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Status of the Important Bioresources of Girwa River with Special Reference to Ganges River Dolphin (*Platanista gangetica gangetica*) in Katerniaghat Wildlife Sanctuary, Uttar Pradesh, India

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Abstract

The Girwa River in India supports a rich variety of fauna including the endangered Ganges River Dolphin and critical endangered gharial. Due to rising conservation concerns, biologists in the country have conducted a great deal of research over the past few decades on the status of these species in its distribution range. However, in the Girwa River such studies are still lacking, both to inform conservation efforts and to help address broader concerns related to biodiversity conservation. In light of the above statement, the present study was conducted in the ca.18 km of the Girwa River in Katerniaghat Wildlife Sanctuary in Uttar Pradesh. During the survey, dolphins, crocodile and aquatic birds were encountered along most of the river with the exception of ca. 1.5 km section below the international border and a ca. 2 km section above the Girijapuri barrage. Based on the best estimate, Low-best-high figures of 27-35-41 dolphins, with an encounter rate of 1.94 dolphins/km were estimated. Besides dolphin, 65 gharial, 20 mugger crocodile and 64 species of aquatic birds were counted. Actual growth may be higher because of possible population under estimation during the present survey. Increasing anthropogenic activities such as dam and barrage, coupled with mortality in fishing nets, are likely to affect the future survival of these populations. Recommendations for management and research are made to ensure the effective conservation of these species in the Girwa River.

Keywords: Girwa, river, dolphin, gharial, mugger, birds, status, platanista, gangetica

1. Introduction

Freshwater ecosystems are fragile environment, are rich in biodiversity and are believed to be at risk than other freshwater animals. To understand the mechanism, driving losses in aquatic biodiversity, is important to the conservation and restoration of freshwater environments worldwide [1].

The Ganges River dolphin is distributed in the Ganges, Brahmaputra, Karnaphuli-Sangu, and Meghna river systems and their tributaries, from the foothills of the Himalaya to the limits of the tidal zone in India, Bangladesh and Nepal [2, 3]. It has already become extinct from most of its earlier distribution ranges and even in its present day distribution range the population is purported to be declining [4]. Extensive population fragmentation has resulted from the widespread construction of dams and barrages [5]. The Ganges River Dolphin however, is a true River Dolphin; it occurs only in fresh water, and is considered endangered [6]. The Government of India declared it as the “National Aquatic Animal” [7] and it has received protection in nine protected areas (PAs); of these the Vikramshila Ganges River Dolphin Sanctuary near Bhagalpur is specifically known for the conservation of the Ganges River Dolphin. They have also received some protection in the Girwa and Chambal River, specially created for the protection of the gharial [8]. In recent years several workers estimated the population of Ganga river dolphin in different segments of Ganga River and its tributaries e.g. In Ganges River ca.1200 km (Bijnor to Varanasi), with an encounter rate of 0.21 dolphin/km. In Yamuna River ca. 400 km (Pachnada-Allahabad), with an encounter rate of 0.07 dolphin/ km [8]. In River Girwa, ca. 18 km, with an encounter rate of 1.56 dolphins/ km. In Ghaghara river with an encounter rate of 0.45 dolphins/km. In Saryu River, ca. 30 km with an encounter rate of 0.51 dolphin/km. In Rapti River ca. 30 km with an encounter rate of 0.26 dolphin/km. However, no dolphin was recorded in Ken river ca. 30 km and Betwa River ca. 29 km [8]. In Chambal river ca. 425 km (Pali-Pachnada), the encounter rate of dolphin was 0.19 dolphin/km [9].

The north Indian State of Uttar Pradesh includes a large extent of the present day distribution of crocodile species, which occurs in the several large rivers flowing through the State viz. the Ganga [10], the Yamuna [11], the Chambal [11], the Ghagra, the Gandak [12] and the Sone River [13]. Early records reveal that these aquatic reptiles were, at one time, very abundant throughout their distribution range [14]. However, due to commercial exploitation and habitat destruction, populations of Crocodile species have been reduced to near extinction. In many habitats, Crocodile populations have been totally wiped out [15]. Considering their vulnerability, the gharial is now listed as Critically Endangered and the Mugger is listed as endangered on the International Union of Conservation of Nature (IUCN) Red List [16].

