



A Review on Aerial Display, Nest site selection, Nest Defense, Courtship display, Copulation, Parental care: key events of vultures during Breeding, threats and Management

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ABSTRACT

One of the fascinating aspects of the life of birds is their breeding phase, which is ultimately tied to the distribution and abundance of food resources in their environment. Breeding is one of the major components, which determine the specific contribution to its gene pool. Breeding is not only determined by gonadal activity but also by the availability of food resources, specific requirements for nesting and nest site. To understand the breeding behavior of vulture we searched for papers, review articles, thesis, Books, websites etc. In this review, we focus on the all behavioral events of breeding in vultures. For successful nesting there is the specific requirement of nesting is the selection of nest site, selection of comfortable nesting material and their arrangement in the nest to maintain the shape of the nest, egg laying, feeding to juvenile, parental care till fledgling fledge. Sometimes nest construction process delaying by Heavy rainfall, high wind speed, photoperiodic. Breeding is the necessary contribution of nature to prove their existence in the world. Now day's impact of human disturbance, splitting of stone and cracks, cutting of mature trees, diclofenac, food unavailability, and predator are the crucial factors for the breeding of vultures. To solve this problem we need to establish artificial feeding stations, convert natural vulture habitat into protected areas, save the mature tree and tall tree, Develop various kinds of community awareness programs.

Keywords : Nest Defense, Courtship display, Parental care, Vulture

INTRODUCTION

Vultures are scavenging birds of prey uniquely equipped to keep the environment clean and help to stop the spread of infectious disease. There are twenty-three Species of vultures found in the world that exist for the most part in the tropics and subtropics. The Vultures of the world has been

divided into two basic categories that are Old World Vulture and New World Vultures. Sixteen Old World Vultures found in Africa, Asia, Europe belong to family Accipitridae and seven New World Vultures (including the two condors) found in America belong to family Cathartidae (Purohit & Saran, 2013). Except Antarctica and Australia vultures occur on all continents. India has nine species of Old World Vultures (Cramp & Simmons, 1980; Kanaujia *et al.*, 2013; Kushwaha, 2014) and all are residential (Purohit & Saran, 2013, Ali & Ripley, 1998, Jha 2015; Jha *et al.*, 2011; Grubh, 1978; Xirouchakis, 2010). Eight species of vultures are found in Madhya Pradesh (Vulture Key by Jha and Amita Kanaujia). Uttar Pradesh has six species of vultures (Jha 2015; Jha *et al.*, 2011) while Kushwaha *et al.*, 2009 reported nine species of vultures in U.P. Egyptian Vulture *Neophron percnopterus* (45.9%), Slender-billed Vulture *Gyps tenuirostris* (25.4%), Indian Vulture (Long-billed Vulture) *Gyps indicus* (16.8%), White-rumped Vulture *Gyps bengalensis* (10.3%), Red-headed Vulture (King Vulture) *Sarcogyps calvus* (0.8%) and Himalayan Griffon *Gyps himalayensis* (0.7%) (Jha 2015; Jha *et al.*, 2011; Kushwaha *et al.*, 2009). They have been listed as critically endangered which is the highest category of endangerment as defined by criteria A1c, e, and A2c, e (Kushwaha *et al.*, 2009). Vultures are fascinating groups of birds extremely adapted for their only one of its kind lifestyle offer luxurious ecosystem tune-up. Vultures are the "Soap of the Savannah" Quickly and efficiently removing waste, controlling pests and preventing a spread of disease. As the scavenger, they eat all dead animals in the food chain, together with lions, tigers, and bears. They are excellent bio indicator of the physical state of the ecosystem. Over the past three decades, vultures have declined catastrophically especially in Asia and Africa. The core reason behind the population decline is a nonsteroidal anti-inflammatory drug (NSAID) called diclofenac (Oaks & Gilbert *et al.*, 2004; Shultz *et al.*, 2004). Sometimes nestlings and fledglings affected with gout, this indicates that cause may be transmitted from adult to descendants at the nest (Virani *et al.*, 2001). Most of the vultures population decline due to breakdown of breeding success, high adult mortality, and habitat conversion due to expanding agropastoral systems, loss of wild ungulates for trade, persecution and illegal poisoning (Margalida *et al.*, 2010; Hernandez & Margalida, 2009; Gilbert *et al.*, 2007) biotic and abiotic threats (Newton, 1998; Mundy *et al.*, 1992). Old World Vultures (Accipitridae) have low breeding rates (maximum of one egg per year) and very slow growth rates (Brown & Amadon, 1968). In Orcha

Madhya Pradesh more deaths of vulture were reported during the summer months when the region was facing severe drought and all vultures behaved in the similar approach before dying they showed symptoms of uneasiness and moved around circles before dying in 2010 (Kanaujia *et al.*, 2010; Kushwaha *et al.*, 2010). Vultures are the monogamous bird (Kanaujia *et al.*, 2015; Kanaujia *et al.*, 2009). They pair up for life (Kanaujia *et al.*, 2009), meaning they have one mate during their lifetime. This may be due to affections of the birds for successful nest sites, rather than loyalist to each other. If one of the pairs dies, the other often will take a new mate (Davitt, 2009). There is no morphological differentiation of male and female thus it is not easy to recognize the sexes (Kanaujia *et al.*, 2009). Sometimes they could be identifying on the basis of their magnitude dissimilarity between males and females in numerous species (Davitt, 2009) and position of the bird during mating. The breeding of *Gyps* Vultures follows in different phases which include an Aerial display, Nest site selection and defense, Courtship and Copulation, Nest building, Brooding and Parental care [143,146]. Conservation of breeding, roosting and feeding sites of vultures plays a significant role in In-situ conservation. Therefore, extensive hard works are required for in situ conservation of vultures in India.

Aerial display

The Aerial display is frequently extreme especially in Raptors which fly together over the territory and in the environs of the nest site. They take hold of their feet and fly bang to each other while one of them turns onto its back. They may fall down together and then, they rise again, but independently before to snatch their claws again in the same way. This type of flight display is performed by numerous birds of prey such as eagles, hawks, buzzards, kites, and falcons from the prevalent to the nominal. The aerial display of old world vultures (Accipitridae) for the genus *Gyps* are not so as impressive as those reported for large raptors (Kanaujia *et al.*, 2013; Newton, 1998; Simmons & Mendelsohn, 1993). Some of the heaviest vultures perform more simple flights during circling soaring and gliding. Vultures show two types of aerial display one is the tandem in which two individuals fly side by side reported for the *Gyps* genus occurs at any time of the year and when two or more individuals fly together termed stacks in fig.1 (Xirouchakis, 2010). The aerial display for Long-billed vulture *Gyps indicus* is the tandem in which male is seen flying higher than the female 2-3 times (Fig.2). This lasted for 5-20 minutes



Fig.1: Aerial display in case of White backed vulture



Fig.2: Aerial display in case of Long billed vulture

and on sometimes more than 30 minutes (Kanaujia, 2013). However the large Bearded vulture *Gypaetus barbatus* performs acrobatic aerial display around the beginning of the breeding season at the end of January or beginning of February (Ali & Ripley, 1998) and a high pitched prolonged whistle accompanied this behavior. Bearded vulture *Gypaetus barbatus* utters a "Sharp guttural Koolik" during aerial courtship display, but they otherwise rarely vocalize (www.oiseavx.birds.com). In Eurasian griffon vulture *Gyps fulvus* aerial display is closely similar as shown in Long-billed vulture *Gyps indicus* which is tandem and stacks exhibited between one and three times by the identical birds with the male flying over the female for 5-20 minutes (Xirouchakis et al., 2007; Xirouchakis, 2010). Female usually occupies the top position; this process lasts on average to 10 seconds (Venom et al., 1982; Tryjanowski, 2009; Xirouchakis et al., 2007; Xirouchakis, 2010). Aerial display in Red-headed vulture *Sarcogyps calvus* takes place in December every year (Chhangani, 2007). Details of aerial display in Red-headed vulture *Sarcogyps calvus*, Himalayan Griffon *Gyps himalayensis* and Cinereous vulture *Aegypius monachus* does not exist any record. The aerial display of Egyptian vulture *Neophron percnopterus* is different from *Gyps* species. It involves the partners rolling and preening claws in the air so-called flight roll (Porter, 2010). However, several species produce nonvocal sounds such as bill-clapping, wing whirring or wing flapping hiss, grunts, and others according to the genus. These facts are especially noticed in the Cathartidae vultures (www.oiseavx.birds.com).

Nest site selection

Vultures normally prefer nesting sites outside of forest edge, untie grasslands with scattered trees or found in colonies in tree tops at 2-10 meters far above the ground (Khatri, 2015). They avoid human disturbances by placing their nests during breeding period at least 100 meters left from human interruption (Chomba et al., 2013). In Spain, vultures preferred to nest in rugged habitat (Donazar et al., 2002). Similarly, vultures in Greece preferred old isolated trees on steeper slopes (Poirazidis et al., 2007). Research in Spain and Greece found that human disturbance (measured by the distance to human habitation or density of roads) negatively impacts nesting success of Cinereous vultures (Fargallo et al., 1998; Donazar et al., 1993; Poirazidis et al., 2004; Reading, 2005). Batbayar 2004 found Cinereous vulture *Aegypius monachus* nest on relatively steep slopes in central Mongolia (Reading, 2005, 2010). Griffon vultures *Gyps fulvus* select nest sites as early as three months prior to egg laying (Xirouchakis et al., 2007, 2010). Griffon vulture (*Gyps fulvus*) appears to prefer nest sites far from humans and on rugged terrain (Sara and Vittoria, 2003; Parra and Telleria, 2004; Reading, 2005). Long-billed vultures *Gyps indicus* nest almost exclusively on cliffs and ruins in colonies, although in areas where cliffs are absent, nest of *Gyps indicus* also reported in ruins of historical monuments (Rajaram temple, Jahangir Mahal, Chaturbhuj temple, Laxmi temple, Badi Chatri) in Orcha, Bundelkhand region, Madhya Pradesh in fig.3 & 4 (Kushwaha et al., 2010) and in trees on *Delbergia lanceolata* (Ramesh and Sankar in 2011; Rasmussen and Anderton, 2005; Kushwaha et al., 2013) whereas the White-rumped vulture *Gyps bengalensis* and Red-headed vulture *Sarcogyps calvus* nests on trees (fig.5), nest of white-rumped vulture *Gyps bengalensis*

observed on Sal tree *Shorea robusta* in Kanha National park Madhya Pradesh (Virani *et al.*, 2004)) and on *Terminalia arjuna* in Mudumalai Tiger Reserve, western Ghat, India (Ramesh and Sankar *et al.*, 2011). Red headed vulture *Sarcogyps calvus* is not live in large group and the entire nest is solitary (Dhakal and Baral *et al.*, 2014), and Egyptian Vulture *Neophron percnopterus* nests at a

variety of sites which include trees, high-electricity poles and have lees (Chhangani, 2007) similar case observed in Cape Vulture *Gyps coprotheres* it the heaviest endemic Accipitrid in southern Africa breed in colonies of cliff faces (Mundy, 1982). They are territorial and it nests solitary in deep cavities on steep cliffs. (Şen and Tavares *et al.*, 2011).



