A look at gap analysis on MSFD Descriptor 2 - "*Non-indigenous species (NIS) introduced by human activities*" in the framework of EU FP7 Project *Perseus*.

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Preamble

The information presented herein is focused on the analysis of assessment elements used by Mediterranean Sea and Black Sea EU countries in Descriptor 2: "*Non-indigenous species (NIS) introduced by human activities*"

The outcome of this analysis, within the PERSEUS project, will be used to help coordination among EU countries and Regional Seas Conventions approaches; and to develop, in a collaborative way, assessment elements for the application in non-EU countries.

RATIONALE

Based on the Marine Strategy Framework Directive (MSFD, 2008/56/EC) EU FP7 Project Perseus offers large and complex opportunities to evaluate the impact of natural and human-derived pressures on marine ecosystems in Southern European Seas (SES) having in view solutions, methods and tools for a better scientific management proper to the knowledge society, to the sustainable development and to the new condition of the global changes in the world system of systems.

EU FP7 Project PERSEUS analysed, among the 11 MSFD Descriptors (Commission Decision 2010/477/EU), **Descriptor 2** referring to non-indigenous species (**NIS**) on which the authors have focused their attention.

This paper is based on the review and analysis of methodological elements provided by nine EU countries (Belgium, Bulgaria, Cyprus, France, Greece, Italy, Romania, Spain and the United Kingdom) in their draft MSFD Initial Assessments.

RATIONALE…

It aims to contribute to EU requirements linked to the limited knowledge about the effects of **NIS** on the environment. The general conclusion of the overall assessment is the lack of information concerning **D2**.

NIS problems are emerging at global scale and are difficult to solve since they depend on the chance of recording the newcomers in particular geographic areas in due time. The problems must be integrated in the general study of biodiversity far from some scientists' fake problem of "hunting after **NIS**".

Likewise, it is necessary that **NIS** multiple potential impacts on the systems should be under permanent monitoring. Spatial and temporal distribution control-monitoring should be a powerful and flexible control system of biodiversity, capable to interfere and record the newcomer in an area; and when an alien species is found, its presence requires an early warning of the scientific community on a large scale.

NIS issues prior to MSFD

What was the situation before MSFD?

◼ Knowledge on NIS resulted from primordial studies of botany and zoology developed at different levels depending on the availabilities of national programs and human resources skills;

◼ Most of the information from the literature;

◼ NIS accidentally found, by chance…;

◼ Scientific interest in NIS permanently open in all marine countries;

◼ last decades – spectacular events and increasing interest in NIS, in methodological approaches and reference conditions in all countries;

◼ Weak legislation and no special programs to keep NIS under observation.

Descriptor 2

"Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystem."

Criteria and indicators defined by the Commission Decision 2010/477/EU

Criteria 2.1. "Abundance and state characterization of non-indigenous species, in particular invasive species"
- **indicator 2.1.1.** "Trends in abundance, temporal occurrence and spatial distribution in the wild of non-indigenous species, particularly invasive non-indigenous species, notably in risk areas, in relation to the main vectors and pathways of spreading of such species"

Criteria 2.2 "Environmental impact of invasive non-indigenous species"
- **Indicator 2.2.1** "Ratio between invasive non-indigenous species and native species in some well studied taxonomic groups (e.g. fish, macroalgae, molluscs) that may provide a measure of change in species composition (e.g. further to the displacement of native species)"
- **Indicator 2.2.2** "Impacts of non-indigenous invasive species at the level of species, habitats and ecosystem, where feasible"

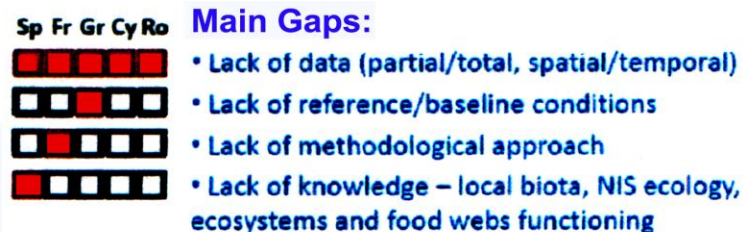**Criteria and indicators defined by the Commission decision 2010/477/EU**

Environmental status assessment methodologies: Mediterranean and Black Sea regions (5 countries)

PERSEUS

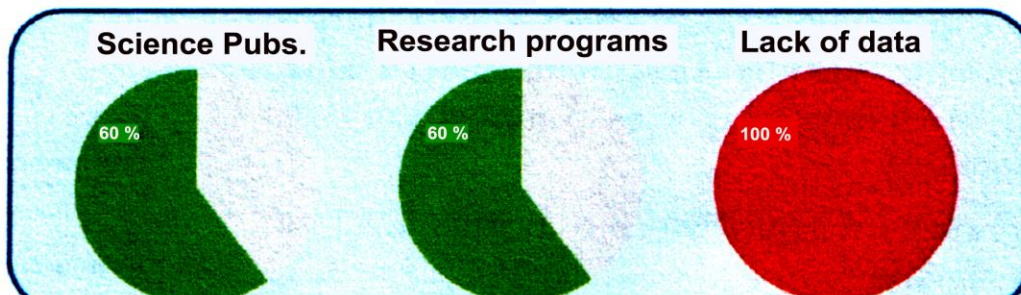## Descriptor 2

Non-indigenous species introduced by human activities are at the levels not adversely alter the ecosystems.