In Girwa River dolphin prefers to stay in deep water in and around the confluence of rivers, shares its habitat with few indicator species such as crocodiles, freshwater turtles and aquatic birds many of which are fish eaters and potential competitors with dolphins [17]. Studying indicator species could create the basis for a sustained research program to see

how the changes of the said species can be related to the health of Indicator species in the river. This would help to implement various programmes for restoration of the river system. This was the first survey of its kind in recent times, where an attempt was made to objectively assess the status of important bio resources of the Girwa River in Katarniaghat Wildlife Sanctuary.

2. Study area

The Karnali River arises in Nepal and bifurcates into two rivers, the Girwa and the Kauriala which reunites again in India to form Ghagra (WWF-India unpublished, 2001). The Girwa River, in the Katarniaghat Wildlife Sanctuary ca.18 km in length is bounded upstream by the Nepalese border and downstream by the Girijapuri barrage in India (**Figure 1**). The river is home to large aquatic animals such as endangered Ganges river dolphin (*Platanista gangetica gangetica*) (**Figure 2A**), critically endangered gharial (*Gavialis gangeticus*) (**Figure 2B**), mugger (*Crocodilus palustris*) (**Figure 2C**), Smooth coated otter (*Lutragale perspicillate*), several freshwater turtle species and aquatic birds (**Figure 2D**).

