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Changes in Yellow-legged Gull (*Larus michahellis* (Naumann, 1840)) diet in urban area of Tigzirt (Kabylian southern shore of Mediterranean Sea), Algeria.

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ABSTRACT
The Yellow-legged Gull's diet (*Larus michahellis*) was studied by analyzing 170 pellets of adults collected on roofs of buildings and houses in Tigzirt city (urban area), from 2013 to 2015. The direct dietary analysis study has resulted in the identification of 65 food items. The dietary diversity of the Yellow-legged Gull in urban area was found to be richer in inorganic than organic items. The proportion of "other remains" in pellets of Yellow-legged Gull adults in Tigzirt is the largest during these three years of observation with 39.53%, 45.09% and 43.73% respectively, followed by the food category represented by meat remains (31.4% in 2013; 17.14% in 2015), and vegetation remains ranking last (10.65% in 2014). With regard to the foraging habitat and nesting urban pairs, it appears that Yellow-legged Gulls of Tigzirt city (southern shore of the Mediterranean Sea) seem to be significantly dependent on landfills.

KEYWORDS: Urban area; Tigzirt (Kabylian southern Mediterranean shore); diet; landfill; Yellow-legged Gulls.

INTRODUCTION

In Mediterranean basin, Yellow-legged Gull (*Larus Michahellis*) colonies have increased over the past forty years, particularly in the occidental northern shore [37]. Its strongly plastic breeding habitat characterizes this seabird species, thus they can colonize both in lagoon environment and banks of the river; on rocky islets and urban littoral area [17]. Demographic growth in Mediterranean coasts continued with an urban colonization [39]. [38] realized a study of this new habitat behavior of Yellow-legged Gulls and counted 300 breeding pairs, which colonized more than ten buildings in French towns. It's in Menton (town in south of France) in 1984, for the first time that a colonization by Yellow-legged Gull of a city had been noted.

Two factors have been exposed to explain this rapid demographic explosion of Laridae colonies: on the one hand, human activities like fish remains of trawlers and household garbage, and protected measures to nesting sites [4, 7, 28, 33, 10]. According to [9], absence of recent exhaustive survey about urban colonies in France,

more than forty (Mediterranean and Atlantic littoral, and continental France) don't allow to actualize amount of nesting pairs of Laridae in urban area.

In Algeria, urban nesting of Yellow-legged Gulls can be proved in seven coastal cities (West to East of southern shore of Mediterranean Sea): Oran, Alger, Tigzirt, Bejaïa, Jijel, Skikda and Annaba [24]. In Kabylie, in Tigzirt city, the breeding of Yellow-legged Gulls is observed since 2005 [34].

This study is intended to analyze annual changes of adult Yellow-legged Gull trophic diet in Tigzirt city (urban area) during three years (2013, 2014, 2015). This study seems to be the first research in southern shore of Mediterranean, particularly in Algeria, about this subject.

Study area:

For this study, we carried out our focus on Tigzirt, a coastal city in Kabylian area (36°53' N, 4°08' E), situated ca. 38 kilometers from the northern of Tizi Ouzou region (Wilaya). With its 35 kilometers of coastline, this town opens towards the Mediterranean with its long, sandy beaches and its fishing port and marina. In the south, there are the first hills of the Tellian Atlas, in the west Mizrana Forest, and the east is characterized by Iflissen region with mountainous terrain, ranging from about 100 to 700 m (Fig.1).

Tigzirt downtown's surface area is 45 km2 with a population of 5.958 people that is increasing at a rate of 2.6 % a year and where there is approximately a hundred buildings, which reach up to 20 meters [32].

