



Ornithofauna of Kocacay Delta, Bursa, Turkey

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ABSTRACT

This study reports the presence of 119 species from 45 families belonging to 19 orders in the Kocacay Delta, Turkey, within the borders of the Karacabey District of Bursa Province, in a study conducted over the course of one year (2017). The distribution of species in terms of orders is as follows: Falconiformes, 1 (0.8%); Phoenicopteriformes, 1 (0.8%); Bucerotiformes, 1 (0.8%); Galliformes, 1 (0.8%); Cuculiformes, 1 (0.8%); Caprimulgiformes, 1 (0.8%); Coraciiformes, 2 (1.6%); Gruiformes, 2 (1.6%); Podicipediformes, 2 (1.6%); Suliformes, 2 (1.6%); Pelecaniformes, 3 (2.5%); Strigiformes, 3 (2.5%); Columbiformes, 4 (3.3%); Accipitriformes, 6 (5.04%); Piciformes, 6 (5.04%); Anseriformes, 9 (7.5%); Ciconiiformes, 9 (7.5%); Charadriiformes, 19 (15.9%); and Passeriformes, 46 (38.6%). The migration status of the species observed in the Kocacay Delta was also defined as follows: 76 (63.8%) resident, 27 (22.6%) summer migrant, 15 (12.6%) winter migrant, and 1 (0.8%) transit migrant.

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Authors' Contribution

The field studies were conducted by AU and other processes by BY.

Key words

Bursa, Kocacay, Ornithofauna, Floodplain, Ecology

INTRODUCTION

Considering the latest updates, there are 13,017 bird species belonging to 233 families from 40 orders worldwide (Birdlife, 2019). A total of 502 bird species belonging to 74 families from 22 orders were identified in Turkey. Among these, 46 species are vagrant, and whether 19 species belong to the avian fauna of Turkey is currently debated. Therefore, the exact number of bird species should be considered 437 in Turkey (Kiziroğlu, 2008).

Turkey creates an ecosystem for many vital species of animals, especially for birds, because of its passageway location between the continents of Europe and Asia on one side and serving as the gateway to Africa on the other. Wetlands, forests, pastures, and steppe ecosystems within Turkey are indispensable for bird species. Breeding bird species in different countries of Europe prefer the southern regions of Anatolia, where the winters are warm. Bird flocks of millions of individuals, during the significant bird species migrations, go through Bosphorus, especially in the

Marmara Region, and in the east from the Caucasus, through Artvin, Borcka, and almost touching the Çoruh valley. They travel to the southern regions and especially to Africa through the Akyatan Lagoon. At this point, the importance of Turkey is revealed to be indispensable for natural systems of birds. All geographic regions of Anatolia have very active biological potential for birds (Anonymous, 2017).

The Kocacay Delta's position is important for Turkey because of its ornithofauna ecosystem characteristics. The aim of this study is to determine the ornithofauna and migration characteristics of the species in that region. At the same time, similar wetlands in the region were compared for their avifaunistic characteristics.

MATERIALS AND METHODS

Study area

The total working area is 17,022 hectares. While 10,476 hectares (61.5%) of the lower basin are located within Karacabey district boundaries, 610 hectares (3.6%) are within Mudanya district boundaries. The remaining 5,936 hectares (34.9%) area is in the sea. In other words, 65% of the study area remains in the terrestrial area. Within this scope, 95% of the terrestrial area is within the boundaries of Karacabey district, while 5% is within the boundaries of the Mudanya district. The Kocacay Delta is located on the shores of the Sea of Marmara and is a wetland with different habitat types. The dominant ecosystem types in the area are lake, reeds, dune, and floodplain. In

