3 The characteristics of CFU (Figure A) and SMB (Figure B) in Jiuduansha wetland

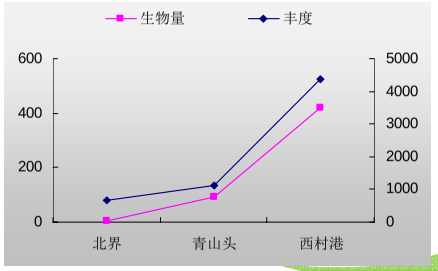
Xi et al., 2009

S1: mudflat; S2: Scripus mariqueter,S3: Spartina alterniflora, S4: Sp. + Ph. S5: Phragmites australis

The impacts of *Spartina alterniflora* on the macrobenthonic invertebrates

The impacts of *Spartina alterniflora* on the macrobenthonic invertebrates

The density and biomass of macrobenthonic invertebrates was impacted by the *spartina alterniflora* during different invaded stage in Beihai, Guangxi Province. And in the newest invaded stage, the abundance was highest.



The impacts of *Spartina alterniflora* on the macrobenthonic invertebrates

The density of macrobenthonic invertebrates in *Spartina alterniflora* was distinguished higher than *Phragmites australis*, but the biomass is different based on the invaded years of *S. alterniflora*.

表 2 大型底栖动物的密度和生物量

Tab. 2 Density and biomass of macrobenthos

样地	密度 (ind · m^{-2})	生物量 (g · m^{-2})	样本容量 (n)
HH-B	257.94 ± 9.79^{a}	45.63 ± 1.72^{c}	10
LW-B	150.94 ± 5.70^{ab}	26.73 ± 1.06^{b}	10
HH-D	156.86 ± 6.46^{b}	28.76 ± 1.65^{b}	10
LW-D	145.16 ± 5.98^{a}	29.18 ± 2.04^{b}	10

平均值后字母不同表示二者差异显著 $P < 0.01$ (LSD 多重比较检验)。

表 3 崇明东滩大型底栖动物的物种多样性

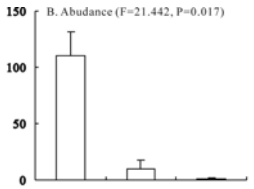
Tab. 3 Species diversity of macrobenthos community at Chongming Dongtan

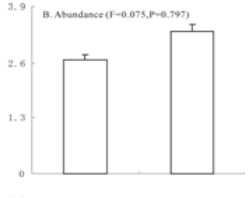
样地	多样性指数				
	S	*N*	*D*	*J'*	*H'*
HH-B	16	257	2.70	0.89	2.48
LW-B	12	151	2.19	0.84	2.09
HH-D	12	157	2.18	0.88	2.19
LW-D	14	145	2.61	0.87	2.29

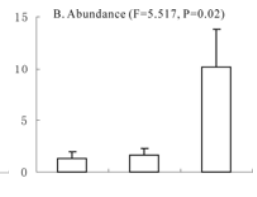
Xie et al. 2008

The impacts of *Spartina alterniflora* on the macrobenthonic invertebrates

The *spartina alterniflora* influence the community of macrobenthonic invertebrates in different invaded stages in Beihai, Guangxi Province. And the *glauconome chinensis* is the dominant species in the community of *spartina alterniflora*.







The impacts of *Spartina alterniflora* on the macrobenthonic invertebrates

The study of Zhang found the abundance of *glauconome chinensis* increased in the *Scripus mariqueter* than *Spartina alterniflora* in all season, but in the high elevation area the density of *galuconome chinensis* is higher in *Spartina alterniflora*, but contrary in the lower elevation areas.

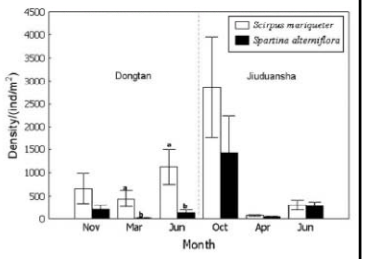


Fig. 2. Density of *Glaucomya chinensis* at the lower marshes of Dongtan and Jiuduansha in three sampling seasons. Different letters above bars (a and b) indicate significant differences between plant species at each sampling site and in each season ($P < 0.05$).

The impacts of *Spartina alterniflora* on the macrobenthonic invertebrates

The mean total density of macrobenthonic invertebrates in *Scripus marqueter* and *Spartina alterniflora* communities was not significantly different between the two communities. However, the *S. alterniflora* change the abundance of five species.

Table 2 – Five species of macrobenthonic invertebrates that were significantly affected by *Spartina alterniflora* invasions, and their mean density in native (*Scirpus mariqueter*) and invaded communities

Taxa	Mean density (individuals m^{-2})	
	Scirpus	*Spartina*
Gastopodia		
Assiminea violacea	1351 ± 181	2086 ± 225
Assiminea lutea	249 ± 57	108 ± 36
Cerithidea sinensis	211 ± 41	81 ± 21
Stenothyra glabra	332 ± 83	54 ± 16
Lamellibranchia		
Glaucomya chinensis	163 ± 45	49 ± 12

All the differences between two plant communities are significant at $P = 5\%$ level (data extracted from Chen et al., 2005).

Li et al. 2009

Presentation funded by APN

The impacts of *Spartina alterniflora* on the macrobenthonic invertebrates

Ten macrobenthos species were found in the *Spartina* salt marsh, and 36 species were found in the mudflat. And only three species were found both in the *Spartina* salt marsh and the mulfalt. This suggested that the species composition has been obviously changed.

Table 3 – Components of macrobenthos community in the *Spartina* salt marsh and the mudflat.

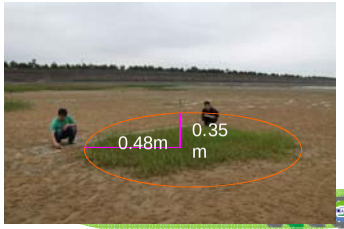
	Spartina salt marsh	Mudflat	Mutual species	Total
Coelenterate	0	2	0	2
Echinoderm	0	1	0	1
Brachiopod	0	1	0	1
Annelid	1	7	1	7
Mollusk	3	16	0	19
Crustacean	5	9	2	12
Fish	1	0	0	1
Total (no. of species)	10	36	3	43

Zhou et al. 2009

Presentation funded by APN

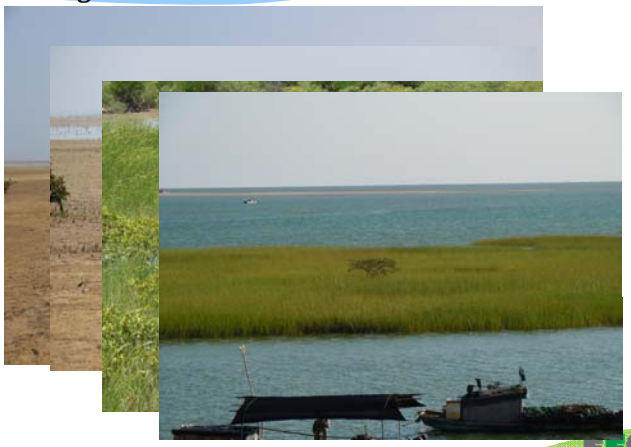
The impacts of *Spartina alterniflora* on the plant - mangroves



Presentation funded by APN

The impacts of *Spartina alterniflora* on the plant - mangroves



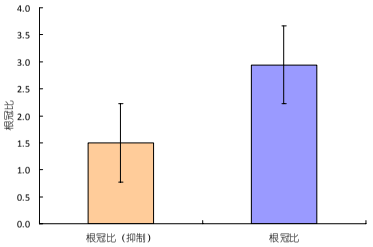
Presentation funded by APN

The impacts of *Spartina alterniflora* on the plant - mangroves

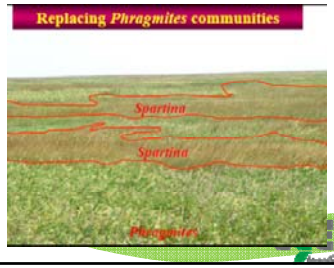
Spartina alterniflora can impacted the soil environmental, and changed the community of microorganism and macrobenthonic invertebrates, and then control the spread of aerial roots of mangroves.

The impacts of *Spartina alterniflora* on the plant - mangroves

The ratio of aerial roots and crown of mangroves can be distinguished impacted by the *spartina alterniflora* （P=0.048) in Beihai, Guangxi.



The impacts of *Spartina alterniflora* on the plant – native herbage



Li et al. 2012

The impacts of *Spartina alterniflora* on the plant – native herbage

The competitive dominance of *S. alterniflora* was shown in the conditions with the highest salinity, sand and full immersion, whereas *Phragmites australis* showed competitive dominance under the conditions with lowest salinity and non-immersion.

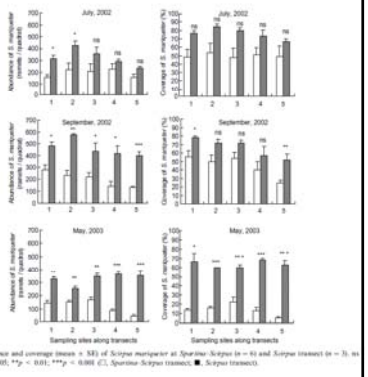
Table 1 – Summary of competitive balance between *Spartina alterniflora* and *Phragmites australis* based on the values of RNE, as affected by the growing conditions (modified from Wang et al., 2006b)

Factors manipulated	Treatments used	Competitive outcome
Salinity	0‰	*Phragmites* > *Spartina*,
	15‰	*Phragmites* = *Spartina*,
	30‰	*Phragmites* < *Spartina*
Sediment type	Sand	*Phragmites* < *Spartina*
	Clay	*Phragmites* = *Spartina*
	Mix	*Phragmites* = *Spartina*
Waterlogging	Non-immersion	*Phragmites* > *Spartina*
	Half-immersion	*Phragmites* = *Spartina*
	Full-immersion	*Phragmites* < *Spartina*

Li et al. 2009

The impacts of *Spartina alterniflora* on the plant – native herbage

In July 2002, the abundance and coverage of *S. mariqueter* between *Spartina–Scirpus* transect and *Scirpus* transect were not significantly different (except the abundance at sites 1 and 2). In September 2002, the abundance of *S. mariqueter* on *Spartina–Scirpus* transect was significantly lower than that in *Scirpus* transect at all sites, but their coverage were not significantly different). As a result, the abundance and coverage of *S. mariqueter* significantly decreased on the *Spartina–Scirpus* transect, compared with those on the *Scirpus* transect at all sites .



