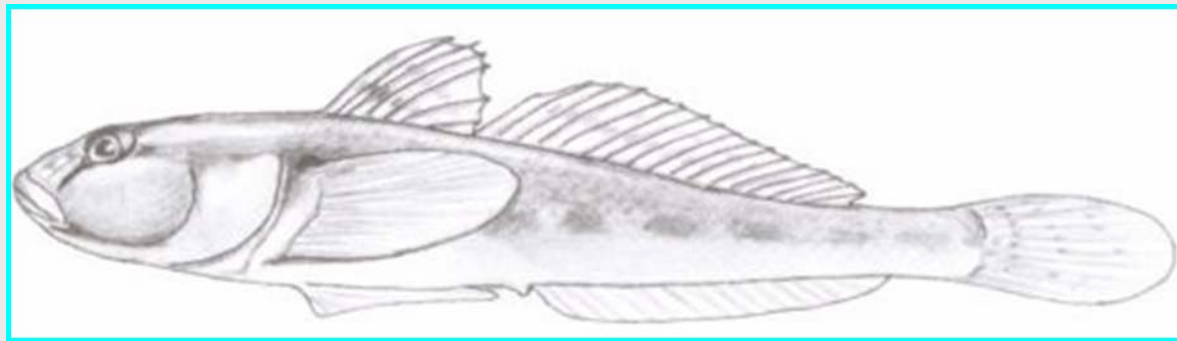


Some life-history patterns of non-native monkey goby, *Neogobius fluviatilis* (Pallas, 1814), from Slovakia

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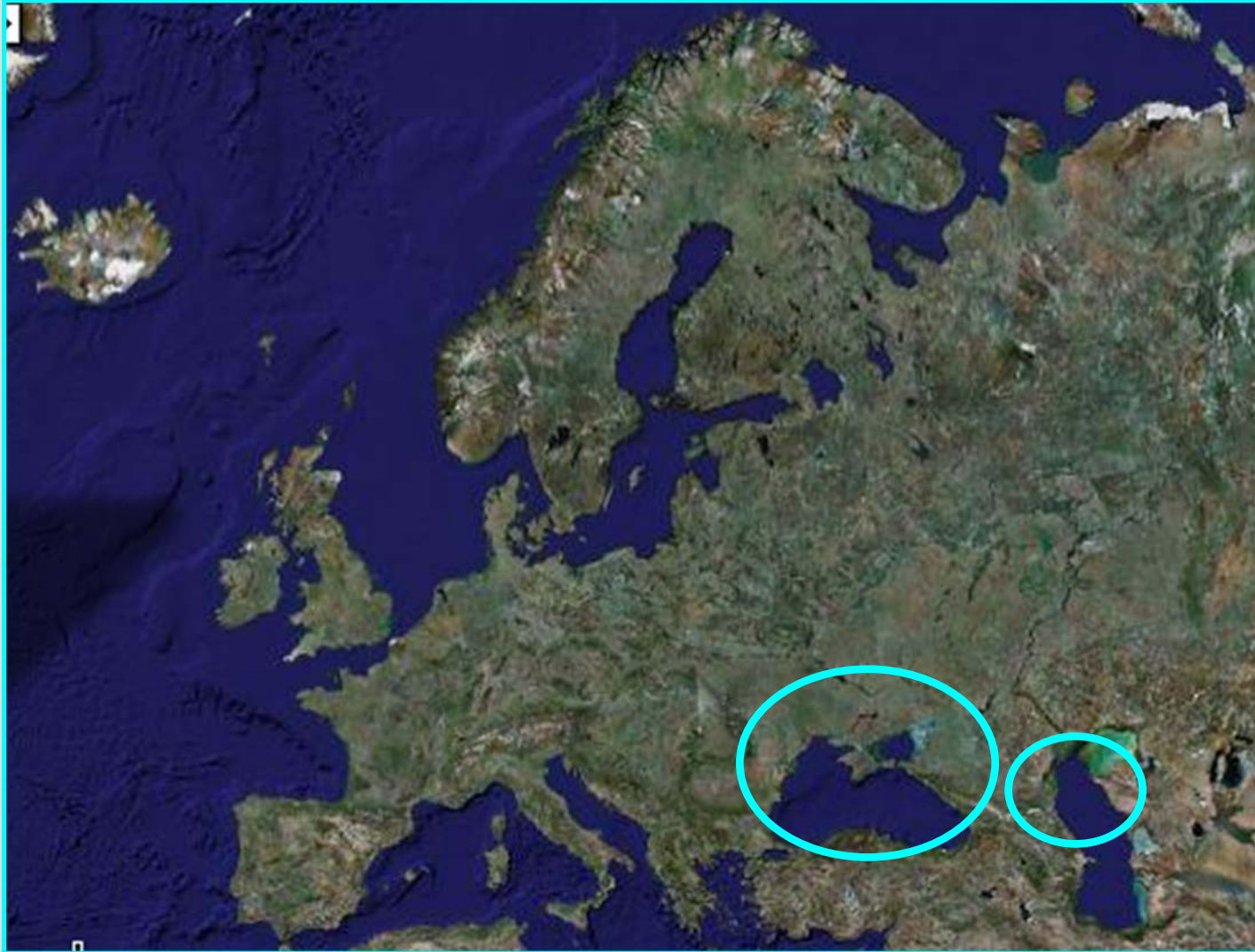


