CHAPTER-6
ECOLOGY
OF
WATERBIRDS
AND
WETLANDS
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Ecology of Waterbirds

During my study period of 24 months, total 86 water birds species were reported belonging to 24 families at study area. They are listed here:

(1) Family: Podicipedidae

World: 21 species; Asia: 06; India: 05; WKD: 03.


❖ Little Grebe (Dabchick) (Tachybaptus ruficollis)

Size: ± 25-29 cm Adult: sexes alike. A small, squat and tailless bird with short pointed bill and backwardly placed legs. It rides the water with rear and raised and dives frequently, white wing patch in flight.

Breeding (summer): forehead, crown and nape blackish-brown; lores face and chin chestnut; upper plumage lighter than the crown; flanks dusky brown and under parts silky smoky-white.

Non-breeding (winter): light brown with whitish chin. Pale rufous neck and whitish under parts. Juvenile: paler, the chestnut on the sides of the head and lower neck is either absent or trace of it, the lower plumage is white with very little brown.

Habitat and Habits: Stays in loose flocks in open waters during non-breeding season, but singly or in pairs in vegetation, dives for safety when disturbed. Breeds from April to October in India. Nest like a pad of weeds either floating or bedded on waterweeds.
**Food**: Molluscs, fish, tadpoles, crustaceans and aquatic insects.

**Population 2008-2012**: Population range 31 to 69 and latest maximum record 38.

**Status and distribution**: (Abundant to Very Common) A resident bird found at all lakes, subject to local or long distance movements depending on water conditions. Locally common throughout India. Conversation of species and habitat at Kheda Wetlands Complex is needed to restore its population.

❖ **Great Crested Grebe** (*Podiceps cristatus*)

**Size**: 45-51 cm **Adult**: sexes alike but the diagnostic less developed in females. A tailless aquatic bird characterized by slender white neck and straight pointed bill; two upstanding, backwardly directed ear tufts above head and a frill of chestnut and black elongated feathers below the head.

**Non-breeding** (winter): these ears much reduced in young birds absent. However, it has the black forehead, crown and crest; a blackish line from gape to eye; white lores and sides of the head, chin and throat; dark nape and back; mottled brown and rufous flanks and white underparts.

**Habitat and Habits**: Prefer open water lakes, reservoirs and saltpans. Swims with body low and erect neck, both male and female perform elaborate courtship display. Breed: June to August.

**Food**: Fish, frog, tadpoles, aquatic insects occasionally macrophytes.

**Population 2008-2012**: population range 04 to 19 and maximum latest record 05.

**Status and Distribution**: Occurs in small numbers from October to April. Conversation is needed.

❖ **Black-necked Grebe** (*Podiceps nigricollis*)

**Size**: ± 28-34 cm **Adult**: Sexes alike, a small dark-brown grebe with a slender, pointed and slightly uplifted bill, white under-parts and silver white flanks.

**Non-breeding** (winter): distinguishable from very similar little grebe by blackish cap to below the eyes, mixed black and white chin and throat and dark brown fore-neck. In summer black head and neck and a golden tuft of feathers behind the eyes.
**Habitat and Habits:** Prefer shallow lakes or reservoirs with patches of emergent vegetation. Prefer reed-bordered water. Occurs in company with dabchicks, sometimes in large flocks.

**Food:** Fish, frog, tadpoles and its own feathers.

**Population 2008-2012:** Population range 02 to 06 and latest maximum record 03.

**Status and Distribution:** Winter visitor, breeder. Conversation is needed.

(2) **Family: Phalacrocoracidae**

World: 36 species; Asia: 11; India: 04; WKD: 02.

**Com. Ids:** Gregarious, fish eating and colonial nesting birds. Plumage black. Body long, spindle shaped. Bill serrated, laterally compressed and hooked at tip. Tail long and stiff. Legs short, feet large, pelecaniform with all four toes united in a web for swimming. Flight either V-shaped or in wavy diagonal lines. Sexes alike.

❖ **Little Cormorant (Phalacrocorax niger)**

**Size:** ± 51 cm  
**Adult:** sexes alike, smaller back body with stout and hooked bill, blackish at tip and bluish purple at base; domed forehead; stiff tail and without yellow gular skin. Breeding: Black with glistening blur-green; upper back and wing-coverts dark silvery gray: short occipital crest, a few white silky feathers on fore crown, sides of the head and neck.

**Non-breeding:** Crest and white feathers disappear and feathers at base at lower bill appear white, sometimes extending to throat. Juvenile: Brown above and paler below with white throat and central abdomen.

**Habitat and Habits:** Found in lakes, rivers, irrigation reservoirs, canals, village ponds etc. often found in large flocks in lakes and reservoirs while also occurring in small numbers in rivers, etc. hunt fish in groups. Breeds in mixed colonies from July to Sept.

**Food:** Largely fish, also on frog, tadpoles and crustaceans.

**Population 2008-2012:** Population range 95 to 100. Maximum latest record was 70.
**Status and Distribution:** A resident species widespread, common in plains of India. Conversation is not needed.

- **Indian Cormorant** (*Phalacrocorax fuscicollis*)

  **Size:** size 63 cm  
  **Adult:** Smaller and slimmer than others. Usually appears thinner neck, slimmer oval-shaped head, finer bill, longer tail. Larger than Little with longer thinner neck, more oval shaped head and longer, thinner bill. In flight looks like Great than little, with larger wings and shorter tail.

  **Adult breeding:** All black, glossed with bronze and green on under-parts, tuft of white, scattering of white filo-plumes on neck behind eye, bare purplish skin around eye, and purplish-black gluer pouch edges with yellow.

  **Non-breeding:** Similar to adult breeding, but head and neck brownish cast (and head lacks white filo-plumes) and whitish chin.

  **Habitat and Habits:** Fresh and salt waters; jheels, lakes, rivers, irrigation tanks, estuaries, and saltwater and mangroves creeks. A typical Cormorant. Gregarious and often in larger flocks than Great. Breeds: July-February.

  **Juvenile:** Brown under-parts and brown-mottled whitish under-parts. Is generally paler on under-parts than immature little, although not so pale as immature Great.

  **Food:** Largely fish, also on frog, tadpoles and crustaceans.

  **Population 2008-2012:** Population range 32 to 52 and latest maximum record is 35.

  **Status and Distribution:** Resident, local migrant depending on water conditions throughout India except North West part of India.

(3) **Family: Anhingidae**

  World: 02 species; Asia: 02; India: 01; WKD: 01.

  **Com. Ids:** Large aquatic birds adapted for hunting fish underwater. Anhinga has a long, slender neck and head, long wings and very long tail.
**Indian Darter Anhinga rufa (Anhinga melanogaster)**

**Size:** 85-97 cm  
**Adult:** Long, slim, heron like head and neck, dagger-like bill and long tail with most striking feathers. Neck is typically held recoiled or with obvious kink. Cormorant like flight action, with prolonged gliding; outstretched neck with kink as base and long tail especially evident. Often swims with most of body submerged.

**Adult breeding:** blackish crown and hind-neck, white stripe extending from behind eye down side of neck, and chestnut fore-neck becoming blacker towards breast, lanceolate white scapular streaks and white streaking on under wing-converts. Head pattern is more striking on breeding male than on female.

**Non-breeding:** Similar but browner head, neck and upper mantle. Juvenile: Brown above and buffish-white below, with contrasting brown flanks with buff fringes to upper wing-coverts forming pale panel on wing.

**Habitat and Habits:** Lakes, Jheels, ponds, reservoirs, rivers, marshes and other inland waters; also mangroves and coastal waters. Seen singly, in scattered pairs and sometimes in large groups, spends much time drying its spread wings and tail while sitting on a favored perch. Often swims with head and body below, giving appearance of a swimming snake. Unlike cormorants, does not leap up before diving but slowly submerge, Pursues fish underwater and catches them by spearing. Breeding: June to March, but varying locally.

**Food:** Largely fish, also on frog, tadpoles and crustaceans

**Population 2008-2012:** Population range 05 to 12 and latest maximum record is 07.

**Status and Distribution:** Resident, local moving depending on water conditions throughout India except NW.

(4) **Family: Ardeidae**

World: 60 species; Asia: 30; India: 16; WKD: 12.

**Com. Ids:** gregarious, waders with long legs, neck and bill. Legs projecting well beyond short tails during flight. Neck retracted into S-curve enables these birds to extend the neck with speed and great force to catch or pierce the prey. Bill straight, sharp-pointed and dagger-like. Nostril oval, close to the base. Most species have
specialized feathers, i.e. powdery downs on each side of breast and rump; they are never shed but continue to grow from the base and give off a powdery substance for preening feathers. Many species acquire filamentous ornamental plumes (‘aigrettes’) during the breeding season. Middle and outer toes united by a small web at their base; middle toe pectinate or comb-like. Sexes alike or nearly so. Breeding colonial.

**Great Bittern (Botaurus stellaris)**

**Size:** 70-80 cm  
**Adult:** Sexes alike. Crown, nape and upper back black; sides of head yellowish-orange faintly dotted with black; remaining back, rump and tail yellowish-buff, profusely barred and mottled with black.

**Non-breeding:** Bill greenish-yellow; lores green to bluish; chin and throat white with a conspicuous buff and black median line that continues down and overhanging

**Breeding:** Yellowish plumes; remaining under parts yellowish-buff with narrow brownish bars on sides of breast. Legs and feet greenish yellow. Juvenile: upper parts pale chestnut to reddish-brown and underparts reddish-buff, except for whitish chin and throat.

**Habitat and Habits:** Inland lakes, marshes and swamps with thick overgrown beds of Phragmites and Typha. Found singly, crepuscular, nocturnal and shy, remains hidden in reed beds, feed alone, feigns freezing.

**Food:** Chiefly fish, frogs, aquatic invertebrates, occasionally small birds and rodents.

**Population 2008-2012:** Population range 09 to 16 and latest maximum record was 05.

**Status and Distribution:** Winter migrant, breeds in northern Eurasia. Conversation is needed.

**Little Bittern (Ixobrychus minutus)**

**Size:** 33-36 cm  
**Adult:** Sexually dimorphic. Male: A ‘hunchbacked’ and buff bird with purplish-yellow bill and greenish-horny legs. Crown to tail black, buff wing patch visible in flight only; sides of head and neck pink-pink or vinous; throat and neck whitish: upper breast and flanks ochre; lower breast blackish-maroon; central abdomen, vent and under tail-coverts almost white.
**Female:** Chestnut-brown above, including shoulder patch; chestnut-rufous below and rufous streaked. Juvenile: Heavily streaked above and below.

**Habitat and Habits:** Lakes, marshes and streams with tall reeds at edges. Solitary, rarely in pairs, most active at dusk, hidden in thick vegetation at the edges of the waterbodies. Breeds: May -July.

**Foods:** Fish, frogs, aquatic insects, crustaceans and molluscs.

**Population 2008-2012:** population range 12 to 27 and latest maximum record was 09.

**Status and Distribution:** Resident, distributed in plains. Conversation is needed.

**Yellow Bittern (** *Ixobrychus sinensis*)

**Size:** 38 cm. **Adult:** very small, slim, thin necked heron. In flight, wings appear narrow and wing-beats are rapid, while large feet usually hang clumsily. Most likely to be seen alongside but readily distinguished from that species in all plumages by yellowish-buff wing coverts contrasting with dark flight feathers and blackish tail.

**Adult male:** warm pinkish brown upperparts, including rump and uppertail-coverts with noticeable black tail; face and neck (except fore-neck) vinaceous and fore-neck and rest of underparts un-streaked creamy-white.

**Adult female:** Similar to male but has rufous streaking on black crown, variable rufous-orange streaking on fore-neck and breast; and diffuse buff edges rufous-brown mantle and scapulars resulting in streaked appearance. Sexing and ageing appear not be straightforward. Some older females similar to male.

**Juvenile:** Similar to female. Mantle and scapulars brown with broad fringes and has brown streaking on buff wing-coverts; streaking on fore-neck and breast is stronger and feathers often dark shafts. Breeds June to September. Nest small pad of reeds and sedges built in a reed-bed or in bushes at the edge of a pond.

**Habitat and Habits:** Reeds and scrub in swamps, flooded paddy fields. Similar to Little Bittern.

**Foods:** Fish, frogs, aquatic insects, crustaceans and molluscs.

**Population 2008-2012:** population range 10 to 23 and latest maximum record was 06.
**Status and Distribution:** Resident, nomadic, mainly distributed in plains. Conversation and restoration at Wetlands of Kheda district is needed for the species.

❖ **Black Bittern (Duptetor flavicollis)**

**Size:** 58 cm. **Adult:** considerably larger than Ixobrychus bitterns occurring in the sub-continent. Most likely to be seen in flight, when upperparts and well-rounded wings are uniform blackish, bill appears long and always shows yellow-buff stripe down sides of neck.

**Adult male:** Blackish head, hind-neck and upperparts, yellow-buff malar stripe extending down sides of neck, black and rufous streaking on whitish fore-neck and breast and dusky-grey underparts.

**Adult female:** Similarly patterned but upperparts blackish-brown, fore-neck and breast more strongly streaked with rufous black and rest of underparts dusky brown.

**Juvenile:** Similar to adult but upperparts have narrow rufous feathers fringes. Breeds: May to September but varying locally.

**Habitat and Habits:** Reed beds and submerged bushes mixed with clumps of reeds and sedges. A typical bittern. Chiefly nocturnal and crepuscular; Skulks in dense swamps during the day. Most often seen flying at dusk.

**Foods:** Fish, frogs, aquatic insects, crustaceans and molluscs.

**Population 2008-2012:** population range 12 to 26 and latest maximum record was 06.

**Status and Distribution:** Resident, distributed in plains. Conversation is needed.

❖ **Night Heron (Nycticorax nycticorax)**

**Size:** 58-65 cm **Adult:** Sexes alike. Strongly built grey, white and black heron with stout black bill. Crown, nape and occipital crest black with two or three very long, narrow white plumes; forehead and a streak over eye white; sides of neck, wings, rump and tail grayish; eyes blood-red; underparts white; legs and feet pale green in breeding season turn pinkish and bill blacker.

**Juvenile:** Pale-Smokey brown with bright yellow eyes and resembles adult pond heron expect for white wings.
**Habitat and Habits:** Reservoirs, lakes, streams, ponds and rivers. Generally gregarious, nocturnal or crepuscular except in breeding season, during daytime roosts on trees, often at dusk. Breeds: April to September.

**Food:** Chiefly fish, frogs, aquatic insects such as odonata larvae.

**Population 2008-2012:** Population range 53 to 166 and latest maximum record is 59.

**Status and Distribution:** Resident, throughout India. Conversation is not needed.

❖ **Indian Pond Heron** (*Ardeola grayii grayii*)

**Size:** 42-45 cm **Adult:** Sexes alike. A thick set earthy-brown at rest and largely snow-white in flight water-bird with yellow bill, black at tip and bluish at base; white chin, throat and fore-neck; Honey-green legs.

**Breeding:** Long recumbent white or buff occipital crest of lanceolate plumes; ashy-brown upper breast; deep-maroon and long decomposed feathers on back: white underparts.

**Non-breeding:** Dark brown head and neck with buff streaks of sides of neck prominent; brown mantle; white streaks on scapulars; white underparts.

**Habitat and Habits:** Streams, ponds marshes, rice fields, ditches, wells and mudflats. Generally solitary or in small groups when hunting, gregarious when roosting, nest in colonies; feast on frogs and fishes from dry waterbodies. Breeds throughout the year.

**Food:** Voracious feeder on frogs and fish, besides aquatic insects.

**Population 2008-2012:** population range between 25 to 56 and latest record was 24.

**Status and Distribution:** A common and widespread resident species. Conversation is not needed.

❖ **Cattle Egret** (*Bubulcus ibis coromandus*)

**Size:** 48-53 cm **Adult:** sexes alike. A lanky snow white bird.

**Non-breeding:** Like Little Egret, but always identified yellow bill contra black.

**Breeding:** Golden-buff plumes on head, neck and back.
Habitat and Habits: Damp grassy fields, fallow, paddy fields, and periphery of canals, lakes and reservoirs. Gregarious when feeding and roosting, invariably accompanying grazing village livestock, feeds on insects distributed by animals. Breeds almost all the year, though mainly from June to August.