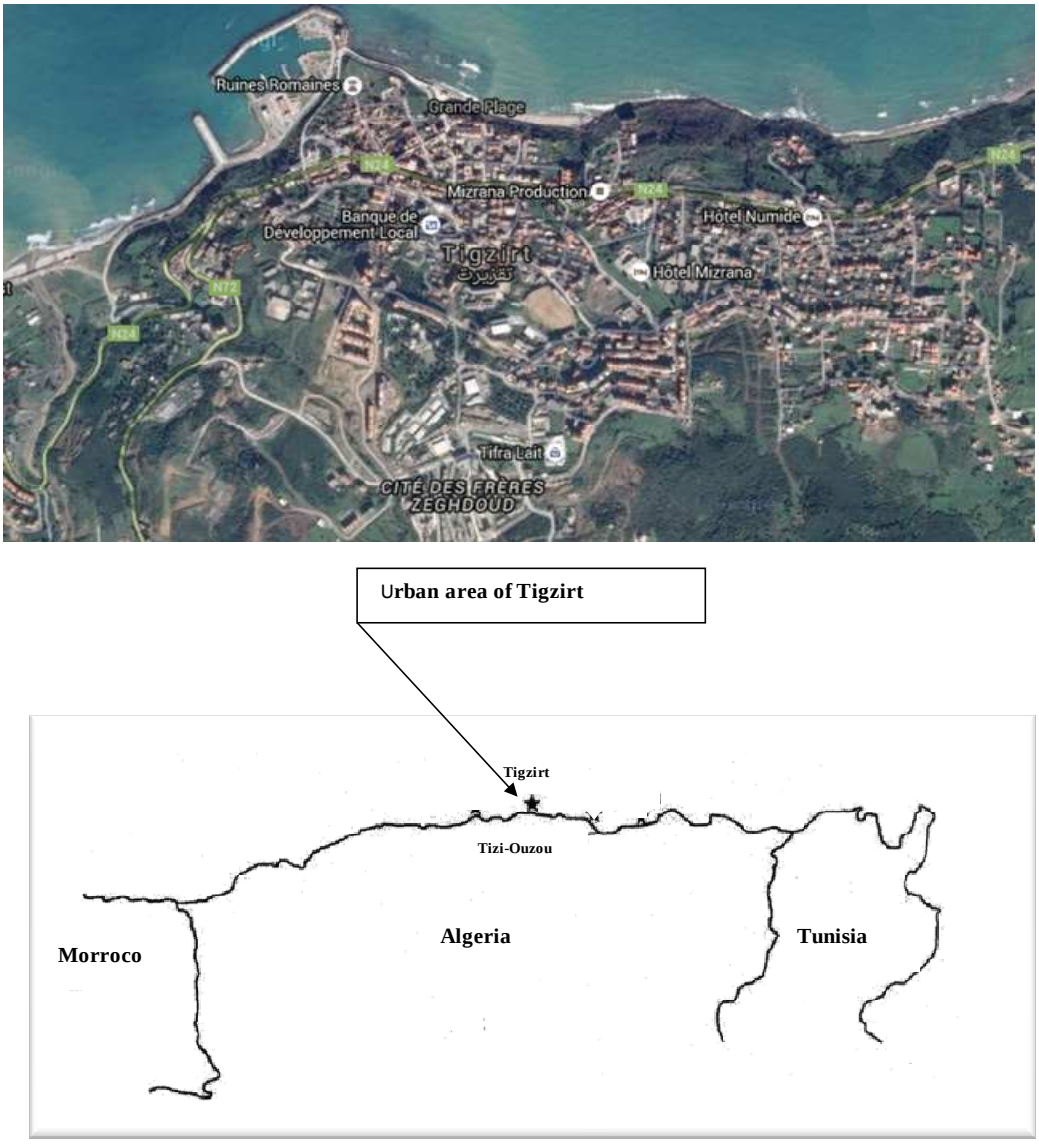

Fig. 1: Geographical location of the Yellow-legged Gull's (*L. michahellis*) on urban area of Tigzirt, Algeria.

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MATERIALS AND METHODS

The current study of *L. michahellis* diet was based on the analysis of adults' pellets. Pellets were collected from the urban colony in Tigzirt during the breeding period between February and May, over a period of three years (2013, 2014, and 2015). Respectively, twenty-nine, forty-six and ninety-five pellets were sampled each year on the roofs of houses. It's often difficult to find the pellets on buildings. However, this continued increase in our sampling can be explained by the increase of Yellow-legged breeding pairs with 25, 38 and 51, in our area of study.

Regurgitated pellets were collected into paper bags with affixed labels containing information on the number of pellets, their sampling date, and location. These bags were transported and stored in the laboratory. Then, pellets were placed in a Petri dish and diluted with water to facilitate their handling. After that, pellets were shelled using two pairs of entomological pliers. Under a binocular microscope, the pellets were divided into constituent fragments and sorted. Detached fragments were collected and arranged in a gridded Petri dish, each one marked again with the number of pellets, sampling date and location.

