Nakkas-Basaksehir Highway Project, Turkey

Stayed Cable Bridge Risk of Collision Impact to Birds

1 Background

The bridge at Sazlidere dam will be a new and novel construction potentially causing displacement and collision risk to avifauna, specifically bird species depending on species behavior. Most birds are expected to modify their flight height when crossing over the bridge, and therefore will avoid collisions with the structure. However, given that there are potential unknowns concerning collision risk to birds under certain situations, ERM conducted a literature review to provide further guidance on collision risk and to inform appropriate mitigation measures as necessary.

2 Available data on bridge-bird collision risks/impacts

Based on a relatively rapid review of publically available published information on the impact of suspension bridges on birds, there appear to be few if any conclusive published studies on the impact of stayed bridges in terms of bird collision and mortality potential. Ove Arup & Partners conducted a literature review of more than 1,500 publications on bird collisions for similar bridge projects to the 'Shenzhen Western Corridor' bridge project in the PRC, with much of the data reviewed from studies in North America, Europe, Asia, Africa and South America and covering a 117-year period (1884-2001). Their research, which was based on an exhaustive literature review and local observations, concluded that there are "*no publications documenting bird collisions with or bird mortality due to collisions with bridges or bridge stays*" and that "*there is no scientific evidence to support the view that bridges are a cause of increased bird mortality".*

There are however several arguments and differences of opinion, that bridge-impacts can still be significant for individual species. Most of the arguments that bridges can be potentially detrimental to birds at the population level stem from research into bird collisions with communication towers and cables (e.g. Longcor *et al.,* 2013; Gehring *et al.,* 2009), with the key argument being that tower mortality is related mainly to collisions with the tower infrastructure itself and guide wires/cables, with nocturnal static lights being a key factor at play. Ove Arup & Partners (2002) indicate that the attraction of birds to light is also stronger during foggy or overcast nights. The findings of the literature review undertaken by Ove Arup & Partners (2002) suggests however that only 1% of human caused bird fatalities was attributable to collisions with tall structures, which potentially represents <0.02% of all bird mortality.

Studies indicate that the highest risk of collision/mortality occurs where infrastructure is located along river valleys that serve as migratory corridors for birds and particularly during periods of inclement weather, when low cloud cover / fog reduces visibility. Avian mortality with communication towers has also been shown to be highly variable across species, with Longcor *et al.* (2013) suggesting that some species of bird's experience mortality from towers up to several percent of their total population each year and the risk is most common for nocturnal migrants and neo-tropical migrants in the USA/Canada due to the migratory period suspected to coincide with inclement weather, with factors including habitat quality before migration and number of towers encountered along the route affecting mortality rate. For short-lived species for example, where a large proportion of individuals may only expect to have a single breeding season, spring mortality is biologically far more important (Longcor *et al.,* 2013).

The comparisons with cable-stayed suspension bridges appears to stem from certain commonalities such as the presence of cables and static night lights that attract birds. However, communication towers and suspension bridges are inherently different types of infrastructure and the commonalities (lights and cables) alone cannot be used as the sole source of comparison such that communication tower impacts on birds can be equated to bridge impacts. Ove Arup & Partners (2002) argue that, with the exception of lighting (which can be designed to advantage), cable-stayed bridges share little to none of the communication tower characteristics that make these structures susceptible to bird collisions, with bird fatalities avoided due to the following reasons:

- heights of bridges are typically lower (less than 150 m height on average);
- bridge locations are not on prominent topographic features (ridges, mountain peaks);
- cable-stayed portions of bridges are not isolated, but attached to the rest of the bridge;
- entire bridges are lighted, not just the tower supporting the cables;

- cable-stays are visible at night because they are larger in diameter than guy wires (±30 cm versus <1 cm); and
- bridge cable-stays are visible at night because they can be directly lighted.

