



TARTU ÜLIKOOL
Pärnu kolledž

Iceland 
Liechtenstein
Norway grants

Rahvusvaheline seadusandlik raamistik ja võõrliikide mõjude hindamismetoodikad

Henn Ojaveer

13 aprill 2023

Definitsioonid (I)

- **Võõr- ehk tulnukorganismideks** nimetatakse liike, alamliike või madalamaid taksoneid, kes on inimese kaasabil levinud elupaikadesse, kuhu nad looduslike tõkete tõttu ise levida ei saaks. See hõlmab organismi mis tahes osa või mistahes elustaadiumit (nt. ka sugurakke), kes võib uues keskkonnas ellu jääda ja paljuneda
- **Krüptogeenseks** nimetatakse teadmata päritoluga liiki, mida ei saa pidada ei kohalikuks ega ka võõraks

Definitsioonid (II)

- **Juhuslik invasioon** toimub inimese teadmatul kaasabil
- **Tahtlik invasioon** tähendab võõrliigi eesmärgipärast toomist väljapoole liigi looduslikku levilat
- **Primaarne invasioon:** inimese poolt esmaselt uude kohta sisse toodud liik
- **Sekundaarne invasioon:** liigi edasine levik uues keskkonnas kas inimese kaasabil või looduslike protsesside vahendusel

Invasiivne võõrliik

- Invasiivsed võõrliigid on sellised võõrliigid, mis on levinud, levivad, või on mujal näidanud võimet levida uude keskkonda ning mõjutavad, või võivad mõjutada kohalikku elurikkust, ökosüsteemi toimimist, sotsiaalmajanduslikke väärtusi ja/või inimese tervist.
- Võõrliigi invasiivsus on ajas ja ruumis dünaamiline nähtus:
 - Üks ja seesama liik võib olla invasiivne mere ühes osas ja mitteinvasiivne mere teises osas
 - Liik võib mingil ajaperioodil (aastad) olla invasiivne ja mingil ajaperioodil (aastad) mitteinvasiivne.

Levikuviisid

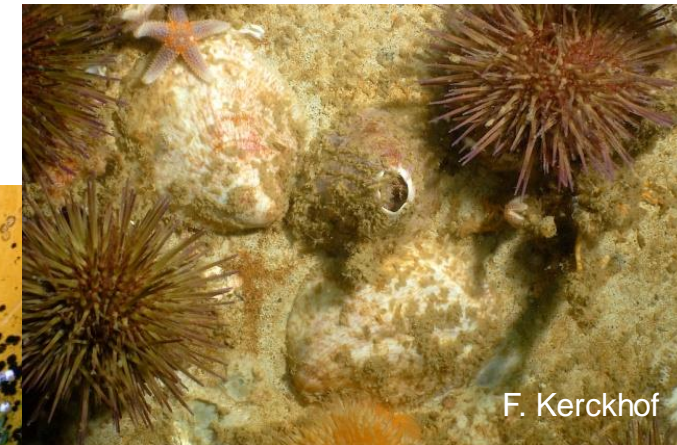
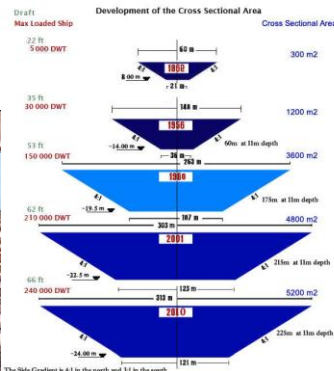
- Veealused ujuvstruktuurid
- Kanalid
- Kalandus
- Vesiviljelus
- Puhkemajandus
- Akvaariumi- ja eluskala kaubandus
- Biotõrje



Läänemerd Ponto-Kaspia piirkonnaga ühendavad kanalid

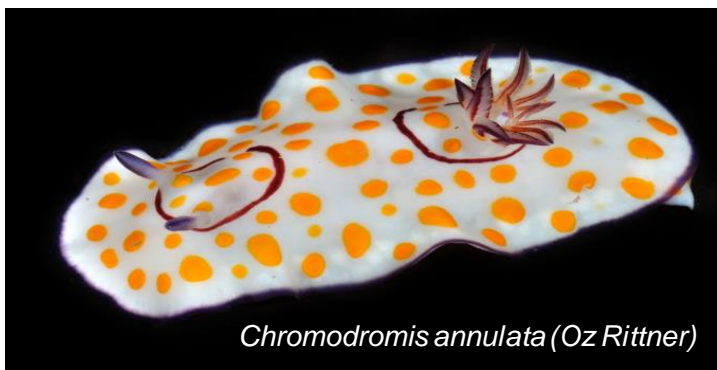


- 1 Oginskij (1768)
- 2 Bug – Pripet (1775)
- 3 Mariinskij (1810)
- 4 Severo-Dvinskij (1829)
- 5 Volga-Don (1952)



F. Kerckhof

F. Kerckhof



Chromodromis annulata (Oz Rittner)



Sargocentron rubrum (IOLR)



Portunus segnis (IOLR)



Percnon gibbesi (B. Yokes)



Stephanolepis diaspros (IOLR)



Rapana rapana



Asparagopsis armata (M. Catra)



Codium fragile (D. Minchin)



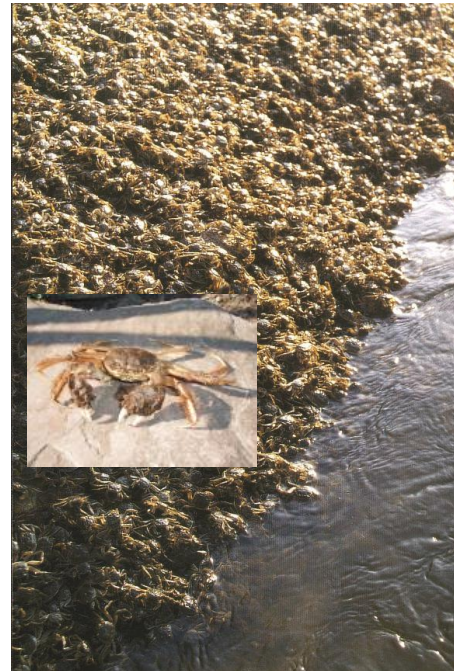
Didemnum vexillum (D. Offer)



Dreissena polymorpha (D. Minchin)



Neogobius melanostomus

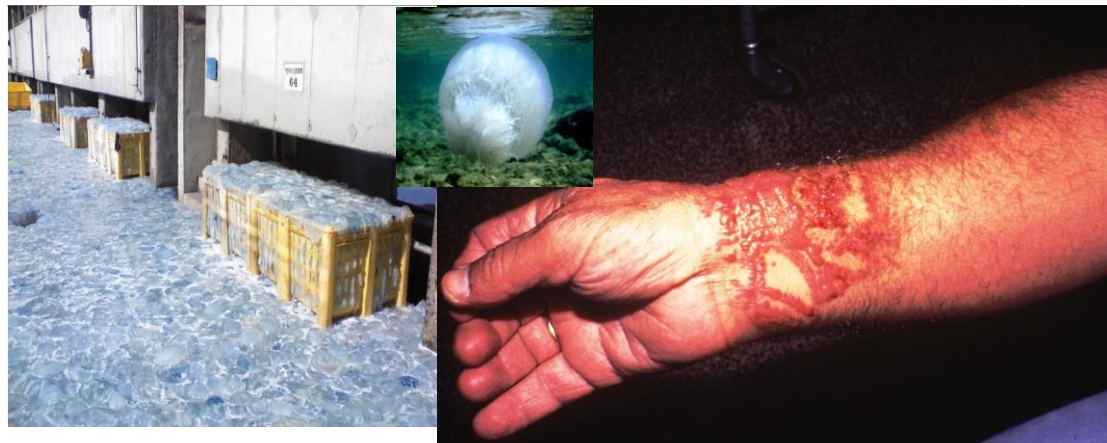


Eriocheir sinensis (S. Gollasch)