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addition, the area is surrounded by rural settlements and agricultural areas. The location of the work area and the monitoring stations is shown in Figure 1. There are public and private lands within the boundaries of the Kocaçay Delta Wetland Lower Basin. The state-owned lands include forest areas, pastures and reeds, marshlands, and coastal areas, including Dalyan, Poyraz, and Arapçiftliği Lake. In private lands, there are olive groves, irrigated and dry (rainfed) agricultural areas, and settlements. Although the maritime area is not subject to ownership, when the property status in the terrestrial area is examined, there are lakes, streams, forests, and wetland habitats in the treasury lands covering approximately 79.7% of the area. On the other hand, the observed private properties cover about 20.3% of the terrestrial area. The Marmara climate is a transition between the Black Sea and Mediterranean climates. Therefore, the winters are not as warm as the Mediterranean climate, and the winters are not as rainy as the Black Sea climate. The climate is not as cold as winter and nor dry in summer. Due to these characteristics, the natural vegetation is comprised in the low parts by those of Mediterranean origin, and the moist forests of the Black Sea vegetation are on the north-facing slopes of the higher parts. The average annual precipitation is 595.2 mm, and most of the precipitation is in the winter. The share of summer rainfall in the annual total is 11.7%. The average annual relative humidity is 73%. The drainage area of the Delta Kocaçay is in the South Marmara region; the rainfall on this region is above the average of Turkey under semi-arid climatic conditions. The rainy period (December–April, average 450 mm/year) is also highly windy (approx. 8 m/s). During the dry period (May–November), the average precipitation is 236 mm/year and is relatively calm in terms of wind (Anonymous, 2017).



Fig. 1. The location of research area and observation stations.

Methods

The field area was studied between January 2017–December 2017. In each season, five days of field work was carried out in different months, and a total of 20 days of field work was performed. Observations were

made using point and line length counting methods at six different stations that characterize the delta. During field observations, in addition to direct observations of birds, indirect observations were made based on the use of footprints, feces, sounds, wing sounds, feathers, and signs such as bird songs.

Species-specific sounds, especially night predators, have been used frequently, as previously installed on mobile phones for all species and in field studies. Observations were carried out with the naked eye, 8 × 30mm magnification Nikon binoculars, and 40 × 80mm Macroptic telescope. Canon EOS 550 D camera with Canon 75-300 mm lens and Sigma 150–500 mm lens was used for photographing the species. Systematics and migration status of species are given according to Kızıroğlu (2008), and conservation status is given according to IUCN (2017).

RESULTS

One-hundred nineteen (119) bird species belonging to 45 families of 19 orders were identified in the Kocaçay Delta. Among the identified species, the following were found: 76 (63.8%) resident, 27 (22.6%) summer migrants, 15 (12.6%) winter migrants, and 1 (0.8%) transit migrant (Table I).

The numerical distribution of species according to orders was observed as follows: Falconiformes, 1 (0.8%); Phoenicopteriformes, 1 (0.8%); Bucerotiformes, 1 (0.8%); Galliformes, 1 (0.8%); Cuculiformes, 1 (0.8%); Caprimulgiformes, 1 (0.8%); Coraciiformes, 2 (1.6%); Gruiformes, 2 (1.6%); Podicipediformes, 2 (1.6%); Suliformes, 2 (1.6%); Pelecaniformes, 3 (2.5%); Strigiformes, 3 (2.5%); Columbiformes, 4 (3.3%); Accipitriformes, 6 (5.04%); Piciformes, 6 (5.04%); Anseriformes, 9 (7.5%); Ciconiiformes, 9 (7.5%); Charadriiformes, 19 (15.9%); and Passeriformes, 46 (38.6%).

The numerical distribution of species according to families was observed as follows: Pelecanidae, 1 (0.8%); Phoenicopteridae, 1 (0.8%); Pandionidae, 1 (0.8%); Falconidae, 1 (0.8%); Phasianidae, 1 (0.8%); Recurvirostridae, 1 (0.8%); Glareolidae, 1 (0.8%); Cuculidae, 1 (0.8%); Caprimulgidae, 1 (0.8%); Alcedinidae, 1 (0.8%); Meropidae, 1 (0.8%); Upupidae, 1 (0.8%); Prunellidae, 1 (0.8%); Acrocephalidae, 1 (0.8%); Aegithalidae, 1 (0.8%); Sittidae, 1 (0.8%); Oriolidae, 1 (0.8%); Laniidae, 1 (0.8%); Emberizidae, 1 (0.8%); Sturnidae, 1 (0.8%); Passeridae, 1 (0.8%); Podicipedidae, 2 (1.6%); Phalacrocoracidae, 2 (1.6%); Ciconiidae, 2 (1.6%); Threskiornithidae, 2 (1.6%); Rallidae, 2 (1.6%); Charadriidae, 2 (1.6%); Alaudidae, 2 (1.6%); Hirundinidae, 2 (1.6%); Motacillidae, 2 (1.6%); Platysteiridae, 2 (1.6%); Sylviidae, 2 (1.6%); Strigidae, 3 (2.5%); Paridae, 3 (2.5%); Columbidae, 4 (3.3%);