3 Conceptualizing bird collision risk

Whilst it would be simple enough to dismiss the potential risk as being very low or negligible based on the readily available literature on the subject, ERM has decided to take a precautionary approach to the assessment of potential collision risk that considers risk under certain situations linked to:

- potential for bird migratory movements to coincide with periods of inclement (poor) weather when visibility would be lower and could increase collision risk for some bird species;
- the potential for birds to undergo nocturnal migrations when conditions would typically reduce visibility and increase reliable collision risk;
- key species behavior that could make these species more vulnerable to collision with the bridge infrastructure.

In considering the collision risk for the cable-stayed bridge for the Turkey Motorway Project, the following influencing factors have been considered in more detail and the findings are discussed below:

1. **Is bridge design potentially conducive to bird collisions in general?**

   Given that the survey findings indicate that most species were recorded at flight heights ranging between 50 and 300 meters, this suggests that the bridge height (79 – 196m) corresponds to expected bird flight height, generally speaking, and therefore a potential collision risk could be involved. That being said, there will still be sufficient room for birds to fly around, over or under the bridge structure. Secondly, the bridge length will be sufficient to provide for effective bird movement beneath the structure over a relatively broad area.

2. **Is the region subject to inclement weather that could affect visibility at the location of the planned suspension bridge and based on the design height of the bridge?**

   Istanbul is subject to inclement weather (low cloud cover, fog rain) at certain periods of the year. This corresponds mostly with near-saturation morning humidity and frequent fog due to Istanbul's maritime position. Due to the hilly topography and maritime influences, Istanbul exhibits a multitude of distinct microclimates. As Istanbul is only slightly rain shadowed from Mediterranean storms and is otherwise surrounded by water, it usually receives some amount of precipitation from both Western European and Mediterranean systems, with frequent rain experienced usually during the autumn (32%, September/October) and winter months (38%, November - April), with spring (May) and summer (June-August/September) rains being less frequent.

   During these periods of poor weather conditions which are mainly experienced in winter/autumn (September/October – March/April), visibility may be significantly impaired and birds utilizing the valley for local movements and as a potential migratory corridor (within which Sazlidere dam and the new stayed cable bridge are located) and particularly at night, may possibly be affected by the obstruction created by the bridge.

3. **Which migratory bird species are present, are there significant numbers and are these a potential collision-risk?**

   *At the location of Sazlidere dam/reservoir where the stayed cable bridge will be located, the key survey findings (focused on migratory/wintering/breeding species and most commonly occurring / abundant species) are included below as Table 1. (see detail also in **Annex. 1**). The detailed findings of the baseline survey of birds is located in Section 5.2.5.1 of the ESIA.*

   Based on this rapid assessment, the following species may be associated with a potential risk of collision with the bridge infrastructure based on several factors including known periods of peak migration coinciding with possible inclement weather, nocturnal migrants susceptible to night time collisions when visibility is lowered, large birds that are less agile, species abundance in the study area and known key threats:

   - **Grey Heron** *Ardea cinerea,*
   - **Pygmy cormorant** *Microcarbo pygmaeus*

- **Great cormorant** *Phalacrocorax carbo*
- **Eurasian Honey-buzzard** *Pernis apivorus*
- **Mediterranean gull** *Larus melanocephalus*

Table 1. Key findings related to bird collision risk with the cable bridge (see Annex. 1)

