

# Inter-assessor reliability of risk classifications for invasiveness of alien species

Rob Leuven

Frank Collas, Lisette de Hoop, Remon Koopman,  
Jon Matthews, Laura Verbrugge & Gerard van der Velde

19<sup>th</sup> International Conference on Aquatic Invasive Species  
April 14, 2016  
Winnipeg, Manitoba, Canada



Radboud University



# EU regulation on management of IAS (1143/2014)



- Legal obligations for Member States to manage IAS of EU concern
- Concerted actions to prevent of introduction, spread and establishment and to mitigate effects
- Prohibition of import, transport, trade, keeping etc.
- Early warning systems, rapid response (eradication), population control and containment
- Regional cooperation of member states
- First list of 37 IAS of EU concern will be soon published
- Risk assessments for species listing: scientific evidence!

# Comparison of risk classifications of alien species

	BE <sup>1</sup>	DE <sup>2</sup>	AT <sup>2</sup>	FISK/FI-ISK	UK <sup>5</sup>	IE <sup>6</sup>	CH <sup>7</sup>
<b>Plants</b>							
<i>Azolla filiculoides</i> Lamarck	Watch list	n.r.	n.r.	n.a.	High risk	High risk	n.r.
<i>Crassula helmsii</i> A. Berger	Black list	Grey list	Grey list	n.a.	High risk	High risk	n.r.
<i>Elodea canadensis</i> Michx.	Black list	Black list	Black list	n.a.	n.r.	Medium risk	Black list
<i>Elodea nuttallii</i> (Planch.) St. John	Black list	Black list	Black list	n.a.	n.r.	High risk	Black list
<i>Hydrocotyle ranunculoides</i> L. f.	Black list	Black list	Black list	n.a.	High risk	High risk	n.r.
<i>Lagarosiphon major</i> (Ridl.) Moss	Black list	n.r.	n.r.	n.a.	High risk	High risk	n.r.
<i>Ludwigia grandiflora</i> (M. Micheli)							
Greuter & Burdet	Black list	Black list <sup>8</sup>	n.r.	n.a.	High risk	High risk	Black list
<i>Myriophyllum aquaticum</i> (Vell.) Verdc.	Black list	n.r.	n.r.	n.a.	High risk	Medium risk	n.r.
<b>Crayfish</b>							
<i>Astacus astacus</i> (Linnaeus, 1758)	n.r. <sup>#</sup>	n.r. <sup>#</sup>	n.r. <sup>#</sup>	Low risk <sup>3</sup>	Low risk	High risk	n.a.
<i>Astacus leptodactylus</i> (Eschscholtz, 1823)	n.r.	n.r.	n.r.	Medium risk <sup>3</sup>	Low risk	High risk	n.a.
<i>Orconectes limosus</i> (Rafinesque, 1817)	n.r.	n.r.	n.r.	High risk <sup>3</sup>	Medium risk	High risk	n.a.
<i>Procambarus clarkii</i> (Girard, 1852)	n.r.	n.r.	n.r.	High risk <sup>3</sup>	High risk	High risk	n.a.
<b>Fish</b>							
<i>Ameiurus nebulosus</i> (Lesueur, 1819)	Watch list	Black list	Grey list	High risk <sup>4</sup>	n.r.	Medium risk	n.a.
<i>Carassius auratus</i> (Linnaeus, 1758)	n.r.	Grey list	Grey list	n.r.	n.r.	Medium risk	n.a.
<i>Ctenopharyngodon idella</i> (Valenciennes in Cuvier and Valenciennes, 1844)	n.r.	Black list	Black list	High risk <sup>4</sup>	n.r.	Medium risk	n.a.
<i>Gambusia holbrooki</i> Girard, 1859	n.r.	Grey list	Grey list	High risk <sup>4</sup>	n.r.	Medium risk	n.a.
<i>Hypophthalmichthys molitrix</i> (Valenciennes in Cuvier and Valenciennes, 1844)	n.r.	Grey list	Grey list	High risk <sup>4</sup>	n.r.	Medium risk	n.a.
<i>Lepomis gibbosus</i> (Linnaeus, 1758)	Watch list	Grey list	Grey list	High risk <sup>4</sup>	n.r.	n.r.	n.a.
<i>Micropterus salmoides</i> (Lacépède, 1802)	n.r.	White list	White list	Medium risk <sup>4*</sup>	n.r.	Medium risk	n.a.
<i>Neogobius melanostomus</i> (Pallas, 1814)	Alert list	Black list	Black list	High risk <sup>4</sup>	n.r.	Medium risk	n.a.
<i>Oncorhynchus kisutch</i> (Walbaum, 1792)	n.r.	White list	White list	n.r.	n.r.	Medium risk	n.a.
<i>Pseudorasbora parva</i> (Temminck and Schlegel, 1846)	Black list	Grey list	Grey list	High risk <sup>4</sup>	High risk	High risk	n.a.
<i>Perccottus glenii</i> Dybowski, 1877	Alert list	Black list	Black list	High risk <sup>4</sup>	n.r.	n.r.	n.a.
<i>Salvelinus fontinalis</i> (Mitchill, 1814)	n.r.	Grey list	Black list	Medium risk <sup>4*</sup>	n.r.	Medium risk	n.a.
<i>Umbra pygmaea</i> (DeKay, 1842)	Not invasive	White list	White list	High risk <sup>4</sup>	n.r.	n.r.	n.a.

