WP3 APPLICATION OF RISK-BASED APPROACH TO NON-INDIGENOUS SPECIES (DESCRIPTOR 2)

Deliverable 3.2 - Shortlist of regional specific criteria elements and integration rules

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This document was elaborated by the WP3 coordinator (IPMA, I.P.) in collaboration with the WP3 partners, DRAM, MARE-ARDITI, MARE-FCUL and INERIS.

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Contents

Introduction

Non-indigenous species (NIS) are one of the Marine Strategy Framework Directive (MSFD) qualitative descriptors of Good Environmental Status (GES) displaying some lack of knowledge, which points out to the need of coordinated monitoring among Member States (MS) at regional and sub-regional levels in order to characterise the pressures and impacts of transboundary nature, and to obtain reliable and comparable information, crucial for the protection of natural resources (EC, 2020a). Moreover, NIS are one of the key pressures considered by the European Union (EU) Member States, in the Common Implementation Strategy within a (sub)regional scope embracing the Bay of Biscay and the Iberian Coast, Macaronesia, the Celtic Seas and the Greater North Sea, including the Kattegat and the English Channel (EC, 2020b).

Under Task 3.1 "Data collection on D2", the existing information on introduction, spread and impacts of non-indigenous, cryptogenic and data-deficient species (definitions according to Tsiamis et al. 2019) from Descriptor 2 (D2) former evaluations, namely the MSFD initial and second assessments, the OSPAR Intermediate Assessment 2017, and the ICES Working Group on Introductions and Transfers of Marine Organisms (WGITMO), was collated and synthesised in Deliverable 3.1 (Bartilotti et al. 2020a). Under Task 3.2: "Define relevant criteria elements", based on the Commission Decision (EU) 2017/848 (EC, 2017), relevant GES criteria elements should be defined for the risk-based approach application. One of the relevant GES criteria elements selected in this work is a list of priority non-indigenous, cryptogenic and data-deficient species, hereinafter referred as NIS, at the sub-regional level (Bay of Biscay and the Iberian Coast- ABI, and Macaronesia- AMA).

The development of a risk-based approach for D2 follows the steps contained in the Deliverable 2.1 and is based on the ISO 31000 (2009) (Figure 1).

Figure 1. The Risk-Based Approach as developed by the RAGES project.

Risk Context

Management objectives

The criteria established by the Decision (EU) 2017/848 (EC, 2017) to assess GES provide the basis for the definition of the management objectives, as shown in Table 1.

Table 1. Criteria elements and criteria laid out in the Decision (EU) 2017/848 for D2. Management objectives developed for each criterion within the RAGES project are also shown.

Criteria elements	Criteria	Threshold values
Newly introduced NIS	**D2C1 - Primary** The number of NIS which are newly introduced via human activity into the wild, per assessment period (6 years), measured from the reference year as reported for the	**Not available**: To be established by MS through regional or sub-regional cooperation.

	initial assessment under Article 8(1) of Directive 2008/56/EC, is minimised and where possible reduced to zero. **Management objective # 1:** the number of new NIS records, per 6-year periods, is minimised or reduced to zero.	
Established NIS, particularly invasive ones, which include relevant species on the list of invasive alien species of Union concern adopted in accordance with Article 4(1) of Regulation (EU) No 1143/2014 and species, which are relevant for use under criterion D2C3. MS shall establish that list through regional or sub-regional cooperation.	D2C2 - Secondary Abundance and spatial distribution of established NIS, particularly of invasive species, contributing significantly to adverse effects on particular species groups or broad habitat types. **Management objective # 2:** the abundance and spreading of established NIS are controlled.	**Not required**
Species groups and broad habitat types that are at risk from NIS, selected from those used for Descriptors 1 and 6. MS shall establish that list through regional or sub-regional cooperation.	D2C3 - Secondary Proportion of the species group or spatial extent of the broad habitat type, which is adversely altered due to NIS, particularly invasive NIS. **Management objective # 3:** established NIS do not adversely affect species groups or broad habitat types.	**Not available:** To be established by MS through regional or sub-regional cooperation.

Given that the current knowledge and the available information to achieve management objectives 2 and 3 are insufficient, it was decided to assess only the risk of not achieving the management objective 1, i.e., *the risk of not minimising the number of newly introduced species by human activity, per 6-year periods,* measured from the reference year (2012, 2018,

2024, etc.). Management objective 1 concerns the primary criterion D2C1, which is the only one mandatory for GES assessment within the MSFD context (Table 1). Management objectives 2 and 3 are associated with the secondary criteria (D2C2 and D2C3), for which the available information is insufficient (e.g., population status). Therefore, the achievement of management objectives 2 and 3 is not considered in this approach and should be treated in the future.

Assessment scale

Deliverable 3.1 (Bartilotti et al. 2020a) compiled the available information on NIS occurring in two MSFD sub-regions of the North-East Atlantic Ocean region, the Bay of Biscay and the Iberian Coast (ABI), and the Macaronesia (AMA). It is important to highlight that the assessment scale initially proposed for this task was the regional one, corresponding to the North-East Atlantic Ocean region, which comprises four sub-regions: (1) the Kattegat and the English Channel, (2) the Celtic Seas, (3) the Bay of Biscay and the Iberian Coast and (4) the Macaronesia. Since ecological and biological data on NIS were not compiled for the Kattegat and the English Channel, as well as the Celtic Seas, the most correct approach in the present Task should be at sub-regional level. Within the sub-regional areas, each MS divided their subdivisions in Marine Reporting Units (MRUs) taking into account their ecological and environmental characteristics. In the ABI sub-region, six MRUs were established: one in France (Bay of Biscay-BoB), two in Spain (North Atlantic-NA and South Atlantic-SA) and three in Portugal (Northwest-A, Southwest-B, and South-C). The AMA sub-region was divided in three MRUs, coincident with the three archipelagos of the two MS: two in Portugal (Azores and Madeira) and one in Spain (Canary Islands) (Figure 2).
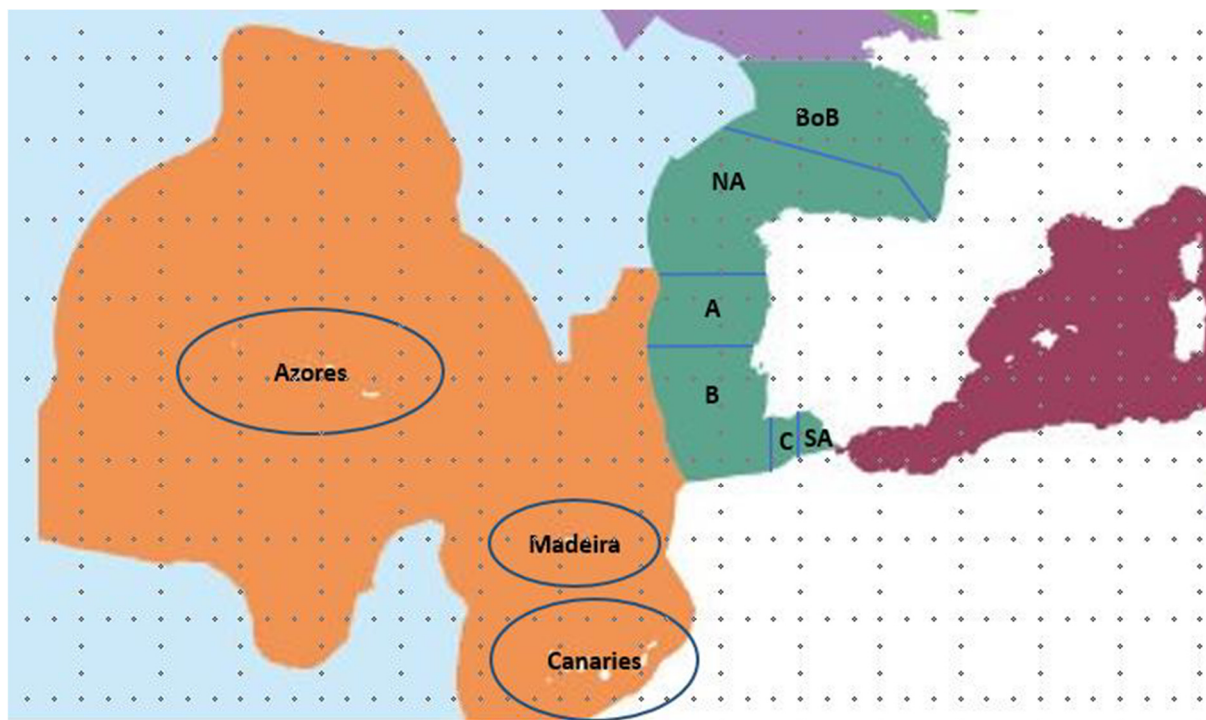
Figure 2. Delimitation of the MRUs. ABI sub-region: France, BoB - Bay of Biscay, Spain, NA - North Atlantic and SA - South Atlantic, and Portugal, A - Northwest, B - Southwest and C - South. AMA sub-region: the Portuguese archipelagos of the Azores and Madeira, and the Spanish archipelago of the Canary Islands.