Species Name	Global Threat Status (IUCN)	Global Population Trend (IUCN)	PBF[1]	Abundance (based on 2021 surveys)	Key Threats (IUCN)	Particularly susceptible to collisions with infrastructure?[2]	Migratory period potentially coincides with inclement weather?[3]	Potentially significant collision risk with bridge[4]
Pygmy cormorant *Microcarbo pygmaeus*	LC	Increasing	☒	High (spring)	Habitat degradation	☒	☒	Possible
Great cormorant *Phalacrocorax carbo*	LC	Increasing	☐	High	Bycatch (fishing)	☒	☒	Possible
Mediterranean gull *Larus melanocephalus*	LC	Decreasing	☒	Moderate	Predation, hunting	☒	☒	Possible
Mallard *Anas platyrhynchos*	LC	Increasing	☐	Low	Habitat degradation and loss	☒	☐	*Unlikely*
Black-headed Gull *Larus ridibundus*	LC	Unknown	☐	High (autumn)	Pollution, disease	☐	☒	*Unlikely*
Yellow-legged Gull *Larus michahellis*	LC	Increasing	☐	High	Egg collection	☐	☒	*Unlikely*
Common Tern *Sterna hirundo*	LC	Unknown	☒	High (autumn)	Human disturbance at nesting sites, hunting	☐	☒	*Unlikely*
Grey Heron *Ardea cinerea,*	LC	Unknown	☐	Moderate	Hunting, timber harvesting	☒	☒	Possible
Great White Egret *Ardea alba*	LC	Unknown	☒	Low	Habitat degradation and loss	☒	☐	*Unlikely*
Little Egret *Egretta garzetta*	LC	Increasing	☒	Low	Habitat degradation and loss	☒	☐	*Unlikely*
Eurasian turtle dove *Streptopelia turtur*	VU	Decreasing	☒	Low	Transformation of agricultural land	☐	☐	*Unlikely*
Eurasian jackdaw *Corvus monedula*	LC	Stable	☐	High	Hunting, habitat loss, displacement	☐	☐	*Unlikely*
Eurasian honey-buzzard *Pernis apivorus*	LC	Stable	☒	Moderate	Hunting, wind energy projects	☒	☒	Possible

[1] PBF: Priority Biodiversity Feature): as per Critical Habtiat Assessment (CHA) by ERM, 2022.

[2] Based on species characteristics / behavior

[3] Assuming this coincides with the winter/autumn (rainy) season in Turkey (typically September/October – March/April of any given year)

[4] Species with potential collision risk based on: key threats, migratory period suspected to coincide with inclement weather, known nocturnal migrants, potential nocturnal migrants, bird behavior (agility, size, sight, etc.)

Species Name	Global Threat Status (IUCN)	Global Population Trend (IUCN)	PBF[1]	Abundance (based on 2021 surveys)	Key Threats (IUCN)	Particularly susceptible to collisions with infrastructure?[2]	Migratory period potentially coincides with inclement weather?[3]	Potentially significant collision risk with bridge[4]
Eurasian magpie *Pica pica*	LC	Stable	☐	High	Hunting	☐	☐	*Unlikely*
Barn swallow *Hirundo rustica*	LC	Decreasing	☐	High	Intensification of agriculture	☐	☐	*Unlikely*
Wood sandpiper *Tringa glareola*	LC	Stable	☒	Moderate	Habitat degradation and loss	☐	☒	*Unlikely*
Alpine Swift *Tachymarptis melba*	LC	Stable	☒	High	Habitat degradation and loss, pesticides	☐	☐	*Unlikely*

See **Annex. 1** for further details on selected key species characteristics.

4 A precautionary Approach to Risk/Impact Mitigation

Whilst it can be argued that collision risk and chance of bird mortality can be considered minimal, a precautionary approach should still be advocated and possible mitigation that could further minimise potential avian collisions and mortalities include:

- Flood-lights to illuminate cable-stayed portions of the bridge at night;
- The under surface of the bridge is to be lit to increase visibility of the piers and deck under surface to birds that fly beneath the bridge at night, subject to detailed design;
- Lighting will increase visibility of the top of the deck to birds that fly over the bridge at night;
- Lighting design to consider the exclusion of non-flashing / steady lights at night and opting for special lighting, such as red-coloured strobe lighting, particularly during inclement weather periods when cloud cover is low over the valley;
- Adding bird flight diverters (mobile brightly coloured and/or reflective plastic plates/tags) to the bridges cables at an internal consistent with (recommend every 5 metres);
- Painting of bridge cables discontinuously (in bands) to increase visibility (recommend use of white paint, to align also with relevant highway/bridge safety codes/requirements);
- Use a sufficiently large cable diameter to increase visibility (bearing in mind alignment with safety standards);
- Power lines are not to be suspended above the bridge deck to reduce the risk of collision and electrocution; and
- Bridge management and maintenance personnel to report cases of bird mortality during operation in the event that dead birds are observed at or near the site of the bridge.

