IFC JHIMPIR WIND POWER PROJECTS

Thatta Sindh

SUPPLMENTARY SIX MONTH BASELINE BIRDS MONITORING SURVEY REPORT

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1 Executive Summary

IFC are financing six 50-60MW wind power projects (WPPs) (Act II, Artistic Wind, Din Energy, Gul Ahmed Metro Wind and Tricom) in the Jhimpir Wind Region (JWR) within the Gharo Wind Corridor, south Sindh, Pakistan. The projects are located amongst at least 19 existing projects within the JWR. Currently five of the six projects are at the pre-construction stage, the other, Tricon, is at the early construction stage.

Information on biodiversity potentially at risk from the six WPPs has been limited to desk-based Initial Environmental Examinations (IEEs), Biological Component Reports; plus an IFC contracted bird data review summarizing bird reporting from projects within the JWR, and species recorded during short visits to each IFC WPP site.

Recognizing bird turbine collision as a principal risk to biodiversity from these developments and the limited data available to quantify this risk, IFC commissioned a 6-month flight activity survey using Good International Industry Practice (GIIP) methods within and around the six projects to provide quantified flying height data for; a) collision risk susceptible 'target' species and b) species likely to be less at risk from colliding with turbines, 'non-target species'. This report provides the results and findings of this study.

The survey was conducted during the late autumn, winter and spring of 2019-20 and provides species specific estimates of all birds flying within each WPP, as well as the proportion of time high risk species are flying at rotor swept height (RSH). The survey is the first quantified flight activity survey fully compliant with GIIP standards and is a valuable supplement to previous project specific desk and field studies for understanding bird collision risk. It does however only provide a 'snapshot' of bird activity during a single autumn, winter and spring period and the recommended monitoring and mitigation for the construction/operational period provided in this report period take account of this uncertainty by emphasizing an adaptive response framework to manage future emerging risks.

The survey was conducted between 15 November 2019 and 15 May 2020 from a total of 16 vantage points (VPs) – between 2 and 3 per WPP – strategically positioned to best estimate flying height of birds using each project site. A total of 1008 hours of survey corresponding to 63 hours per VP was conducted during the 6-month period aligning with planned survey effort in the project design.

Overall, the survey recorded 16 potentially collision risk susceptible 'target' species using one or more of the 6 IFC WPPs. All but Common Crane, were raptors. The survey identified a larger suite of collision risk susceptible species, occurring in slightly higher numbers than suggested by previous studies summarized in the IFC 2019 bird data review.

The number of collision-risk susceptible species recorded at specific IFC WPPs varied between 9 and 15, with Artistic Wind recording 15 species and the other 5 sites recording between 9 and 12.

Nearly all recorded flights, 777 out of 817 (95%) of target species related to flocks of 5 individuals or less. Of these, 627 (80%) related to single individuals passing through WPPs. Only Common Crane was recorded flying over WPPs in flocks of greater than 5 individuals (average flock size 54, range 19-120).

Large eagles and vultures are potentially at greatest risk of colliding with turbines. Of these species Greater Spotted Eagle(VU) [1] and Steppe Eagle (EN) were recorded at all 6 WPPs in low numbers with project specific counts of between 12 and 25 individuals for Great Spotted Eagle and between 10 and 21 for Steppe Eagle. Tawny Eagle (VU) was recorded at five of the 6 WPPs in very low numbers with project specific counts of between 1 and 8 individuals. Recorded numbers of vultures was low with a single flight record of two Griffon Vultures at Gul Ahmed and four Cinereous Vulture (NT) flight records, each of involving a group of 3-4 birds (10 birds at Gul Ahmed and 3 at Artistic Wind).

More agile raptor species (e.g. falcons, harriers) are typically less susceptible to colliding with turbines. Three harrier, two falcon and two kite species were all recorded during the 6-month survey. Except for Shikra – a small falcon - all were recorded in low numbers with project specific total counts for these species at or below 20 records over the 6-month period.

Each of the three larger eagles; Steppe, Greater Spotted and Tawny Eagle, were recorded flying at RSH for a higher proportion of total recorded 15-second intervals compared with other species (Tawny Eagle 49%, Steppe Eagle 47%, Greater Spotted Eagle 31%). For Cinereous Vulture just under a quarter (21%) of 15-sec interval were at RSH. Contrastingly, despite the moderately large number of individuals involved over 99% of Common Crane flight records were above, and all Shikra flight records were below RSH. Similarly, only 1% of harrier flight records (Montagu's, Pallid and Western Marsh Harrier) were at RSH.

Between 27 and 33 'non target' species were recorded at WPP sites. All 33 non-target species are categorized by the IUCN Red List as Least Concern and a therefore not considered as globally threatened.

Although the collision impacts on non-target species are likely to be less than for target species, fatalities will occur, with flocking species e.g. bee-eaters, species with low flight maneuverability e.g. sandgrouse and species with collision risky behaviour (species with display flights e.g. larks) are potentially at risk. Three owl species (Little Owl, Short-eared Owl and Spotted Owlet were recorded. The semi-nocturnal behaviour of these species mean that they will have been under-recorded, but this does not necessarily correspond to an increased risk.

The presence of the survey team on WPP sites during the survey highlighted some other themes relevant to biodiversity risk:

- The IUCN Critically Endangered Guggul (*Commiphora wightii*) was observed within all 6 WPPs and areas containing the plant will likely be disturbed and/or removed during construction phase development.
- Local people have reported that Asian Houbara (VU)) occurs in the area around the ACT II WPP, and the species is being trapped and illegally sold for hunting.

[1] Abbreviations in brackets after bird species names refer to the IUCN global extinction risk categories. These are: LC = Least Concern; NT = Near Threatened; VU = Vulnerable, EN = Endangered, CR = Critically Endangered.

- An initiative by the Government of Sindh to improve water quality at Keenjhar and Haleji Lakes has the potential to increase the number of waterbirds passing through WPP areas.

Based on the results of the 6-month bird flight activity survey data and other observations at the 6 IFC WPPs the following monitoring and mitigation related activities are recommended for the construction/ operational phase:

- Design and conduct an operational phase bird and bat fatality monitoring program, implemented consistently across all sites, and aligned with GIIP. This will provide essential ongoing feedback on species specific collision risk to birds and assess the, currently unknown risk to bats.
- Develop a 'Biodiversity Monitoring and Management Plan (BMMP) for the six projects. This should include details of all monitoring and mitigation measures and an adaptive management framework that includes thresholds for priority species determined using species specific ecological parameters and assessments of human derived effects on affected populations, and an adaptive management response protocol that provides an escalating scale of action should thresholds be exceeded. This should include the option to implement selective shutdown on demand should risk to priority species populations be detected during operational phase fatality surveys. The BMMP should also include a reporting framework, and detailed method protocols for all monitoring and mitigation activities.
- Report all biodiversity monitoring and mitigation activities 6-monthly and include results summaries, key analysis of data (e.g. fatality rate estimate analysis for bird and bat fatality monitoring), details of emerging threats to key biodiversity values, problems encountered and recommended adaptive management responses.
- Conduct a Rapid Biodiversity Assessment, before the start of construction disturbance for the 5 WPPs still at the pre-construction stage, focusing on the abundance and distribution of Guggul (*Commiphora wightii*) with the results used to inform a section in the BMMP focused on compensating for losses to this species.

2 List of Tables

3 List of Figures

4 Purpose of the survey report

The purpose of this survey report is to:

- Report the results of the supplementary six-month vantage point (VP) bird flight activity survey conducted between November 15th 2019 and May 15th 2020 for the six IFC Wind Power Projects located in Jhimpir Wind Region, Sindh Pakistan;
- Use the survey results to evaluate flight activity levels and species specific turbine collision risk for species using the WPP project areas during the autumn, winter and spring survey period;
- Provide updated project specific baseline bird data for the autumn, winter, and spring survey period;
- Highlight likely effects on other biodiversity features;
- Recommend appropriate monitoring and mitigation measures for the construction and operational phase of the project.

Bird names used in this report follow names currently used in the IUCN Red List https://www.iucnredlist.org/

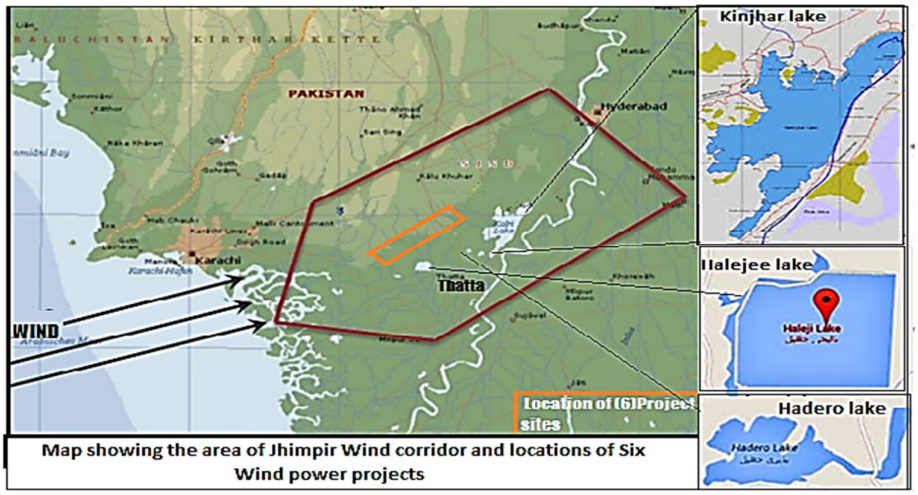
5 Background

IFC are financing six WPPs (also referred to as the 'IFC Super Six' projects) located in the Jhimpir Wind Farm Region (JWR), which is one of two wind resource areas within the Gharo-Jhimpir Wind Corridor, south west Sindh province, Pakistan (Figure 1).

The JWR is a low lying, arid/semi arid landscape dissected by intermittent streams, climatically influenced by the Kirthar mountains to then north/northwest.

The JWR lies within the Central Asian Flyway for migratory birds. Especially relevant to risks from wind energy developments are turbine collision risk susceptible raptor and waterbird migrants that have the potential to use airspace and ground habitat within the six IFC wind project areas. Keenjhar Lake and Haleji Lakes located to the east/northeast and south respectively of the project sites are two Important Bird and Biodiversity Areas (IBAs) also recognized as Key Biodiversity Areas (KBAs). Hadero Lake located close to Haleji Lake is a smaller wetland designated as a Wildlife Sanctuary. Directly to the east of Keenjhar Lake is the Indus river (Figure 1).

Figure 1 Jhimpir Wind Corridor and general location of 6 IFC financed WPPs



Map showing the area of Jhimpir Wind corridor and locations of Six Wind power projects

5.1 Project details

Within the Jhimpir Wind Region there are at least 19 existing WPPs. The six IFC projects are located amongst these with a cluster of five projects in the south western part of the area and one further to the north east (Figure 2). Table 1 provides project details a principal habitat types for each of the six IFC projects where the bird flight activity surveys were conducted.

Tricom WPP has been under construction since February 2020 and the remaining five projects are expected to start the construction in mid July 2020.

