

OBSERVATIONS REGARDING THE STOCKING SOLUTIONS IN TO AQUATIC ENCLOSURES, UNDER CONTROLLED CONDITIONS, WHILE PRESERVING THE BALANCE BETWEEN ICHTHYOLOGICAL LIVESTOCK AND A SMALL POPULATION OF *Pelecanus onocrotalus*

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Abstract. The paper regards an experiment carried in the years 2010-2011 on the pond from the Complex Museum of Natural Sciences Constanta. This pond, isolated from a part of the coastal lake Tăbăcărie, was stocked with native and also with allochtonic fish species. It was considered, in relation to this stocking but also with the development and reproduction of the introduced species, the maintenance of the ecological balance between these effects and a population of 10 specimens of white pelican (*Pelecanus onocrotalus*) living in the warm season in mentioned aquatorium.

Keywords: *Pelecanus onocrotalus*, stocking, ecological balance.

Rezumat. Observații privind soluțiile de populare a unei incinte acvatice în regim dirijat, cu păstrarea echilibrului între efectivele ihtiologice și o populație restrânsă de *Pelecanus onocrotalus*. Lucrarea privește un experiment desfășurat în anii 2009-2011 privind popularea iazului Complexului Muzeal de Științe ale Naturii Constanța, iaz izolat dintr-o parte a lacului litoral Tăbăcărie, cu specii de pești autohtone, dar și alohtone. S-a avut în vedere, în raport cu această populare dar și cu dezvoltarea și reproducerea speciilor introduse, menținerea unui echilibru ecologic între aceste efective și o populație de 10 exemplare de pelicani comuni (*Pelecanus onocrotalus*) care habitează în sezonul cald în acvatoriul menționat.

Cuvinte cheie: *Pelecanus onocrotalus*, populare, echilibru ecologic.

INTRODUCTION

The pond from Microrezervație, section of the Museum Complex of Natural Sciences, Constanța, is the result of actions undertaken to isolate some of the coastal water of Lake Tăbăcărie, part of Tăbăcărie – Siutghiol Complex. The whole area is surrounded by a landscaped green area, well fitted, and a coastal belt with plant species characteristic to limnetic ecosystem.

The pond covers a surface of approx. 2.5 ha of the Microrezervație section area, which has 4 ha. The shores are relatively high, resulting from damming and dredging processes; generally strong grassy, with common reed (*Phragmites communis*) and common tule (*Scirpus lacustris*). Cores of *Typha* sp. (*Typha angustifolia* and *T. latifolia*) are rare and generally concentrated on the west side of the pond. We mention the presence of three island formations separated by narrow channels and the shores of the pond in the most westerly point of peninsular area.

In the proximity of the peninsular area, in 2009, there were made two drillings, 150 m deep, which supply the geothermal heat pumps from the Dolphinarium system, which in its turn discharges overflow clean water, in the pond. There is also discharged sea water from the two pools of the Dolphinarium (S = 20-24‰). Salt water discharges are occasional (usually once every spring and in autumn) and are quickly annihilated by the circulation of the pond water.

The pond has a sewage overflow, protected with mesh to prevent the escape of juvenile fish.

At the beginning of the study, fish population consisted exclusively in carp (*Carassius auratus gibelio*) and pumpkinseed (*Lepomis gibbosus*).

Ornithological fauna is quite rich, but, we first mentioned the presence on the pond, during summer, of 11 individuals of pelicans, 10 individuals of Great White Pelicans (*Pelecanus onocrotalus*) and 1 individual of Dalmatian Pelican (*Pelecanus crispus*), plus 6 individuals of swans (*Cygnus olor*), 2 of black swan (*C. atratus*), 2 of Black-necked Swan (*C. melacoryphus*) and 4 of stork (*Ciconia ciconia*). To these species, which are part of the heritage CMSN, there can be added some specimens of the species: Mallard (*Anas platyrhynchos*), Great Bittern (*Botaurus stellaris*), Common Moorhen (*Gallinula chloropus*), Eurasian coot (*Fulica atra*), etc., individuals in passage or nesting each year in the vegetation on the banks of Microreserve pond.