Food: Chiefly insects such as beetles and grasshoppers, besides earthworms.

Population 2008-2012: Population range 106 to 236. Latest maximum record was 229.

Status and Distribution: A common resident species. Conservation is not needed.

❖ Little Egret (*Egretta garzetta garzetta*)
Size: 55-63 cm Adult: Sexes alike. A pure white bird like other egrets but smaller; bill and leg black; feet yellow.

Breeding (July-September): A drooping nuchal crests of two long narrow plumes: filamentous ornamental feather on breast and scapulars; a thick bunch of decomposed dorsal plumes extended beyond the trail.

Non-breeding: The ornamental plumes dropped though occasionally some of the scapular plumes are retained.

Habitat and Habits: Marshes, lakes, rivers, paddy fields, mudflats etc. generally found in flocks, more gregarious than the two large species, roots commonly on trees. Breeds in colonies and mixed heronries’ in July to September.

Food: Fish, frogs, crustaceans and aquatic insects.


Status and Distribution: very common throughout India. Conversation and restoration is not needed for the species, due to its common status.

❖ Intermediate Egret (*Egretta intermedia intermedia*)

Non-breeding: Often indistinguishable.

Breeding: Develops filamentous plumes on breast as well as back and the yellow bill (non-breeding) turns black.
Habitats and Habits: Lakes, reservoirs, marshes, pools with vegetation and inundations. Diurnal, occur in small flocks, roosts and feeds communally. Often solitary when hunting. Breeds in colonies in mixed heronries’ from July to September.

Food: Fish, frogs and aquatic insects.

Population 2008-2012: population range 20 to 65 and latest maximum record was 32.

Status and Distribution: Common throughout India. Conversation is needed.

❖ Great Egret (Ardea alba alba) or (Egretta alba)
Size: 91-96 cm Adult: Sexes alike, snow white bird with yellow beak and black legs.

Breeding: black beak; edge of gapes, naked lores and orbital skin behind eyes bright green; three sets of long, transparent, white plumes growing from scapulars extending beyond tail. (Plate-6)

Juvenile: Pure white.

Habitat and Habits: Lakes, marshes. Generally solitary though roots and feeds in communally. Breeds in mixed heronries from July to September.

Food: Fish, frogs and aquatic insects and crustaceans.

Population 2008-2012: Population range10 to 32 and latest maximum records was 18.

Status and Distribution: Widespread and locally migratory in winter, also locally sedentary. Conservation and restoration at wetlands of Kheda district is needed.

❖ Grey Heron (Ardea cinerea rectirostris)
Size: 90-98 cm Adult: Sexes alike but female smaller with less developed occipital crest and pectoral plumes. A long-legged and long necked ashy-grey bird with yellow bill; long black occipital crest; white crown and neck; black dotted line down middle of fore-neck; elongated black-streaked white feather on breast; under parts grayish-white; ashy-grey above; darker central feather with black tips; primaries. Outer secondaries, primary coverts and bastard wing almost black; tail grey.

Juvenile: Browner and darker grey with fore-neck more conspicuously black-streaked and without lengthened scapulars and breast plumes.
**Habitats and Habits:** Almost all types of wetlands, from tiny streams to rivers, marshes, Swamps and lakes. Diurnal generally solitary though roots communally in winters. Breeds in colonies from July to October. Nests among reeds, Perches on trees.

**Food:** Fish, frogs and aquatic invertebrates such as insects, crustaceans and molluscs.

**Population 2008-2012:** Population range 20 to 51 and latest maximum record was 26.

**Status and Distribution:** Resident throughout India. Conservation and is needed.

❖ **Purple Heron (Ardea purpurea manilensis)**

**Size:** 78-90 cm **Adult:** sexes alike, female with less developed crest pectoral plumes. A lanky marsh bird with long slender snake-like neck; slaty-purple above; chestnut and black below. Bill dark yellow; drooping crest black; crown, crest and a line down hind neck black; a second up-running black line from gape to crest; a third black line down whole length of side of neck; rest of head and neck rufous with another black streak down fore-neck.(Plate-7)

**Breeding:** Chin and throat white; long drooping plumes on upper breast buff white with black and chestnut streaks; rest of upperparts chiefly chestnut and black; legs reddish-brown.

**Juvenile:** Cinnamon-brown.

**Habitat and Habit:** Marshes with tall grass, lakes, rivers, paddy fields, mudflats and mangroves. Generally solitary, shy, feeds in dense aquatic vegetation. Active in morning and evening. Breeds from June to October.

**Food:** Chiefly fish, Frogs but also water insects.

**Population 2008-2012:** Population range 22 to 54 at WKD and latest record is 25.

**Status and Distribution:** Resident and locally common species throughout the plains of India. Conservation and restoration at wetlands of Kheda district is needed.

(5) **Family: Phoenicopteridae**

World: 05 species; Asia: 02; India: 02; WKD: 02.

❖ Greater Flamingo (*Phoenicopterus ruber*)

**Size:** 125-145 cm  
**Adult:** Sexes alike, female smaller and generally with less pronounced rose colour. A tail white, stet-legged and long-necked bird with a large sharply de-curved massive pink bill, edge of upper mandible and terminal third black; legs and feet pinkish red. (Plate-4)

**Breeding:** Plumage rose and white, wings black and scarlet. In flight, the long neck and legs stretched to full length with contrasting black and scarlet under wing.

**Juvenile:** Greyish-brown with brownish bill and dark plumcous legs.

**Habitat and Habits:** Large shallow brackish water lakes, salt-pans, estuaries, also freshwater lakes. Highly gregarious, occurs in small groups to large flocks, feeds in shallows by emerging its head with inverted bill.

**Food:** Mainly Chironomid larvae, small mollusks, crustaceans and seeds of aquatic plants, fish.

**Population 2008-2012:** Population range 22 to 54 and latest maximum record 22.

**Status and Distribution:** Regular resident, breeding and migratory bird of salt lakes and coastal areas of India. Conservation and restoration is Needed.

❖ Lesser Flamingo (*Phoenicopterus minor*) (State Bird -Gujarat)

**Size:** 120-135 cm  
**Adult:** Sexes alike, female smaller and generally with less pronounced rose colour. A tail white, stet-legged and long-necked bird with a large sharply de-curved massive pink bill, edge of upper mandible and terminal third black; legs and feet pinkish red.
Breeding: Plumage pink and white, wings black and scarlet. In flight, the long neck and legs stretched to full length with contrasting black and scarlet under wing. Juvenile: Grayish-brown with brownish bill and dark plumcous legs.

Habitat and Habits: Large shallow brackish water lakes, salt-panes, estuaries, also freshwater lakes. Highly gregarious, occurs in small groups to large flocks, feeds in shallows by emerging its head with inverted bill.

PLATE-12 Lesser Flamingo (*Phoenicopterus minor*)

Food: Mainly Chironomid larvae, small mollusks, crustaceans and seeds of plants.


Status and Distribution: Regular resident, breeding and migratory bird of salt lakes and coastal areas of India. Conservation and restoration at WKD is needed.

(6) Family: Threskiornithidae

World:06; Asia:05; India:04; WKD:04

Com. Ids: Larger birds with long neck and legs, partly webbed feet and long, broad wings. Ibises have a long de-curved bill, and forage by probing in shallow water, mud and grass. Spoonbills have a long speculate bill to catch floating prey in shallow water.

 Glossy Ibis (*Plegadis falcinellus*)

Size: 55-65 cm Adult: small, dark Ibis with rather fine down-curved bill, and greenish to brownish legs. Graceful, but rather cormorant like in flight, with extended slender
neck, somewhat bulbous head and legs and feet projecting well beyond tail. Flies with rapid wing beats interspersed with short glides; flocks often in V-formation.

**Adult breeding:** Dark olive-brown bill, deep chestnut head, neck and most of body glossed with purple and green, metallic green wings strongly glossed with purple, and narrow white surround to bar lores.

**Adult non-breeding:** Dark brown head and neck streaked with white, blackish-brown mantle and scapulars glossed with purple and green, and dark brown underparts with some chestnut mottling.

**Juvenile:** Dull brown head and neck mottled with white, whitish throat, dark brown upperparts and wings with faint greenish gloss, and brown underparts lacking any chestnut.

**Habitat and Habits:** Freshwater marshes and large lakes, extensive areas of flooded grassland and paddy fields. Seen mainly in parties, sometimes of up to 50 birds. Forages in shallow water and marshes, often in well scattered flocks; walks about or often wades, belly-deep while probing rapidly into water and mud, feeds chiefly on invertebrates, also fish and frogs. Readily perches and roosts in trees. Breeds: May to July. Forms colonies with other large waterbirds.

**Food:** Mainly invertebrates and fishes and frogs.

**Population 2008-2012:** Population range 102 to 224 and latest maximum record 146.

**Status and Distribution:** Regular resident, breeding bird moves depending on water and feeding conditions. Conservation is not needed for the species.

**💗 Black-headed Ibis (Threskiornis melanocephalu)(White Ibis)**

**Size:** 75 cm. **Adult:** stocky; mainly white ibis with stout down-curved black bill, and black legs. (Plate-6)

**Adult breeding:** Darken black head, variable yellow wash to white feathers of mantle and breast, grey on scapulars and elongated tertials, white plumes extending from lower neck and all-white wings. In flight shows stripe of bare red skin on underside of white forewing and on flanks.
**Adult non-breeding:** All-white body plumage and lack neck plumes. Immature: Grey feathering on head and neck, and black fringes and tips to outer primaries. Bare skin on underwing is blackish.

**Habitat and Habits:** Freshwater marshes tanks, jheels, rivers, flooded grassland, paddy-fields, tidal creeks and mudflats, salt marshes and coastal lagoons. Similar to those of Glossy Ibis. Often forages in company with storks, egrets and spoonbills. Breeds: June to March but varying according to monsoon and water conditions. Forms colonies with other large waterbirds.

**Food:** Mainly invertebrates and fishes and frogs.

**Population 2008-2012:** Population range between 153 to 221 at WKD and latest maximum record 160.

**Status and Distribution:** Widespread and locally common resident, breeding bird. Conservation is not needed.

**Black Ibis (Pseudibis papillosa) (Red-napped Ibis)**

**Size:** 68 cm  
**Adult:** stocky dark Ibis with relatively stout down-curved bill and reddish legs. Appears bulky and broad-winged in flight, with only the feet extending beyond the tail. Told from Glossy Ibis in all plumages by white shoulder patch and red legs.

**Adult Male:** dark greenish bill, marked black head with red patch on rear crown and nape, dark brown neck and body glossed with green on scapulars, black wings strongly glossed with green and purple, and white inner wing-coverts (showing as prominent white wing patch in flight).

**Immature:** dark brown, including feathered head, with white lesser wing-coverts (really visible only in flight) and blackish bill. At rest told from immature Glossy Ibis by lack of white mottling on head and neck and by structural differences. Breeds: March to October. Usually nests singly, but sometimes in small, unmixed colonies.

**Food:** Mainly invertebrates and fishes and frogs.

**Population 2008-2012:** Population range between 120 to 255 and latest maximum record 133.

**Status and Distribution:** Widespread, resident breeder. Conservation is not needed.
Eurasian Spoonbill \textit{(Platalea leucorodia)}

\textbf{Size:} 80-90 cm  \textbf{Adult:} largely white; with extraordinary spatulated bill, and stout black legs. In flight, neck outstretched, and flapping is rather stiff and interspersed with gliding. (Plate-3)

\textbf{Adult breeding:} yellow tip, black bill, bare orange yellow skin on throat, prominent crest, yellow wash to breast.

\textbf{Adult non-breeding:} Lacks crest and yellow wash to breast. Juvenile: Pinkish bill and legs, black shafts to secondaries, and more extensive black tips to primaries than immature.

\textbf{Habitat and Habits:} Chiefly larger lakes, lagoons, rivers and marshes; also tidal creeks and mangroves. Usually in small parties or flocks, often with other large waterbirds. Spends much of the day resting on one leg or sleeping with the bill tucked under the wing. Forages mainly in the mornings and evenings and at night. Wades actively in shallow water, making rhythmic side-to-side sweeps of its bill and sifting floating swimming prey. Breeds: During monsoon, July-January, varying locally. Forms colonies, usually with large wading birds.

\textbf{Food:} Aquatic invertebrates and small fishes.


\textbf{Status and Distribution:} Widespread and locally common resident, moves depending on water and feeding conditions. Conservation and restoration at WKD is need.

\textbf{(7) Family: Pelecanidae}

World:03; Asia:03; India:03; WKD:01;

\textbf{Com. Ids:} Large, aquatic, gregarious fish-eating birds. The wings are long and broad and the tail is short and rounded. They have a characteristic long, straight, flattened bill, hooked at the tip, and with a large expandable pouch suspended beneath the lower mandible. Many pelicans often fish cooperatively by swimming forward in a semicircular formation, driving the fish in to shallow waters; each bird then scoops up fish from the water into its pouch, before swallowing the food. Pelicans fly either in V-formation or in lines, and often soar for considerable periods in thermals. They are
powerful fliers, proceeding by steady flaps and with the head drawn back between the shoulders. When swimming, the closed wings are typically held above the back. All frequent fresh and blackish lakes and coastal waters.

**Great White Pelican (Pelecanus onocrotalus)**

**Size:** 140-175 cm  
**Adult:** Best told from Dalmatian and Spot-billed Pelicans by patterning of underwing. Adult and immature birds have black undersides to primaries and secondaries which contrast strongly with white or largely white underwing-coverts. Upperwing also appears more contrasting, with blacker flight feathers. More difficult at rest, when bare-part coloration is more important. Feathering of forehead narrower than on Dalmatian and tapers to a point at bill-base (owing to more extensive area of orbital skin). Adult is generally cleaner and white than others.

**Adult non-breeding:** As adult lacks pink tinge and crest and bare parts are duller.

**Adult breeding:** White feathers of body and wing-coverts fringed with pink, bright yellow pouch and pinkish skin around eye, crimson tinge to pink legs and feet, and white crest.

**Juvenile:** Largely brown head, neck and underparts, including upperwing-coverts, and dark brown flight feathers; upperwing appears more uniformly brown, and underwing shows pale central panel contrasting with dark inner wing-coverts and flight feathers. Grayish pouch become yellower with age.

**Habitat and Habits:** Large lakes, lagoons and tidal creeks. A typical Pelican. May be found singly in small flocks, or in huge concentrations on large lakes and lagoons. Often hunts cooperatively. Roosts in flocks, usually on open sand bars. Breeds: February to April in colonies.

**Food:** Fishes and small vertebrates.

**Population 2008-2012:** Population range 10 to 25 and latest maximum record 12.

**Status and Distribution:** Widespread Resident and winter visitor. Breeds in the Great Rann of Kutch, Gujarat and moves depending on water and feeding conditions. Conservation and restoration at WKD is needed.
(8) **Family: Anatidae**

World: 149 species; Asia: 62; India: 36; WKD: 17.

**Com. Ids:** Plump waterbirds with considerable diversity in size and coloration. Bill typical broad. Flat, rounded at tip and with a comb-like fringe or lamellae. Wings mostly narrow and pointed. Tail and legs short; feet webbed. Young nidifugous. Most of the species are migratory.

- **Graylag goose** *(Anser anser rubrirostris)*

  **Size:** 75-90 cm  
  **Adult:** sexes alike, a large grey-brown goose with pink bill and legs; a very narrow white rim of feathers at base of bill; ash-brown head and neck; pale or grey back and rump; white upper tail-coverts and vent.

  **Habitat and Habits:** Large Rivers, lakes, reservoirs, grassy banks and crops. Shy reserves assemble in large number where food is in abundance, generally on large lakes. Feed by grazing on wet grasslands or crops mainly during the nights, daytime are spent by swimming or resting.