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Original area



Spreading outside the original area

- Hungary: Lake Balaton (Biró 1972), River Tisza (Hárka 1993)
- Poland: River Bug, tributaries of the River Vistula (Kostrzewa a Grabowski 2002, Baltic sea region (Danilkiewicz 1998)
- Slovakia: first observed in mouth of the River Hron, the tributary of the Danube in 2001 (Stráňai & Andreji 2002).

Habitat

- Euryhaline species (Svetovidov 1964, Hureau & Monad 1973).
- Lives in natural shorelines with fine, sandy or clay substrata, and it buries itself into substrata when attempting to avoid a potential predator (Berg 1949, Svetovidov 1964, Holčík *et al.* 2003 Erős *et al.* 2005).



Aims

- The main aim is to assess the invasive potential of monkey goby
- External morphology
- Age and growth
- Fecundity and other LHT (future)



Morphology: Location

- the mouth of the River Hron (a tributary of the Danube)
- In total, n=102: October (n = 82) and November (n = 11) 2006, April (n = 7) and May (n = 2) 2007



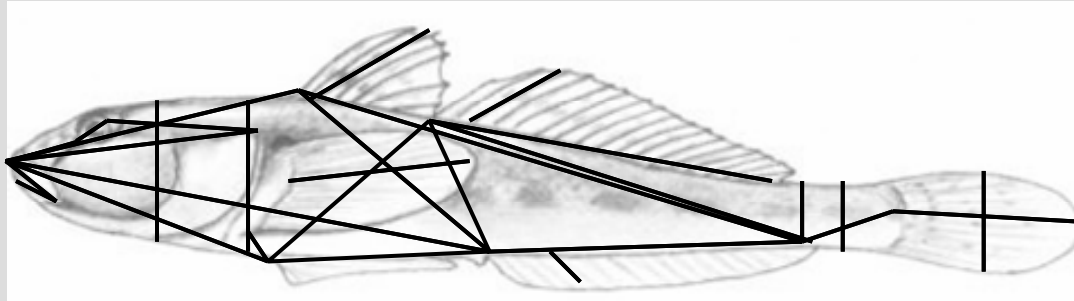
Material and methods

- Collected by electrofishing
- Fixed in 4% formaldehyd
- Photographs of each specimen (Nikon D 200)