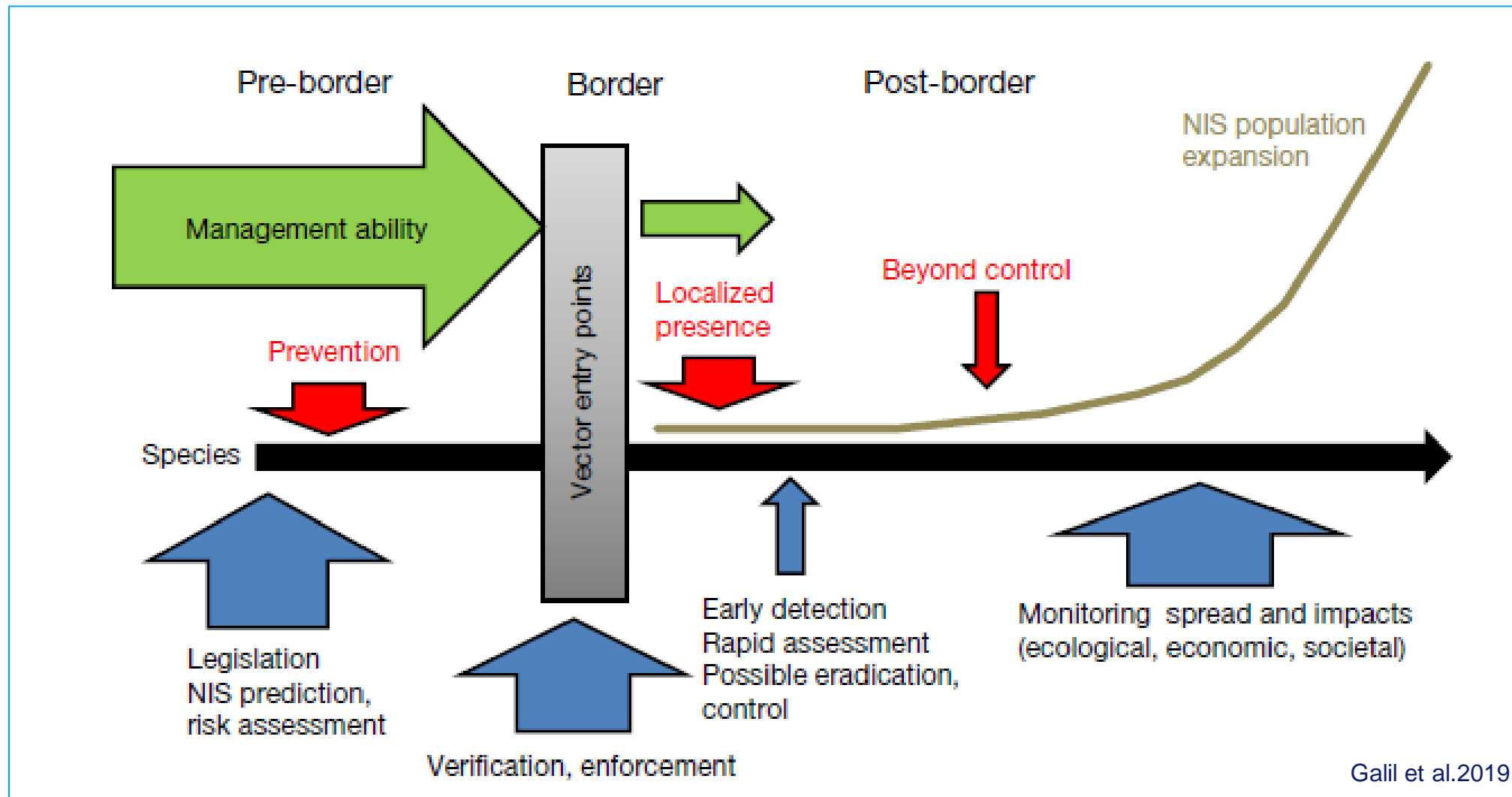
Paralithodes camtschaticus

http://www.barentsportal.com/barentsportal09/index.php?option=com_content&view=article&id=367&Itemid=268&lang=en



Rhopilema nomadica (IOLR, Anon.)

Võõrliikide majandamine



Some key response actions

First scientific
management
advice (ICES)



1970

1980

1990

2000

2010

2020

Examples of introductions

Mya arenaria, W
Europe



1300

1400

1500

1600

1700

1800

1900

2000

Crassostrea angulata,
Portugal



Mytilus spp., South America



Littorina littorea,
Nova Scotia,
Canada



Spartina alterniflora,
France



Paralithoides camchaticus,
Barents Sea



Crassostrea gigas,
USA



Caulerpa taxifolia,
Mediterranean Sea



*Mnemiopsis
leidyi*, Black
Sea



Pterois spp.,
Atlantic,
Mediterranean
Sea



CODE OF PRACTICE TO REDUCE THE RISKS OF ADVERSE EFFECTS ARISING

FROM INTRODUCTION OF NON-INDIGENOUS MARINE SPECIES

(Adopted by the Council 10 October 1973)

I. Recommended procedure for all species prior to reaching a decision regarding new introductions (this does not apply to introductions or transfers which are part of current commercial practice):

- (a) An examination, by the appropriate authorities of the importing country, of each "candidate for admission" in its natural environment, to assess its relationship with other members of the ecosystem, including the role played by parasites and diseases.
- (b) A careful assessment of the probable effects of introduction into the new area, including an examination of the effects of any previous introductions of this or similar species in other areas.


If the decision is taken to proceed with the introduction, the following action is recommended:

- (i) Multiplication of the introduced species in quarantine conditions in a hatchery in the receiving country, followed by transplantation of juveniles to the natural environment if no diseases or parasites become evident. The period of rearing in quarantine will provide a further opportunity for observation of the introduced adults. Where practicable, rearing from introduced eggs and juveniles should present a smaller risk than breeding from introduced adults.
- (ii) Sterilization, in an approved manner, of all effluents from hatcheries or establishments used for quarantine purposes.
- (iii) In cases where artificial propagation techniques would be inappropriate or have not yet been developed for the species, the introduction of eggs or early larvae may be utilized without prior quarantining. In such cases, all appropriate precautions should be taken to minimize the risk of introducing associated undesirable organisms, for example by the use of disinfection procedures.
- (iv) A continuing study of the introduced species in its new environment, and the submission of progress reports to the International Council for the Exploration of the Sea.

II. Recommended procedure for introductions or transfers which are part of current commercial practice

- (a) Regular examination by qualified scientific personnel of consignments of species to be imported, before shipment, within the country of origin.
- (b) Inspection and control of each consignment on arrival.
- (c) Quarantining or disinfection where appropriate.

