

BIRD COMMUNITY AT 2006-2007 IN NEW DAMIETTA

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ABSTRACT

In order to make a decision involving the environment and the wildlife it contains, it is necessary to first obtain some ideas of species present, and their characters and abundance.

Based on our knowledge, this study was the first to survey resident and migratory birds in New Damietta regions. Birds were surveyed from beginning of March, 2006 to the end of February, 2007. Sixty six species were censused, they were belonged to 12 orders and 27 families. The recorded species were 26 of resident breeding birds, 15 species of passage migrants, and 25 species of winter visitors.

A new record was found in the present study that is Great-Backed Gull, *Larus marinus*. It is a winter visitor bird species. With the reclamation of this area, it is expected a great change in its bird community, especially the species related to human either resident or migratory. Collectively, a more thorough knowledge of bird community will be needed to determine how species might be affected with reclamation of New Damietta region specially the coastal area and to identify species that may require special attention for research and management in future.

Keywords: Bird –Resident birds- Migratory birds – New Damietta region

INTRODUCTION

Egypt has a considerable range of habitat and vegetation which support in turn a diversity of fauna. It lies at the junction of four bio-geographical regions: Sahara-Sindian which represented in the vast deserts; Iran- Turanian which occupies a small area in Sinai highlands; Mediterranean which occupies a small area along the Mediterranean coast and afro-tropical. The Nile supports most of the country's wetlands which are some of Egypt's most importance habitat supporting the greater diversity of density of bird species [Baha El Din (1999)].

Egypt has a strategic position geographically along the migration routes of palearctic species which winter in Africa and hence internationally important numbers migrate through Egypt [Porter & Cottridge (2001)].

The first major work on the ornithology of Egypt since Shelly's book (1872) was that of [Meinertzhagen (1930)] which included considerable information not only

on the distribution of birds in Egypt, but also on their habitats. Another work in Egyptian avian fauna was at the book "birds known to occur in Egypt" by [Tharwat (1997)]. Publications dealing with the ornithology of the Red Sea and Eastern Desert are those by [El-Negumi *et al.*, (1950); Goodman (1984); Baha El Din & Saleh (1982) and Saleh (1984)].

Only one study has been taken at Damietta Governorate by SEAM at 2004, this study has reported that 32 resident breeding birds inhabiting the governorate.

In order to make a decision involving the environment and the wild life it contains, it is necessary to first obtain some idea of species present and their abundance. This information can be used to determine possible effects of habitat changes and thus aid in decisions regarding wildlife management, land use, and land development. Bird surveys are the primary tool used to provide valuable information on avian aspects of ecological communities. These surveys can both quantitative and qualitative measures such as species presence, seasonal abundance, migrants, or breeding status.

New Damietta region is considered significant because it provides important habitat for wildlife in the Mediterranean Sea coastal area, but it is also sustaining a considerable amount of human recreation. Due to this overlap of wildlife habitat and human use, as well as the potential for further development, it has become crucial to maintain at least a basic inventory of the wildlife present, including birds, and their ecological requirements.

Study Area:

Fig. (1) a map of Damietta Governorate. New Damietta region is a west northern part of Damietta governorate. It is located between 31° 41' 42" N latitude and 31° 27' 52" E longitude. This region includes Damietta Port and New Damietta City, in addition to their countryside area. The port and the city have been planned on coastline area which is bordered by some scattered marshes (wetland) and dense palm and Guava trees. Hence, this region has the same 4 distinctive habitats of Damietta, which are: marine and coastal habitat (shore of the city), wetland habitat (several scattered marshes neighboring the city), arable land (dense surroundings of palm and Guava trees), urban landscape (New Damietta City).

To represent different habitats, several locations were selected in region of New Damietta as a study area: marine and coastal locations, wetland habitat, urban landscape (building locations, parks and gardens, sub urban locations, cultivated locations).