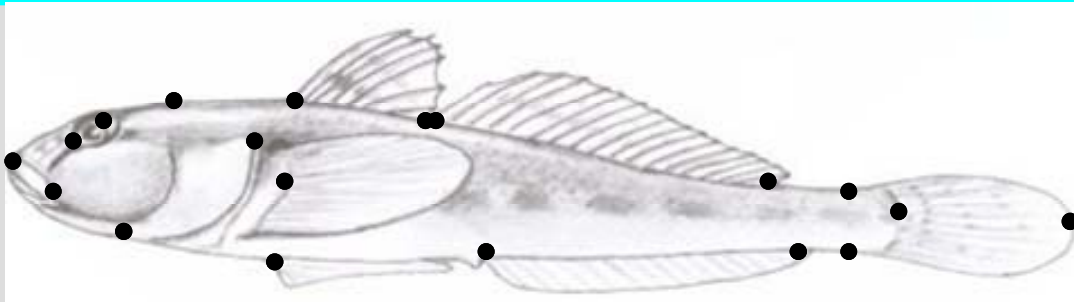


External morphology (ontogenetic context)

- Tripple regression analysis -TRA (IMPOR 2.31 E), 36 characters



- Geometric analysis (IMPORPRO 3.2) 19 landmarks

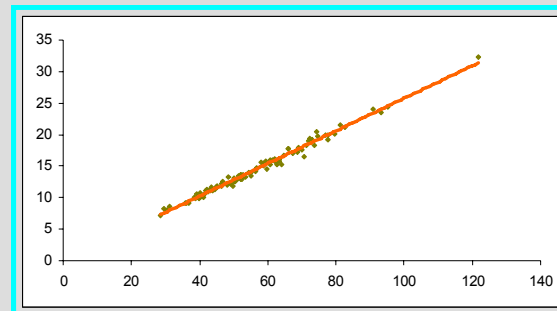


- Comparison with bighead goby, *N. kessleri* and round goby, *N. melanostomus* (coefficient of difference) 32 characters