TEGEVUSJUHEND MERE VÕÖRLIIKIDE SISSETOOMISEST TULENEVATE KÕRVALMÕJUDE RISKIDE VÄHENDAMISEKS

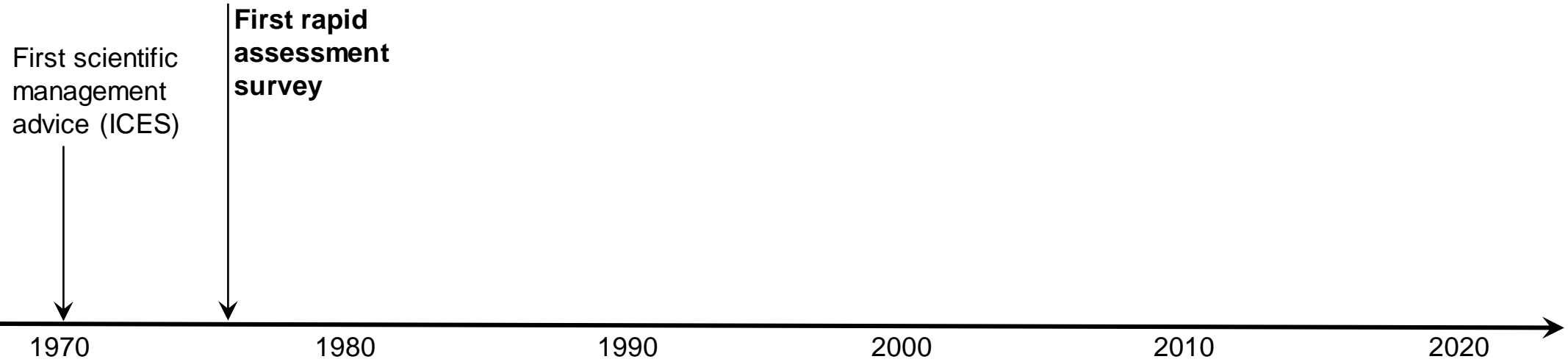


Soovitused 'uute'
võõrliikide kohta



Soovitused 'vanade'
võõrliikide kohta

Some key response actions



Examples of introductions

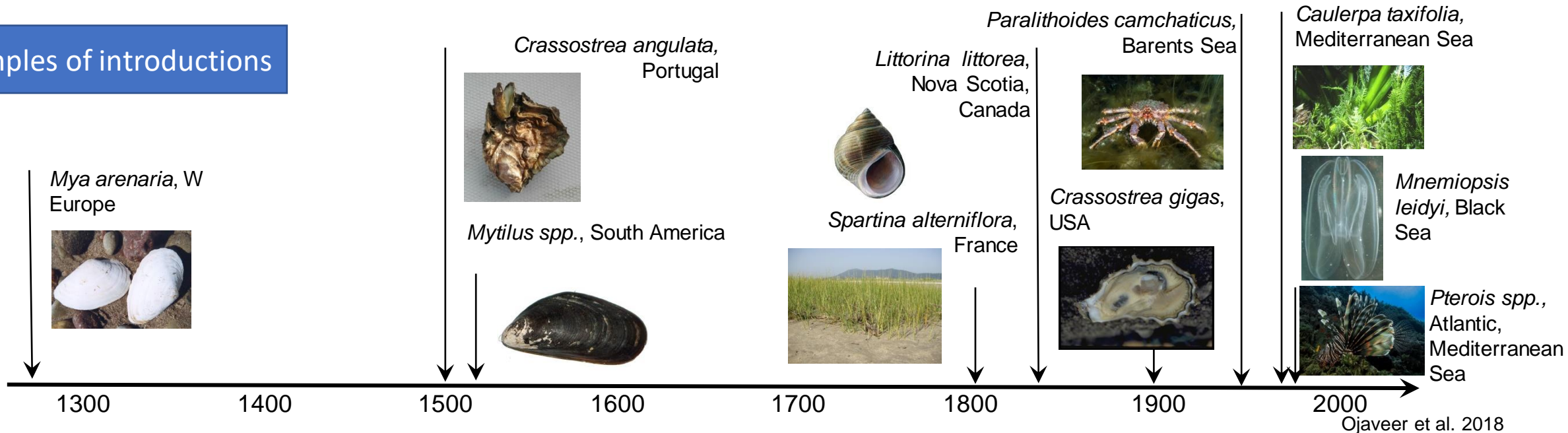


Table 5. Examples of field surveys designed and implemented to detect non-indigenous marine species.

Survey type	Target group	First applied	Examples of later applications
Rapid assessment surveys	Visual scans for target species and qualitative sampling and analysis, to detect NIS in benthic and pelagic habitats [195,196].	Pacific coast of North America, 1976 [137]	US Atlantic and Pacific coasts, England, Scotland, Ireland, and Panama [202–206].

Carlton JT. 1979. Introduced invertebrates of San Francisco Bay. In: Conomos TJ, Leviton AE, Berson M, editors. San Francisco Bay: The urbanized estuary. Investigations into the natural history of San Francisco Bay and Delta with reference to the influence of man. Proceedings of the 58th annual meeting of the Pacific division of American association for the advancement of science; 1977 Jun 12–16; San Francisco, USA. Lawrence: Allen Press; 1979. pp. 427–444.

Some key response actions

First scientific management advice (ICES)



1970

First rapid assessment survey



1980

First global regulation (UNCLOS)



1980

1990

2000

2010

2020

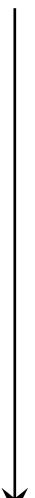
Examples of introductions

Mya arenaria, W Europe



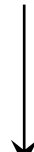
1300

Crassostrea angulata, Portugal



1500

Mytilus spp., South America



1600

Littorina littorea, Nova Scotia, Canada



1700

Spartina alterniflora, France



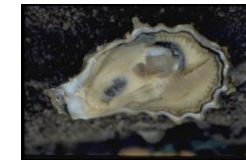
1800

Paralithoides camchaticus, Barents Sea



1900

Crassostrea gigas, USA



1900

Caulerpa taxifolia, Mediterranean Sea



2000

Mnemiopsis leidyi, Black Sea



2000

Pterois spp., Atlantic, Mediterranean Sea



2000



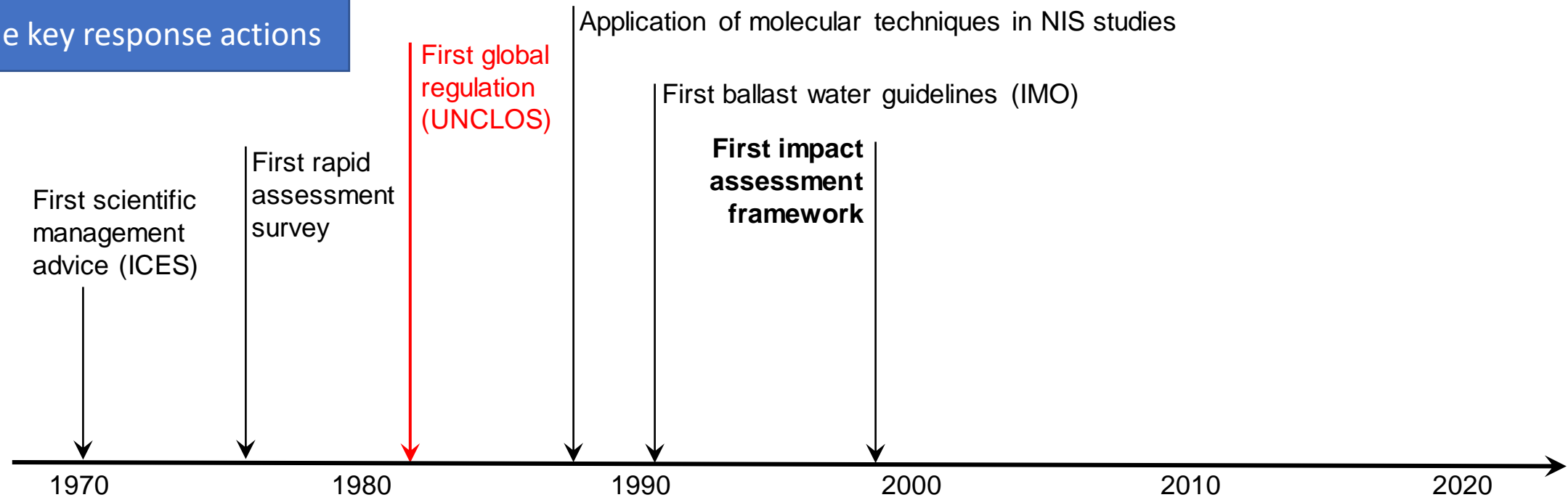
Oceans and Law of the Sea

Division for Ocean Affairs and the Law of the Sea

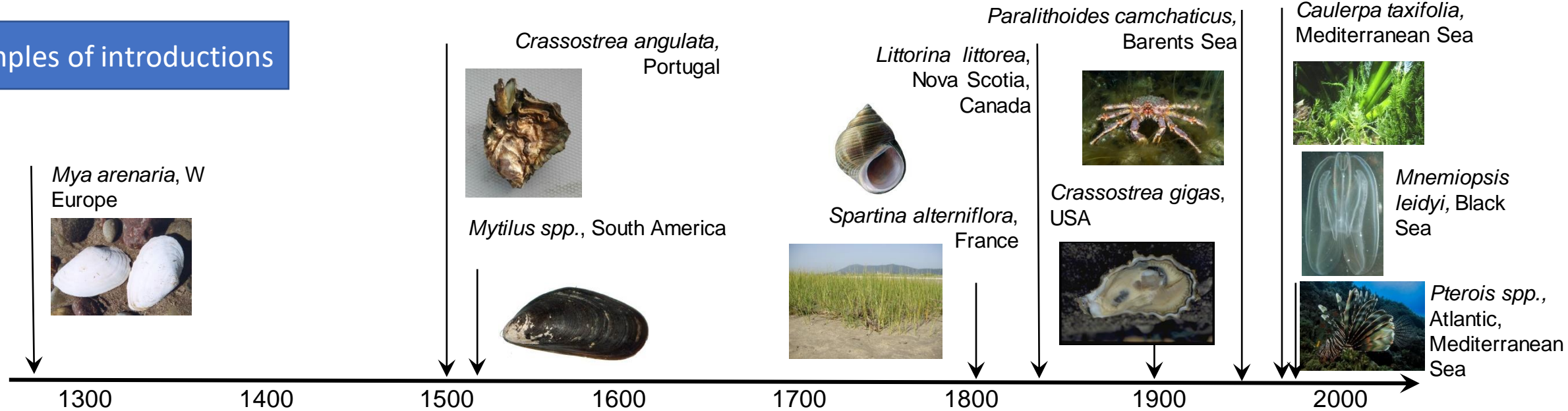
Artikkel 196. Tehnoloogiate kasutamine või võõraste või uute liikide sisseviimine

1. Riigid võtavad meetmeid, et vältida, vähendada ja kontrollida merereostust, mis tuleneb nende jurisdiktsiooni või kontrolli all kasutatavatest tehnoloogiatest või võõraste või uute liikide tahtlikust või juhuslikust sisseviimisest merekeskkonna mingisse ossa, mis võib põhjustada merekeskkonna ulatuslikke ja kahjulikke muutusi.
2. Käesolev artikkel ei mõjuta konventsiooni kohaldamist merekeskkonna reostamise vältimisele, vähendamisele ja kontrollimisele.

