

Full Length Research Paper

Numbers and phenology of the Yellow - legged Gull *Larus michahellis* in the wetland of Réghaïa

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Accepted 10 November, 2009

The Yellow - legged Gull *Larus michahellis* is a common visitor to the Marsh of Reghaïa (Algeria) and breeds off the coast in small numbers on the Agueli islet, a rocky outcrop with scarce vegetation. It is especially frequent in the marsh out of the breeding season, particularly in December (120 individuals) and January (234 individuals) (data from 2004). Gulls breed on the islet: 31 nests were recorded in 2004 but only 14 in 2006, when no chick fledged due to human disturbance. In 2004, 39% of the nests were built by the centre of the islet and only few were located on the western slope exposed to winds blowing from the North, North-west and West. Clutch size varied from 1 to 3 eggs (2 ± 0.93).

Key words: *Larus michahellis*, numbers, breeding, Algeria.

INTRODUCTION

In recent decades, the expansion of the Yellow-legged Gull *Larus michahellis* on the Mediterranean coast has attracted the attention of ornithologists (Jacob and Courbet, 1980; Guiguen and Vincent, 1989; Bonaccorsi, 2002; Moulai et al., 2005). On the Algerian coast, Jacob and Courbet (1980) and Moulai et al. (2005), highlight an increase of nearly 8% of this species from 1978 to nowadays. The Yellow-legged Gull colonized urban areas in many parts of the Mediterranean region although this is a relatively new phenomenon in Algeria (Moulai et al., 2005). The purpose of this work is to focus on the populations of Yellow-legged Gull in the wetland of Reghaïa, including the Agueli islet, from which there is historical information (from Heim Balsac and Mayaud, 1962; Ledant et al., 1979, 1981; Meriem, 1985; Ouarab et al., 2003, 2004).

STUDY SITE

Wetland Reghaïa, (36° 46 '36° 47' N., 3° 19 '3° 20' E, Figure 1) is classified as a Ramsar site since 2003. It is

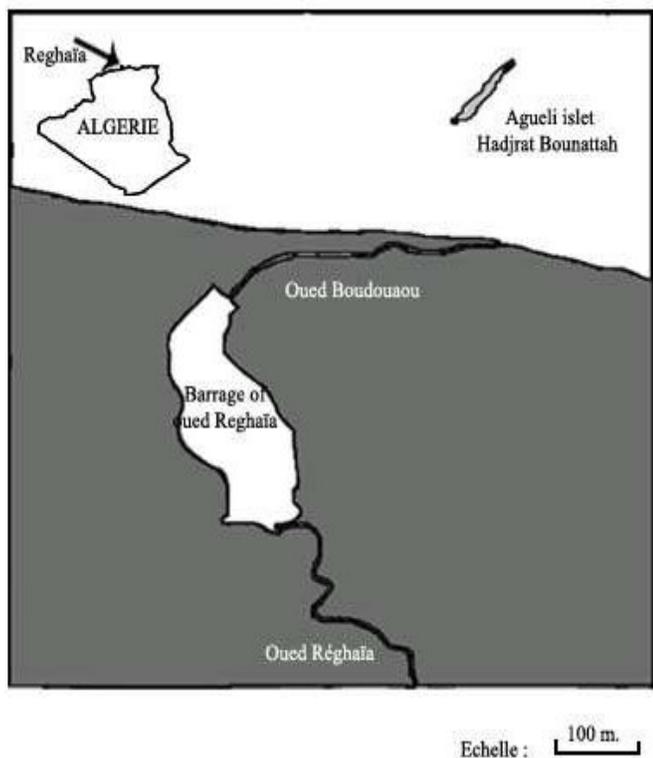
situated at the eastern end of the plain of Mitidja, along the Mediterranean. Tempered by the proximity of the Mediterranean, its climate is for floor sub-humid bioclimatic winter warm. Rainfall varies from year to other between 200 and 800 mm and reached 761 mm in 2004. The average annual temperature is 18.0°C.