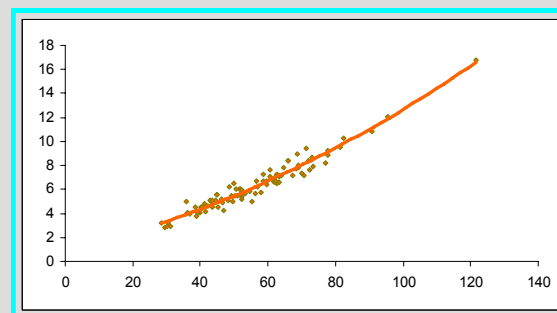
Results-TRA

Standard length ranged from 28.5 to 121.6 mm

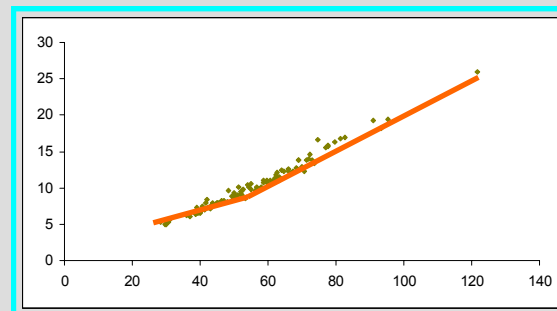
•22 characters developed isometrically



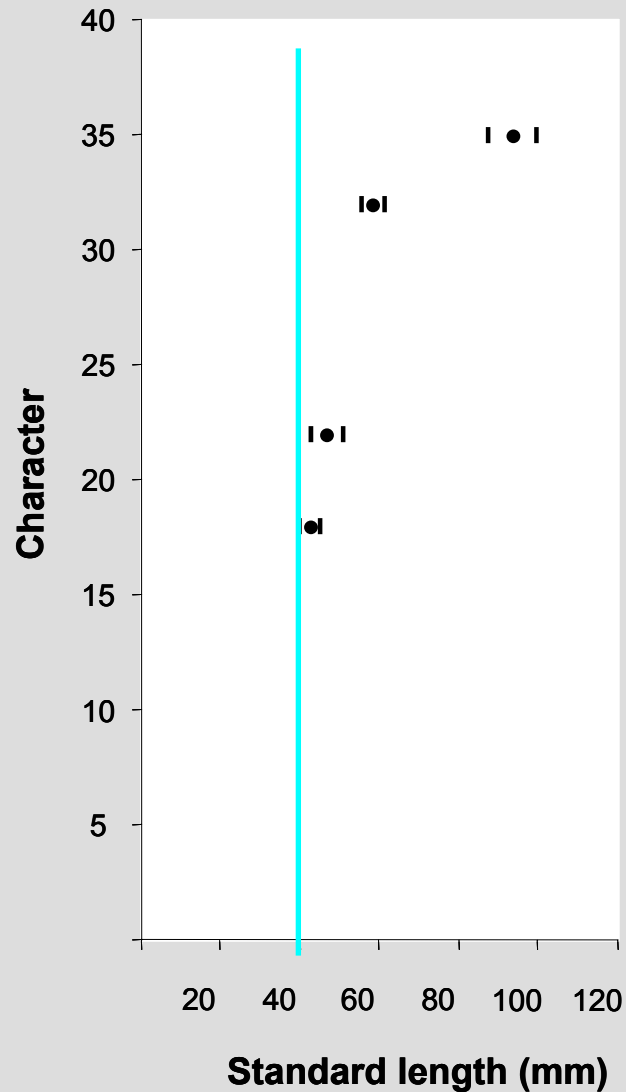
•10 characters developed allometrically



•4 characters developed isometrically with breakpoint



Results-TRA



- caudal peduncle length
- D1 fin depth
- head-width
- post-occipital distance

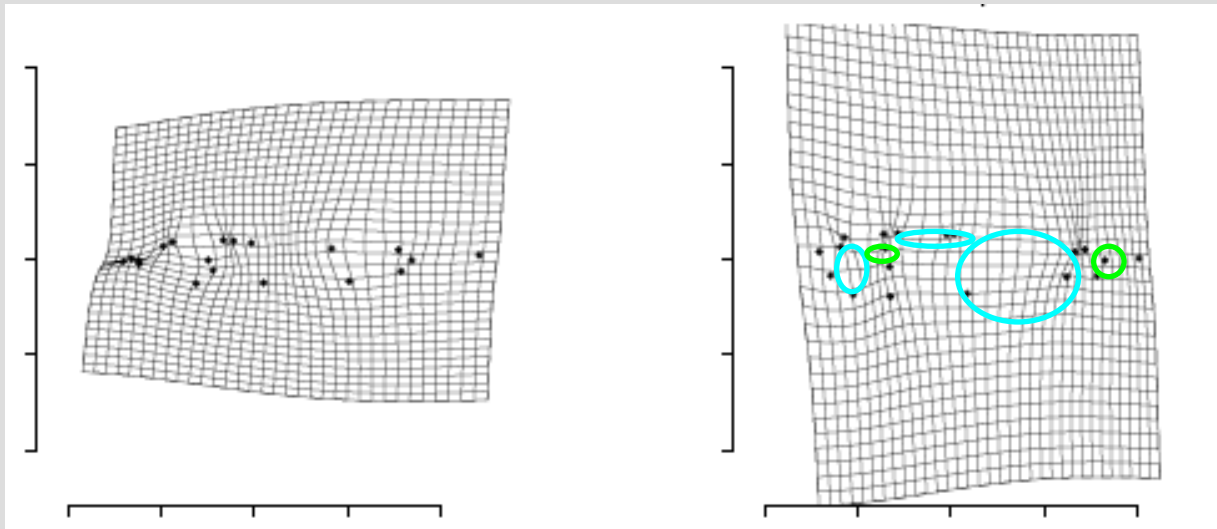


There were no apparent changes at SL lower than 40 mm.

Results-GA

During the development of body shape from juveniles to adults: the affine variability made only 9.2%

- body depth in the trunk region, D1 base fin length, and size of mouth proportionally **increased**
- caudal peduncle depth and occipital region proportionally **decreased**



from the smallest to average

from average to the largest

Results-Coeff. Diff.

character	mean in % of standard length			Coefficient of difference	
	NF	NM	NK	NF/NM	NF/NK
lower jaw length	3,97	6,24	9,21	1,82	3,02
maxilla length	4,42	7,84	10,42	2,27	3,43
pre-dorsal distance	32,60	36,24	37,5	1,70	2,69
pre-anal distance	53,02	58,62	62,66	1,89	3,22
D1-A distance	26,83	32,17	31,39	2,21	1,88
D2-A distance	17,66	21,77	30,82	2,24	5,49
D2-V distance	27,35	31,79	39,3	1,81	4,24
head width	18,25	24,4	26,32	2,14	2,49
V fin width	11,18	16,29	17,84	1,86	1,95
V fin length	17,64	24,6	21,67	2,49	1,42

Monkey goby differs from both bighead and round goby in 10 from 32 distance-based characters.