For 72% of the alien species differential risk classifications!

Verbrugge et al. (2012) Aquatic Invasions 7/1: 49-58

Verbrugge et al. (2012) Aquatic Invasions 7/1: 49-58

# Dissimilarity of risk classifications

## Causes

- Use of different risk assessment schemes
- Differences in invasion stage and species-climate-habitat match: context dependency

## Spatial analyses

- Correlation of risk scores for a species derived with the same scheme increases with decreasing distance between assessment areas
- Invasiveness in neighbouring areas is best risk predictor!

Verbrugge et al. (2012) Aquatic Invasions 7/1: 49-58

# Problem statement: assessors matter!

## Observation

Large differences in interpretation of scientific information and risk perception of alien species by assessors

## Hypothesis

Dissimilar risk classifications are related to inter-assessor variability

## Aim of study

1. To quantify inter-assessor reliability in risk classifications of alien species using a similar assessment protocol and context
2. To identify major causes of the inter-assessor variability in risk classifications
3. To discuss approaches for minimization of inter-assessor variability

# Methods 1: Experimental set-up

## Three experiments for determining risk classifications

1. Alien fish (n=12 species; 8 fish experts)
  2. Alien plants, animals and virus (n=23 species; 4-12 experts per species)
  3. Alien plants and animals (n=9; 28 student groups vs professionals; 4-6 assessors per group)
- ✓ Independent risk classification, using a similar risk inventory (knowledge document) and assessment scheme
  - ✓ Moderation of working group discussions for consensus scores based on scientific evidence
  - ✓ Review of final report, written commenting and additional group discussion in case of disagreement

# Methods 2:

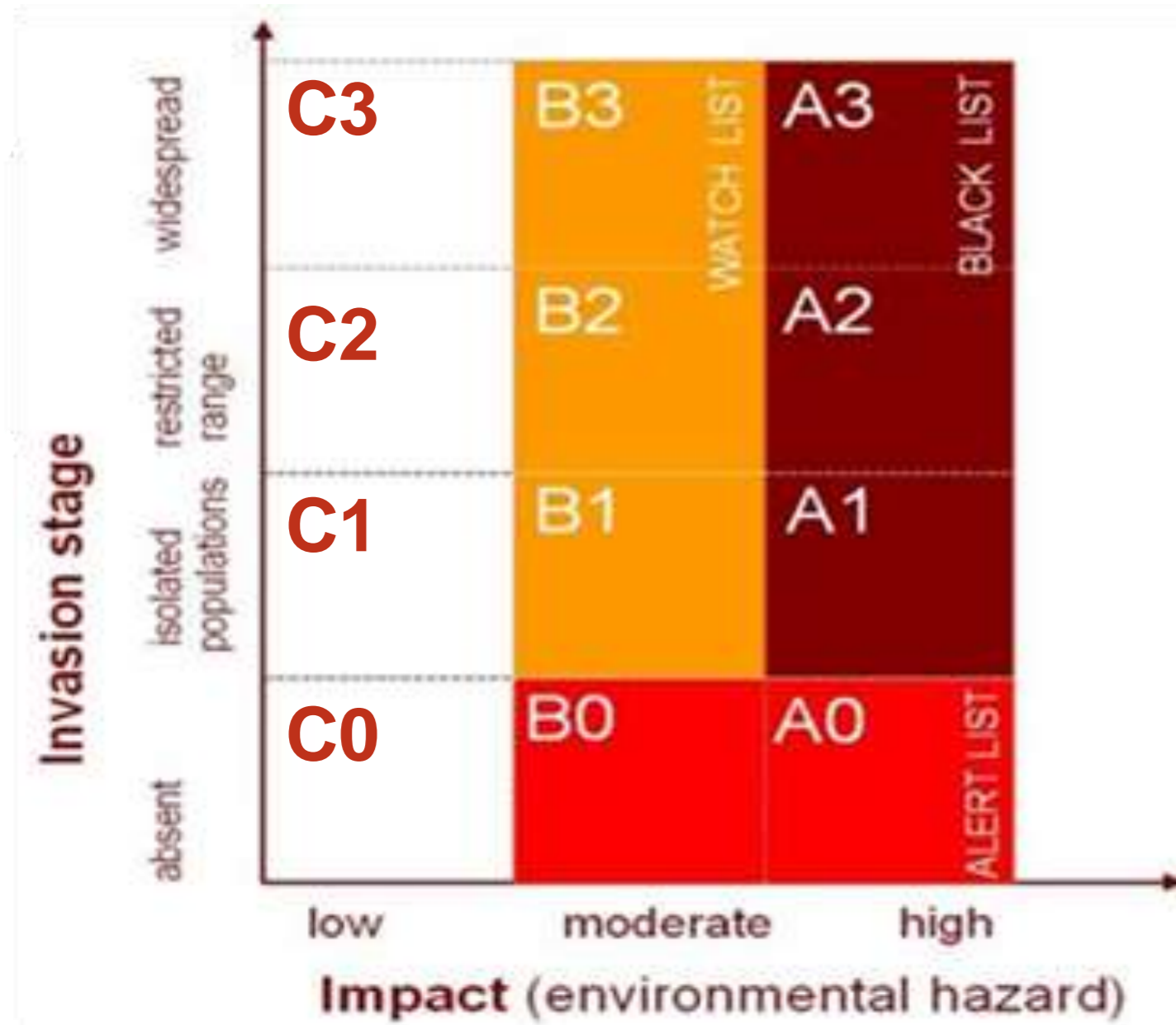
## Risk classification with the ISEIA scheme