Table I. The avian species recorded from Kocacay Delta, but not reported in Yaman (2008) are also shown. New species have been shown in bold.

Order/ Family	Species	Common names	BERN convention	CITES	IUCN	Migration	Not reported in Yaman (2008)
Podicipediformes							
Podicipedidae	1. <i>Tachybaptus ruficollis</i>	Little grebe	Annex II	Unlisted	LC	Native	
	2. <i>Podiceps cristatus</i>	Great crested grebe	Annex II	Unlisted	LC	Native	
Suliformes							
Phalacrocoracidae	3. <i>Phalacrocorax carbo</i>	Great cormorant	Annex III	Unlisted	LC	Native	
	4. <i>Phalacrocorax pygmeus</i>	Pygmy cormorant	Annex II	Unlisted	LC	Native	
Pelecaniformes							
Pelecanidae	5. <i>Pelecanus crispus</i>	Dalmatian pelican	Annex II	Annex I	VU	Native	
Ciconiiformes							
Ardeidae	6. <i>Botaurus stellaris</i>	Eurasian bittern	Annex II	Unlisted	LC	Native	Not reported
	7. <i>Nycticorax nycticorax</i>	Night heron	Annex II	Unlisted	LC	Native	
	8. <i>Bubulcus ibis</i>	Cattle egret	Annex II	Unlisted	LC	Native	Not reported
	9. <i>Egretta garzetta</i>	Little egret	Annex II	Unlisted	LC	Native	
	10. <i>Casmerodius albus</i>	Great white egret	Annex II	Unlisted	LC	Native	Not reported
	11. <i>Ardea cinerea</i>	Grey heron	Annex II	Unlisted	LC	Native	
	12. <i>Ardea purpurea</i>	Purple heron	Annex II	Unlisted	LC	SM	
Ciconiidae	13. <i>Ciconia nigra</i>	Black stork	Annex II	Annex II	LC	SM	
	14. <i>Ciconia ciconia</i>	White stork	Annex II	Unlisted	LC	SM	
Pelecaniformes							
Threskiornithidae	15. <i>Plegadis falcinellus</i>	Glossy ibis	Annex II	Unlisted	LC	SM	Not reported
	16. <i>Platalea leucorodia</i>	Eurasian spoonbill	Annex II	Annex II	LC	SM	
Phoenicopteriformes							
Phoenicopteridae	17. <i>Phoenicopiterus roseus</i>	Greater flamingo	Annex III	Unlisted	LC	Native	
Anseriformes							
Anatidae	18. <i>Cygnus olor</i>	Mute swan	Annex III	Unlisted	LC	SM	Not reported
	19. <i>Tadorna ferruginea</i>	Ruddy shelduck	Annex II	Unlisted	LC	WM	
	20. <i>Anas platyrhynchos</i>	Mallard duck	Annex III	Unlisted	LC	Native	
	21. <i>Anas acuta</i>	Northern pintail	Annex III	Unlisted	LC	WM	
	22. <i>Anas querquedula</i>	Garganey	Annex III	Unlisted	LC	WM	Not reported
	23. <i>Anas clypeata</i>	Spoonbill	Annex III	Unlisted	LC	WM	
	24. <i>Aythya ferina</i>	Common pochard	Annex III	Unlisted	VU	WM	
	25. <i>Aythya nyroca</i>	Ferruginous duck	Annex III	Unlisted	NT	WM	
	26. <i>Aythya fuligula</i>	Tufted duck	Annex III	Unlisted	LC	WM	Not reported
Accipitriformes							
Accipitridae	27. <i>Pernis apivorus</i>	Honey buzzard	Annex II	Annex II	LC	Native	Not reported
	28. <i>Circus aeruginosus</i>	Marsh harrier	Annex II	Annex II	LC	Native	
	29. <i>Circus cyaneus</i>	Hen harrier	Annex II	Annex II	LC	Native	
	30. <i>Buteo buteo</i>	Common buzzard	Annex II	Annex II	LC	Native	
	31. <i>Buteo rufinus</i>	Long-legged buzzard	Annex II	Annex II	LC	Native	Not reported
Pandionidae	32. <i>Pandion haliaetus</i>	Osprey	Annex II	Annex II	LC	Native	Not reported