Ecosystem elements

The sensitivity of the receptors to NIS introduction requires knowledge about the ecosystem elements (e.g., native species, species groups and habitat types) in order to assess the likelihood of change (consequence) arising from the applied pressure. However, there is still a lack of knowledge regarding the ecosystem elements at risk. Despite the observed limitations, the lack of information should not pose a constraint to the proposed risk approach, as the assessment of native species, species groups and broad habitat types at risk from NIS is related to the secondary criteria (D2C2 and D2C3), therefore not considered in this framework.

Risk parameters and categories

The evaluation of the risk of harm from human activities to the criteria elements considers two steps: the exposure of the elements to the pressure, and the consequence. It is important to underline that the parameters to assess exposure and consequence, depend on the data and knowledge available. For instance, to assess exposure, data retrieved from the intensity of a pathway activity may provide information regarding hotspots of NIS introduction. On the other hand, information on species attributes (e.g., behavioural, physiological changes arising from

a given pressure) must be taken into consideration for the appropriate assessment of consequence. Once the information regarding the sensitive areas is unavailable, the sensitivity analysis (consequence) cannot be performed. However, the risk of NIS introduction can be estimated based on the identification of locations where new introductions are more likely to occur, such as marinas, ports, terminals and aquaculture facilities. In addition, some information can be extracted from the distribution of established NIS, which can provide insight into areas more prone to new introductions (e.g., Crooks et al. 2010; Lenz et al. 2011; Clark and Johnston, 2011; Briggs, 2012; Früh et al. 2012).

Finally, broad categories of risk (low, medium, high) should inform the risk levels in order to achieve the first management objective - the number of new NIS records**,** per 6-year periods**,** is minimised or reduced to zero - as thresholds values are not currently available.

Summary of the Proposed Risk Approach for NIS (D2)

This section incorporates an option to support the development of an effective Risk-Based Approach (RBA) to NIS at sub-regional level. The proposed approach focuses primarily on criterion D2C1, which is the only mandatory for the assessment of GES within the MSFD context. However, some information available on the spatial distribution of established NIS (secondary criterion D2C2) and on their known adverse environmental and socioeconomic impacts (secondary criterion D2C3) will be incorporated in order to improve the risk framework. D2 is a particularly relevant descriptor to test a sub-regional approach because it can be considered as a 'transboundary harm' (Riley 2009), since NIS can easily pass from native to recipient regions through transboundary vectors and pathways.

The required steps of the RAGES RBA are summarised in the scheme below (Figure 3).
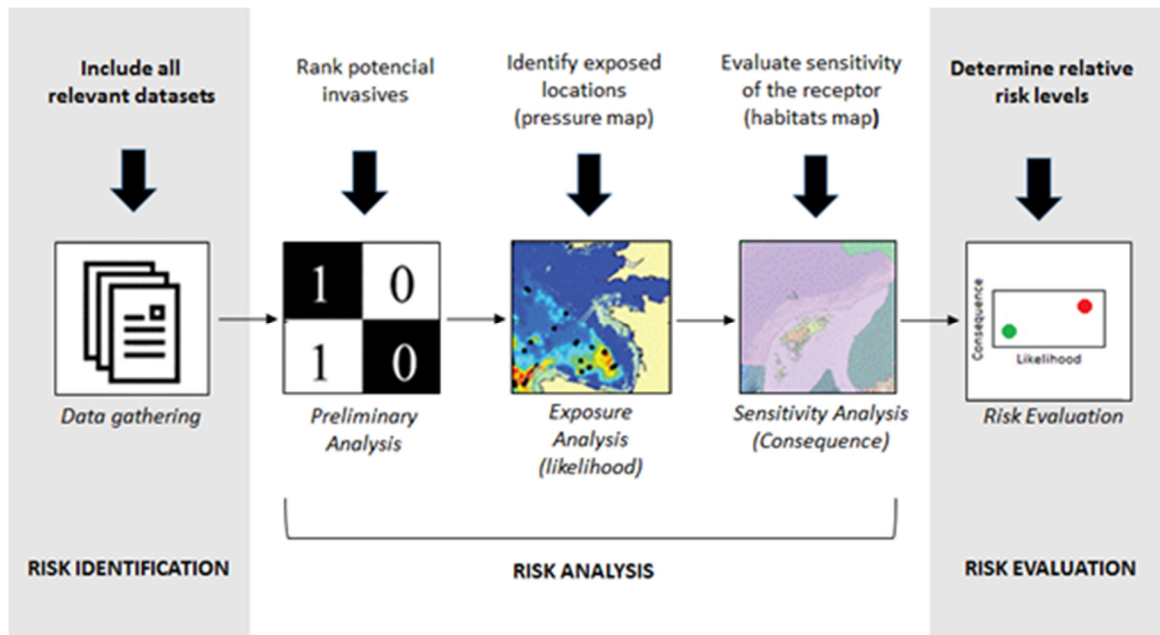
Figure 3. Diagrammatic representation of the work required under step 2 (Risk Identification), step 3 (Risk Analysis) and step 4 (Risk Evaluation) of the RAGES RBA, with a link to the three main steps of the ISO 31000 (2009). The data and analytical steps represented by the black arrows are dynamic and will change depending on the Descriptor, Criteria or the area of interest.

The RAGES RBA involves three main steps. The **risk identification** step relates to the process of determining the risk sources, considering their potential consequences to the receptor. In this step, it is relevant to identify the potential pressures and a list of risks. The **risk analysis** process involves the determination of the likelihood of an event and its consequence. The first component of the risk analysis - preliminary analysis - includes a list of potential pressures. This process is followed by the identification of exposed locations (production of pressure maps) and evaluation of the most sensitive areas (production of habitat maps). The **risk evaluation** step involves the estimation of the level of risk by assessing the likelihood, (the chance of something happening) and the sensitivity (the likelihood of change when a pressure is applied to an ecosystem element). As mentioned above, the sensitivity analysis will not be performed in this approach. Table 2 summarises a proposed risk approach to assess the risk of new introductions (i.e., new records). Further details will be given in the Deliverable 3.3.

