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INTRODUCTION OF GIS TO STUDY MARINE TURTLES

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ABSTRACT

Geographic Information system is a computer based programme by which the data can be stored, retrieved, manipulated and analyzed and the results are obtain in the form of maps. It helps in planning, improving of organizational integration, making better decisions and making map. GIS was introduced during late1960s. In Pakistan various organizations are using GIS such as SUPARCO, Pakistan Forest Institute (Peshawar), NWFP Forest Department, Environment Department (Punjab University), Sindh Forest Department, Sindh Wildlife Department and some NOG's & Petroleum companies. This study reports on the records of satellite data from tags fixed on two female turtles (*Chelonia mydas*) and GIS mapping of the location of marine turtles and their migration pattern. The movement of two turtles fixed with satellite transmitter of their carapace was monitored through GIS and their location was recorded by sophisticated satellite-based data system (ARGOS). The study was carried out in collaboration with WWF-Pakistan and ERWDA-UAE. The results show that turtles visit beaches at every 13-15 days. Turtles may remain restricted in a localized area and can also migrate great distances in a short time. This study will be helpful for better management and research of marine turtles in Pakistan.

Key-words: Marine turtle, Geographical study, computer dat based program, Karachi coast, Pakistan.

INTRODUCTION

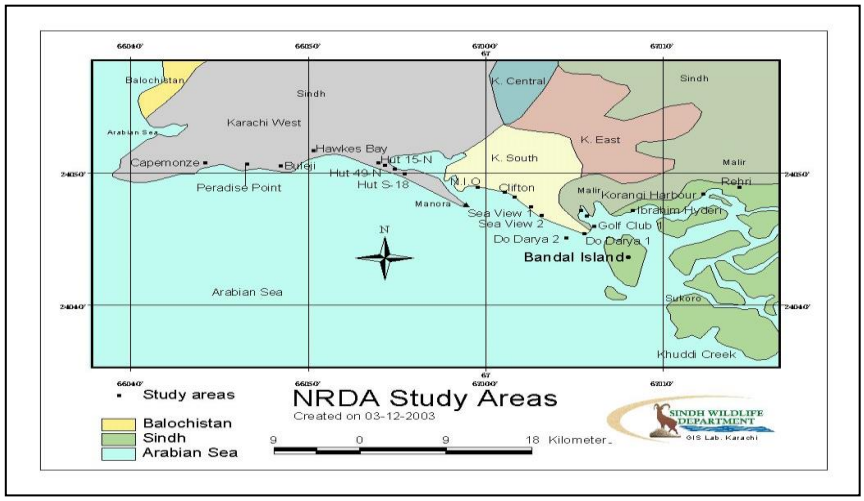
Geographic Information system (GIS) is a computer based programme by which the data can be stored, retrieved, manipulated, analyzed and the results are obtained in the form of maps. It helps in planning, improving organizational integration, and making better decisions through maps. When introduced in 1960s, the use of GIS was limited to a small number among research and application users. GIS combine layers of information about a place to give us a better understanding of that place. Unlike a paper map, where "what we see is what we get" a GIS map can combine many layers of information.

On paper map, cities are represented by a little dots or circles, the roads by black lines, the mountain peaks by tiny triangles, and the lakes by small blue areas. Whereas a digital map created by GIS gives similar type of representation alongwith additional information based on geographical, ecological or biological data or any other information in layers. The difference is that GIS uses information from a database and is shown only if the user chose to show it. The database stores detailed data, such as, where the point is located, how long the road is, and how many square miles is the area of a lake. Each piece of information in the maps placed on a layer and the users can turn on and off the layers according to their needs. One layer could be made up of all the roads in an area. Another could represent all the lakes in the same area, yet another could represent all the cities. The GIS hence retrieve selected information to create specific maps showing details that are required. A complete GIS requires hardware, software, data, trained user, methods for analysis and interpretation of results. An accurate GIS system must contain all of these elements.

A GIS works with observations or measurements that can be tied to a specific geographic location on the ground. Another common term for mapped data is spatial data which vary with location, so the nature of the data that we collect, measure and interpret will change as we consider various locations on the earth's surface. Observations of the earth's surface are recorded on maps to portray the spatial data in a format that is easy to comprehend (Queen and Blinn, 1993). GIS is universally utilized for research in the fields of Natural Resource Management, Agriculture, Forestry, Mining, Health Services, Conservation, Wildlife Management, Petroleum, Marine Sciences and Environmental studies.

In Pakistan various government organizations are using GIS such as SUPARCO, Pakistan Forest Institute (Peshawar), NWFP Forest Department, Environment Department (Punjab University), Sindh Forest Department, Sindh Wildlife Department, National Institute of Oceanography and some NGOs & Petroleum companies. GIS was introduced to Sindh Wildlife Department, Government of Sindh during the year 2000, for base line environmental study of Khirthar National Park. Three-dimensional digital elevation model of this particular geographical area has been generated for the first time in Pakistan. The GIS study on marine turtles was started in 2001. Marine turtles are universally declared as protected wildlife species. They have been given legal protection in Pakistan under provincial wildlife ordinance of 1972 (Firdous, 1988). Their trade and commercial exploitation is prohibited as Pakistan is signatory to CITES (Convention on International Trade in Endangered Species of Fauna and Flora) (Firdous, 1997).