  **Food:** Major source is plants, grasses and arable winter crops like wheat and grams.

  **Population 2008-2012:** Population range 12 to 35 and latest maximum record was 14.

  **Status and Distribution:** Passage winter visitor in India. Conservation is needed.

- **Ruddy Shelduck or Brahminy duck** *(Tadorna feruginea)*

  **Size:** 61-67 cm  
  **Adult:** A large bright orange-brown duck with pale buff head and neck; black beak, feet and tail; white wing-coverts and a prominent metallic green speculum. (Plate-3)

  **Male:** In breeding season develops a narrow black collar on lower neck.

  **Female:** With whiter head and without black collar.

  **Juvenile:** Like female but duller with a grey wash on scapular and territories’.

  **Habitat and Habits:** Common winter migrant to large open lakes and river with extensive shingle banks and mud-flats. Generally found in pairs or small flocks, but large congregations can be seen on lakes and reservoirs, feed by grazing on banks;
breeds around high-altitude lakes and swamps. Arrive in India by October and departs in April through stray birds may be found up to even June.

**Food:** Almost omnivorous, comprising grains, aquatic plants, algae and aquatic invertebrates.

**Population 2008-2012:** Population range 25 to 65 and latest maximum record was 23.

**Status and Distribution:** Mainly winter migrant all India. Conservation is needed.

❖ **Common Shelduck** (*Tadorna tadorna*)

**Size:** 58-67 cm **Adult:** distinctive white and black duck, broad chestnut breast-band, glistering greenish-black head and neck, glossy green speculum bordered above with chestnut, black tail tip, brought red bill and pink legs.

**Male:** With a conspicuous red knob above base of bill and a broad black band from breast to vent.

**Female:** Considerably smaller, dull colored and without red knob. Male: (in eclipse): Head dull blackish with little sheen; feathers of lower black band with white tips.

**Juvenile:** Chestnut breast-band absent, sometimes sides slightly suffused with chestnut.

**Habitat and Habits:** Open lakes, large lakes and mudflats. Generally more gregarious than Brahminy, occurs in small flocks, feeds by walking on mudflats, which it frequents often.

**Food:** Chiefly carnivorous, comprising molluscs, aquatic arthropods, also algae, seeds.

**Population 2008-2012:** Population range 26 to 56 and latest maximum record was 36.

**Status and Distribution:** Uncommon irregular winter migrant to India. Conservation and restoration at WKD is needed for the species.

❖ **Eurasian Wigeon** (*Anus Penelope*)

**Size:** 45-51 cm **Adult Male:** Distinctive creamy patch on forehead contrasting with rust red head and neck, finely penciled grey body; blue grey bill with black tip;
vinous-red breast; metallic green speculum bordered with black; white under plumage; black tail-converts.

**Female:** Mottled brown. Similar to male in eclipse, but much duller, less reddish-brown, the dark vermiculation less coarse, the lesser wing-converts grey. The more rufous plumage and metallic green speculum differentiate it from rather similar female Gadwall (speculum-contrasting white and black). Male (in eclipse): Reddish-brown with black vermiculation above and chiefly white below.

**Habitat and Habits:** Freshwater shallow reedy lakes, marshes, open lakes, reservoirs, rivers and also pools; avoid deep waters overgrown with vegetation. Highly gregarious, large flocks are common, feed chiefly by grazing on edges, sometimes dabbles at water surface.

**Food:** Chiefly vegetarian, plants, algae, grasses, seeds, crops, rarely aquatic animals.

**Population 2008-2012:** Population range 46 to 60 and latest maximum record was 52.

**Status and Distribution:** Common winter visitor. Conservation is needed.

❖ **Falcated (Teal) Duck (Anas falcate)**

**Size**48-54 cm **Adult Male:** Head bronze-green with chestnut crown, lores and cheeks; throat white contrasting with finely penciled body; bill black, inner secondaries very long and falcate (sickle-shaped); stern buff-edged black; upper tail-converts black, overtopping tail; legs grey.

**Female:** Resembles female Gadwall; however, mottled dark and light brown with white-edged greenish-black speculum; 14 rectrices instead of 16; grey legs, Male (in eclipse): Like female but less coarsely mottled, green gloss on head and darker cheeks.

**Habitat and Habits:** Lakes, marshes and rivers. Shy and wary, occurs singly, keep close to emergent vegetation.

**Food:** Chiefly vegetarian.

**Population 2008-2012:** Population range 06 to 10 and latest maximum record was 08.

**Status and Distribution:** Winter migrant. Conservation is needed for the species.
**Gadwall (Anas strepera strepera)**

**Size:** 45-51 cm  
**Adult Male:** Body dark brown and grey; belly whitish; tail velvety-black; breast white crescent marking; chestnut patch with black-white speculum  
**Female:** like female Mallard, but duller and smaller with chestnut on wing and orange-yellow legs.

**Male (in eclipse):** Like female, but greyer and less heavily marked above.

**Habitat and Habits:** Freshwater reedy marshes and lakes with exclusive aquatic and emergent vegetation, open water spread of dams and reservoirs. Gregarious usually found in small flocks of 10-30 birds. Surface feeding duck; shy and wary; keep near emergent vegetation.

**Food:** Primarily vegetarian, comprising aquatic plants and grains of arable crops, occasionally mollusks and aquatic animals.

**Population 2008-2012:** Population range 105 to 123 and latest maximum record 106.

**Status and Distribution:** Commonly winter migrant-India. Conservation is needed.

**Common Teal (Anas crecca crecca)**

**Size:** 34-38 cm  
**Adult:** A small duck with a distinctive tricolored (black, metallic green and buff) speculum, particularly conspicuous in flight; black bill; olive-grey to deep slaty-blue legs. Male: Penciled grayish. Head dark chestnut with broad metallic green band surrounding the eye and running back to the nape. A narrow whitish line from the bill running black towards the eye and then diving to white or buff; tail brown, feathers pale edged, under tail-converts buff laterally, black in centre.

**Female:** Mottled brown and buff; pale belly; black and green speculum.

**Male (in eclipse):** Crown and nape blackish-brown.

**Juvenile:** Belly spotted; secondaries shorter.

**Habitat and Habits:** Freshwater shallow inland wetlands like ponds, lakes, marshes, pools, reservoirs and rivers. One of the commonest and abundant species in India found in flocks up to 100 or more ducks, feeds in the fields at night with other
dabbling ducks. One of the earliest species to arrive by middle or end of August and continues until November. Mostly departs by end of March, or stay as late as May.

**Food:** Chiefly vegetation, comprising aquatic plants their seeds, arable winter crops.

**Population 2008-2012:** Population range 190 to 205 and latest maximum record 52.

**Status and Distribution:** Commonest winter migrants India. Conservation is needed.

❖ **Mallard *Anas platyrhynchos***

**Diagnostics:** size-Duck=; 50-65 cm

**Male:** Head and upper neck glistening metallic dark green separated from chestnut breast by narrow white collar; bill dull olive-yellow; above and below largely grey; rump; tail-converts and two up curled central tail-feathers black; speculum glossy bluish-purple.

**Female:** Brown and buff, streaked and spotted with black; chin, throat and fore-neck plain buff, irregular dark line through eye; orange legs. Easily Id by bill shape and purple-blue speculum. Male (in eclipse): Like female, head darker, upper plumage back to tail much like.

**Habitat and Habits:** Occurs in shallow freshwater lakes, marshes, reservoirs rarely rivers and ponds. A gregarious dabbling duck, keeps in small flocks, sometimes up to 50, mostly feed at night and usually vary.

**Food:** Chiefly vegetarian, comprising arable winter crops such as wheat and gram, aquatic plants sometime molluscs, fish and tadpoles.

**Population 2008-2012:** Population range 99 to 175 and latest maximum record 132.

**Status and Distribution:** Commonest winter migrants-India. Conservation is needed.

❖ **Spot-billed Duck (*Anas poecilorhyncha poecilorhyncha*) (plate-4)**

**Size:** 58-63 cm **Adult Male:** A large, brackish-brown duck with scaly-patterned plumage. Bill black and yellow, tip black, two swollen orange-red spot at the base of the bill on either side of forehead, crown from forehead to nape dark-brown; remaining head and neck buff-white; eye strip dark broad. Feathers with pale edges;
speculum with glossy green narrow black, white margins; tail darker. Legs and feet coral-red.

**Female:** With less conspicuous loral spots, slightly smaller and duller than male.

**Juvenile:** Like adult but, paler without red spot at base of bill and less spotted below.

**Habitat and Habits:** Shallow freshwater lakes, marshes and reservoirs with emergent vegetation, rarely on rivers. Sociable, usually occurs in pairs during breeding season female with cheeks are not a rare sight, in non-breeding period flocks of up to 50 are found; feed on dabbling or walking in marshy vegetation, breeds: July to October.

**Food:** Chiefly vegetarian arable winter crops, aquatic plants, rarely aquatic insects.

**Population 2008-2012:** Population range 15 to 35 and latest maximum record was 19.

**Status and Distribution:** Commonest winter migrants India. Conservation is needed.

**Comb Duck (Sakidiornis melanoto)**

**Size:** 56-76 cm  
**Adult Male:** Large stocky duck with white-speckled black head and neck, blackish upperparts glossed with bronze, blue and green, white breast with incomplete narrow black breast band, white belly and undertail-coverts, and grey wash to flanks. Has gross, fleshy ‘comb’ at base of bill in summer this much reduced in winter. In breeding plumage, has yellowish buff wash to sides of head and neck. In flight, whitish underparts contrast strongly with very dark underwing, and ‘comb’ gives head an oblong-shaped appearance.

**Female:** Lacks ‘comb’ and is much smaller, duller on the underparts, and often brownish mottled on underparts.

**Juvenile:** Whitish supercilium, contrasting with (rufous speckled) brown crown and eye-stripe, rufous-buff fringes to mantle and scapulars, and rufous-buff underparts with brown scaling on sides of breast, Wings strong metallic blue-green similar to adult. Head pattern and green in wing are best distinctions from juvenile.

**Habitat and habits:** pools, jheels and irrigation tanks with good aquatic vegetation. Usually keeps in family parties or small flocks of 25-30. Breeds: July to Sept.
Food: feeds chiefly by grazing in marshes and wet grasslands; also by wading and dabbling in the shallows. Perches readily in trees.


Status and Distribution: Widespread uncommon Resident. Population concentrated mainly in India and declining; locally migratory, depending on water.

❖ Northern Pintail (Anas acuta)

Size 56-75 cm Adult Male: Head, face and neck chocolate-brown; nape black; bill plumbeous; either side of neck with white stripe joining down to white neck and breast; neck finely penciled silver-grey; speculum metallic bronze-green; upper tail-converts grey edged with black; under tail-converts black with broad buff patch in front. Tail long, pointed pin-like.

Female: mottled brown and buff with pointed but pin less tail and without prominent speculum.

Male (in eclipse): Resembles female, but lacks distinctive pale edges to feathers on its back; dark ashy-grey or grayish-white coarsely vermiculated mantle.

Habitat and Habits: Lakes, marshes, reedy and vegetation-covered wetlands and rivers. Highly gregarious, keeps in flocks of up to 100; largely crepuscular feed at night and roosts during day; shy and very wary.

Food: Vegetarian, plant seeds, arable winter crops, aquatic plants and animals.


Status and Distribution: Common winter migrant to India. Conservation is needed.

❖ Garganey (Anas querquedula)


Breeding: Bill brownish black with black nail. Upper plumage blackish-brown with pale edges; scapulars long, drooping and glossy black with white median ribs; speculum green between two white bands. Breast light brown, speckled black, underparts white, finely waved on sides and black spotted near vent.
Female: Mottled brown above and white below and whitish eyebrows. Male: (in eclipse) Like female, but with adult male wing coloration.

Habitat and Habits: Frequent almost all type of wetlands including lakes, marshes, reservoirs, rivers and village ponds, vegetation. Gregarious, flocks in thousands, non-diving duck, nocturnal feeder, shy and wary.

Food: Primarily vegetarian comprising of seeds, winter crops, occasionally aquatic insects, larvae, worms.

Population 2008-2012: Population range 12 to 36 and latest maximum record was 22.

Status and Distribution: India, commonest winter migrant. Conservation is needed.

❖ Northern Shoveler (*Anas clypeata*)

Size: 44-52 cm 

Adult Male: Head and neck glossy green; bill large, flat, grayish black; eyes yellow; breast white; abdomen and flanks chestnut with white-edged black stern; speculum metallic green.

Female: Mottled dark brown and buff. With grayish-blue shoulder patch; faint green speculum bordered above and below with white; bill broad. Flat, greenish-brown tinged with orange.

Male (in eclipse): like female but largely with adult male coloration.

Habitat and Habits: Shallow freshwater like lakes, marshes, reservoirs, ponds and rivers. Gregarious, usually keeps in small flocks, feeds by sweeping sideways. Arrives in late October and one of the last to depart.

Food: Chiefly aquatic animals, mollusks, crustaceans, insect larvae, worms, plants.

Population 2008-2012: Population range 32 to 60 and latest maximum record was 42.

Status and Distribution: All India, common winter migrant. Conservation is needed.

❖ Red-crested Pochard (*Netta rufina*)

Size: 45 cm 

Adult Male: Head golden-orange with silky chestnut crest; bill bright crimson; neck, rump and upper tail-coverts blackish –brown; crown dark;
**Female:** bill dusky black with red tip. Wings like male but paler and duller, white replaced by grey. Male (in eclipse): Like female but browner on underparts; crest bushy; the brightness of eyes. Bill and feet retained.

**Habitat and Habits:** In habits large lakes, marshes, reservoirs and wetlands plenty of submerged and fringe vegetation, occasionally in rivers. A driving duck which prefers deep open waters, generally shy and wary, feeds and small groups though large flocks also common, feed by diving, arrives by October and generally departs by mid-March.

**Food:** Chiefly vegetarian, comprising aquatic plants, algae, seeds, also aquatic insects.

**Population 2008-2012:** population range 04 to 12 and latest maximum record was 06.

 ◆ **Common Pochard (Aythya ferina )**

**Size** 42-49 cm **Adult Male:** Head and neck deep chestnut; bill black with pale grey band near tip; upper black grey; breast black; remaining underparts light grey; sides largely grayish white; rump, upper and under tail-coverts dark grey-brown.

**Male** (in eclipse): Dull and more brownish than in breeding plumage.

**Habitat and Habits:** Frequent open parts of lakes, also occurs in deep waters with emergent vegetation, found in all types of Wetlands. One of our commonest diving ducks forming large flocks from a few hundreds to thousands of birds; feeds under water, mainly nocturnal feeder. Arrives in mid-October and departs by end of March.

**Food:** Chiefly vegetarian, comprising aquatic plants, algae, seeds also occasionally mollusks. Insect larvae, fish and tadpoles.

**Population 2008-2012:** population range102 to 135and latest maximum record 122.

**Status and Distribution:** Common winter migrant. Conservation is not needed.

 ◆ **Ferruginous Duck (Aythya nyroca)**

**Size** 38-42 cm **Adult Male:** Head, neck, breast deep chestnut; nape darker; bill bluish-black; iris white; plumage blackish brown; speculum white; belly with a large white oval patch; under tail-coverts white; legs dark slaty.
Female: Duller with brownish iris and less contrasting off-white belly. The deep chestnut color, white oval belly-patch, white under tail-coverts and broad white crescent band on flight feathers diagnostic of both sexes in flight.

Habitat and Habits: Occurs in weedy and vegetation covered lakes, open irrigations, reservoirs with thick marginal vegetation. A shy and secretive duck, which occurs in pairs or in small groups, feed mainly by diving at night.

Food: Both aquatic vegetation (seeds, plants, algae) and animals (molluscs, larvae).

Population 2008-2012: Population range 02 to 06 and latest maximum record was 02.

Status and Distribution: Globally threatened/Vulnerable. Throughout India. Estimated population in the world is less than 60000. The number declining rapidly all over the world due to hunting. Conservation is needed.

