

Gharial Telemetry Project, National Chambal Sanctuary

Progress/Activity Report May2010-Nov2011



A COLLABORATIVE PROJECT OF MCBT/GCA AND THE UTTAR PRADESH AND MADHYA PRADESH STATE
FOREST DEPARTMENTS

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December 15, 2011



Executive Summary

This activity/progress report covers the period May 2010 through November 2011, and briefly summarizes the Gharial Telemetry Project activities and preliminary results. It updates an Interim Progress Report, and supplements information provided subsequently to FD offices.

During this period, the ten gharial tagged with radios in 2008-09 were monitored until all radios ceased to function, the last in September 2011. Overall, a total of 2321 animal-specific locations for these gharial were recorded over 38 months. The average radio functioned for 2 years (24 months), and provided 152-311 location sightings per animal. The residency patterns of these gharial were restricted to 5-15 km of river length, and were well-defined and predictable, irrespective of season, as noted in prior reports, based on the first 14 months of tracking. The additional information collected during 2010-11 on these individuals confirms and expands on the earlier results and interpretations of spatial ecology. Because six of these individuals remained trackable during the last half of 2010 and the first half of 2011, tracking their movements overlapped with the tracking of ten more gharial, tagged in late 2010 downriver.

In contrast, the second group of gharial tagged with radios (in November 2010) resided at locations between the Udi Bridge and Sashon Ghat. These localities were approximately >40 km downstream of those of the first tagged group. The recently tagged gharial from this lower section of the river exhibited several distinct residency patterns. Like the previous group, some gharial (primarily the smaller males; n=5) had restricted residencies, centered at or near their respective capture sites. These individuals tended not to move very far upstream or downstream (<15km), a spatial pattern similar to most of the previously tagged gharial from the initial study group. However, the other five gharial in the second group, including 3 larger females and two small males, made long-distance seasonal movements, up and downstream for distances > 80 km. These individuals ranged downstream below the Yamuna confluence to Pachanada, and upstream to rocky areas (Gohera, and Godha) above Naangoan. These movements were seasonal and predictable, and tended to occur within 1-2 weeks followed by a stable residency at the new location. Three of these long distance movers were adult females, and one of these nested near her capture site.

In addition to the activities and preliminary results outlined above, selected discussion points are presented in this report. These topics include comments on radio attachment and function, monitoring protocols for tracking locations, seasonal capture scenarios, general gharial population health, seasonal and year-to-year variations, and the relevance of this study to the 2007-08 die-off of gharials in the lower Chambal River.

The workplan for 2012 entails the continued monitoring of the second tagged group of gharial through the entire 12 month period, particularly in an effort to learn and understand how these gharial respond to the major, and substantive changes in riverside landscapes, such as nesting beaches and basking sites, as a result of the extensive flow regime of the 2011 monsoon. The primary project personnel continues to be the two trackers working on motorbike and/or on foot, with periodic visits from MCBT/GCA staff and scientists, based at Sashon and Garhaita, UP.

Introduction

This activity/progress report briefly summarizes various activities carried out on the Gharial Telemetry Project, initiated in June 2008. The present report updates the Interim Progress Report, dated 28 May 2010, and supplements information presented in the Report on Phase II Tagging Operation, dated January 18, 2011, as well as in correspondence with State FD offices. In addition, the background from the telemetry component of this project, as well as the preliminary findings are outlined in a paper entitled "Application of Telemetry Techniques in Crocodilian Research: Gharial (*Gavialis gangeticus*) spatial ecology in the Chambal River, India" to be included in a special ENVIS - Wildlife Institute of India Publication "Telemetry in Wildlife Science, Volume 12 (2012).

Project Activities: May 2010-November 2011

Here, in four distinct sections, the project activities are described briefly for period above, as each section relates to specific project objectives. These included monitoring of the initial group of tagged gharial, capture and tagging of an additional ten gharial, and continued monitoring of all of the tagged gharial that were trackable with functioning radios through November 2011.