Fig.3: Nest of Long billed Vulture in Cliff



Fig.4: Nest of long billed Vulture in monument



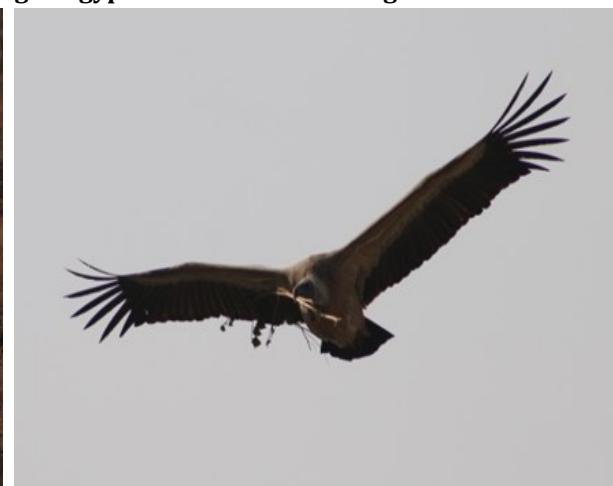
Fig.5: Nest of Red Headed vulture on Tree



Fig.6: Egyptian Vulture select edge of cliff for nesting



Fig.7: Collection of dried sticks and green twigs nest material by *Gyps indicus*



Selender billed vulture *Gyps tenuirostris* in contrast to Indian Vulture *Gyps indicus*, has only been recorded nesting in trees, usually large ones (often *Ficus*), usually at a height of 7–14 m, often near villages (Baker 1932–1935, Ali and Ripley, 1968–1998; Brown and Amadon, 1968; Grubb 1978; del Hoyo *et al.*, 1994, Alström, 1997, Grimmett *et al.*, 1998). White-rumped Vulture *Gyps bengalensis* in a *Ficus religiosa* (Peepal) tree in Lucknow, Uttar Pradesh, in February 1918 (Mathews, 1918).

Nest defense/ Nest Aggression

Nest defense/ Nest Aggression in vultures includes the assurance of the nest sites, food resources or a mate, (Parental care) protection of the offspring against predators (Newton, 1998; Redondo, 1989; Dirkhead and Moller, 1992; Xirouchakis *et al.*, 2007). Competition for the nest sites may be a reason for aggression between conspecifics under conditions of high population density (Martinez and Cobo, 1993; Blanco and Traverse *et al.*, 1997). The argue between two adults, probably of female, Eurasian griffon vulture *Gyps fulvus* at a nesting site usually used in the gorges of the Raza river, Sigovia province (Central Spain) on November 1995 (Blanco and Traverso *et al.*, 1997). The aggressive behavior of bearded vultures *Gypaetus barbatus* towards ravens appears to be directly related to the defense of the nests and its strength is linked to the age of the chicks (Bertran and Margalida, 2004).

In case of cliff dwelling species there is competition for the nest sites which may prevail suitable rock formations like cavities, ledges, thus birds have to guard their nest to avoid intra- or interspecific takeovers or Predators such as Ravens (Newton, 1979; Collias and Collias, 1984; Fernandez and Donzar, 1991; Xirouchakis *et al.*, 2007). In the case of bearded vultures, *Gypaetus barbatus* most attacks (92%) is initiated from the nests or adjacent sites (Bertran and Margalida, 2004). In vultures ongoing nest defense activity of from December prior to egg laying and additionally to the climax of nest construction activity (fig.7), when the stealing of nest material is intense and food delivered to nestling (Blanco and Traverse *et al.*, 1997), reached at peak in June for the guarding of nestling (Xirouchakis *et al.*, 2007). The higher regularity of nest defense observed in March with the hatching period and the first month of the chick's life when exposure to predation is higher (Bertran and Margalida, 2004). Another risk of predation exposure for eggs and chicks can occur occasionally when certain factors lead the birds to

temporarily abandon their nests (human disturbance, looking for and preparing food), as it has been observed in other large raptors (Real and Manosa, 1986; Bertran and Margalida, 2004). The Bearded vultures *Gypaetus barbatus* defensive behavior suggests there are real predation risks during initial phases of the breeding period when chicks (due to their size) may be more vulnerable (Bertran and Margalida, 2004). According to Xirouchakis and Mylonas, 2007 overall defense activities at the nest and the degree of tolerance towards other predators seemed to depend on the stage of the breeding cycle, the nesting density and the age of the intruders (Xirouchakis *et al.*, 2007).

Courtship Display/Allopreening and Copulation

Allopreening = Mutual preening (Preening by one bird of another birds' plumage) is a social behavior in which members of certain species perform the cleaning of another individual belonging to the same group (Souto *et al.*, 2009), related to plumage maintenance and occurring between birds that have formed a social bond. Allopreening is a behavioral characteristic, frequent among vultures and usually, precedes or follows copulation (Houston, 1976; Mendelson and Leshem, 1983; Roberts on 1986; Brown, 1990; Mundy *et al.*, 1992; Xirouchakis *et al.*, 2007, Kushwaha *et al.*, 2013). Allopreening is a function probably to reinforce the pair bond (Newton, 1979). Allopreening being the only occasion, except copulation when vultures are observed in physical contact (Xirouchakis *et al.*, 2007). In allopreening behaviors' two birds are very close to each other, remain for a considerable time in a position and cleaning up feathers, chest neck or head after some time the birds move closer together and touch each other (Fig.8). Allopreening behavior is important in parasite removal (Kanaujia *et al.*, 2013; Kushwah, 2014; Naidoo, K. Wolter, 2009) and its value in intra-social interactions (Souto *et al.*, 2009). Allopreening or courtship of Egyptian vulture takes place at the end of the winter and, as in other vulture species (Mendelssohn, and Leshem, 1983; Elosegi, 1989; Donazar & Margalida, 2009; Cramp & Simmons, 1980) involves partners rolling and preening, claws in air so-called flight roll (Tryjanowski, 2009; Porter, 2010). Whereas in Red-headed vulture *Sarcogyps calvus* nuptial display or Courtship behavior is aerobic, when both the male and female engaging in soaring and dramatic mutual cartwheeling displays takes place in December every year (Chhangani *et al.*, 2007; Mendelssohn, and Leshem, 1983). Harrison in 1965 listed among the Cathartidae

species where allopreening has been observed only in the Turkey vulture (*Cathartes aura*), in captive birds and in the California condor (*Gymnogyps californianus*). Allopreening occurs in vulture before and after the copulation (Alistair, 1986). Vultures are monogamous; they pair up for life (Kushwaha *et al.*, 2013). Vultures are single brooded and long-lived birds in which pair bonding may be maintained from one year to the next year [137]. In vultures copulation occurs at nest site (Kushwaha *et al.*, 2013). but mostly occurs at the roosting site (Alistair, 1986). Copulation started from the male's distinctive hoarse call as he grips the female's ruff while balancing on her back (Mundy, 1982), with lateral motions of his tail, the male knocks the female's

tail from side to side before leaning back and pressing his tail down to ejaculate when the cloacae are juxtaposed (Robertson, 1986).

The male was on the female's back for 42 set (range 22 to 56 set), the male stood on the female's back for longer than 3 min before being jabbed off (Alistair Robertson, 1986). Egyptian vulture begins copulation 25 days before laying but in other raptors, this has been estimated to be around 12 days in fig.9 (Birds and Buckland, 1976; Donazar *et al.*, 2009). In vultures' high copulation rate more than 20 copulations/ Female/ Clutch (Birkhead, Atkin, and Moller, 1987,1992; Donazar *et al.*, 2009).

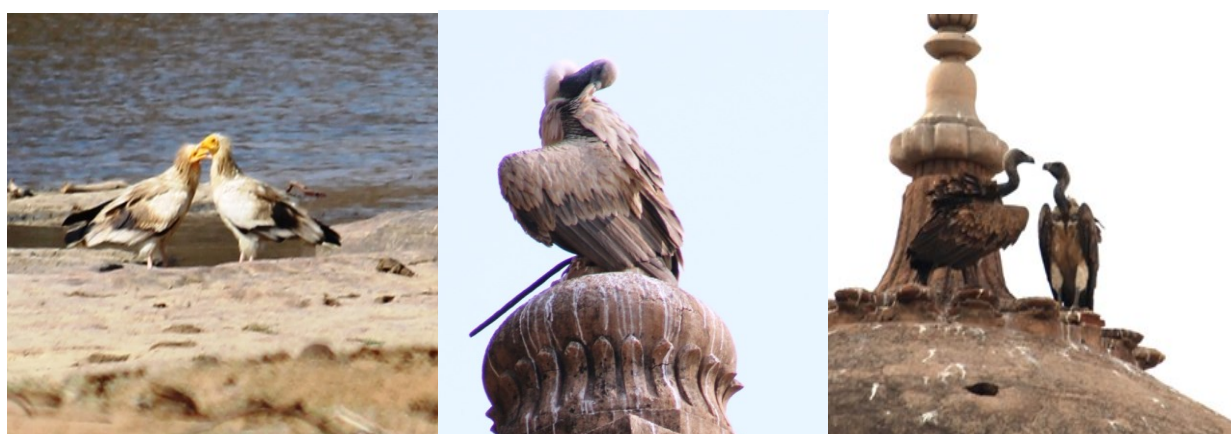


Fig.8: Grooming and Allopreening in *Neophron percnopterus* and *Gyps indicus*



Fig.9: *Neophron percnopterus* during copulation

Nest Construction

Vultures build large perennial and open nest on extensive assortment of supports (e.g. Large tree, cliffs, ruins, monument) (Cramp and Simmons, 1977; Tryjanowski *et al.*, 2009). The constructed nests are reused for years or even decades by the same birds and grow up larger up to each breeding season. (Kanaujia *et al.*, 2010; Davit, 2009; Vergara *et al.*, 2010; Rasmussen, Anderton; Kushwaha *et al.*, 2009). The vultures are sanitary birds; after each mealtime they obtain bathe, so the vulture colonies are situated in close proximity to water bodies. The nest construction is a tedious work and to maintain the appropriate structure of nest a number of sticks and twigs used by vultures. In nest construction activities both male and female participate equally and are at the peak during the morning and mid-day hours and one individual guard the nests and other leaving to look for nesting material (Kanaujia *et al.*, 2010; Kushwah *et al.*, 2009). There is huge variability among species of vultures in relation to nest construction, nest maintenance, nesting time of year, nest material, nest location. Long billed Vulture *Gyps indicus* starts to construct the nest from September every year. Long billed vulture *Gyps indicus* demotes their nests by the side of the water bodies on cliffs monuments. Their nests are made of strong small and thin sticks at the corner of strong branch lined with green leaves, and with pieces of rags and other rubbish (Khatri, 2015). The size and diameter of the nest are about 2-3 feet and a single nest consists of 2000-4000 sticks (Kanaujia *et al.*, 2013). In White-rumped vulture *Gyps bengalensis* nest construction begins in November. Most of the nest placed on the top of trees in the semi ever green forest. Nesting materials such as twigs, dry leaves, grass, thermacol, occasionally polythene covers are used for nest building (Balasundaram and kannan *et al.*, 2014). The Red-headed vulture *Sarcogyps calvus* large and flat nest is constructed from sticks, leaves and dry grass abruptly related to White-rumped vulture (Dhakal and Baral *et al.*, 2014). Griffon vultures *Gyps fulvus*, nest building activity starts only a month before breeding season. The nest construction activity in Griffon vultures is rather energy consuming. *Gyps fulvus* used a large number of items for the nest building which is higher than those reported in other raptors (e.g. *Aquila chrysaetos*). Aoyama *et al.*, 1988; Xirouchakis *et al.*, 2007). Male griffon more conscientious and carrying the maximum possible amount of items may constitute an indication of their genetic quality, parental ability and commitment of the forthcoming duties of breeding than female (Newton, 1979; Mundy *et al.*,