 Tufted Duck (Aythya fulguta)

Size: 40-47 cm  
Adult Male: The only Pochard with long occipital crest. Plumage boldly contrasting black and white. Head, neck, breast, back, tail and vent jet-black; sides of body flanks pure white; belly grayish; iris golden-yellow; bill, legs and feet grayish-blue.

Female: Dark brown with rudimentary occipital crest; belly white; often a white ring of feathers at base of bill. Male (in eclipse): Darker than female; flanks with white moulting; underparts uniformly brown; tough of white at base of bill.

Habitat and Habits: Prefers open and deep waters, irrigation dams, lakes and marshes. Generally gregarious, occurs in large flocks of hundreds. Diving duck that feed mainly by diving in daytime. Arrives by mid-October and departs end of March.

Food: Predominantly aquatic animals such as mollusks, also plant seeds.

Population 2008-2012: Population range 05 to 12 and latest maximum record 08.

Status and Distribution: Commonly all over India. Conservation is needed.

(9) Family: Dendrocygnidae

World: 02 species; Asia: 02; India: 02; WKD: 02.
 Lesser whistling Duck (*Dendrocygna javanica*)

**Size**: 42 cm

**Adult**: very noisy and in flight appears very dark on the upper and under-wings. Smaller and more neatly proportioned than Fulvous whistling duck. Additional distinctions from that specie are grayish buff head and fore-neck. Lake of well define dark line down hind-neck and darker crown contrasting more with sides of (head) in flight. Has maroon chestnut (not white) band across upper-tail coverts and bright maroon chestnut patch on forewing. Sexes: similar. (Plate-3)

**Juvenile**: very similar to Adult but duller, grayish buff on the under parts, Dark cap, absence of dark line down hind neck and bright maroon chestnut forewing are best plumage differences from juvenile fulvous. Both fulvous and laser are possibly confusabla with juvenile Comb duck but that species is more heavily built has stronger flight and is comparatively silent (with no wittering and whistling), legs of Comb do not dangle well beyond tail in flight as they do on the whistling ducks. Main plumage features of Comb are whitish super- cilium and brown crown and eye-stripe, dark scaling on sides of breast and metallic blue-green gloss to wings.

**Habitat and Habits**: Flooded grassland and paddy fields, freshwater marshes, and shallow pools and lakes, favoring those with plentiful fringe cover, emergent vegetation and partially submerged trees. Generally avoids open area of water. Similar to those Fulvous whistling Duck but is more gregarious, Roots in the day-time in trees or on partially submerged branches on undisturbed water; near coasts, may loaf on the open sea or in lagoons. Dabbles in shallow waters, also dives in deeper water. Breeds: December to October, varying locally.

**Food**: Predominantly aquatic animals such as mollusks, also plant seeds.

**Population 2008-2012**: Population range154 to 180 and latest maximum record 165.

**Status and Distribution**: Resident and wide-spread all India. Conservation is needed.

Fulvous Whistling Duck (*Dendrocygna bicolor*)*(Large W. Duck)*

**Size**: 51 cm

**Adult**: Among a flock of the commoner Lesser Whistling Duck is larger and lankier, with a proportionally larger and squatter head and much larger bill. Like lesser, has rather weak, deep-flapping flight, appears very dark on the upperwing and underwing, and is very noisy with repeated whistling.
**Adult Male:** told from lesser by warmer rufous-orange coloration to head, slightly darker rufous-brown crown, dark blackish line down hind-neck and pronounced fine, dark striations on neck. Streaking on the flanks is broad and usually prominent (often not apparent on lesser). In flight, has a white (not maroon- chestnut) band across upper tail-coverts; upper wing-coverts have some chestnut-brown, but this is not so bright or prominent as the maroon-chestnut patch on fore-wing of lesser. Sexes: similar.

**Juvenile:** Usually accompanied by adults and is similar, but sides of head, fore-neck and under-parts are a paler more uniform buff, and flanks striping is less prominent. Best told from juvenile lesser by differences in structure, brighter rufous-brown crown and dark line down hind-neck, and dull chestnut-brown wing-coverts.

**Habitat and Habits:** Marshes, paddy fields, shallow ponds, partly submerged trees. Keeps in small flocks and often with Lesser Whistling Duck. Shy and wary. Feed chiefly at night, mainly by upending and dabbling but can also dive well. Roosts during the day on waterbodies near its feeding grounds. Breeds: June to October.

**Food:** Predominantly aquatic animals such as mollusks, also plant seeds.

**Population 2008-2012:** Population range 125 to 180 and latest maximum record 125.

**Status and Distribution:** Resident and widespread all India. Conservation is needed.

(10) **Family: Rallidae**

World: 124 species; Asia: 34; India: 12; WKD: 04

**Com. Ids:** Small to medium size crepuscular or diurnal birds with plump, laterally compressed body; short rounded wings and short pointed tail. Plumage black or in soft shades of grey, brown, blue or green. Walk, run and swim well but fly very poorly with legs dangling, although some species are long distance migrants. Sexes similar in most species. Young nudifugous.

❖ **White-breasted waterhen** (*Amaurornis phoenicurus*)

**Size** 32 cm **Adult:** very striking with white face, fore-neck and breast, dark slaty-grey hind-neck, upperparts and flanks, rufous-cinnamon lower belly, vent under tail-coverts, lime-green bill with red base and long greenish legs.
Juvenile: Similar to adult, but grayish cast to white face, fore-neck and breast, and dark olive-brown underparts.

Habitat and Habits: Occurs wherever water is surrounded by thick cover, reedy marshes, edges of flooded paddy fields, ponds, ditches. Often seen in villages and in public parks in towns and cities. Similar to those of other rails, but less shy than most of the family; often feeds in the open and on quite dry land. Breeds: June to October.

Food: Predominantly aquatic animals such as molluscs, also plant seeds.


Status and Distribution: Resident and widespread commonly all over India except NW and Himalayas. Conservation and restoration at WKD is not needed.

❖ Common Moorhen (Gallinula chloropus)

Size: 32-35 cm Adult Breeding: Yellow-tipped red bill, red frontal shield red irides, blackish head and neck, slaty-grey underparts, dark olive-brown upperparts, very striking white lateral under tail-coverts and white boarder to flanks, and yellow green legs with red above knee.

Non-breeding: Duller brownish-red bill and duller legs.

Juvenile: Resembles non-breeding adult but duller body plumage, with grey underparts washed with brown-buff, white throat, less prominent pale border to flank.

Habitat and Habits: Marshes, lakes, jheels, ponds, village tanks and ditches with emergent aquatic vegetation. Found singly, in pairs or in small parties; may gather in flocks of 50 or more in winter. Usually forages in the open; spends most of day swimming among aquatic plants, also feeds on lands. Slow and heavy in flight and patters along the water before becoming airborne. Dive well. Breeds: March to Sept.

Food: Predominantly aquatic animals such as molluscs, also plant seeds.


Status and Distribution: Resident and widespread and winter visitor commonly all over India except NW and Himalayas. Conservation and restoration is not needed.
**Purple Swamphen (Porphyrio porphyria) (Plate-3)**

**Size:** 45-50 cm  
**Adult:** A very large rail mainly purplish-blue coloration with huge red bill, and red frontal shield, long stout red legs, huge feet and white under tail-coverts.

**Juvenile:** Duller than Adult with pale throat, grey wash to face, fore-neck and breast, duller red bill (which is blackish at first) and duller legs and feet.

**Habitat and Habits:** Large marshes and extensive reed-beds bordering jheels and lakes. Typically found in parties and in bigger numbers in extensive marshes. Diurnal and undisturbed is not shy. Forages mainly within reed-beds. Breeds: April to Sept.

**Food:** Predominantly aquatic animals such as molluscs, also plant seeds.

**Population 2008-2012:** Population range 155 to 276 and latest maximum record 253.

**Status and Distribution:** Resident, winter visitor. Conservation is not needed.

**Common Coot (Fulica atra atra)**

**Size:** 36-38 cm  
**Adult:** sexes alike, a slaty-black waterbird with stout pointed ivory-white bill, white frontal shield and green legs. Head, neck and throat black; upper plumage slaty-black with steel-blue sheen; under plumage slaty-grey with dark vent and under tail-coverts. (Plate-2)

**Juvenile:** Greenish-brown above and mottled white underneath.

**Habitat and Habits:** Large lakes, reservoirs, irrigation tanks with deep water, marginal emergent vegetation Gregarious, very large flocks during winter, diurnal, forages on aquatic plants. Breeds: May to September.

**Food:** Vegetarian (shoots, seeds of aquatic plants) also molluscs, worms and insects.

**Population 2008-2012:** Population range 109 to 220 and latest maximum record 158.

**Status and Distribution:** Widely distributed in India. Conservation is not needed.

**(11) Family: Gruidae**

World: 15 species; Asia: 09; India: 04; WKD: 03
Com. Ids: Large elegant birds with long necks and long legs superficially resembling storks but with bill either equal or little longer than head. Nostril covered by a membrane on the posterior side and placed above halfway of the mandible, wings broad, with eleven primaries. Inner secondaries much lengthened, drooping over tail. Tail short with twelve feathers. Tibine partly bare; toes short, strong and unwebbed; hind toe raised. Flight powerful, in V-formation or in line with outstretched head, neck and legs. Calls powerful, trumpet-like. Young nidifugous.

❖ Common Crane (Grus grus)

Size: 110-120 cm Adult: Sexes alike; tall grey, black flight feathers, long neck, dull green bill and black legs. Head and upper neck blackish with dull red marked patch across nape; a prominent broad white band runs from behind eye down on sides of upper neck; tail darker grey, concealed by a mass of long grey drooping tertiaries.

Juvenile: Grey with buff-edged feathers, crown and neck covered by rusty feathers tertiaries shorter.

Habitat and Habits: Sandy riverbeds, reservoirs and lakes, affect fields of winter crops. Highly gregarious, keeps in large flocks of hundreds massed tighter on open sand banks of rivers during winters, often in company of Demoiselle Crane. Fly in wide V-formation. Start arriving in August/September and return by end of March.

Food: Vegetarian, arable winter crops, shoots, tubers, seeds also insects, reptiles.

Population 2008-2012: Population range 29 to 45 and latest maximum record is 32.

Status and Distribution: Regular winter migrant. Conservation is needed.

❖ Sarus Crane (Grus antigone)

Size: 156 cm Adult: A huge mainly pale grey crane with reddish legs, naked scarlet head and upper neck (except for ashy-green crown), and very large bill.

Racial variation: Eastern race G. a. sharpie, which occurs in NE subcontinent, darker grey in coloration compared with the widespread nominate race, with tertials concolorous with body. (Plate-3)

Habitat and Habits: Open cultivation in well-water bodies, marshes, jheels, lakes and large rivers. Normally keeps in pairs or family parties of three or four birds, although
sometimes in flocks of 70 or more. Very tame in C and W India and Nepal where it is
undisturbed. Usually makes regular daily flights to and from roosting sites.

**Juvenile:** Heavily marked with brown on underparts, and head and neck covered with
buff or rusty-buff feathers. Older immature have bare head and upper neck duller than
adult, and lack greenish crown. In flight both shows black primaries which contrast
with grey of rest of wing. Breeds: July to October, varying locally.

**Food:** Vegetarian, arable winter crops, shoots, tubers, seeds also insects and reptiles.

**Population 2008-2012:** Population range 700 to 815 and latest maximum record 723.

**Status and Distribution:** Globally threatened/Vulnerable. Throughout India.
Population in the world is declining rapidly due to hunting. Conservation and
restoration at Wetlands of Kheda district is needed for the species.

❖ **Demoiselle Crane (Grus virgo)**

**Size:** 90-100 cm **Adult:** Smallest of the cranes occurring regularly in the sub-continent
and mainly grey in coloration, with short fine bill.

**Adult Male:** Mainly black head and neck with down-curved white tuft behind eye,
and grey crown; black feathers of neck often extend as a point beyond breast, and
elongated grey and black tertials project as a shallow arc beyond body giving rise to
distinctive shape.

**Juvenile:** Initially almost entirely grey, with slaty-grey on fore-neck and with shorter
all grey tertials. By first winter is similar to adult but head and neck are dark grey and
less contrasting, tuft behind eye is grey and less prominent and elongated feathers of
fore-neck and tertials are shorter protrude less than in adult plumage; grey-brown cast
to mantle, coverts and tertials. In flight, both adult and immature show black flight
feathers which contrast with pale grey of rest of wing. Easily confused at a distance
with Common Crane. Elongated breast feathers, sleek appearance of elongated tertials,
relatively short bill (shorter than head) and black of throat extending onto breast are
best features for separating distant Demoiselle from Common at rest. In flight
Demoiselle is best separated at a distance by black breast; in addition, the legs and
neck appear relatively shorter, and the wings shorter and broader-based.
**Habitat and Habits:** Winter crops, ribers with sandbanks, jheels and reservoirs. Similar to those of Demoiselle Crane, with which it often associates.

**Food:** Chiefly vegetarian, arable winter crops, shoots, tubers, seeds also insects and reptiles.

**Population 2008-2012:** Population range 08 to 20 and latest maximum record is 08.

**Status and Distribution:** Fairly common winter visitor. Conservation is needed.

(12) **Family: Ciconiidae**

World:10; Asia:09; India: 09; WKD: 04

**Com. Ids:** Large or very large birds with long bill, neck and legs, long and broad wings and a short tail. In flight, the legs are extended behind and the neck is outstretched (except in case of two Adjutant storks, which hold the neck retracted like the herons). They have a powerful slow-flapping flight and frequently soar for long periods, often at great heights. They capture prey while walking slowly in marshes, at edges of lakes and rivers and in grassland. Typically, storks build a large stick nest, lined with water weeds and leaves, high in trees. Most species also roost in trees.

❖ **Painted Stork (Mycteria leucocephala)**

**Size:** 93-100 cm **Adult:** mainly white, with large, down-curved yellow bill. Bare face is orange-yellow (red in breeding season) and legs red, black flight feathers with white barring on mainly black coverts on upper-wings and under-wings, largely pink tertials and black barring across breast, distractive appearance in flight with extended drooping neck and down-curved bill, long wings with rather deep flapping beats and long trailing legs.

**Juvenile:** Dirty grayish-white with brownish (feathers), head and neck and brown inner wing-coverts; as on adult, white rump and back contrast with black bill, and black flight feathers.

**Habitat and Habits:** Fresh-water marshes, lakes and reservoirs, flooded fields, river banks, intertidal mud-flats and salt-pans. Similar to those of other storks. Found singly, in small parties and some-times in large flocks. Roosts gregariously on trees if available, otherwise on open sandbanks, mud or saltpans. Forages by wading slowly in
shallow water with the Open bill and partly submerged, feeling for prey. Often stirs water with its foot and occasionally flicks a wing to drive prey between its mandibles. Breeds July to April. Starts in latter part of monsoon forms colonies often with other large water-birds. Usually builds nest in trees standing in or near fresh water-body.

**Food:** Mostly feed mainly on fish, frogs, snakes, lizards, large insects, crustaceans and molluscs.

**Population 2008-2012:** Population range 196 to 227 and latest maximum record 206.

**Status and Distribution:** Resident; moving locally according to water conditions. Throughout the plains of India. Except NW and NE. Widespread and common resident. Conservation and restoration at WKD is needed.

❖ **Asian Openbill Stork** (*Anastomus oscitans*) *(Plate-8)*

**Size:** 68 cm **Adult:** Largely white or grayish-white, with stput ‘open bill’, and black flight feathers and tail. At a distance, and in flight, possibly confusabale with white stork but is smaller and stockier, has stout looking, dull-coloured bill, black tail and dull-coloured legs, and usually looks a dirtier, grayish white.

**Adult breeding:** White body and wing-coverts and reddish legs, although this plumage is retained for only short period after the onset of the breeding season.

**Adult non-breeding:** Grey legs. **Juvenile:** Brownish-grey head, neck and breast, and brownish mantle and scapulars; as with adult, grayish-white back and rump contrast with black tail, and has black flight feathers. Has a smaller gap between mandibles than adult and duller legs. **Breeds:** July to April. Starts at beginning of the monsoon, forms large mixed colonies with other water-birds in trees, often over water.