5 Conclusion

Given that the survey findings indicate that most species were recorded at flight heights that correspond with the planned bridge height, a potential collision risk for bird species could be involved. Most bird species in the study area are small and agile, and therefore highly adaptable regarding their flight height and maneuverability and are therefore likely to avoid collision with the bridge infrastructure on the majority of occasions. Key species that may be at risk of collision include the larger, less maneuverable species that are also nocturnal migrants and species or locally active and dispersive at night and those where the period of migration may coincide with the winter/autumn seasons conducive to inclement weather associated with poor visibility. These include the following species of Least Concern (LC) (PBF species indicated by an asterix*):

- **Grey Heron** *Ardea cinerea**
- **Pygmy cormorant** *Microcarbo pygmaeus*
- **Great cormorant** *Phalacrocorax carbo*
- **Eurasian Honey-buzzard** *Pernis apivorus**
- **Mediterranean gull** *Larus melanocephalus**

There will still be sufficient room for birds to fly around, over or under the bridge structure and the bridge length will be sufficient to provide for effective bird movement beneath the structure over a relatively broad area. Taking into consideration the bridge design mitigation recommended in this document, in ERM's opinion the impact rating of 'Minor' reflected in operational impact statement O7 in Table 6-94 of the current version of the ESIA (rev 5) should remain as the overall general impact rating for bird impacts during operation of the motorway.

However, the residual impact rating of 'Negligible' could be increased to a 'minor' residual impact rating to reflect the potential uncertainty regarding bridge collision risks in general in light of: (i) a general lack of rigorous studies and scientific literature on the subject, with key arguments being largely unsupported in the literature; and (ii) certain unknowns as to how effective bridge design mitigation will be in reducing potential collision risk.

The ESIA (rev 5) will be revised as follows based on this document:

- Chapter 6 'Environmental and Social Impact Assessment, and more specifically section 6.2.4 (biological environment) will be updated to include an updated operational impact statement 'O7' in Table 6-94, regarding the bridge-bird collision risk, as per the findings contained in this document;
- The recommended mitigation measures (updates) will be reflected in Table 6-94 of the ESIA, as well as the following documents as necessary: ESMP, CESMP and BAP.

6 References

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Ove Arup & Partners Hong Kong Ltd, 2002. Shenzhen Western Corridor EIA Report. Appendix 9B: Bird Collision with Man-Made Structures with Reference to the Proposed Shenzhen Western Corridor. September 2002. Accessed on 06/09/2022. Available online at: https://www.epd.gov.hk/eia/register/report/eiareport/eia_0822002/EIA%20main%20report/Appendix/appendix%209b.pdf

Annex 1. Key migratory/breeding/wintering bird species considered in understanding bridge collision risk