The wetland of Reghaïa is divided into three main parts: a lake, a forest and islet Agueli off the coast; freshwater surface varies between 75 and 150 ha depending on winter rainfall. Once the lake was naturally open to the Mediterranean to the north and now is being closed by an artificial dam. It is bordered on the south by a swamp. Its Eastern shore is composed of vegetable patches crops and pastures, while in the west there is a 30 ha of maquis. On the edge of the lake, the vegetation consists of *Typha angustifolia* and *Phragmites communis*. Finally, 88 ha of coastal habitat is represented by a dune 50 to 125 m wide and 7.5 km long. Agueli islet (3 ha) is located 1 km off the beach and it harbours several rare plants growing between boulders (Table 1). The immediate vicinity of the marsh is occupied by fields, fallow land forests of eucalyptus and olive trees to scrub (Ledant et al., 1979). The Lake of Reghaïa receives effluents from tanneries, breweries and canneries upstream, discharging 40,000 m³ per day of waste water containing pollutants, both organic and mineral (Chebli, 1971). Organic

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Table 1. Plants identified during the sorties flown in 2004 and 2005 in Agueli islet.

Plants	Agueli islet	
	Ouarab et al. presente etude	Tigzirt islet Talmat 2005
<i>Paronychia argentea</i>	+	-
<i>Euphorbia peplis</i>	+	-
<i>Lavatera cretica</i>	+	+
<i>Chenopodium album</i>	+	-
<i>Chenopodium vulvaria</i>	+	-
<i>Cretmum maritimum</i>	+	-
<i>Erigeron bonariensis</i>	+	-
<i>Saliconia europea</i>	+	-
<i>Mesembryanthemum nodiflorum</i>	+	-
<i>Pistacia lentiscus</i>	-	+
<i>Arisarum vulgare</i>	-	+
<i>Crepis vesicaria</i>	-	+
<i>Leontodon hispidulus</i>	-	+
<i>Erigeron canadensis</i>	-	+
<i>Atriplex halimus</i>	-	+
<i>Suaedafruticosa</i>	-	+
<i>Fumaria capreolata</i>	-	+
<i>Oxalis cernua</i>	-	+
<i>Olea europaea</i>	-	+
<i>Olea europaeaoleaster</i>	-	+
<i>Phillyrea angustifolia</i>	-	+
<i>Solanum nigrum</i>	-	+
<i>Urtica dioica</i>	-	+

**Figure 1.** Location of Wetland of Reghaïa.

organic and mineral (Chebli, 1971). Cleaning products like detergent, which has widespread use daily, are also drained into the marsh. These pollutants already reached 9 mg/ l of water in 1971, while 3 mg/ l is the acceptable limit (Chebli, 1971). Such pollution should have a negative impact on water fauna and flora, but little is known about such impacts.

MATERIAL AND METHODS

During 2004 the counts of gulls were undertaken in the marsh on the 15th of each month to one day close. They were made in calm weather and mostly sunny, with a 20 x 60 spotting scope and avoiding double-counting the same individuals. Twelve observation points were distributed around the lake between 6 and 10 m above the water level. The distribution, structure and protection of nests on the Agueli islet were studied during 9 visits lasting 6h each, 3 in 2004 and 6 in 2006.

To assess the protection of nests against the wind, rain and sun and also to some extent against predation, we established a "protection index" based on the empirically index established by Voisin (1976) for nesting giant petrels *Macronectes* sp. The protection of a given nest is broken down into its various factors that are assigned a certain points number according to the scale shown in Table 4. The index used for a nest is equal to the sum of the items selected for each of these elements and would range from 0 (nest exposed on all sides) to 9 (nest overhanging protection of over 100 cm tall on 3 sides and situated on a ledge over 100 cm from the base and top of a rock), value not found on the Agueli islet.

Table 4. Method used to calculate the index of protection of nests (IP).

	Number of points
Height of the protection	
No lateral protection	0
Between 1 and 10 cm	1
10 to 100 cm	2
More 100 cm	3
Overhang over the nest	
No, nest entirely visible from above	0
Nest partially visible	1
Nest visible from the top	2
Number of sides protected (the nest is assumed inscribed in a square)	
One side protected	0
2 sides protected	1
2 sides protected	2
4 sides protected	3
Situations of the nest	
On a ledge or a cavity in a cliff	1
Same, at least 1 m from the base or top	1

Note: The index used is equal to the sum of points attributed to each factor. The height of protection is measured on the side of the nest, it considers only its maximum value.