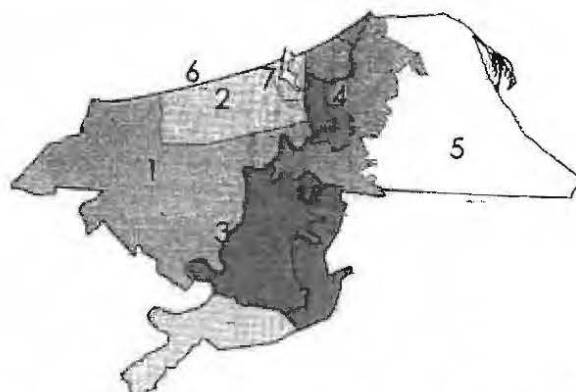


Fig. (1): Map of Damietta Governorate showing New Damietta region [SEAM (2004)].(1) Markaz Kafr Saad,(2)New Damietta region, (3) Fareskour city, (4) Damietta city, (5) Manzala Lake, (6) Mediterranean Sea, and (7) Damietta port.

Materials and Methods

In the present study, a bird survey was conducted for a year; beginning in March, 2006 and ending in February, 2007. This provided 4 seasonal bird surveys; spring, summer, autumn and winter. Each location was visit 2 times monthly.

Observations were conducted on morning of the day (6-9 AM). Additional hours were spent on the site during the same day and the point observations were conducted.

The purpose of these incidental observations was to provide a more complete characterization of the types of birds that inhabit New Damietta region. The birds were identified according to [Tharwat (1997) and Bertel *et al.*, (2004)].

RESULTS

Avian Community Composition:

66 bird species were recorded in different habitats of New Damietta region from the beginning of March, 2006 to the end of February, 2007 Table (1), (2), and (3). They were belonged to 12 orders and 27 families. Based on the number of species, the abundant orders are Passeriformes (25 species), Charadriiformes (16 species), Coraciiformes (6 species),Ciconiiformes(4 species),Gruiformes (4 species),and Columbiformes (4 species), while the other 7 orders (Acciptiformes, Falconiformes,Galliformes,Cuculiformes,Strigiformes,andCaprimulgiformes) were represented by only one or two species. Based on the bird status, the avian community of New Damietta region was distributed into 26 resident species, 15 species of passage migrants, and 25 species of winter visitors in a percent of 39%, 23%, and 38% respectively Fig. (2).

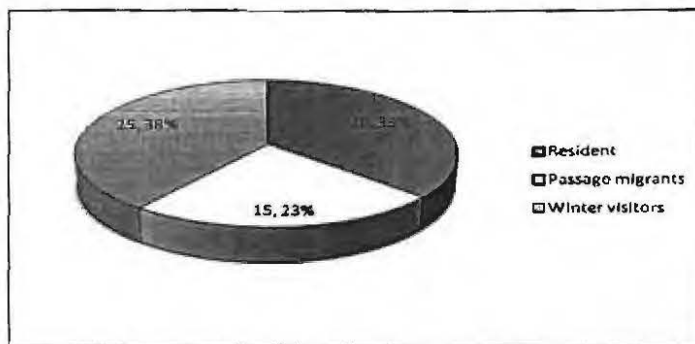


Fig. (2): Distribution of bird community at New-Damietta region censused at March, 2006 to Feb., 2007.

Resident Species:

Of total of 66 censused species, only 26 bird species (39%) were resident birds including 7 bird species of passerines and 19 bird species of non passerines at a percent of 27 % and 73 %, respectively Fig. (3) Table (1) and plate (1). Concerning the resident passerines; according to the bird activity, only one species, great grey shrike, was restricted to the cultivated habitat, while the other 6 species (crested lark, sand Martin, Egyptian barn swallow, hooded crow, common bulbul, and house sparrow) were distributed in different habitats at the city except marine habitat. All passerines, except great grey shrike and sand Martin, were abundant and highly distributed in the sampled habitat and distributed uniformly during different seasons of the year. The most abundant species was house sparrow all over the year, both hooded crow and Egyptian barn swallow increased greatly in summer and spring.