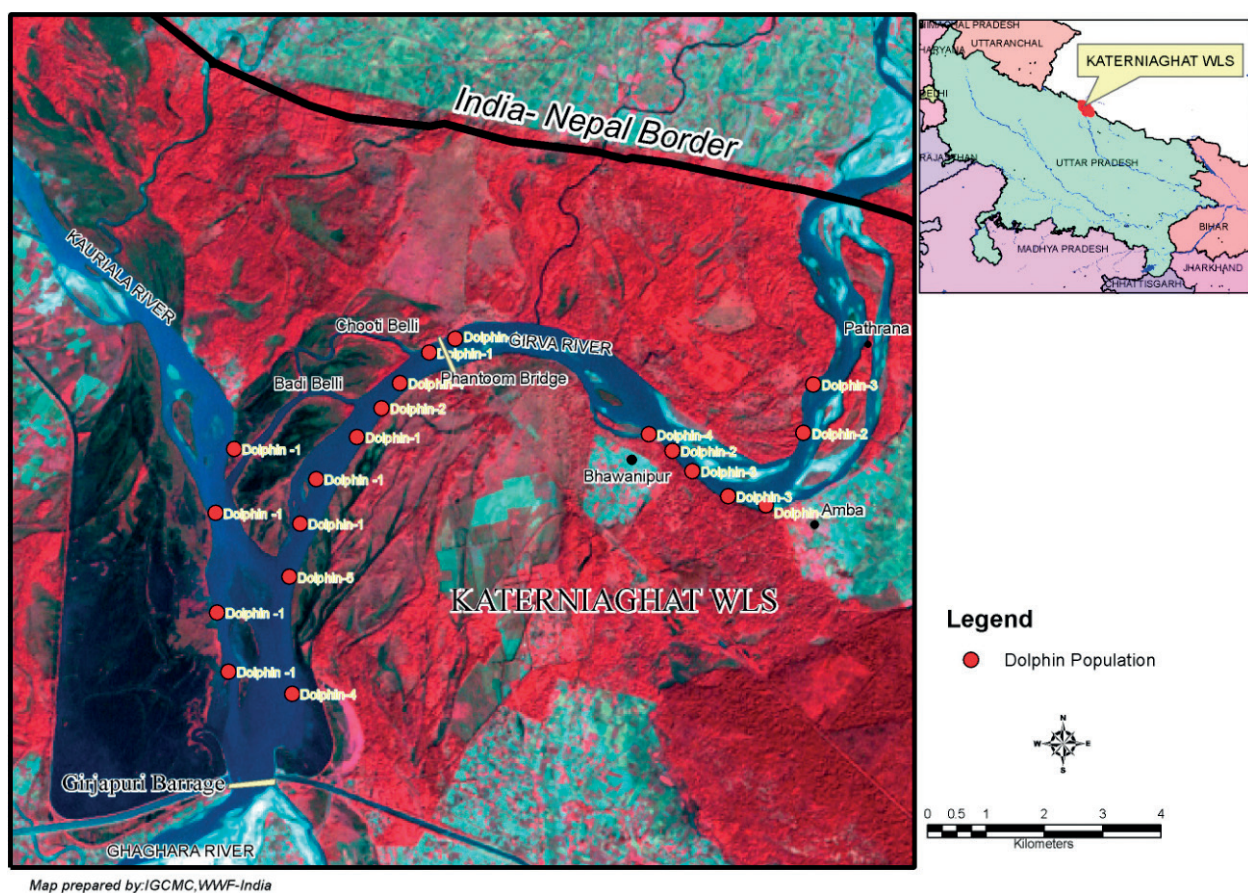


Figure 1. Study area showing dolphin sightings in different locations of Girwa River. (Map Source: WWF-India).

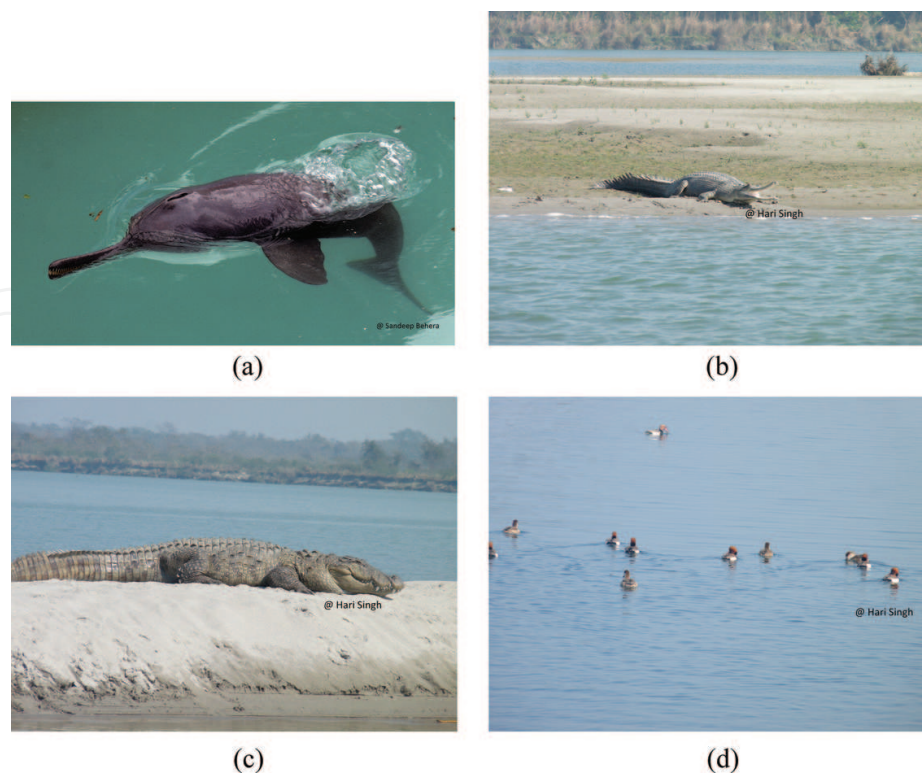


Figure 2. Gangetic dolphin _2A, Gharial_2B, Mugger _2C, and Red Crested Pochard_2D.

3. Methodology

To know the status of key aquatic fauna in the Girwa River, a vessel-based visual survey from Indi-Nepal border to Girijapuri Barrage (N 28° 33'.875; E 81° 12'.981) including the section of Kauriala River (N 28° 28'.640; E 81° 08'.308) in Katarniaghat Wildlife Sanctuary (**Figure 1**) was conducted in a ca.18 km of the river during 8th to 9th February 2013. The survey was conducted by using a motorized boat with an average speed of 4-5 km⁻¹ both in upstream and downstream directions. A single transect line close to one river bank only was followed during the survey.

Methods for dolphin survey, estimation of absolute and relative abundance and study of Asian river dolphins, have been considered and described in detail by [2]. In these method two primary observers, one each on the right and left sides of the vessel searched accurately in a 90° one in front of the vessel. Two independent observers positioned behind the primary observers recorded dolphin sightings missed by the primary team. A Global Positioning System was used to record the distance traveled and the geographical coordinates of dolphin sightings. Group sizes were evaluated with a best, high, and low estimate of numbers to incorporate a degree of uncertainty [3]. The low group size estimate was considered a minimum count and the high estimate a maximum count. Estimates of the total number of individuals and of group size were calculated from the “best” estimates of group size, while the high and low estimates were used to evaluate the uncertainty of the observers about the accuracy of their best estimates [18].