Table continues on next page.....

Order/ Family	Species	Common names	BERN convention	CITES	IUCN	Migration	Not reported in Yaman (2008)
Falconiformes							
Falconidae	33. <i>Falco tinnunculus</i>	Common kestrel	Annex II	Annex II	LC	Native	
Galliformes							
Phasianidae	34. <i>Phasianus colchicus</i>	Common pheasant	Annex III	Unlisted	LC	TM	Not reported
Gruiformes							
Rallidae	35. <i>Gallinula chloropus</i>	Common moorhen	Annex III	Unlisted	LC	Native	
	36. <i>Fulica atra</i>	Eurasian coot	Annex III	Unlisted	LC	Native	
Charadriiformes							
Recurvirostridae	37. <i>Himantopus himantopus</i>	Black-winged stilt	Annex III	Unlisted	LC	SM	
Glareolidae	38. <i>Glareola pratincola</i>	Collared pratincole	Annex III	Unlisted	LC	WM	
Charadriidae	39. <i>Charadrius dubius</i>	Little ringed plover	Annex II	Unlisted	LC	WM	
	40. <i>Vanellus spinosus</i>	Spur-winged lapwing	Annex III	Unlisted	LC	SM	Not reported
Scolopacidae	41. <i>Calidris minuta</i>	Little stint	Annex II	Unlisted	LC	WM	
	42. <i>Calidris alpina</i>	Dunlin	Annex II	Unlisted	LC	WM	
	43. <i>Gallinago gallinago</i>	Common snipe	Annex III	Unlisted	LC	WM	Not reported
	44. <i>Numenius arquata</i>	Eurasian curlew	Annex III	Unlisted	NT	WM	Not reported
	45. <i>Tringa totanus</i>	Common redshank	Annex III	Unlisted	LC	WM	
	46. <i>Tringa stagnatilis</i>	Marsh sandpiper	Annex II	Unlisted	LC	WM	Not reported
Laridae	47. <i>Larus ridibundus</i>	Black-headed gull	Annex III	Unlisted	LC	Native	
	48. <i>Larus cachinnans</i>	Caspian gull	Annex III	Unlisted	LC	Native	
	49. <i>Gelochelidon nilotica</i>	Gull-billed tern	Annex III	Unlisted	LC	SM	
	50. <i>Sterna sandvicensis</i>	Sandwich tern	Annex II	Unlisted	LC	SM	Not reported
	51. <i>Sterna hirundo</i>	Common tern	Annex II	Unlisted	LC	SM	
	52. <i>Chlidonias niger</i>	Black tern	Annex II	Unlisted	LC	SM	
	53. <i>Chlidonias hybrida</i>	Whiskered tern	Annex II	Unlisted	LC	SM	Not reported
	54. <i>Larus genei</i>	Slender-billed gull	Annex II	Unlisted	LC	Native	Not reported
	55. <i>Sterna paradisaea</i>	Arctic tern	Annex II	Unlisted	LC	SM	Not reported
Columbiformes							
Columbidae	56. <i>Columba livia</i>	Rock dove	Annex III	Unlisted	LC	Native	
	57. <i>Streptopelia decaocto</i>	Eurasian collared-dove	Annex III	Unlisted	LC	Native	
	58. <i>Streptopelia turtur</i>	Turtle dove	Annex III	Unlisted	LC	Native	
	59. <i>Stigmatopelia senegalensis</i>	Laughing dove	Annex III	Unlisted	LC	Native	Not reported
Cuculiformes							
Cuculidae	60. <i>Cuculus canorus</i>	Common cuckoo	Annex III	Unlisted	LC	Native	
Strigiformes							
Strigidae	61. <i>Otus scops</i>	Scops owl	Annex III	Annex II	LC	Native	Not reported
	62. <i>Athene noctua</i>	Little owl	Annex III	Annex II	LC	Native	
	63. <i>Asio otus</i>	Long-eared owl	Annex II	Unlisted	LC	Native	Not reported
Caprimulgiformes							
Caprimulgidae	64. <i>Caprimulgus europaeus</i>	Nightjar	Annex III	Unlisted	LC	SM	Not reported