Concerning non passerines; from 19 species, 6 species (Squacco heron, sengel coucal, pied kingfisher, white breasted kingfisher, moorhen, and water rail) were recognized restricted to wetland habitat, 2 species (cattle egret and black winged kite) were restricted to cultivated habitat, 2 bird species, spotted red shank and herring gull, were found in marine habitat, while the other 10 species were found distributed in various habitats. All the resident non passerines were greatly abundant in different habitats and also uniformly distributed all over the year except Squacco heron and Senegal coucal.

Many species were stable during all seasons of the year, while some species such as hoopoe and kestrel increased in summer and spring but decreased slightly in winter and autumn. Cattle egret was noticed in flocks on air, most species were seen in paired or small flocks except kestrel, black-winged kite and both species of kingfisher are usually recorded single. All species are noticed on land, trees, electric wires or dives, except barn swallow was usually in flocks at flight.

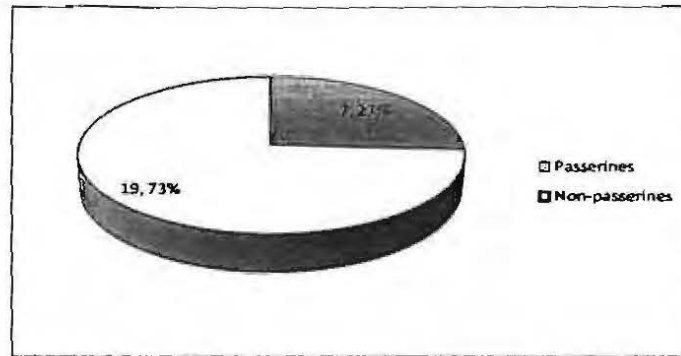


Fig. (3): The percent between resident passerines and resident non-passerines of 26 bird species censused in New-Damietta region (March, 2006 and Feb., 2007).

Passage Migrants:

15 species (23%) of the bird community observed in New Damietta region were passage migrants Table (2) and plate (2). These passage migrants were 9 species from order Passeriformes and 6 ones were non passerines at a percent of 60% and 40%, respectively Fig. (4). All the passage migrants were detected in autumn. Turnstone and sanderling were the first two recorded species which were seen together in flocks. They were actively foraged on small aquatic invertebrates from sandy area of the shore. The rest of passage migrants were observed on vegetation of the sand dunes at coastal habitat. The most abundant species were migratory quail, turnstone, and sanderling, while the rest non passerines including corncrake, nightjar, and European bee eater were very rare. The second abundant group was passerines including Richard's pipit, wheatear, Isabelline wheatear, black-eared wheatear, nightingale, thrush nightingale, while barn swallow, red breasted flycatcher, and red- backed shrike were very rare. All passage migrants were noticed foraging at the shore except European barn swallow was noticed inside the city in urban land habitat.

Table (1): Survey, frequency, and intensity of resident bird species distributed in different habitats at New-Damietta region (March, 2006 to Feb., 2007). M: Marine habitat, Co: Coastal habitat, W: Wetland habitat, Cu: Cultivated habitat, U: Urban landscape, S: status, H: Habitat, I: intensity. Va: Various habitats.

