Fish farms as nesting sites for *Chlidonias hybridus* (Aves, Charadriiformes, Sternidae)

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Abstract: Since 1948 the Prut River basin has been subject to high levels of hydrotechnical and hydrological works. As a result of these many aquaculture ponds for rearing fish have appeared. These aquatic basins represent concentration areas of some important populations of bird species, both during migration and reproduction. The avifauna of the lower basin of River Prut was relatively un-studied until 1992. Since then numerous studies were conducted on the dynamics of the bird populations (including *Chlidonias hybridus*) in the Romanian basin of River Prut. In this study I detail the size of the breeding populations of *Chlidonias hybridus* species in the fish-ponds of the lower basin of River Prut and their change beteen 2002 and 2005. The study was conducted between May and July (2003-2005). *C. hybridus* colonies were surveyed within the Cârja-Maţa-Rădeanu ponds, Vlădeşti ponds and Brateş fishponds complex, located in the Prut river lower basin. The results observed are discussed with respect to the weather conditions that determine the nesting of this species in the fish-ponds, the influence of the fishery works on the *C. hybridus* colonies and the importance of the ponds as nesting places for this species.

Key-words: *Chlidonias hybridus, population size, breeding, fishpond.*

Introduction

Starting with 1948, many territorial hydrotechnical and hydrological works took place in the Prut River basin. The Stânca-Ştefaneşti barrage was created as a result of these works to reduce flood risk, creating the most extensive water surface from the Romanian basin of the Prut River. Another work that led to a radical transformation concerned the Prut water meadow which historically contained one of the biggest Romanian lakes - the Brateş Lake, today reduced to almost a third of its initial surface area (Ujvari 1972).

All these hydrotechnical works were done for: decreasing flood risk, fitting out of ponds for fish rearing, obtaining new agricultural land and providing a water source for irrigation. The fishpond nets attracted a large number of bird species, partially replacing the previous natural habitats that have suffered big

quantitative and qualitative changes (Gache 2002).

Unfortunately, there are few studies on the fauna before these works making a comparative study impossible. However, we can examine the influence of industrialization, agricultural intensification and fish farming on the fauna.

In general, data concerning *Chlidonias* spp. are integrated in studies about dynamics and qualitative and quantitative analysis of avifaunal communities. The majority of these studies were made in the west and central regions of Romania (e.g. Linţia 1955, Nadra 1965, Babuţia 1985, Ciochia 1992, Kiss 1999, Stănescu 2005) and the Danube Delta (e.g. Papadopol 1981, Weber 2000, Ciochia 2001, Bănică 2002).

Data which refer to the dynamics and presence of *Chlidonias hybridus* in the inferior basin of River Prut are known from a number of published sources including: e.g. Onea & Ungureanu 1996, Gache & Ion 2000, Gache 2002, Gache & Muller 2002, Onea 2002.

The systematic list of the bird species found in Romanian basin of the Prut River includes 225 species divided in 50 families and 17 orders. The *Chlidonias* genus is represented by 3 species: *Chlidonias hybridus hybridus* Pallas, *Chlidonias niger niger* L and *Chlidonias leucopterus* Temminck (Cramp 1985). All these 3 species of the genus are encountered in the migratory period, whilst whiskered terns (*Chlidonias hybridus*) and black terns (*Chlidonias niger*) are known to breed in the region. The black tern is recorded as nesting in the middle basin of the Prut River whilst records of incidental breeding are known for whiskered terns.

Chlidonias hybridus hybridus is a polytypical species of mediteranean origin with an emphasized character for the palearctic area (Chiochia 1992). The global population is estimated at 200,000 pairs. Approximately a quarter of the global breeding range of Whiskered Tern lies within Europe (35,000 - 52,000 pairs: BirdLife International / European Bird Census Council 2000), with the main breeding areas occurring in Romania and the forest steppe zone of Ukraine and Russia (e.g. Glutz von Blodzheim and Bauer 1982, Cramp 1985, Ilyichev and Zabukin 1988). The species also breeds in the Iberian Peninsula, France, and Turkey and a number of isolated sites in central Europe and Italy (Tucker & Heath 1994). Although the population has fluctuated considerably, declines have been recorded between 1970 and 1990 in countries containing up to half of the European population. Destruction and deterioration of the wetland habitats which the species use has been cited as the primary cause (Tucker & Heath 1994).