MATERIAL AND METHODS

Between June 28, 2010 and July 7, 2010, in collaboration with the Maritime University of Constanța, there were performed observations on the physicochemical water pond in the four stations established in its area. Sampling was performed at 8:30 a.m. and 2 p.m., measurements being made in the laboratory of the Maritime University during students' practical activities.

The analysed parameters in terms of water quality were: pH, salinity, total dissolved mineral salt content (TDS) and temperature.

Determinations of species for the fish populations were carried out using the source papers: BĂNĂRESCU (1964), CĂRĂUȘU (1952), VASILIU (1959), WILLOCK (1980).

For bird species we used in determining ichthyophagous species the papers of IORDACHE & STĂNESCU (1992), ALDERTON (2009), POLAK (2007) and for plants ANTONESCU (1951).

In order to establish the structure of the ichthyologic population at the beginning of the experiment, we used monofilament gill nets, a tool "năpatca" called and cast nets. For fishing trips we used an inflatable boat equipped with a 15CP two-stroke engine.

After carrying out the stocking actions of the pond with ichthyologic material for about 2-3 months, we were carried out fish surveys (with monofilament gillnet with meshes of $2a = 30$ mm, two gill nets with a total length of 60 m, located in various places, but also fished in fixed points with a special tool (năpatcă), once a week, to check the progress made by the biological material.

Measurements were made both to each lot and the specimens obtained in random fishing, taking into consideration the great length (L) and occasionally total weight (W).

We made observations on the degree of maturation of the gonads, the scale I-VI. CĂRĂUȘU (1952).

For transporting the species used in November 2009, were used CMSN cars, two-FIAT Doblo equipped with tanks with a 100-150 l and aeration-oxygenation systems.

RESULTS

In the adjacent tables (Table 1 and Table 2), there are rendered the main characteristics of pond water, based on the observations from 2010.

Table 1. Water parameters values registered at 8:30 a.m.

Table 1. Valorile parametrilor apei urmărite la orele 8:30.

Sample	Temperature °C	pH	Salinity g/l (‰)	TDS (ppt)
P1	23.5	7.36	0.943	1.088
P2	22.6	7.38	0.767	1.086
P3	23.1	6.62	0.943	1.086
P4	23.6	7.49	0.928	1.059

Table 2. Water parameters values registered at 2.30 p.m.

Table 2. Valorile parametrilor apei urmărite la orele 14:00.

Sample	Temperature °C	pH	Salinity g/l (‰)	TDS (ppt)
P1	26.8	7.62	1	1.158
P2	26.3	7.64	0.946	1.095
P3	26.6	7.55	1.043	1.095
P4	26.4	7.74	0.992	1.155

Ichthyologic population of the pond at the start of the observations, as mentioned above, consisted exclusively of Prussian carp (*Carassius auratus gibelio*) and pumpkinseed (*Lepomis gibbosus*). After establishing ichthyologic composition and making physico-chemical analyses of water, we passed to the second stage that is populating the pond with various species of fish.

Comparing obtained data with those in **Directive EEC 78/659 of July 18, 1978 - quality of freshwaters needing protection or improvement for fish farming practice** we find that the values for pH, suspended solids and temperature are within the limits provided for cyprinid waters and therefore decided that the most adequate species to populate the pond are: mirror carp (*Cyprinus carpio* var.), Chinese cyprinid - grass carp (*Ctenopharyngodon idella*), bighead carp (*Aristichthys nobilis*), silver carp (*Hypophthalmichthys molitrix*).

It was considered possible the introduction of adult specimens of wels catfish (*Silurus glanis*) and its feeding European weatherfish (*Misgurnus fossilis*) and mosquitofish (*Gambusia affinis*), the last one with a role in the eradication of local populations of mosquitoes (*Culex pipiens*). Conditions also allowed populating the pond with a number of sturgeons (*Huso huso*, *Acipenser ruthenus*, *A. gueldenstaedti*).

Pond stocking was done in several steps:

2009 - Two actions:

➤ Prussian carp (*Carassius auratus gibelio*) - from Iormac farm - Băneasa, Constanța County - there have been brought about 1,000 specimens with different sizes (L = 8-22 cm);

➤ Catfish (*Silurus glanis*) - 8 specimens (L = 80-110 cm and the W = 8.5 kg), breeders, with gonads in maturation stage IV-V.

