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HISTORICAL AND CURRENT STATUS OF THE INDUS RIVER DOLPHIN [PLATANISTA MINOR) OWEN 1853: ITS CONSERVATION AND FUTURE.

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Abstract

Platanista minor, the blind Indus dolphin or "Bhulan", is one of the most endangered mammals on earth- Like its close cousin of the Ganges river dolphin Platanista gangetica, it was once widespread in its river basin and was hunted for its meat and oil. Controlling the flow of the Indus by a series of low barrages, which divert water into an infrastructure of irrigation canals, has divided the population into sub-populations demarcated by the barrages.

The direct and indirect effects of fishing and pollution, both domestic and industrial, have reduced the population to a few hundred individuals in the central section of the main Indus river. Since the species gained legal protection and international status, regular monitoring has taken place both with Sindh and Punjab provinces. If survey problems can be overcome and an agreed methodology adopted then better population estimates can be obtained. The future of the animal lies in reducing pollution pressures, returning canal-stranded animals back to the main owner, examining ways of overcoming the barrage as a physical barrier to dolphins, educating both fishermen and the population as a whole as to the value of the species and encouraging eco-tourism.

Keywords: Platanista, river dolphins, Pakistan, Indus.

Introduction

River dolphins, particularly those in Asia, are amongst the most endangered mammals on earth. In the Yangtze the "Baiji" or Yangtze River Dolphin (Lipotes vexillifera} teeters on the brink of extinction, with a total population of less than 200,in spite of last minute efforts to conserve the remaining stock (Peixun & Yuanyu, 1987). The Ganges River Dolphin (Platanista gangetica)or "Susu" still occurs in parts of the Ganges and Brahmaputra catchments and is threatened by many, mainly anthropogenic factors (WDCS, 1998). The second of the two Platanista species, the Indus River Dolphin or "Bhulan", P. minor, (synonym P. indi Blyth, 1858) with a population in the"hundreds" (Reeves & Chaudhry, 1998), is confined to a number of virtually isolated populations in the central section of the River Indus in Pakistan where there are numerous threats to its continued survival.

Status

Although the Bhulan is part of Sindh folklore - (it is said a girl who refused to sell milk to a man in Munghopir was pushed into the river where she changed into a dolphin and could for ever say only "push, push" (Mirza & Khurshid, 1996), the sound of the dolphin surfacing to breathe), - sciencelargely ignored the blind Indus dolphin until very recently. When Anderson in 1879 produced his monograph on two cetacean genera including PIatanista, the Indus river dolphin then occupied much of the river's catchment including its tributaries

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Jhelum, Chenab, Ravi and Sutlej downstream of their upland sections, over 3000km of potential habitat. Hunting of dolphins in both the Ganges and Indus catchments has probably continued for centuries to provide meat and oil (Eschricht, 1852, Jerdon,1874; Blanford, 1891) but at an environmentally sustainable level. Historically the oil has been the most valued product domestically, rubbed into the skin to alleviate muscular pain or as an aphrodisiac. Scientific interest in the species was aroused when, in 1968, a team from San Francisco USA took three young female dolphins from an area upstream of Sukkur and shipped them to the USA, though they all died within three months (Herald, 1969). Although Herald et al. (1969) did confirm that the animal was effectively blind, swam on its side and found prey by echolocation. In 1969, Georgio Pilleri took two of three live specimens caught near Sukkur to Berne in Switzerland; but none survived more than a few years (Reeves et al., 1991). Though a Japanese group visited the area in 1974 and independently confirmed that the species was in decline (Kasuya & Nishiwaki, 1975), it was Pilleri together with the Karachi businessmen'and naturalist T.J. Roberts, who carried out most research on the species and alerted the world to the perilous status of the species. Mainly foreign overviews of aspects of ecology and conservation by Jones, (1976), Reeves & Leatherwood, (1994), Reeves & Chaudhry (1998), Reeves et al., (1991), Reeves et.al, (1993) have built on this leading to the current research jointly between the University of Sindh and Cardiff.