During May through November 2010, ten radioed gharial were tracked via telemetry by two experienced trackers, working together as previously described in detail, on motorbike and/or on foot patrols to locate, record, and observe tagged and marked individuals. During the 214 days from May through November 2010, the tracking team logged 130 days in the field ($130/214=61\%$), or an average 19 days per month for 7 months, including the monsoon period from July through September. A total of 426 animal-specific locations were recorded for the ten tagged gharial. At the end of this period, late October 2010, 6 tagged gharial were still being tracked by telemetry. One radio was recovered after becoming detached, apparently without injury to the gharial (57); the gharial was subsequently observed unharmed on a nearby riverbank. Three radios, presumably still attached to gharial, ceased emitting signals (2 in September=63, 69; and 1 in October=61). All three gharial were later sighted by visual identification with radios attached, but not functioning.

In November 2010, Phase II of capture and tagging was carried out at various localities between Sashon Ghat and the Udi Bridge, a section of the Chambal River selected below the site of the previous tagging and closer to the Yamuna confluence. An experienced field team with MCBT staff, representative Forest Department officials, and local trackers and fishermen captured and tagged ten additional gharial, ranging from 2.1m to 3.6m in length. These gharial were fitted with telemetry radios and visible tags from 18-28 November. The details of this operation are summarized in a previous report, Phase II tagging, dated January 18, 2011. This operation was carried out without incident, and no gharial were injured or died during any of the procedures.

During the third time period covered by this report (December 2010 through May 2011), the tracking team spent a total of 122 days in the field ($122/182=67\%$ of total days during this six months; or an average of 20 days/month). The area of coverage ranged from Sashon Ghat to

Godha, approximately 15 km above Naangoan, or >80 km of river. During most of this period, the team was able to track on a weekly/biweekly basis the 16 gharial that were radio-tagged, including 6 from the initial group, and 10 from the November 2010 tagging operation. All ten of the second group were successfully located during this period, and a major tracking effort was focused on these recently-tagged individuals, since their movement patterns were not yet documented. Eight were located by early January, and two additional gharial (25, 35) were not found until early March. Both of these had "disappeared" for Dec-Feb, and were subsequently located at Godha, >70 km upstream from their respective capture sites.

During this period, 4 additional radios for the first group stopped sending locatable signals (1 in March=75; 3 in May=49, 51, 53), leaving only two of the original group still trackable. During this time, three of the previously tagged gharial were observed and identified and photographed (61, 69, and 75) following the loss of radio function. Their radios were still firmly attached when they were subsequently observed, and there were no ill effects from radios.

From June through November 2011, the trackers were able to monitor all ten recently-tagged gharial, as well as make intermittent sightings of the remaining last two from the first group. During this period, the tracking team spent a total of 128 days in the field (128/183=70% of total days in 6 month period; or an average of 21 days/month). The area of coverage that was monitored via telemetry was substantially increased during this period because the recently-tagged gharial ranged downriver to Pachanada and upriver to Gohera (~130 km river length) due to seasonal monsoonal movements. During this period, the last two gharial with radio tags from first capture (June 2008 and March 2009) were no longer able to be radio-located (1 in July=55; 1 in September=59), but both were observed, along with five other previously tagged gharial from the initial capture group at various localities in October 2011. Thus, at least 7 of the original ten gharial tagged in the initial group were visually observed and photographed after the radios ceased broadcasting trackable signals.

Preliminary Results: Telemetry Tracking Summaries

The preliminary results for the gharial tagged in 2008-09 were summarized in the previous interim report, as well as reported elsewhere (ENVIS paper, in press). In May 2010, all ten gharial from the initial group were still being tracked (14-22 months), and by September 2011, all of these radios had stopped broadcasting. The average broadcast life of a radio tag was 2 years, or 24 months, and ranged from a maximum of 1161 days to a minimum of 551 days. Only one radio was known to have detached, after approximately 500 days. This radio was subsequently recovered in shallow water near the riverbank frequented by the individual carrying this tag. This particular gharial (57) was recognizable because it had a broken snout, and it was later observed to be in good health and behaving normally after losing the radio tag.