Figure 2a shows Location of the six IFC financed WPPs

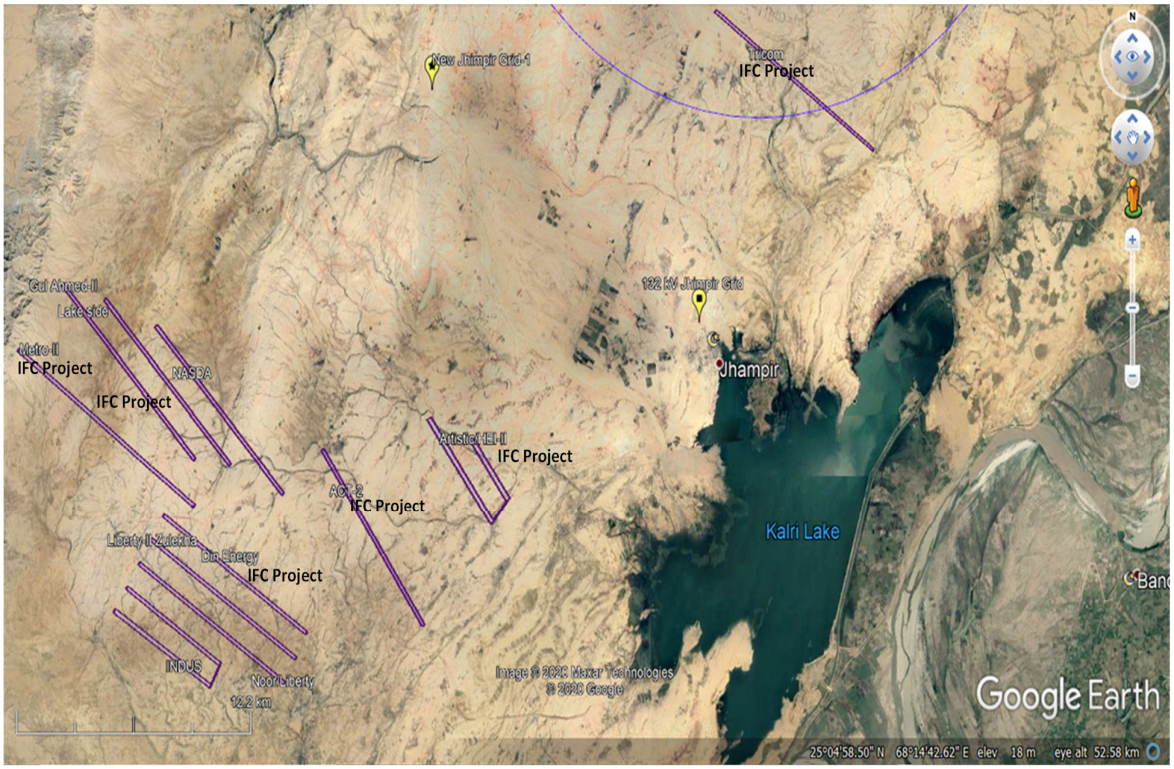


Figure 2b shows existing WPPs in the Jhimpir Wind Farm Region

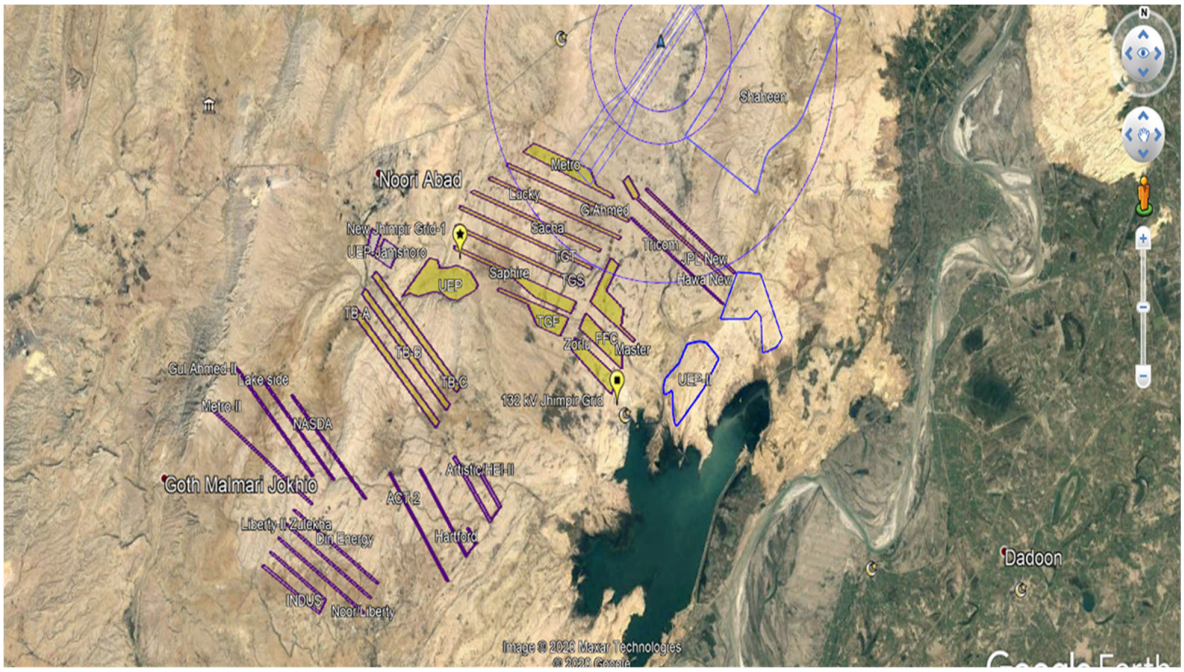


Table 1 Project details and dominant habitat for six IFC wind power projects

S.#	Project	Location	VP	Habitat
1.	Tricom Wind 50 MW 327 acres	25.12859 ,68.03725	1	Soil is loamy. It is actually a combination soil, normally equal parts of clay, silt, and sand, Land area is more or less composed of cultivated land
		25.12461,68.05057	2	VP 2 and 3 area is rocky and elevated land There is seasonal water channel in between VP 2 & 3
		25.12538 ,68.05315	3	
2.	Artistic Wind 50 MW 462 acres	2497504 ,6788283	1	Flat rocky cum sandy, few small mounts covered with lose soil. The low land area is composed of small patches of cultivated land
		24.98037 ,67.89824	2	Channel area mainly comprises of vegetation along the water channel
		24.98806 ,67.88939	3	Located at the edge of the edge of water channel
3.	ACT 2 50 MW 320 acres	24.97818 ,67.79722	1	Rocky Barren Xerophytic
		24.96603 ,6782037	2	Rocky Barren with thinly vegetative
4.	DIN Energy 50 MW 325 acres	24.95561, 67.73512	1	Rocky Barren Xerophytic
		24.95 239 67.74326	2	Rocky Barren Xerophytic
		24.94297 ,67.76574	3	Rocky Barren Xerophytic
5.	Metro Power 60 MW 410 acres	25 .0022, 67.70186	1	Rocky Barren Xerophytic
		25.020678 67.39368	2	Rocky Barren Xerophytic
6.	Gul Ahmad Electric 50 MW 370 acres	25.000369 ,67.7226	1	Rocky with lose soil and vegetative
		25.01001 ,67.7086	2	Rocky with lose soil and vegetative
		25.01868 ,67.70729	3	Rocky Barren Xerophytic

5.2 Existing bird biodiversity information

Existing bird studies relevant to the 6 IFC WPPs come from four main sources;

- pre-construction baseline studies, principally desk based expert reviews appearing in IEEs and 'biological component reports' from ecologists who are familiar with the area in and around project sites;
- field-based bird flight activity and bird fatality surveys at WPP adjacent to IFC projects
- more general assessments of the wider JWR as part of earlier academic studies and a cumulative impact assessment for the area.

IFC contracted a review of all existing bird data relevant to IFC WPPs including information relating to existing adjacent WPPs in the JWR (Ghalib et. al. 2019). The review reported bird species recorded on single day visits during Feb/March 2016 to each of 4 of the 6 IFC WPPs (ActII, Artistic Wind, Gul Ahmed and Metro Wind). During these visits, forty species were recorded with species at each site ranging between 27 and 38 species. Over three quarters (76%) of these were small/medium sized passerines, 4 were raptors (Common Buzzard, White-eyed Buzzard Common Kestrel and Black Kite), two wading birds (Red-wattled Lapwing and Black-wind Stilt) and 3 ground-dwelling species (Grey Francolin locally known as "Grey Partridge", Common Quail and Chestnut-bellied Sandgrouse)

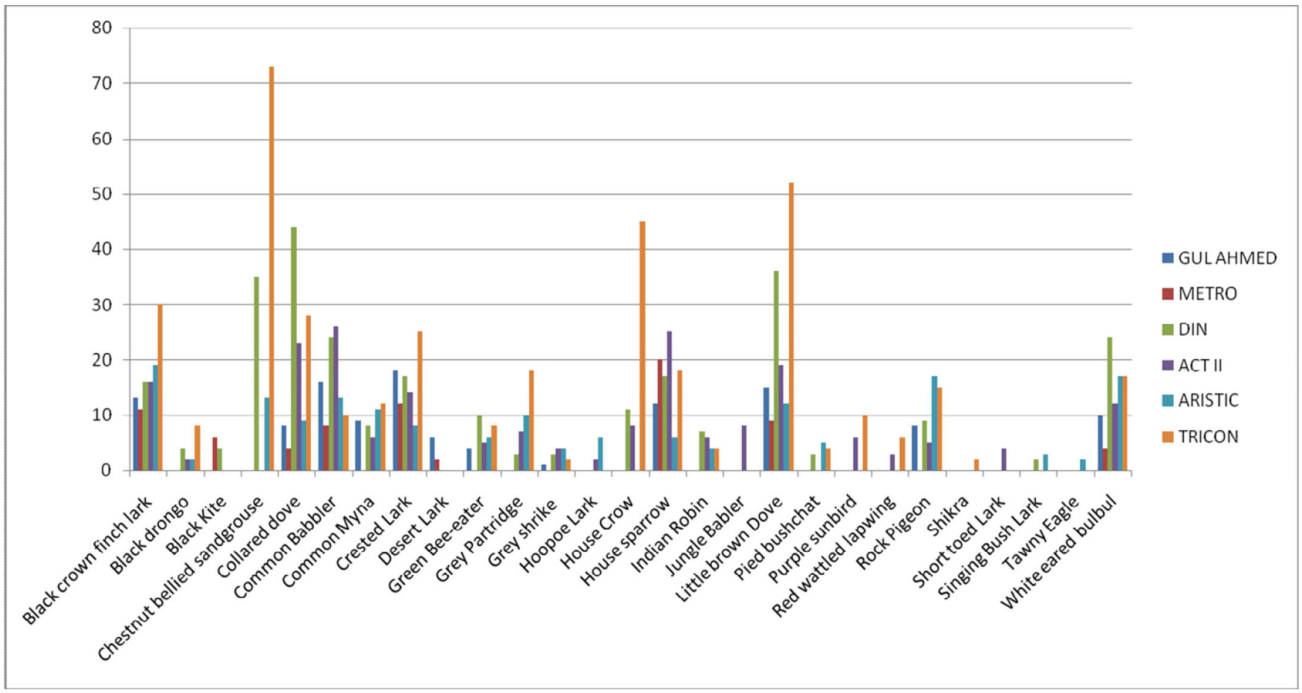
As part of this review a wildlife ecologist and field experts made brief visits to each of the project sites in July 2019. During these visits 27 species were recorded with between 9 and 20 species at individual sites (Table 2). Most species recorded were small/medium sized passerines. The only other species recorded were three raptors (Tawny Eagle, Shikra, and Black Kite), one wading bird (Red-wattled Lapwing) and two medium-sized ground-dwelling species (Grey Francolin, and Chestnut-bellied Sandgrouse) (Figure 3).

Table 2 Number of species recorded during at six proposed IFC WPP sites during field visits in July 2019 (survey effort not given) (Ghalib et. al. 2019)

Name of project	Number of species recorded during site survey
Gul Ahmed	12
Metro	9
Din	19
ACT II	20
ARTISTIC	19
TRICOM	20

Whilst useful in providing 'snapshots' of species that are found on the 6 project sites, these studies lack quantitative flying height information, and the value of any findings are limited by low survey effort.

Figure 3 Numbers of individuals recorded during at six proposed IFC WPP sites during field visits in July 2019 (survey effort not given) (Ghalib et. al. 2019)



In the wider JWR, the IFC bird data review summarized records of 'threatened' (turbine collision risk susceptible species). A small number of records of Steppe Eagle, Greater Spotted Eagle, Tawny Eagle, Egyptian Vulture, Pallid Harrier and Asian Houbara were identified at around half of the 15 WPPs reviewed.

Overall the IFC data review concluded a low presence of collision-risk susceptible species using project sites, and a low risk of collision due to the likelihood of these species flying either below or above turbine height. Acknowledging limitations of the current baseline the IFC bird data review recommended quantified vantage point bird flight activity monitoring at the 6 sites using teams of professionally trained bird surveyors.

Longer term VP flight activity surveys at WPPs adjacent to the IFC projects appear to be limited to Tricon Boston A, B and C WPP, where bird monitoring has been conducted since September 2015 and has included; a 7-month pre-construction phase VP survey following Scottish Natural Heritage guidelines[2], two years of VP monitoring during the construction phase and on-going monitoring VP and fatality monitoring during the operational phase. Operational phase VP and fatality monitoring has also been conducted at Sapphire Wind, Master Wind, Jhimpir Power since 2017[4].

[2] Scottish Natural Heritage. (2013). Recommended bird survey methods to inform impact assessment of onshore wind farms SNH guidance. Scottish Natural Heritage. August 2013

Operational phase fatality monitoring has recorded eight events of mortality comprising of Shikra, Great White Pelican and Bonelli's Eagle at Master Wind and Tricon Boston WPPs[4].

6 Objectives of the 6-month VP bird flight activity survey program

- To update existing (largely qualitative) baseline information on risk particularly to birds at the six IFC WPPs;
- To provide a quantitative assessment of bird flight activity within the footprint of each of the six projects for the 2019-20 autumn migration, winter and spring periods, to inform construction and operational phase bird monitoring and mitigation decisions and provide input for development of a Biodiversity Monitoring and Management Plan (BMMP) for the construction and operational phases;
- To make qualitative assessment of other risks to biodiversity values at the six project sites based on observations made during the six-month bird flight activity monitoring program.

7 Flight activity vantage point survey methods

7.1 Target and non-target species

To focus surveyor effort on those species likely to be at highest risk from colliding with turbines at WPPs, turbine collision-risk susceptible species were regarded as 'target species' (Table 3) and were subject to focal flight activity sampling. Bird species with a known or assumed low-likelihood of collision with turbines were regarded as non-target species and records were limited to the number of birds observed flying within each 5-minute period throughout each VP watch.

Table 3 Target species subject to focal flight activity sampling during VP watches

Target species
All raptor species
All bustard species
Any additional IUCN Globally Threatened Species (Vulnerable-VU, Endangered-EN, Critically Endangered-CR)
Great White Pelican (*Pelecanus onocrotalus*)
Common Crane (*Grus grus*)

7.2 VP survey set up

Before the start of the monitoring (1-7 November 2019) VPs and associated survey areas at each of the WPPs projects were identified. The following points were considered during the identification and establishment of VPs:

- VPs were positioned so that together they covered a survey area that contained all proposed turbine locations with the survey area boundary (determined by the outermost proposed turbine locations, buffered to 500m).
- VPs aimed to cover all the airspace within the survey area.
- VPs were positioned so that ideally no location within the survey area was more than 2km from the VP, and the area viewed by the surveyor did not exceed 180 degrees.

VPs were selected during the site visits taking into consideration the viewshed, and the location of VP relative to turbine locations and topography. Coordinates of each VP were recorded with the help of GPS and then mapped. During the last week of Nov 2019, identified VPs were validated by Simon Hulka-IFC Biodiversity Specialist.

7.3 VP session length and duration

Each VP watch was conducted by a single surveyor and lasted for 3 hours. Each VP was scheduled to receive 9 hours survey per month (i.e. 3 x 3-hour sessions), totaling 63 hours of survey per VP for the 6-month survey. Within each month, watches at each VP were spread through the day with one watch in the morning (0800-1100), one in the afternoon (1100-1400) and one in the late afternoon/early evening (1500-1800).

