Chapter 5 Threats and Conservation Management

The Lesser Flamingo, due to its intrinsic habitat requirements and colonial feeding and breeding habits, is a restricted range species. Due to its erratic breeding nature and very few known breeding sites, the population of Lesser Flamingo is undergoing a moderately rapid decline (IUCN 2001) and thus classified as 'Near Threatened' Species.

During the present study, various threats were identified at both the breeding and non-breeding habitats. The major threats at breeding habitats are both natural and anthropogenic. The threats at breeding habitats are a matter of serious concern as it inhibits a species from producing its offspring for a viable population to sustain.

Threats at Breeding Habitats

Flamingos are habitat specialists' species and rely on range of environmental factors for completing its breeding cycle. A slight disturbance (man-made or natural) in breeding habitat of the species results in desertion of the colony and ultimately failure of nesting. Several such factors were identified during the present study and are discussed below.

Surajbari Creek

One of the important breeding ground of Lesser flamingos in Gujarat, however nesting cycle is seldom complete due to both anthropogenic and natural factors.

Egg lifting by fishermen

One of the major threats observed at Surajbari nesting site is egg lifting by fishermen and local community of surrounding villages. Flamingos congregate in large numbers during breeding season (i.e. June-July) and built nests and lay eggs. At the start of the reproductive season (rainy season), these people use boats to obtain access to the nests. This activity is conducted by most of the fishermen from surrounding villages. There are reports of single fishermen collecting 200-300 eggs in a day. This causes flamingos to desert the nesting

colony and move to other areas, where they might not attempt nesting again. This is one of the major threats considering the habitat specificity displayed by the species and is a major cause of decline in the species nesting success (Plate 5 B).

Tidal Waters of High tide

As, Cherwari mudflats are located amongst the Hadkiya creek, the waters during highest high tide (full moon day) inundates the nesting and the nests built near the edges of the small channels are washed off or are damaged. There is high probability that flamingo's egg laying period falls around full moon day tides and colony gets disturbed and ultimately deserted by the species.

Excessive Rainfall

This is again, one of the natural threats to nesting flamingos. As per the discussion with local fishermen it was revealed that, during years of high rainfall, the nests get washed off and thus, compels flamingo to leave the nesting site (Plate 5 A).

Collision with Power lines

The southern part of the Cherwari nesting colony has one of the largest network of electric power cables ranging in height from 20 mtr to 50 mtr (Plate 5C). This is the only route of power transmission used by various agencies between Kachchh and mainland Gujarat and thus have resulted into a criss-cross network of high voltage power lines. The collisions at these sites are frequent resulting in death of number of flamingos in a year, especially during breeding season (Mundkur 1997; Parasharya and Tere 2005).

Little Rann of Kachchh

Little Rann of Kachchh (LRK) has been the traditional breeding grounds of Lesser Flamingos. It is also one of the major congregation sites of flamingo both during breeding and non-breeding season.

Optimum water level

One of the major requisites of flamingo breeding is presence of optimum water level for feeding, nest building, chick feeding etc. and if there are any alterations in water levels along the nesting colonies of the species, flamingos might abandon the nesting or leave the nest site, even if they have laid and chicks have emerged from the eggs (Plate 5A)

In LRK, the water level depends on two main sources; rainfall and tidal inundation which is a result of inflow of high tide water from Surajbari creek. Flamingos start to congregate in large numbers just after the rains. By July-August, they find suitable sites for nest building. However, sometimes, just after the egg laying, water level starts to recede (either due to insufficient rainfall or variation in tidal water in flow). This caused flamingos to abandon the constructed nests and desert the colony. So, maintenance of optimal water level is an intrinsic part of the successful flamingo breeding.

Flamingo City

Flamingo city has been the traditional breeding ground of the species since the first visit by Dr. Salim Ali in 1945. The surrounding area of the Flamingo city gets inundated by the waters from Banas and Sarswati rivers during the monsoon and creates ideal breeding site for both Lesser and Greater Flamingo.

During the present study, flamingo city was visited during March 2011. It was observed that the island or the 'Anda beyt' is under serious threat of erosion. Due to the inundation of tidal waters from Cori creek and excess rain water from Banas River, the island area has reduced drastically. The total area of flamingo city during Salim Ali's visit in April 1945 was 9.83 Hectare (1,17,600 sq yards) (JBNHS, Vol. 45). During 2011 visit (present study), the measured area of flamingo city was 2.89 hectares, suggesting the decrease of almost 70.6% in total area of flamingo city during the span of 66 years (1945 to 2011). Thus, suggesting a decline of 0.10 Hectare per year. If such erosion continues at such a rate, flamingo city will erode completely within next 25 years (Plate 1,2).