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Order/ Family	Species	Common names	BERN convention	CITES	IUCN	Migration	Not Reported in Yaman (2008)
Coraciiformes							
Alcedinidae	65. <i>Alcedo atthis</i>	Common kingfisher	Annex II	Unlisted	LC	Native	
Meropidae	66. <i>Merops apiaster</i>	Bee eater	Annex II	Unlisted	LC	SM	
Bucerotiformes							
Upupidae	67. <i>Upupa epops</i>	Eurasian hoopoe	Annex III	Unlisted	LC	SM	
Piciformes							
Picidae	68. <i>Picus viridis</i>	Green woodpecker	Annex III	Unlisted	LC	Native	
	69. <i>Picus canus</i>	Grey-headed woodpecker	Annex II	Unlisted	LC	Native	Not reported
	70. <i>Dendrocopos major</i>	Great spotted woodpecker	Annex III	Unlisted	LC	Native	
	71. <i>Dendrocopos syriacus</i>	Syrian woodpecker	Annex III	Unlisted	LC	Native	
	72. <i>Dendrocopos leucotos</i>	White-backed woodpecker	Annex III	Unlisted	LC	Native	
	73. <i>Dendrocopos minor</i>	Lesser spotted woodpecker	Annex III	Unlisted	LC	Native	
Alaudidae	74. <i>Galerida cristata</i>	Crested lark	Annex III	Unlisted	LC	Native	
	75. <i>Alauda arvensis</i>	Eurasian skylark	Annex III	Unlisted	LC	Native	
Hirundinidae	76. <i>Hirundo rustica</i>	Barn swallow	Annex II	Unlisted	LC	SM	
	77. <i>Hirundo daurica</i>	Red-rumped swallow	Annex II	Unlisted	LC	SM	
Motacillidae	78. <i>Motacilla flava</i>	Yellow wagtail	Annex II	Unlisted	LC	SM	
	79. <i>Motacilla alba</i>	White wagtail	Annex II	Unlisted	LC	Native	
Prunellidae	80. <i>Prunella modularis</i>	Dunnock	Annex II	Unlisted	LC	Native	
Platysteiridae	81. <i>Turdus merula</i>	Blackbird	Annex III	Unlisted	LC	Native	
	82. <i>Turdus viscivorus</i>	Mistle thrush	Annex III	Unlisted	LC	Native	Not reported
Acrocephalidae	83. <i>Acrocephalus arundinaceus</i>	Great reed warbler	Annex II	Unlisted	LC	SM	
Sylviidae	84. <i>Sylvia melanocephala</i>	Sardinian warbler	Annex II	Unlisted	LC	Native	
	85. <i>Sylvia atricapilla</i>	Eurasian blackcap	Annex II	Unlisted	LC	Native	
Phylloscopidae	86. <i>Phylloscopus sibilatrix</i>	Wood warbler	Annex II	Unlisted	LC	Native	Not reported
	87. <i>Phylloscopus collybita</i>	Common chiffchaff	Annex II	Unlisted	LC	Native	
	88. <i>Phylloscopus trochilus</i>	Willow warbler	Annex II	Unlisted	LC	Native	Not reported
	89. <i>Phylloscopus bonelli</i>	Bonelli's warbler	Annex III	Unlisted	LC	Native	Not reported
	90. <i>Phylloscopus trochiloides</i>	Greenish warbler	Annex III	Unlisted	LC	Native	
Muscicapidae	91. <i>Erithacus rubecula</i>	European robin	Annex II	Unlisted	LC	Native	
	92. <i>Luscinia megarhynchos</i>	Common nightingale	Annex II	Unlisted	LC	Native	
	93. <i>Luscinia luscinia</i>	Thrush nightingale	Annex III	Unlisted	LC	Native	
	94. <i>Phoenicurus phoenicurus</i>	Common redstart	Annex II	Unlisted	LC	Native	Not reported
	95. <i>Saxicola rubetra</i>	Whinchat	Annex II	Unlisted	LC	SM	
	96. <i>Saxicola torquatus</i>	African stonechat	Annex II	Unlisted	LC	SM	

Table continues on next page.....