Sp Fr Gr Cy Ro **Main Methodologies**
- Scientific publications
- Regional/National Research programs
- Impact Assessment studies

Sp Fr Gr Cy Ro **Main Gaps:**
- Lack of data (partial/total, spatial/temporal)
- Lack of reference/baseline conditions
- Lack of methodological approach
- Lack of knowledge – local biota, NIS ecology, ecosystems and food webs functioning

Marian-Traian GOMOIU, Tatiana BEGUN, Dan VASILIU, Adrian TEACA, Gh.OAIE, D. SECRIERU, Daniela VASILE - Approaches used for MSFD environmental status assessments in the Black Sea Umbrella Workshop, Barcelona 22-23 January 2013

Sp Fr Gr Cy Ro **Criteria/Indicator Gaps:**
- Criteria 2.1
- Criteria 2.2

Science Pubs. 60 %   **Research programs** 60 %   **Lack of data** 100 %

Mediterranean and Black Seas countries with Initial Assessment draft reports available for the analysis: Spain (Sp), France (Fr), Greece (Gr), Cyprus (Cy) a nd Romania (Ro). **Results of NIS analyses in the framework of environmental status assessment methodologies for 5 countries in the Mediterranean and Black Sea regions** (Gonzalez-Fernandez, 2013 and WP5 team - PERSEUS Umbrella Workshop, Barcelona, Spain (22-25 January 2013).

GeoEcoMar

D2 Assessment at Barcelona Umbrella Workshop 2013

Based on the scientific publications and data from national/regional research/monitoring programs most of the MS implemented qualitative methodologies for the assessment of non-indigenous species, but the major issue for this descriptor is that all countries stated a general lack of data:

Spain – proposes to consider GES in relation to a decrease in impacts caused by non-indigenous species and to use biodiversity indexes in the monitoring of impacts;

France - indicates the lack of methodological approach on the NIS impacts and suggests focusing on the vectors of introduction;

Greece - reported quantitative methodology, considering the species *Mnemiopsis leidyi*, *Lagocephalus sceleratus*, and *Caulerpa* and bases its analysis on trends and ratios; no reference points or baseline/reference conditions were provided;

Cyprus - methodology demonstrated a qualitative approach focused on trends;

Romania - NIS assessment was based upon partial information, including both qualitative and quantitative approaches focusing on trends of new arrivals.

Methodology:

- **Qualitative approach.**
- **Proposal: use of biodiversity indexes in monitoring of impacts.**
- **GES should be considered in relation to a decrease in impacts caused by non-indigenous species.**

Gaps:

- **Lack of data, heterogeneous data (spatial and temporal coverage).**
- **Lack of knowledge about local biota, ecology of non-indigenous species, and ecosystem and food webs functioning.**
- **Needs specific monitoring programs and impact assessment studies.**

ASSESSMENT OF A GAP SCORE PER DESCIPTOR 2 NIS on the basis of the information reported in the MSFD reports of the considered countries.

In order to provide a synthetic and illustrative representation of the main gaps underlined for descriptor 2 NIS, on the basis of the information given in the IA for MSFD reports of the considered countries (BELGIUM, FRANCE, GREECE, CYPRUS, SPAIN, UNITED KINGDOM and ROMANIA) the authors, on the basis of the information reported in the MSFD reports of the considered countries, introduced a ranking system on three categories and a gap score (0 – minor gap; 1 – partial gap; 2 – major gap) based on descriptor 2 "NIS" analysis and gave answers to the following questions having as average values as follows:

ASSESSMENT OF GAP SCORE PER DESCIPTOR 2 NIS

Question	How to interpret this question
A - Common understanding	Do the countries consider the same kind of parameters for this descriptor? Is there any misunderstanding / different interpretation of requirements posed by the MSFD documents?
B - Operational methodologies available	Are methodologies already identified in the countries IA reports, which allow the assessment of the environmental status according to each of the criteria and the respective indicators (even if these methodologies are not optimal and can be further improved)?
C - Methodologies under development	Are the countries working to develop methodologies more adapted to this descriptor?
D - Harmonized methodologies	Do the available methodologies allow a harmonization and a comparison at indicator, criteria and descriptor level between the different member states?
E - Thresholds available	Do reference levels exist, which allow to determine if the GES is reached or not at indicator level?
F - Trends available	Are the countries able to determine trends for this descriptor, where pertinent?
G - Sufficient data	Are the available data sufficient to allow a robust assessment?
H - Sufficient knowledge	Is the available knowledge sufficient to allow a robust assessment