### Four risk categories

1. Dispersion potential and invasiveness of species
2. Potential colonisation of high value conservation areas and risk for protected species
3. Negative effects on biodiversity
  - Predation / herbivory
  - Competition
  - Transmission of pathogens and diseases
  - Genetic effects
4. Alteration of ecosystem functioning
  - Physical modification of habitat
  - Modification of nutrient cycles
  - Changes of natural succession
  - Effects on food webs

# Methods 3:

## Risk classification with the ISEIA scheme



### Risk scores for assessment criteria

#### Scientific evidence

- 1 = low risk
- 2 = moderate risk
- 3 = high risk

#### Expert judgement

- 1 = effect unlikely
- 2 = effect likely

#### Data deficiency

No classification

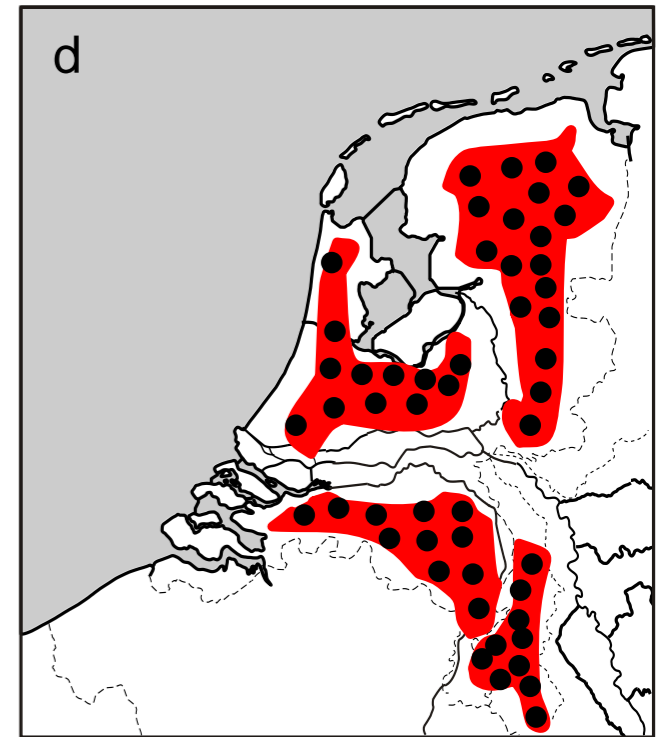
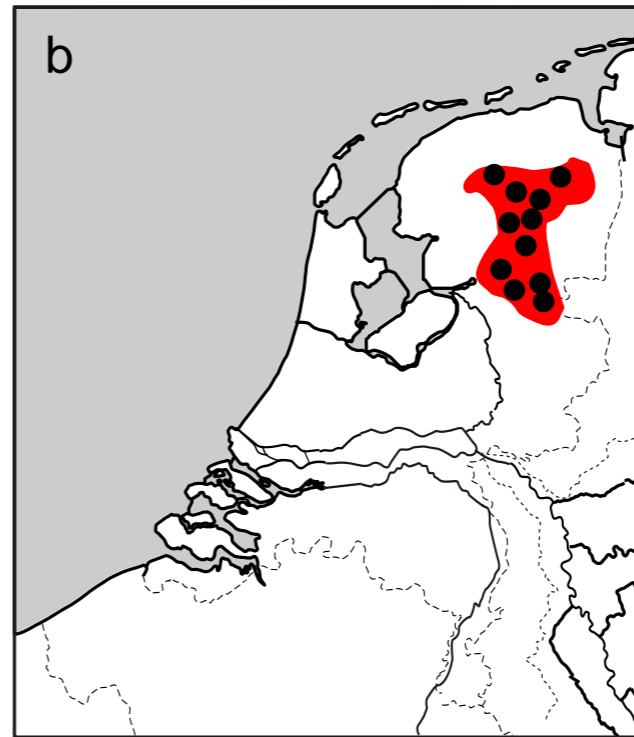
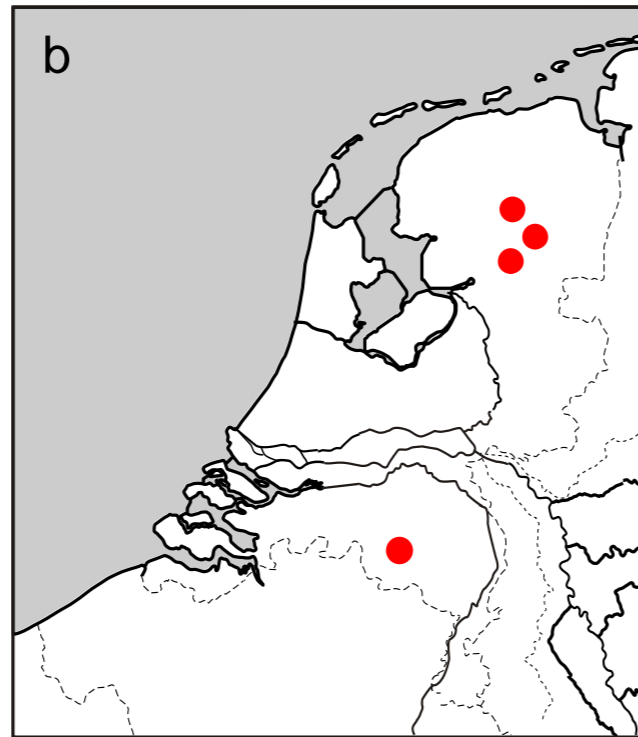
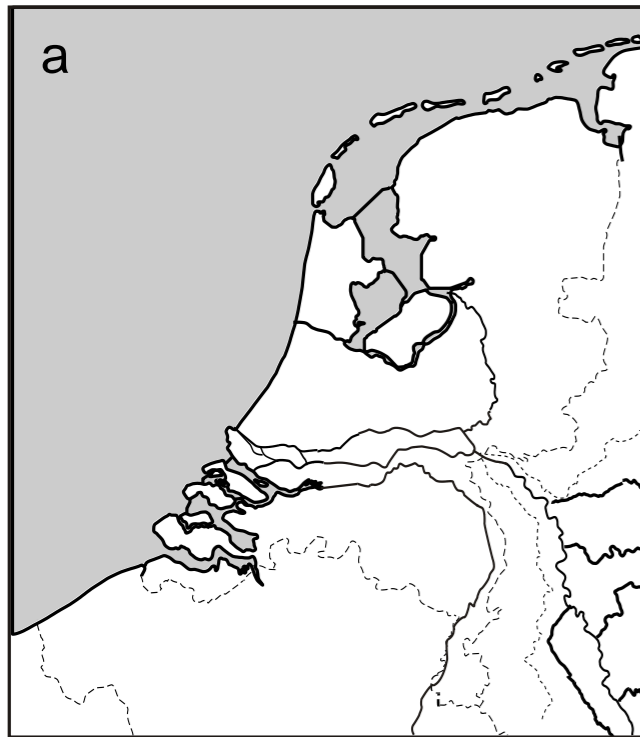
### Highest risk score of subcriteria per section