Chlidonias hybridus is a species whose global population is not concentrated in Europe. However, European populations have an unfavorable conservation status (SPEC Category 3, Tucker & Heath 1994).

Published data shows the whiskered tern's Romanian distribution is concentrated in the Romanian plain and Danube delta where there are stagnant waters and wetlands (Munteanu 2002). Unlike the species status in other countries, In Romania *Chlidonias hybridus* is in territorial expansion in contrast to other countries within its distribution (Gorban 1991, Munteanu 2002, Tucker & Heath, 1994).

Our study had the following objectives:

- to estimate the breeding population size of the *Chlidonias* species within the fish-breeding farms;
- to identify the weather conditions that influence the *Chlidonias hybridus* species nesting in the fishponds;
- the influence of the fishery works on the *Chlidonias hybridus* species.
- to estimate the importance of these basins for the species.

Materials and methods

Study area

The study took place within the fishponds located in the lower basin of the Prut River (fig. 1). The fish farms Carja, Mata,and Radeanu (Vaslui County) have a surface area of 1,517 ha and a mean volume of 16.69 mil m^3 water (the water volume varies annualy depending on the weather conditions and the piscicultural works) and include almost 200 ha of dikes and canals. The site is described as an Important Birds Area (I.B.A.) by the Romanian Ornithological Society (R.O.S.) (S.O.R. 1996). This site includes the ponds used in this study (BirdLife International 2001, Gache & Muller 2002). These ponds belong to three fisheries Carja I, Carja II and Mata - Radeanu. The avifauna of the Carja, Mata and Radeanu ponds, includes 125 bird species, 79 of which are nesting species and 99 of which are used during the I.B.A selection criteria (Gache & Muller). The Vlădeşti - Oancea ponds (Galaţi County) have a surface area of 572 ha. and the Brateş fishpond Complex (Galaţi County) has a surface area of 295 ha and a volume of 4.22 mil m^3 water.

Study period and work method

The study took place during the breeding season of the species in May - July, 2003 - 2005. We used a direct census of the nesting colonies (Blondel & Isenmann 1973). In the cases where it was impossible to visit the colony, the quantitative data were obtained using the census from the higher points that the colony area. The number of pairs and nests were visually assessed using a field telescope or binoculars (Publ. S.O.R. 2000).

Results

In this section of the Prut River basin the species of *Chlidonias* genus build their nests using *Nymphoides peltata* (fig. 2-3). Prior to 2003, only one colony of *C. hybridus,* comprising 108 pairs was observed, in the Brates Lake complex (tab. 1).

In the Vlădeşti fishponds (fig. 4), only one colony was surveyed and the number of pairs observed varied annually (tab. 2) depending on the weather conditions and works conducted around the fish farm.

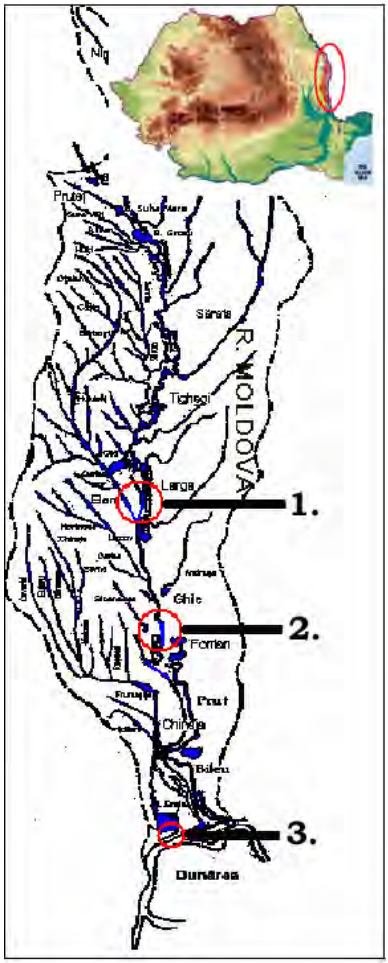

Figure no.1 Lower basin of River Prut (after Ujvari 1972)
1. Cârja-Maţa-Rădeanu fish-ponds
2. Vlădeşti fish-ponds
3. Brateş Complex

In 2005, the pond where whiskered terns had nested was emptied, so the colony moved to another pond containing fish fry.