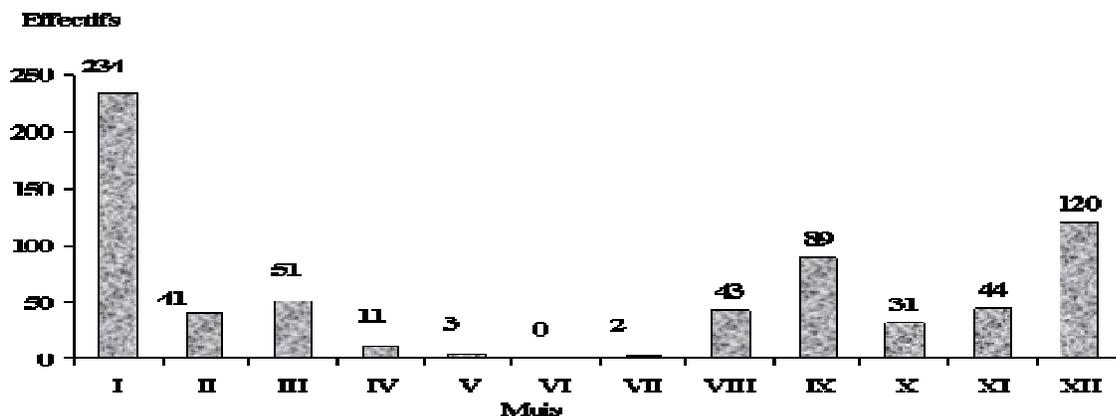


Figure 2. Monthly staff in Yellow-legged Gull Marsh Rehaia in 2004. *L. michahellis* has been considered a distinct species from *L. argentatus* since the late 1970s (Yeatman-Berthelot and Jarry, 1995; Yesou, 2003, Cadiou et al., 2004, Bouzendorf and Laloi, 2005), being the former the only that is endemic of the Mediterranean region.

RESULTS

Yellow-legged Gulls are frequent both in the Reghaia marsh and in the Aguéli islet: during 2004 (Figure 2), it was recorded in numbers exceeding 100 and 200 individuals in December and January and to a lesser extent, in September. After February, numbers decreased sharply to nearly zero during the breeding season (from March to June).

During the first visit to Aguéli islet (mid-February, 2004), no nest (new nor old) was found, but ca. 70 individuals were present. On early April, 31 nests were built but only 8 contained eggs (1 to 3, mean: 0.93 + 2) (0.9 + 2) (Figure 3a), but it was evident that some clutches were not yet completed. During our visit in September, all nest remains had disappeared. In February 2006 no nests were recorded. On late March 5 nests were found, including 3 occupied (contents from 1 to 3 eggs); in early

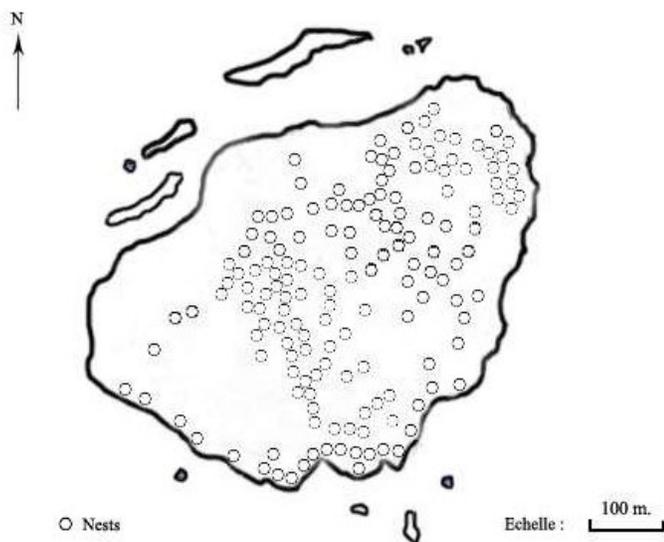


Figure 3a. Locations of nests of Yellow-legged Gull on Tizirt islet in 2003 (Talmat, 2005).