Finally, we proceeded with the identification and quantification of prey species, based on reference collections and specialized literature. Thus, remains in pellets of regurgitation allowed us to determinate seven categories of remains, such as terrestrial and marine vertebrates, terrestrial and marine invertebrates, plant remains, meat remains and the last class is this of other remains, which brings to our notice [25, 26].

Results:

The study of 170 regurgitation pellets of *L. michahellis*, collected from 2013-2015, in Tigzirt city, revealed the existence of 71 food items (Appendix 1). The diversity of food items identified was divided into seven food categories: terrestrial and marine vertebrates, terrestrial and marine invertebrates, meat and plant remains, and the last category comprising "other remains" (Table 1).

The year 2015 represents the highest total abundance, with 46 food items and 6.74 items per pellet and the least was recorded in 2013, with a total abundance of 22 and only 3.91 items. It is evident from Table 1 that the category of other remains is better represented during the 3-year period in the diet of adults Yellow-legged Gull resident in Tigzirt's urban area. From 2013 to 2015, other remains amounted to 39.53%, 45.09% and 43.87%. It is followed by the category of meat remains in 2013 with 31.4% and in 2015 with 20.55% but in 2014, the second position is occupied by plant remains with 19.65%. For the third position, there is a high volatility, because we found in 2013, 11.63% of plant remains in our samplings. However, in 2014 it is marine vertebrate that occupied this third position with 14.45% whereas in 2015, we recorded terrestrial invertebrates with 15.34% of frequency. We realized via our study that terrestrial invertebrates are not insignificant. With 9.30% in 2013 and 6.94% in 2014, they occupied the fourth position in the diet of urban resident Yellow-legged Gull. In 2015, this fourth position was obtained by the category of plant remains.

For years 2013 and 2015, the part of marine and terrestrial vertebrates just as well marine invertebrates are poorly represented in our data. In 2014, categories of meat remains, terrestrial vertebrates and marine invertebrates that are much less in diet of urban Yellow-legged Gull (tab.1).

With occurrence frequencies of 93.10%, 31.03% and 24.81%, respectively for 2013, 2014 and 2015, meat remains were the better food items represented in the diet of our seabirds in Tigzirt city. Inorganic remains in pellets sampled in the same period of time varied from 12.22 % to 33.62%. In 2013, adults urban Laridae pellets of regurgitations are poorly composed by plant remains and terrestrial invertebrates, whereas in 2014 and 2015, the least represented are marine vertebrates, terrestrial invertebrates and plant remains. Finally, from 2013 to 2015, our samplings contain relatively little marine invertebrates and terrestrial vertebrates.

Table 1: Frequency of food categories identified in pellets of *L. Michahellis* in Tigzirt city (urban area). Food categories, expressed as centesimal frequency (FC %) and frequency of occurrence (OC %).

Years	2013		2014		2015	
Food categories	AR%	C%	AR%	C%	AR%	C%
Terrestrial invertebrates	9.30	6.90	6.94	10.35	15.34	4.27
Marine invertebrates	1.16	3.45	4.05	4.83	1.53	1.85
Terrestrial vertebrates	1.16	3.45	4.62	5.52	1.84	1.33
Marine vertebrates	5.81	8.62	14.45	21.55	7.16	7.78
Meat remains	31.4	93.1	5.2	31.03	20.55	24.81
Plant remains	11.63	5.75	19.65	10.54	8.28	4.29
Other remains	39.53	16.75	45.09	33.62	43.87	12.22
Average diversity	3.91		4.02		6.74	

We notes that scores were not normally distributed (W = 0.42, p-value <2.2e-16). Therefore, a nonparametric test is used (Kruskal-Wallis). The Kruskal-Wallis test is a statistical method used for testing samples coming from a common origin. In our study, these are pellets of regurgitation from adult nesting Yellow-legged Gull, collected in Tigzirt urban area from 2013 to 2015.

This test (df = 2, p-value = 4.17e-05) confirms a significant difference between food items in the diet of our seabirds nesting in city according to the 3-year period examined in our study. The scores are classified into two homogenous groups, in which 2015 and 2014 are both in the same group whereas 2013 is in an other one. Next, this test showed a significant difference between food categories (df =6, p-value =0.0001533). These food items are distributed into 3 homogenous groups, where marine vertebrates and inorganic remains are classified in the first homogenous group; the second homogenous group is composed by meat remains and the last homogenous group contains terrestrial invertebrates, plant remains terrestrial vertebrates and marine invertebrates.