Table 2. Summary of the proposed risk approach to assess the risk of new introductions (Criterion D2C1).

Phase	ISO Step	Newly introduced NIS
Risk Identification	Data gathering	Compilation of the existing spatial information on NIS introduction, spread and impacts.
Risk Analysis	Preliminary Analysis	Ranked list of species that should be of high priority for risk assessment.
	Exposure Analysis	- Identification of hotspots of introduction (e.g., marinas, ports, terminals and aquaculture facilities). - Analysis of susceptible areas to NIS introductions (based on the spatial distribution of established NIS per MRU).
	Sensitivity Analysis	Not performed.
Risk Evaluation	Risk Evaluation	Estimation of risk levels: - Likelihood of introduction (ranked NIS) versus the distribution of established NIS per MRU plotted on graph to deliver potential species more likely to be introduced. - Intensity of the pathway activity versus the number of established NIS per MRU plotted on graph to deliver potential areas at greater risk of new introductions.

Risk Identification

In this step, it is relevant to identify potential pressures. According to Ojaveer et al. (2015), the management should primarily focus on the introduction pathways, in order to minimise the risks of new introductions, based on the precautionary approach, with knowledge on the potential impact together with the likelihood of invasion to inform and support pre-border management decisions.

Pressures

The two different types of pressures for D2 are listed in the Commission Decision (EU) 2017/848 (EU, 2017), i.e., input (newly introduced NIS - D2C1) or spread of NIS (established NIS, particularly invasive ones - D2C2).

The relevant anthropogenic pressures were compiled for the sub-regions ABI and AMA and presented in Deliverable 3.1 of the Work-Package 3. A total of 454 species were compiled in the scope of the RAGES project for the two sub-regions, from the initial assessment (2012) to the second cycle assessment of the MSFD (2012-2018). In the second cycle 29 (6%) and 49 (14%) new records of NIS were registered in ABI and AMA, respectively.

The most common vectors of introduction were assessed. The results showed that ballast waters, followed by fouling and aquaculture were the most common vectors for the two sub-regions. However, the introduction vectors are still unknown for a considerable number of NIS. The results highlight the role of maritime transport (commercial shipping and recreational boating) and aquaculture as the major known drivers of the input and spread of NIS.

It was also possible to identify the main taxonomic groups for each sub-region. Within ABI most of the species belong to Arthropoda (23%), Mollusca (15%) and Rhodophyta (15%), while in the AMA sub-region, the majority of the species belong to Bryozoa (26%), Rhodophyta (24%) and Chordata (14%).

In this report, a preliminary list of NIS (herein including the cryptogenic and data-deficient species) is defined, as one of the relevant criteria elements for the assessment of GES for the two sub-regions in the scope of RAGES (ABI and AMA). The selection of NIS involved two steps. The first step considered the following aspects: i) known adverse effects, ii) population status, defined as established, not established and undetermined, and iii) presence/absence in each of the geographic units considered in the RAGES project, i.e., sub-region, MS, and respective Marine Reporting Units - MRUs (Annex 1). In the second step, the analysis was refined, and all the NIS classified with high impact in EASIN (European Alien Species Information Network), that provides technical and scientific support to the MSFD, were listed (Annex 2).

In the **first step**, Portugal (PT), Spain (ES) and France (FR) (ABI sub-region) totalized 113 NIS with known adverse effects (Table 3), with Spain presenting the highest number (79), followed by France (76) and Portugal (63). Most of these NIS are already established in the three MS. According to the information in Annex 1, in mainland Portugal, none of the NIS having its population status as not established or undetermined is widely distributed (present in the three MRU: A- NW; B- SW; C- S), i.e., they occur in one or two MRU only, and most of the times, whenever this happens the two MRU are contiguous. Few NIS with known adverse effects have an undetermined population status in mainland PT: 4 out of the 37 in MRU A-NW, 6 out of the 51 in MRU B-SW and 5 out of the 39 in MRU C-S. In mainland Spain, there are 36 species common to the two MRU (North and South Atlantic), but 14 with different population

status. From the 77 NIS listed in the Spanish North Atlantic MRU, 36 still have an undetermined population status, while in the South Atlantic MRU 21 of the 38 NIS with known adverse effects have an undetermined population status.

In France 28 of the 76 NIS have an undetermined population status. France has the highest number of NIS exclusively recorded in its Bay of Biscay MRU (18 species of which 7 are already established).

In the AMA sub-region 130 NIS have known adverse effects (Table 3). It is worth mentioning that 72 (55%) of these species are not included in the EASIN database to date. The Azores MRU has the highest number (84), followed by Madeira (69) and Canary Islands (31). In Portugal most of these species are already established (62 in the Azores and 43 in Madeira). In Spain, Canary Islands, nearly half (15) of these NIS are established. However, in the Canary Islands MRU, 16 of the 31 NIS listed have still an undetermined population status, while in the Azores and in Madeira the number of NIS with undetermined population status (26 and 21, respectively) represents much less than half the total number of NIS with known adverse effects. Considering the distribution of these NIS in the AMA sub-region (Annex 1), only six species are considered established in the three archipelagos (*Asparagopsis armata*, *Asparagopsis taxiformis, Bugula neritina*, *Bugulina simplex*, *Bugulina stolonifera* and *Caprella scaura*), and one single species is reported as not established: *Corynomorpha prismatica* in the Azores.

Table 3. Number of species with known adverse effects in the ABI and AMA sub-regions, by Member State (FR - France; ES - Spain; PT - Portugal) and MRU (BoB - Bay of Biscay; NA - North Atlantic; SA - South Atlantic; A - Northwest; B - Southwest; C - South) and population status (E - Established; NE - Not Established; U - Undetermined).

MSFD Sub-region (Total number of NIS)	Member State (Total number of NIS)	MRU (Total number of NIS)	Population Status	Number of NIS
ABI (113)	FR (76)	BoB (76)	E	46
			NE	2
			U	28
	ES (79)	NA (77)	E	39
			NE	2
			U	36

		SA (38)	E	17
			NE	0
			U	21
	PT (63)	A (37)	E	32
			NE	1
			U	4
		B (51)	E	43
			NE	2
			U	6
		C (39)	E	34
			NE	0
			U	5
AMA (130)	PT (119)	Madeira (69)	E	43
			NE	2
			U	24
		Azores (84)	E	62
			NE	1
			U	21
	ES (31)	Canary Islands (31)	E	15
			NE	0
			U	16

In the **second step** 70 NIS, reported in EASIN as high impact NIS, were sorted in the ABI subregion. The results, summarized in Table 4, show that France has the highest number of high impact NIS (54), followed by Spain (52) and Portugal (41). The French BoB MRU presents

also the highest number (11) of high impact NIS not shared with the other MS, followed by Spain (5, in the North Atlantic MRU contiguous with the French BoB). Eight high impact NIS are widely spread in the ABI. Three of these have populations established across the sub-region (*Acartia* (*Acanthacartia*) *tonsa*, *Asparagopsis armata* and *Ruditapes philippinarum*). Moreover, from the analysis of species distribution in the ABI sub-region, it is worth mentioning that:

‒ In the French Bay of Biscay MRU *Corbicula fluminea*, an oligohaline species, was not considered in its assessment since it occurs exclusively in its inland systems. Yet, this oligohaline species can be found in transitional waters, and for this reason, while it is considered by some MS in their inventories (e.g., ES and PT), it is not listed by those MS where it occurs exclusively in freshwater systems (see Tsiamis et al. 2019 for further details).