Order/ Family	Species	Common names	BERN convention	CITES	IUCN	Migration	Not reported in Yaman (2008)
	97. <i>Oenanthe oenanthe</i>	Northern wheatear	Annex II	Unlisted	LC	SM	Not reported
	98. <i>Muscicapa striata</i>	Spotted flycatcher	Annex II	Unlisted	LC	Native	Not reported
	99. <i>Cercotrichas galactotes</i>	Rufous-tailed scrub robin	Annex III	Unlisted	LC	Native	Not reported
Aegithalidae	100. <i>Aegithalos caudatus</i>	Long-tailed tit	Annex II	Unlisted	LC	Native	
Paridae	101. <i>Parus ater</i>	Coal tit	Annex II	Unlisted	LC	Native	Not reported
	102. <i>Parus caeruleus</i>	Blue tit	Annex II	Unlisted	LC	Native	
	103. <i>Parus major</i>	Great tit	Annex II	Unlisted	LC	Native	
Sittidae	104. <i>Sitta krueperi</i>	Krüper's nuthatch	Annex II	Unlisted	LC	Native	Not reported
Oriolidae	105. <i>Oriolus oriolus</i>	Golden oriole	Annex II	Unlisted	LC	SM	
Laniidae	106. <i>Lanius collurio</i>	Red-backed shrike	Annex II	Unlisted	LC	SM	
Corvidae	107. <i>Garrulus glandarius</i>	Eurasian jay	Unlisted	Unlisted	LC	Native	
	108. <i>Pica pica</i>	European magpie	Unlisted	Unlisted	LC	Native	
	109. <i>Corvus monedula</i>	Western jackdaw	Unlisted	Unlisted	LC	Native	
	110. <i>Corvus frugilegus</i>	Rook	Unlisted	Unlisted	LC	Native	Not reported
	111. <i>Corvus cornix</i>	Hooded crow	Unlisted	Unlisted	LC	Native	
	112. <i>Corvus corax</i>	Raven	Annex II	Unlisted	LC	Native	
Sturnidae	113. <i>Sturnus vulgaris</i>	European starling	Unlisted	Unlisted	LC	Native	
Passeridae	114. <i>Passer domesticus</i>	House sparrow	Unlisted	Unlisted	LC	Native	
Fringillidae	115. <i>Fringilla coelebs</i>	Common chaffinch	Annex III	Unlisted	LC	Native	
	116. <i>Serinus serinus</i>	European serin	Annex II	Unlisted	LC	Native	Not reported
	117. <i>Carduelis carduelis</i>	European goldfinch	Annex II	Unlisted	LC	Native	
	118. <i>Coccothraustes coccothraustes</i>	Hawfinch	Annex II	Unlisted	LC	Native	Not reported
Emberizidae	119. <i>Emberiza melanocephala</i>	Black-headed bunting	Annex II	Unlisted	LC	SM	

Fringillidae, 4 (3.3%); Accipitridae, 5 (4.2%); Phylloscopidae, 5 (4.2%); Scolopacidae, 6 (5.05%); Picidae, 6 (5.05%); Corvidae, 6 (5.05%); Anatidae, 9 (7.5%); Laridae, 9 (7.5%); Muscicapidae, 9 (7.5%), and Ardeidae, 13 (10.9%).