**Habitat and Habits:** Freshwater marshes, shallow lakes, reservoirs, jheels, tanks, lagoons and paddy fields; rarely on river banks and mud-flats. Similar to those of other storks forages singly or in small or medium sized flocks. Usually seeks food by submerging its head and opened bill in to shallow water and probing the bottom mud; **Breeds:** July-April depending on water condition.

**Food:** Molluscs, crabs, frog and fish.

**Population 2008-2012:** Population range 422 to 927 and latest maximum record 406.
**Status and Distribution:** Resident; moving locally according to water conditions. Through-out the plains except N. Conservation is not needed.

- **Woolly-necked Stork** (*Ciconia episcopus*) *(Plate-6)*

  **Size:** 75-92 cm **Adult:** stocky, largely blackish stork with ‘wooly’ white neck, black ‘skullcap’, and white vent and under tail-coverts. In flight, upper-side and underside of wings are entirely dark and has forked black tail.

  **Adult Male:** Black bill, with variable amounts of red. Black of body and wings is glossed with greenish-blue, purple and copper (and can appear brownish in colour). Bare skin of face is dull bluish or lead-grey, and legs and feet are dull red. White neck contrasting with black breast is best feature for separation from Black Stork.

  **Juvenile:** Similarly patterned to adult, but has dull brown (instead of glossy black) upperparts, wings and breast, feathered fore-head, and duller bill and legs.

  **Habitat and Habits:** Flooded grassland, marshes, irrigated fields and riverine areas, usually in or near open forest or open country with groves of trees. Breeds: July- April.

  **Food:** Molluscs, crabs, frog and fish.

**Population 2008-2012:** Population range 25 to 57 and latest maximum record is 26.

**Status and Distribution:** Widespread sedimentary resident. Except NW and NE India. Locally frequent and in plains of India. Conservation and restoration is needed.

- **Black-necked Stork** (*Ephippiorhynchus asiaticus*)

  **Size:** 129-150 cm **Adult Male:** Large black and white Stork with long red legs and huge black bill. Black neck contrasts with white mantle and under-parts, and, at rest the white mantle and inner wing-coverts contrast with the long black scapulars and rest of coverts. At close range, black of plumage can be seen to be glossed with blue, purple and green. In flight under-wing and upper-wing are largely white, except for broad black band across wing-coverts and tail is black.

  **Adult female:** differs from adult male in having a yellow (rather than brown) iris and is smaller in size.
Juvenile: Has fawn-brown head, neck and mantle, brown-centred wing-coverts and scapulars, and dark legs and feet. In flight, shows whitish lower back and rump, and flight feathers are mainly blackish-brown.

Habitat and Habits: Freshwater marshes, lakes, jheels, tanks and large rivers; occasionally mangroves, rarely coastal mud-flats. Forages singly, in well-separated pairs within sight of each other, or in family parties after the breeding season. Usually vary wary. Wades slowly and sedately while probing in shallow water and among aquatic vegetation with its bill open at the tip. Breeds: September to December.

Food: Molluscs, crabs, frog and fish.

Population 2008-2012: Population range 04 to 06 and latest maximum record is 04.

Status and Distribution: Resident. Throughout plains in India but decline sleepily. Former resident now vagrant. Conservation is needed.

(13) Family: Rostratulidae

World: 02 species; Asia: 01; India: 01; WKD: 01

Com. Ids: Sexually dimorphic. Polyandrous; male attends to nest and rears young.

✧ Greater Painted Snipe (Rostratula benghalensis)

Size: 25 cm Adults: Polyandrous.

Breeding (male): Duller and lacking the chestnut and black on neck and breast.

Juvenile: Similar to adult male but with white throat; lower throat and fore-neck washed with brown, with some dusky streaks.

Female: larger than male. Sexes more or less alike and difficult to distinguish in non-breeding season, colorful mottled snipe with long, flesh-pink bill, slightly down-cur.

Breeding (female): Head and neck chestnut with a broad, median and buff stripe on head down to bill; a pure white circle around and a short band behind eye; remaining underparts metallic bronze-green spotted and streaked with black and buff; broad white bands over shoulder to sides of breast chin, throat and breast chestnut; lover breast brackish. Remaining underparts white.
Habitat and Habits: Found in freshwater marshes, with deep pools, ditches with thick vegetation and mud patches. A crepuscular species, active in early morning, evening and night, solitary or in small flocks, forages by probing into mud, wages hindparts while feeding. Breeds almost throughout year, but chiefly July to September. Nests on grass padding hidden in thick vegetation.

Food: Omnivorous, comprising molluscs, crustaceans, aquatic insects, arable crops.

Population 2008-2012: Population range 02 to 08 and latest maximum record 04.

Status and Distribution: Resident uncommon species-India. Conservation is needed.

(14) Family: Recurvirostridae

World: 12 species; Asia:03; India:02; WKD:02

Com. Ids: White black or brownish-grey waders. Bill straight in Stilts or up-curved in Avocet. Wings long and pointed. Tail short and square. Legs extremely long; feet webbed; hallux or hind-toe vestigial or absent. Sexes alike. Young nidifugous, downy.

❖ Black-winged Stilt (*Himantopus himantopus*)

Size: 35-40 cm Adult: A lanky black and white bird, painted wings, black bill, crimson-red legs.

Male: Head white with a few black spots: wings glossy black above, black below. Duller in winter.

Juvenile: Young males with black anterior crown, upper ear-coverts, a line down the back of neck.

Habitat and Habits: Occurs in freshwater and brackish margins of the lakes, marshes, reservoirs and pools. Gregarious occurs in small flocks round the year, though large groups of 100 or more birds found occasionally, breed in colonies, walks slowly, forages by wading or on dry mud, also float sometimes for feeding. Breeds between April and August.

Food: Chiefly carnivorous (mollusks, aquatic insects). Marshy vegetation, seeds.

Status and Distribution: A resident species throughout in India up to 2000 m, white spread and common, subject to local movements in winter. Conservation and restoration is not needed.

❖ Pied Avocet (Recurvirostra avosetta)
Size: 42-45 cm Adult: Sexes alike. An unmistakable marsh bird with conspicuously up curved long black bill; glistening white body, black head, hind neck and two wing bands, and bluish grey legs. In winter the tail is grayish, the long secondaries more grey and less black.

Habitat and Habits: Generally found in shallow brackish pools, lakes and swamps and mudflats. Generally occurs in pairs or small parties though flocks of about 100 birds may be found, nests in colonies, run about on mudflats and feeds by sweeping bill from side to side from water surface or mud, swim like dabbling duck.

Food: Carnivorous, comprising small mollusks, crustaceans and insects.

Population 2008-2012: Population range 02 to 16 and latest maximum record was 08.

Status and Distribution: Common local winter migrant. Conservation is needed.

(15) Family: Glariodae

World: 18, Asia: 06, India: 06, WKD: 02

Com. Ids: Plover like birds with strong flight. Wings short, broad in Coursers; bill longish and tapering; tail short; legs long and bare; three anterior toes short.

(a) Sub-family: Glareolinae: World: 07; Asia: 06; India: 05; WKD: 02.
Coursers and Pratincoles have an arched and pointed bill, wide gap and long, pointed wings. Coursers are long-legged and resemble plovers; they feed on the ground. Most Pratincoles are short-legged; they catch most of their prey in the air, although, they also feed on the ground. All Pratincoles live near water, whereas Coursers frequent dry grassland and desert.

❖ Indian Courser (Cursorius coromandelicus)
Size: 23 cm Adult: Distinguished from cream-colored Courser by rich orange under-parts contrasting with grey-brown under-parts, and by blackish centre of belly,
chestnut crown, and black lores. In flight, shows white band across under tail-coverts and as cream-colored, very dark under-wings.

**Juvenile:** Dark brown crown, pale lores, strong brown and cream baring and blotching on upper-parts, and brown markings on pale chestnut-brown under-parts. Initially lacks dark patch on belly.

**Habitat and Habits:** Dry fallow fields, wilderness, storny plains, dry river beds. Favours less arid habitats than those preferred by Cream-coloured. Similar to those Cream-coloured, but usually shy and readily takes to the wings. May occur with that species where their habitats overlap. Breeds: March to August.

**Food:** Carnivorous, comprising chiefly insects (beetles, grasshoppers) and larvae.

**Population 2008-2012:** Population range 04 to 14 and latest maximum record 06.

**Status and Distribution:** Resident subject to local movements depending on rainfall. Conservation is needed.

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**Small Pratincole (Grareola lactea) (First time recorded 2012).**

**Size:** 16-19 cm  
**Adult:** small, stocky Pratincole. Easily distinguished from others by smaller size, pale sandy-grey coloration, square-ended tail (or with white very shallow fork), and striking wing pattern in flight. Upper-wing has white panel across secondaries contrasting with grey wing-coverts and black primaries, and tips to secondaries; on under-wing, blackish coverts contrast with white panel across secondaries and pale under-parts. (Plate-6)

**Adult breeding:** Black lores and buff wash to throat and breast. Non-breeding: (briefly) lacks black lores and has faint streaking on throat. Juvenile: has indistinct buff fringes and pale brown sub-terminal bars to feathers of upper-parts, throat and upper breast are ringed by small brownish spots, and tail is tipped buffish-brown.

**Habitat and Habits:** Chiefly large rivers with banks of sand or lakes. Very smaller to those of Collared but often hawks insects later in the evening. Breeds: Feb. to June.

**Food:** Carnivorous, comprising chiefly insects (beetles, grasshoppers and crickets).

**Population records 2008-2012:** Only first time recorded 56 birds in 2012 at WKD.
**Status and Distribution:** Resident and partial migrants. Conservation is needed.

**Family: Charadridae**

World: 152 species, Asia: 82, India: 43, WKD: 05.

**Com. Ids:** Small to medium size waders. Bill short, pigeon-like long. Slender and straight or down-curved. Wings long and pointed. Lakes short to long, with tibine partly bare in many species. Flight strong, swift and well sustained. Sexes may be nearly alike or female may be much smaller and or duller.

◊ **Little Ringed Plover** (*Charadrius dubius Scopoli*)

**Size:** 14-17 cm

**Adult:** Sexes alike. A typical little plover with sandy brown upper parts and white forehead. Black fore-crown, separated from sandy brown crown by a thin white line running back over eyes and ear-coverts, black bands on head and breast, the latter continues into a pectoral band; white neck-ring, chin, throat and underparts; yellow eye-rings and legs. A double collar on hind neck (the upper white, the lower black) separating crown from the sandy-brown underparts.

**Juvenile:** Brown head, breast; white fringes on black pectoral band at first assumed.

**Habitat and Habits:** Sandy, pebbled margins of lakes, rivers, pools, grasslands etc. in pairs or small flocks which scatter over wide area for feeding, generally mixed with other waders. Breeds from April to August.

**Food:** Carnivorous (mollusks, crustaceans, insects) rarely marsh plants seeds.

**Population 2008-2012:** Population range 30 to 65 and latest maximum record was 34.

**Status and Distribution:** Partly resident, winter migrants for many parts of country, breeds up to 1500 m. conservation and restoration at WKD is needed for the species.

◊ **Common Ringed Plover** (*Charadrius hiaticula*)

**Size:** 18-20 cm

**Adult:** Stocky plover with prominent breast band and white hindbeck colour. Larger then Little Ringed Plover. Prominent with white wing-bar in flight.

**Adult Non-breeding:** brownish black breast-band and ear-coverts. More prominent whitish forehead and supercilium, orangey legs, base to bill are further differences from little ringed plover.
**Adult breeding:** Black breast-band extending as dark collar around lower hind-neck, black ear-coverts and band across fore-crown and prominent white forehead disjunct from white supercilium behind eye. Orang base to bill, orange legs are distinctive.

**Juvenile:** Extensive brown patches on sides of breast. Sometimes it is joining to form breast-band, uniform brown crown and ear-coverts, buff fringes to upperparts.

**Habitat and Habits:** Mud banks of tidal creeks mangroves and fresh water lakes and intertidal mudflats. All habits are similar with little ringed Plover.

**Food:** carnivorous (mollusks, crustaceans, insects) rarely marsh plants seeds.

**Population 2008-2012:** Population range 21 to 56 and latest maximum record was 33.

**Status and distribution:** Winter visitor, status uncertain, probably overlooked because of confusion with little ringed plover. Possibly occurs regularly in very small numbers. Conservation and restoration at WKD is needed.

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**Red-wattled Lapwing** (*hoplopterus indicus*)

**Size:** 32-35 cm. **Adult:** sexes alike. A familiar plover with black tipped red bill, crimson-red wattle and eye lids, and bright yellow legs. Head, neck and breast jet-black, upperparts bronze-down; underparts white continuing to broad bands up to the neck sides towards eyes; rump, upper tail-coverts and tail white, the last with a broad sub-terminal black band; primaries and outer secondaries black.

**Juvenile:** black feathers of head broadly fringed with brown; chin, throat and fore-neck white; sides of neck sullied white.

**Habitat and Habits:** lakes, ditches, puddles, open cultivations, open grounds near water. Generally crepuscular and nocturnal, feeds actively in morning, evening or moonlit nights, keeps in pairs or threes or small flocks. Breeds: March to August/September. Nests on ground in natural depressions.

**Food:** carnivorous (molluscs, insects) rarely vegetable matter.

**Population 2008-2012:** population range 610 to 706 and latest maximum record 680.

**Status and distribution:** A common and wide spread resident species gregarious throughout India. Conservation is not needed due to abundant status.
Yellow-wattled Lapwing (*Vanellus malarbaricus*) *(Plate-2)*

**Size:** 26-28 cm **Adult:** Easily identified by lobe-sharped yellow wattles, long yellow legs, and black cap contrasting with white supercilium, sandy-brown underparts and breast contrasting with white belly, with a narrow dark breast band. In flight, show's white greater-covert wing-bar contrasting with black flight feathers, and white tail with black sub-terminal band.

**Habitat and Habits:** Dry stubbles and fallow fields, stony ground, abandoned cultivation, bare gravel plans, and open dry country with very short grass; on drier ground than Red-wattled. Keeps in pairs and sometimes in small flocks, in non-breeding season, foraging behavior similar to that of Red-wattled Lapwing. Flight is buoyant and with rather slows wing beats. Juvenile: Small and dull yellow wattles, brown cap, and prominent buff fringes and dark sub-terminal bars to feathers of underparts. Chin is white (black or brown on adult). Breeds: March to August.

**Food:** Carnivorous (mollusks, insects) rarely vegetable matter.

**Population 2008-2012:** Population range 80 to 104 and latest maximum record 82.

**Status and distribution:** Common, widespread resident. Conservation is not needed.

White tailed Lapwing (*Chettusia leucura*)

**Size:** 26-29 cm **Adult:** Sexes alike. A light brown and white plover with black bill and long prominent yellow legs. Forehead and indistinct supercilium grayish-white; upper plumage light brown; except white rump and tail. Chin, throat and fore-neck ashy-grey; breast dark grey; abdomen and tail-coverts rosy-white. The white rump and tail, contrasting black primaries, white patch on secondaries are diagnostics in flight.

**Juvenile:** Darker in above and sullied white bellow.

**Habitat and Habits:** Freshwater marshes and marshy grassy edges of large lakes. Gregarious, occurs in large flocks when migrating, otherwise in smaller groups of up to 25 birds, feeds in shallow water also on land. Visits India from September to March.

**Food:** Carnivorous comprising aquatic insects, crustaceans, mollusks.

**Population 2008-2012:** Population range 10 to 12 and latest maximum record was 10.
Status and Distribution: locally common winter migrant. Conservation is needed.

(17) Family: Scolopacidae

World: 102 species, Asia: 75, India: 30, WKD: 07

Com. Ids: Small to medium size waders. Bill short, pigeon-like to long. Slender and straight. Wings long and pointed. Lags short to long, with tibine partly bare in many species. Flight strong, swift and well sustained. Sexes may be nearly alike.