Results-Coeff. Diff.

Compared to bighead and round goby, monkey goby has significantly smaller:

- lower jaw length
- maxilla length
- pre-anal distance
- pre-ventral distance
- head width



The smallest head and mouth

- D1-A distance
- D2-A distance
- D2-V distance



The most compressed body

- V fin length
- V fin width



The smallest pelvic disc

Discussion (morphology)

The observed patterns of relative growth with no apparent changes at low SL suggest that monkey goby reach their definite phenotype early in ontogeny...



...and thus represent a strongly precocial (=specialized) species (Balon, 2004)

Which is also supported by the morphological differences between monkey goby and the two other goby species that refer to its strong specialization to sandy substrata and smaller prey.

Age and Growth: Location

- The River Ipeľ (the tributary of the River Danube) near village Chľaba
- All (n=165) specimen were collected on 9th October 2007

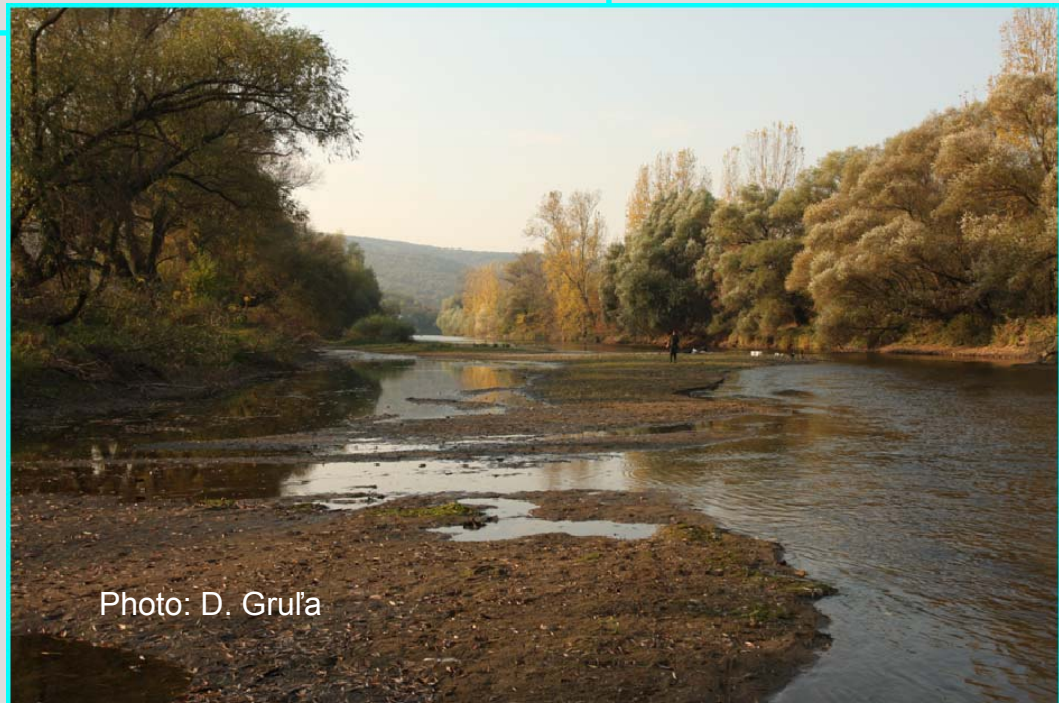
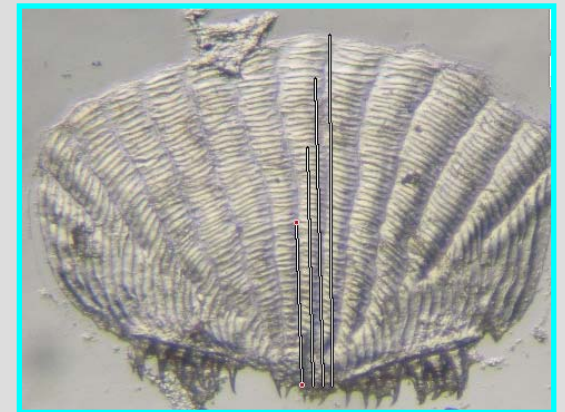
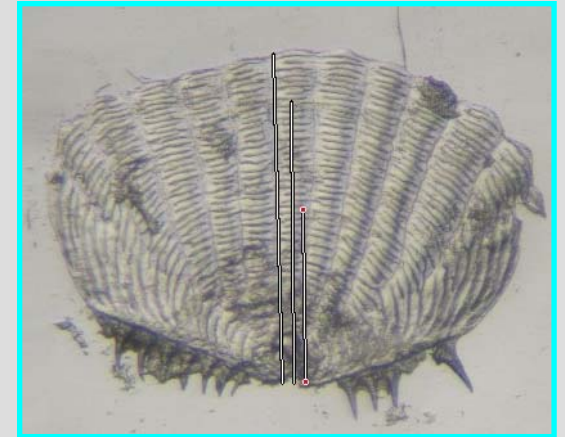