ASSESSMENT OF GAP SCORE PER DESCIPTOR 2 NIS

On the basis of this assessment matrix and of the information available in the above analysis per descriptor 2 each of the six organisms contributing to this deliverable (JRC-IES, HCMR, GEOECOMAR, NIMRD, IO-BAS and IFREMER) has been asked to produce its own assessment of the gap scores per descriptor. The assessment is qualitative (based on expert judgement) and involving several evaluators (the six organisms) is a way to minimize the inherent arbitrariness and subjectivity of this type of process.

In order to ensure a common understanding of the assessment scope among the evaluators, the following guidelines have been provided to each of them:
• For the descriptors 2 and each of the 8 questions, a score was determined among the following levels, on the basis of the assessment matrix: 0 (MINOR GAP), 1 (PARTIAL GAP) & 2 (MAJOR GAP).
• Each assessment considered the 5 countries' information.
• The assessment is based on the content of the MSFD reports (Initial Assessment and GES definition reports), on the basis of the information available in the above analysis per descriptor. This would allow addressing the present methodological gaps.
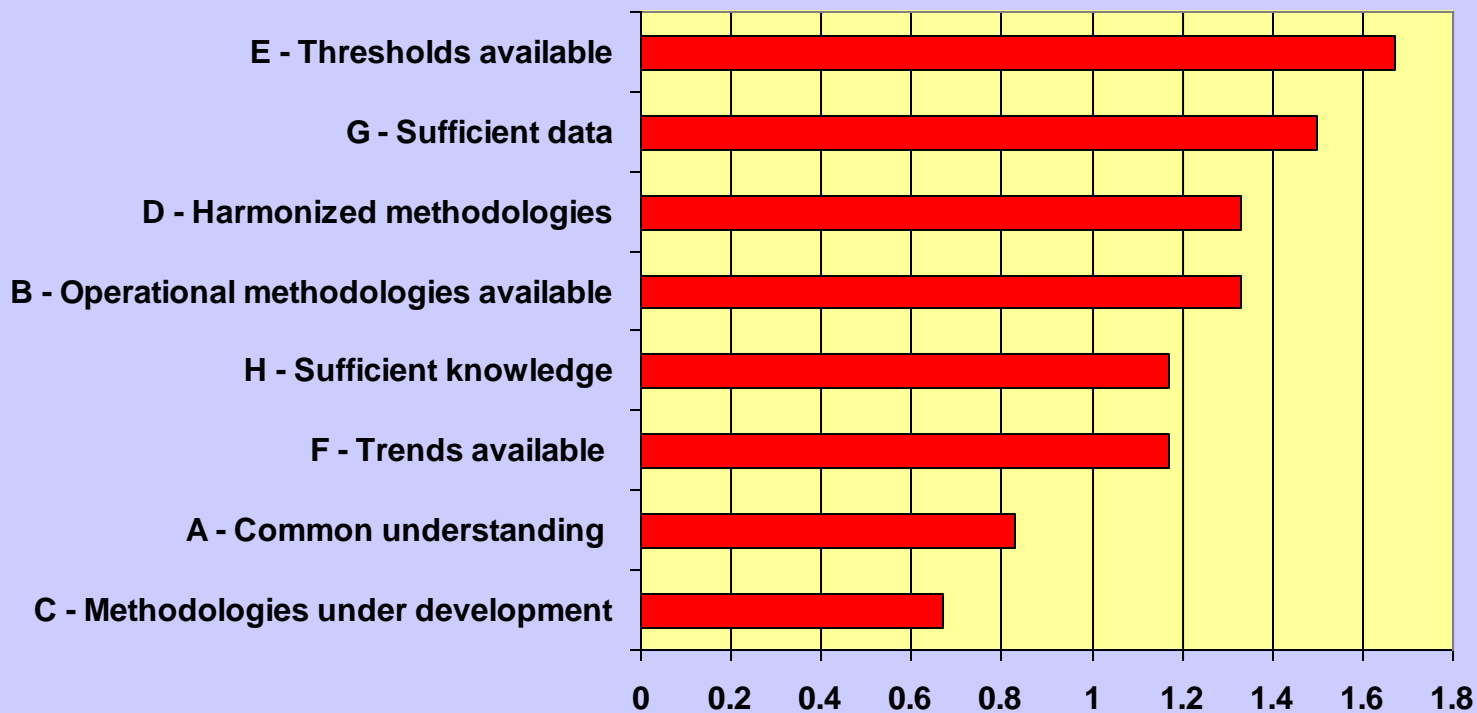
ASSESSMENT OF GAP SCORE PER DESCIPTOR 2 NIS