Thus, there is an urgent need to prevent soil erosion at Anda beyt, by construction of some concrete structures (during non-breeding period) around it. Moreover, flamingo leave the colony in crave of optimum inundation around Anda beyt akin to other sites. A system to maintain sufficient water level (by constructing bunds in nearby areas) around beyt would promote the nesting of both Greater and Lesser Flamingos.

Threats at Non-breeding sites

Various threats at both Kumbharwada site and Newport site were identified during the present study. Most of the threats at both the sites were anthropogenic unlike the breeding sites where natural threats were more.

Threats at Kumbharwada site

Major part of the Kumbharwada site being a sewage water ponds, it is highly prone to disturbance by un-treated waste water disposal from surrounding industries, other disposal of industrial wastes, house hold wastes and from cattle owned by surrounding dwellers.

Cattle Herds and Feral Dogs

Cattle herds of slum dwellers living around the Kumbharwada site, pose a serious threat to feeding habitats of Lesser Flamingo. The cattle herds, especially buffalo use Kumbharwada sewage area and cool itself by lying in mud or sewage open water habitats during the heat of the day, disturbing the feeding activity of the flamingo (Plate 1A, B).

Industrial Pollution

It was observed that, industries surrounding the Kumbharwada area release the untreated waste water into the Sewage ponds which are highly acidic or basic disturbing the water chemistry of the area and ultimately affecting the primary productivity of the ponds. Besides, untreated water, some of the industries dispose of their solid wastes around the area, severely disturbing flamingo habitats and their activity (Plate 2 C).

Due to presence of some large industries such as IPCL, the vehicular traffic also is one of the disturbing factors (Plate 3 B, C). Cattle herding amongst the sewage pans also caused flamingos to increase vigilance and to move away from the shallow water areas that are highly preferred by the species for feeding.

Pollution from Refuse

There are various small scale industries surrounding Kumbharwada site, where organic wastes are released. Moreover, there are many areas around the Sewage pans where organic and inorganic refuse are deposited close to the Kumbharwada site. This refuse/waste is washed into the pans during the rainy season and can also be blown there by the wind at any time of year causing depletion of the water quality thereby affecting the net primary productivity (Plate 3A).

Collision with Power Lines

The collision of flamingos with electric lines was noticed during June 2011, near Kumbharwada site during the study period (Plate 1B). The collision resulted in the death of around 50 Flamingos at Kumbharwada (Down to Earth, 31/12/2011). To prevent collision and die offs, the electric cables should be insulated with rubber coating and reflectors should be placed which are visible during night as flamingos mostly travel during night (Plate 2B).

Invasion of *Portersia coarctata*

P. coarctata, a salinity indicator grass species has been observed to spread very rapidly in the Sewage pan area of the Kumbharwada study site. The species showed increase in its spread among different years. In 2011 with percentage of grass cover increased up to 54.84% ± 7.93 (Minimum 40% and maximum 76%). In 2012, 59.11% ± 7.76 of earth was covered with grass and 40.89% was bare earth. This figures suggests that, if the rate of spread is not controlled, flamingos will lose its open water feeding areas and thus cause decline in their numbers (Plate 1C).

Similarly *Aeluropus lagopoides* also, has occupied open water pools in the KWSP2. In 2012 percentage grass cover increased up to 67.5% (Minimum 52% and maximum 78%) in 2012 (Fig. 15). The present trend in increase in grass cover in sewage ponds habitat of the Kumbharwada shows the decrease in the open water habitat for flamingos to feed in the sewage pond habitat (r^2=0.99, p=0.005) (Fig. 14) (Plate 1D).

Oct 2013 (Open water areas marked)

December 2012 (Open water area)

January 2009 (Open water area marked)

January 2004 (Open water area)

Fig 1: Time series images of Google earth (2004-2013), Note the reduction in open water area

Threats at Newport site

Newport site being located farther from the city of Bhavnagar, threats identified at this site were comparatively less. Major threat at Newport site was not observed till the last year of study period where, large areas of abandoned saltpans were converted to salt manufacturing units. The conversion has led flamingos to totally abandon these sites and migrate to other coastal areas and mudflats surrounding the area (Plate 4 B, C).

Salt works and vehicular traffics

Due to high rate of salt production, the vehicular traffic for the transportation of raw salt to processing unit is more. Trucks and tractors make about 50 trips a day to and fro from a salt manufacturing unit thereby causing disturbance to flamingos while they are feeding or resting (Plate 3C).