Order	Family	Scientific name	Common name	الإسم باللهجة العربية	S	H	I
Ciconiiformes	Ardeidae	<i>Egretta garzetta</i>	Little egret	البهشون الأبيض	R	W	Rare
		<i>Ardeola ralloides</i>	Squacco heron	الورق الأبيض	R	W	Rare
		<i>Bubulcus ibis</i>	Cattle egret	أبو قردان	R	Va	Abundant
Accipitriformes	Accipitridae	<i>Elanus caeruleus</i>	Black-winged kite	الحداة ذات الجناح الأسود	R	Cu	Rare
Falconiformes	(Falconidae)	<i>Falco tinnunculus</i>	Kestrel	الموسق	R	Va	Rare
Gruiformes	Rallidae	<i>Rallus aquaticus</i>	Water rail	مرعة الماء	R	W	Rare
		<i>Gallinula chloropus</i>	Moorhen	دجاج الماء	R	Co	Rare
Charadriiformes	Charadriidae	<i>Hoplopterus spinosus</i>	Spur-winged plover	الزقراق	R	Va	Common
	Laridae	<i>Larus argentatus</i>	Herring gull	نورس أصفر القدم	R	M	Abundant
Columbiformes	Columbidae	<i>Columba livia</i>	Rock dove	الحمام الطويل	R	Va	Rare
		<i>Columba l. domestica</i>	Feral pigeon	الحمام المنزلي	R	Va	Abundant
		<i>Streptopelia decaocto</i>	Collared dove	الديمام المطوق	R	Va	Abundant
		<i>Columba aegyptiaca</i>	Palm Dove	الديمام البلدي	R	Va	Abundant
Cuculiformes	(Cuculidae)	<i>Cuculus aegypticus</i>	Sengal Coucal	الكوكو	R	W	Scarce
Strigiformes (Strigidae)		<i>Athene noctua</i>	Little Owl	أم قويق	R	Va	Rare
Coraciiformes	Alcedinidae	<i>Ceryle rudis</i>	Pied Kingfisher	سويد السمك الأبقع	R	Co	Rare
		<i>Halcyon smyrnensis</i>	White-breasted Kingfisher	القارند	R	Co	Rare
Passeriformes	Meropidae	<i>Upupa sp</i>	Hoopoe	الهدد	R	Va	Rare
	Alaudidae	<i>Galerida cristata</i>	Crested lark	كثيرة متوجة	R	Va	Rare
	Hirundinidae	<i>Riparia riparia</i>	Sand martin	سلونو	R	Va	Rare
		<i>Hirundo r. savignii</i>	Egyptian barn swallow	عصفور البوطة المصري	R	Va	Common
		<i>Lanius excubitor</i>	Great grey shrike	دقنقش البادية	R	Co	Scarce
	Corvidae	<i>Corvus corone cornix</i>	Hooded crow	الغراب البلدي	R	Va	Common
	Pycnonotidae	<i>Pycnonotus barbatus</i>	Common bulbul	بلبل شاع	R	W,U	Scarce
	Passeridae	<i>Passer domesticus</i>	House sparrow	المصفر الدوري	R	Va	Abundant



Plate (1): photos of respectively resident bird species censused in New Damietta region at March, 2006 to Feb., 2007.

Table (2): Survey, frequency, and intensity of passage migrants distributed in different habitats at New-Damietta region (March, 2006 to Feb., 2007). M: Marine habitat, Co: Coastal habitat, W: Wetland habitat, Cu: Cultivated habitat, U: Urban landscape, S: status, H: Habitat, I: intensity, Va: Various habitat