Questions	MINOR GAP (0)	PARTIAL GAP (1)	MAJOR GAP (2)	Average
A. Common understanding	16,7 %	83,3 %	-	0.83
B. Operational methodologies available	-	66.7 %	33.3 %	1.33
C. Methodologies under development	33.3 %	66.7 %	-	0.67
D. Harmonized methodologies	-	66.7 %	33.3 %	1.33
E. Thresholds available	-	33.3 %	66.7 %	1.67
F. Trends available	-	83.3 %		1.17
G. Sufficient data	-	50.0 %	50.0 %	1.50
H. Sufficient knowledge	-	83.3 %	16.7 %	1.17
Average	6.2	66.7	27.1	-

Operational methodologies are available in some instances, (even if they are not optimal and can be further improved) for all the criteria and indicators of the descriptor, and are reported in most of the countries IA reports. Always all responsible for the answer take into considerations pairs of alternatives: 0-1 or 1-2

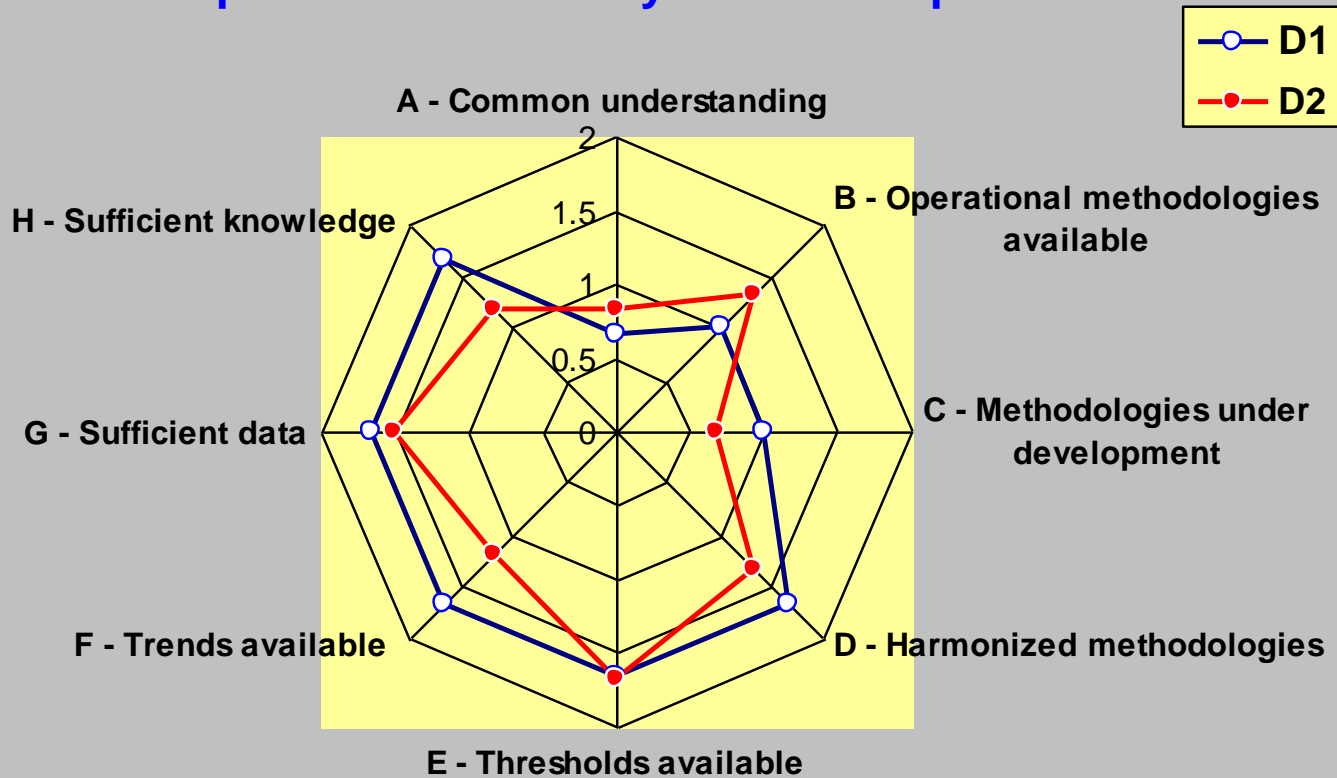# ASSESSMENT OF GAP SCORE PER DESCIPTOR 2 NIS