Chen et al. 2004

Presentation funded by APN

The impacts of *Spartina alterniflora* on the plant – native herbage

The reduction in abundance of *S. mariqueter* due to *S. alterniflora*'s competition resulted in the reduced seed production (except at site 1) and corm pool size of *S. mariqueter* (except at site 2).

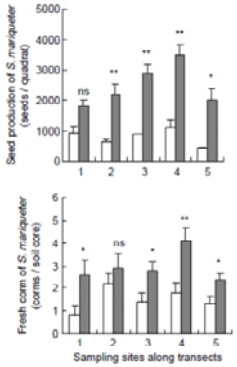


Figure 4. Seed production (sampled in November 2002) and fresh corm number (sampled in November 2002 and February 2003) (mean ± SE) of *Scirpus mariqueter* at *Spartina*–*Scirpus* (seed, $n = 3$; corm, $n = 10$) and *Scirpus transect* (seed, $n = 3$; corm, $n = 10$). ns $p > 0.05$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$ (□, *Spartina*–*Scirpus* transect; , *Scirpus* transect).

Chen et al. 2004

Presentation funded by APN

Conclusions

- *Spartina alterniflora* had significantly larger sizes of carbon and nitrogen stocks, and so increased the microorganisms density and biomass.
- Density and biomass of macrobenthonic invertebrates were different with the invaded time of *Spartina alterniflora* , and the species composition and dominant species of macrobenthonic invertebrates can be altered by *Spartina alterniflora*.
- *Spartina alterniflora* invasion interrupted natural succession of plant communities, and especially the unstable ecosystems can be destroyed by *Spartina alterniflora*, such as mangroves.

Presentation funded by APN

Presentation funded by APN

China's Response to Marine Invasive Species from the Legal Perspective and Challenges Review

Speaker: BAI JIA-YU

Qingdao 2012-10-23

Presentation funded by APN

Outline

- Status of marine invasive species in China
- Management system to counter with marine invasive species in china
- China's response to relevant international conventions and rules
- China's legislation about marine invasive species prevention
- Legislation assessment in the field of marine invasive species prevention
- Challenges for marine invasive species legislation and management regime
- Suggestions for marine invasive species legislations and management regime reform

Presentation funded by APN

What is marine invasive species?

Marine eco-security

Marine bio-security

Resource from: http:// www.great-lakes.net/envt/flora

Marine bio-invasion

Resource from : http://tieba.baidu.com/f?kz=683662693

Presentation funded by APN

Status of marine invasive species in China(1)

China's coastline: 18 000 km

3 semi-closed sea: Yellow Sea, East China sea, South China Sea

Invasive species: 400 categories (data from Ministry of Agriculture) Most threatening species: 50 categories (from Global Invasive Species Databse)

Marine invasive species: more than one hundred categories

Presentation funded by APN

Status of marine invasive species in china(2)

Serial No.	Name of Invasive Alien Species	Origins	
1	Prorocentrum minimum	From coastline of North America	Carried by vessels' ballast water
2	P. Sigmoides		
3	Perocentrum baltricum		
4	Alexandrum catencll a		
5	Scrippsiella trochoidea		
6	Peridinium perardiforme		
7	Chaetoceros Concavicornis	From North America	
8	Cyclindrotheca closterium		
9	Melosiar cancellate		
10	Nitzshia Deicatissima		
11	Pinnularia		
12	Spartina alteriflora	From North Carolina, Florida and Georgia in US.	Intentionally introduced
13	Spartina anglica	UK.	

Presentation funded by APN

Status of marine invasive species in china(3)

Serial No.	Name of Invasive Alien Species	Origins	Type
14	Hydroides elegans	unkonwn	Bio-fouling on the vessles
15	Mytilopis sallei	From central America	
16	Crepidula onyx	From central America	
17	Balanus eburneus	unknown	
18	B. improvisus	unkonwn	
19	B. amphitrite	unkonwn	
20	BRYOZOA 13 types	Europe, America	
21	Ciona intestinalis	unkonw	
22	Molgula manhattensis	From North America, coastline of Pacific ocean	
23	Sphaeroma walkexi	From North Indian Ocean	
24	Styela canopus	From North America, coastline of Pacific ocean	

Presentation funded by APN

Management system to counter with marine invasive species in China

- Ministry of Agriculture
- Ministry of Environmental Pr
- State Oceanic Administration
- Ministry of Transport
- General Administration of Quality S
- General Administration of Customs

ed by APN

China's response to relevant international conventions and rules (1)

International conventions	Status	China
Biological Diversity Convention	In force	ratified
Cartegena Protocol on Biological on Biological Safety	In force	ratified
United Nations Convention on Law of the Sea	In force	ratified
Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention on Wetlands)	In force	ratified
International Convention on the Control of Harmful Anti-fouling Systems on Ships	In force	ratified
International Convention for the Control and management of Ships' Ballast Water and Sediments	Yet in force	Not ratify
Convention on the Law of Non-Navigational Uses of International Watercourses	Yet in force	Not ratify

China's response to relevant international conventions and rules (2)

Soft laws:

- Rio Declaration on Environment and Development(1992)
- Agenda 21(1992)
- IMO Resolutions

Presentation funded by APN

China's legislation about marine invasive species prevention

Laws

Marine Environment Protection Law (2000)

Fisheries Law of People's Republic of China(2004)

Frontier Health and Quarantine Law (2007)

Administrative regulations

Regulation on the Prevention and Control of Vessel-induced Pollution to the Marine Environment(2009)

Divisional rules

Rules for the Implementation of Frontier Health and Quarantine Law(2010)

Local regulations

Regulations on the Prevention and control Vessel-induce Pollution to the Marine Environment of Zhuhai (2001)

Presentation funded by APN

Legislation assessment in the field of marine invasive species prevention(1)

Marine Environment Protection Law(2000)

Art. 25: The introduction of marine biological species shall subject to scientific assessment to avoid damages to marine ecosystems.

✓What is 'introduction' of marine biological species?
✓Who is entitled to such an introduction?
✓ How to organize the scientific assessment?
✓ How is the effectiveness of the scientific assessment?

Presentation funded by APN

Legislation assessment in the field of marine invasive species prevention(2)

Fisheries Law of People's Republic of China(2004)

Art. 6: the department of fishery administration under the State Council shall be in charge of the administration of fisheries throughout the country.
Art. 17: Quarantine must be executed for the import and export of aquatic fingerlings so as to prevent disease from passing into or out of the territory.

Department of fishery administration under the State Council manages the and controls invasive species on the premise of fishery development.

Presentation funded by APN

Legislation assessment in the field of marine invasive species prevention(3)

Frontier Health and Quarantine Law (2007)

Art. 1: This law is formulated in order to prevent infectious diseases from spreading into or out of the country, to carry out frontier healteh and quarantine inspection and to protect human health.

The management is from the perspective of health protection.

Legislation assessment in the field of marine invasive species prevention(4)

Regulation on the Prevention and Control of Vessel-induced Pollution to the Marine Environment(2009)

Art. 15 The ships that discharge ship garbage, daily sewage, oily sewage, sewage that contains poisonous substance, exhaust gas and other pollutants and ballast shall comply with laws, regulations and relevant standards and the relevant international conventions ratified or acceded by China.

Whether ballast water is considered as kind of pollution?
If not, there is no detailed management provisions about ballast water.

Challenges for marine invasive species legislation and management regime(1)

- Lack of comprehensive legislation about prevention from marine invasive species.
- The management system in charge of prevention from marine invasive species is appointed from the perspective of industry development .
- Ecosystem-based management is not considered in management liability distribution

Challenges for marine invasive species legislation and management regime(2)

- Prevention mechanism is not specific to different invasive channels
- Lack of responsibility provisions
- Lack of public attention on the issue

Suggestions for marine invasive species legislations and management regime reform(1)

- Comprehensive legislation about prevention and control of marine invasive species is necessary.
- The aim of the legislation is not only the protection of industry development and human health, but also the protection about biological diversity and biological safety.

Presentation funded by APN

Suggestions for marine invasive species legislations and management regime reform(2)

- Management regime should be arranged in accordance with the features of marine ecosystem.
- Fund institution and other prevention tools could be considered along with responsibility provisions.
- Public awareness should be enhanced.

Presentation funded by APN

Thank you!

Presentation funded by APN

Basic Surveys for International Convention for the control and management of Ships' Ballast Water and Sediments

Regional Workshop on Marine Invasive Species Problems
in Northwest Pacific Region
23-24 Oct. 2012,
Qingdao, China

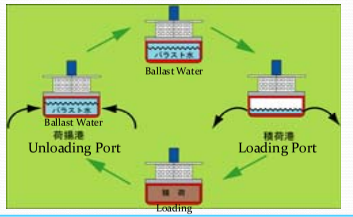
Ministry of Environment
Office of Marine Environment

Presentation funded by APN

Prevention of Harmful Aquatic Organisms and Pathogen in Ballast Water (International Convention for the control and management of Ships' Ballast Water and Sediments, - BWM Convention)

What is Ballast Water ?