Some key response actions



Examples of introductions

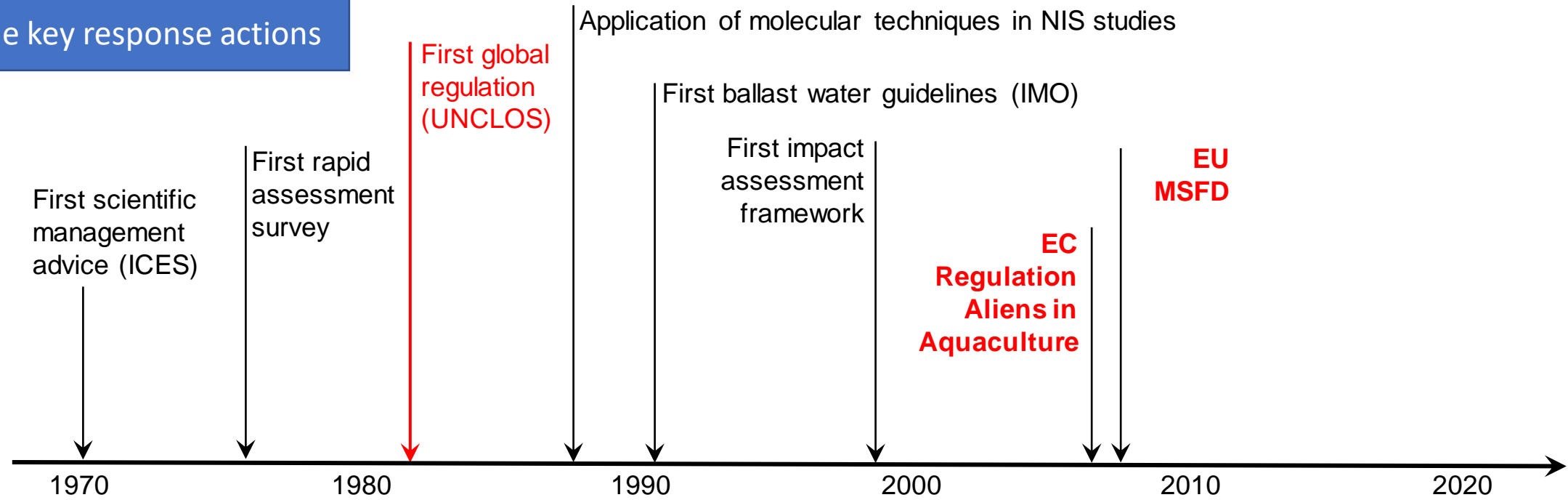


Võõrliikide mõju indeks

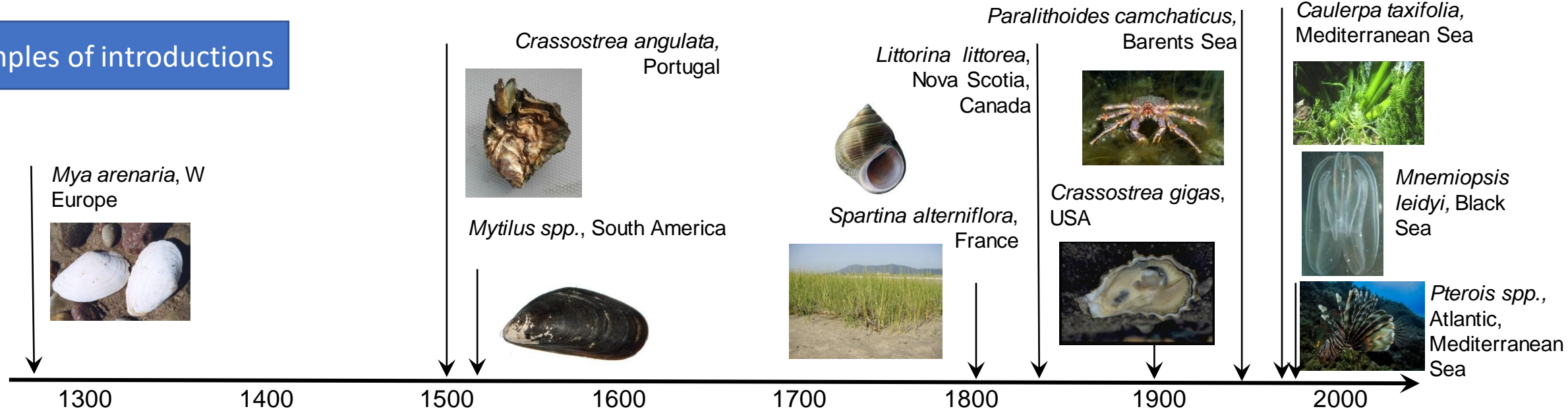
Table 1. Ecological impacts reported among all taxa in Chesapeake Bay. For each species considered to have a significant impact in the bay, the evidence of impacts (information type) is indicated numerically for each impact type: A—competition; B—habitat change; C—food-prey; D—predation; E—herbivory; F—hybridization; G—parasitism; H—bioturbation. Impact summary indicates of the highest numerical score for information type across all impact types by species. Reported abundance is shown by category (rare, common, abundant). Species marked “C” are considered cryptogenic (i.e., possibly introduced) in the bay. Information types: 0—no information; 1—qualitative observations; 2—presence-absence comparison; 3—quantitative correlation; 4—inference from mechanistic, autecological study; 5—controlled experiments; 6—BACI, before-after control vs. invaded comparisons.

Species	Impact summary	A	B	C	D	E	F	G	H	Abundance	References*
Phylum Haplosporidia											
<i>Haplosporidium nelsoni</i>	4	2	1	0	0	0	0	4	0	abundant	1, 2, 3, 4, 5, 6
Phylum Apicomplexa											
<i>Perkinsus marinus</i> (C)	4	2	1	0	0	0	0	4	0	abundant	6, 7, 8, 9, 10, 11
Phylum Angiospermophyta											
<i>Alternanthera philoxeroides</i>	1	1	0	0	0	0	0	0	0	rare	12, 13
<i>Hydrilla verticillata</i>	5	1	5	2	0	0	0	0	0	abundant	14, 15, 16, 17, 18, 19, 20, 21, 22
<i>Iris pseudacorus</i>	3	3	1	1	0	0	0	0	0	common	23
<i>Lythrum salicaria</i>	1	1	0	1	0	0	0	0	0	common	24, 25
<i>Murdannia keisak</i>	1	1	0	1	0	0	0	0	0	abundant	13, 26
<i>Myriophyllum spicatum</i>	3	1	1	3	0	0	0	0	0	abundant	16, 19, 20, 22, 27, 28, 29, 30
<i>Phragmites australis</i> (C)	3	3	1	1	0	0	0	0	0	abundant	31, 32, 33, 34
<i>Trapa natans</i>	1	1	1	1	0	0	0	0	0	rare (now)	16, 20, 30, 35
<i>Typha angustifolia</i> (C)	1	1	0	1	0	0	1	0	0	abundant	31, 33, 36
Phylum Cnidaria											
<i>Cordylophora caspia</i>	5	5	5	1	1	0	0	0	0	abundant	37, 38, 39
<i>Garveia franciscana</i>	1	1	1	1	0	0	0	0	0	abundant	40, 41, 42
<i>Nematostella vectensis</i> (C)	5	0	0	1	5	0	0	0	0	unknown	43
Phylum Bryozoa											
<i>Victorella pavida</i> (C)	1	1	1	1	0	0	0	0	0	abundant	39, 41, 42, 44
Phylum Mollusca											
<i>Bithynia tentaculata</i>	1	1	0	1	0	0	0	0	0	common	45
<i>Corbicula fluminea</i>	4	2	2	2	0	4	0	0	0	abundant	20, 26, 46, 47, 48, 49
<i>Ischadium recurvum</i> (C)	1	1	0	0	0	0	0	0	0	abundant	50, 51, 52
<i>Rangia cuneata</i>	1	0	1	1	0	0	0	0	0	abundant	53, 54, 55
Phylum Crustacea											
<i>Loxothylacus panopaei</i>	1	0	0	0	0	0	0	1	0	abundant	56, 57, 58
<i>Orconectes virilis</i>	1	1	0	0	0	0	0	0	0	abundant	59, 60, 61
Phylum Hexapoda, Class Insecta											
<i>Galerucella californiensis</i>	1	0	0	0	0	1	0	0	0	rare	25
<i>Galerucella pusilla</i>	1	0	0	0	0	1	0	0	0	rare	25
<i>Hylobius transversovittatus</i>	1	0	0	0	0	1	0	0	0	rare	25
Phylum Chordata, Class Ascidiacea											
<i>Botryllus schlosseri</i>	1	1	0	1	0	0	0	0	0	common	62
Phylum Chordata, Class Osteichthyes											
<i>Cyprinus carpio</i>	1	0	0	0	0	1	0	0	1	abundant	30, 63, 64, 65
<i>Dorosoma petenense</i>	1	0	0	1	0	0	0	0	0	common	65
<i>Ictalurus punctatus</i>	1	1	0	0	1	0	0	0	0	common	65, 66, 67
<i>Lepomis macrochirus</i>	1	1	0	0	1	0	0	0	0	abundant	65, 67, 68, 69
<i>Micropterus dolomieu</i>	1	1	0	0	1	0	0	0	0	rare	65, 70, 71, 72
<i>Micropterus salmoides</i>	1	1	0	0	1	0	0	0	0	common	15, 63, 65, 73
<i>Morone saxatilis</i> × <i>chrysops</i>	1	0	0	0	0	0	1†	0	0	rare	74