Survey methodology

Partly due to the lack of modern technology, the usual way to survey the Indus River Dolphin population is by counting them as they surface for air. The method is fraught with problems:

i the main river may be several kilometres wide and animals may surface beyond the visual range of the observer consequently "transects" rather than whole rivers are counted.

ii as the animal often swims in schools and each animal has varying dive times, under and multiple counting of individuals is a potential problem

iii In river, rain, high winds, sand or dust storms, sun glare and sever heat can impair sighting efficiency.

Result

Even between the conservation agencies of Sindh and Punjab there is no absolute agreement concerning methods of counting with each Province counting separately and differently. They feel that making two counts, one sailing upstream and one sailing downstream in a "locally made sailboat" and then taking the mean of the two counts is impracticable in view of the problems of sailing upstream against the current. The Punjab Wildlife Department uses a motorboat with two or three observers to do tine transects whilst travelling downstream at 5-10 km per hour in the low water periods of October - November and March–April, counting and spatially recording animals but not ageing or sexing them other than to note young of the year. However, the relative merits of the two techniques are not clear cut- The Indus, unlike the Ganges, carries very few motorised craft and the use of sailboats is likely to cause less disturbance so could contribute to accuracy. The collection of data in Punjab by Chaudhry *et al.* (1999) records the density of animals in that province as 0.7 /km^2 between Taunsa and Guddu and 0.4/km^2 along the entire Guddu to Chasma length (Table 1). A similar calculation on the Sindh data given by Mirza & Khurshid (1996), for the Sukkur to Guddu section, gives a density of 5.4 animals/km2 (Table 2). In 1997 Chaudhry *et al.* (1999) recorded 90 dolphins in 34 groups between Taunsa and Guddu with group

sizes ranging from 1 to ten with a mean group size of 2.6 individuals. In contrast, in 1996, Mirza & Khurshid on the Sukkur to Guddu section recorded 458 animals in 18 schools, varying in group size between 8 and 50 individuals giving a mean school size of 26.9 individuals (Table 2). Although it is not clear if the definition of "group" and "school" are the same in Punjab and Sindh it is probable that there is a real difference in density in these sections even though the date are, because of the uncertainties about collection, not amenable to statistical analysis. The metapopulation is now effectively divided into a number of sub-populations, each demarcated by the barrages. Moreover, whereas it was widespread in the Indus catchment in the nineteenth century (Anderson 1879), the dolphin is now restricted to the central length of the main river (Figure 1). Reeves *et al.* (1991) estimated that the effective range of the animal has fallen from some 3 500km in the nineteenth century to less than 1700km today. The six main river barrages in upstream order are Kotri barrage near Hyderabad, Sukkur barrage, Guddu barrage, Taunsa barrage, Chashma barrage and Jinnah barrage (Figure 1). Pilleri & Bhatti (1978) counted 17 dolphins between Sukkur and Kotri barrages and Khan (1986) 21 in the same stretch but in 1996 no dolphins were found here by Mirza & Khurshid (1996) in a 29 day survey, neither did they find any downstream of Kotri to the delta. However, GSG (1999) counted 30 dolphins between the Sukkur and Kotri barrages and none below the Kotri barrage (Slater and Gachal, 2003). In a 31 day survey between Sukkur and Guddu in April/May 1996 Mirza & Khurshid (op-cit) found between 339 and 458 dolphins (i.e. their upstream and downstream counts). Chaudhry *et al.* (1999) note the increase in the Sukkur - Guddu population as counted by various recorders from 150 individuals in 1974, to 242 in 1978, 429 in 1986, 450 in April 1987, 439 in 1992 (Table 2). Monthly counts by one of the present authors (GSG) reached a maximum of 367 in August 1999 which is within the 1996 range of Mirza and Khurshid's'counts (Table 2). Whether this is a real increase in population over two decades or reflection of improved counting techniques is not clear. The only recent data for the proportion of calves in the population are those given by Mirza & Khurshid (1996) and unpublished data from GSG both for Guddu to Sukkur. It is possible to differentiate calves from adults by size, less certainty can be attached to sexual differentiation observed in the field, therefore a nominal figure for females has been taken as half the counted adult number. On this basis the ratio of "females" to calves in Mirza & Khurshid's data in a total counted population of 339-458 is between 6: 1 and 8.5 :1 for 1996. For GSG's counts in 1999 the May ratio was 8.2:1 and June 6.3: 1 in a population count of 367. In contrast an April count in 1980 (Bhatti & Pilleri,1982) gave a ratio of 2.6 : 1 in a total population of 346 individuals. Although the overall population counts have increased since the 1970's they have either remained stable or even declined slightly since the early 1990's in both Sindh and Punjab- While these data may not stand statistical scrutiny, the apparently poorer ratio of females to calves in the late 1990's compared with 1980 may be cause for concern- However, so little is known of the biology of these animals (Pilleri, 1972a) that the database on which to make informed judgements is lacking. Given the inaccuracies endemic in counting an animal undetectable except when it comes up to breathe (see Mirza & Khurshid data for 1996 quoted above), absolute numbers need to be approached with caution. A regression analysis of the above numbers against years give $y = -28609 + 14.59 x$; $R2 = 0.84$; $P = 0.01$ suggests a real increase overtime. Upstream of Guddu the river flows through Punjab Province and dolphins are distributed throughout the section through the Taunsa to the Chashma barrage. A few dolphins were reported below the Jinnah