○Ballast water is seawater to be mounted to ensure the safety and security of the ship after it emptied its load. Ballast water is often pumped-in at the departing place of the ship and discharged at the destination. In recent years, it has been suggested that ballast water may cause destruction of marine and coastal ecosystems and damages to fisheries. (It has been reported that native species have been reduced by predatory behavior of alien species in Sagami Bay, Osaka Bay and Hakata Bay and others).



Adoption of the BWM Convention

○ Following adoption of the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) in 2004, which aims to prevent marine ecosystem disturbance by organisms in a ship's ballast water. Basic information has been collected to effectuate the convention.

Organisms which give environmental impacts

daphnia
Black sea→Baltic Sea
- Fishing interference due to breeding

eriocheir
N.Asia→W.Europe, Baltic Sea, and West Coast of USA,
- Damage to ecosystem

undaria
N. Asia→S. Australia, West Coast of USA, and Europe
- Ecosystem destruction,
-Damage to shellfish aquaculture

Vibrio cholerae
? →S. America and Gulf of Mexico.
- In 1991, 1 mil. people infected in S. America and 10,000 died

ref. IMO

Presentation funded by APN

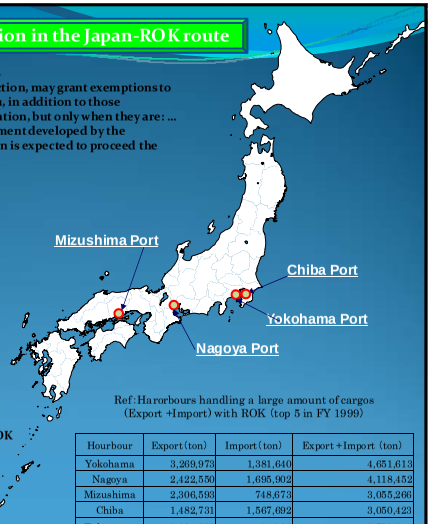
Exemption of the BWM Convention in the Japan-ROK route

■BWM Convention Regulation A-4

A Party or Parties, in waters under their jurisdiction, may grant exemptions to any requirements to apply regulations B-3 or C-1, in addition to those exemptions contained elsewhere in this Convention, but only when they are: ... granted based on the Guidelines on risk assessment developed by the Organization (G7). From FY 2012, the discussion is expected to proceed the conclusion of a treaty on Japan –ROK route.

■BWM Convention G7

1. Environmental matching risk assessment: Compare environmental conditions between donor and recipient ports/regions
2. Species' biogeographical risk assessment: Compare biogeographical distributions of nonindigenous, cryptogenic, and harmful native species that presently exist in the donor and recipient ports and biogeographic regions
3. Species-specific risk assessment: Compare individual species characteristics with environmental conditions in the recipient port, to determine the likelihood of transfer and survival



The organism survey (basic surveys for the BWM Convention) was conducted in FY 2011 and 2012 at harbours handling a large amount of cargos with ROK

Target Harbours	Survey Date	
	1st Survey	2nd Survey
Yokohama Port	2011.Dec.22	2012.Jan.31
Nagoya port	2011.Dec.21	2012.Feb.4
Mizushima Port	2011.Dec.20	2012.Feb.2
Chiba Port	2011.Dec.14	2012.Feb.6

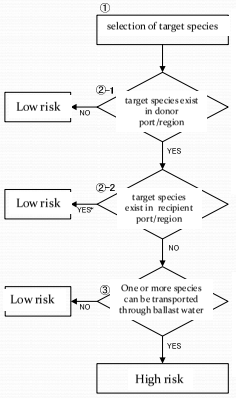
Ref: Harorbours handling a large amount of cargos (Export +Import) with ROK (top 5 in FY 1999)

Hourbour	Export(ton)	Import(ton)	Export+Import (ton)
Yokohama	3,269,973	1,381,640	4,651,613
Nagoya	2,422,550	1,695,902	4,118,452
Mizushima	2,306,593	748,673	3,055,266
Chiba	1,482,731	1,567,692	3,050,423
Fukuyama	2,631,628	91,286	2,722,914

Presentation funded by APN

Risk Assessment based on the BWM Convention (G7)

Assessment	Outline
Environmental matching risk assessment	・Compare environmental conditions including temperature and salinity between donor and recipient ports/regions ・Assess if the species in ballast water could survive in recipient ports/regions when released, in consideration of similarity in key environmental conditions between the two ports/regions (donor and recipient)
Species' biogeographical risk assessment	・Compare inhabiting non-indigenous and cryptogenic species in between donor and recipient ports/regions ・High similarity means that habitat environment of the two ports/regions are similar ・Assess if the species in ballast water could survive in recipient ports/ regions when released
Species-specific risk assessment	・Assess if individual species in donor ports/regions could survive in recipient ports/regions when released



Criteria for selecting "target species"
a. Evidence of introduction in the past
b. Proved impacts on environment, economy, human health, property and/or resources
c. Strength and types of ecosystem interaction
d. Latest distribution
e. Relationship with ballast water as a medium

Elements for judging the transported possibility of target through ballast water
a. Probability of uptake
b. Probability of transfer
c. Probability of discharge
d. Probability of establishment

Flow chart of risk assessment (draft)

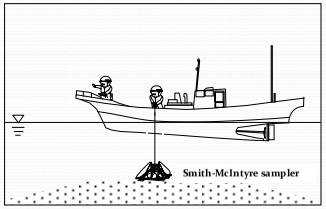
Even if target species exist in the recipient port/region, it is judged as "Low risk" if appropriate countermeasures are taken.

Presentation funded by APN

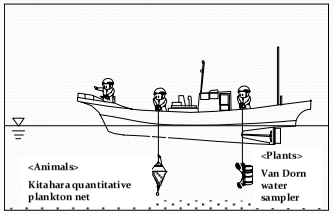
Basic Surveys for the BWM Convention

Survey Method

- **Survey Item**
  - → Water quality and Bottom sediment quality (nutrient load, COD, etc.)
  - → Organisms (macrobenthos, meiobenthos, phyto/zoo-plankton)
- **Survey Method**
  - → Water Quality ... surface layer(0.5 m below the surface), intermediate layer(1/2 water depth), bottom layer (1 m above the bottom)
  - → Bottom Layer ... Smith – McIntyre sampler
  - → Organisms
    - · Macrobenthos ... 0.5 mm and bigger
    - · Meiobenthos ... 0.04 mm and bigger and smaller than 0.5 mm
    - · Phytoplankton... sampling at 3 layers of water quality
    - · Zooplankton
      1st Survey (2 layers) ... 1 m from the surface and 1 m above the seabed
      2nd Survey (2 layers) ... 1 m from the surface and just above the sea bottom



Bottom Sampling System



Phyto-/zoo-plankton Sampling Method

Presentation funded by APN

Basic Surveys for the BWM Convention

Survey in FY 2011

- Different organisms exist between quays next to each other

Survey in FY 2012

- Risk of organism introduction through ballast water
  - → Importance of identifying biota at the front area of loading quays where ballast water is discharged
  - → Existence of different organisms between quays next to each other
  - → Increase of survey numbers at the front area of loading quays

⬇

- · Conducting seasonal surveys in consideration of seasonal variation of the biota
- · Conducting survey twice a day (at low and high tides) in consideration of the impacts of tides which significantly affect the water mass movement in the coastal area where ports are located

- Day/Night samplings
- Survey of biota at places in different distances from the quays

Presentation funded by APN

Preparing the regional report for conservation of marine biodiversity and sustainable use of marine ecosystem services in the NOWPAP region

CEARAC

Presentation funded by APN

Objective

To contribute to policy planning for marine biodiversity conservation in the NOWPAP member states

Regional Report:

- to provide useful information for policy planning on marine biodiversity conservation in each member state
- to contribute to promotion of the future marine biodiversity conservation in the NOWPAP region

Presentation funded by APN

Main Tasks

1. Collecting information on existing MPAs and other related issues in the NOWPAP region
2. Analyzing the status of MPAs in the NOWPAP region
3. Organizing a workshop to discuss possibility of applying other concepts for marine biodiversity conservation to the NOWPAP region
4. Preparing a regional report

Presentation funded by APN

1. Collecting information on existing MPAs and other related issues in the NOWPAP region

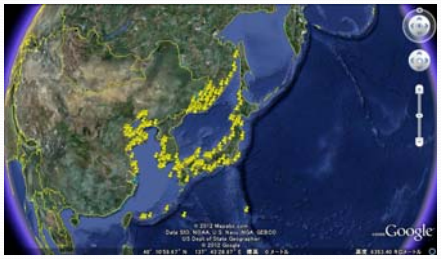
1.1 Collecting basic information on MPAs in the NOWPAP region

1.2 Collecting information on the monitoring and management status in selected MPAs in the member states

Presentation funded by APN

Number and Location of MPAs in the NOWPAP region

Total 278 MPAs are registered in the DINRAC MPA Database (China: 84 (2), Japan: 99 (34), Korea: 30, Russia: 65 (22))



Presentation funded by APN

Number and area of MPAs in the NOWPAP region

(not including MPAs in inland and out of the NOWPAP region)

Country	Number of MPAs	Area (hectares) of MPAs
China	82	2,568,483
Japan	65	412,904
Korea	30	549,867
Russia	43	922,921
Total	**220**	**4,454,139**