1992, Margalida and bertran, 2000; Xirouchakis S.M. *et al.*, 2007). It replenishes their nest with greenery contain volatile chemical substances which repel or even kill ectoparasites throughout the year (Mundy, 1982; Kushwaha *et al.*, 2013; Kushwaha *et al.*, 2014; Xirouchakis *et al.*, 2007). Cinereous vulture *Aegypius monachus* is a large migratory bird of old world. The Cinereous Vulture *Aegypius monachus* breeds in loose colonies or solitarily. It builds a huge nest on top of a tree (Pinus, Quercus, Juniperus, etc.). Himalayan Griffon vulture *Gyps himalayensis* is an old world vulture closely related to the European Griffon vulture *Gyps fulvus* every year nest building and repair carried out in January to march (Maming *et al.*, 2013) and builds its nest on tall trees same as Slender billed vulture *Gyps tenuirostris* with small twigs/sticks of trees and straws of grasses and small amount of feathers are used (Ferguson-Lees & Christie, 2001; Cuthbert *et al.*, 2011; Maming *et al.*, 2013) often near human habitations in northern and central Indian, Pakistan, Nepal, Southeast Asia (Singh and Chauhan, 2015). The outer diameter of nest 90-320 cm, inner diameter 35-60 cm and center depression 7-15 cm deep (Maming *et al.*, 2013).

Brood and Parental care

Vultures are monogamous birds they usually, lay a single egg. They have great degree Parental care during their whole life started from egg lying till the fledgling flew from the nest. Cinereous Vulture *Aegypius monachus* is a large migratory species of Old World Vulture in India. It breeds in loose colonies or solitarily (B. Heredia, 1996). Age of first breeding is habitually 5-6 years. Egg lying frequently starts at beginning of February which is single and finishes at the end of April and hatches in the third week of March [Gavashelishvili *et al.*, 2012, B. Heredia, 1996; Kirazlı and E. Yamaç, 2013]. Incubation is 50-54 days facilitated by both parental birds (B. Heredia, 1996). The chick usually relics with the adults 2-3 months and completed more than 100 days in the nest (B. Heredia, 1996). The chick is fed with meat regurgitated by the adults (B. Heredia, 1996). According to Kiral and Yamac, 2013, earliest six months of its life young depend on their parents and fledged the nest in the second week of August. The chick is fed with meat regurgitated by the adults (B. Heredia, 1996; Kirazlı and E. Yamaç, 2013].

Breeding period of Egyptian vulture is about 4.5 months, starts from egg lying which is in October to the very end of May when the young bird fledged (Donazar and Ceballos, 1989; Porter *et al.*, 2012; Cramp and Simmons,

1977). This includes a fledging period which is near about 80 days (Donazar and Ceballos, 1989; Porter *et al.*, 2012).

In Red-headed Vulture *Sarcogyps calvus* the breeding period begins from December to April at once each year (Kushwaha *et al.*, 2009) Breeding is started by forming a long-term pair bond which is permanent (Saran & Purohit, 2012; Nadeem *et al.*, 2007). King vulture laid single an egg with in cooperation parents sharing incubation duties which are 45 days (Anderson, 2005; Kushwaha *et al.*, 2009) after incubation chick hatches and at the month of June-July it leaves the nest (Chhangani, 2007; Dhakal and Baral *et al.*, 2014).

The Indian vulture breed from November to March every year (Kushwaha *et al.*, 2009) only a single egg is laid by the female (Kanaujia *et al.*, 2013; Kanaujia *et al.*, 2015), So the majority of egg laying begins in November, while fledging occurs in mid-March to mid-May (Kanaujia *et al.*, 2013; Khatri, 2015; Rasmussen & Parry, 2000; Kanaujia *et al.*, 2015). The nest of Long-billed vulture *Gyps indicus* with a single egg or single chick from October 1999 to April 2000 at different nesting sites in Jodhpur Rajasthan (Chhangani, 2007; Kumar & Meena, 2014). Incubation usually lasts for 50 days. Both the sexes participate in incubation and rearing of brood (Kushwaha *et al.*, 2009). The chicks are seen during last week of December or first week of January. The Chicks are fed with the regurgitated food that the parent foraged for the stored in the crop [Kanaujia *et al.*, 2010; Davit, 2009; Kushwaha *et al.*, 2009]. The nestling receives pre-digested food until it is 5-6 weeks old. The whole breeding cycle lasts for 8-9 months. Long-billed vultures *Gyps indicus* provide excellent parental care from the time of egg laying till juvenile started their first flight, (Kanaujia *et al.*, 2013; Kanaujia *et al.*, 2015). The parent pair probably female long billed vulture protects and grooms the chick. Female provide shadow from direct sunlight with its wings and did not leave the nest until the chick reached the fledgling stage, at least one of the parent vultures regularly found to care the chick sitting on the tree (Khatri, 2015).

The breeding season of Slender billed vulture *Gyps tenuirostris* is October to April, December-January in Myanmar and Asam (Collias & Collias, 1994). The clutch-size in Slender-billed vulture is one and incubation accomplished by both the parents (Brown & Amadon, 1968). Another detail about their brooding and parental care is not reported yet.

Himalayan griffon vulture *Gyps himalyansis* is closely related to the Eurasian griffon vulture *Gyps fulvus*. Milky white color single egg lay by Himalayan griffon vulture between February and April (Ferguson-Lees & Christie, 2001; Maming *et al.*, 2013; Freeland, 1976). Hatching occurs between March and May and chick rising until the juveniles fledged and left the nest. The 4-5 month chick raising period is one of the longest or it may be extended as long as 6-7 months (Maming *et al.*, 2013). Chicks are able to bite at birth. Throughout the chick raising period, the parents always guard the nest, even in September when chicks are large (Maming *et al.*, 2013).

Eurasian griffon vultures *Gyps fulvus* breeding season starts from September to August. Like other *Gyps species*, it also lays a single egg and incubates the egg for 57 days hatching of the egg takes place in mid to late March. Vulture nest in open rock ledges or tree crowns, which are completely exposed to sunlight. This demands high protection and shadings of the rising chicks at least cultivate they are dorsally feathered (Hiralod, 1983; Newton 1998; Tryjanowski, 2009; Xirouchakis, 2010; Xirouchakis, 2003). Mendelssohn and Leshem (1883) mention that the nestling receives digested food until it is at least 5 weeks' old which is gradually replaced by food that has been stored in the crop (Mendelssohn, and Leshem, 1983; Xirouchakis, 2007). The chicks are able to move around the nest at the age of 12-14 weeks. Parent birds are highly attentive during the first 2 months of the chick's life to defend it from stormy weather (Mainly rain) and Predators: Ravens (*Corvus species*) which prey upon eggs and chicks (Grubac, 2002; Brown, 1990; Ratcliffe, 1977; Houston, 1976; Xirouchakis, 2007). In the case of White-rumped vultures *Gyps bengalensis* breeding season starts from October to March or April (Monirul & Khan, 2013; Collar, 2001; Kushwaha *et al.*, 2009). Sometimes, it could be extended from October to June depends on environmental factors (Grubh, 1978) usually; Egg laying period is September to October. The single egg is laid during the first weeks of November [13, Grubh, 1978], and sometimes two eggs (Clark, 1994). In condition, if the first egg breaks the second egg is laid within the shortest time period. During winter season morning and evening hours eggs are tightly incubated (Venkitachalam *et al.*, 2013). At the time of incubation both the parents are helped for preening everyone to strengthen the pair bond in *Aquila species* (Clark, 1994). Similar behavior also occurs in *Gyps bengalensis* [Grubh, 1978]. Incubation is 45-52 days from December to January

(Baral and Gautam *et al.*, 2005; Kushwaha *et al.*, 2009). According to Gilbert *et al.* incubation period is 56 days closely related to African white backed vulture *Gyps africanus* (Gilbert *et al.*, 2002; Tryjanowsk, 2009). According to Venkitachalam *et al.*, 2013 standard incubation phase is 57 days. Two types of incubation are known in White-rumped vulture, one is position on the nest and the other is specified by shading to the nest during temperature. Shading of eggs possibly helps in controlling the nest temperature. At the same time, they trying to allow any flow of air to cool them (Elkin, 1983). The parents get shifted during incubation to feed and convey food for nestling (Monirul & Khan, 2013) Nestling occurs from February, March, April (Baral & gautam, 2005). Parental care provided by female vulture as incubation most of the time and feeding required regurgitated food to the nestling more male than female in all three posture like, lie, sit, and stand. Similar

behavior also occurs in *Aquila* raptor species (Prakash 1988, Venkitachalam, *et al.*, 2013).

Prospective threats to Vultures:-

Vultures are the most successful scavengers contributing to ecosystem perform important ecological services such as rapidly eliminating carrions (Moleon *et al.*, 2014). In spite of that, most of vulture species are classified in various threat categories like other large 49 raptor species, generally caused by anthropogenic pressure on wildlife (Margalida *et al.*, 2010, Ogada *et al.*, 2012 Thiollay, 2006).

Today, vultures face many survival problems. Unavailability of food (Margalida *et al.*, 2010; Rooyen, 2000; Anderson, 1994, Anderson, 1995; Simmons, 1955) and electrocution (Ogada *et al.*, 2012; Saran, Purohit, 2012).