barrage in 1977 and 1978, but few records have subsequently been published for this reach. Chaudhry *et al.* (1999), tabulated their own data and that of Kasuya & Nishiwaki (1975), Pilleri & Pilleri (1979), Pilleri & Bhatti (1980), Niazi (1985, 1986) (Table 1-2). They subdivided the Guddu to Taunsa section into two at Nishtar Ghat, the point where the major eastern tributaries enter the main river. Although the numbers fluctuate, the overall trend seems to have been upward from 1989 to 1996, but dropped in 1997 and 1998. The regression analysis given in Table 2 does not show a significant trend in the overall data.

Conservation Problems

Barrages

These structures effectively sub-divide the population such that there is no possibility of natural upstream movement, in spite of the fish ladders within barrages (which themselves are abused as centres of fishing activity). During floods, caused by monsoons the flood gates of the barrages are opened and it is thought that some dolphins may be swept downstream. As the population size increases downstream as far as the Sukkur barrage, it is the smaller upstream populations which will suffer most from such events. It could be argued that the increasing numbers downstream might result from passive displacement. It is, however, significant in our view, that the best population is in the best protected area i.e. between Sukkur and Guddu. Some animals will undoubtedly pass through open barrage gates in time of flood and be stranded downstream but young animals are found in all dolphin inhabited sections of the river and it is likely that natural recruitment is more significant than displacement. The problems associated with small, genetically isolated sub populations has yet to be determined. It may be valuable in genetic terms to replace animals rescued from canals in the nextupstream population in order to introduce an element of genetic mixing-So much water is used for irrigation via the canals which emanate from the barrages that in winter little water is left in the river downstream of about Hyderabad. Such water loss reduces parts of the river to pools, effectively trapping dolphins which may starve or become easy prey for hunters. Some dolphins enter the irrigation canals where at best, they are lost to the main breeding population or at worst are killed or die when canal levels drop (Gachal and Slater, 2001). The barrages have effectively blocked the river upstream of the Kotri barrage to the "Palla" or Hilsa" {Hilsa ilisha) a fish which migrated into and up the river to breed but cannot negotiate the fish ladders. It was once the main catch of thousands of fishermen and potential prey for the dolphins. Downstream of the barrages, changes in flow rate and sediment transport could affect prey, and above barrages the river changes from a lotic to a lentic environment and prey availability may be influenced by changed sedimentation rates, increased nutrients, and at times an elevated BOD (Slater and Gachal, 2002). Just upstream of the Sukkur barrage, the authors observed streams of raw sewage entering the river and floating on the river surface, while large quantities of refuse were boated to the centre of the river and dumped. Because of the ponding effect of the barrage, this polluting material is slow to be dispersed. It is reasonable to assume that this pollution would affect the biota of the river and, in consequence, the dolphins.