During the survey a separate observer searched for gharial, mugger and aquatic birds (in addition to Dolphins) using the naked eye and binoculars [9]. Data were recorded whenever basking gharial, mugger and aquatic birds were sighted. Identification and status of birds was done using field guides [19], and for conservation status and common and scientific names Bird Life [20], was followed.

4. Results and discussion

4.1. Present and past estimates of key aquatic fauna in Girwa river

All sections of the Girwa River were searched both in up and downstream. Certain sections affected by water storage due to the barrage however comprised wide channel. A single transect line close to one river bank only was followed during survey of these sections. The population estimates in these sections could therefore be biased downward. All published and unpublished counts of Crocodile and Dolphin populations are presented in **Table 1**. [21] have reported the numbers of dolphins sighted in two detailed surveys of the Girwa River, one upstream and one downstream, conducted in 19 to 25 February 1994. The low-best-high figures totaled 20-24-29 and 13-15-16 for the two surveys respectively. Basu and Sharma, (Unpublished Report 2000) estimated a population of 25 dolphins for the entire river in the Katarniaghat Wildlife Sanctuary. During 2001, the encounter rate of dolphins in the river based on “best” estimate of 30 dolphins was 1.67 dolphins/ km river length. Low-best-high estimates in the river were 23-30-44 (WWF-India unpublished Report 2001). In 2006, the encounter rate of dolphins based on best estimate of 39 dolphins was 1.95 dolphins/ km. The Low-best-high estimate of dolphin in the river was 31-39-54. Based on best estimate in 2009, a total of 49 dolphins with an encounter rate of 2.22 dolphins/km of river length are estimated. The Low-Best-High estimate was 40-49-62 (WWF-India unpublished Report 2009). In 2012, the encounter rate of dolphins was 1.56 dolphins/ km. The Low-Best-High estimate was 29-39-44 [9]. During present survey, the encounter rate of dolphins based on “best” estimate of 35 dolphins was 1.94 dolphins/km river length where the boat was moving at a speed of 4–5 km⁻¹. The Low-best-high estimates totaled 27-35-41 (**Table 1**).

Evaluation of status of dolphins in the Girwa River, compared to the best estimates of [21], indicates that in the 23 year period following their work, the encounter rate of dolphins is higher than the earlier population record. During the present survey, dolphins were encountered along the entire length of the Girwa with the exceptions of ca. 1.5 km section immediately below the international border entirely of boulder bed riffles and too shallow (< 0.5 m depth) to be habitable by dolphins and a 2 km section just above the barrage. The effect of water storage by the barrage that became operational in 1975–1976, is perceivable up to ca. 10 km upstream of the barrage (WWF-India unpublished 2001).

Earlier count of crocodile in Girwa river was 49 gharial and 14 mugger in 2006, 70 gharial and 16 mugger in 2009 and 65 gharials and 20 mugger in the year 2013 (**Table 1**). The first gharial population survey in Katarniaghat Wildlife Sanctuary was in 1975–1976 followed by [22, 23] 105 individual in 2008 by [24], WWF-India unpublished (2006, 2009) and present survey in 2013 (**Table 1**).