During May through November 2010, a total of 426 animal-specific locations were recorded for the initial group of ten gharial. An additional 77 locations were recorded during December 2010 through May 2011, and a further 6 locations were added for the two remaining radios during May-September 2011. Overall, a total of 509 animal-specific locations were tallied for this group, in addition to the 1812 track locations recorded previously. Overall, for this group, a total of 2321 animal-specific locations were observed from June 2008 through September 2011,

over 38 months. The majority of these individuals ($n=7$) were tracked through two monsoons of 2009 and 2010; two of these were followed through three monsoons (2009-2011); and one (59) was tracked through four monsoons (2008-2011).

The primary dry season (November-June) and monsoon season (July-October) locations of the initial tagged group of ten gharial are summarized for each individual in Table 1. The spatial ecology as evidenced by these additional records for 1-2 subsequent annual cycles reinforces the general patterns of river habitation outlined in the previous reports. In general, the gharial under study showed well-defined residence patterns, restricted to 5-15 km of river length, irrespective of season. During the monsoon months, a majority of tracked gharial moved downstream and monsoon residencies increased in area/extent, but the areas frequented remained well-defined and predictable for each tagged individual. Further comments on these preliminary results as they relate to the die-off are included in the next section of the report.

Tracking of the recently tagged gharial (November 2010) was initiated in mid December and has continued to date (December 2010 through November 2011). During most of this period, all ten individuals have been relocated at various sites within the National Chambal Sanctuary. None of the radios has malfunctioned, and all have remained attached to gharial. All of the tagged gharial have been visually sighted repeatedly and photographed with radios intact and attached, as well as visual identification tags. No adverse effects of the tagging was evident at capture/release, and all tagged gharial are presently in good health and accounted for, based on extensive tracker records and notes.

During December 2010 through November 2011, a total of 495 animal specific locations were recorded for the second group of ten gharial, or an average of 50 records per individual ($\bar{x}=49.5$; range=17 to 70). For the majority of animals, these records are distributed 1-3X weekly over the 11 month period. Preliminary examination of these records reveals the general patterns of movements summarized in Table 1.

These data are still being processed and analyzed, but indicate two distinct patterns of river residency among these ten individuals. Five small males (27, 29, 31, 37, and 39) exhibit well-defined, relatively small residencies with limited seasonal shifts (~5-10 km downstream, and upstream) related to high water during the extensive monsoon of 2011. All of these restricted residencies are located at or very close to the capture sites where these respective gharial were tagged.

In contrast, all of the other 5 gharial (monitored in this second group) made long distance river movements (>80 km up and down river) during this same period. In particular, all moved from locations below Sashon Ghat to locations at Gohera/Godha, upstream from Naangoan. In most instances, these long distance movements were made in 1-2 weeks or less, followed by a lengthy period of residence at the new locality, either up or down stream. The specific river locations were from Pachanada downstream below the Yamuna confluence to Gohera/Godha upstream, above the Naangoan-Ater crossing upriver.

Long-distance movements were made by two small males (25 and 35) as well as three females (21, 23, and 41). Gharial 23 nested on the riverside at Chikni Tower in March-June 2011,

but previously was in residence at Gohera during Dec 2010 through February 2011. Subsequent to her nest hatching, when monsoon waters rose, she was tracked to the confluence locations of Pachanada (below) and Patharra/Bihar (just above) where she resided during July-September. Two of the long distance movers (25 and 35) were not located for the first three months of tracking, but then were "discovered" to be in residence at Godha in March through June. When monsoon water levels rose in late June, both moved downstream to Sashon Ghat and below (>80 km downstream) within 7-10 days.