Water pollution

Water pollution in the form of untreated sewage is endemic in urbanised areas of the river. Tariq et al. (1996} describe the Indus as "a dump house for all types of waste products streaming into it via its tributaries". The Government of Pakistan (1989) says "occurrence of massive fish kills and the destruction of lower aquatic forms due to

the indiscriminate use of pesticides in the agricultural fields along river banks and the release of industrial pollutants into water bodies has become a common feature in various parts of the country".A city such as Lahore discharges 250 million gallons of untreated sewage each day into the Ravi river, a river that is frequently devoid of fish. Chaudhry et al. (1999) describe the industrial pollution on some of the Indus tributaries. Near Lahore various chemical industries, tanneries, textile plants, steel rolling mills discharge effluents containing hydrochloric acid and high levels of organic matter directly into streams and canals, producing BOD levels up to 633 mg/litre and mercury levels of 5.6mg/litre - compared with government standards of 200-and 0.1 respectively. Chaudhry et al. (1999) report an annual 7% rise in the use of fertilisers and a 190% increase in the imports of pesticides between 1981 and 1987 the most recent available data,. The indiscriminate use of agricultural chemicals leads to chemical pollution of the environment. Excess fertiliser run off into water courses causes uncontrolled algal growth and pesticides in water may kill all animal life including fish, and may bioaccumulate through the food chain leading to dolphin contamination (Slater and Gachal, 2002).

River fisheries

While the threats of direct killing are diminishing, for the Indus dolphin the problem of by-catches, the incidental capture of dolphins during routine fishing operations causes most concern. Although Evans (1973) shows that river dolphins have excellent sonar, so may be able to detect gill nets, the increasing human population dependent upon fishing and the increasing use of monofitament line for net construction may lead according to Reeves et al. (1993) based on Ganges data to more entanglements and hence possible fatalities. Reeves et al. (1991) on the one hand show that reported catches of fish at Taunsa barrage rose from about 75,000 kg in 1980 to 170,000kg in 1989, putting pressure on the fish resources. Although one of the present authors (GSG) has observed Sindh fishermen using pesticides spread on the water as a fishing technique, a clear threat to the ecosystem (Gachal and Slater, 2001).

Canal rescues

In November 1999 both authors observed the Sindh Wildlife Service capture and transport back to the Indus a 20kg dolphin calf from a rice canal near Sukkur. While the rescue was underway, in a parallel but unconnected canal some 50 to 100m away, another much larger dolphin was seen. Unless this was a very uncommon coincidence, far more dolphins are trapped in these canals than is generally reported. In December 1999 and again in January 2000 (this latter with the co-operation of WWF - Pakistan) GSG assisted the Sindh Wildlife Service with the capture, transport and release of two more individuals from canals near Sukkur to the main rivers. The January animal was a female 2.1m in length. During this same rescue period a further two animals were reported dead from canals, at least one had been shot.

Discussion

The future

The long term fate of the Indus river dolphin must be viewed in the context of a human population increasing at 3% per year, and an industrial and agricultural economy trying to keep pace with increasing demands but without the environmental constraints which would be imposed in more developed countries.The animal has legal protection but law enforcement is, to say the least, problematical. It has the advantage of not being regarded as food by most Muslims, although its oil is or was used for medicinal and domestic purposes. To be safe, the

