

Non-indigenous freshwater fishes in Flanders: status, trends and risk assessment

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Non-native freshwater fish

- Status
- Trends
- Risk assessment

Status

- In literature: **47 alien species** were reported to have been considered or attempted for introduction in Belgium (Louette *et al.*, 2001)
- Since 1990 in public waters in Flanders: **18 non-native fish species** of which 9 naturalised and 7 acclimatised (+ 2 only in local conditions)
- Relatively high proportion of non-native species (> 35%) relative to the total number of freshwater fish species (Verreycken *et al.*, 2007)
- Origin:
 - Asia: 7 sp.
 - North America: 6 sp.
 - Eastern Europe: 3 sp.
 - Africa: 2 sp.
- Date/period of introduction:
 - < 1800: 3 sp.
 - 1851-1900: 5 sp.
 - 1901-1950: 1 sp.
 - > 1950: 9 sp.



Photographs: Rollin Verlinde

Latin name	Common name	Origin	Introduction	Pathway(s)	Status
<i>Acipenser baeri</i>	Siberian sturgeon	AS	2001	AQ, OR	A
<i>Ameiurus nebulosus</i>	Brown bullhead	NA	1871	AQ, OR	N
<i>Aspius aspius</i>	Asp	EE	1984	AN	N
<i>Carassius auratus</i>	Goldfish	AS	17th c.	OR	A
<i>Carassius gibelio</i>	Gibel carp	AS or EE	17th c.	UN	N
<i>Clarias gariepinus</i>	African catfish	AFR	1980s	AQ	A*
<i>Ctenopharyngodon idella</i>	Grass carp	AS	1967	BC	A
<i>Cyprinus carpio</i>	Common carp	EE	13th c.	AQ	N
<i>Hypophthalmichthys molitrix</i>	Silver carp	AS	1975	BC	A
<i>Hypophthalmichthys nobilis</i>	Bighead carpo	AS	1975	BC	A
<i>Ictalurus punctatus</i>	Channel catfish	NA	1884	AQ	A
<i>Lepomis gibbosus</i>	Pumpkinseed	NA	1885	OR	N
<i>Oncorhynchus mykiss</i>	Rainbow trout	NA	1884	AQ, AN	A
<i>Oreochromis niloticus</i>	Nile tilapia	AFR	1990	AQ	A*
<i>Pimephales promelas</i>	Fathead minnow	NA	1984	AN	N
<i>Pseudorasbora parva</i>	Topmouth gudgeon	AS	1992	UN, AN	N
<i>Sander lucioperca</i>	Pikeperch	EE	1890	AN	N
<i>Umbra pygmaea</i>	Eastern mudminnow	NA	1920	OR, AQ	N

Origin: AS = Asia, EE = Eastern Europe, AFR = Africa, NA = North America

Pathway: AQ = aquaculture, OR = ornamental, AN = angling/bait fish, BC = biological control, UN = unintentional

Status: A = Acclimatized, N = Naturalized; A* = acclimatized in restricted areas

Occurrence of non-indigenous fishes in Flemish river basins

	LS	US	BP	Dm	Dn	Di	GC	Le	Me	Ne	Ys	N
gibel carp	R	C	W	W	R	C	W	C	C	C	W	11
topmouth gudgeon	R	R	C	W	C	C	C	C	R	R	C	11
pikeperch	C	VR	R	VR	VR	R	R	R	R	C	C	11
common carp	R	R	W	C	R	C	W	R	R	C	W	11
pumpkinseed	C	VR	VR	W	R	R	VR	R	C	W		10
brown bullhead	VR			C		VR			R	C		5
rainbow trout		VR		R		R			R			4
goldfish		VR		VR					VR	VR		4
fathead minnow		VR		R						VR		3
eastern mudminnow				C					C	C		3
grass carp				VR							VR	2
asp									VR			1
silver carp								VR				1
bighead carp	VR											1
Siberian sturgeon	VR											1
channel catfish	VR											1
African catfish				VR								1
Nile tilapia				VR								1
Nb	9	8	5	13	5	7	5	6	10	9	5	

