## AACL BIOFLUX

Aquaculture, Aquarium, Conservation & Legislation International Journal of the Bioflux Society

## Identification of *Carassius gibelio* migration patterns in Europe

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**Abstract**. The current short paper is a summary of a wider research on identification of *Carassius gibelio* migration patterns in Europe using mitochondrial markers. Haplotypes distribution was correlated with geographical origin of populations. **Key Words**: *Carasius gibelio*, Cyt B, haplotype.

**Rezumat**. Această lucrare este un rezumat al unei lucrări de cercetare mai amplă pentru identificarea modelului de migrare a speciei *Carassius gibelio* în Europa utilizând markeri mitocondriali. Distribuția haplotipurilor a fost corelată cu originea geografică a populațiilor. **Cuvinte cheie**: *Carasius gibelio*, Cyt B, haplotip.

**Introduction**. The connection of hydrographic basins allowed the spread of many fish species from their native areas to adjacent territories where, most likely, they became the dominant invasive species. Prussian carp - *Carassius gibelio* (Bloch, 1782) is probably the dominant invasive species of the last decades in south-eastern Europe and in some cases it has become the native species in many lakes across the Balkan Peninsula and Turkey. Regarding its origin, *C. gibelio* is considered to be native in the area between east-central Europe and Siberia (Libosvarsky 1961) or heavily introduced from eastern Asia (Asian taxon according for instance to Copp et al (2005)) in the 17<sup>th</sup> century.

The invasive expansion of this species is considered to have taken place through the lower basin of the Danube in 1912, on one side continuing in Bulgaria and Greece since 1950 (Economidis et al 2000) through the network of its tributaries and all the way to the Thrace region of Turkey, three decades later (Baran & Ongan 1988) and on the other side, through the higher tributaries of the Danube, reaching the Czech Republic via the Morava and Dyje rivers. The aim of this study is to identify the migration routes of *C. gibelio*, by cytochrome b DNA sequencing.

**Material and Method**. Muscle tissue samples from Danube Delta *C. gibelio* individuals were stored in 98% ethanol, for DNA isolation and purification, performed according to phenol:chloroform:isoamyl alcohol (25:24:1) protocol. Promega GoTaq Green Master mix PCR reagents were used to conduct the PCR for interest gene in a 25µl volume. The sequencing reaction was performed using the Beckman Coulter CEQ 8000 Genetic Analysis System. We analysed sequences at 710 bp from 124 individuals which were forming 19 populations from different geographical location. The sequences were aligned using MEGA5 (Tamura et al 2011) and ClustalX (Thompson et al 1997), haplotype frequencies and distribution was calculated in ARLEQUIN 3.11 (Excoffier et al 2005).

**Results and Discussion**. A total of 27 haplotyps were identified among the 124 individual specimens of *C. gibelio* from Asia and Europe. The Minimum Spanning Tree between all 28 haplotypes releve four phylogroups unlinked with geographical location (Figure 1).



Figure 1. The Minimum Spanning Tree between all 28 haplotypes.

We have also identified two haplotypes shared between the European and the Asian populations, indicating a migration pattern from Russia in the Danube River and from here in all tributaries (Figures 2a, 2b, 2c and 3). The sequence analysis of cyt B gene correlated with the NCBI data and also with the haplotype frequencies and distribution, suggests that the invasion of *C. gibelio* was facilitated by anthropogenic activities like fisheries.



Figure 2a. Haplotypes distribution in Far Eastern Asia.



Figure 2b. Haplotypes distribution in Middle Asia.



Haplotypes 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 Figure 2c. Haplotypes distribution in Europe.



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Figure 3. Haplotypes distribution in Central-Eastern Europe.

**Conclusions**. The molecular, phylogenetic and biogeographic analysis indicates that the Prussian carp has two migration routes in Europe from East to West, through Ukraine and Turkey aquatic basins as consequence of escape or deliberately releases from intensive aquaculture systems.

## References

- Baran I., Ongan T., 1988 Gala Gölü'nün Limnolojik Özellikleri Balıkcılık Sorunları ve Öneriler (Limnological Features of Lake Gala, Fisheries Problems and Suggestions). Gala Gölü ve Sorunları Sempozyumu, Doğal Hayatı Koruma Derneği Bilimsel Yayınlar Serisi. İstanbul, pp. 46-54.
- Copp G. H., Bianco P. G., Bogutskaya N. G., Erős T., Falka I., Ferreira M. T., Fox M. G., Freyhof J., Gozlan R. E., Grabowska J., Kováč V., Moreno-Amich R., Naseka A. M., Peňáz M., Povž M., Przybylski M., Robillard M., Russell I. C., Stakenas S., Šumer S., Vila-Gispert A., Wiesner C., 2005 To be, or not to be, a non-native freshwater fish? Journal of Applied Ichthyology 21(4): 242-262.
- Economidis P. S., Dimitriou E., Pagoni R., Michaloudi E., Natsis L., 2000 Introduced and translocated fish species in the inland waters of Greece. Fisheries Management & Ecology, 7(43):239-250.
- Excoffier L., Laval G., Schneider S., 2005 Arlequin ver 3.0: an integrated software package for population genetics data analysis. Evolutionary Bioinformatics Online 1: 47-50.
- Libosvarsky J., 1961 Zur palaeoborealen Verbreitung der Gattung *Carassius* (Jarocki, 1822). Zoologische Jahrbucher Syst 90:197-210.
- Tamura K., Peterson D., Peterson N., Stecher G., Nei M., Kumar S., 2011 MEGA5: molecular evolutionary genetics analysis using maximum likelihood, evolutionary distance, and maximum parsimony methods. Molecular Biology and Evolution 28: 2731-2739.

Thompson J. D., Gibson T. J., Plewniak F., Higgins D. G., 1997 The Clustal X windows interface: flexible strategies for multiple sequence alignment aided by quality analysis tools. Nucleic Acids Research 24:4876-4882.

Received: 22 November 2012. Accepted: 30 November 2012. Published online: 08 December 2012. Authors:

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How to cite this article:

Gorgan L. D., Ciorpac M., 2013 Identification of *Carassius gibelio* migration patterns in Europe. AACL Bioflux 6(2):92-96.