7.4 VP recording

Bird flight activity data was recorded in two ways. Target species were followed, and flight height recorded at 15 second intervals and the flight routes mapped. Flight activity of non-target species was summarized in each 5-minute period during a watch (i.e. number of birds of a specific species recorded in flight during each 5-min period).

Full details of the methods used are provided in Annex 13.2

8 Pre-survey training

Before the start of the survey activities, three surveyor training sessions were conducted (Figure 4. Survey training sessions)

The first session was conducted in November 2019 using the Survey Guidance document including data recording templates as provided by IFC Pakistan. (see Annex 13.2).

The second training session was on-site training provided during the period Nov 26-29, 2019 by Mr. Simon Hulka - Biodiversity Specialist of IFC. The focus of this training was to demonstrate the method of data recording particularly relating to target species and their flight height determination.

The third training session was conducted in Dec 2019 after receiving feedback from Mr. Simon Hulka on the design of maps for recording bird flight lines.

Figure 4. Survey training sessions

9 Results

Except for occasional rescheduling of survey sessions, the flight activity VP surveys for all 6 IFC WPPs were conducted according to the planned schedule.

A total of 1629 individuals from 16 different target species were subject to focal flight height recording across the 6 IFC WPPs. Additionally, 33,700 non-target species records from 33 different species were recorded during the 6-month survey. Three IUCN globally threatened (Steppe Eagle (EN), Greater Spotted Eagle (VU) and Tawny Eagle (VU) and two globally near-threatened (Cinereous Vulture and Pallid Harrier) collision risk susceptible species were recorded in small numbers.

9.1 Survey effort

Surveys were conducted for a total of 1008 hours at 16 VPs, corresponding to 63 survey hours per VP over the 6-month survey period (Table 4). This aligns well with international good practice wind energy

guidance for bird VP flight activity surveys for a 6-month period where migratory activity is likely but not expected to involve large numbers of birds[3].

The survey schedule was interrupted three times, for a week on each occasion, however it was possible to reschedule missed surveys and these events had no overall impact on monthly or overall survey effort at each VP.

If a WPP dedicated surveyor was unable to work on a particular day, they were substituted with an available member of the wider survey team. As a result, all planned survey sessions during the 6-month survey were conducted (Table 5 Planned and actual survey sessions compared).

Table 4 Survey effort for each VP for each WPP

Project	Vantage Point	NOV	DEC	JAN	FEB	MAR	APR	MAY	Total
ACT2	VP1	9:00	9:00	9:00	9:00	9:00	9:00	9:00	63:00
	VP2	9:00	9:00	9:00	9:00	9:00	9:00	9:00	63:00
Total		**18:00**	**18:00**	**18:00**	**18:00**	**18:00**	**18:00**	**18:00**	**126:00**
Artistic	VP1	9:00	9:00	9:00	9:00	9:00	9:00	9:00	63:00
	VP2	9:00	9:00	9:00	9:00	9:00	9:00	9:00	63:00
	VP3	9:00	9:00	9:00	9:00	9:00	9:00	9:00	63:00
Total		**27:00**	**27:00**	**27:00**	**27:00**	**27:00**	**27:00**	**27:00**	**189:00**
Din Energy	VP1	9:00	9:00	9:00	9:00	9:00	9:00	9:00	63:00
	VP2	9:00	9:00	9:00	9:00	9:00	9:00	9:00	63:00
	VP3	9:00	9:00	9:00	9:00	9:00	9:00	9:00	63:00
Total		**27:00**	**27:00**	**27:00**	**27:00**	**27:00**	**27:00**	**27:00**	**189:00**
Gul Ahmed	VP1	9:00	9:00	9:00	9:00	9:00	9:00	9:00	63:00
	VP2	9:00	9:00	9:00	9:00	9:00	9:00	9:00	63:00
	VP3	9:00	9:00	9:00	9:00	9:00	9:00	9:00	63:00
Total		**27:00**	**27:00**	**27:00**	**27:00**	**27:00**	**27:00**	**27:00**	**189:00**
Metro Wind	VP1	9:00	9:00	9:00	9:00	9:00	9:00	9:00	63:00
	VP2	9:00	9:00	9:00	9:00	9:00	9:00	9:00	63:00
Total		**18:00**	**18:00**	**18:00**	**18:00**	**18:00**	**18:00**	**18:00**	**126:00**
Tricom	VP1	9:00	9:00	9:00	9:00	9:00	9:00	9:00	63:00
	VP2	9:00	9:00	9:00	9:00	9:00	9:00	9:00	63:00
	VP3	9:00	9:00	9:00	9:00	9:00	9:00	9:00	63:00
Total		**27:00**	**27:00**	**27:00**	**27:00**	**27:00**	**27:00**	**27:00**	**189:00**

[3] see Scottish Natural Heritage. (2017). Recommended bird survey methods to inform impact assessment of onshore wind farms. Version 2 SNH guidance. Scottish Natural Heritage. August 2017

Table 5 Planned and actual survey sessions compared

Parameter	Plan	Actual
Total Sessions	288	288
Morning	96	96
Afternoon	96	96
Evening	96	96
Total Hours	864	864

9.2 Target species

9.2.1 *All projects*

Overall findings for target species flight activity data (Table 6-7 and Figures 5-6):

- The focal flight activity survey of target species recorded 16 potentially collision risk susceptible species using one or more of the 6 IFC WPPs. All but Common Crane, were raptors.
- Focal flight activity surveys identified a larger suite of species occurring in larger numbers than suggested by previous studies summarized in the 2019 bird data review for IFC (Ghalib *et. al.* 2019).
- The number of collision-risk susceptible species recorded during surveys varied between 9 and 15 with Artistic Wind having the highest number and the other 5 sites having lower but similar numbers (between 9 and 12).
- Common Crane (LC) had the highest recorded total of birds over the survey period with 773 individuals. Birds were typically seen flying in flocks of between 50 and 100 birds and over 99.5% were recorded flying above turbine rotor swept height. During surveys a few birds were observed landing toward the north and east side of existing project areas and a collision fatality was recorded at the Master Wind Energy project in February 2020.
- Large eagles and vultures are potentially at greatest risk of colliding with turbines. Of these species Greater Spotted Eagle (VU) and Steppe Eagle (EN) were recorded at all 6 WPPs in low numbers with project specific counts of between 12 and 25 individuals for Great Spotted Eagle and between 10 and 21 for Steppe Eagle. Tawny Eagle (VU) was recorded at five of the 6 WPPs in very low numbers with project specific counts of between 1 and 8 individuals. In other monitoring in the wider region, large groups of Steppe Eagle have been recorded near semi aquatic/aquatic habitats including; 141 birds in November 2017 recorded resting on electricity poles near coastal Tenaga Generasi and HydroChina WPPs to the south of the IFC WPPs (at least 74 km away from Tricom Wind Energy Ltd and 45 km away from Din Energy Ltd); 69 recorded in the same area in February 2018 and a large flock of this species recorded on the west bank of Keenjhar Lake in November 2019, [4]
- Recorded numbers of vultures was low during the survey period a single flight record of two Griffon Vultures at Gul Ahmed and four Cinereous Vulture (NT) flights, each of involving a group of 3-4 birds (10 birds at Gul Ahmed and 3 at Artistic Wind). This species occurs in small numbers in the Kirthar National Park 70 - 80km to the north/north west but only occasionally occurs in and around the six IFC

WPP areas. In other monitoring a large flock of Griffon Vulture have been observed previously near the Tricom project .[4]

- More agile raptor species (e.g. falcons, harriers) are typically less susceptible to colliding with turbines. Three harrier (Montagu's, Pallid and Western Marsh Harrier), two falcon (Shikra and Eurasian Sparrowhawk) and two kite species (Black Kite and Black-winged Kite) were all recorded during the 6-month survey. Except for Shikra all were recorded in low numbers with project specific total counts for these species below 20 records over the 6-month period. Western Marsh Harriers were usually single individuals whereas Montagu's and Pallid Harriers were typically seen in pairs.
- Shikra and Common Buzzard were the most frequently recorded raptors during the survey with similar project specific total counts of between 23 and 37 records for Shikra (typically in pairs[4])and 13 and 41 for Common Buzzard . All flights for Shikra were recorded as below the rotor swept height. Two Shikra turbine collision fatalities have been recorded at the nearby 'Master' WPP in February 2018[4]
- Short-toed Snake-eagle was recorded occasionally, and only at the Gul Ahmed WPP where its presence may be linked to the presence of shrubland habitat supporting snake prey populations. Similarly, Long-legged Buzzard was recorded infrequently but mainly at Act II, Artistic and Din Energy and this may also be due to more abundant prey at these sites, particularly Spiny-tailed Lizard. Long-legged Buzzards were seen hunting and eating this species during the survey.
- Quantitative recording of flying height at 15 second intervals provided useful information on the flight behavior of target species related to wind turbine rotor swept height. Each of the three larger eagles; Steppe, Greater Spotted and Tawny Eagle, were recorded flying at rotor swept height for a higher proportion of total recorded 15-second intervals compared with other target species (Tawny Eagle 49%, Steppe Eagle 47%, Greater Spotted Eagle 31% of species specific 15-second record totals). For Cinereous Vulture for the four flight records just under a quarter (21%) of 15-sec interval were at rotor swept height. Contrastingly, despite the moderately large number of individuals involved nearly all Common Crane and all Shikra flights were above and below rotor swept height, respectively. Additionally, from 3302 15-second records for harrier species combined (Montagu's, Pallid and Western Marsh Harrier) only 19 records (1%) were at rotor swept height.
- Nearly all recorded flights, 777 out of 817 (95%) of target species related to flocks of 5 individuals or less. Of these 627 (80%) related to single individuals passing through WPPs. Only Common Crane was recorded flying over WPPs in flocks of greater than 5 individuals (average flock size 54, range 19-120).
- The overall monthly number of target species records were substantially influenced by occasional moderate-sized flocks of Common Crane passing through WPPs in November, December, February, and March. For the remaining 15 species, the overall monthly totals were similar between November and March (approximately between 120 and 150 birds), reducing to 66 in April and 43 records in May. Although numbers in November were consistent with the higher group of monthly totals, surveys began halfway through the month (November 15) and this number of records would likely have been higher if the whole of November had been surveyed.
- There were few distinct species specific monthly patterns partly due to the low number of records for many target species although records for many species were generally lower in the last full survey month of April compared with full month counts for December- March.

Table 6 Target species. Project specific bird counts.

Common Name	Act II	Artistic Wind	Din Energy	Gul Ahmed	Metro	Tricom	Total number of birds
Black Kite	0	8	5	0	0	8	21
Cinereous Vulture	0	3	0	10	0	0	13
Black-winged Kite	0	2	1	0	0	2	5
Common buzzard	30	41	33	13	21	40	178
Common Crane	314	314	0	0	0	145	773
Eurasian Sparrowhawk	0	1	0	0	0	0	1
Greater Spotted Eagle	15	19	25	18	12	23	112
Griffon Vulture	0	2	0	0	0	0	2
Long-legged buzzard	10	8	7	2	1	2	30
Montagu's Harrier	3	3	7	1	3	4	21
Pallid Harrier	14	20	10	10	12	18	84
Shikra	37	46	23	23	25	34	188
Short-toed Snake-eagle	0	0	0	8	0	0	8
Steppe Eagle	21	19	14	8	10	16	88
Tawny eagle	8	3	0	6	1	2	20
Unidentified raptor	4	7	5	5	3	5	29
Western Marsh Harrier	4	14	9	12	10	7	56
Total number of birds	460	510	139	116	98	306	1629

Table 7 Target species. Monthly counts. All projects

Common Name	Nov	Dec	Jan	Feb	Mar	Apr	May	Total number of birds
Black Kite	0	0	0	8	6	4	3	21
Cinereous Vulture	0	10	3	0	0	0	0	13
Black-winged Kite	2	0	0	0	2	0	1	5
Common buzzard	36	36	30	24	29	11	12	178
Common Crane	200	114	0	114	345	0	0	773
Eurasian Sparrowhawk	0	0	1	0	0	0	0	1
Greater Spotted Eagle	21	30	28	11	10	7	5	112
Griffon Vulture	0	0	2	0	0	0	0	2
Long-legged buzzard	3	4	7	8	3	4	1	30
Montagu's Harrier	7	2	7	3	2	0	0	21
Pallid Harrier	10	22	18	16	14	4	0	84
Shikra	32	32	39	31	22	19	13	188
Short-toed Snake-eagle	0	2	0	0	2	3	1	8
Steppe Eagle	17	14	20	15	18	3	1	88

Tawny Eagle	2	0	1	6	7	2	2	20
Unidentified raptor	10	0	3	12	0	1	3	29
Western Marsh Harrier	8	7	13	11	8	8	1	56
Total number of birds	**348**	**273**	**172**	**259**	**468**	**66**	**43**	**1629**