‒ In Portugal some of the absences might indicate a lack of information, since species that are established both in north and south of Portugal, are absent either from the MRU A-NW (*Asparagopsis taxiformis, Blackfordia virginica, Botrylloides violaceus, Callinectes sapidus, Cordylophora caspia, Microcosmos squamiger* and *Palaemon macrodactylus* all recorded in the B-SW and C-S MRU) or from the MRU C-S (*Anguillicoloides crassus, Eriocheir sinensis, Molgula manhattensis, Mya arenaria, Penaeus japonicus, Rhithropanopeus harrisii, Styela clava, Tricellaria inopinata* and *Undaria pinnatifida,* all recorded in the A-NW and B-SW MRU). *Ulva australis,* recorded in the MRU A-NW and C-S is absent from the MRU B-SW.

In AMA, 30 high impact NIS were sorted (Table 4). Of these, only 4 species are widely spread in the Macaronesian sub-region, 3 of them (*Asparagopsis armata, Asparagopsis taxiformis* and *Bugula neritina*) with established populations, while 7 are present in at least two of the three MRU considered, and 19 are present in only one MRU. The Azores have the highest number of high impact NIS (17) followed by Madeira (14) and Canary Islands (11). All the high impact NIS distributed in the Azores are established, while in Madeira the number of established NIS (7) equals the number of NIS with undetermined population status. In the Canary Islands, 5 NIS were recorded as having established populations and 6 as having undetermined population status. None of the high impact NIS distributed in AMA is classified as not established.

Table 4. Number of species with high impact (according to EASIN) in the ABI and AMA sub-regions, by Member State (FR - France; ES - Spain; PT - Portugal) and MRU (BoB - Bay of Biscay; NA - North Atlantic; SA - South Atlantic; A - Northwest; B - Southwest; C - South) and population status (E - Established; NE - Not Established; U - Undetermined).

MSFD Sub-region (Total number of NIS)	Member State (Total number of NIS)	MRU (Total number of NIS)	Population Status	Number of NIS
ABI (70)	FR (54)	BoB (54)	E	33
			NE	3
			U	18
	ES (52)	NA (51)	E	25
			NE	0
			U	26
		SA (29)	E	14
			NE	0
			U	15
	PT (41)	A (25)	E	20
			NE	2
			U	3
		B (34)	E	28
			NE	3
			U	3
		C (25)	E	23
			NE	0
			U	2

AMA (30)	PT (24)	Madeira (14)	E	7
			NE	0
			U	7
		Azores (18)	E	18
			NE	0
			U	0
	ES (11)	Canary Islands (11)	E	5
			NE	0
			U	6

Final Remarks

This report delivered a shortlist of criteria elements, including the management objectives, assessment scales and risk parameters and categories, defined within the risk context. A list of potential pressures was defined, which includes the NIS with known adverse effects highlighting those classified in EASIN as having high impact, as relevant criteria elements for the assessment of GES, providing support for the development of a risk-based approach to NIS in the Bay of Biscay and the Iberian coast, and in the Macaronesia. It is worth highlighting that the information in this list can be used to identify knowledge gaps (e.g., absence of a widely spread NIS in one MRU that is geographically located between MRU where the NIS is present), and to produce pressure maps considering the NIS with adverse effects and their population status.

A second approach is under development, which will be presented in the next task - T3.3 (Establish risk criteria and significance levels). In this task, risk criteria and aggregation methods will be defined, and risk scales (ratings) will be elaborated for D2 risk evaluation. A ranking system will be developed in order to define a list of relevant GES criteria elements. It is expected that the comparative analysis of the results of the two approaches will allow for an optimization of the definition of the relevant criteria elements, regarding the application of the risk-based approach to D2.

In the following task, T3.4 "Perform risk assessment", the methodology set in the previous steps will be used to perform the assessment on D2, in order to determine if there is a risk of not being in GES.

Finally, Task 3.5: "Risk management common targets and coordinated measures", will propose coordinated actions for D2 risk management to be implemented at sub-regional/national/local level (articles 10, 11 and 13) in areas of concern based on the administrative framework established.

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Annex 1

Species with known adverse effects in the ABI and AMA sub-regions by Member State (FR – France; ES – Spain; PT – Portugal) and MRU (BoB – Bay of Biscay; NA – North Atlantic; SA – South Atlantic; A – Northwest; B – Southwest; C – South) and population status (E – Established; NE – Not Established; U – Undetermined). * Species recorded in mainland Portugal without reference to the location (in Verbruggen et al. 2007).

			ABI																	
			FR			ES						PT								
			BoB			NA			SA			A			B			C		
Phylum	Class	Species	E	NE	U	E	NE	U	E	NE	U	E	NE	U	E	NE	U	E	NE	U
Mollusca	Bivalvia	*Anadara kagoshimensis*						X													
Annelida	Polychaeta	*Boccardia proboscidea*						X													
Annelida	Polychaeta	*Boccardia semibranchiata*						X													
Annelida	Polychaeta	*Boccardiella ligerica*						X													
Cercozoa	Ascetosporea	*Bonamia exitiosa*						X													
Arthropoda	Malacostraca	*Caprella mutica*						X													
Chlorophyta	Ulvophyceae	*Codium arabicum*												*			*			*		
Chlorophyta	Ulvophyceae	*Codium fragile*	X																			
Mollusca	Bivalvia	*Crassostrea rhizophorae*		X																		
Mollusca	Bivalvia	*Crassostrea virginica*		X																		
Mollusca	Gastropoda	*Crepipatella dilatata*				X																
Annelida	Polychaeta	*Dipolydora tentaculata*				X																
Mollusca	Bivalvia	*Ensis leei*				X																
Cnidaria	Anthozoa	*Exaiptasia diaphana*		X																		
Ochrophyta	Raphidophyceae	*Fibrocapsa japonica*					X															
Arthropoda	Malacostraca	*Homarus americanus*		X																		
Annelida	Polychaeta	*Hydroides ezoensis*		X																		
Mollusca	Bivalvia	*Mizuhopecten yessoensis*		X																		
Ctenophora	Tentaculata	*Mnemiopsis leidyi*	X																			
Arthropoda	Malacostraca	*Monocorophium acherusicum*					X															
Arthropoda	Copepoda	*Mytilicola intestinalis*	X																			
Arthropoda	Copepoda	*Mytilicola orientalis*	X																			
Mollusca	Bivalvia	*Ostrea angasi*		X																		
Mollusca	Bivalvia	*Ostrea puelchana*		X																		
Myzozoa	Dinophyceae	*Ostreopsis ovata*																				X
Myzozoa	Dinophyceae	*Ostreopsis siamensis*																X				
Arthropoda	Malacostraca	*Percnon gibbesi*															X					

Annex 1 – Species with known adverse effects in the ABI and AMA sub-regions by Member State (continued)