Table 1: Overall Scenario of Status of Breeding Biology of Vultures

S. N	Scientific Name	Common Name	R/ M	Size	Breeding Season	Breeding Habitat	Egg	Incubation	Status
1.	<i>Gyps indicus</i>	Long-billed vulture	Resident	80-95 cm	November -March	Trees, Monument, Cliff	1	50 days	Critically Endangered A2bce+4bce
2.	<i>Gyps bengalensis</i>	White backed vulture	Resident	75-85 cm	October-March	Mature Trees, Cliff	1	45-52 days	Critically Endangered A2bce+4bce
3.	<i>Gyps tenuirostris</i>	Slender billed vulture	Resident	80-95 cm	December-January	Monument Cliff, Mature Trees	1	...	Critically Endangered A2ce+4ce
4.	<i>Neophron percnopterus</i>	Egyptian vulture	Resident	60-70 cm	March-August	Mature Trees, Cliff	2 (1-3)	42 days	Endangered A2bcde+3bcde
5.	<i>Aegypius monachus</i>	Cinereous vulture	Migratory	100-110 cm	February-April	Mature Trees, Cliff	1	50-54 days	Near Threatened
6.	<i>Sarcogyps calvus</i>	King vulture	Resident	85cm	December-April	Mature Trees	1	54 days	Critically Endangered A2abce+3bce+4abce
7.	<i>Gyps fulvus</i>	Eurasian griffon vulture	Migratory	95-105 cm	December-August	Mature Trees, Cliff	1	57 days	Least Concern
8.	<i>Gyps himalayensis</i>	Himalayan griffon vulture	Migratory	115-125 cm	January-October	Mature Trees, Cliff	1	45-52 days	Near Threatened

Unavailability of material for nest disturbance at place noise pollution, splitting of stone, decline of population are mainly a cause of contamination of carcasses with veterinary drugs (Chaudhary *et al.*, 2011; Oaks *et al.*, 2004; Green *et al.*, 2006), Illegal poisoning (Margalida *et al.*, 2012; Virani *et al.*, 1997; Virani *et al.*, 2011; Ganguly and Mukhopadhyay, 2013). Human emprochment, monkey disturbance, predator, egg theft for black magic and the use of vulture parts for cultural purposes are all threats. In particular, due to development in the western regions of the country, vultures face a series of threats.

Syndrome:-

Due to the habitat loss and an unknown viral epidemic disease most of the vulture populations suffers from higher degree of risk of extinction. The neck down syndrome symptoms were first observed in the Keoladeo national park, Rajasthan. Where birds would exhibits the behaviors for periods of over several weeks, before collapsing and falling of trees, at the point of or just prior to the death, due to pesticide intoxication and calcium deficiency (Saran & Purohit, 2012).

Anthropogenic Disturbance:-

Vulture populations declined markedly in recent decades due to increasing human populations. In India large vulture population decrease in non-protected and urban areas (Pain & Cunningham, 2003) due to closest distance between vulture site and dirt road of railway line town, factory situated by human effected the breeding period of vulture.

Unavailability of food:-

Due to deficiency of food vulture population decrease in the nesting, drinking and dumping sites. The population of migratory species declined during winter season (Chhangani, 2012). That reduction in the migratory species due to unavailability of carcass in plentiful in that areas where vultures live. In Keru dumping area, Jodhpur the municipal waste management started a carcass processing in powder form, a material used in agriculture and as food for fishes (Saran & Purohit, 2012). In the absence of carcass there is a chance of migratory species to move another dumping sites or adjacent areas where food is available for vulture in plentiful amounts.

Most of the king vulture disappearing together with Oriental white-backed vulture, the Long-billed vulture on feeding carcasses of animals treated with the veterinary drug diclofenac. Sometimes feeding is

disturbed by dog bark, sound of vehicles and humans. Now day's scavengers are struggling for their food. Sometimes carcass feeding of large animals creating problems for vulture. There is an example of carcass feeding which is cause of vulture death accidently. And adult white rumped vulture was found dead next to carcass. Its head and upper neck seemed stuck inside the carcass. The vulture probably intended to feed on the visceral organs by inserting its head through the gaps in the vertebral column of the carcass, but its neck got inextricably stuck between two vertebrae, resulting in its death. Such unusual vulture deaths have been recorded in the past too (Mendelssohn and Leshem, 1983; Greenwood, 1938).

Tourism: -

Tourism is mainly a problem of disturbances of vulture population during breeding. There is a problem resulting in downed juvenile due to sporting activities (climbing, paragliding) or Recreation and curiosity. Increase in tourism changes in the used of mountain areas by human can also reduce the breeding success of the vulture during breeding (Heredia, 1996; Heredia, 1999; Terrasse, 1991).

Splitting of stone:-

Mountain habitats are being transformed with the change in human production systems. There is reduction of areas used for extensive grazing of livestock (Heredia, 1996; Terrasse, 1991). In the last 20 years increasing human populations implied extra demands for land, food other resources resulting in the destruction or degradation of Vultures habitat (Saran & Purohit, 2012). Mainly in hilly areas splitting of stones is an alternate income source for the people there. Due to increasing human population, mining works penetrated the nesting sites on the hill cliff and cause adverse disturbances.

Electrocution:-

Dumping sites composed more carcasses thrown by villagers and others. Dumping sites is the most attracted places for vultures where they can feed freely. Due to modernization maximum places are surrounded by electric wires because of need of light. Now days these high tension electricity poles near to dumping sites causes more vulture death including lots of threats. These high current electricity poles adversely affected the diversity of vulture population near road tracks and high voltage electricity line that runs parallel to the dumping sites cause vulture mortality. A case of

maximum vulture's deaths recorded in Keru dumping site Rajasthan by electrocution. On both sides of Keru Dumping site there are road tracks present along with high electric lines. He observed that at the dumping ground, after feeding on Carcasses, vultures sit on the wall of the wall of dumping area. Sometime due to feral dogs and other scavengers' vultures wait for their feeding chance. During this if vehicles pass on the road tracks vultures started to fly away in flocks. Most of the vulture's body touches the electricity wire than they die due to current passes through wires. The death occurs due to lesser distance between the fields, wall and the electricity line that is 50 meters. Therefore, vultures could not take sufficient height to avoid the wire (Saran & Purohit, 2012).

Diclofenac poisoning:-

Most of the vulture's population dependent on the natural death of animals because they don't kill any for their own food. Vultures search their food by travelling several miles away from their breeding site. Maximum carcasses they search are domestic animals like cattle, goat, camel etc. diclofenac is the inflammatory drug given to domestic cow and buffalos for more milk production. Diclofenac is toxic to vultures even if small doses of it given to vultures causing kidney failure. Diclofenac is a kind of drug that is accumulated in the internal organs of body than crystallize that is called visceral gout. Green *et al* in 2004 estimated that about 0.8% of carcasses are diclofenac treated causing population decline. Schultz *et al.*, 2004 found that a high proportion of *Gyps bengalensis* and *Gyps indicus* vultures found dead in the wild. The reason behind death is severe visceral gout, by diclofenac poisoning (Cuthbert *et al.*, 2009; Girit, 1998; Shultz *et al.*, 2004). The license to produce the diclofenac was banned by the drug controller General of India in May 2006. An observation done in and around Jodhpur about the diclofenac affecting population of domestic animals than it is found that about 3.8% of the animals were treated with diclofenac and only 8.08% were cows, buffalos 4%, camels 0%, goats 2% and sheep 0%. Various reports research articles suggested that diclofenac is the main cause of vulture population decline, but we observed that diclofenac is not the main cause of vulture death in this region (Cuthbert *et al.*, 2009; Girit, 1998; Shultz *et al.*, 2004).

Management of Threats: -

Management of threats in their natural places involves in-situ conservation of vultures involves the reduction of

disturbance in the native places of vultures that causes shortness of vulture population in its natural habitat. Vultures avoid human disturbances near to the breeding sites. Threats management includes analysis of the cause of population decline, analyze suitable wild habitat for the vulture species, the number of vultures left in the breeding sites, extinction of vulture species, advocacy, sensitization, monitoring and the use of NSAIDs, swapping diclofenac with meloxicam, the collection of veterinarian pledges to stop using diclofenac and the searching operation of vulture safe feeding sites such as monitoring of vulture restaurant and vulture safe zone. (DNPWC, 2015-2019), and it also involves management of their drinking and bathing sites by creating natural drinking plots in the protected areas such as National Parks and Sanctuaries and protection required from hunting, trapping (Concept paper on In-situ ex-situ linkage -Conservation Breeding of Endangered Wild Animal Species in India).

There are several projects for vulture conservation funded by both Government and Non-Government Organizations over the past few years to maintain balance in ecosystem in India, as in Nepal there are a range of current actions plans such as vulture action plan and programmes run for the conservation of vultures (BCN, 2008/09; Harris, 2013). There are two major limiting factors in Nepal related to vulture's conservation such as financial fetters may limit the prospective of some of these conservation actions (Harris, 2013; Naidoo *et al.*, 2009). Like above BCSG also started Vulture Conservation Programme at Surat in 2006 and at Mahuva in 2007 to remove 'Diclofenac' from the veterinary use and management vultures' population by the help of government and other NGOs. It also aware the people about the 'Meloxicam' which an alternate drug of 'Diclofenac' (BCSG, 2011).

Maintenance of Forest Openings:-

Maintenance of forest openings the mountain grasslands and stream buffers for drinking and bathing of vultures. Forest openings has been maintained for vulture breeding colonies in open scrub areas on mature trees (35%) followed by dry deciduous (25%), moist deciduous (17.5%) and (17.5%) in riverine areas (Ramesh & Sankar *et al.*, 2011). Houston D.C *et al* in 2006 describe the maintenance of forest openings mainly for the conservation birds of prey in the Dadia Forest reserve, Greece. The Dadia Forest Reserve's has extensive distribution of pine and oak forests, shrublands, networks of streams and cultivated lands. These

mountain ranges of the Dadia forest reserve is a home for breeding site for birds and particularly raptors. This forest area allows the birds to find the nesting areas those are safe for breeding and to avoid fear from predator. Therefore, the conservation and maintenance of this type of valuable resources is the source of food for vultures and other wild herbivorous. (Houston *et al.*, 2006). Dadia forest reserve hosts the breeding colony of the Griffon vulture and the Egyptian vulture and black vulture in the Balkans that is increase in number from 25 in 1985 to near about 100 in 2002 (Houston *et al.*, 2006) However, for the conservation of vultures in future there is need to three prevent the degradation of the forest's ecological value for raptors, especially assurance of food and loss of forest openings. There is need to maintain the forest openings by activities of artificial feeding for vultures. the creation of increased forest openings for artificial feeding stations and drinking points for raptors to generate an increase the population of vultures (WWF, 2005).