Hyerarchy of average score values attributed to Descriptor 2 - NIS by GeoEcoMar, NIMRD, IOBAS, IRC-IES, HCMR, IFREMER

Chart — horizontal bar graph (values read approximately):

Category	Value
E - Thresholds available	~1.68
G - Sufficient data	~1.50
D - Harmonized methodologies	~1.33
B - Operational methodologies available	~1.32
H - Sufficient knowledge	~1.17
F - Trends available	~1.17
A - Common understanding	~0.83
C - Methodologies under development	~0.67

X-axis: 0, 0.2, 0.4, 0.6, 0.8, 1, 1.2, 1.4, 1.6, 1.8

ASSESSMENT OF GAP SCORE PER DESCIPTOR 2 NIS

Same methodology was used for testing issues on D1 and D2 and usually the results for D2 are under those for D1

Comparative average score values attributed to Descriptor 1 - Biodiversity and Descriptor 2 - NIS

Legend: D1, D2

A - Common understanding
B - Operational methodologies available
C - Methodologies under development
D - Harmonized methodologies
E - Thresholds available
F - Trends available
G - Sufficient data
H - Sufficient knowledge

Average score values attributed to Descriptor 2 - NIS
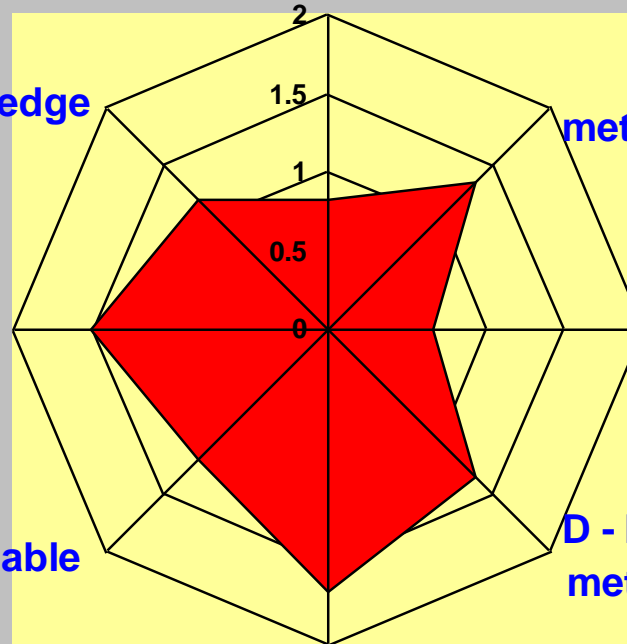
D2 Assessment – MS Contribution to IA Reports on NIS

1. **SPAIN:** Alien species, once introduced, are components of ecosystems and can be assessed through indicators of status; but, in terms of GES they should be considered as a pressure to native ecosystems. So, the GES for this descriptor would be ensured if there was absence of pressure, i.e., the absence of alien species. GES is achieved by reducing the rate of increase of impacts.

Criterion 2.1 - 2.1.1. Value of the slope of the trend in the number of accumulated citations of alien species in each subregion, defining citation as observation of species in a given locality on a given date.

Criterion 2.1 - 2.2.1. Due to lack of reliable data on the subject, a proxy (indirect indicator) is proposed, such as the ratio between the number of alien and native species in determined taxonomic groups, in those in which it is assumed that native biota and allochthonous are well known, such as fish, seaweed and macrobenthos. The indicator would be the slope of the trend describing the parameter evolution.

It is suggested to apply indicators based on direct impact quantification.

2. **FRANCE:** indicates the lack of methodological approach on the NIS impacts and suggests focusing on the vectors of introduction and on **further development of methodologies**;

3. GREECE reports **no specific methodology for D2.** The determination of GES was based on qualitative criteria (trends). It is attempted to approach GES quantitatively using environmental thresholds/limits, in order to describe its desired state. GES status is going to be established based on proposed indicators. It is not mentioned if Descriptor 2 is in GES or not.

4. CYPRUS reports **no specific methodology**. In spite of the assessment performed by different authors for a number of NIS, the only highly valued and exploited *L. sceleratus* managed to be included as indicator for the criterion 2.1. for which temporal and spatial data are available. Fragmentary information is available for *F. commersonii* and *C. racemosa*. Therefore the indicators 2.1.1. and 2.1. cannot be fully determined. Criterion 2.2. and 2.2.1. and 2.2.2. were not assessed.

5. ROMANIA reports **no specific methodology**. Criterion 2.1. and criterion 2.2. include indicators that can be used for GES status and targets establishment but there is still need of information and the methodological gaps to be filled out.