Discussion:

The Yellow-legged Gull is known to respect an opportunistic feeding behavior (plants and animal prey) and foraging in marine, agricultural and natural spaces. The analysis of 170 adult *L. michahellis* pellets during the 3-year period (2013-2015) at an urban colony in Tigzirt city (kabylian Coast, Algeria) confirms a high variability of this seabird diet, as is the case with trophic diet of this species in its natural space [20, 3, 6, 16, 12, 26, 27, 11, 2, 21, 36].

The diet composition of Tigzirt urban Yellow-legged Gull appears to be similar for the three years of study. The category of "other remains", specifically inorganic, is mainly represented in its diet. This significant proportion can be explained by the municipal landfill, located within less than 300 m from urban colony of Laridae. Our results agree with the results of [24] on landfill of Bejaïa and by [7]; [33]; [13] ; [26] ; [27] ; [35] ; [15]; [35] ; [1] and [10].

[30] noted that owing to the generalist and opportunistic feeding habits of the Yellow-legged Gull, it is reasonable to assume that the availability of these resources makes a considerable contribution to the expansive dynamics of its populations in the Mediterranean.

Comparing with other close seabird species, like Herring Gull, *Larus argentatus*, [19, 5, 29] or Ring-billed Gull, *Larus delawarensis*, [8], wastes from landfills composed with a significant share the diet of these nesting gulls.

It has been demonstrated that a significant inverse correlation between landfill accessibility and foraging on terrestrial habitats [14], underlining the influence of landfill accessibility on the characteristics of the chick's diet.

Wild animals get well-known reservoirs of Campylobacter and Salmonella. The influence of insalubrious diets on the prevalence of both enterobacteria in seagulls is investigated. So, campylobacter occurrence in Gull chicks sampled along the north eastern Iberian coast was directly related to the degree of refuse consumption. Thus, Campylobacter and Salmonella spp. are the leading causes of zoonotic enteric infections, in developed and developing countries, and their incidence is increasing even in countries with adequate public health surveillance [31]. In addition, [22] draws our attention to the prevalence of Campylobacter spp. in a subset of wild bird species, including gulls, and found that C. jejuni prevalence was greatest in the Laridae. *Campylobacter* infections are among the most common bacterial infections in humans and responsible for the majority of bacterial foodborne illnesses like gastroenteritis, usually due to the consumption of undercooked poultry. Research on which avian species transmit the bacterium is limited, especially in the US. [23], in their study, sampled wild birds in three families—Anatidae, Scolopacidae, and Laridae in eastern North America to determine the prevalence and specific strains of Campylobacter. Again, [18] specified that Salmonella enterica serovar Newport pattern JJPX01.0061 has been identified as causing several multistate outbreaks in the last 10 years, primarily due to contamination of tomatoes grown in Virginia (USA). It would therefore be valuable to realize a public health survey associated with a new research on Yellow-legged Gulls in Tigzirt to characterize this possible threat for the Laridae and population.

In conclusion, we can therefore confirm, with our own study, that the same percentages of food items in the composition of diet during the 3-year period and urban colonization by Yellow-legged Gull in Tigzirt city, on kabylian coast of Algeria, reflect impact of landfills.

This monotonous Yellow-legged Gull diet, which often consists mainly of refuses from landfills, can be dangerous for health of this protected seabirds and for the public health of citizens because Tigzirt is situated between Mediterranean Sea and land? Could this high availability of food derived from human activities create a dependence on landfills? Could Laridae trophic diet and nesting in urban area be affected by exploitation of a sanitary landfill despite of a trend of a current urbanisation in Tigzirt?