Vulture Restaurants/ Jatayu Restaurants: -

The use of supplementary feeding sites for vultures also known as vulture restaurant (Kanaujia *et al.*, 2014). These restaurants provide safe diclofenac-free carcasses in close proximity to the breeding areas. These feeding sites play important role in successful survival of the vulture species in Nepal and Dadia forest reserve. These vulture restaurants strictly ment for new feeding sites for vultures not for the attraction of tourists (Houston, 2006). As a result breeding records have been increased near vulture restaurants for White-rumped Vultures that is *Gyps bengalensis* (BCN, 2008/09; Harris, 2013). The food is providing for vultures is taken from the farmers who want to sale them when domestic cattle's and goats are old (Harris, 2013). After death of the domestic animals firstly insure the diclofenac free carcass by treating them with safe drug and then left out for the vultures to feed on the carcasses (Aryal, 2010; Harris, 2013). Vulture restaurants also successfully introduced to Pithouli Village in East Nawalparasi, Gaidahwa Lake, Lumbini, Rupandehi District, Laimatiya VDC and Bijouri VDC of Dang, Kailali and Kaski districts (Naidoo,2009). In Nambia, the first vulture restaurant was established in 1987 in waterberg plateau Park. South Africa also developed artificial feeding stations for the Bearded vulture in 1966 and for the cape vulture in 1978 (Kanaujia *et al.*, 2014). The population of Egyptian vulture also increases in Provence (Southern France) by establishment of artificial feeding sites in Lubeorn massif (Kanaujia *et al.*,

2014). In India, the Surat Nature Club in 2009 started a "Vulture Feeding site" in Hazira, Gujrat where diclofenac free food is regularly provided at the site, Dogs and other disturbance are kept away from the site (natureclubsurat.org; Kanaujia *et al.*, 2014). Phasand wildlife Sanctuary also started vulture reastaurant project in 2012, in Raigad district of Maharastra in association with the Non-Governmental organizations. An another vulture restaurant was established at Toawala, in Punjab province Pakistan near the colony of the Oriental White-backed Vulture (*Gyps bengalensis*) (Gilbert, 2007; Chaudhary & Ogada *et al.*, 2012), The wildlife wing of the forest department plans to set up more vulture restaurant in thane, Nagpur, Nashik, Raigad, Ladchiroli district in India. the first vulture restaurant in Uttar Pradesh started in 2013 in Deogarh Lalitpur and three vulture restaurant in Punjab (Kanaujia *et al.*, 2014). Establishment of vulture restaurant is much better method to conserve vultures in both ecologically and economically sound promotes in situ conservation.

Community Education: -

To improve the community learning and to develop capacity of individuals and group of all ages through their actions, the capacity of communities, to improve their quality of life. Among people in Mustang and in other cultures including the Sherpa, based on priest advice the dead body is cut in to pieces and offered to vulture. they are highly respected in Buddhist culture and have a significant role in terms of cultural unity and social stability (Ma Ming *et al.*, 2015). In Hindu Mythology, vulture are said to be the carrier of god Sani (Saturn). In Ramayana, the vulture fights with Ravana to rescue Sita, However, in other Nepali communities, vultures are regarded as bearers of ill luck and their presence and sighting are associated with death. His belief is an obstacle in securing the confidence of the community in vulture conservation. (Action plan in Nepal 2015-2019). In Gujrat Vulture awareness programs conducted with audio visual tools especially in schools, other organization, between local people, Cattle breeding tribes (Rabaries) near areas in habituated by vultures (www.natureclubsurat.org/vultureproject.html). In Nepal, the first International Vulture Awareness Day was held on 05 September 2009. Awareness programmes were held at 35 different districts attracting 8,200 participants from the general public, industry and media through to academics. This programme promotes and actively generates awareness on the use of meloxicam rather than diclofenac for

livestock treatment to various levels of the government, NGOs, veterinary communities and drug traders (BCN 2011; Harris, 2013). Ongoing public education has helped generate positive attitudes towards vulture conservation (BCN 2009, 2011; Harris, 2013). BCN has also been involved in monitoring and education work promoting the advocacy of using the safe NSAID meloxicam and removing diclofenac from sale. (Harris, 2013).

Diclofenac Ban: -

Vultures are highly intolerant to the NSADs diclofenac. The Government of India, Pakistan and Nepal banned the manufacture and veterinary use of diclofenac on March 2006 (Dama 2013; Kanaujia *et al.*, 2014) and started the first Vulture conservation Action plan for Nepal (2009-2013) and seven community managed Vulture safe feeding sites that is vulture restaurants were established in Nawalparasi, Rupandehi, Dang, Kaili, Kaski and Sunsari Districts. The establishment of vulture safe feeding sites started from 2007 to the year of 2013 (Naidoo, 2009). Where diclofenac free food is provided to vultures (DNPWC, 2015—2019). Along with it the government of India also ban the manufacturing and import of diclofenac in Nepal and other regions of India in June 2006, made various promoting efforts for the use of safe alternative meloxicam (Swaroop *et al.*, 2007; Cuthbert *et al.*, 2011; Harris, 2013; Naidoo *et al.*, 2009). Harris R.J. 2013 demonstrated that meloxicam was safe to use for the six species of *Gyps* vultures that is residential to India and at least 54 other raptors and scavenging bird species. We have convinced the managers of the 'Panjarapol' not to use 'Diclofenac' since 2006 when the Gujarat Government first banned its use, and distributing meloxicam all over Gujrat at subsidized rates because meloxicam is safe substitute for diclofenac but is a little costlier (Kanaujia *et al.*, 2014; <http://www.natureclubsurat.org/vultureproject.html>). So Diclofenac is totally removed from the practice and the market from this area. The managers of Panjarapols have also agreed to supply the dead animals as and when the animals die for offering to the vultures at nominal cost. Now the carcasses are being transported to the newly created feeding site known as "Asrana" which is 20 km from the Chhapariyali Panjarapol. WWF – Pakistan, in partnership with the Punjab wildlife and Parks Department, launched the Gyps Vulture Restoration Project in 2005. One of the biggest successes of this project has been lobbying to ban the drug diclofenac sodium which was effectively banned in September in 2006 by the National Assembly's standing

committee on environment (WWF 2005 conservation of Gyps vulture).

Establishment of the breeding centers in India: -

The Ministry of Environment and Forest has supported vulture conservation breeding centers at Pinjore (Haryana), Buxa (west Bengal) and Rani Reserve Forests (Assam) through the respective State Governments.

The first center was established at Pinjore, Haryana in 2002 by Bombay Natural History Society (BNHS) (2001) in collaboration with the Haryana Forest Department. This centre initially establish as diagnosis Centre. but when diclofenac was identified as the cause of vulture declined, it was converted to a breeding Centre. The Pinjore Centre has 120 vultures and The centre is funded by the Darwin Initiative for the Survival of Species Fund of Government of U.K. (2001-2006) and supported by Rudford Maurice Laing Foundation through RSPB, ZSL and National Birds of Prey Trust, U.K. (Jatayu, 2002-2003) together with some wild adults and subadults caught by trained BNHS trappers, and sick and injured birds brought to the centres. Pinjore is the most advanced and equipped of the three Indian centres run by dr Vibhu Prakash of BNHS.

A second centre was initiated in December 2005 at Raja Bhat Khawa, west Bengal jointly by Bombay Natural History Society and West Bengal Forest Department. In west Bengal a number of Forest Department Buildings have been made available to the project. The Raja Bhat Khawa Centre has 76 vultures of three species (white-backed, long-billed, and slender-billed vulture).

The third breeding centre was established in 2008 in Assam at Rani forest near Guwahati. The Govt. of Assam in collaboration with the BNHS, Bombay has established a vulture conservation and Breeding centre at Rani. In Assam a purpose- built staff office and visitor reception room has been constructed by Assam forest Department the Rani centre has 33 vultures of two species (white-backed and slender-billed vulture). The objectives of the project are to have 50 pairs of Vultures for breeding with the ultimate goal to release than in the wild.

For the reintroductions or supplementations to the wild Gyps vultures' conservation centres have been established in South Asia. In Pakistan such a centre has been established at Change Manga for Gyps bengalensis. Changa Manga forest is approximately 80 km southwest of Lahore. This centre is managed by WWF-Pakistan in

partnership with the Punjab Wildlife and Parks Department, whilst technical and financial support of the Hawk Conservancy Trust, UK and keystone funding comes from the Environment Agency Abu Dhabi, UAE (WWF, 2005).

In Changa Manga a large communal aviary 38m long and increase in width of 14 m to 27.5m construction materials consists of 150mm steel pole supports and welded steel frames on a concrete base. The walls and roof are chain like. Holds 15 *Gyps bengalensis*. The Aviary at the conservation centre at Changa Manga has a capacity of approximately 30 vultures and 4 separate breeding aviaries have been developed already.

Aviaries: -

Aviaries are also known as 'Colony Aviaries', conservation breeding centers designed by raptor breeding experts. Colony aviaries are for vultures consist of single colony. Parameters of single colony are 32 meter long, 12 meter wide and 6 meter in height. The large aviaries consist more no of small aviaries. These small aviaries are considered as temporary aviaries present at each centre. Vultures aviaries also play important role training and advice and conservation related awareness programmes given by the raptor breeding expert along with veterinary staff (Cuthbert, 2009). In the previous literature there is important progress report of successful breeding aviaries with the first 2 white-rumped vultures fledged in 2008, and a further 3 in 2009. 2 slender-billed vultures also successfully fledged in 2009, and Indian vultures also laid eggs, giving hope that will breed successfully near future (Cuthbert, 2009). The Aviary consists of live trees, Roosting/nesting ledge; this provides shade and shelter for the birds. Management of Vultures aviaries include providing diclofenac fee carcass to vultures, cleaning of colony time to time.

Future Needs: -

Identification of natural habitat includes guarding the natural active nest sites at their breeding region for future conservation. Protecting such nest sites and conserving the existing nest tree in private lands, reintroduction of captive breed vulture in the wild where such chicks have been successfully fostered in the nests of their wild breeding counterparts. Both in situ and ex situ breeding of vultures should be coordinated till the vulture populations increase to an acceptable level and stabilizes in the Indian subcontinent (Pande *et al.*, 2013). *In situ* measures like establishment of Vulture

Safe Zones in a radius of 100 km from existing nesting sites are attempted through targeted advocacy and awareness programmes (Bonal *et al.*, 2014). The diclofenac for veterinary use has been banned, but the misuse of multi-dose vials of human formulations of the drug in treating animals continues to be a problem. Strong advocacy measures are being taken to get these vials banned, and allow only smaller single dose ampoules for human use. Frequent monitoring of vulture populations and prevalence of diclofenac and other NSAIDS is being carried out to ensure that there is no use of toxic drugs to vultures in treating livestock in Vulture Safe Zones, so that the Zones are ready for the release programme for augmenting the vulture populations (Bonal *et al.*, 2014; Cuthbert *et al.*, 2011). There is a need for individual recovery plans tailored for each of these threatened species. Examples of this format of recovery plan can be viewed from various government web sites (Alstrom, 1997; Harris, 2013). A holistic approach is required that provides education for the general public, government and NGOs through these plans. Research is also urgently required to determine the principle threat or cumulative threats causing the declines of Red-headed Vultures and Egyptian Vultures (Harris, 2013). Further efforts are required to enhance conservation outcomes for Accipitridae vultures. There is also a need for continuing and enhancing concentrated unilateral conservation efforts within the Asian and Indian subcontinents, which will strengthen the knowledge base and conservation outcomes (Harris, 2013).