Some key response actions



Examples of introductions



I

(EÜ asutamislepingu / Euratomi asutamislepingu kohaselt vastu võetud aktid, mille avaldamine on kohustuslik)

MÄÄRUSED

NÕUKOGU MÄÄRUS (EÜ) nr 708/2007,

11. juuni 2007,

võõrliikide ja piirkonnast puudevate liikide kasutamise kohta vesiviljeluses

DIREKTIIVID

EUROOPA PARLAMENDI JA NÕUKOGU DIREKTIIV 2008/56/EÜ,

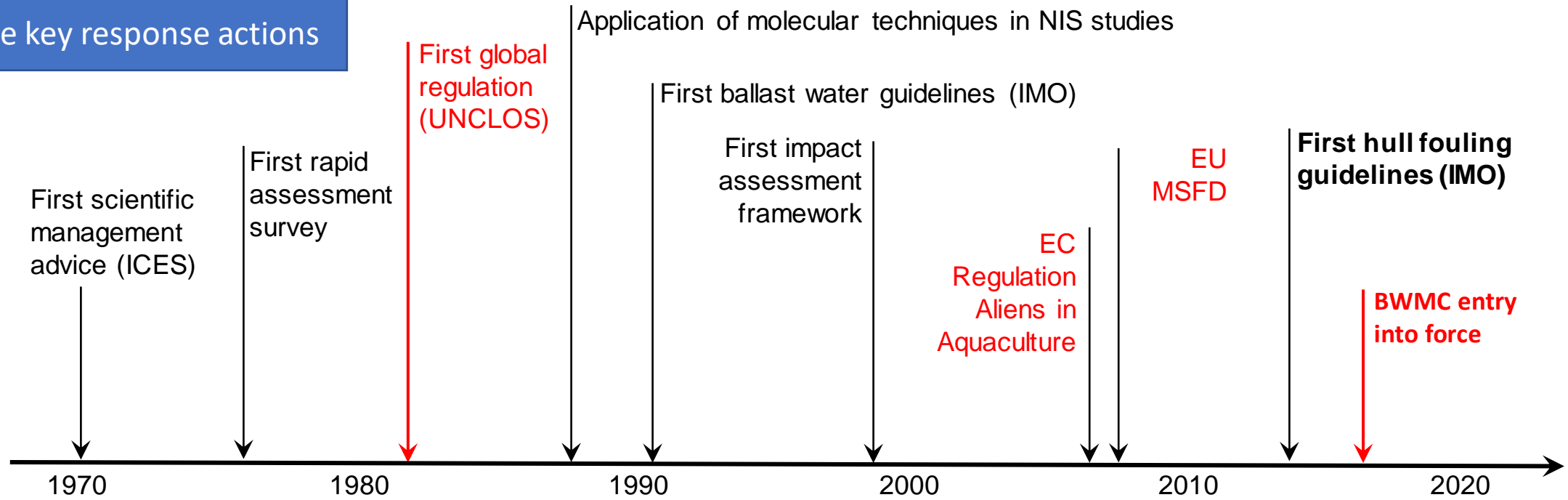
17. juuni 2008,

millega kehtestatakse ühenduse merekeskkonnapoliitika-alane tegevusraamistik (merestrategia raamdirektiiv)

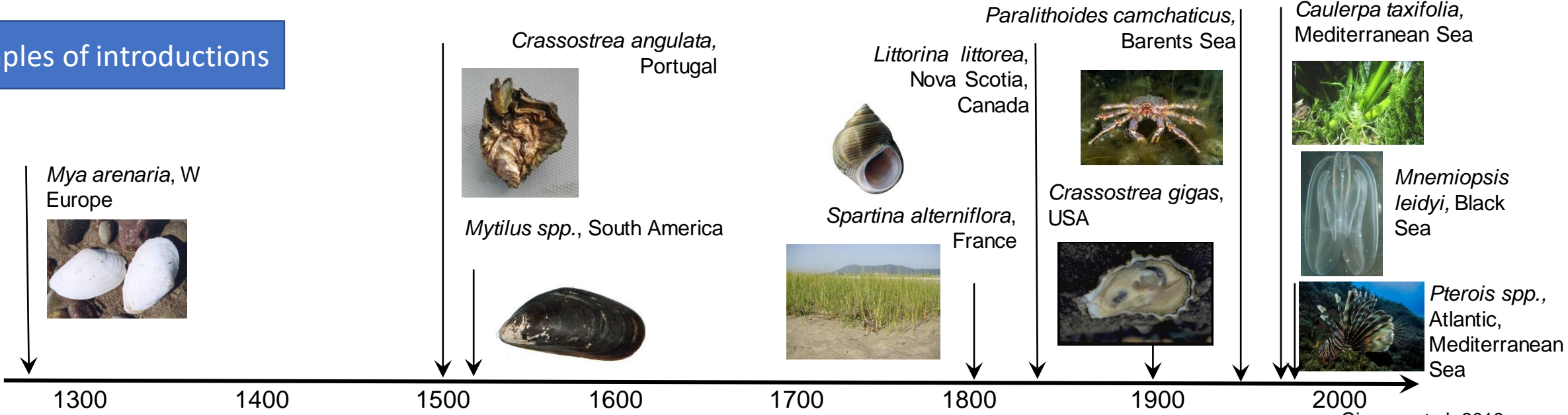
(EMPs kohaldatav tekst)

2. Inimtegevuse tulemusel sisse toodud võõrliigid jäävad tasemele, millel ei ole negatiivset mõju ökosüsteemile.

Some key response actions



Examples of introductions



Väljaandja: Riigikogu
Akti liik: välisleping
Teksti liik: algtekst
Jõustumise kp: 17.07.2018
Avaldamismärge: RT II, 22.02.2018, 2

Laevade ballastvee ja selle setete kontrolli ning käitlemise 2004. aasta rahvusvaheline konventsioon

Vastu võetud 13.02.2004

Laevade ballastvee ja selle setete kontrolli ning käitlemise 2004. aasta rahvusvahelise konventsiooniga
ühinemise seadus

Välisministeeriumi teadaanne välislepingu jõustumise kohta

INTERNATIONAL MARITIME ORGANIZATION



IMO

E

INTERNATIONAL CONFERENCE ON
BALLAST WATER MANAGEMENT FOR
SHIPS

Agenda item 8

BWM/CONF/36
16 February 2004
Original: ENGLISH

**ADOPTION OF THE FINAL ACT AND ANY INSTRUMENTS, RECOMMENDATIONS
AND RESOLUTIONS RESULTING FROM THE WORK OF THE CONFERENCE**