Phylum	Class	Species	ABI FR BoB E	NE	U	ES NA E	NE	U	ES SA E	NE	U	PT A E	NE	U	PT B E	NE	U	PT C E	NE	U
Annelida	Polychaeta	*Pileolaria berkeleyana*			X															
Annelida	Polychaeta	*Pista unibranchia*				X														
Ochrophyta	Bacillariophyceae	*Pseudo-nitzschia multistriata*											X							
Platyhelminthes	Monogenea	*Pseudodactylogyrus bini*						X												
Tracheophyta	Magnoliopsida	*Spartina alterniflora*	X																	
Tracheophyta	Magnoliopsida	*Spartina townsendii var. anglica*	X																	
Tracheophyta	Magnoliopsida	*Spartina townsendii var. townsendii*	X																	
Mollusca	Bivalvia	*Theora lubrica*				X														
Chlorophyta	Ulvophyceae	*Ulvaria obscura*		X																
Bryozoa	Gymnolaemata	*Victorella pavida*		X																
Cercozoa	Ascetosporea	*Bonamia ostreae*				X					X									
Chordata	Ascidiacea	*Botryllus schlosseri*					X									X				
Rhodophyta	Florideophyceae	*Dasysiphonia japonica*	X			X														
Chordata	Actinopterygii	*Fundulus heteroclitus heteroclitus*								X									X	
Cnidaria	Hydrozoa	*Gonionemus vertens*	X													X				
Mollusca	Gastropoda	*Haloa japonica*				X					X									
Arthropoda	Malacostraca	*Hemigrapsus takanoi*	X			X														
Mollusca	Gastropoda	*Hexaplex trunculus*		X		X														
Annelida	Polychaeta	*Hydroides dianthus*		X					X											
Myzozoa	Dinophyceae	*Karenia mikimotoi*							X		X									
Cnidaria	Hydrozoa	*Maeotias marginata*	X																	X
Cercozoa	Ascetosporea	*Marteilia refringens*				X				X										
Arthropoda	Hexanauplia	*Megabalanus tintinnabulum*		X												X				
Arthropoda	Malacostraca	*Monocorophium sextonae*	X						X											
Arthropoda	Copepoda	*Myicola ostreae*		X															X	
Mollusca	Gastropoda	*Ocinebrellus inornatus*	X										X							
Mollusca	Bivalvia	*Petricolaria pholadiformis*		X					X											
Rhodophyta	Florideophyceae	*Polysiphonia morrowii*		X					X											
Platyhelminthes	Monogenea	*Pseudodactylogyrus anguillae*	X						X											
Mollusca	Gastropoda	*Rapana venosa*		X					X											

Annex 1 – Species with known adverse effects in the ABI and AMA sub-regions by Member State (continued)

Phylum	Class	Species	FR BoB E	FR BoB NE	FR BoB U	ES NA E	ES NA NE	ES NA U	ES SA E	ES SA NE	ES SA U	PT A E	PT A NE	PT A U	PT B E	PT B NE	PT B U	PT C E	PT C NE	PT C U
Mollusca	Gastropoda	*Urosalpinx cinerea*		X		X														
Mollusca	Bivalvia	*Xenostrobus securis*	X								X									
Bryozoa	Gymnolaemata	*Amathia verticillata*										X			X			X		
Arthropoda	Hexanauplia	*Amphibalanus improvisus*		X		X					X									
Mollusca	Bivalvia	*Arcuatula senhousia*	X													X			X	
Arthropoda	Hexanauplia	*Balanus trigonus*		X			X									X				
Ochrophyta	Bacillariophyceae	*Biddulphia sinensis*		X												X			X	
Mollusca	Gastropoda	*Crepidula fornicata*	X			X										X				
Cnidaria	Anthozoa	*Diadumene lineata*	X				X				X									
Chordata	Ascidiacea	*Didemnum vexillum*		X			X													X
Rhodophyta	Florideophyceae	*Grateloupia turuturu*	X			X						X								
Arthropoda	Malacostraca	*Penaeus japonicus*		X								X				X				
Arthropoda	Malacostraca	*Procambarus clarkii*										X				X				X
Bryozoa	Gymnolaemata	*Schizoporella errata*				X													X	X
Rhodophyta	Florideophyceae	*Asparagopsis taxiformis*				X					X					X			X	
Rhodophyta	Florideophyceae	*Bonnemaisonia hamifera*	X			X		X											X	
Chordata	Ascidiacea	*Botrylloides violaceus*	X				X									X			X	
Cnidaria	Hydrozoa	*Cordylophora caspia*	X						X							X			X	
Chordata	Ascidiacea	*Corella eumyota*	X			X						X				X				
Annelida	Polychaeta	*Desdemona ornata*		X		X										X			X	
Annelida	Polychaeta	*Ficopomatus enigmaticus*	X			X		X								X				
Mollusca	Bivalvia	*Mercenaria mercenaria*	X				X					X				X				
Chordata	Ascidiacea	*Microcosmus squamiger*				X		X								X			X	
Chordata	Ascidiacea	*Molgula manhattensis*	X				X					X				X				
Mollusca	Bivalvia	*Mya arenaria*	X				X					X				X				
Annelida	Polychaeta	*Prionospio pulchra*				X						X				X			X	
Chordata	Ascidiacea	*Styela clava*	X			X						X				X				
Chordata	Ascidiacea	*Styela plicata*				X				X						X			X	

Phylum	Class	Species	FR BoB E	NE	U	ES NA E	NE	U	SA E	NE	U	PT A E	NE	U	B E	NE	U	C E	NE	U
Chlorophyta	Ulvophyceae	*Ulva australis*	X			X						X						X		
Ochrophyta	Phaeophyceae	*Undaria pinnatifida*	X			X						X			X					
Nematoda	Chromadorea	*Anguillicoloides crassus*	X						X		X	X			X					
Rhodophyta	Florideophyceae	*Antithamnionella ternifolia*	X			X						X						X		
Cnidaria	Hydrozoa	*Blackfordia virginica*	X						X		X				X			X		
Arthropoda	Malacostraca	*Callinectes sapidus*		X					X	X					X			X		
Chlorophyta	Ulvophyceae	*Codium fragile* subsp. *fragile*			X	X					X				X			X		
Ochrophyta	Phaeophyceae	*Colpomenia peregrina*				X			X			X			X			X		
Mollusca	Bivalvia	*Corbicula fluminea*				X			X			X			X			X		
Arthropoda	Malacostraca	*Eriocheir sinensis*	X						X	X		X			X					
Myzozoa	Dinophyceae	*Gymnodinium catenatum*				X					X	X			X			X		
Arthropoda	Malacostraca	*Palaemon macrodactylus*	X						X		X					X				X
Arthropoda	Malacostraca	*Rhithropanopeus harrisii*			X				X	X		X			X					
Bryozoa	Gymnolaemata	*Tricellaria inopinata*	X			X			X			X			X					
Rhodophyta	Florideophyceae	*Agarophyton vermiculophyllum*	X						X		X	X			X			X		
Ochrophyta	Phaeophyceae	*Sargassum muticum*	X						X		X	X			X			X		
Arthropoda	Copepoda	*Acartia (Acanthacartia) tonsa*	X			X			X			X			X			X		
Arthropoda	Hexanauplia	*Amphibalanus Amphitrite*	X			X			X			X			X			X		
Rhodophyta	Florideophyceae	*Anotrichium furcellatum*	X						X		X	X			X			X		
Rhodophyta	Florideophyceae	*Antithamnionella spirographidis*	X			X					X	X			X			X		
Rhodophyta	Florideophyceae	*Asparagopsis armata*	X			X				X		X			X			X		
Arthropoda	Hexanauplia	*Austrominius modestus*	X			X					X	X			X			X		
Bryozoa	Gymnolaemata	*Bugula neritina*			X	X					X	X			X			X		
Mollusca	Bivalvia	*Magallana gigas*	X			X					X	X			X			X		
Rhodophyta	Florideophyceae	*Melanothamnus harveyi*	X			X					X	X			X			X		
Mollusca	Gastropoda	*Potamopyrgus antipodarum*		X					X		X	X			X			X		
Mollusca	Bivalvia	*Ruditapes philippinarum*	X			X				X		X			X			X		

1 2 3 4 5 6 Number of MRUs shared by species.