Figure 5 Target species. Total number of birds. All projects

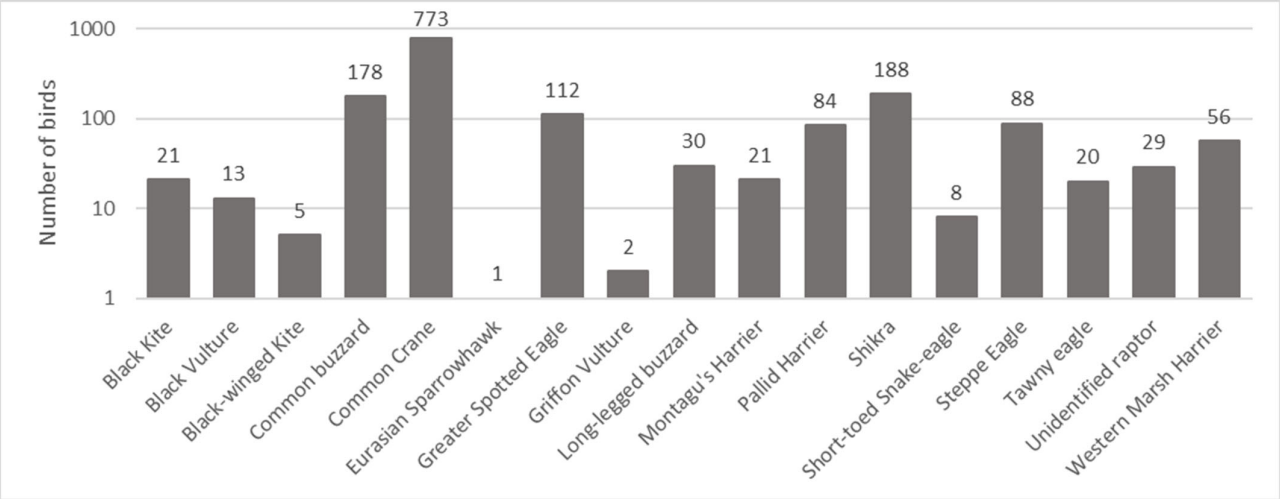
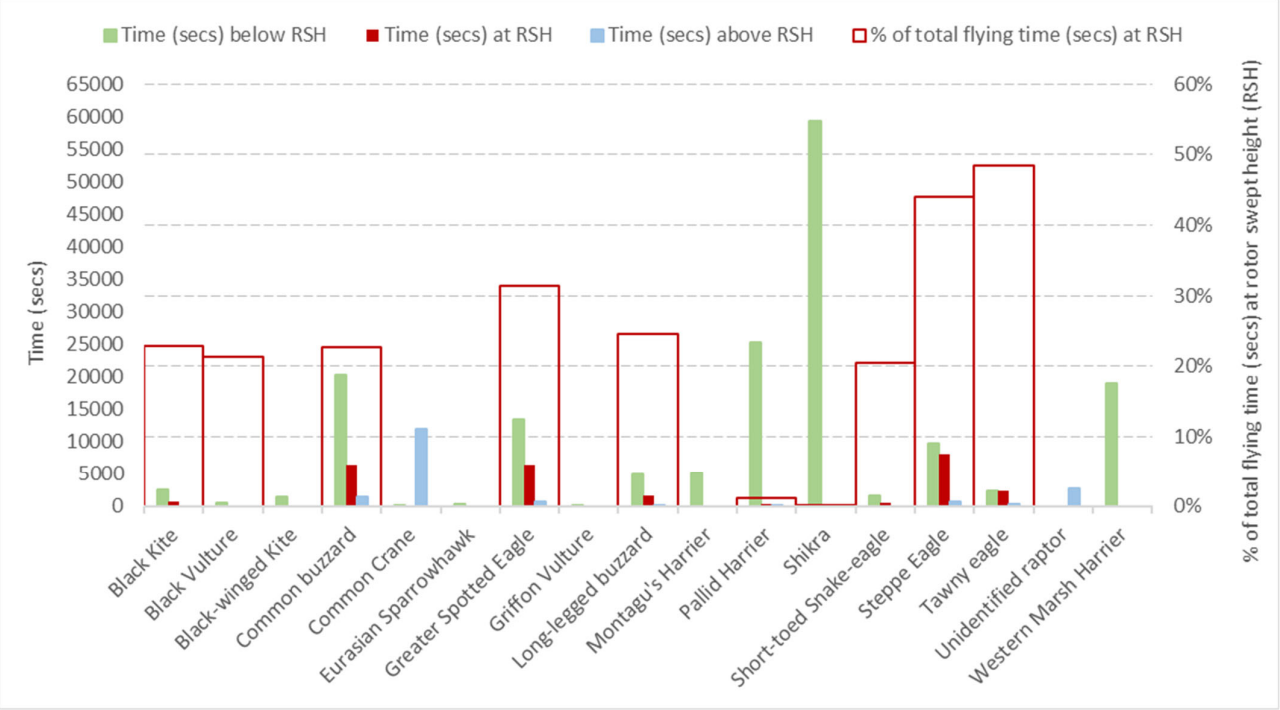


Figure 6 Target species – flying height and % of time at rotor swept height (RSH). **All projects**



9.2.2 *ACT II*

Key findings for target species flight activity data (Figures 7-8)

- The number of target species recorded (10) was typical compared with the other 5 sites
- Overall raptor numbers were average (146 records) compared with the other 5 sites.
- The highest recorded counts of Common Crane occurred at Act II. Birds were recorded flying in a few moderately sized flocks (47-80 birds) above RSH.
- Steppe Eagle and Tawny Eagle records were slightly higher at Act II compared with other sites but because the number of records is similar for each of these two species at all 6 WPPs Act II should not be considered as relatively important for Steppe or Tawny Eagle.
- Steppe Eagle had the highest proportion of recorded flying height records at RSH (53%), followed by Tawny Eagle (44%). Common Buzzard, Long-legged Buzzard and Greater Spotted Eagle were each recorded at rotor swept high for approximately a quarter of their recorded flying time.
- Flying height records for Shikra and three harrier species (Montagu's Pallid and Western Marsh Harrier) were all below RSH.

Figure 7 Target species – Total number of birds. **ACT II**

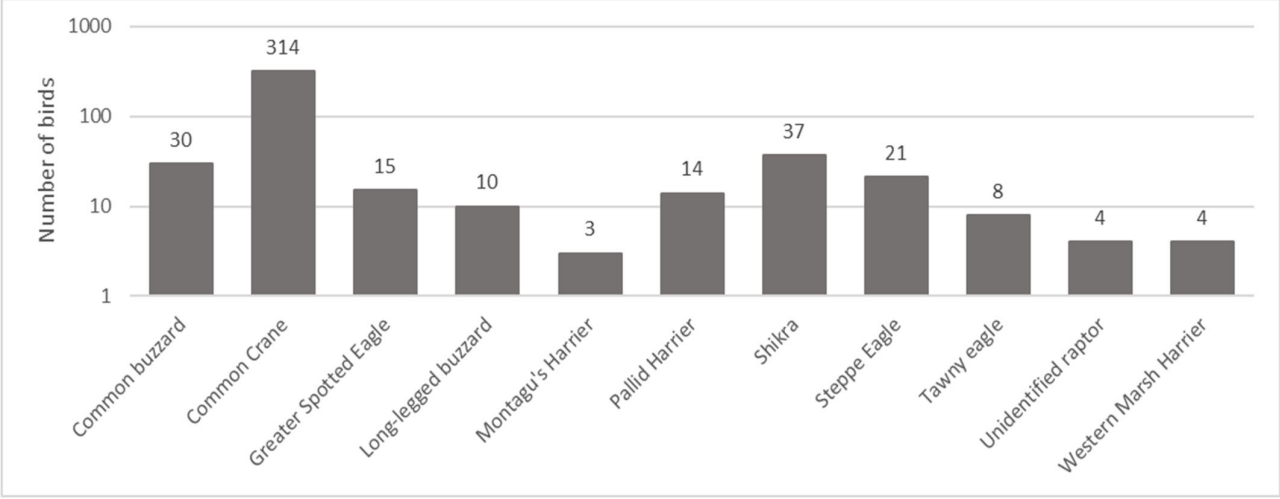
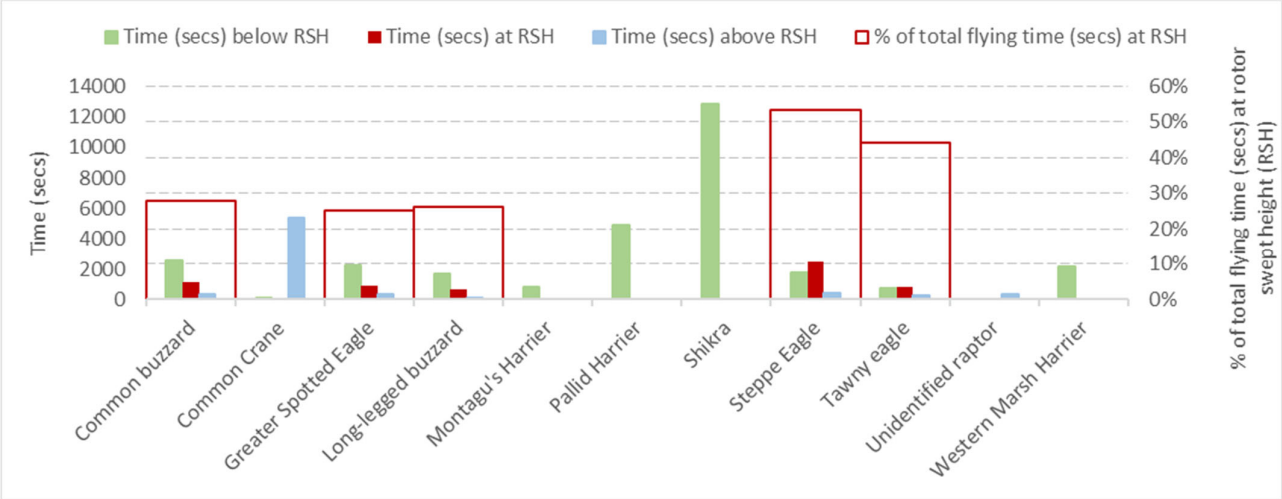


Figure 8 Target species – flying height and % of time at rotor swept height (RSH). **ACT II**



9.2.3 *Artistic Wind*

Key findings for target species flight activity data (Figures 9-10)

- The number of target species recorded (15) was higher than at any of the other 5 sites
- Overall raptor numbers were higher (196 records) than at any of the other 5 sites.
- Recorded numbers of Common Buzzard, Griffon Vulture, Pallid Harrier, Shikra and Western Marsh Harrier were slightly higher than at the five other IFC WPPs.
- The highest counts of Common Crane occurred at Artistic Wind, equal with total count for ACT II. Many of the dates on which these records occurred were different from those at ACT II suggesting that some if not all were different individuals. Birds were recorded flying in a few moderately sized flocks (55-80 birds) above RSH.
- Three Cinereous Vulture and two Griffon Vulture were recorded on a single date (9 January). In total these birds were only recorded flying for just over five minutes, during which all recorded flight heights were below RSH.
- Like other sites, Steppe Eagle and Tawny Eagle had the highest proportion of recorded flying height records at RSH (Steppe Eagle 40% Tawny Eagle 52% of recorded flying time).
- Flying height records for Shikra, Black-winged Kite and three harrier species (Montagu's Pallid and Western Marsh Harrier) were all below RSH.

Figure 9 Target species – Total number of birds. **Artistic Wind**

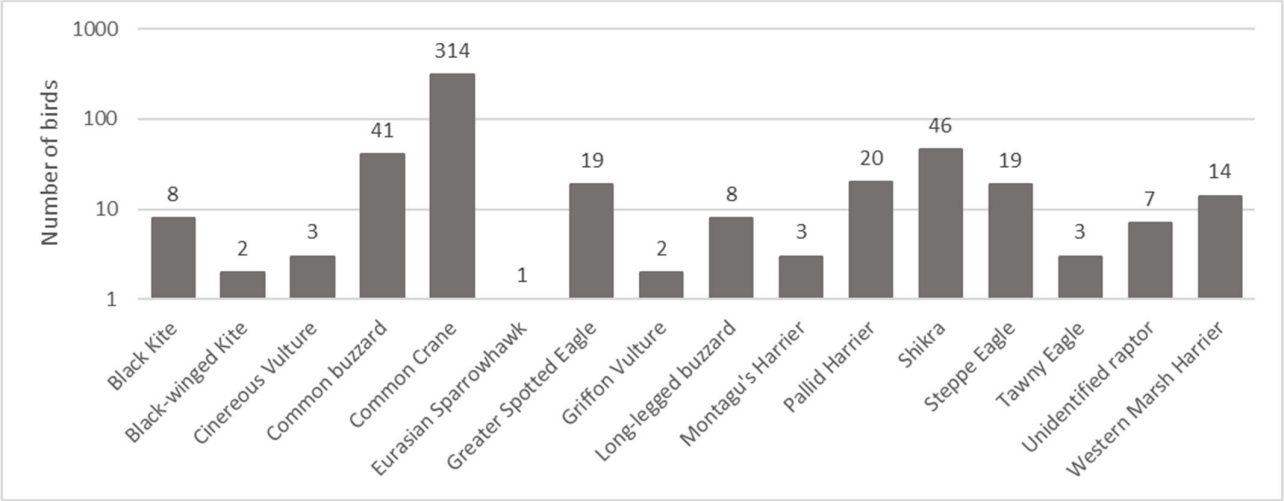
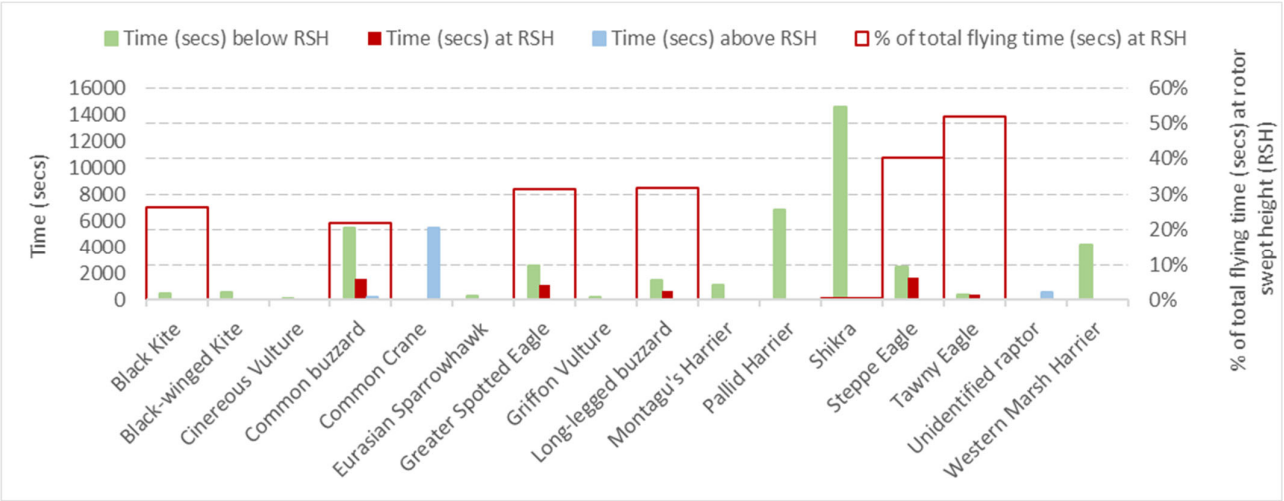


Figure 10 Target species – flying height and % of time at rotor swept height (RSH). **Artistic Wind**



9.2.4 *Din Energy*

Key findings for target species flight activity data (Figures 11-12)

- The number of target species recorded (10) was typical compared with the other 5 sites
- Overall raptor numbers were average (139 records) compared with the other 5 sites
- Recorded numbers of Greater Spotted Eagle and Montagu's Harrier were slightly higher than at the five other IFC WPPs.