**INTERNATIONAL CONVENTION FOR THE CONTROL AND MANAGEMENT OF
SHIPS' BALLAST WATER AND SEDIMENTS, 2004**

Väljaandja:
Akti liik:
Teksti liik:
Jõustumise kp:
Avaldamismärge:

Riigikogu
välisleping
algtekst
25.10.1994
RT II 1994, 13, 41

Bioloogilise mitmekesisuse konventsioon

Vastu võetud 05.06.1992

Artikkel 8. *In-situ* kaitsmine

(h) **takistada** ökosüsteeme, kasvukohti ja elupaiku või liike ohustavate **võõrliikide** **introdutseerimist, takistada nende levimist või hävitada neid**

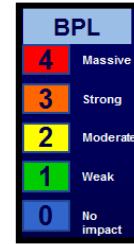
Võõrliikide mõjude hindamismetoodikad

Võõrliikide mõju indeks

Table 1. Ecological impacts reported among all taxa in Chesapeake Bay. For each species considered to have a significant impact in the bay, the evidence of impacts (information type) is indicated numerically for each impact type: A—competition; B—habitat change; C—food-prey; D—predation; E—herbivory; F—hybridization; G—parasitism; H—bioturbation. Impact summary indicates of the highest numerical score for information type across all impact types by species. Reported abundance is shown by category (rare, common, abundant). Species marked “C” are considered cryptogenic (i.e., possibly introduced) in the bay. Information types: 0—no information; 1—qualitative observations; 2—presence-absence comparison; 3—quantitative correlation; 4—inference from mechanistic, autecological study; 5—controlled experiments; 6—BACI, before-after control vs. invaded comparisons.

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Phylum Apicomplexa											
<i>Perkinsus marinus</i> (C)	4	2	1	0	0	0	0	4	0	abundant	6, 7, 8, 9, 10, 11
Phylum Angiospermophyta											
<i>Alternanthera philoxeroides</i>	1	1	0	0	0	0	0	0	0	rare	12, 13
<i>Hydrilla verticillata</i>	5	1	5	2	0	0	0	0	0	abundant	14, 15, 16, 17, 18, 19, 20, 21, 22
<i>Iris pseudacorus</i>	3	3	1	1	0	0	0	0	0	common	23
<i>Lythrum salicaria</i>	1	1	0	1	0	0	0	0	0	common	24, 25
<i>Murdannia keisak</i>	1	1	0	1	0	0	0	0	0	abundant	13, 26
<i>Myriophyllum spicatum</i>	3	1	1	3	0	0	0	0	0	abundant	16, 19, 20, 22, 27, 28, 29, 30
<i>Phragmites australis</i> (C)	3	3	1	1	0	0	0	0	0	abundant	31, 32, 33, 34
<i>Trapa natans</i>	1	1	1	1	0	0	0	0	0	rare (now)	16, 20, 30, 35
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<i>Hylobius transversovittatus</i>	1	0	0	0	0	1	0	0	0	rare	25
Phylum Chordata, Class Ascidiacea											
<i>Botryllus schlosseri</i>	1	1	0	1	0	0	0	0	0	common	62
Phylum Chordata, Class Osteichthyes											
<i>Cyprinus carpio</i>	1	0	0	0	0	1	0	0	1	abundant	30, 63, 64, 65
<i>Dorosoma petenense</i>	1	0	0	1	0	0	0	0	0	common	65
<i>Ictalurus punctatus</i>	1	1	0	0	1	0	0	0	0	common	65, 66, 67
<i>Lepomis macrochirus</i>	1	1	0	0	1	0	0	0	0	abundant	65, 67, 68, 69
<i>Micropterus dolomieu</i>	1	1	0	0	1	0	0	0	0	rare	65, 70, 71, 72
<i>Micropterus salmoides</i>	1	1	0	0	1	0	0	0	0	common	15, 63, 65, 73
<i>Morone saxatilis</i> × <i>chrysops</i>	1	0	0	0	0	0	1†	0	0	rare	74

Bioreostuse taseme indeks



Bioloogiline reostus on invasiivsete võõrliikide mõju sellisel tasemel, mis kahjustab ökoloogilist kvaliteeti, mõjutades: isendit, populatsiooni, elupaika või ökosüsteemi.

BPL indeks võtab arvesse võõrliigi arvukust ja leviku ulatust võrreldes loodusliku elustikuga ning koondab andmed mõjude ulatuse kohta kolme kategooriasse: 1) mõjud põliskooslustele, 2) elupaigad ja 3) ökosüsteemi toimimine.

Abundance and distribution range of alien species.

A	Species occurs in low numbers in one or several localities
B	Species occurs in low numbers in many localities, or in moderate numbers in one or several localities, or in high numbers in one locality
C	Species occurs in low numbers in all localities, or in moderate numbers in many localities, or in high numbers in several localities
D	Species occurs in moderate numbers in all localities, or in high numbers in many localities
E	Species occurs in high numbers in all localities

Impact on community - the changes caused in native species composition and abundance, including shifts in type-specific communities

C0	No displacement of native species, ranking of native species unchanged, type specific community present
C1	Local displacement of native species, dominant species remain the same, type-specific communities are present
C2	Large scale displacement of native species, changes in type-specific communities, shifts in community dominant species
C3	Population extinctions, alien species are dominant, loss of type-specific community
C4	Extinction of native keystone species, extinction of type-specific communities

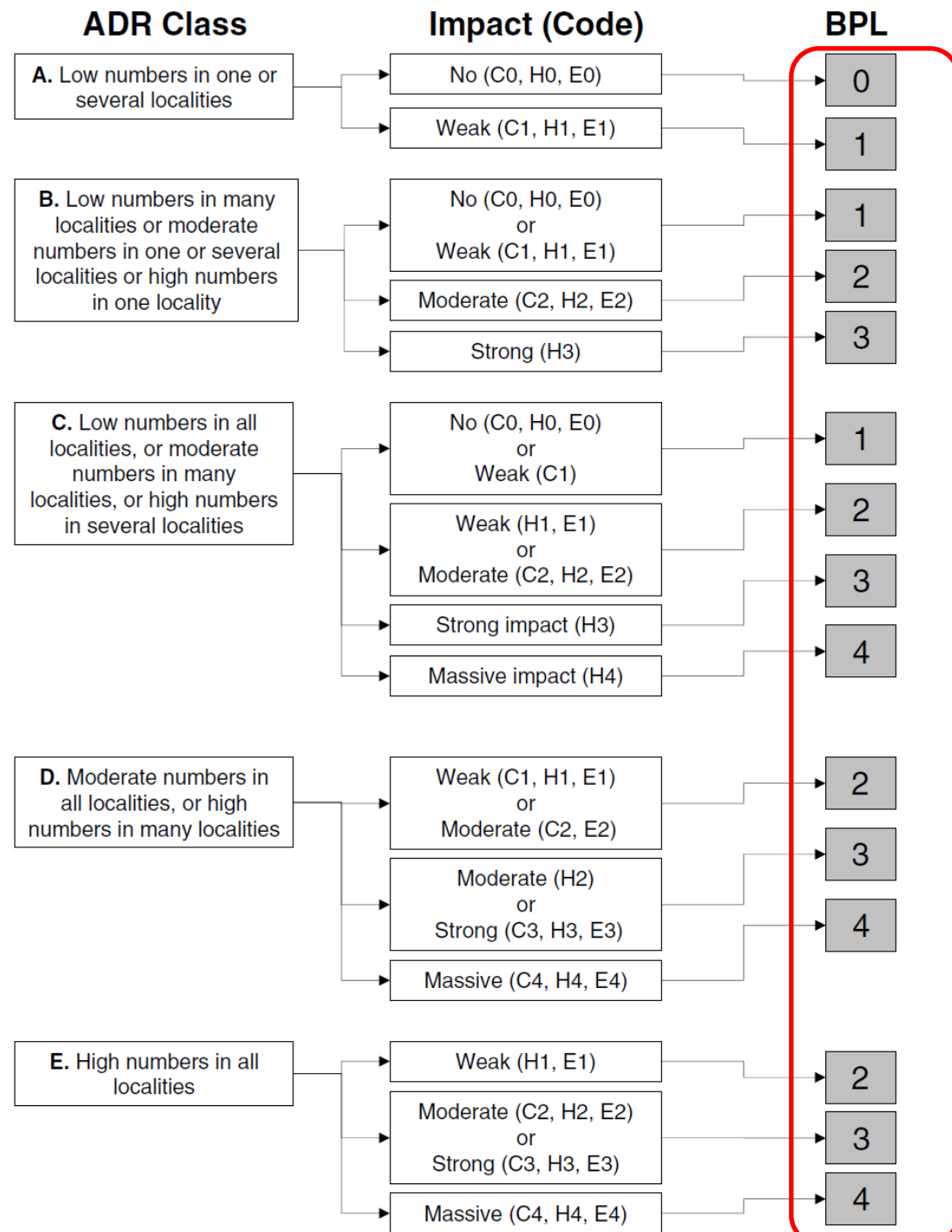
Impact on habitat - the character of habitat modification