Annex 1 – Species with known adverse effects in the ABI and AMA sub-regions by Member State (continued)

			AMA								
			PT						ES		
			Madeira			Azores			Canary Islands		
Phylum	Class	Species	E	NE	U	E	NE	U	E	NE	U
Rhodophyta	Florideophyceae	*Acrothamnion preissii*				X					
Myzozoa	Dinophyceae	*Alexandrium minutum*				X					
Bryozoa	Gymnolaemata	*Amathia gracilis*						X			
Arthropoda	Hexanauplia	*Amphibalanus eburneus*				X					
Rhodophyta	Florideophyceae	*Antithamnion densum*						X			
Rhodophyta	Florideophyceae	*Antithamnion hubbsii*				X					
Rhodophyta	Florideophyceae	*Antithamnionella ternifolia*				X					
Mollusca	Gastropoda	*Aplus dorbignyi*				X					
Mollusca	Gastropoda	*Aplysia dactylomela*	X								
Chordata	Actinopterygii	*Argyrosomus regius*							X		
Chordata	Ascidiacea	*Ascidia interrupta*						X			
Arthropoda	Hexanauplia	*Austrominius modestus*		X							
Bryozoa	Gymnolaemata	*Beania maxilladentata*		X							
Mollusca	Gastropoda	*Bedeva paivae*	X								
Chordata	Ascidiacea	*Botrylloides violaceus*		X							
Annelida	Polychaeta	*Branchiomma bairdi*	X								
Annelida	Polychaeta	*Branchiomma luctuosum*				X					
Chlorophyta	Ulvophyceae	*Caulerpa cylindracea*							X		
Chlorophyta	Ulvophyceae	*Caulerpa prolifera*				X					
Bryozoa	Gymnolaemata	*Celleporaria inaudita*	X								
Chordata	Ascidiacea	*Ciona intestinalis*						X			
Chordata	Ascidiacea	*Clavelina dellavallei*	X								
Chordata	Ascidiacea	*Clavelina oblonga*				X					
Chlorophyta	Ulvophyceae	*Codium fragile*								X	
Chlorophyta	Ulvophyceae	*Codium fragile* subsp. *fragile*				X					

Annex 1 – Species with known adverse effects in the ABI and AMA sub-regions by Member State (continued)

Phylum	Class	Species	AMA PT Madeira E	NE	U	AMA PT Azores E	NE	U	AMA ES Canary Islands E	NE	U
Bryozoa	Gymnolaemata	*Copidozoum tenuirostre*						X			
Rhodophyta	Florideophyceae	*Corynomorpha prismatica*					X				
Bryozoa	Gymnolaemata	*Cradoscrupocellaria bertholletii*		X							
Bryozoa	Stenolaemata	*Crisia denticulata*						X			
Bryozoa	Gymnolaemata	*Cryptosula pallasiana*	X								
Porifera	Demospongiae	*Desmacella meliorata*						X			
Chordata	Actinopterygii	*Dicentrarchus labrax*									X
Chordata	Ascidiacea	*Didemnum perlucidum*		X							
Chordata	Actinopterygii	*Diplodus vulgaris*				X					
Chordata	Ascidiacea	*Distaplia magnilarva*	X								
Annelida	Polychaeta	*Eurythoe complanata*	X								
Cnidaria	Anthozoa	*Exaiptasia diaphana*	X								
Annelida	Polychaeta	*Ficopomatus enigmaticus*				X					
Rhodophyta	Florideophyceae	*Grallatoria reptans*						X			
Rhodophyta	Florideophyceae	*Grateloupia doryphora*									X
Rhodophyta	Florideophyceae	*Grateloupia lanceola*									X
Porifera	Demospongiae	*Haliclona (Rhizoniera) indistincta*		X							
Chlorophyta	Ulvophyceae	*Halimeda incrassata*				X					
Annelida	Polychaeta	*Hydroides elegans*				X					
Rhodophyta	Florideophyceae	*Hypnea flagelliformis*				X					
Rhodophyta	Florideophyceae	*Laurencia brongniartii*				X					
Rhodophyta	Florideophyceae	*Laurencia chondrioides*				X					
Rhodophyta	Florideophyceae	*Lophocladia trichoclados*				X					
Cnidaria	Hydrozoa	*Macrorhynchia philippina*		X							
nidaria	Hydrozoa	*Millepora alcicornis*		X							

Phylum	Class	Species	Madeira E	Madeira NE	Madeira U	Azores E	Azores NE	Azores U	Canary Islands E	Canary Islands NE	Canary Islands U
Porifera	Demospongiae	*Mycale (Carmia) senegalensis*			X						
Mollusca	Bivalvia	*Mytilus edulis*				X					
Cnidaria	Hydrozoa	*Obelia dichotoma*			X						
Mollusca	Bivalvia	*Ostrea edulis*				X					
Echinodermata	Echinoidea	*Ova canalifera*			X						
Bryozoa	Gymnolaemata	*Parasmittina alba*	X								
Bryozoa	Gymnolaemata	*Parasmittina multiaviculata*	X								
Bryozoa	Gymnolaemata	*Parasmittina protecta*	X								
Cnidaria	Hydrozoa	*Pennaria disticha*	X								
Arthropoda	Hexanauplia	*Perforatus perforatus*				X					
Chordata	Ascidiacea	*Perophora viridis*						X			
Ochrophyta	Phaeophyceae	*Petalonia binghamiae*				X					
Mollusca	Gastropoda	*Phorcus sauciatus*				X					
Annelida	Polychaeta	*Phyllodoce mucosa*		X							
Annelida	Polychaeta	*Pileolaria berkeleyana*		X							
Mollusca	Bivalvia	*Pinctada imbricata radiata*				X					
Chordata	Ascidiacea	*Polyandrocarpa zorritensis*	X								
Chordata	Ascidiacea	*Polyclinum aurantium*						X			
Porifera	Demospongiae	*Prosuberites longispinus*	X								
Chordata	Ascidiacea	*Pycnoclavella taureanensis*	X								
Chordata	Ascidiacea	*Pyura tessellata*						X			
Mollusca	Bivalvia	*Ruditapes decussatus*				X					
Annelida	Polychaeta	*Sabella spallanzanii*						X			
Rhodophyta	Florideophyceae	*Scageliopsis patens*						X			
Bryozoa	Gymnolaemata	*Schizoporella pungens*	X								