- The highest proportion of species-specific flight time at RSH was for Greater Spotted Eagle (54%) and Steppe Eagle (51%). Black Kite and Long-legged Buzzard were each recorded flying at rotor swept high for approximately a third (32%) of their total recorded flying time.
- Flying height records for Shikra, Black-winged Kite and three harrier species (Montagu's Pallid and Western Marsh Harrier) were all below RSH.

Figure 11 Target species – Total number of birds. **Din Energy**

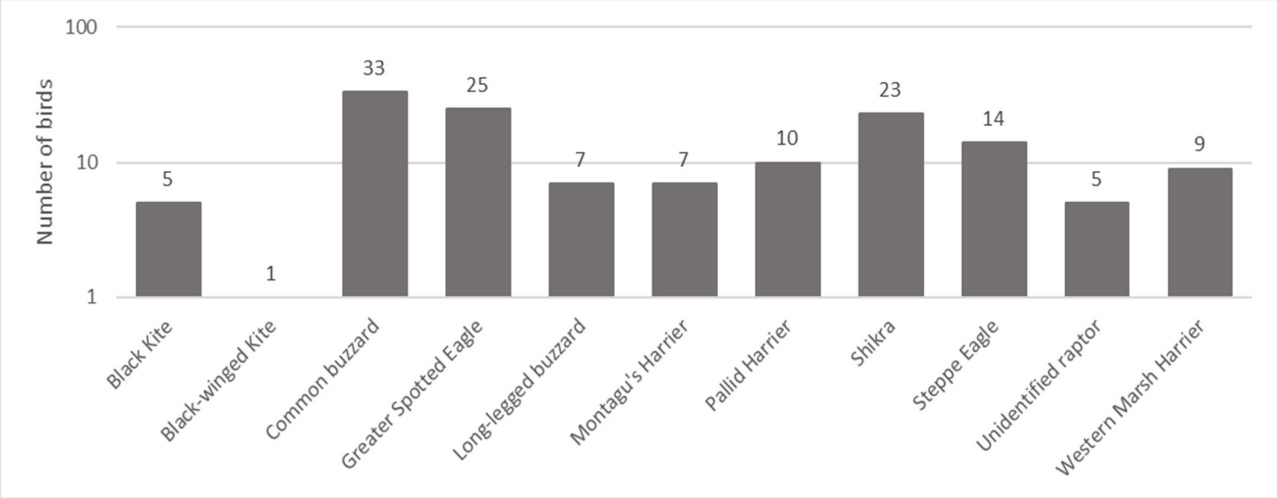
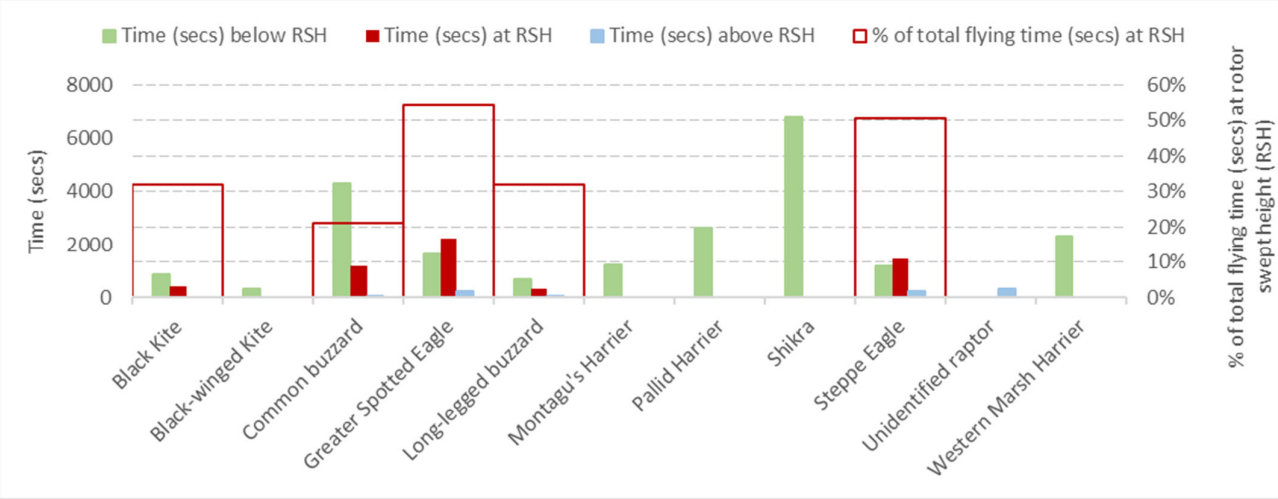


Figure 12 Target species – flying height and % of time at rotor swept height (RSH). **Din Energy**



9.2.5 *Gul Ahmed*

Key findings for target species flight activity data (Figures 13-14)

- The number of target species recorded (11) was typical compared with the other 5 sites

- Overall raptor numbers were lower (116 records) than at four of the five other sites with only Metro Wind having slightly fewer records.
- A total of 10 Cinereous Vultures (one group of four birds and two groups of three birds) were recorded between 1st and 4th December. Except for a record of three birds at Artistic these were the only record of this species during the survey. The species was recorded flying at RSH for approximately a quarter (26%) of their total recorded flying time.
- Individual records of Short-toed Snake-eagle occurred periodically through the survey period. This species was only recorded at Gul Ahmed. The species was recorded flying at RSH for 20% of the total recorded flying time.
- Like other sites Steppe Eagle and Tawny Eagle had the highest proportion of recorded flying height records at RSH (Steppe Eagle 45% Tawny Eagle 60% of recorded flying time).
- Flying height records for Shikra, Long-legged Buzzard and three harrier species (Montagu's Pallid and Western Marsh Harrier) were all below RSH.

Figure 13 Target species – Total number of birds. **Gul Ahmed**

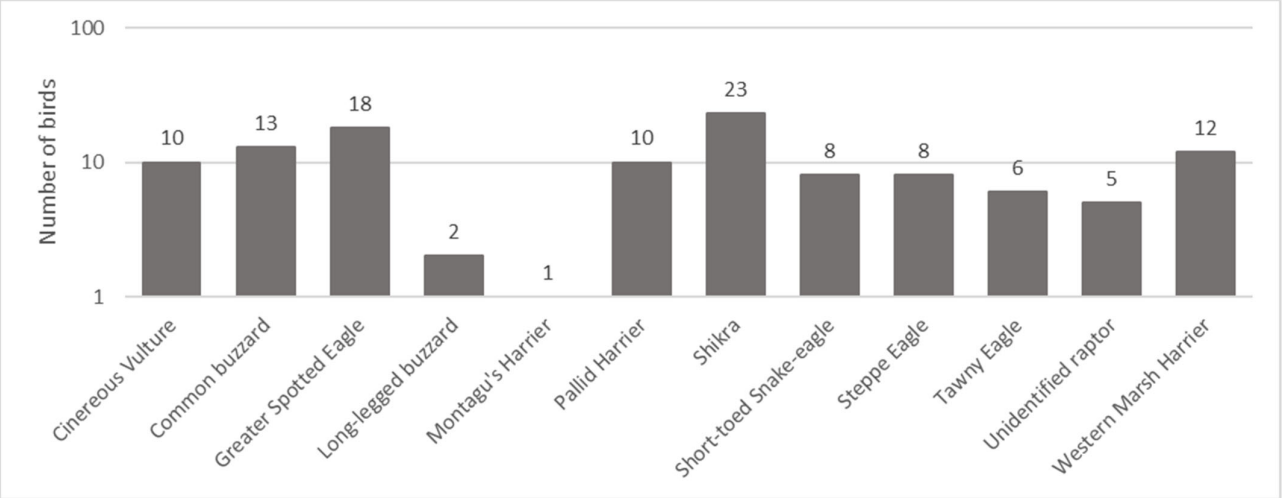
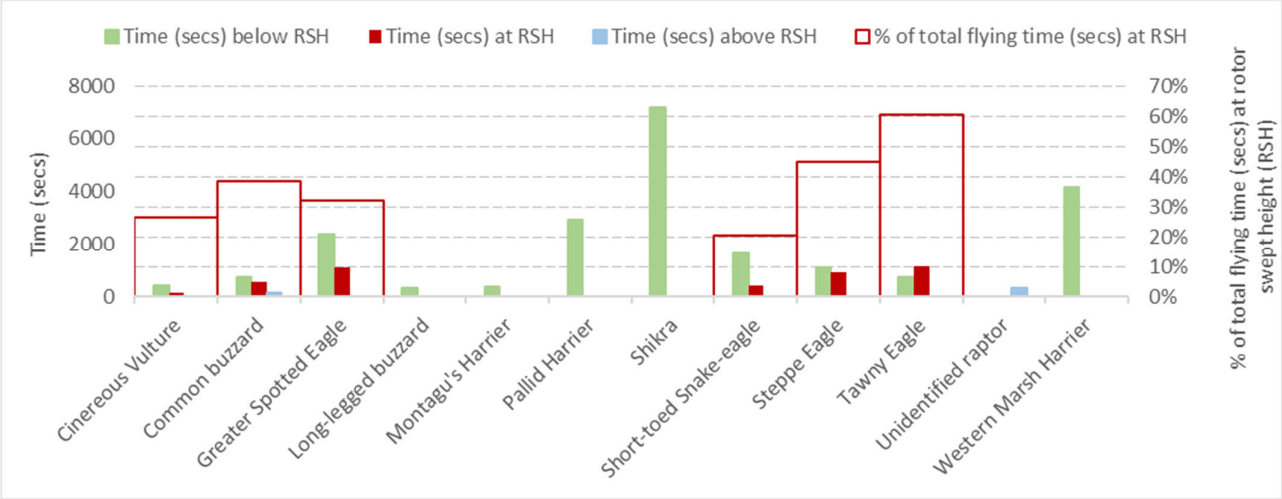


Figure 14 Target species – flying height and % of time at rotor swept height (RSH). **Gul Ahmed**



9.2.6 *Metro Wind*

Key findings for target species flight activity data (Figures 15-16)

- The number of target species recorded (9) was the lowest of the 6 IFC WPPs
- Overall raptor numbers were the lowest (98 records) of any of the 6 WPPs
- Like other sites Steppe Eagle and Tawny Eagle had more flight records at RSH with 41% for Steppe Eagle and a single record of Tawny Eagle recorded at RSH for 36% of its recorded flight time. Common Buzzard and Greater Spotted Eagle were each recorded at rotor swept high for approximately a quarter of their recorded flying time.
- Flying height records for Shikra, Long-legged Buzzard and three harrier species (Montagu's Pallid and Western Marsh Harrier) were almost all below RSH with Pallid Harrier having the highest proportion of flight records (8%) at RSH.