S.No.	Location	Dolphin			Crocodile	
		Low	Best	High	Gharial	Mugger
7th–10th February 2001 (Reference: WWF-India unpublished)						
Indo-Nepal border to Katerniaghat pontoon bridge						
I	Pathrana-Amba	7	9	12	NA	NA
II	Amba-Bhawanipur	4	7	13	NA	NA
III	Phantoom bridge-Girjapuri barrage	5	7	10	NA	NA
IV	Geruwa-Kauriala Confluence	7	7	9	NA	NA
Total		23	30	44		
11th–12th December 2006 (Reference: WWF-India unpublished)						
I	Bhawanipur to Amba	11	14	20	NA	NA
II	Amba to Pathrana	4	5	5	NA	NA
III	Bhawanipur to Girijapuri barrage	16	20	29	NA	NA
IV	Geruwa-Kauriala Confluence	5	5	7	NA	NA
Total		36	44	61	49	14
9th–10th December 2009 (Reference: WWF-India Unpublished)						
I	Katerniaghat to Girija Barrage	9	9	14	NA	NA
II	Kauriala to Katerniaghat	6	7	9	NA	NA
III	Katerniaghat to Amba	20	27	30	NA	NA
IV	Geruwa-Kauriala Confluence	5	6	9	NA	NA
Total		40	49	62	70	16
5th–7th October 2012 (Reference: Behera <i>et al.</i> 2014)						
I	Katerniaghat to Girija Barrage	5	7	9	NA	NA
II	Kauriala to Katerniaghat	7	8	10	NA	NA
III	Katerniaghat to Amba	13	19	20	NA	NA
IV	Geruwa-Kauriala Confluence	4	5	5	NA	NA
Total		29	39	44	NA	NA
8th–9th February 2013 (Present study)						
Indo-Nepal border to Katerniaghat pontoon bridge						
I	Katerniaghat to Girija Barrage	5	7	8	9	10
II	Kauriala to Katerniaghat	6	8	8	30	3
III	Katerniaghat to Amba	11	14	19	26	7
IV	Geruwa-Kauriala Confluence	5	6	6	0	0
Total		27	35	41	65	20

Legend: NA = Data not available.

Table 1. Distribution of dolphin and crocodile in Girwa River.

S.No.	Common name	Scientific name	Status
1	Asian open billed Stork	<i>Anastomus oscitans</i>	LC
2	Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	NT
3	Black Stork	<i>Ciconia nigra</i>	LC
4	Black-Bellied Tern	<i>Sterna acuticauda</i>	EN
5	Black-headed Ibis	<i>Threskiornis melanocephalus</i>	NT
6	Black-tailed Godwit	<i>Limosa limosa</i>	NT
7	Black-winged Stilt	<i>Himantopus himantopus</i>	LC
8	Brahminy Kite	<i>Haliastur indus</i>	LC
9	Bronze-winged Jacana	<i>Metopidius indicus</i>	LC
10	Brown-headed Gull	<i>Chroicocephalus brunnicephalus</i>	LC
11	Comb Duck	<i>Sarkidiornis melanotos</i>	LC
12	Common Coot	<i>Fulica atra</i>	LC
13	Common Greenshank	<i>Tringa nebularia</i>	LC
14	Common Kingfisher	<i>Alcedo atthis</i>	LC
15	Common Moorhen	<i>Gallinula chloropus</i>	LC
16	Common Pochard	<i>Aythya ferina</i>	VU
17	Common Redshank	<i>Tringa totanus</i>	LC
18	Common Sandpiper	<i>Actitis hypoleucos</i>	LC
19	Common Teal	<i>Anas crecca</i>	LC
20	Cotton Pygmy-Goose	<i>Nettapus coromandelianus</i>	LC
21	Darter	<i>Anhinga melanogaster</i>	LC
22	Egyptian vulture	<i>Neophron percnopterus</i>	EN
23	Eurasian Curlew	<i>Numenius arquata</i>	NT
24	Eurasian Spoon bill	<i>Platalea leucorodia</i>	LC
25	Eurasian Wigeon	<i>Mareca penelope</i>	LC
26	Ferruginous Pochard	<i>Aythya nyroca</i>	NT
27	Gadwall	<i>Mareca strepera</i>	LC
28	Garganey	<i>Spatula querquedula</i>	LC
29	Great cormorant	<i>Phalacrocorax carbo</i>	LC
30	Great thick-knee	<i>Esacus recurvirostris</i>	NT
31	Green Sandpiper	<i>Tringa ochropus</i>	LC
32	Gray heron	<i>Ardea cinerea</i>	LC
33	Indian Skimmer	<i>Rynchops albicollis</i>	VU