Species Name	Global Threat Status (IUCN)[5]	PBF[6]	Global Population Trend (IUCN)	Status (based on 2021 survey[7])	Total No. Observations	Abundance recorded in study area	Main season observed (based on 2021 survey[8])	Main migratory period(s) (IUCN) (BirdLife, 2017[9])	Diet (IUCN)	Feeding behavior (IUCN)	Breeding behavior (IUCN)	Key Threats (IUCN)	Potential collision risk with bridge[10]
Pygmy cormorant *Microcarbo pygmaeus*	LC	☒	Increasing	Breeding	Spring: + Autumn: 6	High, in spring	Spring: April – May Autumn: Aug - Sept	End of August, returning March/April	Fish	Singly or in small groups	Breeds between April and July in large mixed-species colonies	Wetland habitat degradation	Possible – peak migratory period coincides with season for possibly inclement weather
Great cormorant *Phalacrocorax carbo*	LC	☐	Increasing	Breeding	Spring: + Autumn: 45	Yes	Spring: April - May Autumn: Aug	Locally dispersive	Fish, vertebrates, molluscs	Solitary feeder but may form large fishing flocks	breeds in mixed-species colonies	Bycatch (fishing)	Possible, but locally dispersive only
Mediterranean gull *Larus melanocephalus*	LC	☒	Decreasing		Spring: 50	Moderate	Spring: May	Seasonal migration in Autumn (late June), returning late February to early April	Insects, vertebrates, fish, seeds/berries		most beginning to breed from early-May	Predation, hunting	Possible – migratory period suspected to coincide with season for inclement weather, potential nocturnal migrant

[5] LC = Least Concern, VU = Vulnerable

[6] PBF: Priority Biodiversity Feature): as per Critical Habtiat Assessment (CHA) by ERM, 2022.

[7] KAB Ecology, 2021. Nakkas Highway: Bird Surveys Report 2021. 30 September 2021.

[8] KAB Ecology, 2021. Nakkas Highway: Bird Surveys Report 2021. 30 September 2021.

[9] BirdLife International, 2017. European Birds of Conservation Concern: population, trends and national responsibilities.

[10]Species with potential collision risk based on: migratory period suspected to coincide with inclement weather, nocturnal migrants

Species Name	Global Threat Status (IUCN)[5]	PBF[6]	Global Population Trend (IUCN)	Status (based on 2021 survey[7])	Total No. Observations	Abundance recorded in study area	Main season observed (based on 2021 survey[8])	Main migratory period(s) (IUCN) (BirdLife, 2017[9])	Diet (IUCN)	Feeding behavior (IUCN)	Breeding behavior (IUCN)	Key Threats (IUCN)	Potential collision risk with bridge[10]
													based on diet
Mallard *Anas platyrhynchos*	LC	☐	Increasing		Spring: 5	Low	Spring: May	Often making local movements during severe weather	Seeds, plants, invertebrates, insects, molluscs, fish, vertebrates		breeds between March and June in single pairs or loose groups	Habitat degradation and loss	Possible – species often makes local movements during severe weather
Black-headed Gull *Larus ridibundus*	LC	☐	Unknown	Migrant Breeding	Spring: 9 Autumn: 96	High, in autumn	Spring: May Autumn: Aug				breeds between April and May	Pollution, disease	Unlikely – small, agile and mobile, capable of avoiding infrastructure
Yellow-legged Gull *Larus michahellis*	LC	☐	Increasing	Breeding	Spring: + Autumn: 496	High	Spring: April – May Autumn: Aug - Sept	Winter migration July to November, returning mid-February to mid-June	invertebrates, insects, molluscs, fish, vertebrates		breeds from mid-March to April	Egg collection	Unlikely – small, agile and mobile, capable of avoiding infrastructure
Common Tern *Sterna hirundo*	LC	☒	Unknown	Migrant	Spring: + Autumn: 1	High, in autumn	Spring: April - May	Migrate between August and October, returning to the breeding grounds in March or April	Fish, occasionally insects		breeds between April and June	Human disturbance at nesting sites, hunting	Unlikely – small, agile and mobile, capable of avoiding infrastructure
Grey Heron *Ardea cinerea,*	LC	☐	Unknown	Migrant, Breeding	Spring: 27 Autumn: 31	Moderate	Spring: April – May	Dispersing widely in September-October, returning in February,	Fish, invertebrates, insects, molluscs, fish, vertebrates	feeds at any time day or night, but is most active at		Hunting, timber harvesting	Possible – migratory period suspected to coincide with season