Figure 15 Target species – Total number of birds. **Metro Wind**

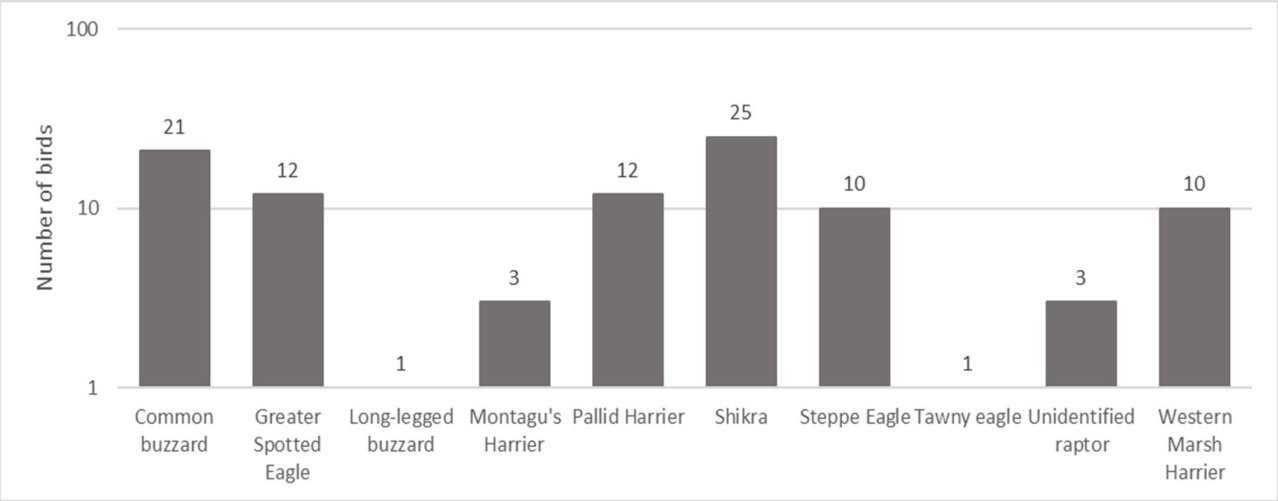
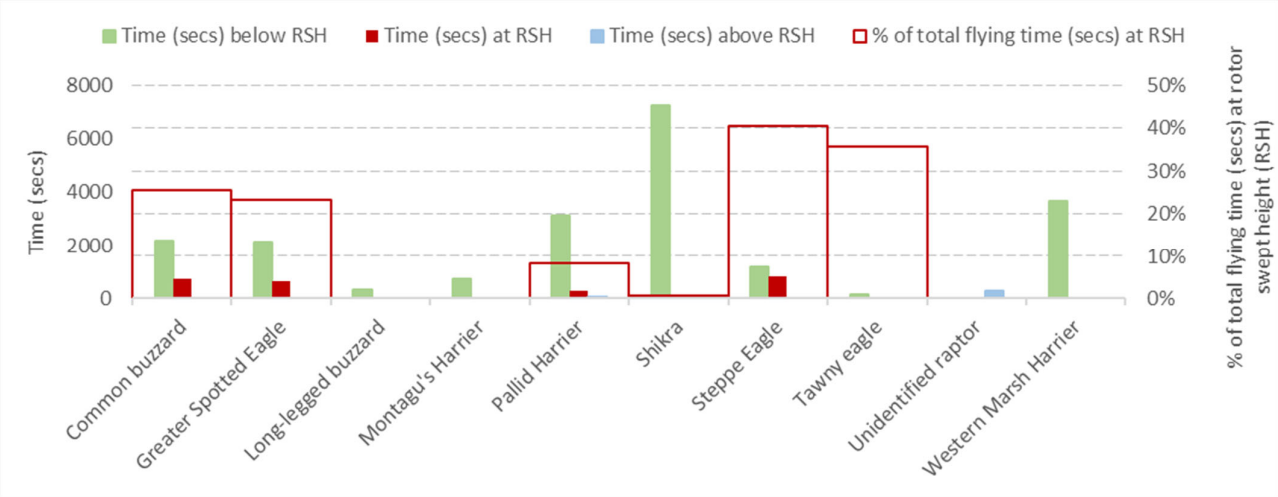


Figure 16 Target species – flying height and % of time at rotor swept height (RSH). **Metro Wind**



9.2.7 *Tricom*

Key findings for target species flight activity data (Figures 17-18)

- The number of target species recorded (12) was slightly above the average compared with the other 5 sites
- Overall raptor numbers (161 records) were slightly above the average of 142 records for the 6 WPPs.
- Common Crane was recorded flying in a few moderately sized flocks (22-80 birds) above RSH on the 7th March.
- Steppe Eagle had the highest proportion of recorded flying height records at RSH (30%). This was slightly lower than for this species at other sites. The proportion of flying records at RSH for other

raptors was also slightly lower than at other sites (Greater Spotted Eagle (13%) Black Kite (13%) and Common Buzzard (18%)).

- Flying height records for Shikra, Black-winged Kite, Long-legged Buzzard, Tawny Eagle and three harrier species (Montagu's Pallid and Western Marsh Harrier) were all below RSH.

Figure 17 Target species – Total number of birds. **Tricom**

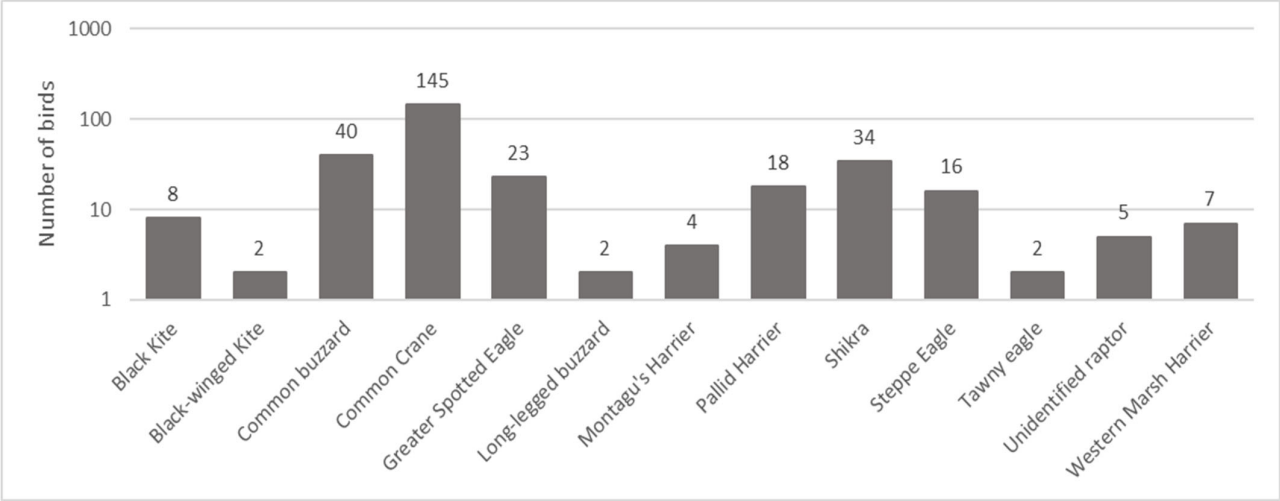
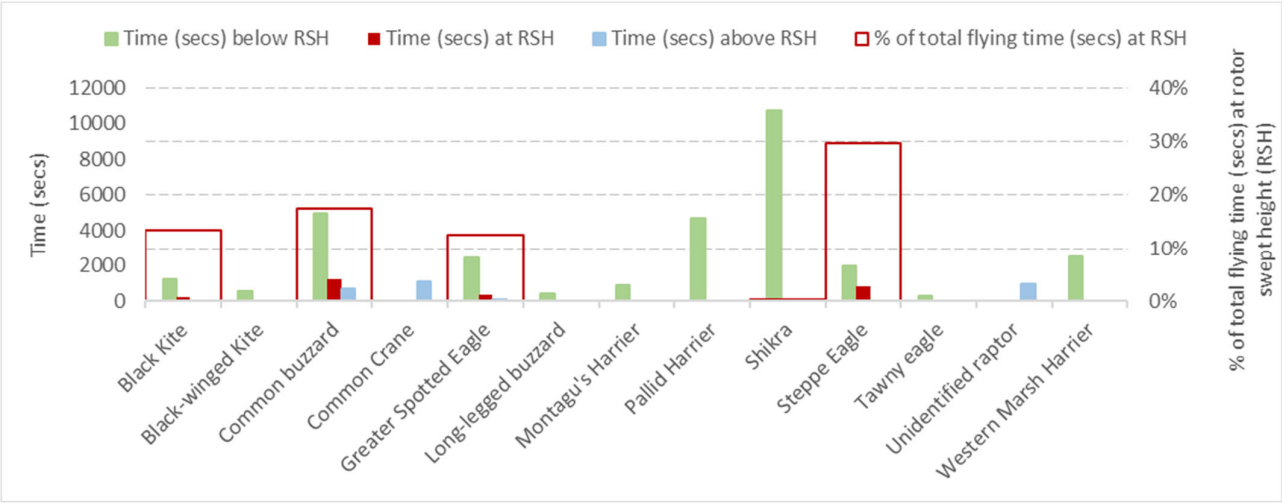


Figure 18 Target species – flying height and % of time at rotor swept height (RSH). **Tricom**



9.3 Non-target species

Key findings for non- target species (Table 8 and Figure 19)

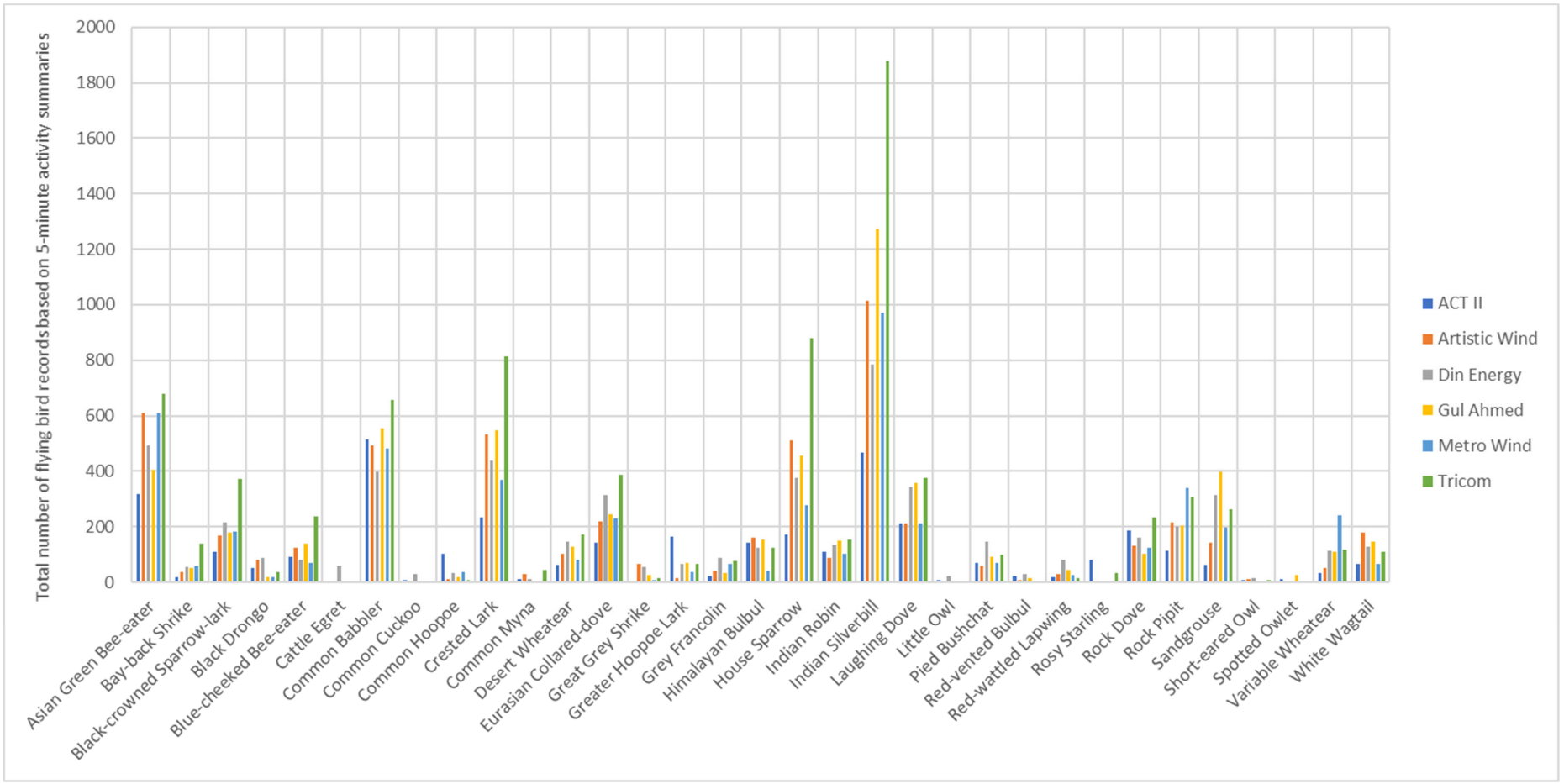
- The suite of species using each of the 6 IFC WPPs was very similar. The number of non-target species recorded during the 6-month autumn/winter/spring survey varied from 27 species at Metro Wind to 33 species at ACT II.
- Most of the species recorded at the 6 WPPs were small or medium sized perching birds (passerines) 26 out of 33. Of the seven other species, three were owls (Short-eared Owl, Little Owl and Spotted Owlet, two were ground-dwelling species (Grey Francolin, Sandgrouse *sp*.), one was a wader (Red-wattled Lapwing and one was an egret (Cattle Egret).
- All 33 non-target species are categorized by the IUCN Red List as Least Concern and a therefore not considered as globally threatened. Sandgrouse records were not identified to species, but all species have and IUCN Red List status of Least Concern.
- Some species had a higher number of flight records. Indian Silverbill was the commonest recorded species with typically 1000 records per site. Asian Green Bee-eater, Common Babbler and Crested Lark and House Sparrow were the next most recorded group of species with typically 4-500 records per site over the 6-month survey. Less numerous were Laughing Dove, Eurasian Collared-dove Rock Pipit Sandgrouse Black-crowned Sparrow-lark with typically around 200 records per site. All other species had less than 200 records.
- Except for Sandgrouse *sp*. non-passerines were recorded in lower numbers; Red-wattled Lapwing and Grey Francolin had on average 36 and 54 records per site but with considerable inter-site variability, and Cattle Egret had a total of 64 records across all sites.
- Little Owl, Short-eared Owl, Spotted Owlet had 41, 30 and 51 records respectively, across all sites. These species are all semi-nocturnal so actual flight activity at these sites is likely to be higher than recorded on this survey.
- There were some differences between sites. Tricom overall had the highest number of records for the greatest number of species. Contrastingly ACT II and Metro Wind had the lowest number of records for the greatest number of species. These findings may suggest that the likelihood of non-target species colliding with wind turbines at Tricom is greater than at other sites especially Metro Wind and ACT II.
- There were also a few species specific differences between sites: Indian Silverbill had around double the number of records at Tricom compared with average for the other five sites; Cattle Egret was almost exclusively recorded at Din Energy WPP and Spotted Owlet had 25 records at Gul Ahmed compared to between 2 and 12 at the other five WPPs.
- Overall, the highest activity levels were in February (10769 records) and March (5990 records). May appeared to have the lowest activity levels assuming the unsurveyed second half of the month had similar activity levels as the first. Assuming the same for November, had the survey started at the beginning of the month, November would have been one of the higher activity months.