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REFERENCES

[1] Alonso, H., A. Almeida, J.P. Granadeiro and P. Catry, 2015. Tempor al and age- related dietary variation in a population of Yellow legged gulls *Larus michahellis*: implication for management and conservation. Eur. J. Wildl. Res. Publisched on line.
[2] Arizaga, R., A. Aldalu, Herrero, J.F. Cuadrado, E. Diez and A. Crespu, 2014. Foraging distance of a resident yellow-legged gull (*Larus michahellis*) population in relation to refuse management on a local scale. *Eur. J. Wildl. Ress*., 60: 171-175.
[3] Beaubrun, P.C., 1988. Le Goéland leucophée (*Larus cachinnans michahellis*) au Maroc. Reproduction, alimentation, répartition et déplacements en relation avec les activités de pêche. Thèse de Doctorat d'état, Univ. Montpelier, pp: 448.
[4] Beaubrun, P.C., 1994. Controllo numerico di una specia in espansione : il Gabbiano reale *Larus cachinnans* in Monbailliu X. e Torre A. - La gestione degli studi ambiente costieri e insulari de Mediterraneo. Ed. Medmaravis, Monbailliu X. e Torre A., Alghero, pp: 353-379.
[5] Belant, J.L., T.W. Seamans, S.W. Gabrey and S.K. Ickes, 1993. Importance of landfills to nesting Herring Gulls. The Condor, 95: 817-830.
[6] Borgo, E. e S. Spano, 1994. Primi data sull Gabbiano reale *Larus cachinnans* all' isola Gallinara (Liguria occidentale). Boll. Mus.Ist.biol.Univ. Genova, 54-55: 91-116.
[7] Bosch, M., D. Oro and X. Ruis, 1994. Dependence of yellow-legged Gulls (*Larus cachinnans*) on food from human activity in two Western Mediterranean colonies. Avocetta, 18: 135-139.
[8] Brousseau, P., J. Leffebvre and J.F. Giroux, 1996. Diet of Ring-billed Gull chicks in urban and non urban colonies in Quebec. Colonial Waterbirds, 19: 22-30.
[9] Cadiou, B., 2011. Cinquième recensement national des oiseaux marin nicheurs en France métropolitaine 2009-2011. Groupement d'intérêt scientifique oiseaux marins. pp: 60.
[10] Castège, I., E. Milon, Y. Lallane and J. d'Elbée, 2015. Colonization of the Yellow-legged gull in the southeastern Bay of Biscay and efficacy of deterring systems on landfill site. In press
[11] Ceia, F.R., V.H. Paiva, V. Fidalgo, L. Morais, A. Baeta, P. Crisóstomo, E. Mourato, S. Garthe, J.C. Marques and J.A. Ramos, 2014. Annual and seasonal consistency in the feeding ecology of an opportunistic species, the yellow-legged gull *Larus michahellis*. *Mar. Ecol. Prog. Ser*., 497: 273-284.
[12] Duhem, C., E. Vidal, J. Legrand and T. Tatoni, 2003. "Opportunistic feeding responses of the Yellow-legged Gull *Larus michahellis* to Accesibility of Refuse Dumps: The Gulls Adjust their Diet Composition and Diversity according to Refuse Dump Accessibility." *Bird Study*, 50: 61-67.
[13] Duhem, C., 2004. Goélands surabondants et ressources alimentaires anthropiques : cas de colonies insulaires de Goélands leucophées du littoral provençal. Thèse doctorat Biosc., Univ.Paul Cezane, pp: 181.
[14] Duhem, C., E. Vidal, P. Roche, & J. Legrand, 2005. How Is the Diet of Yellow-legged Gull Chicks Influenced by Parents' Accessibility to Landfills? Waterbirds, 28(1): 46-52.
[15] Galarza, A., A. Herrero, J.M. Domínguez, A. Aldalur and J. Arizaga, 2012. Movements of Mediterranean Yellow-legged Gulls *Larus michahellis* to the Bay of Biscay. Ringing & Migration, 27(1): 26-31.
[16] Gonzales-solis, J., X. Ruiz and L. Jover, 1997. Influence of food availability on interactions between *Larus cachinnans* and *L. audouinii*. *Cana. J. Zool*., 75: 719-724.
[17] Goutner, V., 1992. Habitat use in Yellow-legged Gull (*Larus cachinnans michahellis)* in coastal wetland colonies of North-East Greece. *Avocetta*, 16: 81-85.
[18] Gruszynski, K., S. Pao, C. Kim, D. M. Toney, K. Wright, A. Colón, T. Engelmeyer and S.J. Levine, 2014. Evaluating Gulls as Potential Vehicles of Salmonella enterica Serotype Newport (JJPX01.0061) Contamination of Tomatoes Grown on the Eastern Shore of Virginia. Appl. Environ. Microbiol., 80(1): 235-238.
[19] Hunt, J.L. Jr., 1972. Influence of food distribution and human disturbance on the reproductive success of Herring Gulls. Ecology, 53: 1051-1061.
[20] Isenmann, P., 1976. Contribution à l'étude de la biologie de la reproduction et de l'écologie du Goéland argenté à pieds jaunes (*Larus argentatus michahellis*) en Camargue. *Rev.Ecol. (Terre Vie*), 30: 551-563.
[21] Jordi, O.A., A. Herrero, Aldalur, J.F. Cuadrado and J. Arizaga, 2014. The impact of non– local birds on yellow–legged gulls (*Larus michahellis*) in the Bay of Biscay: a dump–based Assessment. Animal Biodiversity and Conservation, 37(2): 183-190.
[22] Keller, J.I., W.G. Shriver, J. Waldenstrom, P. Griekspoor and B. Olsen, 2011. Prevalence of Campylobacter in wild birds of the Mid-Atlantic region, USA. J Wildlife Dis 47: 750-754.
[23] Keller, J.I. and W.G. Shriver, 2014. Prevalence of three campylobacter species, *C. jejuni*, *C. coli* , and *C.lari* , using multilocus sequence typing in wild birds of the mid-atlantic region, USA. *J.Wildlife Dis*., 50(1): 31-41.
[24] Moulaï, R ., N. Sadoul and S. Doumandji, 2005. Nidification urbaine et à l'intérieur des terres du Goéland leucophée en Algérie. *Alauda*, (73): 35-40.