Recommendations for Conservation: -

1. Nests of Indian vulture are supposed to be protected from human disturbances and mining works because it comes under the category of critically endangered which is the highest category of risk.
2. Vultures are large bird, body weight almost 2-6 kg. In weight and they could do with big and strong trees nesting. The full-grown trees necessity to be saved.
3. Not to put together tourist places near nest sites for cinematography, and leave birds in their natural habitat.
4. The nesting area should be conserved for future breeding potential.
5. Never make railway tract near breeding sites.
6. Feral dogs are main threat for vultures. An infrastructure plan is required to fall this major problem.
7. Regular monitoring of vulture should be done specially during breeding season.

8. Develop artificial feeding stations and water body to increase the number of declining vulture population.

CONCLUSION

Vultures are scavenging birds of Prey they play important role to maintain ecosystem. Therefore their presence is the need for healthy environment. They need not to us to maintain existence in the environment apart of that they play scavenging activity to maintain the environment clean and healthy that's why there is need to work for the conservation of vulture in their natural habitat. Different species of birds mature at particular time of year like this Vultures mature at the age of five years they lay single egg in one breeding period. They choose their habitat on the basis of good availability of water (as unpolluted), food, roosting, nesting and soaring sites. In this area anthropogenic activities restricted. But in present scenario due to increasing anthropogenic activities and wood cutting, browsing, lopping, grazing, fishing, mining, presence of road etc. were the main cause that factor affected the decline of vulture population. The other anthropogenic activities as wood cutting and lopping cause the loss of nesting and roosting habitat. Fishing was also factor affecting the vulture habitat due to human interference or interaction increase and cause the habitat degradation of vulture survival in this area. so there is need to protect vulture in their natural habitat and aware the farmers about their importance and develop new method of in-situ breeding.

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REFERENCES

Ali, S and Ripley SD (1968–1998) Compact handbook of the birds of India and Pakistan, *Oxford University press*, 296-314.

Ali, S and Ripley SD (1983) Handbook of the birds of India and Pakistan, compact Ed. *Oxford University Press*.

Ali, S and Ripley SD (1998) Handbook of the Birds of India and Pakistan, 9 (2).

Allen, G. O., 1920. Accidents to vultures. *Journal of the Bombay Natural History*

Allen, G. O., 1920. Accidents to vultures. *Journal of the Bombay Natural History*

Alstrom P (1997) Field identification of Asian *Gyps* vultures, *Oriental Bird Club Bull*, 25:32-49.

Anderson JC (2005) Birds of South Asia: The Ripley Guide, Smithsonian Institution and Lynx Edicions. ISBN, 2:89-90.

Anderson MD (1994) Mass African White backed Vulture poisoning in the northern Cape, *VultureNews*, 29:31-32.

Anderson MD (1995) Mortality of African Whitebacked Vultures in the North-West Province, South Africa, *Vulture News*, 33:10-13.

Aryal M (2007) Slowly, Vulture numbers picking up.

Ayoama I, Sekiyama F, Obara N, Tamura G and Sakaguchi H (1988) Breeding biology of a pair of Golden Eagles in the Kitakami Mountains, *Aquila chrysaetos*, 6: 14-23.

Balasundaram R and Kannan G et al., (2014) Nesting of white rumped vulture (*Gyps bengalensis*) in the Segur plateau of the nilgiri North forest, *Indian Forester*, 140 (10):1014-1018.

Baral N and Gautam R et al., (2005) Population status and breeding ecology of White-rumped Vulture *Gyps bengalensis* in Rampur Valley, Nepal", *Forktail*, 21:87-91.

Baral N and Gautam R et al., (2007) Population Status and Breeding Success of White-rumped Vulture *Gyps bengalensis* in Rampur, Syanja and Tanahu, Nepal.

Batbayar, Nyambayar (2004) Nesting Ecology and Breeding Success of Cinereous Vultures (*Aegypius Monachus*) in Central Mongolia, *Boise State University Theses and Dissertations*, 2004.

BCN (2008/09) Annual Report, *Bird Conservation Nepal*, 2008/09.

Bertran J and Margalida A (2004) Interactive behaviour between Bearded Vultures *Gypaetus barbatus* and common Ravens *Corvus corax* in the nesting sites: Predation risk and kleptoparasitism, *Ardeola*, 51 (2): 269-274.

Bird Conservation Society, Gujarat (BCSG) (2011) Conservation of Vultures in Mahuva and Rajula Tahsils of Bhavnagar and Amreli Districts, Gujarat.

Bird DM and Buckland RB (1976) The onset and duration of fertility of the American kestrel, *Can. J. Zool*, 54:1595-1597.

Birkhead T and Møller AP (1992) Sperm competition in birds: Evolutionary causes and consequences, *London: Academic Press*.

Birkhead T, Atkin L and Møller AP (1987) Copulation behaviour of birds, *Behaviour*, 101-138.

Birkhead TR and Møller AP (1992) Sperm competition in birds: Cause and consequences, *Academic Press, London*.

Blanco G, Martinez F and Traverso JM (1997) Pair bond and age distribution of breeding Griffon Vultures *Gyps fulvus* in relation to reproductive status and geographic area in Spain, *Ibis*, 139 (1):180-183.

Bonal BS and Prakash V (2014) *Ex situ* and *in situ* efforts in saving three Critically Endangered Resident *Gyps* species of vultures (White-backed Vulture-*Gyps bengalensis*, Longbilled Vulture-*Gyps indicus*, and Slender-billed vulture- *Gyps tenuirostris*) from possible extinction in India.

- Brown CJ (1990) Breeding biology of the bearded vulture in Southern Africa, Parts I-III.
- Brown L, and Amadon D (1968) Eagles, hawks and falcons of the world, *Country life books*.
- Chaudhary A, Subedi T R, Giri JB, Baral HS, Bidari B, Subedi H, Chaudhary B, Chaudhary I, Khadanda P, and Cuthbert RJ (2012) Population trends of Critically Endangered Gyps vultures in the lowlands of Nepal, *Bird Conservation International*.
- Chaudhry MJI, Ogada LD, Malik NR, Virani ZM and Giovanni DM (2012) First evidence that populations of the critically endangered Long-billed Vulture *Gyps indicus* in Pakistan have increased following the ban of the toxic veterinary drug diclofenac in south Asia, *Bird Conservation International*.
- Chhangani AK (2007) Sightings and nesting sites of Red-headed Vulture *Sarcogyps calvus* in Rajasthan, India, *Indian Birds*, vol. 3 (6): 218–221.
- Chhangani AK (2012) The impacts of La Niña-induced drought on Indian Vulture *Gyps indicus* populations in Western Rajasthan, *Bird Conservation International: 01-13*.
- Chomba C, and Simuko EM (2013) Nesting patterns of raptors; White-backed Vulture (*Gyps africanus*) and African Fish Eagle (*Haliaeetus vocifer*), in Lochinvar National Park on the Kafue flats, Zambia, *Open Journal of Ecology*, 3(5):325–330.
- Clark WS (1994) Himalayan Griffon *Gyps himalayensis* species account. P.127 in J. del Hoyo, A. Elliott and J. Sargatal, eds. *Handbook of the birds of the world*, 2.
- Collar NJ (2001) BirdLife International Threatened birds of Asia: the BirdLife International Red Data Book. Cambridge, UK: BirdLife International.
- Collias NE and Collias CE (1994) Nest building and bird behavior, *Princeton: Princeton University Press Ostrich*, 61:24-49.
- Concept paper on In-situ ex-situ linkage -Conservation Breeding of Endangered Wild Animal Species in India.
- Cramp S and Simmons KEL (1977) The birds of the Western Palearctic, vol I. – *Oxford University Press, Oxford*.
- Cramp S and Simmons KEL (1980) The birds of Western Palearctic, Oxford: *Oxford University Press*, 2.
- Cuthbert R, Parry-Jones J, Green RE, and Pain DJ (2007) NSAIDs and scavenging birds: potential impacts beyond Asia's critically endangered vultures, *Biol. Lett.*, 3:91–94.
- Cuthbert R, Taggart MA, Prakash V, Saini, Swarup D, S. Upreti, R. Mateo, S.S. Chakraborty, P. Deori and R.E. Green (2011) Effectiveness of Action in India to Reduce Exposure of *Gyps* Vultures to the Toxic Veterinary Drug Diclofenac, *PLoS ONE*, 6 (5).
- Cuthbert RJ, Prakash V, Saini M, Upreti S, Swarup D, Das A, Green RE and Taggart M (2011) Are conservation actions reducing the threat to India's vulture populations? *Current Science*, 101 (11).
- Cuthbert R, V. Prakash, C. Bowden, D. Das, R. Green, Y. Jhala, D. Pain, R.K. Sanacha, N. Shal and A.M. Taggari (2009) Royal Society for the Protection of Birds, *In Journal of veterinary Medicine*, 29(2):80-85.
- Cuthbert R, V. Prakash, C. Bowden, D. Das, R. Green, Y. Jhala, D. Pain, K. R. Senacha, N. Shah and M. A. Taggart (2009) Role of veterinary diclofenac in decline of vulture population in south Asia, *Indian J. Vet*, 29(2): 80-85.
- D.C. Houston, and S.E. Piper (2006) Proceedings of the International Conference on Conservation and Management of Vulture Populations Thessaloniki, Greece, *Natural History Museum of Crete and WWF Greece*. 176.
- Dama M (2013) Role of veterinarians in vulture conservation, *Current Science*, 105(7).
- Davit C (2009) *Missouri Raptors*, 1-15.
- Del Hoyo J, Elliott A and Sotagall J (1994) Handbook of the Birds of the World, *New world vultures to Guinea fowl* (Barcelona: Lynx Editions).
- Dhakal, Hemanta, Baral KM, Bhusal KP and Sharma HP (2014) First record of nests and breeding success of Red-headed Vulture
- DNPWC (2015—2019) Vulture Conservation Action Plan for Nepal, Department of National Parks and Wildlife Conservation.
- Donazar JA *et al.*, (2002) Conservation status and limiting factors in the endangered population of Egyptian vulture (*Neophron percnopterus*) in the Canary Islands, *Biological Conservation*, 107(1):89-97.
- Donazar JA, and Ceballos O, (1989) Growth rates of nestling Egyptian Vultures *Nephron percnopterus* in relation to brood size, hatching order and environmental factors, *Ardea*, 77: 217–226.
- Donazar JA, and Feijoo JE (2002) Social structure of Andean Condor roosts: influence of sex, age and season, *Condor*, 104:832-837.
- Donazar JA, Ceballos O and Tella JL (1994) Copulation behavior in the Egyptian Vulture *Neophron percnopterus*, *Bird Study*, 41(1):37-41.
- Donazar JA, Hiraldo F, Bustamante J (1993) Factors Influencing Nest Site Selection, Breeding Density and Breeding Success in the Bearded Vulture (*Gypaetus barbatus*) , *Journal of Applied Ecology*, 30(3) :504-514.
- Donazar JA, Margalida A, Carrete M, Sanchez-Zapata JA (2009) Too sanitary for vultures, *Science*, 326- 664.
- Elkin N (1883) Weather and bird behaviour and *T.D. Poyser Calton*.
- Elosegi I (1989) Vautour fauve (*Gyps fulvus*), Gypaete barbu (*Gypaetus barbatus*), Percnoptere d'Egypte (*Neophron percnopterus*). Synthèse bibliographique et recherché, Pau: *CBEA/UPPA*.
- Fargallo JA, Blanco G, Largo ES (1998) Forest management effects on nesting habitat selected by Eurasian black Vultures (*Aegypius monachus*) in central Spain, *The Raptor Research Foundation*, 2(3):202-207.
- Ferguson-Lees J, Christie DA (2001) *Raptors of the World*. Christopher Helm, London, UK.
- Fernández C and Donazar JA (1991) Griffon Vultures (*Gyps fulvus*) occupying eyries of other cliff-nesting raptors, *Bird Study*, 38: 42-44, 1991.
- Freeland WJ (1976) Pathogens and the evolution of primate sociality, *Biotropica*, 1:8: 12–24.
- G. Blanco and J.M. Traverso *et al* (1997) Interspecific and Intraspecific aggression among Griffon and Cinereous vulture at nesting and foraging sites, *The Raptor Research Foundation, Inc. J. Raptor Res*, 31(1):77-79.