(a) Sub-family: Calidridinae

❖ Little Stint (Calidris minuta)

Size: 13-15 cm Adult: Sexes alike; Non-breeding (winter). Bill black; forehead and supercilium white; underparts scaly grey-brown with smoky brown outer feathers; underparts white with faint streaks on breast. Legs and feet blackish.

Breeding (summer): Forehead and small supercilium often obsolete, pale brown; feathers on back black with broad rufous edges; fore-neck and upper breast indistinctly spotted dark brown.

Juvenile: Like adult (summer), hind neck greyer and mantle less rufous, white bellow.

Habitat and Habits: Occurs at lakes, coastal areas, marshes and grassy fields in winters. Gregarious, often found in large flocks of hundreds mixed with other waders in coastal areas constantly run around mud packing up field, when disturbed whole flock flies simultaneously and swiftly like a cloud. Arrives in September/October and departs by April/May.

Food: Chiefly carnivorous, small molluscs, crustaceans, insects, aquatic plants, seeds.

Population 2008-2012: Population range 14 to 18 and latest maximum record was 16.

Status and Distribution: Winter migrant coastal or inland. Conservation is needed.

(b) Sub-family: Gallinaginae

❖ Common Snipe (Gallinago gallinago)

Size: 25-27 cm Adult: Sexes alike. Dark brown above heavily streaked with black, rufous and buff; whitish below. Head with a buff median stripe and supercilium. Bill
olive-yellow on basal half and dark and dark horny-brown to blackish on terminal half. Tail feathers 14 to 16. Legs and feet dull olive-green. In flight, the long straight bill held downwards. Distinguished from pintail Snipe only when the bird is in hand.

**Juvenile:** Like adults, but with whitish fringes on mantle feathers and wing-converts.

**Habitat and Habits:** Occurs at swampy edges of lakes, marshes around reservoirs, paddy stubble, muddy edges of river and ponds. Solitary, occasionally in flocks, crepuscular and nocturnal, though feeds in daytime. Breeds: late April to mid-June.

**Food:** Carnivorous, comprising small mollusks and worms.

**Population 2008-2012:** Population range 12 to 19 and latest maximum record was 14.

**Status and Distribution:** Resident, breed at high altitudes and winter migrant to rest of India. Conservation and restoration at WKD is needed for the species.

(c) **Sub-family: Tringinae**

- **Common redshank** (*Tringa tetanus*)

  **Size:** 27-29 cm  
  **Adult:** Sexes alike.

  **Non-breeding** (winter): Mottled grey-brown above and white below with orange-red legs and basal third of bill. Lower back, rump and tail white, the last barred with brown. Breast finally streaked with brown.

  **Breeding** (summer): Upperparts streaked and spotted with black and fulvous; upper breast heavily streaked with brown and lower breast with dark crescent spots. The white edges to the dark grayish wings and the white lower back and rump are diagnostic in flight.

  **Juvenile:** Most rufous above; scapulars with fulvous spots; flanks more black bands.

  **Habitat and Habits:** Marshes, muddy edges of rivers, salt-pan and muddy pools, occurs solitary or in small groups with other waders, wary and noisy, feeds by picking.

  **Food:** Carnivorous, comprising mollusks, insects and worms.

**Population 2008-2012:** Population range 10 to 25 and latest maximum record is 18.

**Status and Distribution:** Uncommon winter migrant. Conservation is needed.
Common Greenshank (*Tringa nebularia*)

**Size:** 30-34 cm  
**Adult:** Sexes alike.

**Non-breeding** (winter): Dark grayish-brown above and white below, white forehead, lower back, rump and tail, the last with faint, almost invisible barring. Grayish on forehead and sides of head. Bill greenish-brown, black at tip and slightly up-curved. Legs and feet olive-green.

**Breeding** (summer): Darker above, with broad black centres on back and scapulars. Distinguished from sandpiper by large size and from Redshank by absence of white wing bar, olive-green legs and slightly up-curved bill.

**Habitat and Habits:** Found at riverbanks, marshes, lakes and paddy fields. Forages in scattered parties with other sandpipers, occurs in flocks of 15-30 birds when migrating, runs around on mud often probing for food, wads in shallow water. Arrives by second half of August and departs by April end or early May.

**Food:** Carnivorous (tadpoles, mollusks and crustaceans)

**Population 2008-2012:** Population range 06 to 18 and latest maximum record was 12.

**Status and Distribution:** A winter migrant all over India. Widespread over different kinds of wetlands. Conservation and restoration at WKD is needed for the species.

Eurasian curlew (*Numenius arquata*)

**Size:** 50-60 cm.  
**Adult:** Confusion most likely with Whimbrel by combination of larger size, much longer bill, more uniform of head pattern and paler plumage. Head typically looks rather uniform but can show dark eye-stripe and supersingly distinct pale supercilium, similar to Eastern curlew.

**Juvenile:** Similar in plumage to adult but with shorter bill.

**Habitat and Habits:** Intertidal mudflats, tidal estuaries and creeks, mud banks of mangroves also uncommonly on large river and inland lakes. Usually keeps singly or in small groups. Generally wary and difficult to approach. Feeds by walking on mud and probing deeply or by picking from the surface. Flocks often fly in V-formation.

**Food:** Carnivorous (tadpoles, molluscs and crustaceans)
Population 2008-2012: Population range 04 to 08 and latest maximum record was 04.

Status and Distribution: Winter visitor on coast, lakes. Conservation is needed.

❖ Green Sandpiper (*Tringa ochropus*)

Size: 21-24 cm Adult: Sexes alike.

Non-breeding (winter): Head and neck ashy-brown; remaining upperparts dark brown with green-bronze sheen; tail white with faint blackish terminal bars; underparts white with fine brown streaks on throat, breast and flanks.

Breeding (summer): Darker spotted lightly with white.

Juvenile: With bronze narrow scalloping on underparts and narrow bars with a broad terminal band on tail. Distinguished from similar Wood Sandpiper by more white on rump and tail. And darker surface of upper and under wings.

Habitat and Habits: Generally favors small wetland though affects lakes, streams, marshes and paddy fields. Solitary, gathers into small flocks of 15-20 at migration, runs about and feeds at water edge, also wades in shallow water and probes by bill. A common passage migrant arrives from August and departs in May.

Food: Carnivorous, comprising mollusks, crustaceans, aquatic insects and worms.

Population 2008-2012: Population range 30 to 49 and latest maximum record was 34.

Status and Distribution: A common winter migrant in almost all over India, widespread up to 2000 m. Conservation and restoration at WKD is needed for the species.

❖ Common Sandpiper (*Actitis hypoleucos*)

Size: 19-21 cm Adult: Sexes alike.

Non-breeding (winter): Olive-brown and white below with more ashy-brown on head and sides of necks; supercilium pale and indistinct; rump and tail brown with only the outer tail-feathers white; breast lightly brown streaked. A prominent small white patch-diving band of wing from side of breast.

Breeding (summer): Darker above and speckled. Fore-neck and breast boldly brown-streaked. In flight distinguished by white wing bar and brown rump.
**Habitat and Habits:** Fresh waterbodies, streams, ditches and lakes. Solitary or two or three in non-breeding season, runs along water edge. Breeds: May and June.

**Food:** Carnivorous, comprising mollusks, crustaceans, aquatic insects.

**Population 2008-2012:** Population range 40 to 45 and latest maximum record was 44.

**Status and Distribution:** Winters migrant to all over. Conservation is not needed.

(18) **Family: Laridae**

World 81 species; Asia: 45; India: 23; WKD: 04.

**Com. Ids:** Heavily-bodied gregarious birds with grey, white and black plumage long pointed wings; sharply pointed or blunt and slightly hooked bill; square or forked tail. Legs short: feet webbed; hind-toe small or vestigial.

(a) **Subfamily: Larinidae**

**Com. Ids:** Medium-sized to large birds with long, narrow wings, stout bill, moderately long legs and webbed feet. Immature are brownish and cryptically patterned. In flight, Gulls are graceful and soar easily in up-draughts. All species swim buoyantly and well. Mostly founds coastal or inlands.

- **Common black-headed Gull (Larus ridibundus)**
  
  **Size:** 38-43 cm  
  **Adult:** Sexes alike. Medium sized gulls with white leading edges to wings instead of white mirror as in Brown-headed Gull; deep red bill, legs and feet.

  **Non-breeding** (winter): head white with a vertical black crescent mark on ear-coverts.

  **Breeding** (summer): Head dark brown; upperparts grey except white tail; underparts white.

  **Habitat and Habits:** Found as passage migrant in varying numbers on inland rivers and lakes during winter. Gregarious, feed terrestrial inland or by capturing winged insects, scavengers at sea.

  **Food:** Carnivorous (fish, crabs and carcasses, insects etc.)

  **Population 2008-2012:** Population range 10 to 16 and latest maximum record was 12.
**Status and Distribution:** A rare passage migrant at inland waters and regular winter visitor to coastal areas of India. Conservation and restoration at WKD is not needed for the species, because its population was mainly due to fish eating habit, visiting the area of fish ponds.

(b) **Sub-family: Rynchopinidae**

Com. Ids: Very long wings, a short forked tail, a long bill and short legs and toes and are black above and white below. They are frequently seen at rivers, lakes and coast.

❖ **Indian Skimmer** *(Rynchops albicollis)*

Size: 40 cm

Adult: very distinctive with large drooping orange-red bill (with lower mandible projecting noticeably beyond upper), black crown and nape contrasting with white forehead and collar, black mantle and wings are contrasting with white underparts. Inflight shows broad white trailing edge to upperwing, white underwing with blackish primaries and white rump and tail with black central tail feathers.

Non-breeding: plumage of underparts is duller and browner.

Juvenile: Dark brown upperparts with white to buffish fringes to mantle and wing-coverts, diffuse cap and pale collar, dull orange bill with black tip, dull orange legs.

**Habitat and Habits:** Mainly larger rivers with sandbanks also reservoirs, rare on inland lakes and coastal areas. Breeds: Mid Feb. to May.

Food: Carnivorous (fish, crabs and carcasses, insects etc.)

Population 2008-2012: Population range 15 to 18 and latest maximum record was 16.

**Status and Distribution:** Widely local migrant, rare in most areas except Gujarat.

(c) **Sub-family: Steninidae**

World: 30; Asia: 27; India 22; WKD::02.

Com. Ids: Small to medium-sized aerial birds with a Gull-like body but with the exception of the largest species, more delicately built. The wings are long and pointed, typically narrower than those of Gulls, and the flight is buoyant and graceful. There are three main groups: Sterna, Chlidonius (Marsh Tern) and Noddies.
River Tern (*Sterna aurantia*)

**Size:** 38-46 cm **Adult:** freshwater tern and likely to be confused only with black-bellied Tern. Larger size (noticeably larger than common Tern), longer and stouter bill, and stronger, more purposeful flight separate it from black-bellied in all plumages. Head pattern of non-breeding and immature birds is also usually different. Flight is purposeful and often jerky.

**Adult breeding:** large orange-yellow bill, black cap and nap, and red legs and feet, fresh grayish-white primaries and primary coverts contrast with darker grey wing-coverts and secondaries to form striking ‘flash’ on outer wing in flight, and grey rump and centre of tail contrast with very long grayish-white outer tail feathers. Pale grayish-white underparts (some birds showing noticeable white cheek-stripe) separate it from breeding-plumaged Black-bellied. Birds can be seen in this plumage throughout the year.

**Adult non-breeding:** Lacks long tail-streamers and bill is yellower with variable dark tip, blackish mask and nape with variable black streaking on grey crown, dark mask merges into greyer ear-coverts and neck sides.

**Juvenile:** Black streaking on crown and nape, whitish supercilium and dark mask extending as dark streaking onto ear-coverts and sides of throat. Also brownish-black fringes to mantle, scapulars, tertials and coverts; uniform grey secondaries and primaries, with paler primary coverts; and brownish-black sub-terminal bars to tail feathers. Bill is yellow with black tip.

**Habitat and Habits:** Frequents larger rivers, lakes, tanks and canals. Typically as other black-capped Sterna terns. Feeds in noisy flocks, mainly by plunge-diving from the air; also by dipping to the surface and picking up prey. Breeds: November to August in colonies with Little Tern and small Pratincole in rivers or reservoirs.

**Food:** Carnivorous (fish, crabs and carcasses, insects etc.)

**Population 2008-2012:** Population range 15 to 26 and latest maximum record was 26.

**Status and Distribution:** Resident, throughout India. Conservation is needed.
Common Tern (*Sterna Hirundo*) (*Plate-6*)

**Size:** 31-35 cm  
**Adult breeding:** Orange-red bill with black tip, and orange-red legs. For differences from the vagrant Arctic Tern see that species. Main differences from Adult breeding Roseate Tern are shorter tail-steamers (which do not extended beyond tail at rest), darker grey upperparts contrasting with white rump and upper tail-coverts, dark trailing edge to underside of primaries and broader dark outer wedge to underside, grey wash to under-parts, and different flight action and call. Typically, shows less black at tip of bill than Roseate. Main differences from White-cheeked are paler grey upper-parts and under-parts, white rump and upper tail-coverts, lack of well-defined white cheek-stripe, and paler and more uniform under-wings.

**Adult non-breeding:** First-winter/First-summer: Black bill, black hood contrasting with white forehead, white under-parts, and dark lesser-covert bar. Through wear, first-summer birds show contrastingly dark outer primaries and darker bar on secondaries. Best told from Roseate Tern by darker grey upper-parts (although back often does not contrast with rump as in breeding plumage), shorter and stouter bill, larger and stockier appearance, shorter tail(with noticeable grey outer webs to feathers), narrow and indistinct white trailing edge to secondaries and primaries, and more prominent lesser-covert bar for further difference see Roseate Tern.

**Juvenile:** Roseate extensive orange at base of bill when newly fledged, bill becoming black with age, and orange legs. Mantle and scapulars are initially fringed with buff and sub-terminally with dark brown and forehead is buff.

**Habitat and Habits:** Mainly estuaries, tidal creeks and other coastal areas; lakes, jheels and rivers. Typically black-capped Sterna. Breeds: June-July. Usually colonial.

**Food:** Fishes mainly by plunge-diving from the air.

**Population 2008-2012:** Population range 25 to 38 and latest maximum record was 36.

**Status and Distribution:** Widespread local winter visitor. Conservation is needed.

**(19) Family: Jacanidae**

World: 02; Asia: 02; India: 02; WKD: 02

**Com. Ids:** very long toe, which helps to walk over floating vegetation in lakes, ponds.
Pheasant-tailed Jacana (*Hydrophasianus chirurgus*)

**Size:** 31 cm (39-58 cm in breeding season). **Adult:** Extensive white in upper-wing, and white under-wing, distinguish this from Bronze-winged Jacana in all plumage.

**Adult Breeding:** Has white head and fore-neck, Orange-yellow hind-neck, dark brown body contrasting with white of wings and long down curved tail.

**Adult non-breeding:** Lacks long tail and white under-parts and is confusable with juvenile Bronze-winged. Best told by daintier appearance, finer dark bill, dark brown neck line contrasting with yellow sides of neck and brown breast-band.

**Juvenile:** Duller than non-breeding adult. Breast band can be less prominent, has pale buff on sides of neck stripe and rufous fringes to wing-coverts and rufous cap.

**Habitat and Habits:** Lakes, jheels, pools and village tanks well vegetated with floating aquatic plants. Gregarious, outside the breeding season. Walks or rests on floating vegetation; usually found in the open and is quite tame. Forages actively throughout the day; eats mainly seeds and roots and also aquatic invertebrates. Swims well and floats buoyantly. Flight is slow and flapping, with the large feet dangling behind. Breeds: May to September.

**Foods:** Plant seeds and roots and also aquatic invertebrates.

**Population 2008-2012:** Population range 204 to 260 and latest maximum record 204.

**Status and Distribution:** Resident, except Himalayas. Conservation is needed.

Bronze-winged Jacana (*Metropidious indicus*) (*Plate-3*)

**Size:** 28-31 cm **Adult:** Very dark upperwing and underwing distinguish from Pheasant-tailed Jacana at all times.

**Adult Male:** Has white supercilium contrasting with glossy black head, black neck and underparts and bronze-green upperparts. Further, rufous chestnut rump, upper tail-coverts and tail. Bill is yellow with bright red shield.