2010 - The following actions:

➤ Mirror carp (*Cyprinus carpio* var.) specimens from Brateș farm / Galați, (L = 12-20 cm and the W = 25-75 g / specimen), (4 transports);

➤ Chinese cyprinid - grass carp (*Ctenopharyngodon idella*), bighead carp (*Aristichthys nobilis*), silver carp (*Hypophthalmichthys molitrix*), of different sizes (L = 10-30 cm) from Brateș farm / Galați (four shipments totalling 400 kg);

➤ Prussian carp (*Carassius auratus gibelio*) - juveniles 1-3 summers, from different backgrounds (Sarinusuf / Iormac / Băneasa, Constanța Pomacost S. C.) of different sizes (L = 20-25 cm) and the W = 40-250 g (4 transports totalling 350 kg);

- Material from S. C. Pomacost Constanța consisted entirely of specimens belonging to the red variety of ornament;
 - European weatherfish (*Misgurnus fossilis*), specimens of varying sizes (L = 18-25 cm and the W = 80-150 g), two transports totalling 200-300 specimens;
 - Mosquitofish (*Gambusia affinis*), biological material derived from Năvodari farm, Danube-Black Sea Canal, (L = 1.5 to 4 cm), approx. 2,000 specimens in two transports;
 - Beluga (*Huso huso*) – three specimens from Horia farm, Tulcea County (L = 74-77 cm and the W = 2000 to 2100 g), a single transport;
 - Sterlet (*Acipenser ruthenus*) and the Danube sturgeon (*Acipenser gueldenstaedti*) - 15 specimens from Horia, Tulcea county, (L = 61-63 cm and the W = 1100-1500 g), a single transport.

After the completion of these populating actions and the random fishing we noticed that initial results are poor, being composed of isolated catches of carp, with gonads in stage II of maturity.

The first fishery survey was conducted in the cold period, when fish winters.

In the cold period of 2009, there were applied aeration holes in the ice covering the pond. Later, in 2010-2011, by bringing water with temperatures between 17-19°C, from the Dolphinarium geothermal station, central and northern areas remained ice-free, frost being limited to the southern area.

In 2011, from May until early October it was made again random fishing, with “năpatca” and cast nets.

There were identified specimens belonging to the following species:

- Common carp (*Cyprinus carpio*) - L = 27-30 cm;
- Prussian carp (*Carassius auratus gibelio*) - L = 14 to 18.5 cm (W = 5-126 g)
- Pumpkinseed (*Lepomis gibbosus*) - L = 5-6 cm;
- Leaping mullet I (*Mugil saliens*) - L = 25-30 cm (W = 250 g);
- Golden grey mullet (*Mugil auratus*) - L = 28-30 cm (W = 250 g);
- Common rudd (*Scardinius erythrophthalmus*) - L = 5 - 6 cm;
- Catfish (*Silurus glanis*) - juvenile

- With “năpatcă”, there were also fished specimens of beluga (L = 1 m, W = 7 kg) and the Danube sturgeon (L = 0.75 m, W = 3 kg), all in excellent condition.

The presence of those two species of mullet was a surprise; their presence is probably due to the marine waters discharged from the Dolphinarium basins, or the accidental transports of embryonated eggs, brought by the ichthyophagous birds.

CONCLUSIONS

The conducted experiment allowed us to draw the following conclusions:

- At present, the pond water is kept clean by bringing fresh water facilitated by the geothermal pump system.
- During the winter of the years 2010-2011, the pond water did no longer freeze except for small areas.
- In summer, since 2010, it has not been reported any algal blooming
- We mention the presence of two dominant species, namely the native carp and the Prussian carp. Of the two species mentioned, the second one, the Prussian carp, is the most abundant. The caught specimens belong to pre-existing population in the pond, which increased in number naturally or from biological material.
 - The random fishing revealed specimens of Asian cyprinids. There were observed either isolated specimens or compact groups jumping out of water in summer. There were not caught-specimens of European weatherfish, catfish and mosquitofish because fishing methods are not appropriate. Regarding the 8 specimens of catfish, even though mature individuals have not been caught, we are sure that they reproduced, as some juveniles were captured in summer 2010. Moreover, it was noted a concentration of juveniles in surface waters.
 - The summer 2011 favoured the explosive growth of the population of *Gambusia* (mosquitofish).
 - The common Rudd specimen identified during the fishing survey was probably brought with the biological material in the transport from Sarinasuf and Brateș, as well as the Prussian carp. The presence of two species of Mugilidae is probably due to sea water intake in ponds from the Dolphinarium, reaching the pond by circulating water through the basins of this section, as juveniles or hatched eggs. The study of the caught specimens revealed that these species found excellent conditions in this water. This is underlined by the fact that all specimens were in excellent health status, stage III-IV gonads maturation and digestive tract filling grade III-IV.
 - Introduced sturgeons have excellently resisted to the water conditions in the winter of 2010-2011: a single-noted sturgeon in the 2012 spring.

From March to October, on the lakes, there appeared 11 individuals of pelicans beside swans and storks.

The losses of populating actions were estimated to about 40%.

Given that daily intake of a pelican is 1-2 kg of fish per day (WERNER, 2004), we can say that they would have consumed about 12-24 kg of fish / day from the brought biological material. Regarding other species of birds present on the pond the quantity consumed by them is very small, e.g. swans consume 3-4 kg-day moist biomass (submerged vegetation and molluscs) (BAILEY *et al.*, 2008), and can eat only accidentally juveniles hiding in submerged vegetation; the Great bittern (*Botaurus stellaris*) consumes about 0.500 kg / day moist biomass (50% benthic invertebrates and 50%

small fish) EPA (2009). From the swallow fish, especially in lakes where aquaculture is practiced, 33.3% of the consumed biomass may consist of carp (Summer I and Summer II), 9.2% Prussian carp (juveniles), 1.6% European weatherfish (*Misgurnus fossilis*) POLAK (2007).

The appetite of the pelicans present on the pond is moderate because they are given a quantity of 15-20 kg Prussian carp, or 6-10 kg capelin (*Mallotus villosus*) (derived from sorting food for marine mammals) daily.

However the presence of fish in the pond, made them act very naturally; every morning the flock fished like in the Danube Delta, grouped in a circle, with wings beating the water. Fishing pelicans were directed at the pelagic and Asian cyprinid shoal of fish and mullet.

Therefore, to maintain balance in aquatorium requires a continuous input of Cyprinid juveniles and Gambusia and European weatherfish occasionally. As the predators, given that catfish is reproduced, and the lake is quite small, a new restocking with this species may achieve only after 6-8 years. However, it is necessary to identify a species of predator the food spectrum of which include pumpkinseed (*Lepomis gibosus*), as this is a fish species detrimental to the introduced livestock, causing big losses as they eat eggs, fertilized eggs and larvae.

The Chinese cyprinid species are compatible with the pond conditions, as food resources are rich. These species may represent an excellent source of food for catfish and pelicans, and occasionally for predators living on the shore, such as Mustelidae (mink).

ACKNOWLEDGEMENTS

Thanks for the support in this project to:

Professor Maria PANAITESCU - Constanța Maritime University, Department of Environment, Professor Victor CRISTEA Ph.D.- vice rector of Galați "Dunărea de Jos" University, Professor eng. Nicolae PATRICHI Ph.D. - Galați "Dunărea de Jos" University, eng. Neculai OLARU - Research Institute - Development for Aquatic Ecology, Fisheries and Aquaculture Galati, Dumitru MAIEREANU - Kaviar Hause București, eng. Cristina DINU Ph.D. - manager of the Institute Eco-Museum Tulcea, eng. Gheorghe VREMULEȚ, eng. Cornel IVANOV, eng. Walter BONEA from Tulcea, eng. Dragoș ONEA - Năvodari farm Danube-Black Sea channel, eng. Gabriel DIMOFTACHE - Constanța, technician Tit Liviu IRIMESCU-CATONE.

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Received: March 31, 2012
Accepted: June 20, 2012