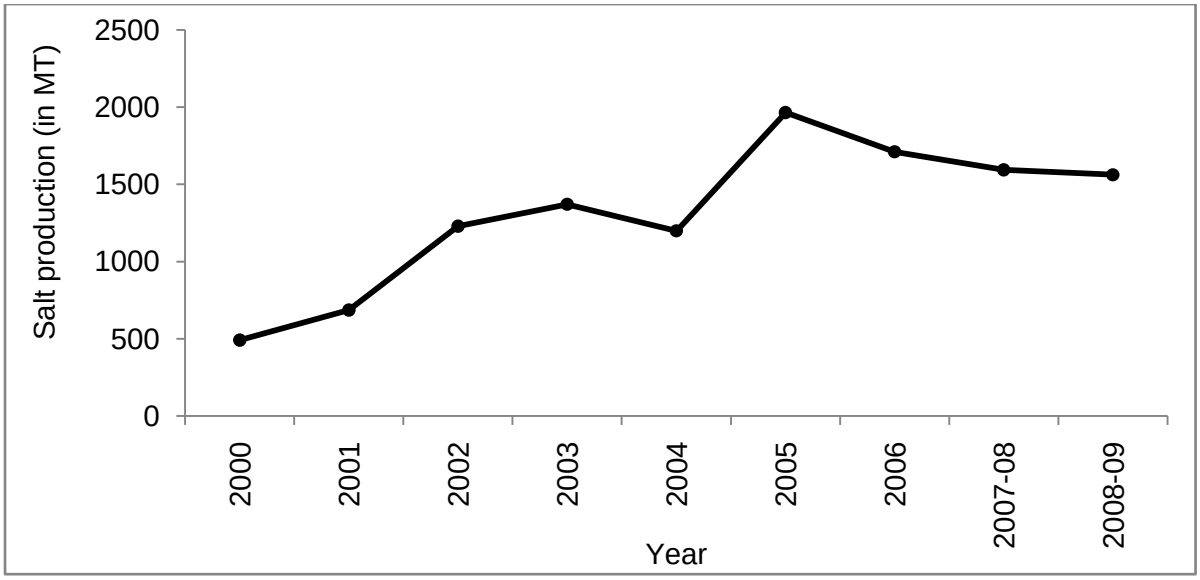
General Threats

One of the important threats to flamingo habitats is conversion of coastal waste lands into salt pans. During the recent period, many such areas at Newport site and Kumbharwada site are being converted to saltpans. These conversion leads to the reduction in the feeding areas for flamingos, as saltpans are rarely used for feeding by flamingos (present study).

Table 1: Year wise increase in area under saltpans in GoKh

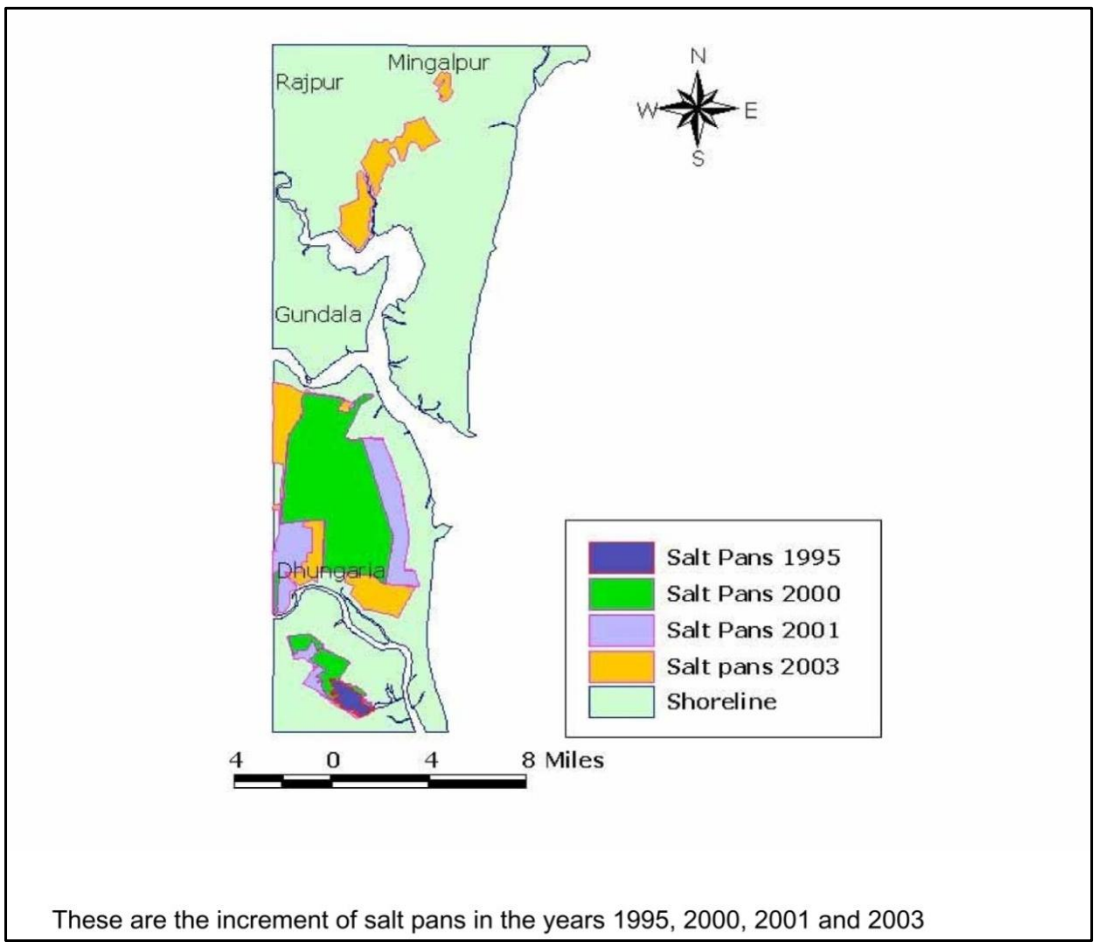
Class	1995	2000	2001	2003
Area of Salt pan (sq. km)	6.84	58.79	78.64	112.32