[25] Moulaï, R., 2006. Bioécologie de l'avifaune terrestre et marine du Parc National de Gouraya (Béjaia), cas particulier du Goéland leucophée, *Larus michahellis* Naumann, 1840.Thèse de doctorat d'état en sciences agronomique, Inst. nati.agro., El-Harrach, pp: 146.
[26] Moulaï, R., S. Doumandji and N. Sadoul, 2008. Impact des décharges d'ordures ménagères sur le régime alimentaire du goéland leucophée *Larus michahellis* dans la région de Béjaia (Algérie). Rev. Écol. (*Terre Vie*), 63: 239-250.
[27] Moulaï, R. and A. Bougaham, 2010. Place des déchets ménagers dans l'alimentation du Goéland leucophée, *Larus michahellis* de la région de Jijel (Algérie). Proceedings of the International Conference on « Biodiversity of the Aquatic Environment » 13-15 December 2010, Lattakia, Syria. BAE Conference-INOC, 2010. Ed. A. Chouikhi & A. Saad, pp: 600-610.
[28] Oro, D., M. Bosch, & X. Ruiz, 1995. Effects of a trawling moratorium on the breeding success of the yellow-legged Gull *Larus cachinnans*. *Ibis*, 137(4): 547-549.
[29] Pons, J.M., 1994. Feeding strategies of male and female Herring Gulls during the breeding season under various feeding conditions. Ethology Ecology and Evolution, 6: 1-12.
[30] Ramos, R., F. Ramırez, C. Sanpera, L. Jover and X. Ruiz, 2009. Diet of Yellow-legged Gull (*Larus michahellis*) chicks along the Spanish Western Mediterranean coast: The relevance of refuse dumps. J Ornithol, 150: 265-272.
[31] Ramos, R., M. Cerda-Cuellar, F. Ramírez, L. Jover and X. Ruiz, 2010. Influence of Refuse Sites on the Prevalence of Campylobacter spp. And Salmonella Serovars in Seagulls. Applied and environmental microbiology, 76(9): 3052-3056.
[32] RGPH, (Recensement General de la Population et de l'Habitat). 2008. *"Armature urbaine." Technical Directorate for Regional Agricultural Statistics and Cartography*. Statistical Collection, Series: Social Statistics 163/2001.
[33] Sol, D., J.M. Acros and J.C. Senar, 1995. The influence of refuse tips on the winter distribution of yellow-legged Gulls Larus cachinnans. Birds study, 42: 216-221.
[34] Talmat, N., 2005. Bioé-écologie et régime alimentaire du Goéland leucophée (*Larus michahellis*) dans la région de Tigzirt en grande Kabylie. Dipl.Magister.sci.agro., Inst. Nati.agro., EL -Harrach, pp: 165.
[35] Talmat-Chaouchi, N., M. Boukhemza and R. Moulaï, 2014. Comparative analysis of the Yellow-legged Gull's (*Larus michahellis* (Naumann, 1840)) trophic ecology in two colonies of the Central Coast of Algeria. Zoology and Ecology, 24(4): 324-331.
[36] Talmat-Chaouchi, N., 2015. Biologie De la reproduction et écologie trophique du Goéland leucophée *Larus michahellis* (Naumann, 1840) en Kabylie et dans l'Algérois (Algérie). Thèse de doctorat. Université de Mouloud Mammei de Tizi-Ouzou, pp: 139.
[37] Thibault, J.C., R. Zotier, I. Guyot and V. Bretagnole, 1996. Recent trends inbreeding marine birds of the Mediterranean region with special reference to Corsica. Colonial, Waterbirds, 19: 31-40.
[38] Vidal, E., C. Duhem, P.C. Beaubrun and P. Yesou, 2002. Goéland leucophée *Larus michahellis. In : Oiseaux marins nicheurs de France métropolitaine (1960-2000)* (Cadiou, B., J.M. Pons, & P. Yésou, Coord.), Rapport au Ministère de l'aménagement du territoire et de l'environnement. G.I.S. Oiseaux Marins, Muséum National d'Histoire Naturelle, Paris, pp: 75-79.
[39] Yesou, P., 2003. Les goélands du complexe *Larus argentatus-cachinnans-fuscus :* où en est la systématique ? *Ornithos*, 10(4): 144-181.