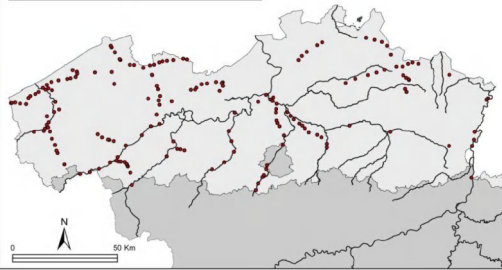
VR=very rare (<=2,0%), R= rare (2,1-10,0 %), C=common (10,1-25,0%), W=widespread (>25,0%)

Lower Scheldt (LS), Upper Scheldt (US), Bruges Polders (BP), Demer (Dm), Dender (Dn), Dijle (Di), Ghent Canals (GC), Leie (Le), Meuse (Me), Nete (Ne) and Yser (Ys)

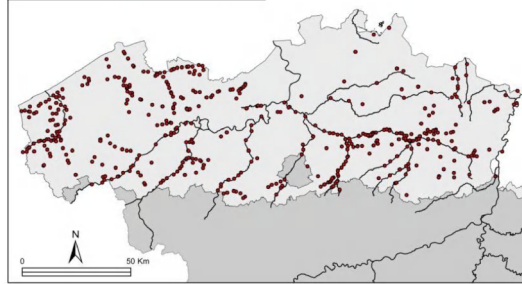
Total number of basins where a species is present (N); Total number of species in a basin (Nb).