Order	Family	Scientific name	Common name	الإسم باللغة العربية	S	H	I	
Galliformes	(Phasianidae)	<i>Coturnix coturnix</i>	Migratory quail	السمان	PM	Co	Common	
Gruiformes	Rallidae	<i>Crex crex</i>	Comcrake	مرعة النلة	PM	W	Scarce	
Charadriiformes	Charadriidae	<i>Arenaria interpres</i>	Turnstone	قنبرة الماء	PM	Va	Common	
	Scolopacidae	<i>Calidris alba</i>	Sanderling	المديرون	PM	Va	Common	
Caprimulgiformes	Caprimulgidae	<i>Caprimulgus europaeus</i>	Nighthaw	البخاخ	PM	Co	Scarce	
Coraciiformes	Meropidae	<i>Merops apiaster</i>	European bee-eater	الوروار الأوروبي	PM	Co	Rare	
Passeriformes	Hirundinidae	<i>Hirundo rustica rustica</i>	European barn swallow	عصفور الجنة الأوروبي	PM	U	Rare	
	Motacillidae	<i>Anthus novaeseelandiae</i>	Richard's pipit	أبو أصمية	PM	Co	Scarce	
	Laniidae	<i>Lanius collurio</i>	Red-backed shrike	دقنقش أحمر	PM	Co	Scarce	
	Turdidae		<i>Oenanthe oenanthe</i>	Wheatear	أبلق أبو بلق	PM	Co	Rare
			<i>Oenanthe isabellina</i>	Isabelline wheatear	أبلق أسيوط	PM	Co	Rare
			<i>Oenanthe hispanica</i>	Black-eared wheatear	أبلق أسود الأذن	PM	Co	Rare
			<i>Picedula prava</i>	Red breasted flycatcher	خاطف الذئب أحمر البطن	PM	U	Scarce

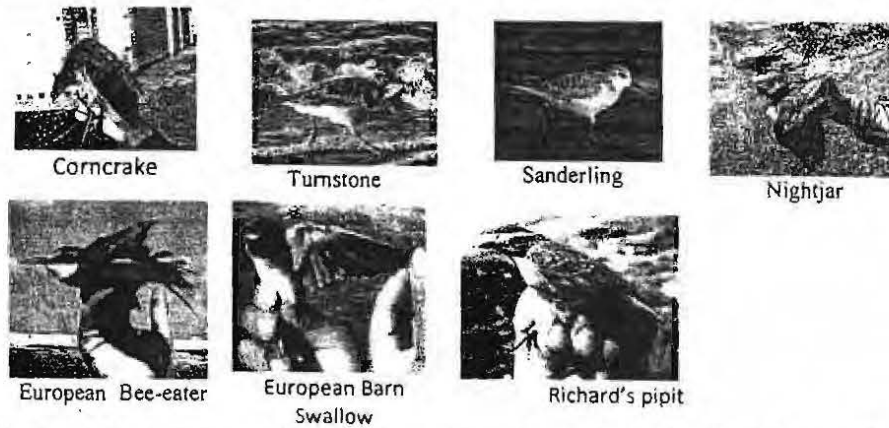


Plate (2): photos of respectively passage migrants censused in New Damietta region at March, 2006 to Feb., 2007

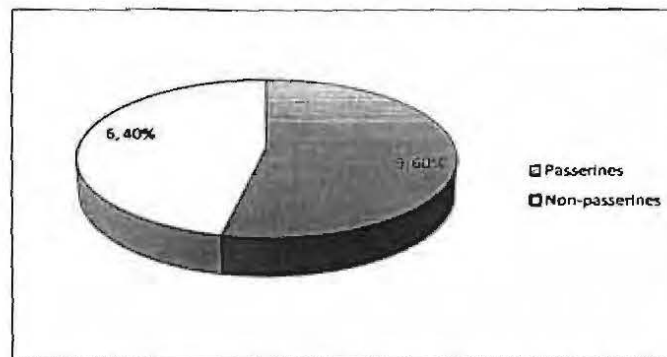


Fig.(4):The percent between non passerine passage migrants and passerine passage migrants of 15 bird species censused in New Damietta region (March, 2006 to Feb., 2007).

Winter Visitors:

Table (3) and plate (3). They were belonged to 6 orders Ciconiiformes, Accipitriformes, Gruiformes, Charadriiformes, Coraciiformes, and Passeriformes, at a percent of 64% of non passerines and 36% passerines Fig. (5). Most of these species were recorded early in September and continued nearly to the end of February. These species were distributed in different habitat based on their foraging habit. All passerines (yellow wagtail, white wagtail, icterine warbler, whinchat, stonechat, and Spanish sparrow) were observed in various habitats except redstart, black redstart, and robin were restricted to urban landscape.