#### Total risk score for four risk sections

- Score 4 - 8 = C
- Score 9 - 10 = B
- Score 11-12 = A



# Methods 4: Spread classification with the ISEIA scheme



**0: Absent**

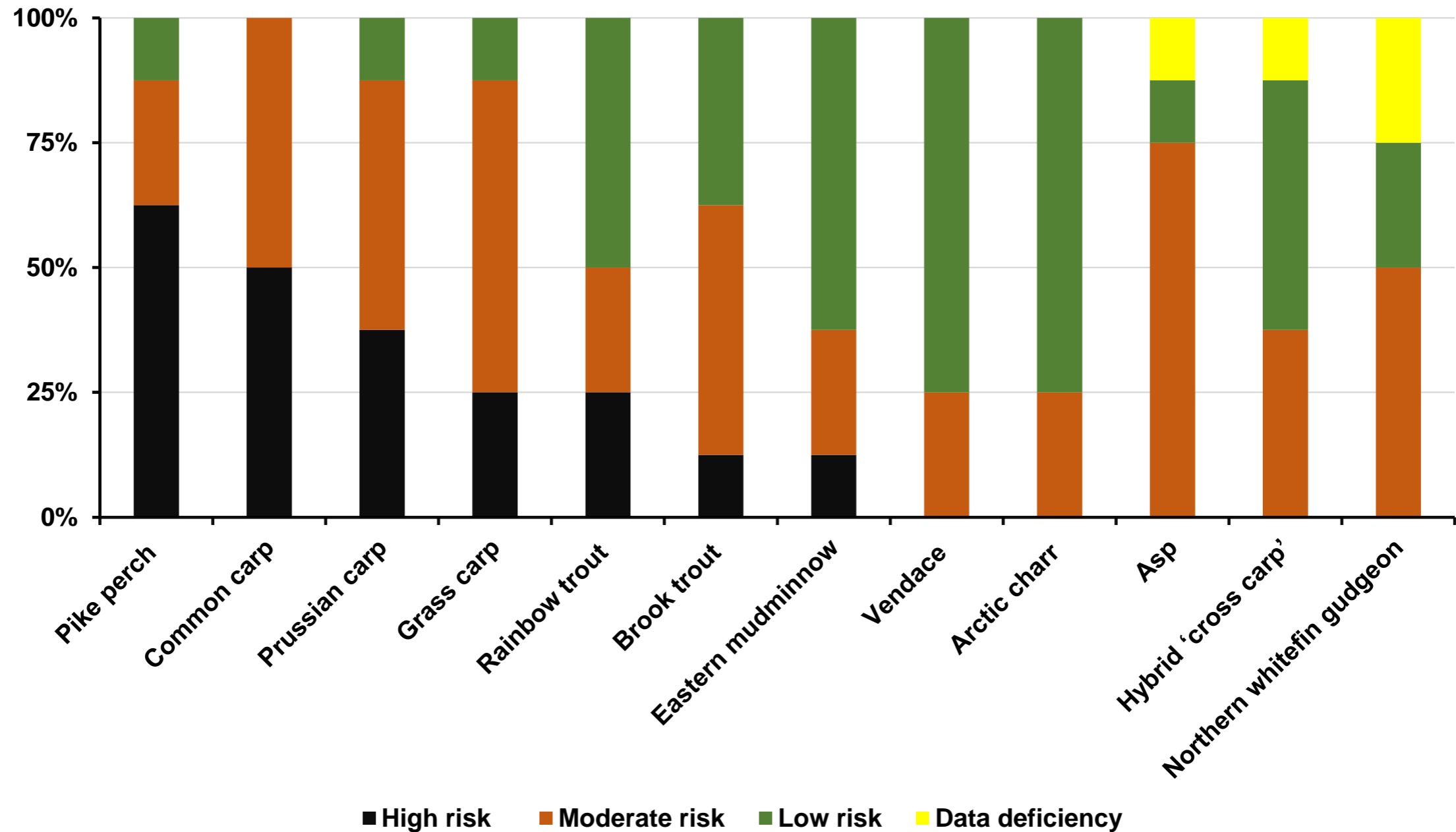
**1: Isolated populations**

**2: Restricted range**

**3: Wide spread**

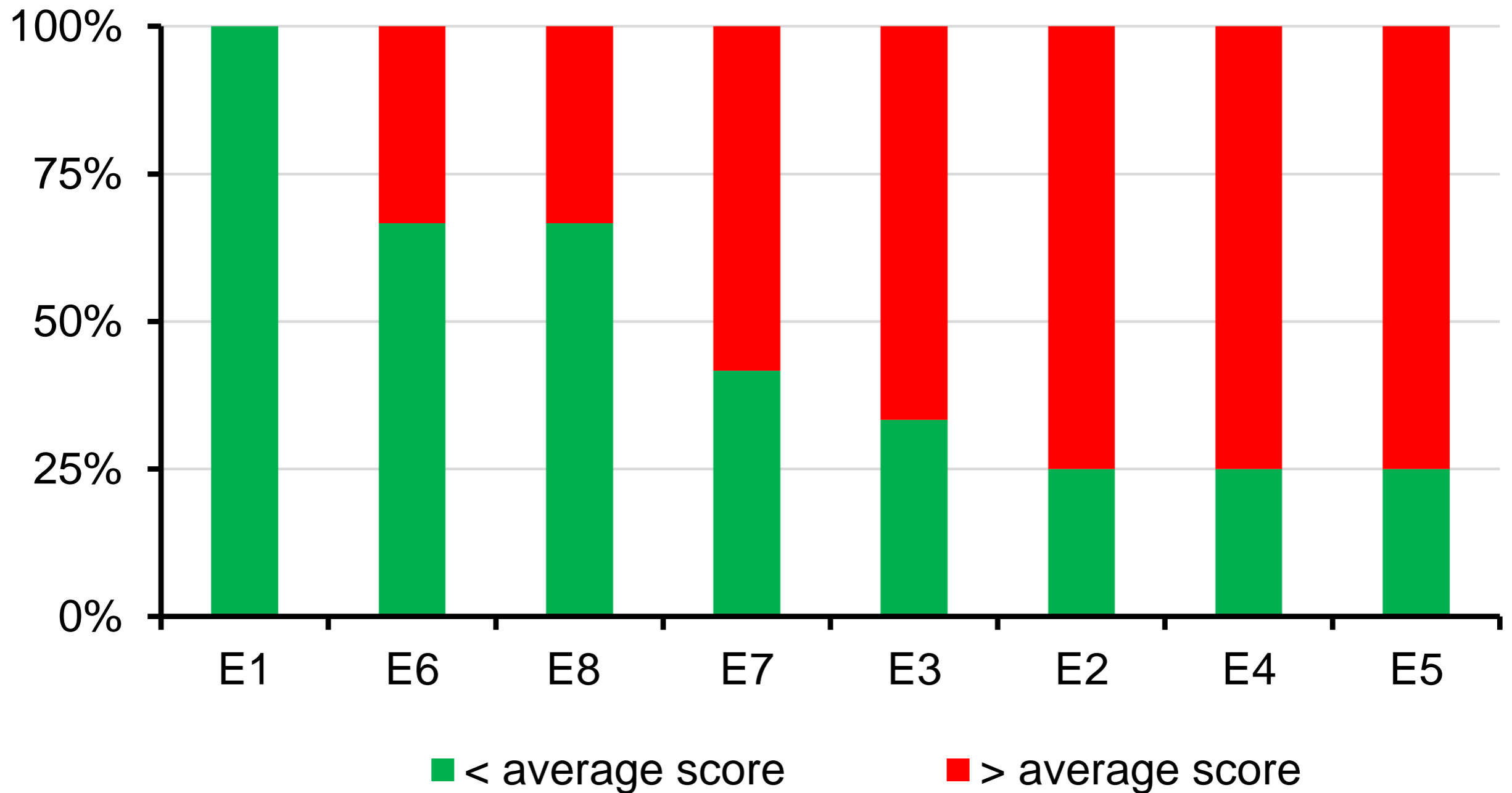
# Results 1:

## Dissimilar risk classifications of alien fish species (n=12) by 8 experts



# Results 2:

## Dissimilar risk classifications of alien fish species (n=12) by experts



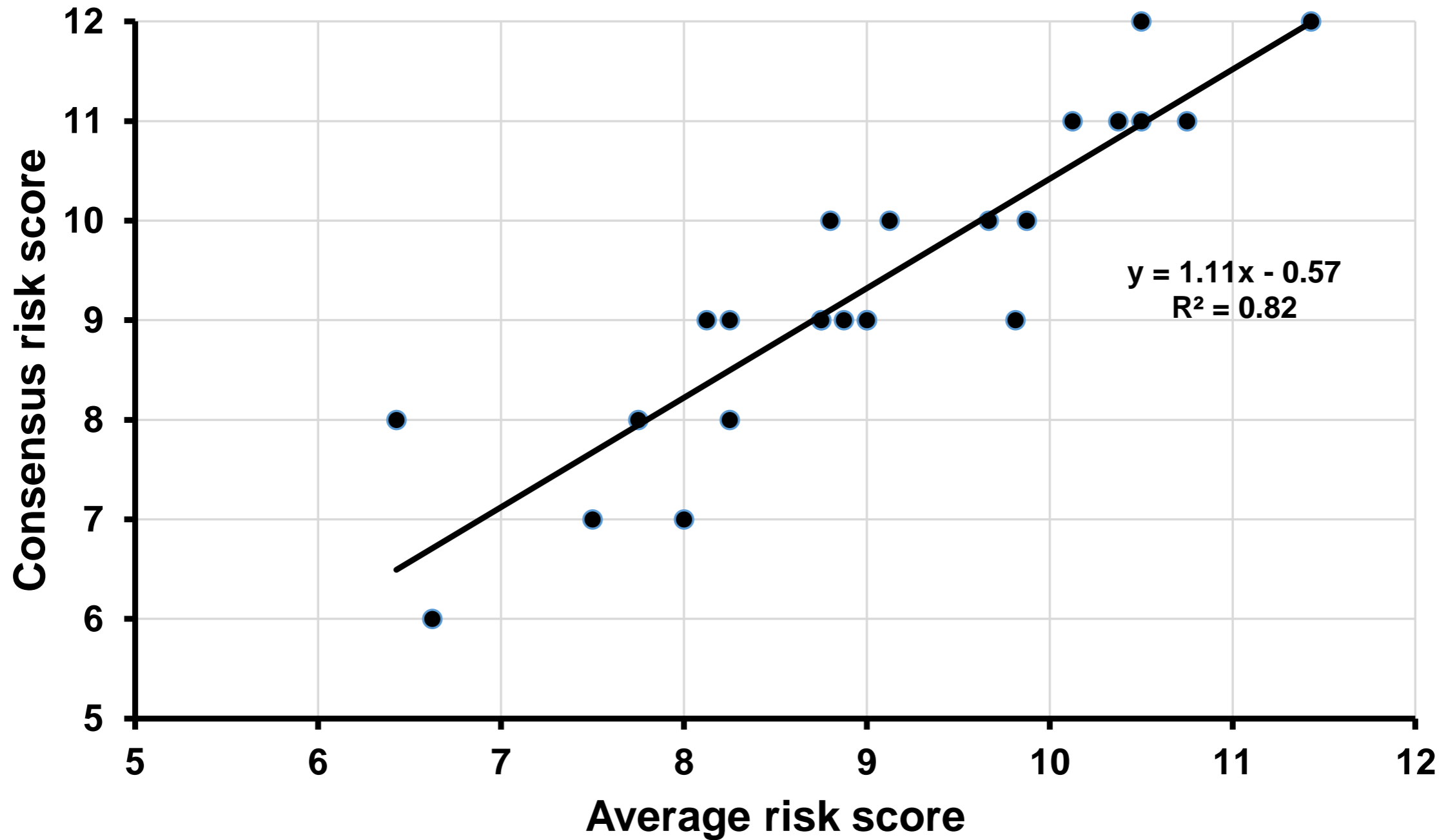
# Results 3:

## Causes for dissimilar risk classifications

- Unclear definitions and concepts
- Complexity of invasions process (lag time, time horizon)
- Data limitations (ecosystem specific information)
- Lack of quantitative assessment endpoints for ecological effects
- Cut off levels for 'negligible' and 'significant' effects (low, moderate and high risks)
- Overlapping effect categories
- Normative choices during knowledge interpretation and effect assessment