Distribution maps

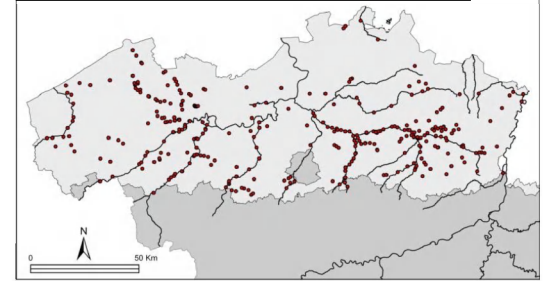
Pikeperch



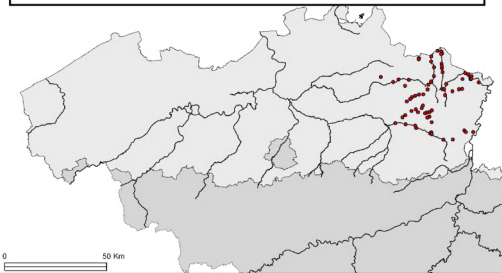
Gibel carp



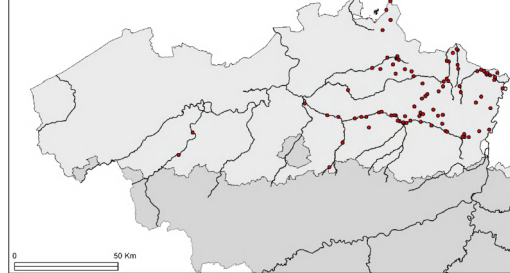
Topmouth gudgeon



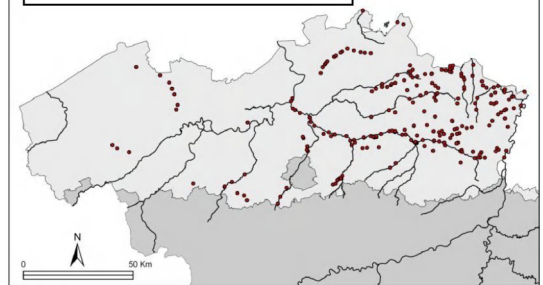
Eastern mudminnow



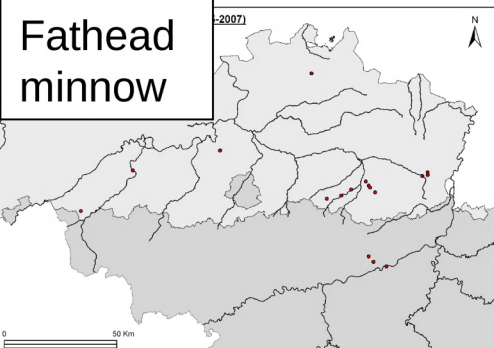
Brown bullhead



Pumpkinseed



Fathead minnow



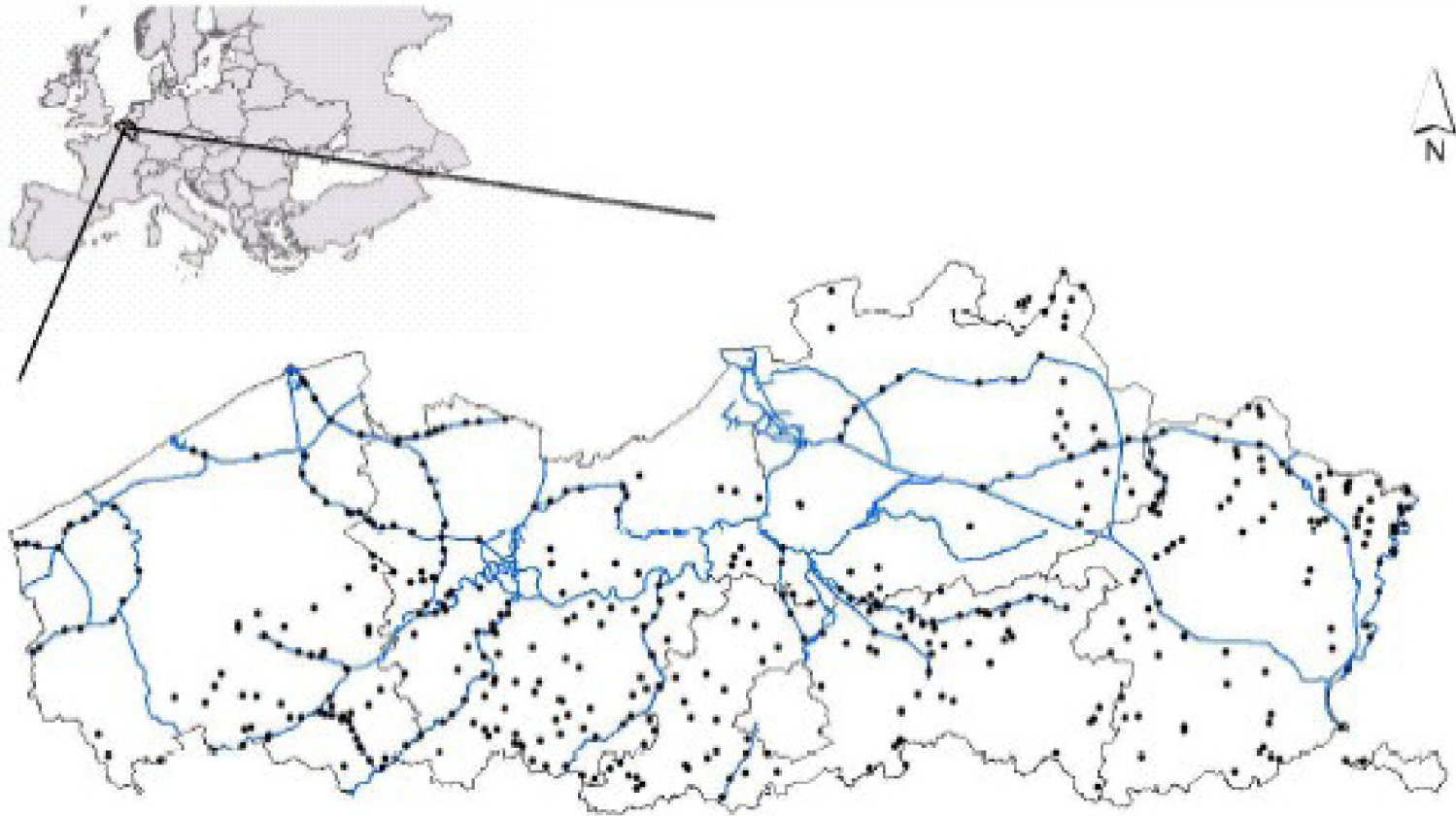
Non-native freshwater fish

- Status
- Trends
- Risk assessment

Trends

- 487 site specific fish surveys (INBO) (two 5 y. periods) (1996-2000 & 2001-2005): trends in 'frequency of occurrence' and in 'abundance'
- Electrofishing, fyke nets or combination
- Statistics
 - Logistic regression: changes in the frequency of occurrence
 - Linear mixed model: changes in abundance
 - Splus 6.2