Selected Discussion Topics

1. Radio Function and Attachment: The method of radio attachment utilized in this study has proven effective for tracking, and was used successfully with no evidence of injury and/or harm to the gharial during the study or afterwards. As noted in previous reports, the signal range in the Chambal riverside habitat is 1-5 km depending on animal position, weather, time of day, etc.

2. Monitoring Protocols: The tracking methodology involves finding high vantage points along the riverbank adjacent to where the gharial are living. The two trackers have moved to these areas with the help of locals, and moved between sites on motorbike and/or on foot. These procedures do not disturb gharial, which are habituated to people moving along the river. In contrast, use of a boat, particularly a motor boat, is not effective, and alerts and disturbs gharial on land and in the water. If a gharial dives into deep water, below 2-3 m, then signal strength is greatly reduced, and tracking becomes difficult, if not impossible. At depths exceeding 3m, the radio signal does not broadcast beyond 100 m.

3. Seasonal Timing of Capture/Tagging: The best time of year to capture and tag gharial is the post monsoon period when water levels are relatively low, but seasonal breeding and nesting are not yet underway. On the lower Chambal, this period corresponds to October through December. The preferred time for capture/tagging when disturbance is minimized is from early October through mid November, when ambient temperatures are still seasonally mild prior to winter.

4. Population Profiles: During this period of study, no adverse evidence of any ill health or abnormal behaviors were noted during the course of tracking and observing gharial in the NCS. The gharial population on the lower Chambal on all of the river stretches frequented by the trackers appeared to be healthy and relatively abundant, and comparable to the situation and/or condition observed in previous years. Nesting has been observed at the traditional nesting sites in 2010 and 2011, and seasonal counts of gharial at selected sites frequented by tagged animals have been similar to those observed at these sites in other years.

5. Seasonal and Year-to-Year Variations in River Habitats: As noted in the Interim Report, the monsoon of 2009 "failed" and water levels were estimated to be at 5 year lows prior to the 2010 monsoon. The low water conditions continued through 2010, and gharial altered their basking sites, based on changing water levels. For example, Dinnpura was a favored basking site during 2008, 2009, and 2010, but another site was favored upriver when the midriver islands at Dinnpura were connected to the riverbank by low water levels prior to the 2011 monsoon. The 2010 monsoon was also late and below average, so it has only been with the 2011 monsoon that water levels were high, and much of the riverbank topography has been modified. The responses

of the tagged gharial to these recent riverbank alterations are of interest, and should be evident during the upcoming breeding season, commencing in late January of 2012, followed by nesting during March/April through June. Many of the nesting sites, stable from 2008 through 2011, are now changed dramatically, and new nesting areas are likely to be selected during 2012.

6. Relevance of Study to the 2007-08 Die-Off: Previously, the initial group of tagged gharial resided along a 30 km stretch of the Chambal River, from Dinnpura to the Udi Bridge. The restricted residencies evident in these animals suggested that the epicentre of the die-off, e.g., above and below Sashon Ghat, was close enough to the Yamuna confluence to allow resident gharial at Sashon Ghat to be exposed to potential contaminants in the Yamuna. In this phase of the study, the second group of tagged gharial were selected because they were residents of the lower Chambal just above Sashon Ghat. It was conjectured that these individuals were more likely to move down to the confluence during the monsoon flooding.

In fact, tracking locations for this cohort of tagged animals have provided solid evidence that the majority of these gharial move downstream below Sashon Ghat, to the Yamuna confluence and further downstream during the monsoon of 2011, in July through September. In particular, several tracked gharial in this study were observed at the confluence and/or immediately upstream in the Yamuna, as well as further downstream near Pachanada and beyond. These observations provide clear evidence that gharial resident just above the confluence do move into downstream river habitats during the monsoon where they would be exposed to downstream flow from the Yamuna. These observations are also consistent with other observations of gharial sighted in the Yamuna at considerable distances upstream, >10 km, during monsoon flooding.