Appendix 1: Frequency of food items identified in regurgitation pellets of *L. michahellis* in urban area of Tigzirt (Kabylian Mediterranean coast, Algeria), from 2013 to 2015, expressed as centesimal frequency (AC %) and frequency of occurrence (OC %).

Food Categories	Years / Food items	2013			2014			2015		
		Ni	AR%	OC%	Ni	AR%	OC%	Ni	AR%	OC%
Terrestrial invertebrates	Insects sp. ind.	4	4,65	13,8	8	4,62	27,59	16	4,91	17,78
	Coleoptera sp_1. ind.	2	2,33	6,9	1	0,58	3,45	5	1,53	5,56
	Coleoptera sp_2. ind.	-	-	-	-	-	-	2	0,61	2,22
	Coleoptera sp_3. ind.	-	-	-	-	-	-	1	0,31	1,11
	Carabidae sp_1. ind.	1	1,16	3,45	-	-	-	4	1,23	4,44
	Carabidae sp_2. ind.	-	-	-	-	-	-	4	1,23	4,44
	Aphaenogaster testaceo pilosa	1	1,16	3,45	2	1,16	6,9	3	0,92	3,33
	Pheidole pallidula	-	-		1	0,58	3,45	-	-	-
	Tetramorium biskrensis	-	-	-	-	-	-	1	0,31	1,11
	Componotus sp. ind.	-	-	-	-	-	-	3	0,92	3,33
	Messor sp. ind.	-	-	-	-	-	-	3	0,92	3,33
	Crematogaster sp. ind.	-	-	-	-	-	-	1	0,31	1,11
	Formicidae. Ind.	-	-	-	-	-	-	6	1,84	6,67
	Hemiptera sp. Ind.	-	-	-	-	-	-	1	0,31	1,11
Marine invertebrates	Lamellibranchia sp_1. ind.	-	-	-	1	0,58	3,45	2	0,61	2,22
	Lamellibranchia sp_2. ind.	-	-	-	1	0,58	3,45	-	-	-
	Lamellibranchia sp_3. ind.	-	-	-	1	0,58	3,45	-	-	-
	Lamellibranchia sp_4. ind.	1	1,16	3,45	2	1,16	6,9	1	0,31	1,11