2% of the entire NOWPAP region

Presentation funded by APN

The IUCN Protected Area Management Categories

Category of protected area		Primary objective
Ia	Strict nature reserve	To conserve regionally, nationally or globally outstanding ecosystems, species (occurrences or aggregations) and/or geodiversity features: these attributes will have been formed mostly or entirely by non-human forces and will be degraded or destroyed to all but very light human impact
Ib	Wildness area	To protect the long-term ecological integrity of natural areas that are undisturbed by significant human activity, free of modern infrastructure and where natural forces and processes predominate, so that current and future generations have the opportunity to experience such areas
II	National park	To protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote education and recreation.
III	Natural monument of feature	To protect specific outstanding natural features and their associated biodiversity and habitat
IV	Habitat and species management area	To maintain, conserve and restore species and habitats
V	Protected landscape and seascape	To protect and sustain important landscape/seascape and the associated nature conservation and other values created by interactions with humans through traditional management practices
VI	Protected area with sustainable use of natural resources	To protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial

Presentation funded by APN

Relation of IUCN categories and MPAs in the NOWPAP member states

IUCN categories	China	Japan	Korea	Russia
Ia	Nature Reserve	Nature Conservation Area		State Nature Reserves State Nature Partial Reserve Natural Park
Ib		Nature Reserve		State Nature Reserves State Nature Partial Reserves Natural Park National Park
II	Marine Special Reserve	Natural Park		National Park
III	Nature Reserve	Natural Monument		State Nature Reserves State Nature Partial Reserves Natural Park Nature Sanctuaries
IV	Nature Reserve	Natural Habitat Conservation area Wildlife Protection Area Protected Water	Marine Ecosystem Protected Area Coastal Wetland Protected Area	State Nature Reserves State Nature Partial Reserves Natural Park
V	Nature Reserve Ocean Park	Natural Park Natural Seashore Conservation Area		State Nature Reserves State Nature Partial Reserves Natural Park National Park Nature Sanctuaries
VI	Fisheries Genetic Resources Reserve	Natural Park Coastal Fishery Resources Enhancement Area or Designated Marine Area Common Fishery Right Area Protected Water Various Areas designated by Prefecture Government, Fishery cooperatives groups of local fishers	Environment Conservation Sea Areas	State Nature Partial Reserves Natural Park

Presentation funded by APN

1.2 Collecting information on monitoring and management in the selected MPAs in the member states

Nominated experts are collecting following information

- Hydrographic condition
- Ecological characteristics
- Presence/absence of regular monitoring
- Presence/absence of the management plan
- Presence/absence of specific protected species and their conditions

Presentation funded by APN

Selected target MPAs in each member state

China (10 MPAs)

Haiyang Qianliyan Island Marine Ecosystem Provincial Nature Reserve; Zhifu Archipelago National Marine Special Reserve; Rongcheng Bay National Fisheries Genetic Resource Reserve; Sanggou Bay Marine Creatures Country Nature Reserve; Rushan National Fisheries Genetic Resources Reserve; Jiaozhou Bay Wetland Provincial Marine Special Reserve; Jinshitan Seashore Geological Municipal Nature Reserve; Haizhou Bay National Ocean Park; Kongdong Islands Provincial Nature Reserve; Yancheng Rare Bird National Nature Reserve

Japan (10 MPAs)

Danjyo guntou islands; Breeding habitat of Streaked Shearwater and Japanese Cormorant in Awashima island; Genkai Quasi National Park; Niseko-Shakotan-Otarukaigan Quasi National Park; San'in kaigan National Park; Daiseb-Oki National Park; Kanmurijima-Kutsujima National Wildlife Protected Area; Kosado Toubu National Wildlife Protected Area; Sakiyama Bay

Korea

TBD

Russia (8 MPAs)

Far Eastern Marine; Kuril; Lazovsky; Sikhote-Alin; Lamd of the Leopard; Tumninsky; Vostok Bay; Moneron Island

Presentation funded by APN

2. Analyzing the status of MPAs in the NOWPAP region

2.1 Analysis on the status of MPAs in the NOWPAP region
- Definition of MPA in each member state
- Current status of MPAs in the NOWPAP region
- Protected species in MPAs in the NOWPAP region

2.2 Analysis on the status of monitoring and management in the selected MPAs
- Hydrographic condition
- Ecological characteristic
- Implementing status of monitoring
- Management status on the marine environment and marine species
- Situation of protected species

Presentation funded by APN

3. Organizing a workshop

Objective:
- To discuss the possibility for application of a new concept to sea area for marine biodiversity conservation and sustainable use of marine ecosystem services

Timing: End of 2012 or Beginning of 2013

Expected participants
- Expert(s) of each member state
- Experts from relative international organizations

Presentation funded by APN

3. Organizing a workshop

Discussion points
- Current status of MPAs in the NOWPAP region
- New concepts for marine biodiversity conservation
  - Ecologically and Biologically Significant Area
  - Marine Protected Area Network
- Self-assessment on management effectiveness

Expected outputs
- Potential new concepts for the NOWPAP region
- Possibility of self-assessment on management effectiveness

Presentation funded by APN

4. Preparation of regional report

Draft table of contents

1. Introduction
2. Regional overview on existing MPAs in the NOWPAP region
   - 2-1 Situation of existing MPAs in the NOWPAP region
   - 2-2 Criteria of MPAs in the NOWPAP member states
   - 2-3 Purposes of MPAs in the NOWPAP member states
3. Monitoring and management status in the selected MPAs in the NOWPAP region
   - 3-1 Oceanic condition
   - 3-2 Monitoring status of the marine environment and marine species
   - 3-3 Management status of the marine environment and marine species
   - 3-4 Situation of protected species

Presentation funded by APN

4. Preparation of regional report

Draft table of contents

4. New concept for marine biodiversity conservation and sustainable use of marine ecosystem services
   - 4-1 Possibility on applying a concept of ecologically and biologically significant sea areas to the NOWPAP region
   - 4-2 Possibility on establishing MPA networks for marine biodiversity conservation
   - 4-3 Possibility of self-assessment on the management effectiveness

5. Conclusion

Presentation funded by APN

Other information on marine biodiversity

Information on invasive species, endemic species and endangered species in MPAs of each member state

DINRAC MPA DB
DINRAC Report
DINRAC WS

Common target species among the NOWPAP member states

New Concept
- MPA Network
- Common conserved sea area

Presentation funded by APN

Expected outcome

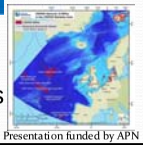
- Useful information for policy makers of the member states in order to enhance marine biodiversity conservation measures
- Basic concepts for marine biodiversity conservation in the NOWPAP region

➡ Regional Action Plan for marine biodiversity conservation

Potential partners

- NOWPAP DINRAC
  - Database on MPAs
  - Information on Invasive species

- OSPAR
  - Experiences on designing EBSAs
  - Self-assessment on management effectiveness



Presentation funded by APN

Aquaculture & MIS in China: Status , management and policy
水产养殖和海洋外来物种：现状，管理和政策

WANG Yamin

王亚民

College of Ocean,
Shandong University at Weihai

E-mail: wildlifes66@yahoo.com.cn

Presentation funded by APN

Aquaculture in China

China is largest aquaculture country in the world

56 million T in 2011

Marine: 29 million T

Presentation funded by APN

Aquatic AS in China

(Fresh and Marine species)

Total: about 129 species most from aquaculture introduction

Fish: 89 (15)
(65 from foreign country)
Crustacean: 10 (7)
Shellfish: 12 (12)
Aquatic plant : 18 (5)
other: 12
(2006 Y.WANG)

Turbot 大菱鲆
Scophthalmus maximus

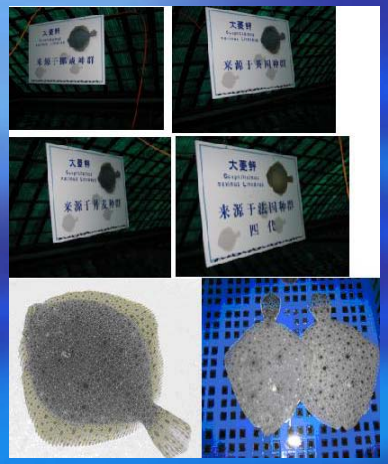
南美白对虾(Penaeus vannamei Boone)

Presentation funded by APN

表1 山东省主要水产养殖外来物种情况

Table 1 General description of alien species introduction for aquaculture in Shandong Province