According to the IUCN (2017) Red Data Book, 115 (96.6%) of the species identified in the study area were LC (Least Concern), 2 (*Aythya nyroca* and *Numenius arquata*) (1.6%) NT (Near Threatened), and 2 (1.6%) have VU (Vulnerable) protection status. According to CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora), *Pelecanus crispus* species is categorized Annex-I (trade is banned); 11 species (*Ciconia nigra*, *Platalea leucorodia*, *Pernis apivorus*, *Circus aeruginosus*, *Circus cyaneus*, *Buteo buteo*, *Buteo rufinus*, *Pandion haliaetus*, *Falco tinnunculus*, *Otus scops*, *Athene noctua*) are Annex-II (trade is partially allowed).

According to the BERN Convention, out of 119 species, 68 are Annex-II (strictly protected species), and 44 are from Annex-III (protected species) categories.

DISCUSSION

Yaman (2008) identified 114 species belonging to 44 families from 15 orders in the Kocaçay Delta between April 2004- January 2008. According to Anonymous (2009), 268 species belonging to 58 families from 21 orders were identified in Bursa province. In this study, 125 bird species belonging to 45 families from 19 orders were recorded. Although the Anonymous (2009) study covers all Bursa Province except Kocaçay Delta, the species in this study are likely to be seen in the study area. Therefore, it is important to compare the data. As a result, according to Kocaçay Delta and Bursa literature and the results arising

from these studies, birds from 21 orders, belonging to 59 families and 279 species, were found.

According to Yaman (2008), six families (Gruidae, Sternidae, Turdidae, Remizidae, Certhiidae, Troglodytidae) and 32 species which were not determined in Kocay Delta are shown in Table II. Eight families (Pandionidae, Phasianidae, Caprimulgidae, Prunellidae, Acrocephalidae, Sittidae, Platysteiridae, Phylloscopidae) and 37 species identified in this study are given in Table I and these taxa were not recorded by Yaman (2008).

It is thought that the differences in species occurring in both studies were caused by differences in the duration of the studies and observation times, and also because different species were located in different study areas. This study also recorded eight new species (*Picus canus*, *Phylloscopus collybita*, *Larus genei*, *Asio otus*, *Phylloscopus boneli*, *Cercotrichas galactotes*, *Vanellus spinosus*, *Sterna paradisaea*) in the Kocay Delta and Bursa Province, and these are part of Turkey ornithofauna (Table I).

The Marmara Region, where the Kocay Delta is located, is rich in wetlands with similar characteristics. This is especially important in terms of accommodation, nutrition and reproductive needs of the native and migratory species that migrate through the Balkans and the North West Black Sea via Anatolia. This region has great importance in terms of Turkey ornithofauna, offering a variety of habitats suitable for different species.

All these areas have different surface areas but share wetland characteristics. However, there is no literature on the ornithological features of all areas. The ornithological characteristics of the studied areas were compared in terms of the number of species per hectare (Number of species/ Surface area-hectare), and results are as follows: İznik Lake (Bursa), 0.001; Sarıçay Delta (Çanakkale), 0.0022; Uluabat Lake, (Bursa) 0.0024; Kocay Delta (Bursa), 0.006; Sapanca Lake (Sakarya), 0.015; Acarlar Floodplain (Sakarya), 0.024; Büyükçekmece Lake (Istanbul), 0.059; and Körfez Wetland (Kocaeli), 1.807 species were recorded. *Podiceps cristatus*, *Ardea cinerea*, *Fulica atra*, *Turdus merula*, *Parus major*, *Pica pica*, *Corvus corax*, *Passer domesticus*, *Carduelis carduelis* are common species recorded in all areas (Table III).

The number of species recorded only in one area out of the compared areas is as follows: 36 in Acarlar floodplain, 1 in İznik Lake, 4 in Sapanca Lake, 42 in Büyükçekmece Lake, 10 in Körfez Wetland, 13 in Sarıçay Delta, and 12 in Kocay Delta. All species identified in Uluabat Lake were recorded in other areas too. In addition, the Acarlar floodplain and Büyükçekmece Lake have the most species (107 species) in common.

Table II. The species not recorded from Kocay Delta in this study but reported in other studies.