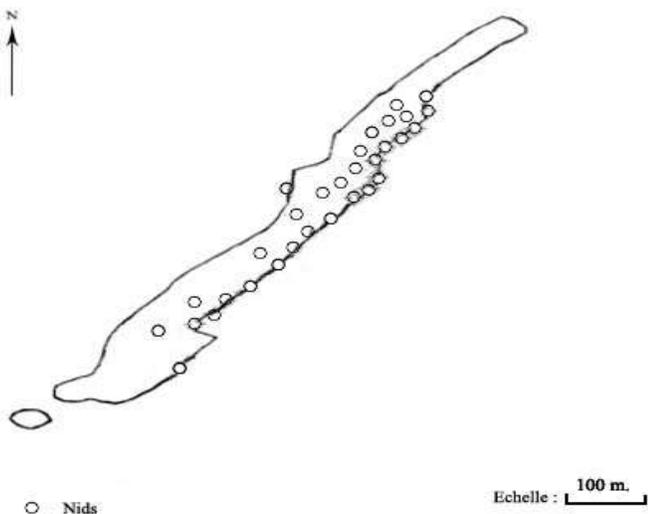


Figure 3b. Locations of nests of Yellow-legged Gull on Agueli islet in 2004 (present study).

April only 3 new clutches were found (2 and 3 eggs), while in early May we found only 12 nests, 7 of which were occupied with 1 to 3 eggs and 3 chicks died because of severe weather, which affected continuously the region from 3 to 6 May. During these visits, we observed anthropogenic disturbances on the island mainly due to fishermen setting their nets. On 6 June, 14 nests were all empty, some completely destroyed and dead eggs were found. Finally, on 5 August the island was occupied by tourists and no trace of breeding was visible. The number of eggs laid in 2006 ranged from 0 to 3 per nest, but the reproduction of gulls was too disturbed

by human activities that we could not calculate a unbiased average. No chick was seen alive on the island so reproductive success was nil. In both years most nests were located in the centre of the island without clear preferential orientation (Table 3). Few nests were scattered in small groups with variable orientation, with some preference for the north-east. The index of the highest protection (7) was recorded for the nest located in the North-northwest (Table 3). In 2006, the average distances inter-nests were ca. 22 m and much higher than those recorded by other authors in five other Algerian sites (Table 5).

The materials used to build the nests on Agueli were diverse and consisted mainly of plant debris such as leaves and stems of *Lavatera cretica*, *Vitis venifera*, *Cichorium intybus*, *Erigeron bonsriensis*, *Chenodium album*, *Verbascum sinuatum*, *Suaeda maritima*, *Galectites tomentosa*, *Saliconia europea*, *Picris echioides*, *Stachys* sp., *Trifolium* sp. *Hyroseris radiata*, *Plantago lanceolata*, *Phalaris* sp. *Squamatus aster*, *Rumex* sp., *Solanum nigrum*, *Stachys* sp. *Convomvulus arvensis*. The birds added feathers, plastic bags, bones, debris cotton shells and anything that could be found near the nest.

DISCUSSION

Ledant et al. (1979) stressed the importance of Agueli islet for the reproduction of the Yellow-legged Gull and they estimated a breeding population of 30 pairs (Table 2). They also noted that out of the breeding season the island serves as a roosting for "several hundreds" of gulls. The main factor influencing the nest-site selection is the Northern, North-western and Western winds during reproduction (Figure 3b), that form high waves that sweep the exposed portion of the island. Thirty pairs at Agueli islet in 2004 represented a very small fraction of the ca. 800 pairs breeding in the coast of Bejaia counted by Moulai (2002) and it is similar to the 30 pairs at Pisans and Cape Carbon, located about 200 km further east (Moulai et al., 2006). The total failure of reproduction in 2006 with the building of only 14 nests shows how the human disturbances can be important. The high value of the distance between nests measured in 2006 (Table 5) is probably linked to these disturbances and the subsequent decrease in the number of pairs. In undisturbed colonies and normally dense, there are much lower and less variable values.

In 2004 and 2006, we estimated that the first eggs were laid in the first days of March. This is earlier than 20th and 23rd of March in Cape Town noted Corbon and 20th of March at the island of El Euch, both located a few kilometers from Bejaia (Moulai et al., 2006). The only laying date we have in urban areas in Algeria is rather late on 12th April 1999, in the heart of Bejaia (Moulai et al., 2006) (Table 6).

The versatility shown by the Yellow-legged Gull in the

Table 2. Numbers of Yellow - legged Gulls wintering and breeding in the wetland of Reghaia from 1979 to 2004.