			AMA								
			PT						ES		
			Madeira			Azores			Canary Islands		
Phylum	Class	Species	E	NE	U	E	NE	U	E	NE	U
Arthropoda	Malacostraca	*Sphaeroma walkeri*	X								
Cnidaria	Myxozoa	*Sphaerospora testicularis*									X
Rhodophyta	Florideophyceae	*Spongoclonium caribaeum*				X					
Chordata	Ascidiacea	*Styela clava*				X					
Ochrophyta	Phaeophyceae	*Stypopodium schimperi*									X
Rhodophyta	Florideophyceae	*Symphyocladia marchantioides*				X					
Chordata	Ascidiacea	*Symplegma brakenhielmi*	X								
Cnidaria	Hydrozoa	*Tubularia indivisa*						X			
Ochrophyta	Phaeophyceae	*Undaria pinnatifida*									X
Ctenophora	Tentaculata	*Vallicula multiformis*		X							
Rhodophyta	Florideophyceae	*Womersleyella setacea*							X		
Rhodophyta	Florideophyceae	*Xiphosiphonia pinnulata*				X					
Bryozoa	Gymnolaemata	*Amathia verticillata*	X			X					
Arthropoda	Hexanauplia	*Amphibalanus amphitrite*		X		X					
Rhodophyta	Florideophyceae	*Anotrichium furcellatum*	X					X			
Rhodophyta	Florideophyceae	*Antithamnion diminuatum*				X					X
Rhodophyta	Florideophyceae	*Antithamnionella spirographidis*		X				X			
Arthropoda	Hexanauplia	*Balanus trigonus*	X			X					
Rhodophyta	Florideophyceae	*Bonnemaisonia hamifera*				X			X		
Chlorophyta	Ulvophyceae	*Caulerpa webbiana*	X			X					
Rhodophyta	Florideophyceae	*Ceramium cingulatum*				X					X
Chordata	Ascidiacea	*Clavelina lepadiformis*	X			X					
Porifera	Demospongiae	*Crambe crambe*	X						X		
Chordata	Ascidiacea	*Diplosoma listerianum*	X								X
Chordata	Ascidiacea	*Distaplia corolla*	X			X					

Annex 1 – Species with known adverse effects in the ABI and AMA sub-regions by Member State (continued)

Phylum	Class	Species	Madeira E	Madeira NE	Madeira U	Azores E	Azores NE	Azores U	Canary Islands E	Canary Islands NE	Canary Islands U
Cnidaria	Hydrozoa	*Ectopleura crocea*			X	X					
Chordata	Ascidiacea	*Eudistoma angolanum*			X			X			
Rhodophyta	Florideophyceae	*Grateloupia turuturu*			X	X					
Rhodophyta	Florideophyceae	*Gymnophycus hapsiphorus*				X					X
Mollusca	Gastropoda	*Hexaplex trunculus*	X			X					
Cnidaria	Hydrozoa	*Kirchenpaueria halecioides*	X			X					
Mollusca	Bivalvia	*Lyrodus pedicellatus*			X			X			
Rhodophyta	Florideophyceae	*Melanothamnus harveyi*				X			X		
Rhodophyta	Florideophyceae	*Melanothamnus sphaerocarpus*			X	X					
Arthropoda	Malacostraca	*Paracerceis sculpta*	X			X					
Mollusca	Bivalvia	*Psiloteredo megotara*			X			X			
Chordata	Actinopterygii	*Sparus aurata*			X						X
Annelida	Polychaeta	*Spirorbis (Spirorbis) marioni*			X	X					
Chordata	Ascidiacea	*Styela plicata*				X			X		
Bryozoa	Gymnolaemata	*Tricellaria inopinata*	X			X					
Mollusca	Gastropoda	*Truncatella subcylindrica*			X	X					
Bryozoa	Gymnolaemata	*Virididentula dentata*	X			X					
Bryozoa	Gymnolaemata	*Watersipora subtorquata*	X			X					
Rhodophyta	Florideophyceae	*Asparagopsis armata*	X			X			X		
Rhodophyta	Florideophyceae	*Asparagopsis taxiformis*	X			X			X		
Chordata	Ascidiacea	*Botryllus schlosseri*	X			X					X**
Bryozoa	Gymnolaemata	*Bugulina fulva*	X					X			X
Bryozoa	Gymnolaemata	*Bugulina simplex*	X			X			X		
Bryozoa	Gymnolaemata	*Bugula neritina*	X			X			X		
Bryozoa	Gymnolaemata	*Bugulina stolonifera*	X			X			X		

Annex 1 – Species with known adverse effects in the ABI and AMA sub-regions by Member State (continued)

Phylum	Class	Species	Madeira E	Madeira NE	Madeira U	Azores E	Azores NE	Azores U	Canary Islands E	Canary Islands NE	Canary Islands U
Arthropoda	Malacostraca	*Caprella scaura*	X			X			X		
Chordata	Ascidiacea	*Microcosmus squamiger*		X		X					X
Porifera	Calcarea	*Paraleucilla magna*		X		X			X		
Bryozoa	Gymnolaemata	*Reptadeonella violacea*	X					X	X		
Bryozoa	Gymnolaemata	*Schizoporella errata*	X			X					X

** *Botryllus schlosseri* is present in the Canary Islands but it is not considered in the NIS group (as defined in this report) by the Spanish MSFD experts on D2, because of its hypothetical native distribution in the NE Atlantic. However, the species is classified as cryptogenic in EASIN. Its register in the Canary Islands is kept in this list solely for the purpose of assessing its geographical distribution.

| 1 | 2 | 3 | Number of MRUs shared by species.

Annex 2

Species classified as having high impact in EASIN in the ABI and AMA sub-regions, by Member State (FR – France; ES – Spain; PT – Portugal) and MRU (BoB – Bay of Biscay; NA – North Atlantic; SA – South Atlantic; A – Northwest; B – Southwest; C – South) and population status (E – Established; NE – Not Established; U – Undetermined).

Phylum	Class	Species	FR BoB E	FR BoB NE	FR BoB U	ES NA E	ES NA NE	ES NA U	ES SA E	ES SA NE	ES SA U	PT A E	PT A NE	PT A U	PT B E	PT B NE	PT B U	PT C E	PT C NE	PT C U
Mollusca	Bivalvia	*Anadara kagoshimensis*						X												
Annelida	Polychaeta	*Boccardiella ligerica*						X												
Arthropoda	Malacostraca	*Caprella mutica*						X												
Mollusca	Bivalvia	*Crassostrea virginica*			X															
Mollusca	Bivalvia	*Ensis leei*				X														
Arthropoda	Malacostraca	*Homarus americanus*			X															
Annelida	Polychaeta	*Hydroides ezoensis*			X															
Ctenophora	Tentaculata	*Mnemiopsis leidyi*	X																	
Arthropoda	Copepoda	*Mytilicola intestinalis*	X																	
Arthropoda	Copepoda	*Mytilicola orientalis*	X																	
Arthropoda	Malacostraca	*Percnon gibbesi*														X				
Annelida	Polychaeta	*Pileolaria berkeleyana*			X															
Platyhelminthes	Monogenea	*Pseudodactylogyrus bini*						X												
Tracheophyta	Magnoliopsida	*Spartina alterniflora*	X																	
Tracheophyta	Magnoliopsida	*Spartina townsendii var. anglica*	X																	
Tracheophyta	Magnoliopsida	*Spartina townsendii var. townsendii*	X																	
Bryozoa	Gymnolaemata	*Victorella pavida*			X															
Cercozoa	Ascetosporea	*Bonamia ostreae*				X					X									
Cnidaria	Hydrozoa	*Gonionemus vertens*	X													X				
Arthropoda	Malacostraca	*Hemigrapsus takanoi*	X			X														
Annelida	Polychaeta	*Hydroides dianthus*		X				X												
Myzozoa	Dinophyceae	*Karenia mikimotoi*						X			X									
Cercozoa	Ascetosporea	*Marteilia refringens*				X			X											
Arthropoda	Malacostraca	*Monocorophium sextonae*	X					X												
Arthropoda	Copepoda	*Myicola ostreae*		X																X	
Mollusca	Bivalvia	*Petricolaria pholadiformis*		X				X												
Rhodophyta	Florideophyceae	*Polysiphonia morrowii*		X				X												
Platyhelminthes	Monogenea	*Pseudodactylogyrus anguillae*	X					X												