Decision Tree for Descriptor 2
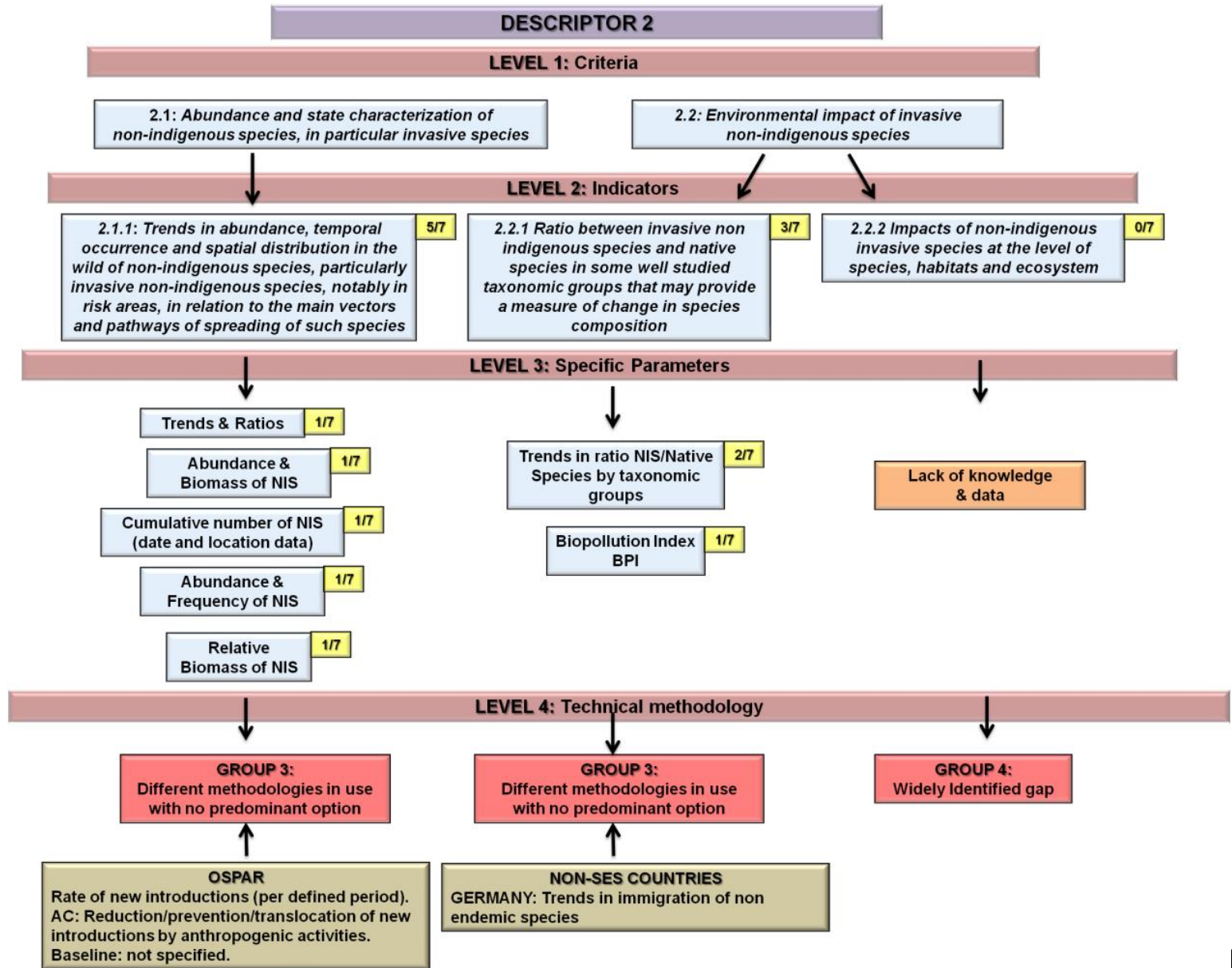
Lesson learned from the NIS state in the SES countries as a summary

- **G**eneral conclusion of the overall assessment is the lack of information concerning **D2**.

- **NIS** problems are emerging at global scale and difficult to solve since they depend on the chance of recording the newcomers in particular geographic areas in due time.

- The **NIS** problems must be integrated in the general study of biodiversity far from some scientists' fake problem of "hunting after NIS".

- Likewise, it is necessary that **NIS** multiple potential impacts on the systems be under permanent monitoring. Spatial and temporal distribution control - monitoring should be a powerful and flexible system control of biodiversity, capable to interfere and record the newcomer in an area; and when an alien species is found, its presence requires an early warning of the scientific community on a large scale.

Lesson learned from the NIS state in the SES:

■ **NIS** challenge remains an open subject and its management requires specific tools and methods, the identification of the sources of pressures and impacts, including their cumulative and synergetic effects upon the good environmental status; obtaining data on NIS is one of the important conditions to support the ecosystem-based management of human activities linked to the sea.