WorkPlan for 2012--Gharial Telemetry Project

The current group of ten tagged gharial, marked in November 2010, will be monitored during 2012. The radios with which this group is outfitted are designed to operate for 18-30 months, so it should be feasible to follow this group through a second monsoon, and further document whether the established patterns of seasonal movements and residencies are maintained or altered during 2012. In addition, because the river morphology and riverbank topography has been altered recently during the 2011 monsoon, it will be beneficial to reconnoiter/survey the entire stretch of riverbank from Pinahut to the Yamuna confluence to document how the nesting areas and basking sites have been rearranged, and how the resident gharial known to frequent these areas previously respond to such alterations in riverside habitats.

The tracking team, consisting of 2-3 trained observers will monitor tagged gharial, and continue to make detailed observations on gharial activities and behaviors. Representative staff and advisors at MCBT will be the primary project staff, in addition to the trackers, and will visit the project sites periodically and be resident at Garhaita, Sashon, and Etawah, and continue to access the river habitats within the NCS by jeep, on motorbike, and on foot. Boat patrols along selected stretches of river may be useful to document changes in river landscapes, and how gharial are responding to these changes.

Table 1: Summary of Tracking Locations for Gharial tagged with radio transmitters in NCS
Abbreviations noted in legend below table. Trackable locations are tallied for the initial group of ten (49 thru 75) tagged in 2008-09, and for the second group (21-41) tagged in November 2010. During the first half of 2011, as many as 16 gharial were being tracked on a weekly/biweekly basis at Chambal locations ranging from Sashon to above Naangoan.

ID	sex	tl(m)		2010	2010	2010	2011	2011	2011	2011			
				may-jun	july-sept	oct-dec	jan-mar	apr-jun	july-sept	oct-dec		loc10-2011	total locat
49	F	2.9		KH	BD	KH	KH	KH				46	218
51	F	2.8		DN	CH	DN	DN	DN		***		49	246
53	F	2.3		DN	NK	DN	DN	DN		***		61	255
55	M	2.1		CH	CH	CH	CH	CH	CH	***		97	311
57	F	2.9		BD	BD	BD	**					38	228
59	M	2.0		KT	CH	KT	KT	KT	CH	***		62	174
61	F	2.9		CH	CH	CH		***		***		67	308
63	F	3.3		?	CH	CH						33	152
69	F	3.0		DN	CH			***		***		21	213
75	F	2.5		DN	NK	DN	DN	***		***		35	216
												=509	=2321
21	F	2.9				(PN)	GH	GH	SG	GH		70	
23	F	3.6				(PN)	GH	KH*	CF	SG		64	
25	M	2.6				(PN)	GD	GD	CF	SG		17	
27	M	2.2				(PN)	PN	PN	PN	PN		59	
29	M	2.2				(PN)	PN	PN	SG	PN		64	
31	M	2.3				(KH)	KH	KH	KH	KH		63	
35	M	2.3				(KS)	GD	GD	CF	SG		56	
37	M	2.1				(KS)	KS	KS	KS	KS		53	
39	M	2.3				(PN)	KH	KH	SG	KH		34	
41	F	3.1				(BR)	GH	GH	CF	GH		68	= 495

ID=gharial tagged with radio, e.g., 49 is 151.49 MHz, 51 is 151.51 MHz, etc

sex: F=female, M=male

tl (m) is total length in meters

Chambal location abbreviations KH=Khera Ajab Singh; BD= Badpura; DN=Dinnpura; CH=Chilonga; NK= Nachnoli; KT=Koroth; PN= Pituwan ka Nagla (Philmunnagara); BR=Barchauli GH=Gohera; SG=Sashon Ghat; CF=confluence Yamuna-Chambal; GD=Godha; KS=Kasaua

(PN), (KH), (KS), (BR)=capture/ release sites for gharial tagged in November 2010

***=visual observation of tagged gharial with radio attached, but no longer broadcasting

**=visual observation of tagged gharial, radio detached

*=this female was observed to have nested at Chikni Tower, just below Khera in 2011.