Table 8 Non-target species. Number of flying bird records based on 5-minute activity summaries

Common Name	ACT II	Artistic Wind	Din Energy	Gul Ahmed	Metro Wind	Tricom	Total bird records
Asian Green Bee-eater	318	610	494	406	608	679	**3115**
Bay-back Shrike	19	35	54	51	60	140	**359**
Black-crowned Sparrow-lark	108	168	216	178	182	374	**1226**

Black Drongo	51	82	88	17	18	37	**293**
Blue-cheeked Bee-eater	92	124	82	139	68	237	**742**
Cattle Egret	1	5	58	0	0	0	**64**
Common Babbler	515	494	398	553	480	657	**3097**
Common Cuckoo	9	2	28	0	0	0	**39**
Common Hoopoe	101	10	33	19	35	9	**207**
Crested Lark	235	533	438	549	368	814	**2937**
Common Myna	10	31	12	0	1	43	**97**
Desert Wheatear	62	104	146	129	82	171	**694**
Eurasian Collared-dove	144	219	315	246	231	387	**1542**
Great Grey Shrike	3	64	55	24	6	14	**166**
Greater Hoopoe Lark	164	16	66	69	37	67	**419**
Grey Francolin	21	42	89	33	64	76	**325**
Himalayan Bulbul	143	159	126	153	41	124	**746**
House Sparrow	170	510	376	457	276	880	**2669**
Indian Robin	111	89	134	149	103	154	**740**
Indian Silverbill	466	1015	784	1274	969	1880	**6388**
Laughing Dove	210	210	344	358	212	376	**1710**
Little Owl	7	0	23	0	0	0	**30**
Pied Bushchat	71	58	145	91	70	98	**533**
Red-vented Bulbul	21	9	28	15	0	3	**76**
Red-wattled Lapwing	18	31	81	45	27	16	**218**
Rosy Starling	80	2	0	0	0	34	**116**
Rock Dove	187	132	161	104	124	234	**942**
Rock Pipit	114	216	200	204	341	308	**1383**
Sandgrouse sp.	62	143	313	396	198	264	**1376**
Short-eared Owl	7	10	15	0	0	9	**41**
Spotted Owlet	12	4	5	26	2	2	**51**
Variable Wheatear	34	50	112	110	241	118	**665**
White Wagtail	67	178	127	147	65	110	**694**
Total bird records	**3633**	**5355**	**5546**	**5942**	**4909**	**8315**	33700

Figure 19 Non-target species. Number of flying bird records based on 5-minute activity summaries.



10 Other observations

- It was stated by local people that Asian Houbara (VU) occurs in the area of ACT-2 Wind Power however due to the capture and illegal sale for hunting this species is under severe threat. Birds are trapped and caged in Jhimpir city and then released when hunters visit the area. Isolated events of Asian Houbara hunting were also recorded in 2018 in the buffer area of the nearby Tricon Boston Consulting wind farm project[4].
- A flock of more than 50 Great White Pelicans were observed resting in the Artistic Wind buffer area on 1st April. Initially 37 birds were seen resting on the ground and remaining individuals were seen to arrive . Only six birds were observed in flight at height of approximately 6m from ground. The observation was made for one day and same flock was not seen in the area again.
- The Government of Sindh has initiated steps to improve the water quality in Keenjhar Lake and Haleji Lake, which has resulted in increased number of birds using these lakes. 76 wintering migrant species and 26 resident species were recorded at Haleji Lake during the period between November 2019 and February 2020. These water quality improvement measures along with increased rainfall in the area in Aug 2017 and Sep 2019 and isolated cases of low rainfall in Dec 2018 and April 2020, has increased the food availability in the area thereby increasing the probability of higher number of birds landing in the project area or passing through the project area on route to these lakes[4].
- Excavation of soil from the buffer area of current operational projects e.g. Tricon Boston Consulting project A, B & C has resulted in large trenches that have filled with water and become ponds. Locals prefer not to have these ponds backfilled and keep them as collection ponds for rainwater and then use them for agricultural purposes. However, during 2019 monsoon season it was observed that these ponds also attract waterbirds in to the vicinity of the WPPs[4].
- The status and distribution of Guggul plant (*Commiphora wightii*) in the six IFC project sites has not been assessed. Guggul is existing in the area but its distribution and habitat is severely disappearing[4]. A recent detailed survey conducted on behalf of CDC by Mott MacDonald UK Contractor during the period Dec 2019- June 2020 of three wind project i.e. Liberty Power I & II and Indus Wind Energy in neighborhood of the six IFC WPPs reveal that this plant is under immense pressure due to unregulated construction activities of wind projects. During the construction of wind farm infrastructure (e.g. wind turbine foundations, sub stations, access roads) at Tricom and other operational projects, the distribution of this plant has not been evaluated or any mitigation measures taken during construction to minimize the impact of this IUCN Critically Endangered species. During the 6-month bird flight activity survey this species was observed to have a patchy distribution within all six IFC WPPs.

[4] Nooruddin Jahangir Durranee – personal comment/observation

11 Recommended future monitoring and mitigation measures

- Based on the results from this study and relevant information provided in the 2019 IFC bird data review for the six IFC WPPs (Ghalib *et. al.* 2019), a principal recommended measure from the start of the operational stage at all 6 projects is to design and conduct a formal bird and bat fatality monitoring program, aligned with good international industry practice and implemented consistently across all sites. This will provide essential ongoing feedback on species specific collision risk to birds and assess the currently unknown risk to bats.
- Steppe Eagle, Greater Spotted Eagle and Tawny Eagle are IUCN globally threatened species that were recorded in small numbers at most sites during all months of the current survey, spent relatively high proportions of time flying at RSH compared to other recorded collision risk susceptible target species, and along with rarely occurring vulture species, should be regarded as species potentially at highest risk of the effects at each of the six IFC WPPs. Assuming activity levels are not substantially higher during the summer and early autumn periods when no survey took place, and this study reflects typical levels between years, then the principal mitigation measure for safeguarding this type of risk i.e. observer led shut down on demand is not likely to represent the best use of resources and is not recommended at this time. However, if future activity levels of large raptors, or waterbirds increase then a turbine specific shutdown on demand program may be necessary during periods of peak activity. The improvement in water quality at nearby Lake Keenjhar and Haleji and evidence of Great White Pelicans resting close to the Artistic WPP indicate that an increased risk to large waterbirds is a possibility and WPPs should be aware of this when developing operational monitoring and mitigation budgets.
- A formal Biodiversity Monitoring and Management Plan for the construction and operational phases should be developed and implemented by each IFC Super Six Wind Power Projects. This should include and adaptive management framework that includes thresholds for priority species, determined using species specific ecological parameters and assessments of human derived effects on affected populations, and an adaptive management response protocol that provides an escalating scale of action should thresholds be exceeded. It should also include a reporting framework, and detailed methods protocols for all monitoring and mitigation activities.
- Construction phase and early operational phase resident/breeding bird monitoring is recommended for IFC Super Six Projects especially for any globally or regionally threatened species that may be displaced from the project sites
- The globally threatened plant species Guggul *Commiphora wightii* (CR) has been severely impacted by previous construction phase activities at existing Sapphire Energy, Master Wind, Sachal Energy, Jhimpir Power, Artistic Wind, Tricon Boston, ACT 1 WPPs and during current construction at the IFC Tricom WPP[4]. To assess the extent of this and other globally/regionally threatened species in areas to be disturbed during the construction phase at ACTII, Artistic Wind, Din Energy, Gul Ahmed and Metro Wind, a Rapid Biodiversity Assessment for each project area buffered to 1km, focusing on the abundance and distribution of Guggul is recommended. This assessment should be conducted before developing a Biodiversity Monitoring and Management Plan.
- Each Project should engage their neighboring villages through Community Liaison Officer to ensure no trapping and hunting of birds within project areas or project buffer area.

- All biodiversity monitoring and mitigation activities should be reported to IFC and other lenders 6-montly and include results summaries, key analysis of data (e.g. fatality rate estimate analysis for bird and bat fatality monitoring), details of emerging threats to key biodiversity values, problems encountered and recommended adaptive management responses.

12 References

Ghalib, S. A., Zehra, A., Obaidullah, Hasnian, S. A., & Khan, A. R. (2019). Review of bird data and input into micro-siting of turbines for wind power projects in Jhimpir, Sindh, Pakistan. Renewable Resources (Pvt.) Ltd. October 2019

13 Annexes

13.1 Summary data tables for target species

[Annex] Table 9 Target species – flying height and % of time at rotor swept height (RSH). **All projects**

Common Name	Time (secs) below RSH	Time (secs) at RSH	Time (secs) above RSH	% of total recorded flying time at RSH
Black Kite	2580	765	0	23%
Cinereous Vulture	555	150	0	21%
Black-winged Kite	1455	0	0	0%
Common buzzard	20265	6390	1470	23%
Common Crane	45	0	11895	0%
Eurasian Sparrowhawk	315	0	0	0%
Greater Spotted Eagle	13440	6405	615	31%
Griffon Vulture	180	0	0	0%
Long-legged buzzard	4935	1650	120	25%
Montagu's Harrier	5205	0	0	0%
Pallid Harrier	25260	285	30	1%
Shikra	59415	90	0	0%
Short-toed Snake-eagle	1635	420	0	20%
Steppe Eagle	9705	8160	675	44%
Tawny Eagle	2340	2430	240	49%
Unidentified raptor	0	0	2775	0%
Western Marsh Harrier	19065	0	0	0%
Grand Total	**166395**	**26745**	**17820**	

[Annex] Table 10 Target species – flying height and % of time at rotor swept height (RSH). **ACT II**

Common Name	Time (secs) below RSH	Time (secs) at RSH	Time (secs) above RSH	% of total recorded flying time at RSH
Common buzzard	2550	1125	345	28%
Common Crane	45	0	5370	0%
Greater Spotted Eagle	2265	885	345	25%
Long-legged buzzard	1695	630	90	26%
Montagu's Harrier	840	0	0	0%
Pallid Harrier	4950	0	0	0%
Shikra	12840	0	0	0%
Steppe Eagle	1755	2475	420	53%
Tawny Eagle	765	795	240	44%
Unidentified raptor	0	0	315	0%

Western Marsh Harrier	2175	0	0	0%
Grand Total	**29880**	**5910**	**7125**	

[Annex] Table 11 Target species – flying height and % of time at rotor swept height (RSH). **Artistic Wind**

Common Name	Time (secs) below RSH	Time (secs) at RSH	Time (secs) above RSH	% of total recorded flying time at RSH
Black Kite	465	165	0	26%
Cinereous Vulture	135	0	0	0%
Black-winged Kite	600	0	0	0%
Common buzzard	5505	1590	180	22%
Common Crane	0	0	5445	0%
Eurasian Sparrowhawk	315	0	0	0%
Greater Spotted Eagle	2550	1170	0	31%
Griffon Vulture	180	0	0	0%
Long-legged buzzard	1455	675	0	32%
Montagu's Harrier	1140	0	0	0%
Pallid Harrier	6885	0	0	0%
Shikra	14580	30	0	0%
Steppe Eagle	2460	1650	0	40%
Tawny Eagle	390	420	0	52%
Unidentified raptor	0	0	600	0%
Western Marsh Harrier	4200	0	0	0%
Grand Total	**40860**	**5700**	**6225**	

[Annex] Table 12 Target species – flying height and % of time at rotor swept height (RSH). **Din Energy**

Common Name	Time (secs) below RSH	Time (secs) at RSH	Time (secs) above RSH	% of total recorded flying time at RSH
Black Kite	855	405	0	32%
Black-winged Kite	315	0	0	0%
Common buzzard	4320	1170	75	21%
Greater Spotted Eagle	1635	2220	240	54%
Long-legged buzzard	705	345	30	32%
Montagu's Harrier	1230	0	0	0%
Pallid Harrier	2640	0	0	0%
Shikra	6810	0	0	0%
Steppe Eagle	1170	1470	255	51%
Unidentified raptor	0	0	315	0%
Western Marsh Harrier	2325	0	0	0%
Grand Total	**22005**	**5610**	**915**	

[Annex] Table 13 Target species – flying height and % of time at rotor swept height (RSH). **Gul Ahmed**

Common Name	Time (secs) below RSH	Time (secs) at RSH	Time (secs) above RSH	% of total recorded flying time at RSH
Cinereous Vulture	420	150	0	26%
Common buzzard	720	540	150	38%
Greater Spotted Eagle	2370	1125	0	32%
Long-legged buzzard	330	0	0	0%
Montagu's Harrier	360	0	0	0%
Pallid Harrier	2940	0	0	0%
Shikra	7200	0	0	0%
Short-toed Snake-eagle	1635	420	0	20%
Steppe Eagle	1110	900	0	45%
Tawny Eagle	750	1140	0	60%
Unidentified raptor	0	0	315	0%
Western Marsh Harrier	4155	0	0	0%
Grand Total	**21990**	**4275**	**465**	

[Annex] Table 14 Target species – flying height and % of time at rotor swept height (RSH). **Metro Wind**

Common Name	Time (secs) below RSH	Time (secs) at RSH	Time (secs) above RSH	% of total recorded flying time at RSH
Common buzzard	2190	750	0	26%
Greater Spotted Eagle	2130	645	0	23%
Long-legged buzzard	315	0	0	0%
Montagu's Harrier	735	0	0	0%
Pallid Harrier	3120	285	30	8%
Shikra	7260	45	0	1%
Steppe Eagle	1185	810	0	41%
Tawny Eagle	135	75	0	36%
Unidentified raptor	0	0	285	0%
Western Marsh Harrier	3690	0	0	0%
Grand Total	**20760**	**2610**	**315**	

[Annex] Table 15 Target species – flying height and % of time at rotor swept height (RSH). **Tricom**

Common Name	Time (secs) below RSH	Time (secs) at RSH	Time (secs) above RSH	% of total recorded flying time at RSH
Black Kite	1260	195	0	13%
Black-winged Kite	540	0	0	0%
Common buzzard	4980	1215	720	18%
Common Crane	0	0	1080	0%
Greater Spotted Eagle	2490	360	30	13%
Long-legged buzzard	435	0	0	0%
Montagu's Harrier	900	0	0	0%
Pallid Harrier	4725	0	0	0%
Shikra	10725	15	0	0%
Steppe Eagle	2025	855	0	30%
Tawny Eagle	300	0	0	0%
Unidentified raptor	0	0	945	0%
Western Marsh Harrier	2520	0	0	0%
Grand Total	30900	2640	2775	

13.2 VP flight activity methodology

Supplementary bird baseline survey Oct -19 - Apr 20

Vantage point flight activity survey guidance[5]

Draft v1

PURPOSE OF THE SURVEY

To provide quantified flight activity information on bird species using six wind power project (WPP) sites (Gul Ahmed Electric Ltd (GAEL), Artistic Wind Power Project Ltd (AWPPL), ACTII Wind Ltd, Tricom, Din Energy Ltd. and Metro Wind Power Ltd (MWPL)) to inform an operational phase monitoring and mitigation strategy.