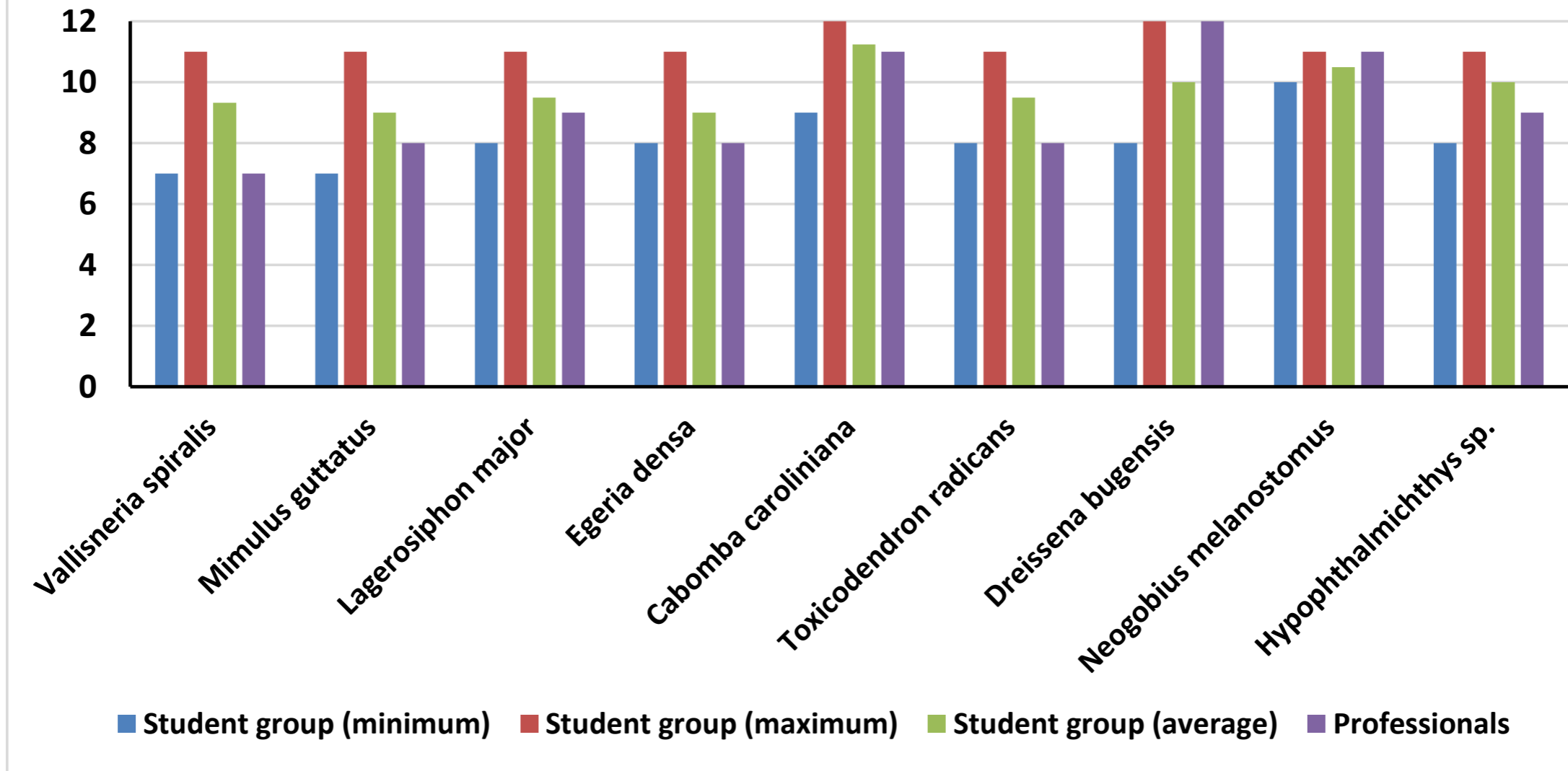
# Results 4:

## Risk classifications of alien species (n=23) by multidisciplinary teams



# Results 5: Level of experience

Risk score student groups and professional assessors



# Results 6: Effects of level of experience

Alien species	Students (consensus score)	Professionals (consensus score)
<i>Vallisneria spiralis</i>	<b>C1, B2, A1</b>	C1
<i>Mimulus guttatus</i>	<b>B2, B3, C3</b>	C3
<i>Lagerosiphon major</i>	<b>B1, B1, B1, C1</b>	B1
<i>Cabomba caroliniana</i>	<b>A1, A3, A3, A1</b>	A2
<i>Egeria densa</i>	<b>B3, B2, B1, C1</b>	C1
<i>Toxicodendron radicans</i>	<b>C1, C2, A1, B1</b>	C1
<i>Dreissena r. bugensis</i>	<b>A1, B3</b>	A3
<i>Hypophthalmichthys</i> sp.	<b>B0, B0</b>	B1
<i>Neogobius melanostomus</i>	<b>B3, A3</b>	A3

- List classification consistent with experts **2015-2016** 57.2 %
- Spread classification consistent with experts 53.6 %

# Discussion

## Opportunities to improve reliability of risk classifications

- High quality literature search for risk inventory (knowledge document)
- Quantitative effect criteria and clear cut-off levels for 'significant' effects
- More attention to species-habitat match (in addition to species-climate match)
- Multidisciplinary teams of independent experts
- Quality assurance of risk assessment process:
  - Content of knowledge document
  - Procedures for deriving scientific consensus
  - Required expertise and experience of assessors
  - Transparency of knowledge gaps and uncertainties
  - Peer review of all documents
  - Stakeholder consultation and transparent decision making





# Take home message

1. Large differences in risk classifications by individual risk assessors
2. Consensus scores are significantly correlated with average risk scores of individual assessors
3. Expertise of risk assessors matters
4. Many feasible options for improvement of reliability of risk classifications

# Next steps!

1. Detailed analyses of variability in risk scores for various impact criteria and frequently applied assessment risk schemes
2. Development of guiding documents for improving reliability of risk classifications
3. Quality assurance of risk assessments for listing IAS of EU concern (e.g., by Scientific Forum on Invasive Alien Species)

**Thanks for your attention!**

**Questions?**

**Our risk assessments were financially supported by  
Netherlands Food and Consumer Product Safety Authority**



For further information or cooperation  
[r.leuven@science.ru.nl](mailto:r.leuven@science.ru.nl)

Radboud University Nijmegen & Netherlands Centre of Expertise – Exotic Species