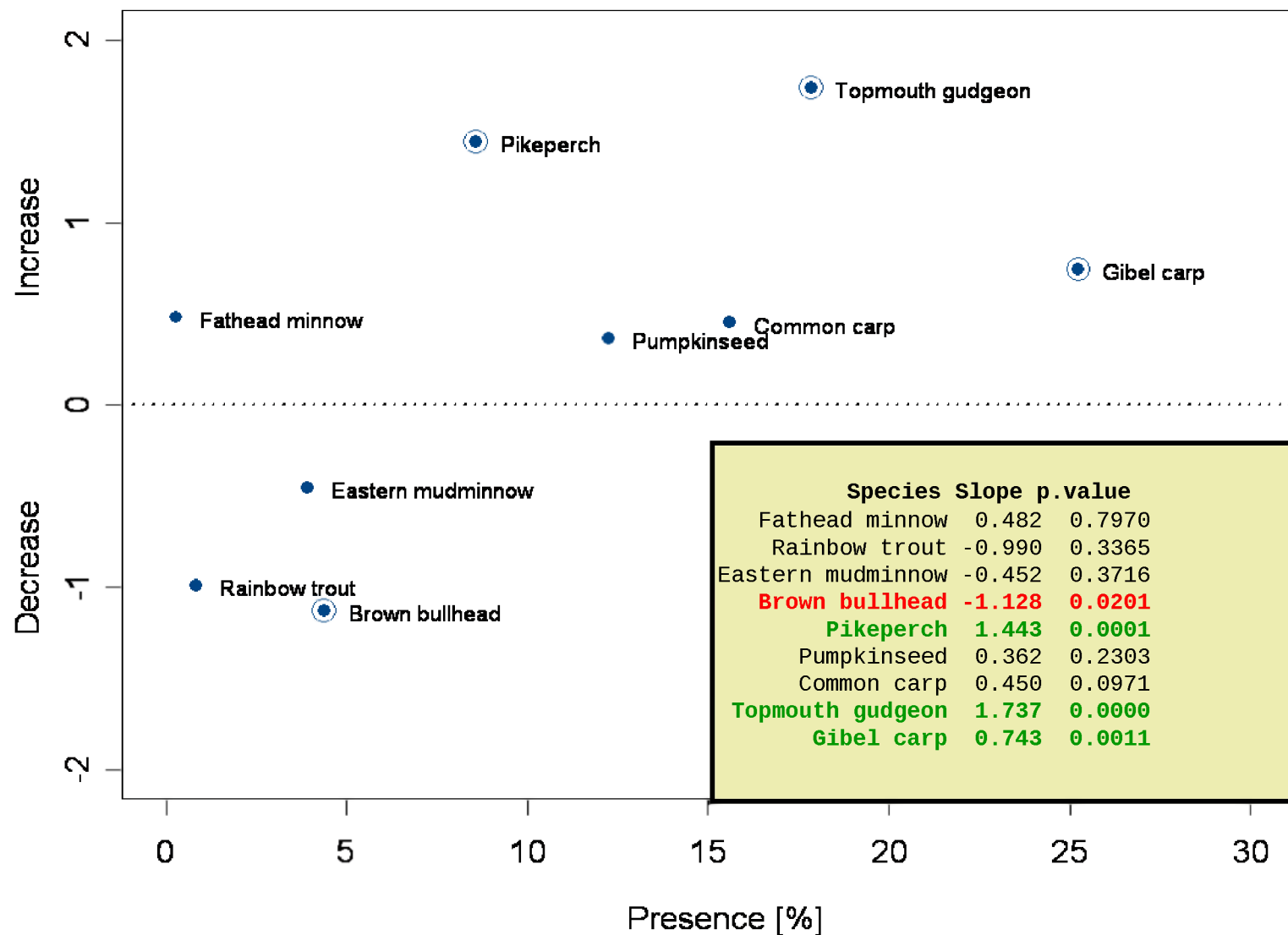
487 site specific surveys



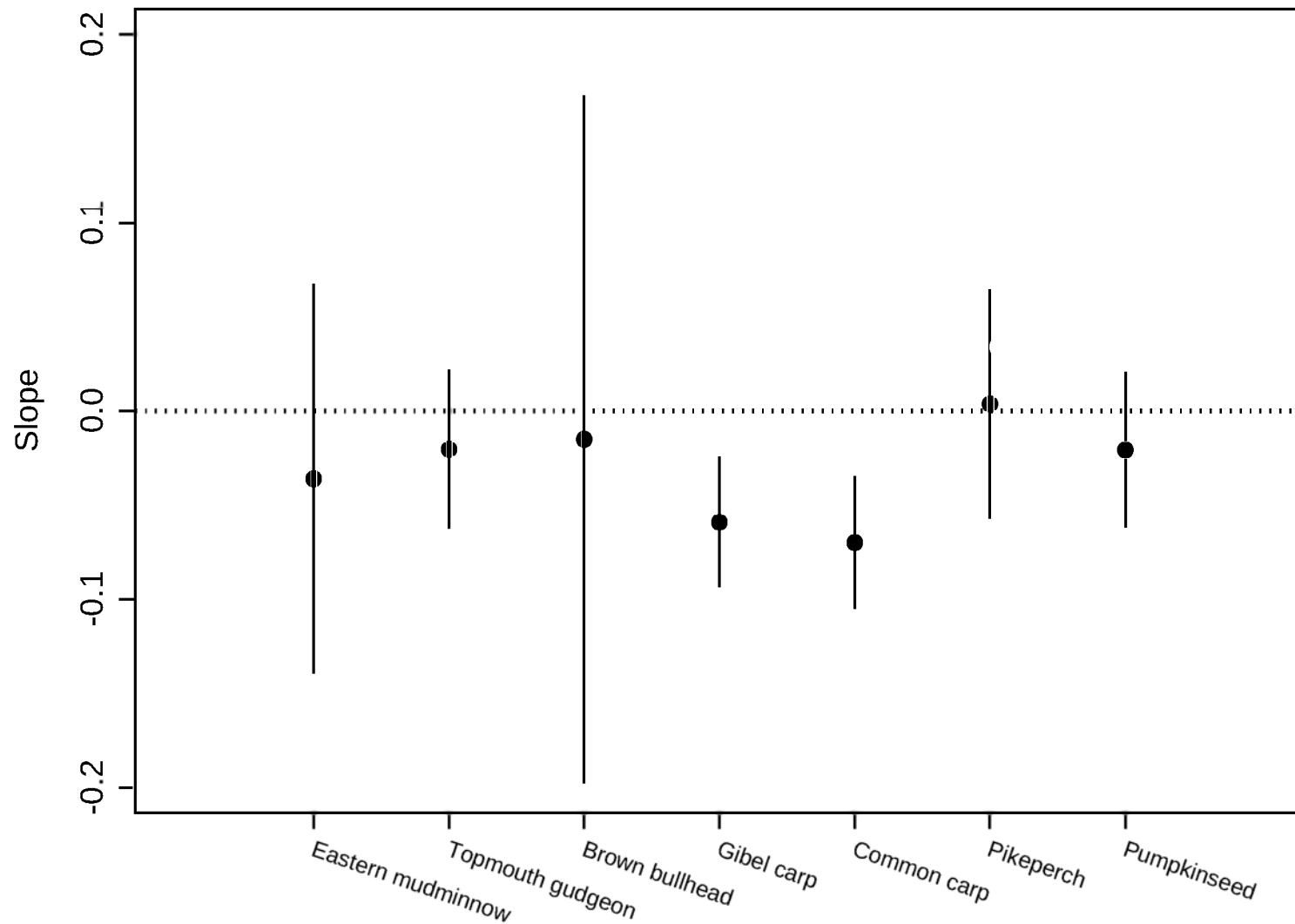
Frequency of occurrence during 487 site specific surveys

- gibel carp (25.2%)
- topmouth gudgeon (17.9%)
- common carp (15.6%)
- pumpkinseed (12.2%)
- pikeperch (8.6%)
- brown bullhead (4.4%)
- eastern mudminnow (3.9%)
- remaining species < 1% of the sites

Trends in frequency of occurrence



Trends in abundance



- Trends in frequency of occurrence
 - Increase: topmouth gudgeon *P. parva*, gibel carp *C. gibelio* and pikeperch *S. lucioperca*
 - Decrease: bullhead *A. nebulosus*
- Trends in abundance
 - Decrease: gibel carp and common carp *C. carpio*
- Trends can be explained for some fishes
 - Changed stocking policies
 - Improved water quality