序号 No	物种名称 Introduced species	序号 No	物种名称 Introduced species
1	眼斑拟石首鱼(*Sciaenops ocellatus*)	32	史氏鲟(*Acipenser schrenckii* Brandt)
2	美国石首鱼(*Cynoscion nebulosus*)	33	南美白对虾(*Penaeus vannamei* Boone)
3	大菱鲆(*Scophthalmus maximus* L.)	34	厄瓜多尔南美白对虾
4	红鳍东方鲀(*Fugu rubripes*)	35	澳大利亚雅比虾(*Cherax destructor*)
5	条纹鲈(*Morone saxatilis*)	36	澳大利亚麦龙虾(*C. tenuimanus*)
6	漠斑牙鲆(*Paralichthys lethostigma*)	37	蓝对虾(*Penaeus stylirostris*)
7	条纹锯鮨(*Centropristis striata*)	38	无病毒(SPF)对虾(*P. vannamei*)
8	犬齿牙鲆鱼(*Paralichthys dentatus*)	49	日本对虾(*P. japonicus*)
9	斑点犬牙石首鱼(*Cynoscion nebulosus*)	40	罗氏沼虾(*Macrobrachium rosenbergii*)
10	道纳尔逊虹鳟(*Salmo gairdneri Richardson*)	41	红螯螯虾(*Cherax quadricarinatus*)
11	斑点叉尾鮰(*Ictalurus punctatus*)	42	海湾扇贝(*Argopecten irradians*)
12	虹鳟(*Oncorhynchus mykiss/Salmo gairdneri*)	43	美国墨西哥扇贝南方种群
13	美国大口胭脂鱼(*Ictiobus cyprinellus*)	44	美国墨西哥扇贝北方种群
14	淡水白鲳(*Piaractus brachypomus*)	45	塔斯马尼亚扇贝
15	红罗非鱼(*Tilapia zillii*)	46	中间球海胆(*Strongylocentrotus intermedius*)
16	苏氏圆腹鲇(*Pangasius sutchi*)	47	美国红鲍(*H. rufescens*)
17	尼罗罗非鱼(*Oreochromis niloticus*)	48	美国绿鲍(*H. fulgens*)
18	奥利亚罗非鱼(*O. aureus*)	49	虾夷扇贝(*Patinopecten yessoensis*)
19	莫桑比克罗非鱼(*Tilapia mossambica*)	50	太平洋牡蛎(*Crassostrea gigas*)
20	大西洋鲑(*Salmon salar*)	51	象拔蚌(*Panopea abrupta*)
21	银鲈(*Gerridae*)	52	澳洲栉孔扇贝(*Chlamys asperrima*)
22	金鲈(*Perca flavescens*)	53	巨藻(*Macrocystis pyrifera*)
23	大口黑鲈(*Micropterus salmoides*)	54	异枝麒麟菜(*Eucheuma striatum* Schmitz)
24	革胡子鲶(*Clarias lazera*)	55	绿孔等鞭金藻(*Isochrysis galbana* Parke)
25	斑点胡子鲶(*C. macrocephalus*)	56	盐生杜氏藻
26	日本香鱼(*Plecoglossus altivelis*)	57	牟氏角毛藻
27	小口脂鲤(*Prochilodus scrofa*)	58	钝顶螺旋藻
28	德国镜鲤(*Cyprinus carpio var. specularis*)	69	长叶海带(*Laminaria longissima* Miyabe)
29	鳄龟(*Chelydra serpentina*)	60	日本真海带(*Laminaria japonica*)
30	俄罗斯鲟(*Acipenser gueldenstaedti Brandt*)	61	美国青蛙(*Rana* [illegible])
31	匙吻鲟(*Polyodon spathula*)	62	牛蛙(*Rana catesbeiana*)



大菱鲆*Scophthalmus maximus(Rafinesque*

Turbot ,
Introduce in 1992, from UK
China Weihai, Qingdao

Presentation funded by APN

眼斑拟石首鱼*Sciaenops ocellatus*

红鲍
Haliotis rufescens

Presentation funded by APN

Law and Regulation in China Related MIS Management

No special Law and Regulation on MIS or IS Management, but some articles related

"Law of Fisheries, China"
"Law of Marine Environment Protection,"
"Law of Wildlife Conservation"
"Regulation of Wild Plant Conservation"

Presentation funded by APN

Law of Fisheries, China

Article 16: Import and export aquatic seed, must be approved by Fisheries Agency, State Department or fisheries agency of province government.

渔政色标
M90Y100
M100Y100K35
M15Y100
C65M30
C100M50

Presentation funded by APN

Law of Marine Environment Protection, China

Article 25:

Introduce marine Fauna and Flora species, should implement scientific assessment, and avoid damage marine ecology system.

Presentation funded by APN

Law of Wildlife Conservation

Article 24:

The export of wildlife under special state protection or the products thereof, and the import or export of wildlife or the products thereof, whose import or export is restricted by international conventions to which China is a party, must be approved by the department of wildlife administration under the State Council or by the State Council (Fisheries or forestry Agency)

Presentation funded by APN

Regulation of Wild Plant Conservation

Article 20:

The export of wild plant under special state protection or the products thereof, and the import or export of wild plant or the products thereof, whose import or export is restricted by international conventions to which China is a party, must be approved by the department of wild plant administration under the State Council or by the State Council (Agriculture, Fisheries or Forestry Agency)

Presentation funded by APN

Who manage IS , AS and IAS in China?

At first, IAS ,SEPA before 2002 (?) on bio-safety,
Late, co-ordinate and adjust by State Council of China :
Transfer IS duty from SEPA to Ministry of Agriculture

MOA draft a regulation "China Invasion Alien Species management " now and will Promulgate or action in end 2012 or 2013

Presentation funded by APN

Who manage marine and aquatic species in China?

By law and regulation:

"Law of Fisheries, China"
"Law of Marine Environment Protection,"
"Law of Wildlife Conservation"
"Regulation of Wild Plant Conservation"

Central Government:
Ministry of Agriculture (fisheries Bureau)
Local Government:
Province (City, Country) Fisheries Agency

Presentation funded by APN

Why MOA, BOF

In China, According Law of fisheries and Law of Marine Environment Protection and other law:

"fisheries resources" means "aquatic biology resources (Marine and freshwater plant and animal)
So manage fisheries means manage aquatic species.

Presentation funded by APN

Key Management Authority of Aquatic and Marine IS in China

Central Government:
Bureau of Fisheries, MOA
Local Government:
Province (City, Country) Fisheries Agency
Related Management Authority:
Environment Agency, Marine Agency, Custom, Quarantine Agency .....

Presentation funded by APN

Who manage EIA in China

By Law of EIA,China
Ministry of Environment Protection.
How to co-ordinate EIA and aquaculture or MIS introduction?

Presentation funded by APN

Management and policy ?

Management ?
No.

Action Plan?
Only plan,
No action

Presentation funded by APN

Recommendation

Cooperation of international and national level,

Coordination of MOA & MEP, China

Reinforce law and regulation on aquatic alien species management

Set up institution on risk evaluating for aquatic Alien invasive species

Presentation funded by APN

Recommendation

EIA on introduce alien aquatic species for aquaculture by MEP, and participate by SOA;

Strengthen animal and plant inspection and enforcement

Presentation funded by APN

Distinguish focal point and key management authority and responsibility in China, cooperation and dividing the work

Develop international cooperation, control aquatic alien invasive species

Process research input and enhance capability building

Develop education and public awareness.

Presentation funded by APN


Thank you
Presentation funded by APN

Ballast Water Management (BWM) — An Approach to Combat MIS

Nahui Zhang, Zhitao Zhang
Institute of Environmental Engineering, Dalian Maritime University, China

Email: zhangnahui@gmail.com

INSTITUTE OF ENVIRONMENTAL ENGINEERING DALIAN MARITIME UNIVERSITY

Regional Seas NOWPAP DINRAC

Qingdao, China, October 24, 2012

Presentation funded by APN

OUTLINE

- Introduction – background issue
- International regulation – BWM Convention
- Ballast water treatment technology – current status
- Conclusion

INTRODUCTION

- **Shipping transfers approximately 3 to 5 billion tons of ballast water internationally each year.**
- **An estimated 7,000 marine and coastal species travel across the world's oceans via ship's ballast water.**

What is ballast water?

Ballast water is water carried by ships to ensure stability, trim and structural integrity.

INTRODUCTION

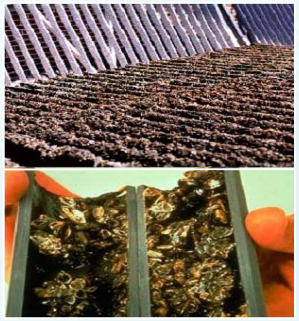
The Issue

- **The introduction of marine invasive species into new environments by ships' ballast water has been identified as one of the four greatest threats to the world's oceans.**
- **Non-native species, if they become established, can have a serious ecological, economic and public health impact on the receiving environment.**

INTRODUCTION

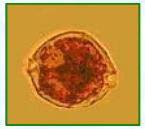
Invasive marine alien species to the world's oceans

Chinese mitten crab in the coast of UK and America

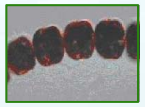


European Zebra Mussel infested in the Great Lake

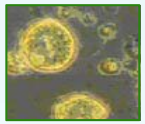
INTRODUCTION



Alexandrium minutum
Native country: Egypt
Invasive country: Australia, Japan, China, North America
Management: Periodically monitor coastal seawater plankton community.



Gymnodinium catenatum
Native country: Tasmania, Liberia
Invasive country: Mexico, New Zealand
Management: Strengthen the detection, control, inactive and long-term management in non-invasive place.



Scrippsiella trochoidea
Native country: No data found.
Invasive country: China
Management: Periodically monitor coastal seawater plankton community.

OUTLINE

- Introduction – background issue
- **International regulation – BWM Convention**
- Ballast water treatment technology – current status
- Conclusions

INTERNATIONAL REGULATION

- **BWM Convention - the IMO adopted the International Convention for the Control and Management of Ships' Ballast Water and Sediments in 2004.**

Status of 2004 BWM Convention

As of 5 October 2012

Countries	% Tonnage	States to the Convention
Needed: 30 Current: 36	Needed: 35 Current: 29.07	Albania, Antigua and Barbuda, Barbados, Brazil, Canada, Cook Islands, Croatia, Egypt, France, Iran, Kenya, Republic of Korea, etc.