Source: Charatkar et al. (2004)



Source: Industries Commissionerate, GoG

Fig 2: Rate of increase of salt production in study area



Source: Source: Charatkar et al. (2004)

Fig 3: Increase in area of saltpans from 1995-2003

A study carried out by Charatkar et al. (2004), shows that the there is a tremendous increase in area under saltpans category in Gulf of Khambhat since past decade. The area under saltpans which was 6.8 sq.km in 1995 increased ten folds in five years (58.79 sq km in 2000). In 2001, the area under saltpans increased to 78.68 sq.km showing the rise of 33.7% in one year. In 2003, the area under saltpans was 112.32 Sq km, showing the rise of 42.8% (Table 1). This is also evident from the increase in salt production from 2000 to 2009 (Fig. 2).

DISCUSSION

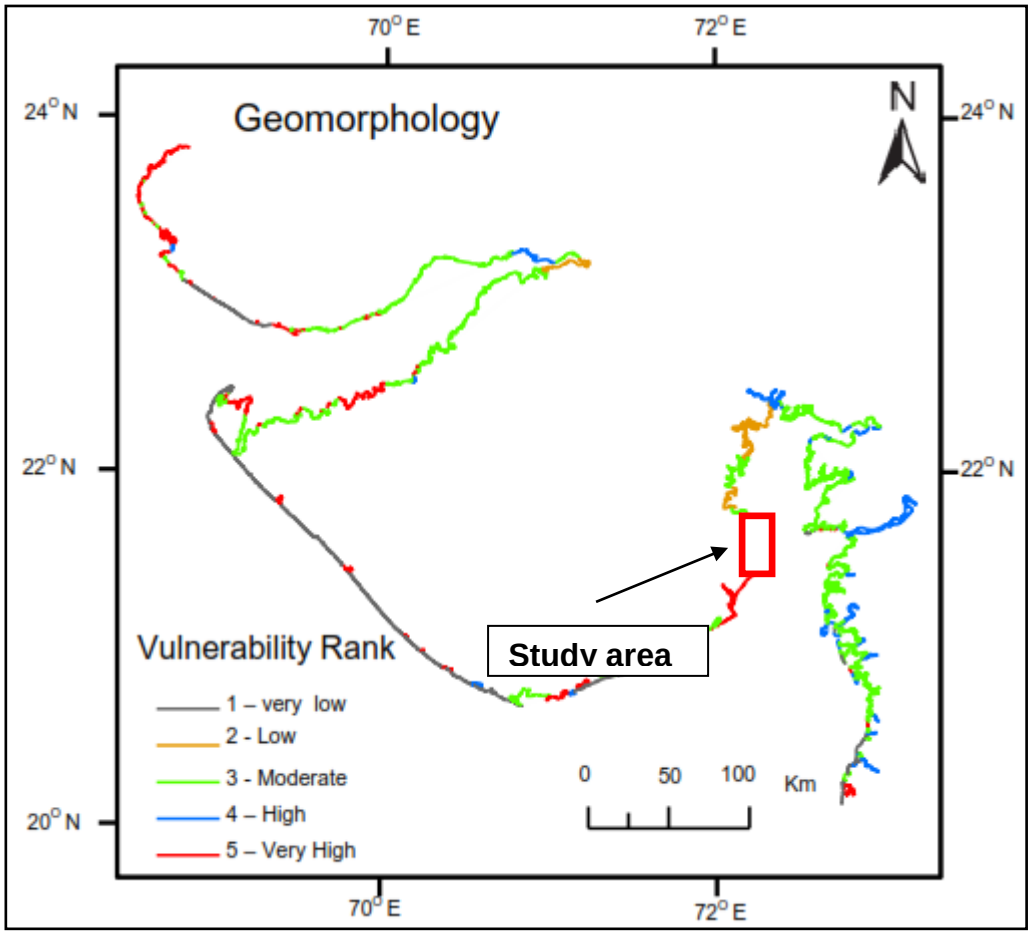
Flamingo species distribution is associated with inland and coastal alkaline or brackish waters and they are morphologically adapted to exploit microscopic food resources from these ecosystems through filter feeding. These habitats are threatened by conversion to salt pans and soda ash mining, degradation and fragmentation of associated ecosystems especially catchments (Simmons, 1996). The present study demonstrates various threats identified at both breeding and non breeding habitats of the species. The threats at breeding sites included egg proliferation, disturbance to nesting sites by fishermen, damming of rivers that drain into LRK resulting into low or no water at the time of flamingo breeding. Threats at breeding sites include pollution from the surrounding industries at Kumbharwada and conversion of abandoned saltpans into salt manufacturing units at Newport site.