H0	No habitat alteration
H1	Alteration of a habitat, but no reduction of spatial extent of a habitat
H2	Alteration and reduction of spatial extent of a habitat
H3	Alteration of a key habitat, severe reduction of spatial extent of habitat
H4	Loss of habitats in most or the entire assessment unit, loss of a key habitat

Impact on ecosystem - the impact on ecosystem processes and functioning

E0	No measurable impact
E1	Weak changes with no loss or addition of new ecosystem function
E2	Moderate modification of ecosystem performance, changes in functional group(s)
E3	Severe shifts in ecosystem functioning, reorganization of the food web
E4	Extreme, ecosystem-wide shift in the food web and/or loss of the role of a functional group(s)

Bioreostuse taseme indeks (BPL)



Võõrliikide kumulatiivse mõju indeks

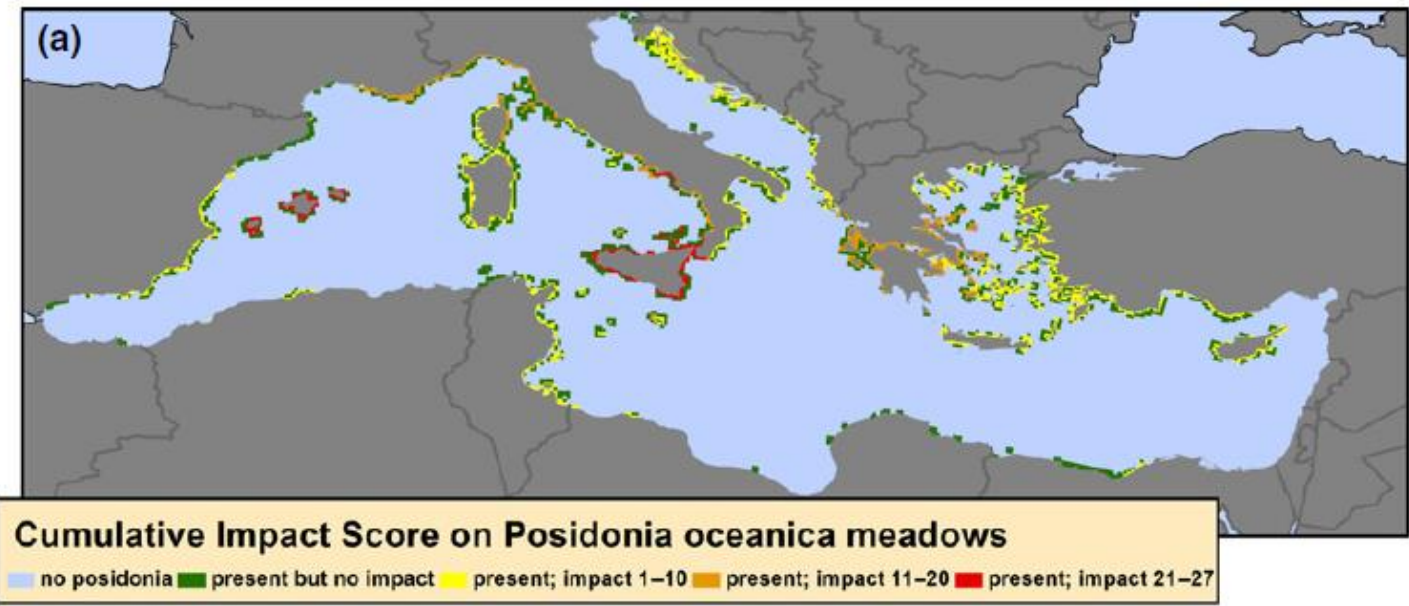
Cumulative impact index

The study area has to be divided into equal-area cells. For each such cell cumulative impact scores I_c are estimated as

$$I_c = \sum_{i=1}^n \sum_{j=1}^m A_i H_j w_{i,j}, \text{ where:}$$

w_{ij} : impact weights for species i and habitat j

		Impact				
		Minimal	Minor	Moderate	Major	Massive
Strength of evidence	Robust	0	1	2	4	8
	Medium	0	0	1	2	4
	Limited	0	0	0	1	2



Võõrliikide keskkonna- ja sotsiaalmajandusliku mõju klassifikatsioon

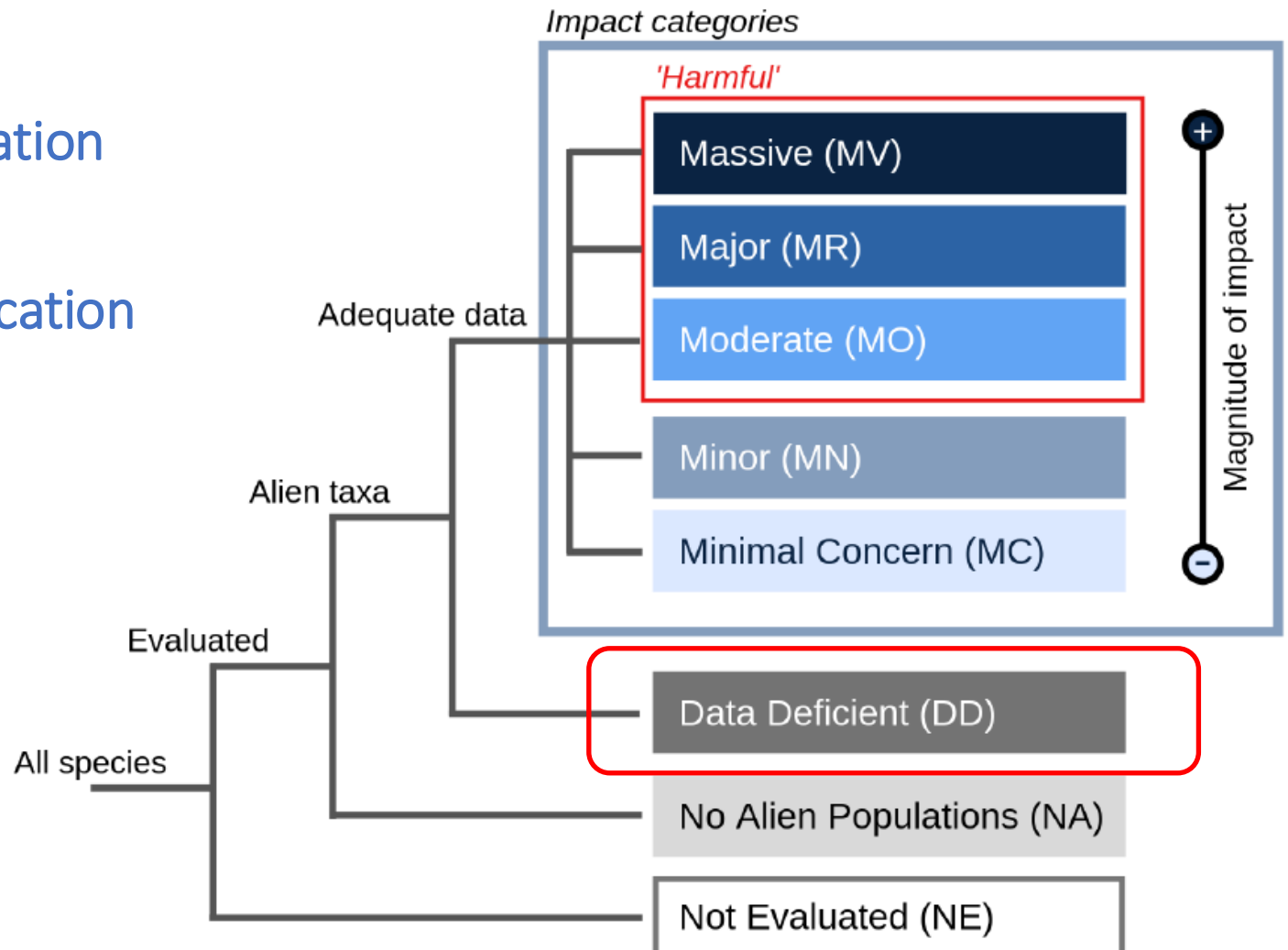
4

- Environmental Impact Classification for Alien Taxa (EICAT)
- Socio-economic Impact Classification for Alien Taxa (SEICAT)