IMO BWM CONVENTION TREATMENT STANDARDS

- Regulation D-1 - the Ballast Water Exchange standard
- Regulation D-2 - the Ballast Water Treatment Performance standard

REGULATION D-2

Organism group	Regulation D-2
Plankton, > 50 µm in minimum dimension	< 10 cells/m³
Plankton, 10-50 µm	< 10 cells/ml
Escherichia coli	< 250 *cfu*/ 100 ml
Intestinal enterococci	< 100 *cfu* / 100 ml
Vibrio cholerae	< 1 *cfu* / 100 ml

Note: cfu = colony forming unit

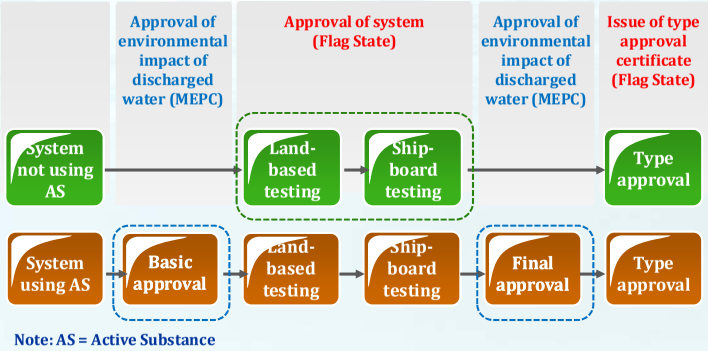
IMO BWM CONVENTION COMPLIANCE TIMEFRAME

IMO BWM Convention Implementation Schedule

Ballast Capacity (m³)	Build Date	2009	2010	2011	2012	2013	2014	2015	2016	2017
< 1,500	< 2009	D-1 or D-2								D-2*
	in 2009	Note: D-1; D-2 by 2nd annual but not beyond 31 Dec. 2011 or EIF, whichever is later								
	> 2009			D-2 (at delivery or EIF, whichever is later)						
≥ 1,500 or ≤ 5,000	< 2009	D-1 or D-2						D-2*		
	in 2009	Note: D-1; D-2 by 2nd annual but not beyond 31 Dec. 2011 or EIF, whichever is later								
	> 2009			D-2 (at delivery or EIF, whichever is later)						
> 5,000	< 2012	D-1 or D-2								D-2*
	≥ 2012	N/A			D-2 (at delivery or EIF, whichever is later)					

Note: EIF = Entry into force;
* First Intermediate or Renewal Survey, whichever occurs first, after the anniversary date of delivery in the respective year.

TREATMENT SYSTEM APPROVAL



Note: AS = Active Substance

OUTLINE

- Introduction – background issue
- International regulation – BWM Convention
- **Ballast water treatment technology – current status**
- Conclusions

BW TREATMENT TECHNOLOGIES

Two generic types of process technology used in ballast water treatment: SOLID-LIGUID SEPARATION and DISINFECTION.

Physical solid-liquid separation

Treatment:
- Hydrocyclone
- Surface filtration

Chemical enhancement:
- Coagulation / Flocculation

Disinfection

Chemical treatment:
- Chlorination
- Ozonation
- AOP
- Chlorine dioxide

Residual control:
- Chemical reduction

Physical enhancement:
- Ultrasonic
- Cavitation

Or

Physical:
- UV irradiation
- Deoxygenation
- Cavitation

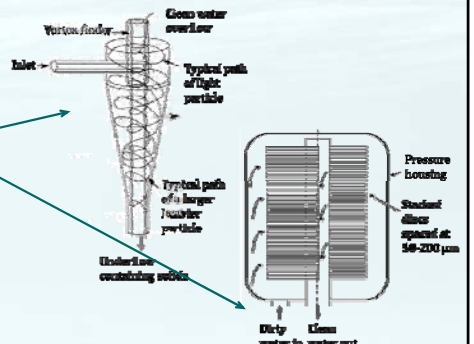
BW TREATMENT TECHNOLOGIES

Two generic types of process technology used in ballast water treatment: SOLID-LIGUID SEPARATION and DISINFECTION.

Physical solid-liquid separation

Treatment:
- Hydrocyclone
- Surface filtration

Chemical enhancement:
- Coagulation / Flocculation



BW TREATMENT TECHNOLOGIES

Two generic types of process technology used in ballast water treatment: SOLID-LIGUID SEPARATION and DISINFECTION.

Disinfection

Chemical treatment:
- Chlorination
- Ozonation
- AOP
- Chlorine dioxide

Residual control:
- Chemical reduction

Physical enhancement:
- Ultrasonic
- Cavitation

Or

Physical:
- UV irradiation
- Deoxygenation
- Cavitation

TECHNICAL INFORMATION FOR BWMS

AOP TECHNOLOGY

Methods: Filtration + ·OH (AOP)

Approval Status: Basic Approval for Active Substances, March 2012

Operational Notes:

During ballasting -
50 µm self-cleaning automatic filter + ·OH unit

During de-ballasting -
Neutralization

TECHNICAL INFORMATION FOR BWMS

ELECTROLYSIS TECHNOLOGY

Methods: Filtration + electrolysis (sodium hypochlorite)

Approval Status: Final Approval for Active Substances, October 2010
Type Approval, March 2011, China (BalClor™ System)

Operational Notes:

During ballasting - 50 µm filter + electrolysis

During de-ballasting - Neutralization

The status of installation of BWMS on ships

Construction year	Number of ships	Ballast water capacity (m^3)		
		< 1,500	1,500-5,000	> 5,000
< 2009	BWMS installed	0	0	2
	BWMS not installed	465	342	579
	Total	465	342	581
≥ 2009 and ≤ 2011	BWMS installed	0	1	9
	BWMS not installed	122	74	256
	Total	122	75	265
≥ 2012	BWMS installed	0	0	0
	BWMS not installed	0	0	136*
	Total	0	0	136*

* On order book

(Source: CCS Database)

CONCLUSIONS

- The uncertainty of the sampling and analysis method on BWMS used during port state inspection discourages shipowners from early installation before the entry into force of BWM Convention.
- The uncertainty of entry into force of the BWM Convention still remains, an early installation of BWMS will mean additional cost. The shipowners would certainly prefer a product that meets the latest requirements with better performance at a lower price.
- Alternative methods of ballast water treatment are also under development now, such as storing fresh water in ballast tank or flow-through ballast water system, which provide the shipowners with other choices.

Thank You!

Nahui Zhang, Zhitao Zhang
Institute of Environmental Engineering, Dalian Maritime University, China

INSTITUTE OF ENVIRONMENTAL ENGINEERING DALIAN MARITIME UNIVERSITY

UNEP Regional Seas NOWPAP DINRAC

Qingdao, China, October 24, 2012

Current Policies, Measures and the Challenges on Preventing and Controlling MIS Problems in Korea

2012. 11

Jae-Young Lee
Marine Ecology Division, MLTM

Presentation funded by APN

Contents

Presentation funded by APN

❖ Legislations for MIS

Marine Organisms/ Ecosystem	**Conservation and Management of Marine Ecosystem Act** ▪ Chapter III. Protection of M. Organisms ▪ Article 23 (Management of **Organisms Disturbing Marine Ecosystems**) / including LMO(Living Modified Organisms)
Ballast Water	**Marine Environment Management Act** ▪ Chapter III. Regulations for Prevention on M. Pollution ▪ Article 22 (Prohibition of Discharges, etc. of Pollutants) **Ballast Water Management Act** ▪ (Purpose) To **control of the infusion of harmful aquatic organisms** in to the ROK / **conservation of the marine ecosystem** ▪ treatment, exchange, uptake, and discharge

Presentation funded by APN

❖ Baseline Monitoring for Marine Ecosystem

What are Marine Invasive Species ?

▪ **non-native** (or exotic) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health

What are Native(Endemic) Species?

▪ Establishing National Monitoring System First

▪ Then Establishing Monitoring System for M.Invasive Species

Presentation funded by APN

❖ Baseline Monitoring for Marine Ecosystem

Marine

MLTM
Ministry of Land, Transport and Maritime Affairs

- National Investigation on Marine Ecosystem
- National Monitoring on Coastal Wet-lands
- Long-term Marine Ecological Research(R&D)

MIFAFF
M. for Food, Agriculture, Forestry and Fisheries

- Oceanographic and Fisheries Monitoring System

Terrestrial

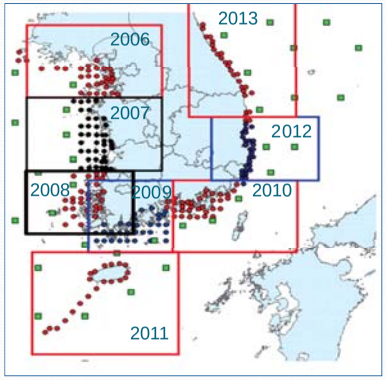
ME
Mistry of Environment`

- Korea National Long-term Ecological Research

Presentation funded by APN

❖ Baseline Monitoring for Marine Ecosystem

- **National Investigation on Marine Ecosystem (1st Phase since 2006)**



Environment	Items
Benthic (Sediment, Rock, etc)	General Environ. Condition
	Benthos
	Sea-weeds, algae, plants
Pelagic Environ.	General Environment Cond.
	Phytoplankton
	Zooplankton
Nekton	Fish, cephalopods, Crustacea, etc

- Taxonomy /Distribution
- Biomass, Diversity, Richness, etc
- Bio-diversity Hotspot
- Seasonal Obs.