Concerning non passerines, 10 species (Little Ringed Plover, Kentish Plover, Great Black-backed Gull, Lesser Black-backed Gull, Audouin's Gull, Common Gull, Black-headed Gull, Mediterranean Gull, Little Gull, and Sandwich Tern) were restricted to the marine habitat, 3 species (grey heron, marsh harrier, and coot) were restricted to

wetland habitat, stone curlew was restricted to urban landscape, while the rest two species (European kingfisher and European hoopoe) were observed in various habitats

The observation showed that all the winter visitors began to appear nearly at the middle of September and increase gradually to reach high level during the winter and began to decrease again at the beginning of March. The most abundant species were gulls (great black-backed gull, lesser black-backed gull, Audouin's gull, common gull, Mediterranean gull, black-headed gull, and little gull), and plovers (little ringed plover and Kentish plover) but the other species (grey heron, marsh harrier, coot, European kingfisher, and European hoopoe) were very rare. All passerines (yellow wagtail, white wagtail, icterine warbler, whinchat, stonechat, redstart, black redstart, and Spanish sparrow) were abundant except robin.

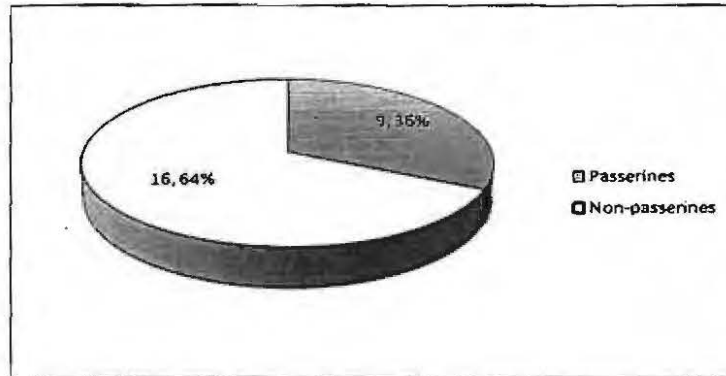


Fig. (5): The percent between winter visitor passerines and winter visitor non passerines of 25 bird species censused in New Damietta region (March, 2006 to Feb., 2007).

Table (3): Survey, Frequency, and intensity of winter visitor bird species distributed in different habitats at New-Damietta region (March, 2006 to Feb., 2007). M: Marine habitat, Co: Coastal habitat, W: Wetland habitat, Cu: Cultivated habitat, U: Urban landscape, S: status, H: Habitat, I: intensity. Va: Various habitats.