Agueli islet	Marais		Remarks	Years of observation	References
	Wintering	Sedentary			
30 nests	-	-		1978	Ledant et al. (1979)
-	20	50		1984	Meriem (1985)
-	40	-		1988	Molinari (1989)
-	42	-	> 200 ind. / roosting	1990	Doumandji et al. (1990)
31 nests	-	-		2003	C.C.R. (com. pers., 2003)
-	10	101	Wintering partial	2003	Ouarab et al. (2003)
31 nests	234	148		2004	Ouarab et al. (2004)
14 nests	-	-		2006	Ouarab obs. pers. (2006)

CCR : Centre cynegetique de Reghaia.

Table 3. Degree of vegetation protection and orientation of nests of Yellow-legged Gull at Agueli islet in 2004 and 2006.

	Index of protection (IP)							
	1	2	3	4	5	6	7	8
N2004	1	12	13	3	0	0	2	0
%	3,2	38,7	41,9	9,7	0,0	0,0	6,5	0,0
N2006	3	1	3	4	1	0	1	1
%	21,4	7,1	21,4	28,6	7,1	0,0	7,1	7,1

	Orientation								
	C	ENE	NNE	ESE	SSE	SSW	WSW	WWN	NNW
N2004	12	9	0	1	2	6	0	0	1
%	9	29,0	0	3,2	6,5	19,4	0	0	3,2
N2006	3	0	2	1	0	4	1	1	0
%	21,4	0	14,3	7,1	0	28,6	7,1	7,1	0

C : Centre of the island without preferred orientation, ENE : east-northeast, NNE : north-north-east, ESE : east-southeast, SSE : south-southeast, SSW : south-south-west, WSW : south-southwest, WWN : west-north-west NNW : north-northwest, N2004 : numbers in 2004, N2006 : numbers in 2006.

choice of materials of its nest on Agueli probably reflected the variety of local resources and the same is true on the island of Tigzirt, located 94 km far from Agueli, near the city of Tigzirt where Talmat (2005) recorded the use of 31 plant species. On the contrary, in urban areas of Bejaia, Moulai et al. (2005) found that four species plants (*Eucalyptus camaldulensis*, *Oryzopsis miliacea*, *Fraxinus angustifolia* and *Ceratonia siliqua*), a small quantity of material in the nests, while anthropogenic materials (wool, synthetic fibers, bones, remnants of egg shells) were dominant. In general, Yellow-legged Gull, like all Larides build their nests with what there is nearby (Isenmann, 1976; Launay, 1983, 1985).

The Yellow-legged Gull has greatly increased its density in the non-breeding wetland of Reghaia since 1990, when 42 individuals were counted (Doumandji et al., 1990). However, the breeding population of the island has little changed at Agueli, with few nests in 2006 due to human activities. The stability in numbers probably indicates that the islet is fully occupied. Large variations

in numbers observed during the year in the wetland of Reghaia are probably due to the arrival of wintering birds in the autumn, which left the area in March.

Although eight times smaller than Agueli (3 428 m instead of 29 705), the islet of Tigzirt holds 110 nests of Yellow-legged Gull, mainly concentrated in its centre (Talmat, 2005) (Figures 3 and 4). This difference may be partly explained by the form of Tigzirt, which has more suitable nesting habitat, protected from westerly winds and at less than 180m from the coast. As a result, Tigzirt has a larger vegetation cover than Agueli, comprising two strata, herbaceous and shrub (Table 1). This vegetation is associated with more boulders, allowing birds build nests with shelter (Talmat 2005). Talmat (2005) showed that the level of nest protection was generally high, often reaching and even exceeding the value 5.

Since the late 90's, the Yellow-legged Gull began to colonise the roofs of houses in various coastal towns on the Algerian coast, such as Oran, Algiers, Tigzirt, Bejaia and Jijel (Moulai, 2002; Talmat, 2002; Moulai and Doumandi,

Table 5. Comparison between the average inter-nests distances measured at some islands of the Algerian coast.

Average distance (in m)					
Agueli Islet (2006)	Cap Carbon	Sahel Islet	Pisans Island	El Auch Islet	Tigzirt Islet (2003)
22, 23 + 20, 41 (83, 3 - 2, 35)	11, 84 + 12, 83 (1, 8 - 5, 4)	14, 30 + 10, 78 (1, 2 - 40, 3)	8, 01 + 7, 63 (1, 7 - , 40)	9,55 + 7, 80 (2, 1 - 30)	5, 50 + 3, 12 (1, 1 - 16)
22, 2 + 20, 4 (83,36 - 2, 4)	11, 8 + 12, 8	14, 3 + 10, 8	8 + 7, 6	9, 6 + 7,8	5, 5 + 3, 1
	(1, 8 + 5, 4)	(1, 2 - 40, 3)	(1, 7 - 4)	(2, 1 - 30)	(1, 1 + 3)
Ouarab et al., (2009)	Moulai et al., 2006				Talmat 2005

The first value is the average; the second is the gap - then values in brackets are the value maximum and minimum distances average inter-nest.