Species to be expected

- white-finned gudgeon *Romanogobio belingi* => Netherlands, Germany
- vimba *Vimba vimba* => Netherlands
- round goby *Neogobius melanostomus* => Netherlands
- tubenose goby *Proterorhinus semilunaris* => Netherlands, Germany
- bighead goby *Neogobius kessleri* => Netherlands, Germany
- Amur sleeper *Perccottus glenii* => Danube



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Risk Analysis Tools

- Freshwater Fish Invasiveness Scoring Kit (FISK)
- Harmonia system with ISEIA protocol

Fish Invasiveness Scoring Kit

- Fish Invasiveness Scoring Kit (FISK by Copp *et al.*, 2005) is an adaptation of the Weed Risk Assessment by Pheloung *et al* (1999)
- A screening tool for freshwater fishes
- 49 questions in 8 categories
(Domestication, Climate and Distribution, Invasive elsewhere, Undesirable traits, Feeding guild, Reproduction, Dispersal mechanisms, Persistence attributes)
- Confidence (certainty/uncertainty) ranking of the assessors
- Classifies nonnative species into low-, medium-, and high-risk categories

ISEIA-protocol & Harmonia system

- Harmonia system

(<http://ias.biodiversity.be/ias/species/all>)

- categorizes invasive alien species in alert, watch or black list
- based on (1) Invasive Species Environmental Impact Assessment (ISEIA) protocol and (2) the distribution range in Belgium

Comparison FISK UK – FISK Flanders

Species	Common name	FISK UK	FISK FL
<i>Ameiurus melas</i>	Black bullhead	28.8	25
<i>Ameiurus nebulosus</i>	Brown bullhead	25	28
<i>Aspius aspius</i>	Asp	28.5	12
<i>Carassius gibelio</i>	Gibel carp	36.5	34
<i>Ctenopharyngodon idella</i>	Grass carp	24	16
<i>Cyprinus carpio</i>	Common carp	NA	30
<i>Hypophthalmichthys molitrix</i>	Silver carp	22.8	10
<i>Hypophthalmichthys nobilis</i>	Bighead carp	24.3	11.5
<i>Lepomis gibbosus</i>	Pumpkinseed	27.5	25
<i>Neogobius fluviatilis</i>	Monkey goby	19	10
<i>Neogobius gymnotrachelus</i>	Racer goby	27.5	11
<i>Neogobius kessleri</i>	Bighead goby	22.5	10
<i>Neogobius melanostomus</i>	Round goby	29.5	22
<i>Oncorhynchus mykiss</i>	Rainbow trout	NA	9
<i>Perccottus glenii</i>	Amur sleeper	28	27
<i>Pimephales promelas</i>	Fathead minnow	19	22
<i>Proterorhinus semilunaris</i>	Tubenose goby	18.5	13
<i>Pseudorasbora parva</i>	Topmouth gudgeon	35	26
<i>Sander lucioperca</i>	Pikeperch	23	20
<i>Umbra pygmaea</i>	Eastern mudminnow	24	9
<i>Vimba vimba</i>	Vimba	20.5	5