Order	Family	Scientific name	Common name	الإسم باللغة العربية	S	H	I
Ciconiiformes	Ardeidae	<i>Ardea cinerea</i>	Grey heron	البنتون الرمادي	WV	W	Scarce
Accipitriformes	Accipitridae	<i>Uleus aeruginosus</i>	Marsh harrier	الفراع	WV	W	Scarce
Grulliformes	Rallidae	<i>Fulica atra</i>	Coot	القر	WV	W	Common
Charadriiformes	Charadriidae	<i>Charadrius dubius</i>	Little-ringed plover	قلقلط بنوح صغير	WV	W	Scarce
		<i>Charadrius alexandrinus</i>	Kenish plover	قلقلط ابو روس	WV	W	Scarce
	Scolopacidae	<i>Tringa erythropus</i>	Spotted red shank	طيطوي أحمر الدناق	WV	M	Rare
	Burhinidae	<i>Burhinus ocbizenens</i>	Stone curlew	الكروان	WV	U	Scarce
	Laridae	<i>Larus marinus</i>	Great black-backed gull	نورس البك	WV	M	Common
		<i>Larus fuscus</i>	Lesser black-backed gull	دجبة نورس	WV	M	Abundant
		<i>Larus audouini</i>	Audouin's gull	أدوين نورس	WV	M	Common
		<i>Larus canus</i>	Common gull	نورس شاع	WV	M	Rare
		<i>Larus melanocephalus</i>	Mediterranean gull	نورس البحر المتوسط	WV	M	Common
		<i>Larus ridibundus</i>	Black-headed gull	نورس أسود الرأس	WV	M	Common
		<i>Larus minutus</i>	Little gull	نورس صغير	WV	M	Rare
	Sternidae	<i>Sterna sandracensis</i>	Sandwich tern	خرشنة	WV	M	Rare
		<i>Alcedo atthis</i>	European kingfisher	صوبد السمك الأوروبي	WV	Co, W	Rare
	Coraciiformes	Alcedinidae	<i>Upupa vp</i>	European hoopoe	الهدمد الأوروبي	WV	Va
<i>Motacilla flava</i>			Yellow wagtail	أبو قصادة أصفر البطن	WV	W	Common
Motacillidae		<i>Motacilla alba</i>	White wagtail	أبو قصادة أبيض	WV	Va	Abundant
		<i>Hippolais icterina</i>	Icterine warbler	خنشلة ليونيه	WV	Va	Scarce
Turdidae		<i>Saxicola rubetra</i>	Whinchat	كلبسي أحمر	WV	Cu, U	Scarce
		<i>Saxicola torquata</i>	Stonechat	كلبسي مطوق	WV	Cu, U	Scarce
		<i>Phoenicurus phoenicurus</i>	Redstart	الدمبراء	WV	U	Scarce
		<i>Phoenicurus ochrosus</i>	Black redstart	الدمبراء السوداء	WV	U	Scarce
		<i>Erithacus rubecula</i>	Robin	أبو العناء	WV	U	Scarce
		<i>Luscinia megarhynchos</i>	Nightingale	الصفاء	WV	Cu, U	Scarce
		<i>Luscinia luscinia</i>	Thrush Nightingale	عقاب الفجر	WV	Cu, U	Scarce
Passeridae		<i>Passer hispaniolensis</i>	Spanish sparrow	المستور الإسباني	WV	W, U	Abundant



Grey Heron



Marsh Harrier



Coot



Little-Ringed Plover



Kentish plover



Spotted Red Shank



Stone curlew



Sandwich tern



European Kingfisher



European Hoopoe



Yellow wagtail



white wagtail



Icterine Warbler



Whinchat



Stonechat



Redstart



Black redstart



Redstart



Thrush nightingale



Spanish Sparrow

Plate (3): photos of respectively winter visitor bird species censused in New Damietta region at March, 2006 to Feb., 2007.

DISCUSSION

In order to make a decision involving the environment and the wildlife it contains, it is necessary to first obtain some ideas of species present and their abundance. These surveys provided both quantitative and qualitative measures such as species presence, seasonal abundance, migrant, or even breeding status. In general, this study is the first extensive quantitative survey of resident and migratory birds undertaken to date in the region of new Damietta. Collectively, the structure of bird community was 66 species in New Damietta region at March 2006 to Feb. 2007. Of such bird community, 26 species were resident breeding and 40 species were migratory. Of migratory birds, 15 species were passage migrants and 25 species were winter visitors.

The study of bird community in Damietta Governorate at 2004 by SEAM reported that 32 resident breeding bird species inhabiting the governorate. In the present study, 26 species only of resident breeding birds were recorded in New Damietta region. By reviewing the species, it was found that the most resident species recorded by SEAM inhabiting Manzala Lake which is far away from the study area of New Damietta. In the present study, 7 species were recorded herein and not included in SEAM report, these species are Little egret, Spotted red shank, Herring gull, Sand martin, Great grey shrike, Hooded crow, and House sparrow.

During February 2002, winter surveys were carried out for 25 species of water birds at Manzala Lake [SEAM (2004)]. In the present work, 11 species of these water birds were recorded in marine and wetland habitats of New Damietta region. In addition, new record of 30 migratory species were surveyed than that presented by [SEAM (2004)].