Table 6. First observation of urban nesting in Yellow-legged Gull and several sites in Europe.

City	Year	Number of nests	References
Algerie			
Oran	2000	5	Moulai et al., 2005
Alger	2001	3	Moulai et al., 2005
Tizgirt	2003	1	Moulai et al., 2005
Bejaia	1999	1	Moulai et al., 2005
Jijel	2000	2	Moulai et al., 2005
INA	2006, 2007	1	Ouarab, Pers. Obs.
France	1984,	21700	Launay,1984;
	1996, 2001	24 and 27 (267 and 332 °C.) couples (pairs)	Vidal et al., 2004
Reste of Europe	1970 and 1980	/	Sommani, 1980; Carrera et al. 1981; Vidal et al. 2004

INA : Institut National Agronomique El Harrach, near Algiers.

Doumandji, 2003; Moulai et al., 2005, 2006). In early 2000, Moulai et al. (2005) counted, from west to east, five couples in Oran city, three in Algiers, one in Bejaia and Tigzirt and two in Jijel. This settlement was started later in Algeria than in Europe, where it began in the late 70s or early 80s depending on the localities (Sommani, 1980; Carrera et al., 1981; Vidal et al., 2004). In France, between 1996 and 2001, there were between 24 and 27 urban settlements of Yellow-legged Gull

along the Mediterranean coast, with 267 - 332 pairs. At the same time, two to six urban pairs were found in various sites of the interior (Vidal et al., 2004).

Moulai et al. (2005) suggested that the colonization of urban areas by the Yellow-legged Gull could result from the saturation of traditional nesting sites. The saturation in the number of nests on Agueli and Tigzirt in recent years may support this hypothesis. The delay at colonizing in

cities in Algeria compared to those in Europe may be that the available sites were saturated later along the Algerian coast, but the fact that people collected eggs for food (SO, obs. pers.) may have also played a role in limiting the growth of populations.

The wintering birds are probably attracted to the wetland Reghaia by food resources, particularly landfills, which have proliferated in recent decades with increasing human population of the

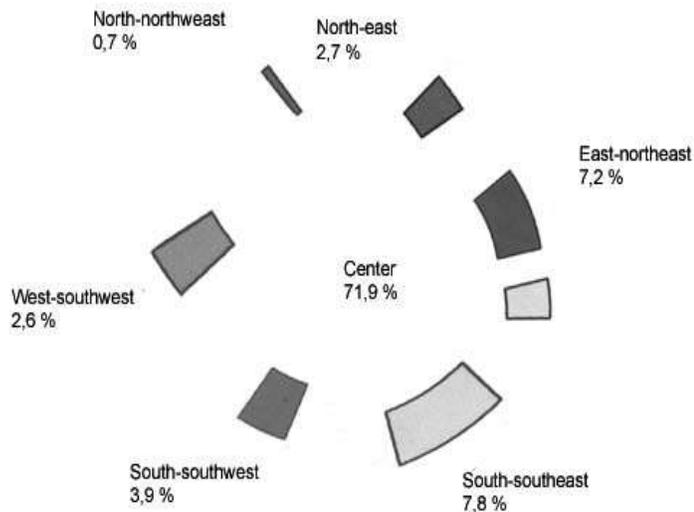


Figure 4. Percentage of exposures nests of Yellow-legged Gull at Tizgirt islet in 2003.

human population of the surrounding communities of Rouiba, Ain Taya and Reghaia. In addition, they greatly benefited from the waste discarded by fishing boats.

Eutrophication of the lake by the effluent from a detergent factory and release of agglomerations surrounding (Bouam, 1989; Adjerid, 2000) did not seem much hinder the expansion of the Yellow-legged Gull so far and indeed water status of the lake has improved somewhat due to the installation in the 1990s, a system for mixing and oxygenation, as evidenced by the Archives Center Reghaia hunting. According to these documents, the drop in the 1980s of several species of fish, including carp have probably made the lake more attractive to the gulls.

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