Phylum	Class	Species	FR BoB E	FR BoB NE	FR BoB U	ES NA E	ES NA NE	ES NA U	ES SA E	ES SA NE	ES SA U	PT A E	PT A NE	PT A U	PT B E	PT B NE	PT B U	PT C E	PT C NE	PT C U
Mollusca	Gastropoda	*Rapana venosa*			X		X													
Mollusca	Gastropoda	*Urosalpinx cinerea*			X		X													
Mollusca	Bivalvia	*Xenostrobus securis*	X								X									
Arthropoda	Hexanauplia	*Amphibalanus improvisus*			X	X					X									
Mollusca	Bivalvia	*Arcuatula senhousia*	X										X			X				
Ochrophyta	Bacillariophyceae	*Biddulphia sinensis*			X								X			X				
Mollusca	Gastropoda	*Crepidula fornicata*	X			X							X							
Chordata	Ascidiacea	*Didemnum vexillum*			X		X													X
Rhodophyta	Florideophyceae	*Grateloupia turuturu*	X			X						X								
Arthropoda	Malacostraca	*Penaeus japonicus*			X							X			X					
Arthropoda	Malacostraca	*Procambarus clarkii*										X			X			X		
Rhodophyta	Florideophyceae	*Asparagopsis taxiformis*				X					X				X			X		
Rhodophyta	Florideophyceae	*Bonnemaisonia hamifera*	X			X				X								X		
Chordata	Ascidiacea	*Botrylloides violaceus*	X				X								X			X		
Cnidaria	Hydrozoa	*Cordylophora caspia*	X						X						X			X		
Annelida	Polychaeta	*Ficopomatus enigmaticus*	X			X			X						X					
Mollusca	Bivalvia	*Mercenaria mercenaria*	X						X					X			X			
Chordata	Ascidiacea	*Microcosmus squamiger*				X			X						X			X		
Chordata	Ascidiacea	*Molgula manhattensis*	X				X					X			X					
Mollusca	Bivalvia	*Mya arenaria*	X				X					X			X					
Chordata	Ascidiacea	*Styela clava*	X			X						X			X					
Chordata	Ascidiacea	*Styela plicata*	X			X				X					X				X	
Chlorophyta	Ulvophyceae	*Ulva australis*	X			X						X							X	
Ochrophyta	Phaeophyceae	*Undaria pinnatifida*	X			X						X				X				
Nematoda	Chromadorea	*Anguillicoloides crassus*		X					X		X	X				X				
Cnidaria	Hydrozoa	*Blackfordia virginica*	X						X		X				X			X		
Arthropoda	Malacostraca	*Callinectes sapidus*		X					X	X					X			X		
Chlorophyta	Ulvophyceae	*Codium fragile subsp. fragile*			X	X					X				X			X		
Mollusca	Bivalvia	*Corbicula fluminea*				X				X		X			X			X		
Arthropoda	Malacostraca	*Eriocheir sinensis*	X						X	X		X			X					

Annex 2 – Species classified as having high impact in EASIN in the ABI and AMA sub-regions, by Member State (continued)

Phylum	Class	Species	FR·BoB·E	FR·BoB·NE	FR·BoB·U	ES·NA·E	ES·NA·NE	ES·NA·U	ES·SA·E	ES·SA·NE	ES·SA·U	PT·A·E	PT·A·NE	PT·A·U	PT·B·E	PT·B·NE	PT·B·U	PT·C·E	PT·C·NE	PT·C·U
Myzozoa	Dinophyceae	*Gymnodinium catenatum*				X					X	X				X		X		
Arthropoda	Malacostraca	*Palaemon macrodactylus*	X				X				X						X			X
Arthropoda	Malacostraca	*Rhithropanopeus harrisii*			X			X	X			X				X				
Bryozoa	Gymnolaemata	*Tricellaria inopinata*	X			X				X		X				X				
Arthropoda	Copepoda	*Acartia (Acanthacartia) tonsa*	X			X				X		X				X			X	
Ochrophyta	Phaeophyceae	*Sargassum muticum*	X			X					X	X				X			X	
Rhodophyta	Florideophyceae	*Asparagopsis armata*	X			X				X		X				X			X	
Arthropoda	Hexanauplia	*Austrominius modestus*	X			X					X	X				X			X	
Bryozoa	Gymnolaemata	*Bugula neritina*			X		X				X	X				X			X	
Mollusca	Bivalvia	*Magallana gigas*	X			X					X	X				X			X	
Mollusca	Gastropoda	*Potamopyrgus antipodarum*		X			X				X	X				X			X	
Mollusca	Bivalvia	*Ruditapes philippinarum*	X			X				X		X				X			X	

1 2 3 4 5 6   Number of MRUs shared by species.

			AMA						ES		
			PT								
			Madeira			Azores			Canary Islands		
Phylum	**Class**	**Species**	E	NE	U	E	NE	U	E	NE	U
Rhodophyta	Florideophyceae	*Acrothamnion preissii*				X					
Myzozoa	Dinophyceae	*Alexandrium minutum*				X					
Mollusca	Gastropoda	*Aplysia dactylomela*	X								
Arthropoda	Hexanauplia	*Austrominius modestus*		X							
Chordata	Ascidiacea	*Botrylloides violaceus*		X							
Chlorophyta	Ulvophyceae	*Caulerpa cylindracea*							X		
Chlorophyta	Ulvophyceae	*Codium fragile subsp. fragile*				X					
Annelida	Polychaeta	*Ficopomatus enigmaticus*				X					
Rhodophyta	Florideophyceae	*Grateloupia doryphora*									X
Annelida	Polychaeta	*Hydroides elegans*				X					
Cnidaria	Hydrozoa	*Macrorhynchia philippina*		X							
Mollusca	Bivalvia	*Mytilus edulis*				X					
Annelida	Polychaeta	*Pileolaria berkeleyana*		X							
Mollusca	Bivalvia	*Pinctada imbricata radiata*				X					
Chordata	Ascidiacea	*Polyandrocarpa zorritensis*	X								
Chordata	Ascidiacea	*Styela clava*				X					
Ochrophyta	Phaeophyceae	*Stypopodium schimperi*									X
Ochrophyta	Phaeophyceae	*Undaria pinnatifida*									X
Rhodophyta	Florideophyceae	*Womersleyella setacea*							X		
Rhodophyta	Florideophyceae	*Bonnemaisonia hamifera*				X			X		
Chordata	Ascidiacea	*Diplosoma listerianum*	X								X
Rhodophyta	Florideophyceae	*Grateloupia turuturu*		X		X					
Mollusca	Gastropoda	*Hexaplex trunculus*	X			X					
Annelida	Polychaeta	*Spirorbis (Spirorbis) marioni*		X		X					
Chordata	Ascidiacea	*Styela plicata*				X			X		

Annex 2 – Species classified as having high impact in EASIN in the ABI and AMA sub-regions, by Member State (continued)

			AMA								
			PT						ES		
			Madeira			Azores			Canary Islands		
Phylum	**Class**	**Species**	**E**	**NE**	**U**	**E**	**NE**	**U**	**E**	**NE**	**U**
Bryozoa	Gymnolaemata	*Tricellaria inopinata*	X			X					
Rhodophyta	Florideophyceae	*Asparagopsis armata*	X			X			X		
Rhodophyta	Florideophyceae	*Asparagopsis taxiformis*	X			X			X		
Bryozoa	Gymnolaemata	*Bugula neritina*	X			X			X		
Chordata	Ascidiacea	*Microcosmus squamiger*			X	X					X

| 1 | 2 | 3 | Number of MRUs shared by species.