Species Name	Global Threat Status (IUCN)[5]	PBF[6]	Global Population Trend (IUCN)	Status (based on 2021 survey[7])	Total No. Observations	Abundance recorded in study area	Main season observed (based on 2021 survey[8])	Main migratory period(s) (IUCN) (BirdLife, 2017[9])	Diet (IUCN)	Feeding behavior (IUCN)	Breeding behavior (IUCN)	Key Threats (IUCN)	Potential collision risk with bridge[10]
							Autumn: Aug - Sept	most migratory movements occur nocturnally in small parties or larger flocks of 200-250, nocturnal migrant		dawn or dusk			for inclement weather, mainly a nocturnal migrant, active at dawn/dusk
Great White Egret *Ardea alba*	LC	☒	Unknown	Breeding	Spring: 3	Low	Spring: April – May Autumn:		Fish, invertebrates, insects, molluscs, fish, vertebrates	diurnal feeder but is most active at dawn and dusk	temperate breeders tend to nest in the spring and summer	Habitat degradation and loss	Unlikely
Little Egret *Egretta garzetta*	LC	☒	Increasing		Spring: 13	Low	Spring: April - May		Fish, invertebrates, insects, molluscs, fish, vertebrates	commonly feeds solitarily or in loose flocks during the day,	breed in spring and summer	Habitat degradation and loss	Unlikely – small, agile and mobile, capable of avoiding infrastructure
European Turtle-dove *Streptopelia turtur*	VU	☒	Decreasing		Autumn: 3	Low	Autumn: Aug	wintering south of the Sahara	Seeds, fruits, berries, invertebrates	feeds on the ground	commences in April and can last until September	Transformation of agricultural land	Unlikely – small, agile and mobile, capable of avoiding infrastructure
Eurasian jackdaw *Corvus monedula*	LC	☐	Stable		Spring: + Autumn: +	High	Spring: April - May Autumn: Aug - Sep	sedentary or a short-distance migrant	omnivorous, during the breeding season it is mainly carnivorous			Hunting, habitat loss, displacement	Unlikely – small, agile and mobile, capable of avoiding infrastructure

Species Name	Global Threat Status (IUCN)[5]	PBF[6]	Global Population Trend (IUCN)	Status (based on 2021 survey[7])	Total No. Observations	Abundance recorded in study area	Main season observed (based on 2021 survey[8])	Main migratory period(s) (IUCN) (BirdLife, 2017[9])	Diet (IUCN)	Feeding behavior (IUCN)	Breeding behavior (IUCN)	Key Threats (IUCN)	Potential collision risk with bridge[10]
									(invertebrates)				
European Honey-buzzard *Pernis apivorus*	LC	☒	Stable		28	Moderate	Autumn: August	highly migratory species, depart August and September, returning between April and June	Insects	mostly solitary except on migration		Hunting, wind energy projects	Possible – migratory period suspected to coincide with season for inclement weather, potential nocturnal migrant based on diet
Eurasian magpie *Pica pica*	LC	☐	Stable	Breeding	Spring: + Autumn: +	High	Spring: April - May Autumn: Aug - Sep		Invertebrates, vertebrates seeds, berries		as early as December in and mid-April	Hunting	Unlikely – small, agile and mobile, capable of avoiding infrastructure
Barn swallow *Hirundo rustica*	LC	☐	Decreasing		Spring: + Autumn: 76	High	Spring: April – May Autumn:	European birds wintering in sub-Saharan Africa, although some individuals winter in southern and western Europe	Flying insects		May to August	Intensification of agriculture	Unlikely – small, agile and mobile, capable of avoiding infrastructure
Wood sandpiper *Tringa glareola*	LC	☒	Stable	Migrant	30	Moderate	Autumn: Aug	late-June, with juveniles following in	Invertebrates, vertebrates seeds			Habitat degradation and loss	Unlikely – small, agile and mobile, capable of