Recently, GIS has been used in marine environment to study the location of marine turtles and their migration pattern. This study will be helpful for better management and research of marine turtles in Pakistan.

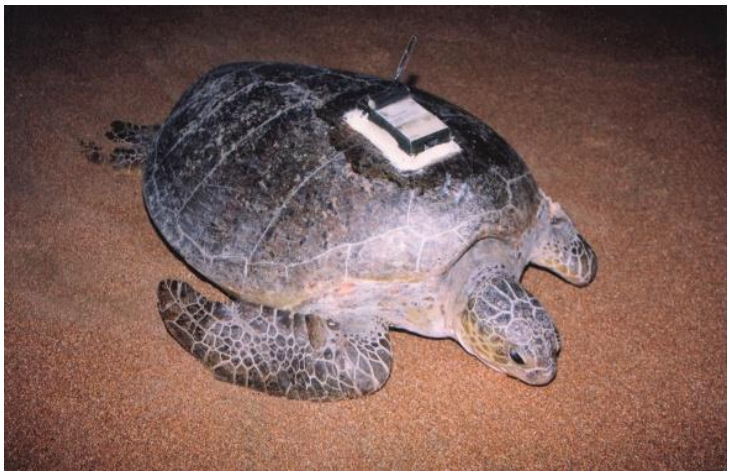


MATERIALS AND METHODS

With the collaboration of World Wide Fund for Nature-Pakistan (WWF-P) and Environmental Research & Wildlife Development Agency-UAE (ERWDA), the movement of two green turtles (*Chelonia mydas*) referred as Chandni 1 and Chandni 2, respectively, was monitored using satellite transmitters fixed on the carapace (Fig. 1). Data on the location of these turtles was recorded via satellite-based data system, ARGOS, and plotted on GIS maps. Their migration pattern and behavior during feeding, mating and nesting were also observed.

RESULTS

A satellite transmitter was installed carapace of Chandni 1 (97x87 cm shell size) on 02-08-2001 after it has laid eggs (Table I), and released on same date. Position of the turtle was monitored via satellite through surfacing records of the animal. A signal is recorded every time turtle surfaces for breathing. Data was recorded at 12 instances on 11, 17, 21, 22, 30 and 31 August 12 September before it became unusable.



During the period from first release upto the last observation recorded by the satellite the turtle was observed lying eggs only for 3 times. Details of nestings, eggs laid and interval between nesting are given in Table I. It was interesting to note that turtle visited beach four times in a month (August 2001) and laid eggs at three instances at 13 – 15 days interval.

Table I. Nesting behavior of Chandni 1 and 2

Nesting date	Number of eggs laid	Interval (days)
Chandni 1		
02 August 2001	102	First nesting
17 August 2001	93	15
28 August 2001	Returned without lying eggs	26
30 August 2001	103	28
Chandni 2		
03 August 2001		First nesting
17 August 2001		14

The second green turtle, Chandni 2 was released on 03-08-2001 after a transmitter has been fixed on its carapace. Chandni 2 surfaced at 7 occasions on 07,15, 17 and 24 August 2001 and 04, 13 and 14 September 2001. It has laid eggs twice during the whole duration of 43 days (Table I) with an interval of 14 days between two nesting occasions.

The results obtained through GIS maps (Figs. 2 and 3) reveal that Chandni 1 remained in the vicinity of Karachi after it has been released. It traveled a calculated distance of about 150 km. On the other hand Chandni 2 traveled longer distances and surfaced along the Balochistan coast on 07 and 15 August. Chandni 2 returned to Karachi coast to lay eggs on 17 August. Although Chandni 2 remained in the vicinity for another 28 days, but she did not return to the beach for nesting.