In 2004 I observed a colony of *C. hybridus*, comprised of 72 pairs of birds (tab. 3/5), in the Mata-Radeanu fishery (fig. 5). The colonies presence in this area was confirmed by the staff of the fish farm as being present since 2000. In this area, the *C. hybridus* was observed building its nest using leaves of *Nymphaea alba* (fig. 2-3).

Two new colonies of *C. hybridus* were observed within the perimeter of the Carja II fishery in 2005. The two colonies comprised 106 pairs and 202 pairs respectively (tab. 4). Due the difficulty of access to the colonies our observations were done from a point at raised elevation near to the colonies. On 19 July 2005, chicks aged between 10 and 22 days were observed in the colonies and fully fledged juveniles were also observed.

Discussions

Chlidonias hybridus (fig. 6-9) is the only species of the found in Romania to nest constantly in the lower basin of the Prut River. This species forms colonies on most of the fishponds where it finds suitable conditions (Gache 2002, Gache & Müller 2002, Cazacu & Gache 2005).

The fish-ponds which have appeared as a result of the hydro-technical works represent new ele-

Figure no.2-3 *Chlidonias hybridus* nests (built using *Nymphoides peltata*) at the Mata – Radeanu ponds (photo by: M. Cazacu)

Figure no.4 The emptied pond V_I (Vladesti, 2005)
(photo by: M. Cazacu)

Figure no.5 *Chlidonias hybridus* colony in the Mața-Rădeanu ponds
(photo by: M. Cazacu)

Figure no.6 *Chlidonias hybridus* adults and chicks
(photo by: M. Cazacu)

Figure mo.7 *Chlidonias hybridus* chick (3-5 days)
(photo by: M. Cazacu)

Figure mo.8 *Chlidonias hybridus* chick (14 days)
(photo by: M. Cazacu)

Figure mo.9 *Chlidonias hybridus* juvenile
(photo by: M. Cazacu)

Table no.1. Changes in the colonies of *Chlidonias hybridus* dynamics observed in the Brates lake complex between 2003 - 2005.

Year / Colony type		2003	2004		2005	
			Two colonies		Two colonies	
Monospecific colony	***Chlidonias hybridus***	_	**188** pairs	**33** pairs	-	-
Polispecific colony	***Chlidonias hybridus***	**125** pairs	**118** pairs	**304** pairs	**162** pairs	**45** pairs
	Chlidonias niger	_	12 pairs	23 pairs	2 pairs	_
	Podiceps cristatus	15 pairs	6 pairs	22 pairs	5 pairs	3 pairs
	Podiceps nigricollis	_	_	5 pairs	_	1 pairs
	Fulica atra	_	_	_	1 pairs	_

Table no.2. Changes in the *Chlidonias hybridus* colony dynamics observed at the Vlădeşti fish-ponds between 2003 - 2004.

Year / Colony type		2003	2004	2005
Monospecific colony	***Chlidonias hybridus***	**109** pairs	_	_
Polispecific colony	***Chlidonias hybridus***	_	**161** pairs	**170** pairs
	Podiceps cristatus	_	6 pairs	6 pairs
	Sterna hirundo	_	_	3 pairs
	Larus ridibundus	_	_	11 pairs

Table no.3. Changes in the *Chlidonias hybridus* colony dynamics observed at the Mata – Radeanu fishery's perimeter between 2003 – 2004

Year / Colony type		2003	2004	2005
Monospecific colony	***Chlidonias hybridus***	_	**72** pairs	**104** pairs

Table no.4. Changes in the *Chlidonias hybridus* colony dynamics observed within the Carja I fishery's perimeter between 2003 – 2004

Year / Colony type		2003	2004	2005
Monospecific colony	***Chlidonias hybridus***	**72** pairs **45** pairs	**106** pairs	_
Polispecific colony	***Chlidonias hybridus***	_	**3** pairs	**188** pairs
	Podiceps cristatus	_	12 pairs	14 pairs
	Podiceps nigricollis	_	_	15 pairs
	Larus ridibundus	_	_	11 pairs
	Fulica atra	_	_	6 pairs

ments in the River Prut basin's landscape that influence the presence of avifauna. Different authors have highlighted these changes with reference to wetlands that have partially replaced the natural stagnant waters (e.g. Onea & Ungureanu 1996, Gache & Ion 2000, Gache 2002, Gache & Muller 2002, Onea 2002).