**Juvenile:** could be confused with juvenile non-breeding adult Pheasant-tailed Jacana, but lacks brown band down sides of neck and brown breast-band, and strong orange-
buff wash to fore-neck and breast; short white supercilium but this does not extend beyond eye. Bill broader and yellowish.

Habitat and Habits: Lakes, jheels, pools and village tanks well vegetated with floating aquatic plants. Gregarious, outside the breeding season. Walks or rests on floating vegetation; usually found in the open and is quite tame. Forages actively throughout the day; eats mainly seeds and roots and also aquatic invertebrates. Swims well and floats buoyantly. Flight is slow and flapping, with the large feet dangling behind. Breeds: June to September soon after the start of the monsoon.

Foods: Plant seeds and roots and also aquatic invertebrates.


Status and Distribution: Resident, widespread, common resident in Gujarat and NW.

(20) Family: Burhinidae

World: 03; Asia:03; India:02; WKD: 01

Com. Ids: Medium sized to large waders, mainly crepuscular or nocturnal and with cryptically patterned plumages. Their flight is swift and low over the ground, with legs stretched out behind.

✈ Eurasian Thick-Knee (*Burhinus oediscnemus*) (Stone-curlew)

Size: 40-44 cm Adult: Unmistakable wader, sandy-brown in coloration, strongly streaked with dark brown; very large yellow eye, short black and yellow bill and long stout, yellowish legs. At rest most striking, plumage feathers are white supercilium and cheek-stripe, dark sub-moustachial stripe, and black and white band across wing-coverts. In flight shows white patches on primaries.

Habitat and Habits: Thorn-scrub desert, sand-dune desert, stony hills, open dry forest, dry river beds, fields, orchards and village groves; favours dry country with scrub patches. Usually in pairs, also in small groups. Typically, spends the day sitting in the shade. A very wary; if suspicious, run off furtively with its head low, then squat and flattens itself on the ground, relying on camouflage for concealment. When foraging, make short runs, stopping to capture prey with swift snatch; eats mainly
insects, worms, small reptiles and mice. If undisturbed, will remain in the same place day after day. Breeds: February to August.

**Food:** invertebrates’ animals.


**Status and Distribution:** Resident, widespread, common resident from Gujarat.

(21) **Family: Passeridae**

(a) **Sub-family: Motacillinae**

**World:** 06; **Asia:** 06; **India:** 06; **WKD:** 04

**Com. Ids:** Small, slender with long legs, relatively long toes, and a thin, pointed bill. Wagtails generally have brighter and more contrasting patterns; some wagtail’s exhibit wide geographical variation, all walk with a deliberate gait and run rapidly. The flight is undulating and strong, especially in the case of the wagtails. Most of the wagtails wag the tail up and down but usually to a lesser extent. They feed mainly by picking insects from the ground as they walk along, or by making short rapid runs to capture insects. They have flushed.

Forest Wagtail (*Dendronanthus indicus*) (Plate-7)

**Size:** 18 cm **Adult:** forest dwelling wagtail, readily distinguished from other wagtails by combination of broad yellowish-white median- and greater-covert wing bars and white patch on secondaries, double black breast band (lower band broken at centre of breast), olive upperparts, white supercilium, whitish underparts. Sexes alike.

**Habitat and Habits:** Paths and glades in tropical broadleaved evergreen forest; also shady coffee and cardamom plantations, deciduous forest and mangroves in winter. Characteristic habit of swaying its tail and the hind-part of its body from side to side with a rather deliberate motion, instead of wagging the tail up and down, forages chiefly on the ground on forest paths and glades with rather a sedate walk; also captures insects by running along horizontal branches. Flies up on to the lower branches of trees when disturbed. Breeds: May.

**Food:** invertebrates’ animals

**Population 2008-2012:** Population range 15 to 46 and latest maximum record was 36.
**Status and Distribution:** Breeds in N. Cachar, Assam; mainly a winter visitor, chiefly to NE and SW India. Locally common in the southwest foothills up to 2100m.

❖ **White Wagtail** (*motacilla alba*)

**Size:** 19 cm  
**Adult:** extremely variable, with black and white head pattern, grey or black mantle; and largely white to largely black wing-coverts. Black-backed birds are possibly confusable with white-browed wagtail, but that species is much larger and a largely black head with a broad white supercilium. Racial variation among

**Breeding adult** (sexes are similar): covered below. There is considerable variation in patterning of black on head and breast of non-breeding and first wintering birds, although in some races non-breeding birds retain characteristics of breeding plumage.  
**Juveniles:** two breeding races have grey head, mantle, breast with white supercilium.

**Habitat and Habits:** Summers by streams and rivers in open country in hills and mountains; winters in open country near water e. g. marshes, rivers, streams, canals, lakes and wet fields, also lawns, and fallow cultivation. Breeds: April- early August. Typical wagtail readily perches on telegraph wires, roofs of building.

**Food:** invertebrates’ animals

**Population 2008-2012:** Population range 25 to 36 and latest maximum record was 32.

**Status and Distribution:** Resident, with altitudinal and short range movements, and a winter visitor. Breeds in Himalayas from N. Pakistan east to Arunachal Pradesh; winters in Himalayan foothills and south India.

❖ **White-browed Wagtail** (*Motacilla manderaspatensis*)

**Size:** 21 cm  
**Adult:** very large wagtail. Adult black and white. Head is black with white supercilium, neck, mantle, breast black; wing converts white; this combination of black mantle, black head broken by white supercilium separates from all races of white wagtail, sexes similar.

**Juvenile:** brownish grey head, mantle and breast with white supercilium. Breed: March-October.

**Habitat and Habits:** Banks of rivers, ponds, lakes, canals and around irrigation barrages. A typical wagtail. Usually keeps in pairs throughout the year.
Food: invertebrates’ animals

Population 2008-2012: Population range 35 to 50 and latest maximum record was 36.

Status and Distribution: Resident, with altitudinal and short range movements, and a winter visitor. Breeds in Himalayas from N. Pakistan east to Arunachal Pradesh; winters in Himalayan foothills, most of the sub-continent.

❖ Yellow wagtail Motacilla flava (Plate-6)

Size: 18 cm Adult Male Breeding: Olive green upperparts and yellow underparts with considerable variation in coloration of head depending on race.

Female: In breeding plumage usually shows some features of breeding male. Juvenile: Dark malar stripe and band across breast.

Habitat and Habits: Damp pastures, especially near grazing livestock, irrigated fodder crops and grassy margins of lakes and marshes. A typical wagtail when foraging characteristically associates with grazing domestic livestock. Breed: June.

Food: invertebrates’ animals

Population 2008-2012: Population range 20 to 55 and latest maximum record was 25.

Status and Distribution: Common and widespread and winter visitor. Breeds in Himalayas from N. Pakistan east to Arunachal Pradesh; In winters most of parts.

(22) Family: Alcedinidae

❖ Common Kingfisher (Alcedo atthis)

Size: 16 cm. Adult: small, brilliant turquoise-blue and orange kingfisher, typically found in open country. Distinguished from the similar forest-dwelling Blue-eared Kingfisher (below) by orange ear-coverts, paler greenish-blue underparts (crown, scapulars and wings) with paler turquoise-blue line down back, and paler orange underparts. For differences from juvenile Blue-eared, which is also has rufous ear-coverts, and from Blyth’s Kingfisher (p.402), see those species.

Juvenile: similar to adult, but duller and greener above, with dusky scaling on breast. Racial variation: A. a. taprobana of peninsular India and Sri Lanka is darker blue, less
green, than other two races occurring in the subcontinent, although not so blue as Blue-eared.

**Habitat and Habits:** Tame and confiding. Uses a post, reed, or bank at the water's edge as a vantage point, perching 1-2 m above the surface. Plunges headlong into the water to catch prey; may submerge completely, and sometimes hovers before diving. Flies swiftly and directly low over the water or trees, often calling. Breeds: November-June, varying locally.

**Food:** Fishes and invertebrates.

**Population 2008-2012:** Population range 100 to 110 and latest maximum record 104.

**Status and Distribution:** Resident subcontinent, except NW, partly migratory.

**(23) Family: Halcyonidae**

- **White-throated Kingfisher** (*Halcyon smyrnensis*)

  **Size:** 28 cm. **Adult:** large, cosmopolitan kingfisher with large red bill, chocolate-brown head and most of underparts, white throat and center of breast, brilliant turquoise-blue underparts including rump, tail. In flight, shows prominent white patches at base of black primaries. Sexes alike.

  **Juvenile:** duller, with brown bill and dark scalloping on breast.

  **Habitat and Habits:** Wide-ranging, often far from water. Cultivation, forest edges, gardens, dry deciduous forest, as well as streams, rivers, pools, canals, villages tanks, ditches, coasts, and fish-carrying yards; also mangroves on Andaman. Bold and noisy. Typically perches on fence posts, telegraph wires or branches. Breeds: January-August, varying locally.

  **Food:** Fishes and invertebrates.

  **Population 2008-2012:** Population range 110 to 120 and latest maximum record 114.

  **Status and Distribution:** Resident throughout much of the subcontinent, except parts of the northwest parts of India. Common and subject to local movements; from plains up to 2250 m.
(24) Family: Cerylidae

❖ Pied Kingfisher (*Ceryle rudis*) (Plate-7)

**Size:** 31 cm **Adult:** large, crested, black and white kingfisher. Distinguished by white-streaked black crown and crest, white supercilium contrasting with broad black eye-stripe and finely white-streaked black ear-coverts, white under-parts with black breast-band; and black and white patterning of wings and tail.

**Female:** Same as Male but has single (rather than double), usually broken, breast band. For differences from larger Crested Kingfisher.

**Habitat and Habits:** Slow-moving streams and rivers, all type of still water in open country; ponds, lakes, canals, irrigation tanks, flooded ditches jheels. Sometimes also tidal creeks and intertidal pools. Characteristically hunts by hovering over water with bill pointing down and fast-beating wings, then plunging vertically downwards when it sees a fish; sometimes checks its dive and hover again closer to the water. Forages to a lesser extent by using a post or rock in water as a vantage point. Breeds: Almost throughout the year, varying locally.

**Food:** Fishes and invertebrates.

**Population 2008-2012:** Population range between 50 to 62 and latest maximum record at wetland of Kheda district is 54.

**Food:** Fishes and invertebrates.

**Status and Distribution:** Resident throughout most of the subcontinent except SW.S

**Conservation of waterbirds Species**

Studies of the migratory birds at wetlands of Kheda district revealed that most of the bird species requires conservation at national level and because of sharp decline in their population during recent few years at wetlands of Kheda district and a significant number (75%) of recorded waterbirds species needs restoration efforts. Among them some species needs immediately attention like Grey-lag Goose, Ferruginous Duck, Painted stork, Sarus Crane, Darter, Lesser Flamingo, Greater Flamingo, Indian Skimmer, Large Whistling Duck etc (Grimmet *et al.*, 2001). Single species conservation Action Plan must be needed for some migratory waterbirds like Lesser
Flamingos, Sarus Crane, Domicile Crane, Great White Pelican, Graylag Goose, Painted Stork, Wooly-necked Stork, Black-necked Stork, Greater Flamingos, Indian Skimmer, Large Whistling Duck, Yellow wagtail, Greater Flamingoes, Darter etc.

Ecology of Wetlands of Kheda district

Environmental impacts on wetlands may affect remarkably during the whole year. All parameters measured by standard methods described in APHA (1998). (Annexure-2)

Climatic Conditions of Wetlands of Kheda district

**Temperature:** Local climatic data have been recorded from May 2010 to April 2012. Maximum air temperature 42.6\(^\circ\)C was recorded in June 2012 and minimum air temperature 7.5\(^\circ\)C in December 2010. Average monthly maximum temperature was 39.7\(^\circ\)C in June and the average monthly minimum temperature was 16.8\(^\circ\)C in January. Frosts were common during winter and the vegetation around the lakes affected. Table-6.4 depicts average minimum and maximum temperatures for air and water at wetlands of Kheda district during 2010-2012. (Table-6.1 to 6.4)

Water temperature recorded from May 2010 to April 2012 was maximum 28.5\(^\circ\)C in June 2010 and minimum 15.2\(^\circ\)C in January 2011. Average monthly maximum temperature was 26.3\(^\circ\)C in June and the mean monthly minimum temperature was 16.1\(^\circ\)C in the month of January. Salve and Hiware (2006) observed that during summer, water temperature was high due to low water level and clear atmosphere which is quite similar with obtained results (Thakor et al, 2011).
Table 6.1 Average Monthly temperature during 2010.

<table>
<thead>
<tr>
<th>Year</th>
<th>Temp. °C</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
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<tr>
<td>2010</td>
<td>Air (Max)</td>
<td>21.5</td>
<td>25.8</td>
<td>27.6</td>
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<td></td>
<td>Air (Min)</td>
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<tr>
<td>2010</td>
<td>Water Max</td>
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<td>19.8</td>
<td>23.2</td>
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<tr>
<td></td>
<td>Water Min</td>
<td><strong>16.3</strong></td>
<td>16.8</td>
<td>17.2</td>
<td>18.6</td>
<td>18.9</td>
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<td>21.2</td>
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Table 6.2 Average Monthly temperature during 2011.

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<td>2011</td>
<td>Air (Max)</td>
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Table 6.3 Average Monthly temperature during 2012.

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<td>27.2</td>
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Table 6.4 Average Monthly temperature during 2010-12.

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<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air T (Max)</td>
<td>21.2</td>
<td>25.2</td>
<td>27.6</td>
<td>29.0</td>
<td>34.4</td>
<td>39.7</td>
<td>36.4</td>
<td>33.4</td>
<td>31.0</td>
<td>28.4</td>
<td>26.0</td>
<td>21.9</td>
</tr>
<tr>
<td>Air T (Min)</td>
<td>16.8</td>
<td>17.6</td>
<td>22.8</td>
<td>23.9</td>
<td>25.2</td>
<td>26.0</td>
<td>27.3</td>
<td>28.4</td>
<td>27.2</td>
<td>19.6</td>
<td>21.8</td>
<td>17.0</td>
</tr>
<tr>
<td>Water T (Max)</td>
<td>18.0</td>
<td>19.1</td>
<td>21.5</td>
<td>21.9</td>
<td>25.3</td>
<td>26.3</td>
<td>25.1</td>
<td>24.6</td>
<td>23.3</td>
<td>22.1</td>
<td>20.3</td>
<td>16.5</td>
</tr>
<tr>
<td>Water T (Min)</td>
<td>16.1</td>
<td>17.2</td>
<td>17.5</td>
<td>18.8</td>
<td>19.5</td>
<td>24.1</td>
<td>23.6</td>
<td>22.7</td>
<td>21.4</td>
<td>20.3</td>
<td>16.7</td>
<td>15.7</td>
</tr>
</tbody>
</table>
Graph-5 Average Monthly temperature during 2010.

Graph-6 Average Monthly temperature during 2011.

Graph-7 Average Monthly temperature during 2012.

Graph-8 Average Monthly temperature during 2010-12.
Rainfall

Monthly rainfall data shows that maximum rainfall was observed in months July and August; driest months were December to May. Rainfall data were available since 2008 to 2012. (Anneure-5). Year 2009 was, however an exceptionally wet year. When heavy recharge of lakes and ground water was observed. The climatic conditions were varying from year to year. But after 2010 rainfall has been decline year by year regularly (Table-6.5) (Table-6.6).

Graph-9 Monthly Average Rainfall (cm) (2008-2012).