Species Name	Global Threat Status (IUCN)[5]	PBF[6]	Global Population Trend (IUCN)	Status (based on 2021 survey[7])	Total No. Observations	Abundance recorded in study area	Main season observed (based on 2021 survey[8])	Main migratory period(s) (IUCN) (BirdLife, 2017[9])	Diet (IUCN)	Feeding behavior (IUCN)	Breeding behavior (IUCN)	Key Threats (IUCN)	Potential collision risk with bridge[10]
								late-August, returning from late-April,					avoiding infrastructure
Alpine Swift *Tachymarptis melba*	LC	☒	Stable	Migrant	Spring: + Autumn: 51	High	Spring: April – May Autumn: Aug - Sept	Palearctic populations probably wintering all across the northern tropics of Africa			breeds from March to June	Habitat degradation and loss, pesticides	Unlikely – small, highly agile and mobile, capable of avoiding infrastructure

Pygmy cormorant *(Microcarbo pygmaeus, LC), breeds between April and July in large mixed-species colonies, leaving the breeding grounds towards the end of August and returning between March and April, is sedentary over much of its range with some populations migrating over short distances and throughout the year it normally feeds singly or in small group, diet consists predominantly of fish – IUCN.*

Great cormorant *(Phalacrocorax carbo, LC), sedentary or locally dispersive, throughout its range, with northerly populations also making strong migratory movements, breeds in mixed-species colonies, usually a solitary feeder but may form large fishing flocks in some areas, roosts communally at nesting sites or in major feeding areas and flies in flocks of varying sizes, diet consists predominantly of fish as well as crustaceans, amphibians, molluscs and nestling birds – IUCN.*

Mediterranean gull *(Larus melanocephalus, LC), most populations of this species are fully migratory and travel along coastlines between their breeding and wintering areas (although a minority travel inland across Asian Turkey), autumn migration to the wintering grounds occurs from late-June onwards, returns to its breeding colonies from late-February to early-April, with most beginning to breed from early-May, diet consists of terrestrial and aquatic insects, gastropods, small numbers of fish and rodents, berries, seeds, offal and occasionally sewage and refuse – IUCN.*

Mallard *(Anas platyrhynchos, LC), breeds between March and June in single pairs or loose, groups in temperate regions, breeding populations of this species are sedentary or dispersive, often making local movements during severe weather, Other populations are fully migratory, outside of the breeding season the species can be found in small to very large flocks, may also roost both nocturnally and diurnally in communal groups when not breeding, requires water less than 1 m deep for foraging, and shows a preference for freshwater habitats, diet consists of seeds and the vegetative parts of aquatic and terrestrial plants (e.g. crops), as well as terrestrial and aquatic invertebrates (especially in the spring and summer) such as insects, molluscs, crustaceans, worms and occasionally amphibians and fish – IUCN.*

Black-headed Gull *(Larus ridibundus, LC), northern breeding populations of this species are strongly migratory, breeds between April and May, may roost in large flocks during the winter, commonly forms nesting colonies on the margins of lakes shows a strong preference for nesting near vegetation – IUCN.*

Yellow-legged Gull *(Larus michahellis, LC), may be dispersive or sedentary, breeds from mid-March to April, species nests near lakes / reservoirs surrounded by reedbeds, outside of the breeding season the species remains gregarious and is more common along the coast, congregating around ports, harbours and refuse dumps, post-breeding movements to wintering areas occur from July to November, with the return migration occurring from mid-February to mid-Jun, diet consists of fish, invertebrates (including insects, molluscs [Olsen and Larsson 2003] and crabs [Munilla 1997]), reptiles, small mammals (e.g. voles [del Hoyo* et al*. 1996] and ground squirrels [Snow and Perrins 1998]), refuse, offal, and bird eggs and chicks – IUCN.*

