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Application of Probability Method in Indus Dolphin (*Platanista minor*) Population Estimation

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Abstract: During the study 129 dolphins were observed at 56 different sites with mean group size of 2.30. Total 199.2 dolphins were estimated from Chashma barrage to Guddu Barrage. 81.19% dolphin population had surfacing-interval 0-120 seconds, 16.83 percent 120-240 seconds. The dolphins were observed with probabilities $p=1.0$, $p=0.26$ and $p=0.21$ respectively. Sighting distance and surfacing-intervals were important parameters in dolphin population estimation. With increase in sighting distance and surfacing-interval, the probability of visibility of dolphins on surface of water decreases and chances of missing dolphins from observations are increased.

Key words: Indus dolphin, sighting probability, dive time, correction factor, population estimation

Introduction

Blind Indus dolphin or Bhullan (*P. minor*) is an endemic Cetacean distributed in the Indus River System in Pakistan. Its present distribution ranges from Chashma Barrage downstream up to Sukkur. Historically the species was distributed, in the Indus river system, including all the main tributaries (Jhelum, Chenab, Ravi and Sutlaj) from the foothills, where the river entered the plains to Indus delta (Anderson, 1879). Presently it is confined to heavily turbid and silt laden waters of the Indus from downstream of Chashma Barrage (Punjab) to Kotri Barrage (Sindh). Due to construction of barrages and link-canals, available habitat for dolphin has been limited and population has declined drastically.

The Indus dolphin has been enlisted as endangered in IUCN (International Union for Conservation of Nature) Red Data Book since 1976 and is on Appendix of the CITES (Convention on International Trade in Endangered Species), hence warranting strict protection. It is protected under the Punjab Wildlife Act (1974), NWFP (1975) and Sindh (1997). Indus river stretch, in northern Sindh from Sukkur Barrage upstream to Guddu Barrage near Kashmor (135 Km) has been declared a Dolphin Reserve. Taunsa Barrage (657 has) was declared a Wildlife Sanctuary and the river stretch between Chashma-Sukkur Barrage was proposed to be declared a Wildlife Heritage Site.

Materials and Methods

Cetaceans lack gill-system and appear on surface of water to take oxygen. This appearance on water-surface is termed as surfacing. The interval between two consecutive surfacings is called surfacing-interval or dive time. It is the surfacing-phase only when dolphins appear on water-surface and can be noticed and recorded.

River-segment from Chashma-Guddu Barrage (685 km) was surveyed during April and December-1997, on a motor-boat driving downstream at moderately slow speed. Three observers with boatman deployed on front, right side, left side and behind on motor boat recorded observations to make maximum counts. Sighting distance of dolphins from observers, surfacing-intervals and group size were noted. With increase in sighting distance and surfacing-intervals, the chances of missing some of animals from observation are increased. Correction factor (CF) was worked out from sighting probability for distance and surfacing-interval probability to compensate missing population.

$$\text{Correction factor (CF)} = \epsilon \frac{\text{Surfacing-Interval Probabilities}}{\text{Probabilities for sighting distance}}$$

$$\text{Estimated population} = \text{No. of dolphin sightings} \times \text{CF} \times \text{Mean group size}$$

Mean group size was worked out dividing total number of dolphins observed by total number of sites, where dolphin or dolphin groups were observed (Reeves and Leatherwood, 1994).

Results and Discussion

Population estimates were based on Probability Methods. Sighting distance and dive time were considered two important parameters in dolphin study. 129 dolphins were observed at 56 different sites with mean group size of 2.30. Within distance ranging from 0-100 m from observer 38 dolphin groups were observed. From distance 100-200 m, ten and from 200-300 m, eight dolphin groups were observed. Sighting probabilities were derived on the basis that all dolphins present within distance 0-100 m from the observe were 100 percent visible on the surface of water ($p = 1.0$) due to small sighting distance and there were no chances of missing dolphins from sighting within this distance. With increase in distance from 100-200 m and 200-300 m, the probabilities of sighting dolphins on surface of water decreased as 0.26 and 0.21 respectively (Table 1).

For surfacing-intervals (dive-time) 101 observations were recorded on different animals, preferably 3-4 observations on one animal. In 82 observations, surfacing-interval ranged 0-120 seconds, in 17, 120-240 seconds and in two observations 240-360 seconds. 81.19 percent dolphin population was visible on water surface within dive-time ranging from (0-120) seconds, 16.83% (120-240) seconds and 1.98% (240-360) seconds. With increase in surfacing interval, probability of visibility of dolphins on water surface decreased from 0.811 to 0.168 and 0.019 respectively (Table 1).

Correction factor was derived by dividing surfacing-interval probabilities by sighting probabilities for distance to compensate for missing dolphin population. 199.2 dolphins were estimated to be present from Chashma-Guddu Barrage out of which 129 dolphins were actually observed. According to estimates 70 dolphins could not be observed due to increase in sighting distance and surfacing-interval and were missed from counting (Table 1).

According to results 81.19 percent dolphin population had surfacing-interval upto 120 seconds and this population was observed 100 percent ($p=1.0$) within distance 0-100 m from observer. 16.83 percent population with probability (0.26) within distance 100-200 m and. 1.98 percent population had surfacing-interval 240-360 seconds and was observed with probability (0.21) within distance 200-300 m (Table 1).

A fairly good population of Indus dolphin was reported to be present at Taunsa Barrage by Niazi (1985, 1986), Chaudhry and Chaudhry (1988), Niazi and Azam (1988), Chaudhry and Khalid (1989). Roberts (1977) estimated total population of dolphin well below 200. Reeves and Leatherwood (1994) counted a minimum of 35 dolphins in the first 50 km of river upstream of Guddu Barrage.

Table 1: Estimated population of Indus dolphin from chashma-guddu barrage

Sighting distance (m)	Surfacing intervals (second)	Sighting probability for distance	Surfacing interval probability	Correction Factor (CF)	Mean Group Size	Estimated population
0-100	0-120	1.0	0.811	0.811		
100-200	120-240	0.26	0.168	0.646	2.30	199.2
200-300	240-360	0.21	0.019	0.090	1.547	

Recovita (1964) was among the first biologist to call attention on the importance of surfacing-interval performed by the cetaceans. According to Chaudhry and Chaudhry (1988), surfacing-intervals are useful in adjusting the scan time of the river surface and observed this range between 09-98 seconds. According to Pilleri (1980) dolphin exhibit longer surfacing-intervals during active swimming while chasing its prey, particularly at night. All these estimates were direct counts and no attempt was made by any author for population estimation following standard statistics. However, surfacing-interval and sighting distance were considered for the first time to make dolphin population estimates in the present study.

The study was very important to make precise dolphin population estimates for the first time in the river Indus. Sighting distance and surfacing-interval were identified very important factors in making precise and accurate estimates. As distance between observer and dolphins increases, the chances of sighting dolphins on water surface decreases. Similarly with the increase in surfacing-intervals, there are chances that observer may pass without noticing animal under water missing dolphins from counting. When both of these factors were increased, chances of sighting dolphins on water-surface were decreased and chances of missing some of the animals from counting were increased. It was concluded from the present study that accuracy of the estimates depends upon:

- i. Correct recording of sighting distance
- ii. Inter-surfacing interval recording precisely
- iii. Data recording on clear days
- iv. Accuracy in determining group size

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