Graph-10 Year-wise Rain data Last Five Year (2008-12).
Table-6.5 Monthly Average Rainfall (cm) (2008-2012)

<table>
<thead>
<tr>
<th>Year</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Total cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>3.59</td>
<td>20.70</td>
<td>31.35</td>
<td>20.15</td>
<td>0.00</td>
<td>0.00</td>
<td>0.02</td>
<td>75.81 cm</td>
</tr>
<tr>
<td>2009</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.17</td>
<td>28.50</td>
<td>14.48</td>
<td>0.30</td>
<td>1.36</td>
<td>0.28</td>
<td>0.00</td>
<td>90.18 cm</td>
</tr>
<tr>
<td>2010</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>2.19</td>
<td>26.48</td>
<td>40.86</td>
<td>11.73</td>
<td>0.00</td>
<td>3.38</td>
<td>0.06</td>
<td>84.70 cm</td>
</tr>
<tr>
<td>2011</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.41</td>
<td>14.58</td>
<td>37.46</td>
<td>5.98</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>58.43 cm</td>
</tr>
<tr>
<td>2012</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>2.50</td>
<td>12.49</td>
<td>22.25</td>
<td>27.20</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>64.44 cm</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td><strong>1.77</strong></td>
<td><strong>20.55</strong></td>
<td><strong>29.23</strong></td>
<td><strong>13.07</strong></td>
<td><strong>0.27</strong></td>
<td><strong>0.73</strong></td>
<td><strong>0.01</strong></td>
<td><strong>74.71 cm</strong></td>
</tr>
</tbody>
</table>

Table-6.6 Year-wise Rain data Last Five Year (2008-12).

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Rain cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>75.81 cm</td>
</tr>
<tr>
<td>2009</td>
<td>90.18 cm</td>
</tr>
<tr>
<td>2010</td>
<td>84.70 cm</td>
</tr>
<tr>
<td>2011</td>
<td>58.43 cm</td>
</tr>
<tr>
<td>2012</td>
<td>64.44 cm</td>
</tr>
</tbody>
</table>

Table-6.7 Average Monthly year-wise pH values from 2010 to 2012.

<table>
<thead>
<tr>
<th>Year</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>7.3</td>
<td>7.5</td>
<td>8.0</td>
<td>8.5</td>
<td>8.9</td>
<td>8.8</td>
<td>7.8</td>
<td>7.6</td>
<td>7.4</td>
<td>7.2</td>
<td>7.4</td>
<td>7.6</td>
</tr>
<tr>
<td>2011</td>
<td>7.1</td>
<td>7.9</td>
<td>8.2</td>
<td>8.6</td>
<td>8.7</td>
<td>8.9</td>
<td>7.5</td>
<td>7.9</td>
<td>7.5</td>
<td>7.4</td>
<td>7.6</td>
<td>7.8</td>
</tr>
<tr>
<td>2012</td>
<td>7.6</td>
<td>7.8</td>
<td>8.3</td>
<td>8.5</td>
<td>8.6</td>
<td>8.5</td>
<td>8.1</td>
<td>7.8</td>
<td>7.7</td>
<td>7.6</td>
<td>7.8</td>
<td>7.9</td>
</tr>
</tbody>
</table>
Water pH

The effects of $p^H$ on the chemical and biological properties of liquids make its determination very dynamic. It is one of the most dynamic parameter related to water chemistry and defined as $-\log [H^+]$. It’s measured as intensity of acidity or alkalinity on a scale ranges from 1-14. Natural water pH governed by carbon dioxide/bicarbonate/carbonate ions. Its increase during daytime largely due to the photosynthetic process of plants and decrease during night due to respiratory activity of organisms. The range of pH at WKD was from 7.1 to 8.9. Thus all the sampling sites remained alkaline throughout this study. (Table-6.7)

![Graph](image.png)

Graph-11 Average Monthly year-wise pH values from 2010 to 2012.

*Data shows that there is no much differences in pH values due to same climatic and geographical conditions of all wetlands of Kheda district.
Chemical Parameters of Wetlands of Kheda district (2010-12)

**Total Hardness**

Hardness is predominantly caused by divalent cations such as calcium, magnesium, alkaline earth metal such as iron, manganese, strontium etc. The total hardness is defined as the sum of calcium and magnesium concentrations. Carbonates and bicarbonates of calcium and magnesium cause temporary hardness. Sulphates and chlorides cause permanent hardness. The total hardness of water, at various sampling sites varied from 122.1mg/L to 145.4mg/L during 2010, 132.5mg/L to 146.8mg/L during 2011 and 124.8mg/L to 144.9mg/L during 2012.

**Calcium Hardness**

The presence of calcium in water results from passage through or over deposition of limestone, dolomite, gypsum and such other calcium bearing rocks. Calcium contributes to the total hardness of water and an important micro-nutrient in aquatic environment and is especially needed in large quantities by molluscs and vertebrates. Calcium hardness at various sampling sites varied from 85.4mg/L to 96.8mg/L during 2010, 84.2mg/L to 96.5mg/L during 2011 and 82.5mg/L to 96.5mg/L during 2012.

**Magnesium Hardness**

Magnesium is a relatively abundant element in in the earth crust, ranking eighth in abundant among the elements. It is found in all natural waters and its source lies in rocks, generally present in lower concentration than calcium. It is also an important element contributing to hardness and a necessary constituent of plant chlorophyll. Magnesium level ranges between 42.0mg/L to 48.4mg/L during 2010, 42.6mg/L to 48.4mg/L during 2011 and 44.4mg/L to 48.5mg/L during 2012.

**Chlorides**

The presence of chlorides in natural waters can mainly be attributed to dissolution of salt deposits in the form of ions (Cl⁻). Otherwise, high concentrations may indicate pollution by sewage. It is the major form of inorganic anions in water for aquatic life. High chloride content has a deleterious effect on agricultural plants. The chloride
values at various sampling sites varied from 46.9mg/L to 49.5mg/L during 2010, 46.8mg/L to 49.8mg/L during 2011 and 46.5mg/L to 49.9mg/L during 2012.

**Total Dissolved Solids (TDS)**

Water with high dissolved solids generally are of inferior palatability and may induce an unfavorable physiological reaction in transient consumer. The total dissolved solids at various sampling sites varied from 351.9mg/L to 421.8mg/L during 2010, 355.5mg/L to 453mg/L during 2011 and 366.0mg/L to 426.0mg/L during 2012.

**Dissolved Oxygen (DO)**

Oxygen dissolved in water is a very important parameter in water analysis as it serves as an indicator of physical, chemical and biological activities of the water body. Two main sources of dissolved oxygen are diffusion of oxygen from the air and photosynthetic activities performed by aquatic plants. Diffusion of oxygen from the air into water depends on the solubility of oxygen, and is influence by many other factors such as water movement, temperature, salinity etc. Photosynthesis, a biological phenomenon carried out by the autotrophs, depends on aquatic plants and phytoplankton population, light condition, gases etc. Oxygen is considered to be the major limiting factor in water bodies with organic materials. The values of DO at various sampling sites varied from 4.5mg/L to 8.1mg/L during 2010, 4.1mg/L to 8.2mg/L during 2011 and 4.2mg/L to 8.3mg/L during 2012.

Seasonal variations in water quality parameters show that during pre-monsoon period all chemical parameters’ values were high due to less water quantity in water bodies and during monsoon it’s low due to abundant water. While post monsoon period all parameters were found to be moderate. (Table-6.8, Table-6.9, Table-6.10, Table-6.11)

Results Data shows that all parameters were beyond the irrigation Indian standard but high as per WHO (1984) drinking water quality standard so it should not useful for drinking purpose without treatment. It should be used for irrigation for agriculture, domestic purposes and fisheries only.
Table-6.8 Average Monthly Chemical parameters of WKD during 2010

<table>
<thead>
<tr>
<th>Months→ Parameters</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca-HD</td>
<td>85.4</td>
<td>86.0</td>
<td>88.3</td>
<td>89.3</td>
<td>90.5</td>
<td>90.3</td>
<td>96.8</td>
<td>80.1</td>
<td>80.4</td>
<td>82.5</td>
<td>85.3</td>
<td>85.4</td>
</tr>
<tr>
<td>Mg-HD</td>
<td>44.3</td>
<td>44.4</td>
<td>44.8</td>
<td>45</td>
<td>45.7</td>
<td>48.4</td>
<td>47.8</td>
<td>42.0</td>
<td>44.5</td>
<td>44.4</td>
<td>46.0</td>
<td>44.3</td>
</tr>
<tr>
<td>Tot-HD</td>
<td>130.8</td>
<td>130.7</td>
<td>133</td>
<td>134</td>
<td>137</td>
<td>138</td>
<td>145.4</td>
<td>122.1</td>
<td>124.4</td>
<td>126.8</td>
<td>131.2</td>
<td>130.8</td>
</tr>
<tr>
<td>Chloride</td>
<td>48.4</td>
<td>48.3</td>
<td>47.8</td>
<td>47.9</td>
<td>48</td>
<td>46.9</td>
<td>48.3</td>
<td>48.6</td>
<td>48.4</td>
<td>48.8</td>
<td>49.5</td>
<td>49.4</td>
</tr>
<tr>
<td>TDS</td>
<td>385.5</td>
<td>395.4</td>
<td>410</td>
<td>412</td>
<td>415</td>
<td>421.8</td>
<td>351.9</td>
<td>355.4</td>
<td>355.5</td>
<td>371</td>
<td>381.1</td>
<td>385.6</td>
</tr>
<tr>
<td>D.O.</td>
<td>6.8</td>
<td>6.7</td>
<td>4.6</td>
<td>4.7</td>
<td>4.8</td>
<td>4.5</td>
<td>7.9</td>
<td>7.7</td>
<td>8.1</td>
<td>7.9</td>
<td>6.9</td>
<td>6.8</td>
</tr>
</tbody>
</table>

Table-6.9 Average Monthly Chemical parameters of WKD during 2011

<table>
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<tr>
<th>Months→ Parameters</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
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<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca-HD</td>
<td>84.2</td>
<td>85.6</td>
<td>87.6</td>
<td>89</td>
<td>91</td>
<td>90.2</td>
<td>96.5</td>
<td>79.8</td>
<td>78.7</td>
<td>77.9</td>
<td>76.8</td>
<td>76.4</td>
</tr>
<tr>
<td>Mg-HD</td>
<td>42.6</td>
<td>44.9</td>
<td>43.6</td>
<td>46.8</td>
<td>47.1</td>
<td>48.4</td>
<td>47.8</td>
<td>44.9</td>
<td>43.8</td>
<td>44.4</td>
<td>43.8</td>
<td>43.2</td>
</tr>
<tr>
<td>Tot-HD</td>
<td>132.5</td>
<td>134.8</td>
<td>137</td>
<td>138.5</td>
<td>140.6</td>
<td>145</td>
<td>146.8</td>
<td>138.4</td>
<td>134.9</td>
<td>132.4</td>
<td>131.2</td>
<td>130.8</td>
</tr>
<tr>
<td>Chloride</td>
<td>46.8</td>
<td>48.3</td>
<td>47.4</td>
<td>47.9</td>
<td>48.6</td>
<td>46.9</td>
<td>48.3</td>
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<td>49.8</td>
</tr>
<tr>
<td>TDS</td>
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<td>385</td>
<td>410</td>
<td>412</td>
<td>419</td>
<td>422</td>
<td>453</td>
<td>365</td>
<td>355.5</td>
<td>371</td>
<td>381.1</td>
<td>385.6</td>
</tr>
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<td>4.3</td>
<td>4.2</td>
<td>4.1</td>
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<td>8.2</td>
<td>7.9</td>
<td>6.9</td>
<td>6.8</td>
</tr>
</tbody>
</table>

Legend: Ca-HD=Calcium Hardness, Mg-HD=Magnesium Hardness, Tot-HD=Total Hardness, Chloride, TDS= Total Dissolved Salts, DO= Dissolved Oxygen
Table-6.10 Average Monthly Chemical parameters of WKD during 2012

<table>
<thead>
<tr>
<th>Months→ Parameters↓</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca-HD</td>
<td>90.5</td>
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<td>94.2</td>
<td>95.2</td>
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<td>95.6</td>
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<td>80.4</td>
<td>82.5</td>
<td>85.3</td>
<td>85.4</td>
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<tr>
<td>Mg-HD</td>
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<td>46.9</td>
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<td>48.4</td>
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<td>45.9</td>
</tr>
<tr>
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<td>140.6</td>
<td>141.1</td>
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<td>124.8</td>
<td>127.9</td>
<td>131.1</td>
<td>131.3</td>
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<tr>
<td>Chloride</td>
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<td>47.2</td>
<td>47.6</td>
<td>48.2</td>
<td>49.9</td>
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<td>47.5</td>
<td>48.4</td>
<td>48.8</td>
<td>49.5</td>
<td>48.6</td>
<td></td>
</tr>
<tr>
<td>TDS</td>
<td>385</td>
<td>395</td>
<td>412</td>
<td>416</td>
<td>422</td>
<td>426</td>
<td>402</td>
<td>385</td>
<td>366</td>
<td>371</td>
<td>383</td>
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<td>4.5</td>
<td>4.8</td>
<td>4.3</td>
<td>4.2</td>
<td>7.6</td>
<td>7.8</td>
<td>8.3</td>
<td>7.8</td>
<td>6.9</td>
<td>6.5</td>
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</table>

Table-6.11 Average Monthly Chemical parameters of WKD during 2010-12.

<table>
<thead>
<tr>
<th>Months→ Parameters↓</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca-HD</td>
<td>86.7</td>
<td>87.9</td>
<td>87.6</td>
<td>89</td>
<td>91</td>
<td>90.2</td>
<td>96.5</td>
<td>79.8</td>
<td>78.7</td>
<td>77.9</td>
<td>76.8</td>
<td>76.4</td>
</tr>
<tr>
<td>Mg-HD</td>
<td>45.1</td>
<td>44.8</td>
<td>43.6</td>
<td>46.8</td>
<td>47.1</td>
<td>48.4</td>
<td>47.8</td>
<td>44.9</td>
<td>43.8</td>
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<td>132.5</td>
<td>134.8</td>
<td>137</td>
<td>138.5</td>
<td>140.6</td>
<td>145</td>
<td>146.8</td>
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<td>134.9</td>
<td>132.4</td>
<td>131.2</td>
<td>130.8</td>
</tr>
<tr>
<td>Chloride</td>
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<td>48.3</td>
<td>47.4</td>
<td>47.9</td>
<td>48.6</td>
<td>46.9</td>
<td>48.3</td>
<td>48.6</td>
<td>48.4</td>
<td>48.8</td>
<td>49.5</td>
<td>49.8</td>
</tr>
<tr>
<td>TDS</td>
<td>380</td>
<td>385</td>
<td>410</td>
<td>412</td>
<td>419</td>
<td>422</td>
<td>453</td>
<td>365</td>
<td>355.5</td>
<td>371</td>
<td>381.1</td>
<td>385.6</td>
</tr>
<tr>
<td>D.O.</td>
<td>6.7</td>
<td>6.5</td>
<td>4.6</td>
<td>4.3</td>
<td>4.2</td>
<td>4.1</td>
<td>6.9</td>
<td>7.2</td>
<td>8.2</td>
<td>7.9</td>
<td>6.9</td>
<td>6.8</td>
</tr>
</tbody>
</table>

Legend: Ca-HD=Calcium Hardness, Mg-HD=Magnesium Hardness, Tot-HD=Total Hardness, Chloride, TDS= Total Dissolved Salts, DO= Dissolved Oxygen
Graph-12 Average Monthly Chemical parameters of WKD during 2010.

Legend: Ca-HD=Calcium Hardness, Mg-HD=Magnesium Hardness, Tot-HD=Total Hardness, Chloride, TDS= Total Dissolved Salts, DO=Dissolved Oxygen

Graph-13 Average Monthly Chemical parameters of WKD during 2011.

155
Graph-14 Average Monthly Chemical parameters of WKD during 2012.

Legend: Ca-HD=Calcium Hardness, Mg-HD=Magnesium Hardness, Tot-HD=Total Hardness, Chloride, TDS= Total Dissolved Salts, DO= Dissolved Oxygen.

Graph.-15 Average Monthly Chemical parameters of WKD during 2010-12.