	Gasteropoda sp. ind.	-	-	-	2	1,16	6,9	-	-	-
	Sepia officinalis	-	-	-	-	-	-	2	0,61	2,22
Terrestrial vertebrates	*Erithacus rebicula*	-	-	-	-	-	-	1	0,31	1,11
	Aves sp_1. ind.	1	1,16	3,45	-	-	-	1	0,31	1,11
	Aves sp_2. ind.	-	-	-	2	1,16	6,9	1	0,31	1,11
	Aves sp_3. ind.	-	-	-	2	1,16	6,9	-	-	-
	Aves sp_4.ind.	-	-	-	2	1,16	6,9	-	-	-
	Columbidae sp. ind.	-	-	-	1	0,58	3,45	2	0,61	2,22
	Passer sp. ind.	-	-	-	1	0,58	3,45	-	-	-
	Passeriforms sp.ind.	-	-	-	-	-	-	1	0,31	1,11
Marine Vertebrates	*Pisces* sp_1. ind.	2	2,33	6,9	7	4,05	24,14	7	2,15	7,78
	Pisces sp_2. .ind.	-	-	-	5	2,89	17,24	6	1,84	6,67
	Pisces sp_3 ind.	-	-	-	4	2,31	13,79	4	1,23	4,44
	Sardina pilchardus	3	3,49	10,3	9	5,2	31,03	11	3,37	12,22
Meat remains	*Gallus domesticus*	27	31,4	93,1	9	5,2	31,03	65	19,94	72,22
	Bones of bovidae	-	-	-	-	-	-	1	0,31	1,11
	Felis catus	-	-	-	-	-	-	1	0,31	1,11
Plant remains	*Zea mays*	5	5,81	17,2	3	1,73	10,34	6	1,84	6,67
	Fruit sp_1. ind.	1	1,16	3,45	4	2,31	13,79	-	-	-
	Fruit sp_2. ind.	-	-	-	2	1,16	6,9	-	-	-
	Fruit sp_3. ind.	-	-	-	1	0,58	3,45	-	-	-
	Fruit sp_4. ind.	-	-	-	2	1,16	6,9	-	-	-
	Fruit sp_5. ind.	-	-	-	1	0,58	3,45	-	-	-
	Fruit sp_6. ind.	-	-	-	1	0,58	3,45	-	-	-
	Fruit sp_7. Ind.	-	-	-	1	0,58	3,45	-	-	-
	Fruit sp_8. ind.	-	-	-	2	1,16	6,9	-	-	-
	Poaceae sp. ind.	1	1,16	3,45	7	4,05	24,14	-	-	-
	Solanum lycopersicum	-	-	-	3	1,73	10,34	-	-	-
	Allium sativum	-	-	-	2	1,16	6,9	-	-	-
	Allium cepa	-	-	-	1	0,58	3,45	-	-	-
	Malus domestica	-	-	-	1	0,58	3,45	-	-	-
	Citrus sp. ind.	-	-	-	1	0,58	3,45	1	0,31	1,11
	Cucumis sp. ind.	-	-	-	-	-	-	1	0,31	1,11
	Triticum sp. ind.	-	-	-	-	-	-	3	0,92	3,33
	Capsinum sp. ind.	-	-	-	-	-	-	3	0,92	3,33
	Seed sp. ind.	-	-	-	-	-	-	3	0,92	3,33
	Olea europea	1	1,16	3,45	2	1,16	6,9	10	3,07	11,11
	Anthemis nobilis	1	1,16	3,45	-	-	-	-	-	-
	Dicotelydone sp ind.	1	1,16	3,45	-	-	-	-	-	-
Other remains	Fragment of eggshell	2	2,33	6,9	25	14,5	86,21	31	9,51	34,44
	Human hairs	2	2,33	6,9	11	6,36	37,93	28	8,59	31,11
	Pebbles	16	18,6	55,2	-	-	-	35	10,74	38,89
	Paper	3	3,49	10,3	20	11,6	68,97	-	-	-
	Plastic	7	8,14	24,1	5	2,89	17,24	28	8,59	31,11
	Synthetic fiber	3	3,49	10,3	5	2,89	17,24	2	0,61	2,22
	Glass	1	1,16	3,45	6	3,47	20,69	7	2,15	7,78
	Foil	-	-	-	1	0,58	3,45	6	1,84	6,67
	Soap	-	-	-	5	2,89	17,24	-	-	-
	Tar	-	-	-	-	-	-	3	0,92	3,33
	Fer	-	-	-	-	-	-	1	0,31	1,11
	Sticky tape	-	-	-	-	-	-	1	0,31	1,11
	Rubber band	-	-	-	-	-	-	1	0,31	1,11
		86	100		173	100		326	100	