Presentation funded by APN

❖ Baseline Monitoring for Marine Ecosystem

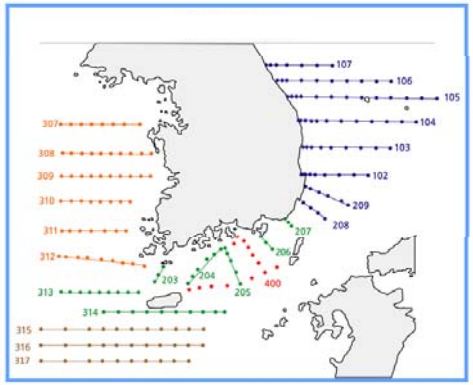
- **National Monitoring on Coastal Wet-lands(2nd Phase since 2009)**

- Taxonomy / Distribution
- Sediment(tidal-flat) Quality Condition
- Biomass, Diversity, Richness, etc

Presentation funded by APN

❖ Baseline Monitoring for Marine Ecosystem

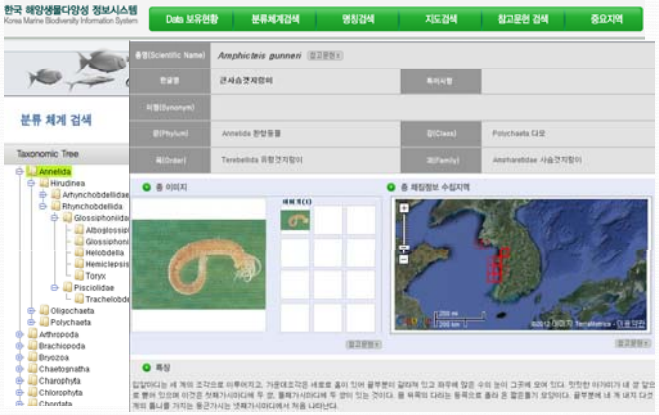
- **Oceanographic and Fisheries Monitoring System (Since 1961)**



Presentation funded by APN

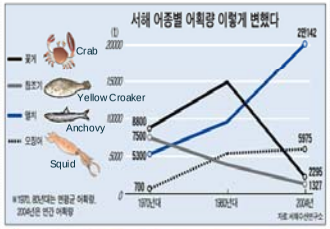
❖ Baseline Monitoring for Marine Ecosystem

▪ Korea Marine Biodiversity Information System(KOMBIS, http://kombis.re.kr)

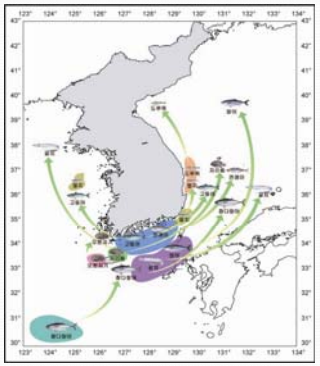


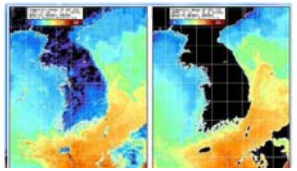
❖ Baseline Monitoring for Marine Ecosystem

▪ Changes in Fisheries



▪ Distribution Changes



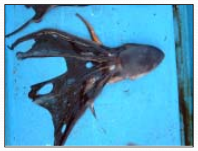


▪ Increase of Surface Sea-water Temperature

❖ Baseline Monitoring for Marine Ecosystem

▪ Issue of Climate Change(Global Warming) / Invasive Exotic Species


[Giant Red Sting Ray]


[Purple Octopus]


[Whale Shark]


[Red Sea-turtle]


[Blue Marlin]


[Japanese Rock Crab]

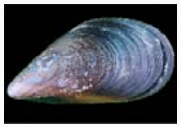
❖ Specific Study and Research on MIS

▪ Study on the monitoring and Management for Disturbing Organisms (Since 2007)

Monitoring on Invasive Species	10 Ports (Twice a year)	▪ Designation of 7 Candidate Species as Disturbing Organisms to Marine Ecosystem (in 2009) ▪ 27 candidates of invasive species ▪ Developing Management Tool - Risk Assessment - Procedures for Designation of Disturbing Organisms to Marine Ecosystem - Study on countermeasure against Disturbing Organisms
Monitoring on Spreading of MIS	6 Ports (Twice a year)	
Active Monitoring (Biofouling)	Key Area (Three time/year)	
Environment Risk Assessment	Key Area (Twice a year)	

❖ Discussions

▪ **Seven Candidates for Disturbing Organisms to M. Ecosystem in ROK**



Mytilus galloprovincialis

Balanus amphitrite

Balanus perforatus

Styela plicata

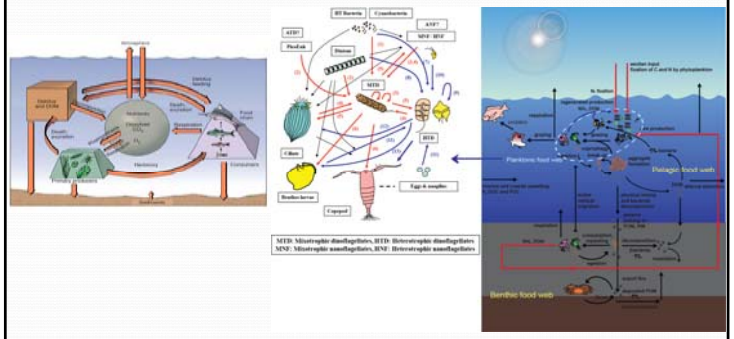
Ciona intestinalis

Ulva armoricana

Ulva fasciata

❖ Baseline Monitoring for Marine Ecosystem

▪ **Long-term Marine Ecological Study (R&D)**
<Function and Structure of Marine Ecosystem>



❖ Discussions

▪ **Definition of Marine Organisms**

<Conservation and Management of M. Ecosystem Act>

- Marine Organisms / Migratory Marine Animals / Marine Mammals
- Marine Organisms under Protection
- **Organisms Disturbing M. Ecosystems**
  (a) flowing in from abroad artificially or naturally, which cause or are likely to cause disturbance to the balance of marine ecosystems
  (b) cause or are likely to cause disturbance to the balance of marine ecosystems, from among genetically modified organisms produced through genetic modification
- **Harmful Marine Organisms** : harmful to the life or property of people

❖ Discussions

▪ **Implementing Environment Risk Assessment / Management Response**

- Designating Disturbing Organisms(or MIS) in Different Category(Grade)
- Applying Different Countermeasures
  (a) **Routine Monitoring** : to detect MIS before they become spread
  (b) **Rapid Response** to Eradicate or Control MIS (prevent spreading)
  (c) **Long-term Response** to Mitigate Impacts of MIS (after spreading)
- Control of Pathways that lead to the introduction, spread and re-invasion

❖ Discussions

- **Joint Project in Regional Level (e.g. NOWPAP)**
  - D/B of species based information on the physiological and ecological attributes
  - Sharing experience and outcomes of risk profiling activities for species

Presentation funded by APN

THANK YOU

Presentation funded by APN

Current policies and measures on preventing and controlling MIS problems in Russia

Olga Ya. Semenikhina

Far Eastern Marine Research, Design and Technology Institute
Vladivostok, Russia

Presentation funded by APN

The Russian environmental legislation:

- *is based on the Constitution of the Russian Federation*
- *includes Federal Laws, Presidential Decrees, Governmental Orders, acts of federal executive bodies etc.*
- *contains principles and provisions of ratified international conventions and agreements*
- *comprises provisions of other international treaties if they do not contradict the state policy and national environmental legislation*

Presentation funded by APN

- ***Russia has not specific legislative acts aimed at solving the issue of invasion of alien species including marine and coastal ones***
- ***A national strategy for alien species is lacking too***

Presentation funded by APN

The list of base legal acts applicable to marine and coastal invasive species

The Federal Law of the Russian Federation "On the Conservation of the Environment" N 7-FZ, dated January 10, 2002:

prohibits production, raising and use of plants, animals and organisms, which are not peculiar to natural ecological systems or artificially made, without development of the effective measures for preventing their uncontrolled reproduction, positive decision of governmental ecological expertise, and permission of federal authorities performing functions in the sphere of the environmental protection

The Federal Law of the Russian Federation "On the Specifically Protected Natural Territories" N 33-FZ, dated March14, 1995:

prohibits the introduction of living organisms for their acclimatization on the territory of the state wildlife reserved areas and national parks

Presentation funded by APN

The list of base legal acts applicable to marine and coastal invasive species

The Federal Law of the Russian Federation "On the Animal World" N 52- FZ, dated April 24, 1995:

allows to acclimatize the objects of the fauna which are new to Russia's fauna, to move the objects of the fauna to new habitats, and to perform the hybridization of the animal world's objects only with the permission of special authorized governmental bodies in protecting, controlling, and regulating the use of objects of the animal world and habitats and in presence of resolution of competent scientific organization taking into consideration the requirements for environmental safety

The list of base legal acts applicable to marine and coastal invasive species

The Federal Law of the Russian Federation "On Fishery and Conservation of Water Biological Resources" N 166-FZ, dated December 20, 2004:

determines the acclimatization of water living resources as an activity on placement of water living resources of valuable species into water bodies with fishery capabilities and in creation of stable populations of these species in the water bodies with fishery capabilities, which have not been inhabited before by these species or have lost its value. The order of measures for acclimatization of water living resources is defined by the federal executive body in the field of fishery

The list of base legal acts applicable to marine and coastal invasive species

The Federal Law of the Russian Federation "On the Exclusive Economic Zone of the Russian Federation" N 191-FZ, dated December 17, 1998:

obliged the persons who catch fish in the exclusive economic zone to not disturb the habitat of water living resources, to not illegally acclimatize the water living resources and to comply with the requirements of the quarantine regime

The federal law of the Russian Federation "On the Continental Shelf of the Russian Federation" N 187-FZ, dated November 30, 1995:

obliged the persons who catch fish on the continental shelf to not allow degradation of natural habitats of water living resources, to not illegally acclimatize the water living resources and to comply with the requirements of the quarantine regime

The list of base legal acts applicable to marine and coastal invasive species

The Federal Law of the Russian Federation "On Hunting and Conservation of Game Resources and on Amending Specified Legislative Acts of the Russian Federation" N 209-FZ, dated July 24, 2009:

allows the acclimatization, relocation, and hybridization of game resources to settle them in new habitat and provide the conservation their specific diversity only in presence of the permissions and on the base of scientifically substantiated recommendations

"Order of measures for acclimatization of water living resources" approved by Order of the Federal Agency for Fishery of the Russian Federation N 433, dated May 6, 2010:

defines the order of measures for acclimatization of water living resources in water bodies with fishery capabilities

The list of base legal acts applicable to marine and coastal invasive species

"The Regulations on the Federal Supervisory Natural Resources Management Service" approved by Resolution of the Government of the Russian Federation N 400, dated July 30, 2004:

includes into the list of powers of the Federal Supervisory Natural Resources Management Service the issuance of the license (permission) to acclimatize the objects of fauna which are new to the fauna of Russia, to relocate the objects of the animal world to new habitats, and to hybridize the objects of the animal world which are enlisted in the Red book of the Russian Federation

The National Strategy of Biodiversity Conservation in Russia

approved at the National Forum on the Wildlife Conservation, 2001

⬇

The Environmental Doctrine of the Russian Federation

approved by Prescription of the Government of the Russian Federation N 1225-r, dated August 31, 2002

⬇

The Strategy for Conservation of Rare and Endangered Species of Animals, Plants, and Fungi

approved by Order of the Ministry of Natural Resources and Environmental Protection of the Russian Federation N 323, dated April 6, 2004

The National Strategy of Biodiversity Conservation in Russia

- *It determines* principles, priorities and main trends of the Russia policy related to the biodiversity conservation,

main lines of elaboration of legislative and other normative and legal acts,

a system of organizational, administrative, financial, and economic mechanisms to ensure conservation and sustainable use of biodiversity.