Common Tern *(*Sterna hirundo, LC), *a strongly migratory coastal seabird, breeds between April and June in solitary pairs or colonially in groups, migrate south after breeding between August and October, returning to the breeding grounds in March or April, forage over fresh water as well as marine habitats, most feeding trips are to sites within 10 km of the colony, nest along lake shores, diet consisting predominantly of small fish and occasionally planktonic crustaceans and insects – IUCN.*

Grey Heron *(Ardea cinerea, LC), fully migratory, dispersing widely in September-October after the breeding season and returning to breeding grounds in February, most migratory movements occur nocturnally with birds moving in small parties or larger flocks of 200-250, feeds at any time day or night, but is most active at dawn or dusk, a generalist in its habitat use, diet consists predominantly of fish and eels, as well as amphibians, crabs, molluscs, crustaceans, aquatic insects, snakes, small rodents, small birds and plant matter – IUCN.*

Great White Egret *(Ardea alba, LC), post-breeding dispersive movements, Palearctic and Nearctic populations are migratory, temperate breeders tend to nest in the spring and summer, species is a diurnal feeder but is most active at dawn and dusk, diet consists of fish, amphibians, snakes, aquatic insects and crustaceans although in drier habitats terrestrial insects, lizards, small birds and mammals are more commonly taken – IUCN.*

Little Egret *(Egretta garzetta, LC), undergo post-breeding dispersive movements, European and north Asian populations breed in spring and summer, shows a preference for shallow waters, during the non-breeding season the species commonly feeds solitarily or in loose flocks during the day, diet consists of small fish, aquatic and terrestrial insects and crustaceans as well as amphibians, molluscs, spiders, worms, reptiles and small birds – IUCN.*

Eurasian turtle dove (*Streptopelia turtur, VU), breeding commences in April and can last until September, strongly migratory, wintering south of the Sahara, feeds on the ground with a diet consisting of seeds and fruits of weeds and cereal crops, rarely also berries, fungi and invertebrates – IUCN.*

Eurasian Jackdaw (*Corvus monedula, LC), sedentary or a short-distance migrant in western and southern Europe, Central European birds appear to disperse north, feeds mostly on the ground and is omnivorous, during the breeding season it is mainly carnivorous, feeding on a wide variety of invertebrates, eggs and household scrap – IUCN.*

Eurasian honey-buzzard (*Pernis apivorus, LC), a highly migratory species, spending the non-breeding phase in in tropical sub-Saharan Africa, departs breeding grounds in August and September, returning between April and June, mostly solitary except on migration, when they flock throughout, gathering in large numbers at preferred crossing points as well as roosting socially, fly chiefly by soaring, Predominately an insectivore, mainly feeding on wasps and hornets but also noted to take flying termites and locusts – IUCN.*

Eurasian magpie (*Pica pica, LC), resident species, breeding season begins with nest-building as early as December in and mid-April is the peak time for first egg-laying, diet varies according to local habitats, but generally consists of invertebrates, small mammals and lizards, frogs, bird eggs and nestlings, as well as carrion. In addition, various seeds, berries and fruits are taken seasonally – IUCN.*

Barn swallow (*Hirundo rustica, LC), breeding season lasts from May to August, feeds almost entirely on flying insects, species is migratory, with European birds wintering in sub-Saharan Africa, although some individuals winter in southern and western Europe – IUCN.*

Wood sandpiper (*Tringa glareola, LC), a full migrant, travelling overland on a broad front across Europe and the Middle East, dults start to move away from the breeding grounds in late-June, with juveniles following in late-August, breeding areas starting to be reoccupied from late-April, species is chiefly carnivorous, taking small insects, during the non-breeding season the species has a more varied diet consisting of aquatic and terrestrial insects and their larvae, worms, spiders, crustaceans, gastropod molluscs, small fish and frogs, as well as plant matter such as seeds – IUCN.*

Alpine Swift *(Tachymarptis melba, LC), occurs over a wide range of habitats and forages over vast areas, breeds from March to June, species is migratory, with West Palearctic populations probably wintering all across the northern tropics of Africa – IUCN.*