High risk ≥ 19
Invasive

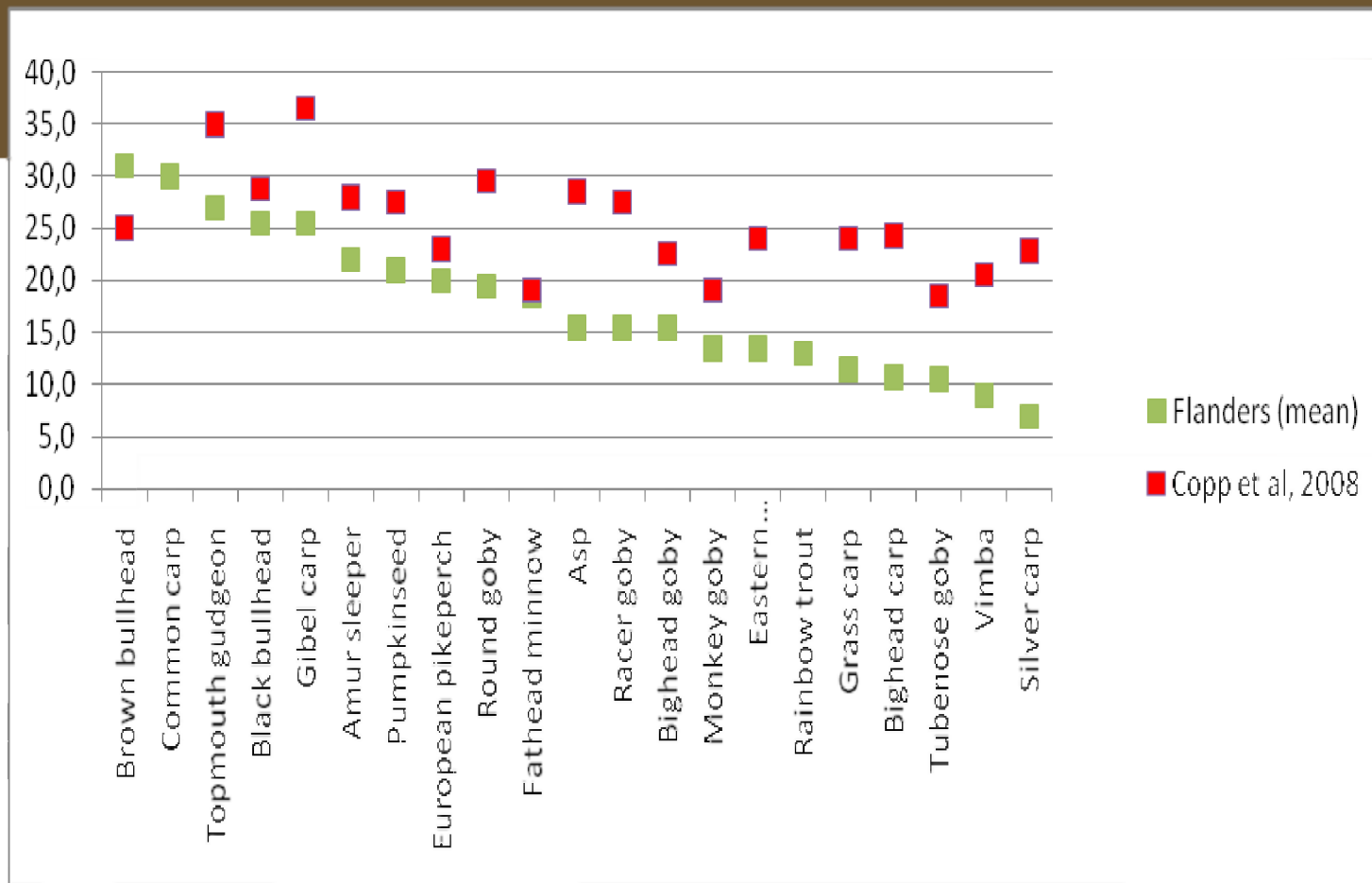
High risk > 6
Non-invasive

1 $\leq$ Medium risk
 ≤ 6

Low risk < 1

NA Not assessed

FISK scores range
from -11 to 54



- FISK UK scores are consistently higher
- Trend similar
- Large differences between assessors (within UK & in Flanders), only two assessors per region

Comparison FISK - ISEIA

Species	Common name	FISK UK	FISK FL	ISEIA	LIST
<i>Carassius gibelio</i>	Gibel carp	36,5	34	12	A3
<i>Neogobius melanostomus</i>	Round goby	29,5	22	12	A0
<i>Pseudorasbora parva</i>	Topmouth gudgeon	35	26	11	A2
<i>Perccottus glenii</i>	Amur sleeper	28	27	11	A0
<i>Ameiurus nebulosus</i>	Brown bullhead	25	28	10	B2
<i>Sander lucioperca</i>	Pikeperch	23	20	9	B3
<i>Lepomis gibbosus</i>	Pumpkinseed	27,5	25	9	B2
<i>Pimephales promelas</i>	Fathead minnow	19	22	9	B1
<i>Umbra pygmaea</i>	Eastern mudminnow	24	9	8	-

- Scores vary but main categories are more or less consistent
- Need to harmonise existing risk assessments
- Expert opinion remains important => need for more data on impact of non-native species

Conclusions

- 18 non-native fish species in Flanders of which 9 naturalised
- gibel carp & topmouth gudgeon most widespread and invasive
- two species expected to become invasive when introduced (Amur sleeper and round goby)
- need for risk assessment tools that are (1) simple, (2) objective and (3) effective