- *It is a basis of* elaboration of strategies of biodiversity conservation of regional importance,

conservation strategies for particular species and ecosystems,

and action plans and strategies of governmental, public and commercial institutions to the same effect.

The Environmental Doctrine of the Russian Federation

It considers the control of use and distribution of alien species and genetically modified organisms as one of the priority directions of activity in providing the environmental safety of Russia.

The Environmental Doctrine of the Russian Federation

It is necessary to solve the following issues:

- to ensure the effective work of quarantine services, to prevent the invasion and unauthorized import to the territory of the country of alien species and genetically modified organisms as well as pests, carriers, and agents of diseases
- to perform the control of domestic acclimatization activities
- to develop and fulfill the system of arrangements for prevention of uncontrolled distribution of alien species and genetically modified organisms in natural environment and for elimination of the consequences of these processes
- to perform control and support of safe use of alien species and genetically modified organisms in economical turnover

The Strategy for Conservation of Rare and Endangered Species of Animals, Plants, and Fungi

It determines the development and realization of measures for prevention of uncontrolled distribution of alien invasive species and elimination of the invasion consequences as well as for prevention of penetration of living genetically modified organisms in natural environment and their further hybridization with populations conserved as the main means of conservation of rare and endangered species in natural habitats at a population level.

The Strategy for Conservation of Rare and Endangered Species of Animals, Plants, and Fungi

The following measures should be taken to fulfill these tasks:

- to reveal the main transit ways of invasive alien species penetration
- to draw up an inventory and monitoring of alien species
- to prevent a hybridization of individuals in populations conserved with those of closely related alien species
- to forecast and assess a risk of potential alien species invasions because of increasing interstate exchange
- to carry out an environmental risk assessment of application of living genetically modified organisms related to their probable contagiousness and pathogenicity as well as ability to compete and transmit genes to other organisms

Russia's leading authorities responsible for introduction of marine and coastal species

The Government of the Russian Federation

⬇ ⬇

The Ministry of Natural Resources and Environmental Protection of the Russian Federation

⬇

The Federal Supervisory Natural Resources Management Service

The Federal Agency for Fishery

Russia and International programmes on MIS problems

- Russia was not a member of international programme ***"Removal of Barriers to the Effective Implementation of Ballast Water Control and Management Measures in Developing Countries" (the GEF-UNDP-IMO GloBallast Programme)***
- Russia does not take a part in new project ***"Building Partnerships to Assist Developing Countries to Reduce the Transfer of Harmful Aquatic Organisms in Ships' Ballast Water" (the GEF-UNDP-IMO GloBallast Partnerships Project)***

Presentation funded by APN

Russia and International Treaties on MIS problems

- In 2012 Russia was acceded to ***the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004***
- Russia is also a Party to ***the International Convention for the Prevention of Pollution from Ships, 1973/1978 (MARPOL 73/78).***

Presentation funded by APN

The large Russian ports in NOWPAP region

Presentation funded by APN

Only two Russian ports in NOWPAP region take measures to prevent ballast water discharge in a harbour:

- Before calling at *the Prigorodnoye Port* (Sakhalin) tankers should exchange ballast water in an open sea
- There are ballast water reception facilities at the oil-loading terminal at *the port of Nakhodka*

Presentation funded by APN

The gas tanker “Grand Elena” bounding for the Prigorodnoye Port (Sakhalin)

Presentation funded by APN

The Prigorodnoye Port (Sakhalin)

Presentation funded by APN

The oil-loading terminal at the port of Nakhodka (the Primorsky Territory)

Presentation funded by APN

What should Russia do to prevent and control MIS problems?

To enact the specific national legal acts as well as subordinate acts, regulations, guidelines and standards in the development of the international Convention for the prevention and liquidation of transfer of harmful aquatic species by ships:

- to develop systems of control and management of ballast water aboard the ship including the recruitments on composition of ballast water and procedure of its analytic control
- to organize the system to control and manage ballast water in the ports including procedures to inform touching at a port ships about the requirements regarding the management of ship water ballast as well as regulations of control by specialized executive bodies

Presentation funded by APN

What should Russia do to prevent and control MIS problems?

To enact the specific national legal acts as well as subordinate acts, regulations, guidelines and standards in the development of the international Convention for the prevention and liquidation of transfer of harmful aquatic species by ships:

- to determine areas for exchanging the ballast water;
- to organize monitoring of the marine environment over the ballast's discharge and exchange areas as well as in the ports' waters for early detection of alien species brought with the ships' ballast water

Presentation funded by APN

What should Russia do to prevent and control MIS problems?

- ***To implement mechanisms of control of potential invasions transferring by means of the biological ships' fouling***
- ***To develop new normative and legal documents and amend the existing ones in the field of introduction of marine and coastal species***
- ***To train personnel adequately (managers, scientists, taxonomists, technical experts and enforcement officers) and purchase facilities***

Presentation funded by APN

What should Russia do to prevent and control MIS problems?

To create awareness of marine invasive species and their impacts

Russian Journal of Biological Invasions appeared since 2008 publishes scientific papers dealing with biological invasions of alien species in both terrestrial and aquatic ecosystems

Presentation funded by APN

What should Russia do to prevent and control MIS problems?

To create awareness of marine invasive species and their impacts

Presentation funded by APN

What should Russia do to prevent and control MIS problems?

- *To elaborate the National Strategy on preventing and controlling the invasion of alien species including the marine and coastal ones*

Presentation funded by APN

Regional Workshop on Marine Invasive Species Problems in Northwest Pacific Region
Qingdao, the People's Republic of China, 23-24 October 2012

Annex 4: Conclusion of the Workshop

1. During October 23-24, 2012, the Regional Workshop on marine invasive species (MIS) Problems in Northwest Pacific Region was held in Qingdao, China and supported by the Asian-Pacific Network for Global Change Research. The officials from China, Korea, and experts from China, Japan, Korea and Russia attended this workshop. Other relevant persons from China also attended this workshop.

2. Participants to the workshop stressed that that the problem of MIS is one of the major threats to marine ecosystem, including the Northwest Pacific area, and this workshop is very necessary for the Northwest Pacific region to brings together relevant officials and experts to exchange information and experiences on the prevention and control of MIS.

3. Participants noted that the problem of MIS is of international concern, and that the Convention on Biological Diversity states that each Contracting Party shall, as far as possible and as appropriate, prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species.

4. Participants noted that the Agenda 21 called on the International Maritime Organization (IMO) and other international bodies to take action to address the transfer of harmful organisms by ships.

5. Participants noted that the World Summit on Sustainable Development in 2002, in its Johannesburg Plan of Implementation, urges all countries to strengthen national, regional and international efforts to control invasive alien species, encourage the development of effective work programme on invasive alien species at all levels, and urges nations to accelerate the development of measures to address invasive alien species.

6. Participants noted that, in the outcome document of “Rio+20”, “the future we want”, it is stated that “We note the significant threat of alien invasive species pose to marine ecosystems and resources and commit to implement measures to prevent the introduction of, and manage the adverse environmental impacts of alien invasive species, including, as appropriate, those adopted in the framework of the IMO”.

7. In the Northwest Pacific region, there are already a lot of research and information on the current situation of MIS, such as the origins, pathways, categories, distribution and impacts of MIS, but they are still inadequate for policy-making and management. There is insufficient reliable research and statistics of the origins, pathways, categories, distribution and impacts of MIS.

8. Countries in the Northwest Pacific region have made many efforts to prevent and

control MIS, including legislations, putting management responsibilities on governmental organizations, implementation of international rules and guidelines, development of technologies, etc. However, due to limited knowledge and understanding of MIS, and also due to the extreme difficulty to fully investigate and control this problem, the measures are still inadequate in terms of legislation, management system and concrete actions. Participants acknowledged that, through this workshop, they shared many information, experiences and knowledge on MIS in the Northwest Pacific region, and their understanding of the issue of MIS was improved, which will benefit their future international cooperation on MIS.

9. Participants recommended that more investigation of and research on MIS are needed, and countries in the Northwest Pacific region need to provide resources to strengthen the investigation and researches on this issue, and to develop regional cooperation on data-sharing in the framework of NOWPAP, and close cooperation with other international organizations.

10. Participants stressed that, since it is very difficult to eliminate MIS after their invasion, prevention measures are very important and indispensable, including strict inspection and environmental impact assessment.

11. Participants recommended that a rapid entry into force of the IMO Ballast Water Convention is essential to prevent further spread of MIS. There is a need to strengthen regional cooperation through participation in international organizations, including FAO, UNEP and PICES, etc.

12. Participants recommended that current national legislation and management systems for MIS need to be improved to further prevent and control MIS, including control of pathways that lead to the introduction and spread of MIS, routine monitoring to detect and rapid response to eradicate or control MIS before they spread, and long-term response to mitigate the impacts of MIS.

Group Photo of "Regional Workshop on Marine Invasive Species Problems in Northwest Pacific Region", Qingdao, China, Oct. 23-24, 2012

Shilaoren National Tourist Resort, outside of the venue