S.No.	Common name	Scientific name	Status
34	Indian Spot-billed Duck	<i>Anas poecilorhyncha</i>	LC
35	Intermediate egret	<i>Ardea intermedia</i>	LC
36	Kentish Plover	<i>Charadrius alexandrinus</i>	LC
37	Large egret	<i>Ardea alba</i>	LC
38	Little cormorant	<i>Microcarbo niger</i>	LC
39	Little Egret	<i>Egretta garzetta</i>	LC
40	Little Ringed Plover	<i>Charadrius dubius</i>	LC
41	Mallard	<i>Anas platyrhynchos</i>	LC
42	Marsh Sandpiper	<i>Tringa stagnatilis</i>	LC
43	Northern Pintail	<i>Anas acuta</i>	LC
44	Northern Shoveler	<i>Spatula clypeata</i>	LC
45	Osprey	<i>Pandion haliaetus</i>	LC
46	Painted Stork	<i>Mycteria leucocephala</i>	NT
47	Pallas gull	<i>Ichthyaelus ichthyaelus</i>	LC
48	Pheasant-Tailed Jacana	<i>Hydrophasianus chirurgus</i>	LC
49	Pied Avocet	<i>Recurvirostra avosetta</i>	LC
50	Pied Kingfisher	<i>Ceryle rudis</i>	LC
51	Red-Crested Pochard	<i>Netta rufina</i>	LC
52	Red-Wattled Lapwing	<i>Vanellus indicus</i>	LC
53	River Lapwing	<i>Vanellus duvaucelii</i>	NT
54	River Tern	<i>Sterna aurantia</i>	NT
55	Ruddy Shelduck	<i>Tadorna ferruginea</i>	LC
56	Sarus Crane	<i>Antigone antigone</i>	VU
57	Small Pratincole	<i>Glareola lactea</i>	LC
58	Spot-Billed Duck	<i>Anas poecilorhyncha</i>	LC
59	Stork-Billed Kingfisher	<i>Pelargopsis capensis</i>	LC
60	Tufted Duck	<i>Aythya fuligula</i>	LC
61	Whiskered Tern	<i>Chlidonias hybrida</i>	LC
62	White-Breasted Waterhen	<i>Amaurornis phoenicurus</i>	LC
63	White-Throated Kingfisher	<i>Halcyon smyrnensis</i>	LC
64	Wooly-necked Stork	<i>Ciconia episcopus</i>	VU

Legend: LC = least concern; VU = vulnerable; EN = endangered; NT = near threatened.

Table 2. Checklist of avifauna species recorded in Girwa River.

At least sixty-four species of birds, most of them aquatic or semi-aquatic, were observed during the survey. Of the species listed 49 species are least concern (LC), 09 near threatened (NT), 04 vulnerable (VU), 02 endangered (EN) (**Table 2**). The list is not complete because of failure to identify some related species such as ducks, teals, snipes, terns and certain raptors. The only avifaunal record from Girwa and Ghagra river was 57 species by WWF-India unpublished (2001), and 151 species in Katarniaghat Wildlife Sanctuary [25]. Although, comparison of the result of the earlier surveys and the present one though not fully valid due to difference in study site. Also non-aquatic birds were not studied during the present survey. It is felt to safely indicate that Girwa River supports great avifaunal diversity.

5. Conservation constraint

The major cause of concern about the future survival of the species was gross hydro ecological changes that may occur in the stream characteristics of the Girwa River resulting from the construction of the Chisapani high dam, in Nepal and Girijapuri Barrage in India. Beside this, every year the entire barrage gates of the Girijapuri Barrage on the Girwa River, are opened at once for maintenance. When this is done in summer months of April/May, water flow in the river is at its lowest. The entire stretch of the river within the sanctuary up to (and beyond) the Nepal border is “drained” and there is very little flow left, with much of the river only knee deep or less with large number of fish left stranded and dying. The River dolphins and the gharial and whatever fish that survives have to congregate in the few remaining pools of water. This is not only in the interests of saving the habitats for endangered riverine fauna such as gharial and river dolphin but also for the important fish stocks and other commercially valuable species (WWF-India unpublished). Fishing was observed in the Girwa River at several locations. Also, reports of dolphins being intentionally caught in gill nets being used close to dolphins surfacing (WWF-India unpublished).

To understand the health of river ecosystem available information of important key aquatic resources is urgently needed to effectively understanding the conservation needs. These are reliable indicator species that is threatened by human activities. In light of the results of the present study, conservation management recommendations are suggested. These include highlighting the need for habitat management, control of illegal activities, and long-term monitoring program.

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