However, most if not all, bird species that recorded in this work were reported by [Tharwat (1997)] in Egyptian avian fauna at the book "birds known to occur in Egypt" that published by Publication of National biodiversity unit. No 8, 1997, A.R.E, Cabinet of Ministers, EEAA, Department of Nature Protection.

Only one new record was found in the present study for Great-Backed Gull, *Larus marinus*. This species was not recorded by [Tharwat (1997)] nor by [SEAM (2004)]. This species is a migratory bird. It is widely distributed in west Europe and the Baltic [Bertel *et al.*, (2004)]. Hence, the present study is considered the first complete report of bird community in the study area.

By communication with many volunteers, they stated that a great change in the bird community was observed since the reclamation of this area. The main observation was the great increase in the intensity of urban birds and the decrease of the water birds in both marine and wetland areas. This in agreement to the report by [Marzluff (1997)], who suggested that settlement can change ecosystem processes, habitat, food, predators and competitors, and disease. These effects lead to significant changes in the population biology of birds in urban areas with resulting effects on the structure and composition of bird communities [Marzluff (2001)]. Because urban gardens and parks became more increasingly distributed in New Damietta, they are likely to become increasingly important to conservation as the urban landscape deteriorates, as they are arguably the main contributor to urban biodiversity in many developed countries [Cannon (1999) and Chamberlain *et al.*, (2004)] have shown that the likelihood of many bird species

occurring in gardens is dependent on the surrounding local habitat rather than the garden habitat. This implies that if there is a continuing degradation of the urban environment then further declines bird population will increase.

Many of the resident and migratory human-related birds are observed in the study area. This may be attributed to the urbanization which is likely to directly affect arthropods, the primary food for many birds, especially during reproduction [McIntyre (2000)]. Urbanization can create a complex environmental gradient, from undisturbed natural areas to highly-modified urban landscapes that can be useful in exploring relationships between environmental heterogeneity and the diversity and abundance of species [McDonnell&Pickett (1990)]. Local bird abundance, demographic rates, and ecological processes may be a function of the larger urban landscape [Bolger (2001)]. Therefore studies of foraging, breeding, competition and predation of avian species need to be carried out along this gradient in order to compile the complete picture and reveal the key functional elements of an urban landscape and the bird communities within New Damietta.

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الملخص العربي

مجتمع الطيور في ٢٠٠٦-٢٠٠٧ بمنطقة نمياط الجديدة- مصر

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من أجل اتخاذ قرار تجاه البيئة والحياة البرية التي تحويها، يجب أولاً معرفة الأنواع الموجودة بها وصفاتها وكذلك أيضاً مدي انتشارها.

واستناداً لمعلوماتنا، فإن هذه الدراسة تعد الأولى من نوعها في مسح الطيور المقيمة والمهاجرة بمنطقة نمياط الجديدة. تم حصر الطيور ابتداءً من مارس ٢٠٠٦ وحتى فبراير ٢٠٠٧. تم رصد ٦٦ نوع من الطيور، منها ٢٦ نوع من الطيور المقيمة و ١٥ نوع من الطيور المهاجرة العابرة و ٢٥ نوع من الطيور الزائرة الشتوية. تم تسجيل نوع جديد من اللوارس بالمنطقة وهو نورس السمك (زلتر شتوي). من المتوقع أن يحدث تزايد في عدد الأنواع المتعلقة بنشاط الإنسان مع التزايد المستمر في إعمار في هذه المنطقة.

وخلاصة القول أنه يجب أن يكون هناك المزيد من الدراسات والمعرفة حول مجتمع الطيور وذلك ليتم تحديد الأنواع التي يمكن أن تتأثر بإعمار المنطقة وكذلك معرفة الأنواع التي تحتاج لمزيد من البحث والاهتمام مستقبلاً.