Table no.5. Nest characteristics observed for *Chlidonias hybridus* at 13.06.2005 in the Mata – Radeanu fishery.

No.	Nest type	No. of nests
1.	Empty [1)]	21
2.	1egg	14
3.	2eggs	22
4.	3eggs [2)]	39
5.	4eggs	5
6.	5eggs	1
7.	3 - 5 day chicks	2

[1)]The pairs of empty nests had 27 chicks of age between 10 - 14 days and 14 flying juveniles.
[2)]The Whiskered Tern, generally, lay 3 eggs (Cramp 1985).

Prior to 2003, only one colony of *C. hybridus,* comprising 108 pairs was observed, in the Brates lake complex. In 1997, in the eastern border of this colony one pair of *Sterna albifrons* with two flying juveniles has nested (Gache 2002). Two colonies of *C. hybridus* comprising 122 pairs were observed between 1996 – 2002 within in the Carja I fishery's perimeter (Gache 2002, Gache & Müller 2002) (see fig. 10).

In the lower basin of the Prut river there are natural permanent pools (e.g. Cotul Chiulului, Brăneşti pool, Vlăşcuţa and Cotul Văleni) and temporary pools that appear as a result of the rains and snow-melt during spring. Until now, we have observed two colonies of Whiskered Tern on the Brăneşti and Vlăşcuţa pools.

During the present study I have observed numerous *C. hybridus* individuals displaying nesting behavior such as: mating parades, nest site selection and nest construction. As a result of the temporary pool's drying and permanent pool's decreasing, the birds often abandon these surfaces, moving to the existing fish farms in the studied area, or to other northern wetlands.

Our study, conducted during the breeding season of three years (2003 - 2005), it would appear that the fishponds offer suitable conditions for *C. hybridus* nesting through:

- a feeding place richer than in the natural aquatic ecosystem, as a result of the intensive aquaculture.

- the presence of suitable nesting places near to this rich feeding source.

- the reduced disturbance that has resulted from the lack of access due the border area status of the Prut river basin and of the protection measures

against the poaching taken by the staff of the fish farms.

According to our observations, *Chlidonias hybridus* adapts very easily to the changes that take place within the fisheries as a result of the fishery works. All the conditions mentioned above determine the nesting of this species on pools that have aquatic vegetation such as *Nymphaea alba, Nymphoides peltata, Trapa natans, Sagittaria sagittifolia, Myriophyllum spicatum, Myriophyllum despicatum, Potamogeton* sp., etc. In the exceptional cases, this species will nest on clumps of the reed. (*Phragmites communis*) as has been recorded in one case at Cârja I, in 2004 (Cazacu & Gache 2005).

An interesting example presents the pond EC no 1' (breeding pond) within the Cârja I fishery. Each spring, this pond fills as a result of the abundant rains and snow-melt during this period. However, this pond is emptied yearly, during the spring.