Specifically, surveys will collect:

1. **detailed information on flight activity** for '**target species**[6] (see Annex A for list of target species and section 8.1 for methods)
2. **activity summary information** on the presence and flight frequency of **non-target species**[7] (see section 8.2 for methods)

MONITORING PERIOD AND OVERALL SURVEY EFFORT

The monitoring program will be conducted **over six months** between **October 2019 to April 2020** at each of the WPPs.

DEFINING THE FLIGHT ACTIVITY SURVEY AREA

- Before surveys begin, define the survey area and mark on all survey field maps.
- The survey area should encompass the turbine footprint, if known, or the maximum extent of any proposed turbine layouts if the turbine locations have not yet been finalized.
- The boundary of the survey area should extend 500m from the outermost turbines.

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[5] Following guidance in *Scottish Natural Heritage. (2017). Recommended bird survey methods to inform impact assessment of onshore wind farms. Version 2 SNH guidance. Scottish Natural Heritage. August 2017*

[6] Collision risk susceptible species and other high conservation status species that could potentially occur in the project site

[7] All species recorded during vantage point watch surveys that **are not** 'target species'

SELECTING VANTAGE POINTS

- Flight activity information will be collected during timed watches at strategically positioned vantage points (VPs) overlooking this survey area. There is no need to use point count surveys or transect surveys.
- Select and map the location of VPs on a dedicated pre-survey visit to the project site. During this visit identify, map and determine the height of 'reference features' in the landscape (if any) that can be used as aids to estimating flying height and mapping of flight lines during surveys (e.g. masts, powerlines etc.).
- Together VPs should aim to cover all the airspace within the survey area. **Note that VPs should be selected for each project site.**
- No location within the survey area should be more than 2km from a VP.
- Choose VPs that achieve the **maximum visibility with the fewest VPs**.
- Where possible locate VPs assuming that one observer at each VP will be able to effectively scan and arc of up to 180 degrees.
- One observer per VP should be able to survey the area assign to their VP. If target species flight activity is very high two observers may be required at a VP.

To reduce observer effects on bird behavior

- Where possible choose VPs looking into the survey area from outside the survey area boundary
- Locate VPs away from sensitive areas for target species
- Observers should position themselves as inconspicuously as possible when on the VP.
- Avoid positioning VPs between the site and a roost or nest site of a target species.

TIMING OF VANTAGE POINT WATCHES

- Ensure that VP watch schedules are relevant to the ecology of the target species
- Spread watches from each VP across all daylight hours (example in Table 1).
- Spread watches across all survey months that target species are present or likely to be present.
- During migratory periods take account of known peaks in migration for target species and weather patterns that can produce peaks in activity.
- Conduct watches when visibility is good (>2km). If visibility becomes poor during a watch, indicate on recording forms any periods when monitoring was not possible or limited.
- See Table 1 example, which defines a schedule for all daylight hours covered for all VPs at the WPP within 4 survey days.

Table 1 Example 1. VP visit timings through the day for one observer covering a WPP with 3 VPs monitoring at 3 VPs per day (3x3hrs). In practice the time of day 'categories' will differ slightly on different days to allow the observer time to move between sites. For example on day 1 VP2 will likely be monitored from 0930-1230 and VP3 from 1300-1600. In this example all daylight hours are covered for all VPs at the WPP in 4 survey days.

Survey Visit	Time of day			
	dawn-0900	0900-1200	1200-1500	1500-dusk
Visit 1 (Day 1)	VP1	VP2	VP3	
Visit 1 (Day 2)		VP1	VP2	VP3
Visit 1 (Day 3)	VP3		VP1	VP2
Visit 1 (Day 4)	VP2	VP3		VP1

VANTAGE SESSION LENGTH

- VP watches are best conducted in sessions of 3hrs or less, with no more than 9 hours conducted by the same observer over a 24-hour period.
- Allow a minimum break of 30 minutes between VP watches. This can include time spent moving between VPs.
- Minimize disturbance to birds in the survey area when moving between VPs.

OVERALL SURVEY EFFORT

- Approximately 72 hours **per VP location** is recommended over the 6-month survey program. This roughly corresponds to a 3-hour monitoring session at each VP per week for 6 months (3hrs x 26 weeks = 78hrs).
- Spread survey days as evenly as possible across the 6-month survey period. Aim to cover VPs at all 6 WPPs for all periods of the day each month
- Surveys should be conducted for at least 1 day per week per WPP to avoid extended survey gaps at specific WPPs.

VANTAGE POINT RECORDING

- VP recording involves scanning the area in view throughout the session for birds in flight. Divide scanning into 5-minute intervals. Summarize the number of non-target birds seen on the '*Non-target species activity summary recording form*' (see Annex B) during each 5-minute period, if a target species is detected follow the bird estimating its height category every 15 seconds until it disappears from view. Record the start and end of flight and 15-second flight height categories on the '*Target species flight activity recording form*' (see Annex C), estimate the route of the flight on a map of the survey area.
- Even if no birds are recorded fill in the top section of the form to indicate that the survey was completed
- Start new target and non-target activity summary recording form and a new map for each VP watch

Non-target species – activity summaries

(see Annex B for example recording form, Annex D for blank forms to print out)

- Divide each VP watch into 5-minute periods
- While scanning the area in view from the VP for target species summarize all other species present in each 5-minute period.
- Non-flying birds should be highlighted with a code on the recording form
- Perched birds and birds on waterbodies should be recorded once and the area or site they are using marked on a map

- If a target species is being tracked at the end of a 5-minute period do not enter a summary and not this on the recording form (see Annex B example recording sheet for the 5-minute period ending at 08:30)

Target species – detailed flight activity recording

(see Annex C for example recording form, Annex D for blank forms to print out)

- Scan the area in view from the VP using binoculars until a target species is detected.
- Estimate the flight height at the time when the bird is detected and then at 15 second intervals until the bird/s disappear from view. Ideally use a countdown timer set to bleep every 15 seconds. If this is not possible then counting to 15 can be a reasonable alternative. To ensure this is as accurate as possible practice counting each second in time to a watch that shows seconds.
- Record a sequential flight ID, flight start time and flight height categories on the target species recording form (see Annex C.)
- Often the same bird will disappear from view and then reappear. Use a bout number define multiple flight records of the same bird as in Target Flight ID 01 and 02 on the target species recording form in Annex C.
- Estimate flight height as one of 3 categories; 1) below rotor swept height, 2) at rotor swept height or 3) above rotor swept height. *Rotor swept height* is the lowest to the highest point of the rotor blade and should be based on the WPPs largest turbine blade diameter option. Use reference features in the landscape to help locate and assess flying height (see Section 4 above).
- If a flock of a target species is detected estimate the average flying height of the flock every 15 seconds.
- Prioritize target species flight activity recording over recording activity summaries for non-target species.
- Maps should be labeled with site, date, VP number, and start and end times of VP watch. Project site boundary, VP locations should be marked on map printouts. Flight lines should have 'target flight ID' number and direction of flight. Google Earth images can be used if maps of suitable scale are unavailable, but these images should have a scale bar to assist estimating flight distance from the VP.

RECORDING EQUIPMENT LIST

- Binoculars
- Clipboard and pens
- Blank **non-target species** recording forms – see Annex B
- Blank **target** species recording forms – see Annex A
- **Maps** with survey area boundary marked **for mapping flight lines**
- **Watch** with facility for repeating 15sec countdown alarm to estimate target species flying height
- **GPS/Compass** to locate VPs and to improve accuracy of mapping flight lines

ANNEX A - TARGET SPECIES

The table below gives a list of species that are susceptible to collision with turbines or powerlines plus other IUCN globally threatened species that could occur on the project site based on the recent bird data review[8]. (Consultants please review and add species that may be missed or suggest revisions).

All raptor species
All bustard species
Any additional IUCN Globally Threatened Species (Vulnerable-VU, Endangered-EN, Critically Endangered-CR)
Great White Pelican (*Pelecanus onocrotalus*)
Common Crane (*Grus grus*)

[8] Ghalib, S. A., Zehra, A., Obaidullah, & Hasnian, S. (2019). Review of bird data and input into micro-siting of turbines for wind power projects in Jhimpir, Sindh, Pakistan. Renewable Resources (Pvt.) Ltd.

ANNEX B **EXAMPLE** NON-TARGET SPECIES ACTIVITY SUMMARY RECORDING FORM

Hypothetical example of a '*Non-target species activity summary recording form*" for a 3hr VP watch at VP2 at the Tricom Site – In practice all the text in orange will be filled in by hand by the field observer when they arrive at the VP. Each species is added when they are first seen during the VP watch. All birds recorded here are in flight except where indicated with a 'p' or 'g' (add other codes if needed making sure that these are clearly defined on the form e.g. w = bird on waterbody). For the 5-minute period ending 08:30 activity summaries were not collected because the observer was prioritizing tracking the flight height and route of a Steppe Eagle when this 5-minute period ended (see Target Flight ID 02 on the 'Example '*Target species flight activity recording form'* (Annex C).

Site	Tricom	Start of VP watch	07:00	Weather	Overcast, Heavy Rain (0900-0930)
Date	10 Oct 2019	End of VP watch	10:00	Wind Direction	SW
VP Number	2	Observer		Wind Strength	F4 (Beaufort)
				Average Visibility (1-10km)	5

Time	Maximum number of birds recorded in each 5-min period																
End of 5-min period	Crested Lark	Common Babbler	Green Bee-eater	Pied Bushchat	Little Brown Dove	Grey Partridge	Desert Lark	Grey Shrike	White-eared Bulbul	Chestnut-bellied Sandgrouse	[add species here]	[add species here]	[add species here]	[add species here]	[add species here]	[add species here]	Notes
07:05										11g							Sandgrouse together on ground
10																	
15	3	1p															
20								1									
25																	
30			1														
35					1			1p									Gr. Shrike perched 07:35 – end of survey - same bird
40		1															
45	4																
50				1				1									
55			2														
08:00		1							1								
05																	
10							4										
15																	
20	2	1															
25			4														
30																	NO SUMMARY – TARGET SPECIES RECORD 05
35																	
40		2															
45																	
50	1		1														
55																	
09:00		1															
05	1																
10																	
15																	
20																	
25	1	1															
30																	

35																	
40	1	2															
45																	
50																	
55	1																
10:00																	
Codes used: p = perched, g = on the ground																	

ANNEX C - **EXAMPLE** TARGET SPECIES FLIGHT ACTIVITY RECORDING FORM

Hypothetical example of a '*Target species flight activity recording form*' for the same 3hr VP watch at VP2 at the Tricom Site. Shows a Steppe Eagle flight for 30 secs at 08:26 followed by the same Steppe Eagle recorded for 2mins 45 seconds at 08:29, a Black Kite recorded for 30 seconds at 08:50 and a different Black Kite recorded for 45 seconds at 09:20.

Site	Tricom	Start of VP watch	07:00
Date	10 Oct 2019	End of VP watch	10:00
VP Number	2	Observer	
Sheet	1 of 1		

Target flight ID	Species	Bout Number	No of Individuals	Flight start	Flying height every 15 seconds (1=below 2=at 3=above rotor swept zone)									Additional Notes
					0	15	30	45	60	15	30	45	60	
01	Steppe Eagle	1	1	08:26	1	2	1							
02	Steppe Eagle	2	1	08:29	2	2	2	1	1	1	2	2	3	
					3	3	3	3						
03	Black Kite	1	1	08:50	2	3	3							
04	Black Kite	1	1	09:20	1	2	1	1						Foraging

ANNEX D BLANK RECORDING FORMS TO PRINT OUT (see pages BELOW)

JIMPHIR WPPs – SUPPL. VP SURVEY OCT 19 – APR 20

NON-TARGET SPECIES ACTIVITY SUMMARIES *RECORDING FORM*

Site		Start of VP watch		Weather	
Date		End of VP watch		Wind Direction	
VP Number		Observer		Wind Strength	
				Average Visibility	>2km/1-2km

End of 5 - minute period	Maximum number of birds recorded in each 5-min period																Notes
Codes used:																	

JIMPHIR WPPs – SUPPL. VP SURVEY OCT 19 – APR 20

TARGET SPECIES *RECORDING FORM*

Site		Start of VP watch	
Date		End of VP watch	
VP Number		Observer	
Sheet			

Target flight ID	Species	Bout Number	No of Individuals	Flight start	Flying height every 15 seconds (1=below 2=at 3=above rotor swept zone)									Additional Notes
					0	15	30	45	60	15	30	45	60	

13.3 Flight line maps for target species.

- These are maps are provided as separate documents in the "*PAKISTAN IFC super 6 WPP VP survey target species flight lines 201911-202005 zip. file"*.