- Ganguly S and Mukhopadhyay SK (2013) Population Threat to Vultures in India, *International Journal of Livestock Research*, 3(1).
- Gavashelishvili A, McGrady M, Ghasabian M and Bildstein K.L (2012) Movements and habitat use by immature Cinereous Vultures (*Aegypius monachus*) from the Caucasus, *Bird Study*.
- Gilbert M et al (2002) Breeding and mortality of Oriental White-backed Vulture *Gyps bengalensis* in Punjab Province, Pakistan, *Bird Conservation International*.
- Gilbert M et al., (2007) Vulture restaurants and their role in reducing diclofenac exposure in Asian Vultures *Bird Conservation International*, 17: 63-77.
- Gilbert M, Watson RT, Virani MZ, Oaks JL, Ahmed S, Chaudhary MJI, Arshad M, Mahmood S, Ali A & Khan AA (2007) Neck-drooping posture in oriental White-backed Vultures (*Gyps bengalensis*): An unsuccessful predictor of mortality and its probable role in thermoregulation, *Journal of Raptor Research*, 41: 35-40.
- Gole P (1989) The status and ecological requirements of *Sarus Crane*, Phase I. Pune, *Ecological Society*.
- Green RE, Newton I, Shultz S, Cunningham AA, Gilbert M, Pain DJ and Prakash V (2004) Diclofenac poisoning as a cause of Vulture population declines across the Indian subcontinent, *J. Appl. Ecol*, 41: 793-800.
- Green RE, Taggart MA, Das D, Pain DJ, Kumar CS, Cunningham AA, and Cuthbert R (2006) Collapse of Asian vulture populations: risk of mortality from residues of the veterinary drug diclofenac in carcasses of treated cattle, *Journal of Applied Ecology*, 43, 949-956.
- Greenwood JAC (1938) Strange accident to a Vulture, *J. Bombay Nat. Hist. Soc*, 40 (2):330.
- Grimmett R, Inskipp C, and Inskipp T Birds of the Indian subcontinent, *Oxford University Press*.
- Grubač B (2002) The Raven (*Corvus corax*) as a predator of a young Griffon Vulture (*Gyps fulvus*), *Wassenaar, Foundation of the Conservation of the Bearded Vulture*, 102-103.
- Grubh RB (1978) Competition and co-existence in griffon vultures: *Gyps bengalensis*, *G. indicus* and *G. fulvus* in Gir Forest, *Journal of the Bombay Natural History Society*, 75, 810-814.
- Harris RJ (2013) The conservation of Accipitridae vultures of Nepal: a review", *Journal of Threatened Taxa*, 5(2), 3603-3619.
- Heredia B (1996) Action plan for the Cinereous Vulture in Europe, *Bird Life International* on behalf of the European Commission.
- Heredia B (1999) El plan coordinado de actuaciones para la protección del quebrantahuesos. *El quebrantahuesos (Gypaetus barbatus) en los Pirineos* (eds R. Heredia & B. Heredia), 117-126.
- Hernández M and Margalida A (2009) Poison-related mortality effects in the endangered Egyptian vulture (*Neophron percnopterus*) population in Spain, *Eur. J. Wild. Res*, 55:415-423.
- Hiraldo F (1883) Breeding biology of the Cinereous Vulture biology and management, *Berkeley: University of California Press*, 197-213.
- Houston DC (1976) Breeding of the White-backed and Ruppell's Griffon Vultures, *Gyps africanus* and *Gyps eppellii*, *Ibis*, 118:14-40.
- http://www.natureclubsurat.org/vulture_c_project.html
- Jha KK (2015) Distribution of vultures in Uttar Pradesh, India, *Journal of Threatened Taxa*, 7(1): 6750-6763.
- Jha KK, Singh P, Kanaujia A and Kushwaha S (2011) Vulture Species in Uttar Pradesh: An identification key. Lucknow, India: Forest Department, UP and Zoology Department, Lucknow University,
- Kanaujia A & Kushwaha S (2014) Vulture restaurants: time to serve them, *Science reporter*: 12-18.
- Kanaujia A and Kushwaha S (2013) Vulnerable Vultures of India: Population, Ecology and Conservation. *Rare Animals of India, Bentham Publication*, 113-144.
- Kanaujia A, Kushwaha S, Shukla JP and Mishra AK (2010) Giddhraj Again Falls Victim to Human Negligence", *E-magazine, Uttar Pradesh State Biodiversity Board*, 1(4):11-14.
- Khatri PC (2015) First nesting of critically endangered vulture in Bikaner: the nest site record of long billed vulture (*GYPS INDICUS*) in Kolayat Tahsil , Bikaner", *An online international journal*, 3 (2): 8-13.
- Khatri PC (2015) Survival of an adult Eurassian Griffon Vulture (*Gyps fulvus*) in summers at Jorbeer, Bikaner.
- Kirazlı C and Yamaç E (2013) Population size and breeding success of the Cinereous Vulture, *Aegypius monachus*, in a newly found breeding area in western Anatolia (Aves: Falconiformes), *Zoology in the Middle East*, 59(4): 289-296.
- Kumar S, Meena H, Jangid PK and Nama KS (2014) Current Status of Vulture Population in Chambal Valley of Kota, Rajasthan, *International journal of pure and applied bioscience*, 2 (5): 224-228.
- Kushvaha S (2014) Parasitological and pathological investigation on vultures (*Gyps* Species) declining in Bundelkhand Region of India, Ph.D Thesis, University of Lucknow, Lucknow India.
- Kushvaha S et al., (2009) Study on present status of vulture (*Gyps* spp.) fauna in some regions of Bundelkhand, India, *Res. Environ. Life Sci*, 2(1), 7-10.
- Kushvaha S et al., (2010) Ecology of Vultures in and Around Orcha, Madhya Pradesh, *Asian J. Exp. Biol. Sci*, 1 (1): 112-118.
- Kushvaha S et al., (2013) Parasitological and pathological investigation on vulture (*Gyps* species declining in the bundelkhand region of India.
- Kushvaha S, Kanaujia A (2015) Protection of Long-billed Vultures (*Gyps indicus*) from the impacts of shooting of Hollywood movie "Singularity" in Orchha, Madhya Pradesh, *Nature & Environment*, 20 (1): 1-10.
- Kushvaha S, Kanaujia A et al., (2013) Parasitological and pathological investigation on vultures (*Gyps* species) declining in bundelkhand region of India.
- Maming R and Dao et al., (2013) Why are juvenile Himalayan Vultures *Gyps himalayensis* in the Xinjiang Tien Shan still at the nest in October? *BirdingASIA* vol.20: 84-89.
- MaMing R and G. Xu (2015) Status and Treats to Vultures in China, *Vulture News*, 68.