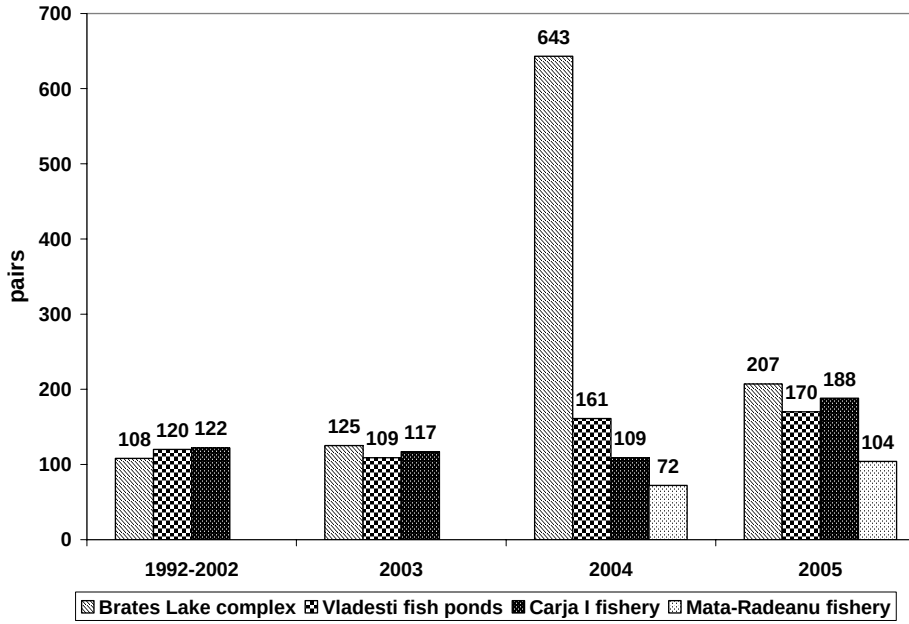

Figure no.10 Changes in the number of pairs of *Chlidonia hybridus* observed at five sites in the lower basin of the Prut River between 1992-2002 and 2005
(the data collected between 1992-2002 is from Gache 2002,
and 2003-2005 represent the present study)

In 2005, as a result of the previous year's high rainfall the pond had water all the year, facilitating the development of rich vegetation including; *Nymphaea alba, Nymphoides peltata, Potamogeton* sp. *Phragmites communis, Thypha angustifolia* etc. Therefore, on this pond *C. hybridus* formed a large colony (188 pairs) with other species, such as: *Larus ridibundus, Podiceps cristatus, Podiceps nigricollis* and *Fulica atra* (see: tab.1-4, fig.10).

Some fishery works, such as drainage of the ponds for fishing, can have negative effects on *C. hybridus* colonies. The drainage of ponds, usually once every three years determines whether they are abandoned by the breeding colony (Cazacu personal observation). This was observed for the colony within the Vlădeşti ponds in 2005 that left the V_I pond (fish sfry from the summer I), where it was present for many years, but occupied the V_{III} pond (fish from the summer III).

Another interesting case is presented by the colony from the EC $_{0+}$ F_{0+} no. 1\2 pond (fry breeding and fish recovery after reproduction pond) (Cârja I). *C. hybridus* formed a colony on this basin for many years, appearing at the end of May. The colony was first observed in 1996 (Gache 2002). The pond is emptied during the winter and refilled with water between the end of April and the beginning of May, to allow artificial forced reproduction to be conducted. In 2004, this pond was refilled with water at the end of May as a result of the intensive weather changes observed, such as; abundant rains, low temperatures for this period of the year and large thermal differences between night and day. As a result, *C. hybridus* could not form a colony on this basin because the vegetation of *Nymphoides peltata*, used by the birds for nest production, had not developed. As a consequence, the colony was present on another pond on the clumps of the reed.

Also, the present economic situation affects some essential aspects of the aquatic surfaces. The rise in cost of electrical energy needed to pump water into the basins led to the abandonment of some ponds within the fisheries' perimeter (Cârja I, Cârja II, Maţa - Rădeanu). Therefore, some of these ponds were invaded by the reed that created nesting places for many species (*Ardeidae, Acrocephalus*, etc.) but not for the *C. hybridus*. However, some ponds with large surface areas were partially occupied by the reed and, due the abundant rains from the last three years, these ponds contained water (1-1, 5 m depth) with richly developed floating vegetation. This is the case of a pond within the Cârja II

fishery. These are optimal conditions for the *C. hybridus* colonies and, in this instance, surveying in 2005 revealed a colony of 220 pairs.

The abundant rains seem to encourage the expansion of *C. hybridus* colonies by creating new feeding and nesting places. This is a possible explanation for the big difference in colony size, from year to year, observed within the Brateş fishery and the appearance of a new colony within the Cârja II pond.

High rainfall encourages growth of the aquatic vegetation which contributes to a increased abundance of aquatic and terrestrial insects and their larvae, providing rich feeding places for *Chlidonias hybridus*.

Also, the increasing breeding population is encouraged by the fact that some ponds are not used for the fishery production in some years.

Whilst, according to our observations, *C. hybridus* numbers are expanding in the Prut River's lower basin, we believe that the fish-ponds need better management to create a lasting equilibrium since this species prefers to nest in the same location every year (Gorban 1991) although it adapts easily to certain changes.

In conclusion, because of the decrease of the aquatic biotopes, the fish-ponds represent the only areas from the Prut River's lower basin with a high importance as both a nesting and feeding site for *Chlidonias hybridus* and numerous other water birds.

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