Order / Family	Scientific name (Common name)
Suliformes	
Phalacrocoracidae	1. <i>Phalacrocorax aristotelis</i> (European shag)
Pelecaniformes	
Pelecanidae	2. <i>Pelecanus onocrotalus</i> (Great white pelican)
	3. <i>Pelecanus crispus</i> (Almatian pelican)
Ardeidae	4. <i>Egretta alba</i> (Great egret)
	5. <i>Ardeola ralloides</i> (Squacco heron)
Anseriformes	
Anatidae	6. <i>Cygnus cygnus</i> (Whooper swan)
	7. <i>Tadorna tadorna</i> (Common shelduck)
Accipitriformes	
Accipitridae	8. <i>Accipiter nisus</i> (Sparrowhawk)
	9. <i>Aquila clanga</i> (Lesser spotted eagle)
	10. <i>Aquila chrysaetos</i> (Golden eagle)
Gruiformes	
Gruidae	11. <i>Rallus aquaticus</i> (Water rail)
	12. <i>Grus grus</i> (Common crane)
Charadriiformes	
Charadriiformes	13. <i>Charadrius alexandrinus</i> (Kentish plover)
	14. <i>Charadrius hiaticula</i> (Ringed plover)
	15. <i>Pluvialis squatarola</i> (Grey plover)
Laridae	16. <i>Larus minutus</i> (Little gull)
	17. <i>Chlidonias leucopterus</i> (White-winged tern)
Passeriformes	
Passeridae	18. <i>Anthus campestris</i> (Tawny pipit)
	19. <i>Anthus pratensis</i> (Meadow pipit)
Motacillidae	20. <i>Motacilla citreola</i> (Citrine wagtail)
Laniidae	21. <i>Lanius senator</i> (Woodchat shrike)
Acrocephalidae	22. <i>Acrocephalus scirpaceus</i> (Reed warbler)
Muscicapidae	23. <i>Ficedula hypoleuca</i> (European pied flycatcher)
	24. <i>Luscinia svecica</i> (Bluethroat)
Paridae	25. <i>Parus lugubris</i> (Sombre tit)
Emberizidae	26. <i>Emberiza calandra</i> (Corn bunting)
	27. <i>Emberiza schoeniclus</i> (Reed bunting)
Troglodytidae	28. <i>Troglodytes troglodytes</i> (Eurasian wren)
Certhiidae	29. <i>Certhia brachydactyla</i> (Short-toed treecreeper)
Alaudidae	30. <i>Calandrella brachydactyla</i> (Short-toed lark)
Hirundinidae	31. <i>Delichon urbica</i> (House martin)
Remizidae	32. <i>Remiz pendulinus</i> (Penduline tit)

Table III. Ornithofaunistic properties of wetlands.

City	Name	Size (ha)	Number of orders	Number of families	Number of species	Reference
Istanbul	Büyükçekmece lake	2850	14	42	170	Bacak, 2012
Canakkale	Sarıçay Delta	39,378	15	34	90	Gurkan, 2005
Bursa	Uluabat Lake	13,600	-	-	33	Mutlu, 2005
Sakarya	Acarlar Lake	7200	17	39	178	Uzun <i>et al.</i> , 2008
Sakarya	Sapanca Lake	4500	12	28	69	Uzun, 2010
Bursa	Iznik Lake	29,800	11	29	58	Irmak Turkmen and Uzun, 2010
Kocaeli	Körfez Wetlands	51.45	11	31	93	Yaşa and Uzun, 2016
Bursa	Kocaçay Delta	17,022	19	45	119	This study

Although it is in the same geographical area, the differences between lakes in terms of number of species may be related to the time and duration of observations. All these species belong to the ornithofauna of the Marmara Region. In addition, the lakes' habitat diversity and location relative to the migration routes may be another reason. Although the common characteristics of lakes are wetlands, factors such as vegetation structure, depth of lake, size and quantity of reeds, human pressure, species-specific food sources, and biological-chemical properties of lake water determine the habitat diversity and affect the spread of species. However, the presence or absence of lakes, especially migratory species, may be considered as another factor.

As a result, Kocaçay Delta is an important wetland both bioecologically and for ecotourism. Both species and habitat diversity and location are very important for both native and migratory species. The area preserves its natural structure.

Statement of conflicts of interest

The authors have declared no conflict of interests.

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