■ By developing the methodologies and new approaches to improve the assessment of **GES** we consider to be both in the letter and spirit of the EC documents. Identifying and assessing pathways and vectors of **NIS** spreading and applying an action program should be permanent tasks for scientific community and stakeholders of marine environment.

Thank you!

Relevant policies and conventions related to Descriptor 2 Framework in the SES

- **MSFD - Good Environmental Status of EU marine waters by 2020**

- **Mediterranean Action Plan (UNEP/MAP), Barcelona Convention - In 2008 adopted the Ecosystem Approach (ECAP) management for the Mediterranean region**

- **Black Sea Commission (BSC), Bucharest Convention - Black Sea Strategic Action Plan 2009 (BS SAP) introduced Ecosystem Approach management for the Black Sea region**

- **Convention on Biological Diversity (CBD)**

- **Convention on the Conservation of European Wildlife and Native Habitats (Bern   Convention, 1979)**

- **Convention on Wetlands (Ramsar Convention, 1971)**

- **Convention on Migratory Species (1979)**

- **IMO International Convention on the Control and Management of Ships" Ballast Water and Sediments (BWMC)**

Regional conventions and activities in European Seas

- **ICES** has two working groups to address the issue, i.e. the ICES Working Group on Introductions and Transfers of Marine Organisms (WGITMO) to deal with the movement of NIS for e.g. aquaculture purposes and the ICES/IOC/IMO Working Group on Ballast and Other Ship Vectors which focuses on species movements with ships.
- The Commission on the Protection of the Black Sea against Pollution **(BSC)** developed Transboundary Diagnostic Analysis, which, inter alia, describes recent situation in relation to introduction of exotic species.
- **HELCOM** have developed an approach to address spatial scale for GES assessment within MSFD for a regional sea which is harmonised with WFD assessments in marine coastal areas.
- **OSPAR** Quality Status Report 2010 provides an evaluation of the quality status of the marine environment of the North-East Atlantic, summarizing 10 years of assessment work under the OSPAR Joint Assessment and Monitoring Programme.
- The **Barcelona Convention** addresses the subject NIS and associated impacts in respect of protected areas.
- The **Regional Activity Center/ Specially Protected Areas for the Mediterranean** has coordinated a number of initiatives for the Mediterranean, including also the countries of the east and south coast, addressed the harmonization of methods for controlling IAS.

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Ratios between average score values attributed to Descriptor 1-Biodiversity and Descriptor 2-NIS (D1/D2)
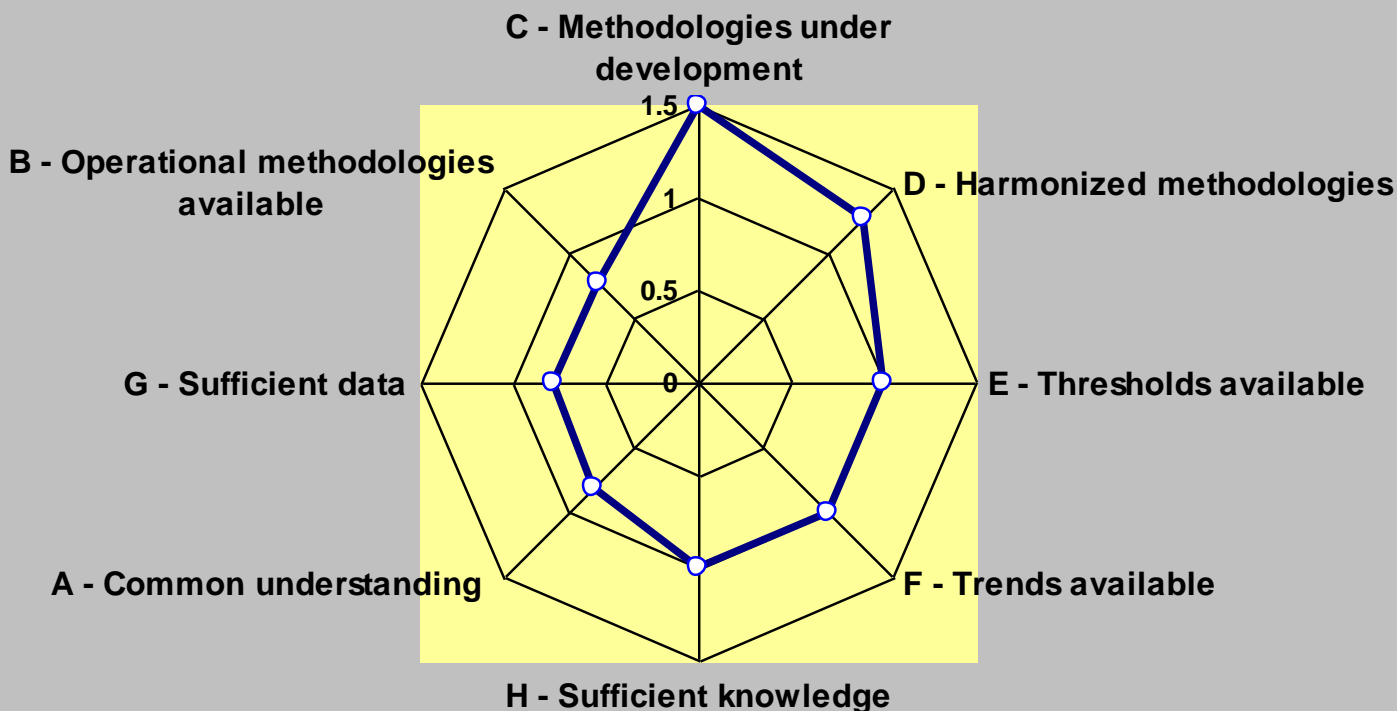
Definitions:

(a) "**Alien species**" means, with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.

(b) "Control" means, as appropriate, eradicating, suppressing, reducing, or managing invasive species populations, preventing spread of invasive species from areas where they are present, and taking steps such as restoration of native species and habitats to reduce the effects of invasive species and to prevent further invasions.

(c) "Ecosystem" means the complex of a community of organisms and its environment.

(e) "**Introduction**" means the intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity.

(f) "**Invasive species**" means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

(g) "**Native species**" means, with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

(h) "Species" means a group of organisms all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms.

U.S. General Services Administration, 1999 - **Executive Order 13112 - INVASIVE SPECIES**
http://www.gsa.gov/portal/content/101587

Generalized characteristics of successful invasive

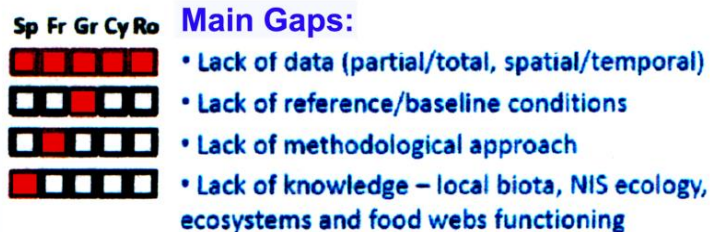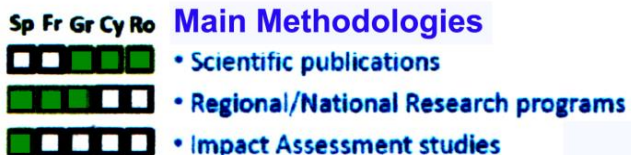|	
rate of reproduction	high
colonizing disturbed habitats before other species	
generation time	short
life span	long
dispersal rate	high
single-parent reproduction by a female that has eggs or is pregnant	
reproduction	asexual
genetic variability	high
phenotypic plasticity, which means it changes form in response to environmental conditions	
native range	broad
richnes in native range	abundant
tolerant of a wide range of conditions	
habitat generalist, which means it lives in a variety of habitats	
diet	broad
gregarious, which means it lives in groups	
benefits from living with humans without causing us harm, that is lives as a commensal	

Environmental status assessment methodologies: Mediterranean and Black Sea regions (5 countries)

PERSEUS

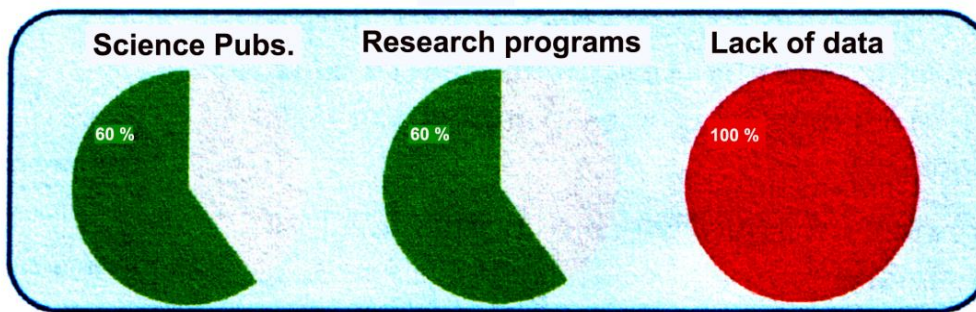## Descriptor 2

Non-indigenous species introduced by human activities are at the levels not adversely alter the ecosystems.

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Science Pubs. 60 %
Research programs 60 %
Lack of data 100 %

JRC - IES

ASSESSMENT OF A GAP SCORE PER DESCIPTOR 2 NIS

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Average	**6.2**	**66.7**	**27.1**	