Low recruitment rate has been cited as the most probable cause of lesser flamingo declines in Southern Africa (Fox *et. al.,* 1997). A study carried out in Lakes Nakuru, Elementeita and Bogoria from 1994 to 1998; found that food availability was an important factor affecting recruitment (Githaiga, 2003). Periods of low food availability were associated with fledgling failure in subsequent periods. No such information on recruitment rate of the species has been collected during the present studies and also during the studies carried out earlier in Gujarat (Tere 2005).

Increase in the area under saltpans in Gulf of Khambhat and Bhavnagar in particular is one of the major threats to feeding habitats of Lesser Flamingo. Due to very high tides, large coastal plains, fine spread of seawater, large tracts in these areas are potential salt manufacturing areas. This increase in area under saltpans on the western coast of Gulf of Khambhat is also a threat to the Flamingo habitat. The area under salt manufacturing processes has increased manifolds in past decade resulting into decline of Flamingo habitats (Charatkar et al 2004).

On the basis of vulnerability to sea level rise and possible inundation, Space Application Centre (ISRO), Ahmedabad, has divided the Gujarat coastline into

several vulnerable classes/ranks, these are Very High (Beaches, Mangroves, Coral Reefs, Intertidal Mudflat, Sub-tidal Mud Flats, Creeks), High (Water logged low depressions, Lagoon, Estuaries), Moderate (Supra and High Tidal Mud Flats, Salt Flat and Salt Mars), Low (Coastal Plain and paleo mud flats), Very Low (High lands and Rocky coasts) (Fig. xx). (Coastal zones of India, SAC, ISRO).



Source: Coastal zones of India, SAC, (ISRO)

Fig 4: Map showing Coastal Vulnerability on the basis of geomorphology for the Gujarat coast

The report states that, the soft sandy and muddy forms such as, mudflats, mangroves, etc. that are typical of the Gulf of Khambhat offer least resistance, and are highly vulnerable to sea-level rise. Fig 4 below shows that the study area falls in the category of 'Very high' category of vulnerability to sea level rise.

Plate 1

A. Cattle herds at Kumbharwada site

B. Cattle population of slum dwellers is a major threat

C. Rapid spread of *Porteresia coarctata* shrinking open water habitat

Plate 2

A. Spread and growth *of Aeluropus lagopoides*

B. Industrial power-lines at Kumbharwada site

C. Release of Industrial effluents

Plate 3

A. Solid waste disposal at Kumbharwada site

B. Vehicular traffic at Kumbharwada site

C. Salt transportation activities

Plate 4

A. Conversion of Fellow lands into Salt pans

B. Lesser Flamingos engaged in Nest building at Cherwari site

Plate 5

A. Water level flactuations during breeding season

B. Egg lifting by fishermen at Cherwari nesting site

C. Powerlines across Surajbari Creek