Consultation Document

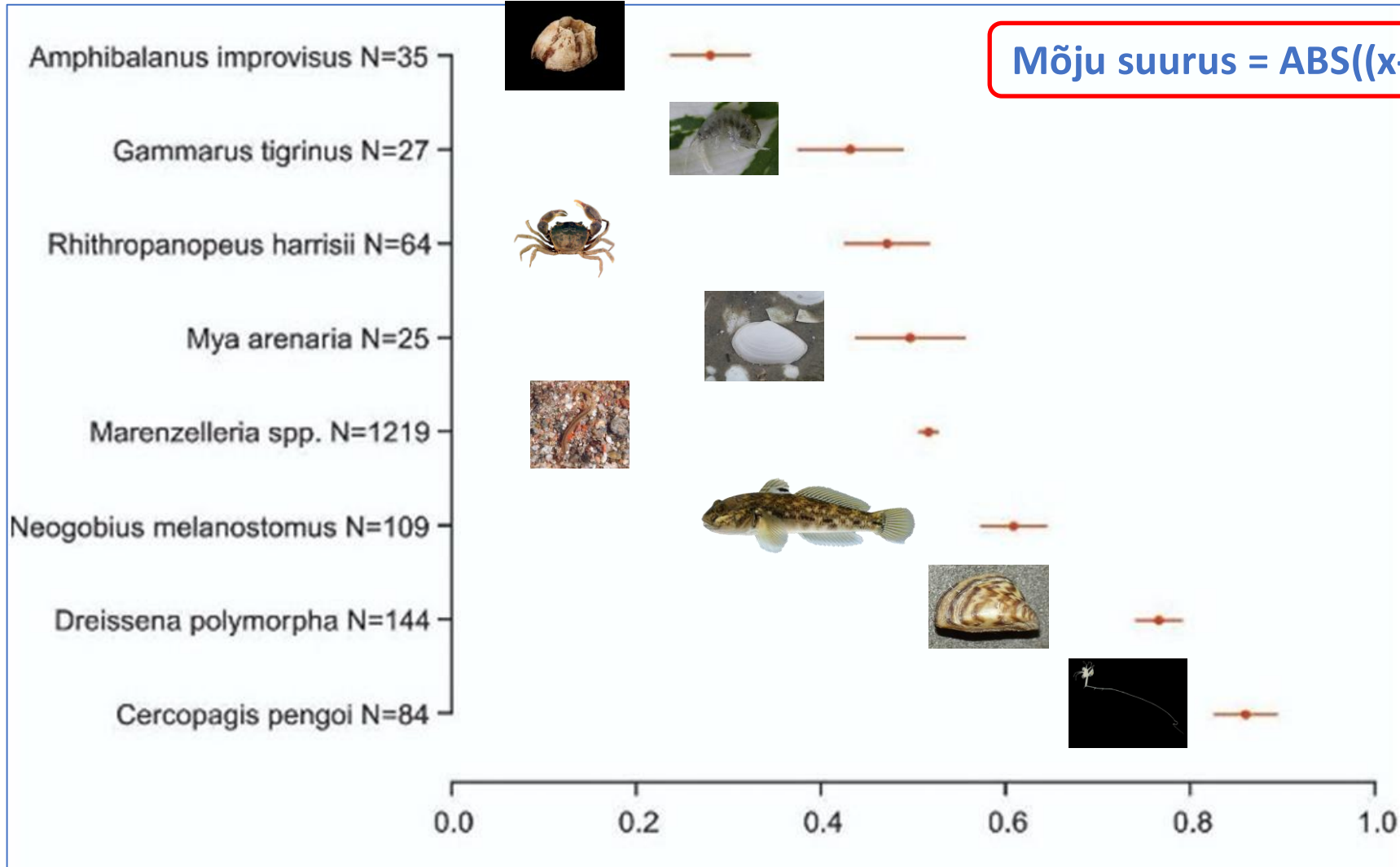
Proposed IUCN standard classification of the impact of invasive alien taxa. Version 2.3 - July 2019.



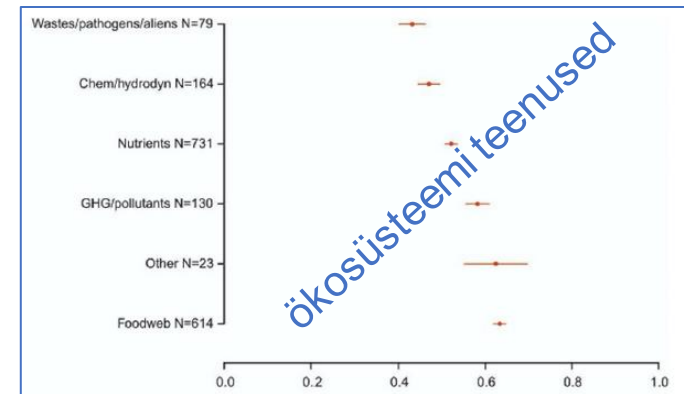
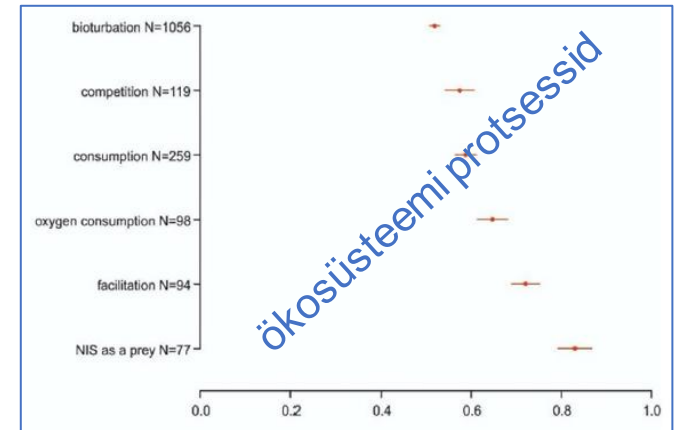
Impact

Minimal	No effect on fitness of native species; negligible impact on native species due to competition, predation, parasitism, toxicity, bio-fouling, or grazing/herbivory; negligible impact on ecosystem processes and ecosystem functioning; negligible impact on keystone species or species of high conservation value; no chemical, physical or structural impact on the ecosystem (not an ecosystem engineer).
Minor	Reduction in individual fitness due to competition, predation, parasitism, toxicity, bio-fouling, or herbivory, but no substantial population declines; minor impact on ecosystem processes and ecosystem functioning with no related population declines; negligible impact on keystone species or species of high conservation value; or causes changes in chemical, physical or structural habitat characteristics without decline of native populations.
Moderate	Declines in population densities because of competition, predation, parasitism, toxicity, bio-fouling, or herbivory, but no changes in community composition; or displacement of no more than one species of similar niche; or impact on ecosystem processes and ecosystem functioning resulting in population declines but no substantial change in species composition; or reduction in individual fitness of at least one keystone species or species of high conservation value, but no substantial population declines; or ecological engineering, resulting in population declines but no substantial change in community composition.
Major	Changes in community composition and local or population extinction of at least one native species, because of competition, predation, parasitism, toxicity, bio-fouling, or herbivory; impact on ecosystem processes and ecosystem functioning resulting in species composition changes; or population decline of at least one keystone species or species of high conservation value; or ecological engineering, resulting in change in community composition. Induced changes are reversible in the short term (<1 decade) with proper management measures or if the alien species population declines naturally.
Massive	The same as in 'major' but changes are irreversible in the short term (<1 decade) or currently there is no known effective management action for the control of the invasive alien species and a natural decline of its population seems highly unlikely.

Võõrliikide mõju suurus absoluutväärtusena



$$\text{Mõju suurus} = \text{ABS}((x-y)/\text{MAX}(\text{ABS}(x), \text{ABS}(y)))$$





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