Photo: D. Grul'a

Material and methods

- minimum 5 scales were removed from the left side of each specimen, below the pectoral fin
- the SL at which the scales start to form was found according to relationship between SL and scale radius and was estimated to be 5.41 mm
- back-calculated standard lengths (SL) were determined
- two growth models were applied to the back-calculated SL data: the von Bertalanffy growth model and cubic B-spline model

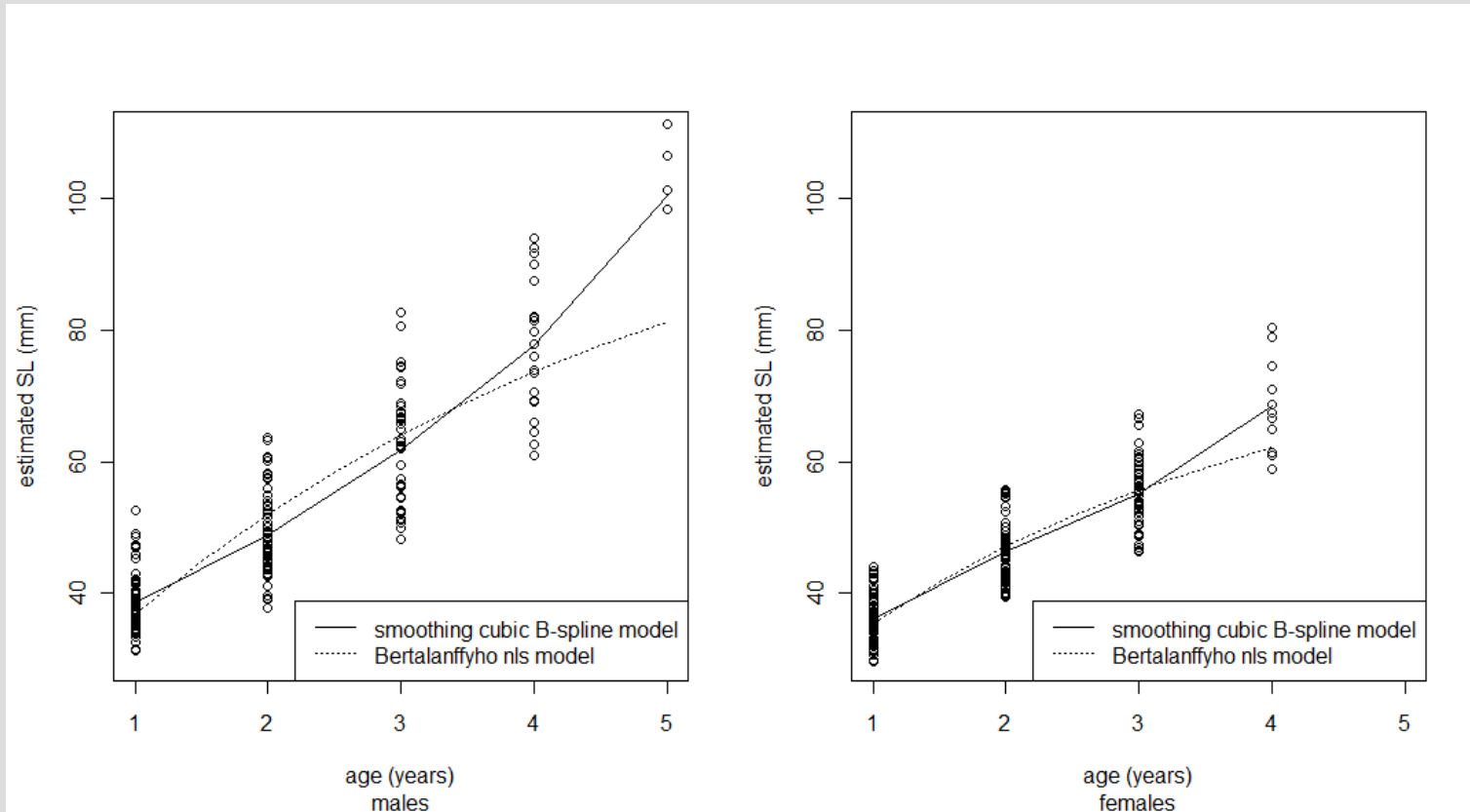


Results

- females (n=87), five age groups from 0+ to 4+
- SL 35.88 – 88.71 mm
- males (n=78), six age groups from 0+ to 5+
- SL 33.44 to 123.16 mm
- back-calculated lengths of males were significantly larger than females in all years

($W_1 = 4122$, P-value = 0.000; $W_2 = 2714$, P-value = 0.015;
 $W_3 = 1541$, P-value = 0.000; $W_4 = 188$, P-value = 0.012).

Results



The cubic B-spline growth model seems to be more appropriate than von Bertalanffy model, especially by males in the higher ages.

Results

author	locality	sex	n	SL in age groups					
				0+	1+	2+	3+	4+	5+
Trifonov 1955	Azov sea	♀	-		108	113			
	Azov sea	♂	-		108	135			
Biľko 1965	Dnieper	♀	31		62	84	113		
	Dnieper	♂	111		73	105	116		
	Bug	♀	111		53	104	116		
	Bug	♂	128		53	118	134		
Biľko 1971	Dnieper	♀	31		42	78	107		
	Dnieper	♂	111		52	93	112		
Plachá	Ipeľ	♀	87	39	42	54	61	75	
	Ipeľ	♂	78	37	44	52	65	82	114

The slowest growth in specimens of monkey goby from Ipeľ (Slovakia).

Discussion (Age and Growth)

Monkey goby become sexually mature mostly in the second year of life at a total length of 9-12 cm (Berg *et al.* 1949) although in fresh water, sexual maturity may be reached at only 3.2 cm (females) and 4.0 cm (males) (Smirnov, 1986).



So it can be assumed, that all (n = 134) specimens in the age groups 2+, 3+, 4+ and 5+ were sexually mature and represented a good potential to maintain the invasive population.

Discussion (Age and Growth)

Non-native monkey goby from Slovakia were found to be smaller (at each age group) than the native populations.



It can be assumed, that non-native monkey goby also reached their sexual maturity at smaller length than native populations, though fecundity has not been evaluated yet.

Conclusions

Monkey goby was found to be an extremely specialized species, and therefore it is not expected to spread into new areas as fast as round and bighead gobies and if it does, it should be limited to habitats with sandy bottom.



If this assumption is correct, then it follows that the potential impact of monkey goby on native fauna or even ecosystems is likely not to be as negative as in case of bighead and round gobies.

Conclusions

On the other hand, the analyses of age and growth suggests, that in new areas that fulfill its habitat requirements, monkey goby has the potential to establish new populations, and therefore, the species requires our attention.

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Thank you for your attention

Foto by Daniel Grula

Neogobius fluviatilis