human population must be favourably disposed towards the species and this is an education task. The Worldwide Fund for Nature in Lahore are encouraging a group of folk dancers to extol the virtues of the species in dance and song, and to take the performance to riverside villages. The dolphin calf rescue in November 1999 from near Sukkur also demonstrated a way of educating the local people. Many people from the local settlement came to watch the process of catching and transporting the animal. Many had never seen the animal before and some were afraid of it because of its array of teeth. As the animal was being brought to the bank some young boys were in the water at the same time and were, not surprisingly, unharmed- This, however, ensured that the local people would all know about the animal and would also have heard that it was harmless to them - a message difficult to put across in a more effective way- If animals could be routinely captured when they became trapped in canals, they could be used/translocated to reinforce small populations. Too little is known about the genetic viability of the sub-populations. It is of concern to compare these populations with isolated populations of Bighorn Sheep (Ows canadensis) which Berger (1990) found to be destined for extinction within 50 years if populations were fewer than 50 individuals. It is necessary to determine the minimum viable population size with genetic studies incorporating work on the closely related Ganges river dolphin. Care must be exercised in interpreting some of the census data as information on school sizes has been shown by one of the present authors (GSG) to vary from month to month, suggesting possible mobility of individuals outside the core school area. If such mobility is part of the natural activity of dolphins, the isolation caused by barrages may be disrupting their behaviour. The current method of visual counts is far from satisfactory and other methods need to be considered. The difficulty of capture and the topography of the animal make tags of any kind generally unsuitable (discussion - S Asia River Dolphin Workshop, Lahore, November 1999) The use of recording hydrophones (Pierpoint et al. 1999) similar to those used with marine porpoises seem to be a possible method of tracking the animals in a non-invasive way . Reeves et al. (1991) suggest dolphin corridors to get the animals around barrages, but accepted that preparing a workable design would be a"formidable challenge". However, Reeves & Leatherwood (1994) reported that a Montreal engineer, at their request, prepared a preliminary sketch of a prototype dolphin swimway; there is no way of knowing that it would be used by dolphins if built. It is probable that in the long term the future of the dolphin lies in education not only of the people who live by or near the river but also of people of political influence and engineers. Teaching people that, by controlled eco-tourism, they may make an income from showing these animals to wealthy foreigners which would give the dolphin an economic value. An holistic approach to the conservation problem might be a way forward- In the developed world, there is a move towards the use of natural or constructed wetlands to treat sewage and other effluents (Cooper & Findlater, 1990). In comparative terms these are cheap and effective ways of solving pollution problems. If sewage or suitable industrial waste could be passed through a peripheral wetland before discharge into the river itself, many of the pollutants would be significantly reduced and with suitable management the wetland itself could produce a fuel crop to the benefit of the local population (Slater and Gachal, 2002). It these and other low cost water and environmental planning solutions could be brought to bear on the problems of the Indus. and if the international profile of the species was promoted – which is an aim of WWF – Pakistan.

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Table 1: Numbers of dolphins counted in the Punjab

SECTION OF THE INDUS: RAW TRANSECT DAT 1987-1998 (after Chaudhry et al. [1999]).

Year	Chashma-Taunsa Barraage	Taunsa Barrage Nashtar Ghat	Nashtar Ghat-Guddu Barrage	Total (n)
1987	47	22	47	109
1988	-	-	-	-
1989	15	30	53	98
1990	20	65	42	127
1991	35	37	71	143
1992	49	65	59	173
1993	51	54	57	162
1994	34	61	67	160-162
1995	38	57	60	155
1996	43	78	46	167
1997	39	80	10	129 (214-355)
1998	31	53	47	131 (218-289)

Table 2: Indus dolphin data between Sukkur and Guddu Barrages from 1974

Data	No of Dolphins	Source
January 1974	138	Pilleri and Zbinden, 1974
December 1974	233	Kasuya and Nishiwaki, 1975
February 1977	171	Pilleri and Bhatti, 1978
April-May 1977	187	Pilleri and Bhatti, 1978
October 1977	168	Pilleri and Bhatti, 1978
Feb-March 1978	191	Pilleri and Bhatti, 1978
May 1978	241	Pilleri and Bhatti, 1978
April 1979	240	Pilleri and Bhatti, 1980
June 1979	292	Pilleri and Bhatti, 1980
September 1979	291	Pilleri and Bhatti, 1980
February 1980	291	Bhatti and Pilleri, 1982
April 1980	346	Bhatti and Pilleri, 1982
March 1986	429	Khan and Niazi, 1986
March 1987	437	Reeves and Chaudhry, 1998
March 1989	370	Reeves and Chaudhry, 1998
November 1992	439	Reeves and Chaudhry, 1998
April-May 1996 upstream count	339	Mirza and Khurshid, 1996
April-May 1996 Down stream	458	Mirza and Khurshid, 1996
May 1999	104	Gachal and Sindh Wildlife Departt
June 1999	220	Gachal and Sindh Wildlife Departt
August 1999	367	Gachal and Sindh Wildlife Departt



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