- Margalida A and Bertran J (2000) Nest-building behaviour of the Bearded Vulture *Gypaetus barbatus*, *Ardea*, 88 (2): 259-264.
- Margalida A, Benítez JR, Sanchez-Zapata JA, Avila E, Arenas R, Donazar JA, (2012) Long term relationship between diet breadth and breeding success in a declining population of Egyptian Vultures *Neophron percnopterus*, *Ibis*, 154:184-188.
- Margalida A, Moreno-Opo R, Arroyo BE and Arredondo A (2010) Reconciling the conservation of endangered species with economically important anthropogenic activities: interaction between cork exploitation and the cinereous vulture in Spain, *Animal Conservation*, 1-8.
- Martinez F, and Cobo J, (1993) Gestión actual de ADENA/WWF España en el Refugio de rapaces de Montejo de la Vega (Segovia)", *Alytes*, 6:507-521.
- Mendelssohn H, and Leshem Y (1983) Observations on reproduction of Old World vultures, *Vulture Biology and Management*, 214-244.
- Moleón M, Sánchez-Zapata JA, Margalida A, Carrete M, Owen-Smith N, Donazar JA (2014) humans and Scavengers: evolution of interaction and ecosystem services, *bioscience*, 64:394-403.
- Monirul M, Khan H (2013) Population, breeding and threats to the White-rumped Vulture *Gyps bengalensis* in Bangladesh, *Forktail*, 29: 52-56.
- Mundy P, Butchart D, Ledger J, and Piper S (1992) The vultures of Africa, Acorn Books CC and Russell Friedman Books CC, South Africa.
- Mundy PJ (1982) The comparative biology of southern African vultures, Johannesburg, *Vulture Study Group*.
- Nadeem MS, Asif M, Mahmood T and Mujtuba G (2007) Reappearance of Red-headed Vulture *Sarcogyps calvus* in Tharparker, Southeast Pakistan, *Podoces*, vol. 2(2), 146-148.
- Naidoo V, Wolter K, Cromarty D, Diekmann M, Duncan N, and Meharg AA (2009) Toxicity of NSAIDs to *Gyps* vultures: a new threat from ketoprofen, *Biology Letters*, 6: 339-341.
- New Zealand Government (2012) Threatened species Recovery Plan archive.
- Newton I (1998) Population Limitation in Birds, *Academic Press, London*.
- Oaks JL, Gilbert M, Virani MZ, Watson RT, Meteyer CU, Rideout B, Shivprasad HL, Ahmed S, Chaudhry MJ *et al.*, (2004) Diclofenac residues as the cause of vulture population decline in Pakistan, *Nature*, 427:630-633.
- Ogada DL, Torchin ME, Kinnaird MF and Ezenwa VO (2012) Effects of vulture declines on facultative scavengers and potential implications for mammalian disease transmission, *Conservation Biology*.
- Pain DJ, Cunningham AA, Donald DF, Duckworth JW, Houston DC, Katzner T, Parry-Jones I, Poole C, Prakash V, Round P, and Timmins R (2003) Causes and effects of temporospatial declines of *Gyps* vultures in Asia, *Conservation Biology*, 17 (3): 661-671.
- Pande S *et al.*, (2013) Promising trend of in situ breeding of Oriental White-rumped Vulture *Gyps bengalensis* in Raigad District, Maharashtra, India: conservation implications for re-introduction of ex situ populations, *Journal of Threatened Taxa*, vol5(7):4106-4109.
- Parra JL, Tellería JL (2004) The increase in the Spanish population of Eurasian griffon vulture *Gyps fulvus* during 1989-1999: effects of food and nest site availability, *Bird Conserv. Int*, 14:33-41.
- Poirazidis K, Goutner V, Tsachalidis E, Kati V (2007) Comparison of nest-site selection patterns of different sympatric raptor species as a tool for their conservation, *Animal Biodiversity and Conservation*, 30(2): 131-145.
- Porter RF (2010) Social behavior of the Egyptian vulture, *British Birds*, 103: 60-64.
- Porter RF, Suleiman AS (2012) The Egyptian Vulture *Neophron percnopterus* on socotra, yemen: population, ecology, conservation and ethno-ornithology, *Sandgrouse*, 34.
- Ppirazidis K, Goutner V, Skartsi T, Stamou G (2004) Modelling nesting habitat as a conservation tool for the Eurasian black vulture (*Aegyptius monachus*) in Dadia Nature Reserve, northeastern Greece, *Biol. Conserv*, 118: 235-248.
- Prakash V (1988) The General Ecology of Raptors in Keoladeo National Park, Bharatpur, Ph.D. Thesis, Bombay University, Bombay.
- Purohit A and Saran R (2013) Population Status and Feeding Behavior of Cinereous Vulture (*Aegyptus monachus*): Dynamics and Implications for the Species Conservation in and Around Jodhpur, *World Journal of Zoology*, 8 (3):312-318.
- Ramakrishnan B, Kannan G, Samson A, Ramkumar K and Ramasubramanian S, (2014) Nesting of White-rumped Vulture (*Gyps bengalensis*) in the segur plateau of the Nilgiri North Forest division, Tamilnadu, India, *Indian Forester*, 140 (10),1014-1018.
- Ramesh T, Sankar K and Qureshi Q (2011) Status of vultures in Mudumalai Tiger Reserve, Western Ghats, India". *Forktail*, 27: 91-92.
- Rasmussen PC, and Anderton JC (2005) Birds of South Asia. *The Ripley Guide*, 1 and 2:116.
- Rasmussen PC, and Parry SJ (2000) On the specific distinctness of the Himalayan Long-billed Vulture *Gyps [indicus] tenuirostris*, 118th Stated Meeting of the American Ornithologists' Union, Memorial University of Newfoundland, St. John's, Newfoundland.
- Ratcliffe D (1977) the Raven, *London: T. & A.D. Poyser*.
- Reading RP *et al.*, (2005) Cinereous Vulture Nesting Ecology in Ikh Nartyn Chuluu Nature Reserve, Mongolia, *Mongolian Journal of Biological Sciences*, vol. 3(1) pp. 13-19.
- Reading RP, Amgalanbaatar S, Kenny D and Dashdembe B (2005) Cinereous Vulture Nesting Ecology in Ikh Nartyn Chuluu Nature Reserve, Mongolia, *Mongolian Journal of Biological Sciences*, vol. 3(1): 13-19.
- Reading RP, David K, Aua, Travis JG, Jo WM, and Tsolmonjav P (2010) Ecology of Eurasian Black Vultures (*Aegyptius monachus*) in Ikh Nart Nature Reserve, Mongolia, *The Biological Resources of Mongolia*, 46.
- Real J, and Manosa S, (1986) Pla d'estudi i protecció de l'Àliga perdiuera (*Hieraetus fasciatus*) a Catalunya, Dept. Biol. Anim. (Vert.), Fac. Biol.Univ. de Barcelona. Barcelona.
- Redondo T (1989) Avian nest defence: theoretical models and evidence, *Behaviour*, 111: 161-195.
- Roberts T () The birds of Pakistan", Non-passeriformes. Oxford: Oxford University Press.
- Robertson AS (1986) Copulation throughout the breeding in a colonial Accipitrid vulture, *Condor*, 92:257-258.

- Sarà M and M. D. Vittorio (2003) Factors influencing the distribution, abundance and nest-site selection of an endangered Egyptian vulture (*Neophron percnopterus*) population in Sicily, *Animal Conservation*, 6(4):317-328.
- Saran EP, Purohit A (2012) Ecotransformation and electrocution. A major concern for the decline in vulture population in and around Jodhpur, *International Journal of Conservation Science*, 3 (2):111-118.
- Saran RP, Purohit A (2012) Eco-Transformation and electrocution. A major concern for the decline in vulture population in and around Jodhpur, *International Journal of conservation sciences*, 3 (2): 111-118.
- Sarcogyps calvus* and implementation of Vulture Conservation Programs in Nepal, *Ela Journal*, 3(3):9-15.
- Şen B, İsfendiyaroğlu S, and Tavares J (2011) Egyptian vulture (*Neophron percnopterus*) Research and Monitoring 2011 Breeding Season Report-Beypazarı, Turkey, Doğa Derneği, Ankara, Turkey.
- Shultz S, Baral HS, Charman S, Cunningham AA, Das D, Ghalsasi DR, Goudar MS, Green RE, Jones A, Nighot P, Pain DJ, and Praksh V (2004) Diclofenac poisoning is widespread in declining vulture populations across the Indian subcontinent, *Proceedings of Royal Society of London*, 271 (6): 458-460.
- Simmons RE (1955) Mass poisoning of Lappet faced Vultures in the Namib Desert, *Journal of African Raptor Biology*, 10: 3.
- Simmons RE and Mendelsohn JM (1993) A critical review of cartwheeling flights of raptors, *Ostrich*, 64:13-24.
- Singh CP, Chauhan RRC, (2015) A sight of Himalayan griffon vulture (*Gyps himalayensis*) at Kaswa Baberpur - Ajitmal Auraiya UP, India, *International Journal of Fauna and Biological Studies*, 2 (3): 84-85.
- Souto HN, Francjin AG, Junior OM (2009) New Record of Allopeening Between Black Vultures (*Coragyps atratus*) and Crested Caracara (*Caracara plancus*), *Sociobiology*, 53, (1).
- Swarup D, Patra RC, Prakash V, Cuthbert R, Das D, Avari P, Pain DJ, Green RE, Sharma RK, Saini M, Das D, and Taggart M (2007) Safety of meloxicam to critically endangered *Gyps* vultures and other scavenging birds in India, *Animal Conservation*, 10(2): 192-198.
- Terrasse JF (1991) Le gypaete barbu les Pyrenees francaises. El quebrantahuesos (gypaetus barbatus) en los Pirineos (eds R.Heredia & B. heredia) , *Madrid*, 15-25.
- The government of Nepal (2009-2013) Ministry of Forest and Soil Conservation - Department of National Parks and Wildlife Conservation.
- Thiollay J (2006) The decline of raptors in west Africa: long-term assessment and the role of protected areas", *Ibis*, 148: 240-254.
- Tryjanowski P, Kosicki JZ, Kuzniak S, and Sparks TH (2009) long-term changes and breeding success in relation to nesting structures used by the white-stork, *Ciconia ciconia*.- *Annals zoologici fennici*, 46: 34-38.
- Van Rooyen CS (2000) An overview of vulture electrocutions in South Africa", *Vulture News*, 43:5-22.
- Venkitachalam R et al., (2013) Some aspects of breeding biology of the White-backed vulture *Gyps bengalensis* in Nilagiri North Forest division in western Ghats, Tamil Nadu, *I.J.S.N*, 4(3): 411-414.
- Vergara P, and Aguirre JI (2006) Age and breeding success related to nest position in a white-stork, *Ciconia ciconia* colony, *Acta Oecologica*, 30:414-418.
- Vergara P, et al., (2010) Nest size, nest building behavior and Breeding success in species with nest reuse. The White stork *ciconia ciconia*- *Ann.Zool. Fennici*, 47:184-197.
- Vernon CJ, Piper SE and Schultz DM (1982) The breeding success of Cape Vultures at Collywobbles, Transkei, *Vulture News*, 8:26-29.
- Virani MZ et al., (2004) A Survey of the Reproductive Activities at some *Gyps* Vulture Nests in Kanha, Bandhavgarh and Ranthambhore National Parks, India, in the 2002/2003 breeding season.
- Virani MZ, Gilbert M, Watson JL, Oaks, Benson P, Khan AA, Giri JB and Baral HS (2001) Asian Vulture Crisis Project: Field results from Pakistan and Nepal for the 2000-2001 field season. In reports from the workshop on Indian *Gyps*. Vultures, (Eds.) 4, *Eurasian Congress on Raptors*, 1-133.
- Virani MZ, Kendall C, Njoroge P, and Thomsett S (2011) Major declines in the abundance of vultures and other scavenging raptors in and around the Masai Mara ecosystem, Kenya, *Biological Conservation*, 144:746-752.
- Virani MZ, Kirui P, Monadjem A, Thomsett S and Githiru M (1979) Nesting status of African White-backed Vultures *Gyps africanus*, *Population ecology of raptors. BerkhaNsted: Poyser*.
- Wimberger PH (1984) The use of green plant material in bird nests to avoid ectoparasites, *Auk*, 101:615-618.
- Xirouchakis SM (2003) The ecology of the Griffon Vulture (*Gyps fulvus*) on the island of Crete, *Ph.D. Thesis, University of Crete, Heraklion*.
- Xirouchakis SM (2010) Breeding biology and reproductive performance of Griffon Vultures *Gyps fulvus* on the island of Crete (Greece), *Bird Study*, 57(2): 213-225.
- Xirouchakis SM et al., (2007) Breeding behaviour and parental care in the Griffon Vulture *Gyps fulvus* on the island of Crete (Greece), *Ethology Ecology and Evolution*, 19 (1): 1-26.
- WWF (2005) Conservation of *Gyps* vulture.
- WWF (2005) The Dadia Forest Reserve: Conservation Plan for the after-LIFE period, 1-19.
www.oiseavx.birds.com