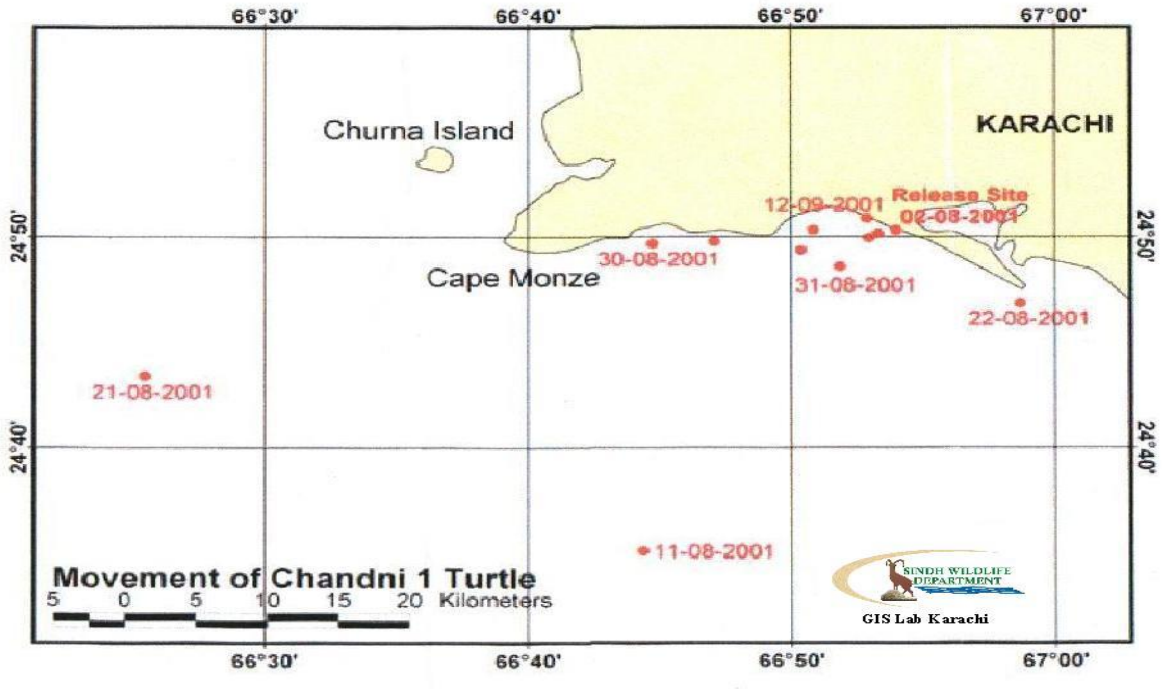


Fig. 2. GIS map showing movement of Chandni 1 during August 2001.

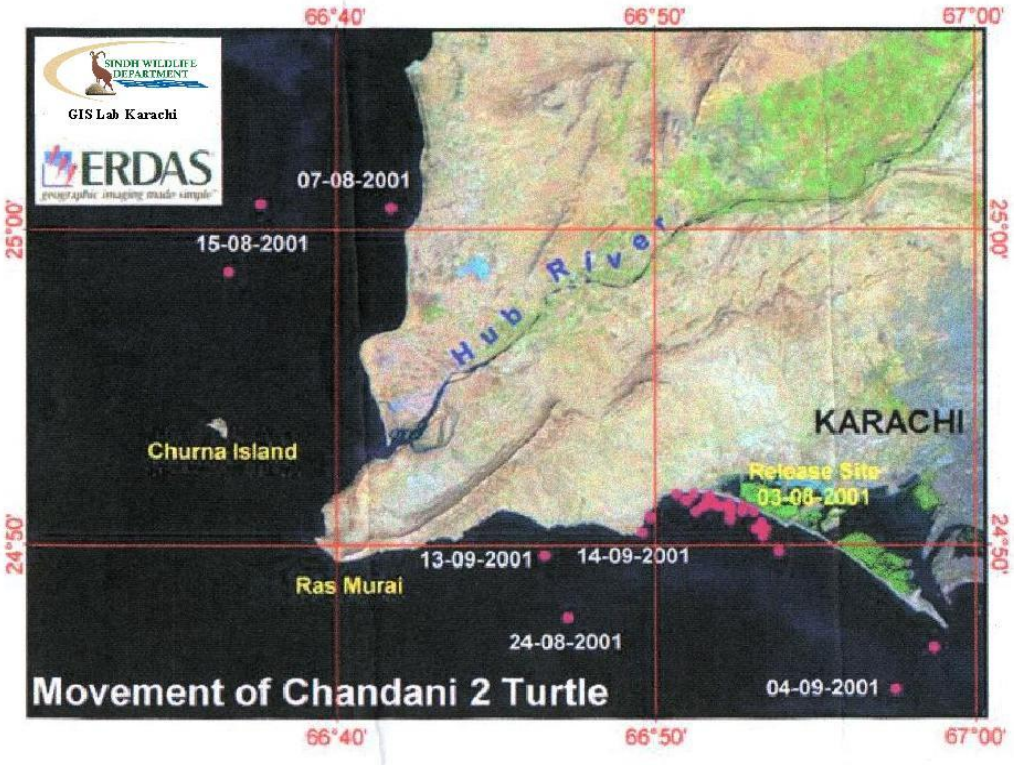


Fig.3. GIS map showing movement of Chandni 2 during August and September 2001.

It may be recommended that satellite tagging and monitoring of turtles and use of GIS mapping is required on a larger scale in which long term monitoring is done on more turtles and possibly of different species to investigate home ranges of these turtles, their migratory pattern and nesting frequency.

REFERENCES

Queen, L. P. and C.R. Blinn (1993). (1993) "The Basics of Geographic Systems" NR-F05926S. NR-PC-6136-S, MINNESOTA EXTENSION SERVICE, University of Minnesota, Natural Resources.

Firdous, F. (1988). Conservation of Turtles at Hawkes Bay Sandspit Beaches,Karachi. *Proc. Of an International Conference Marine Science of the Arabian sea*; 217-22, edited by Mary-Frances Thompson & Nasima M.Tirmizi. Published by American Institute of Biological Sciences Washington, D.C.

Firdous, F. (1997). Marine Turtles and CITES in Pakistan. *Natura, W.W.F Pakistan*, 23(21): 7-8.

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