

Population, breeding and threats to the White-rumped Vulture *Gyps bengalensis* in Bangladesh

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The population of the White-rumped Vulture *Gyps bengalensis* in Bangladesh has declined very rapidly in recent years, so a research-cum-conservation project was launched in July 2008 that continued until June 2012. Three species of vultures were found during the survey—White-rumped Vulture, Himalayan Vulture *Gyps himalayensis* and Cinereous Vulture *Aegypius monachus*. Based on nesting sites and frequent sightings of vultures, a total of six 'hotspots' were identified in the areas of Moulvibazar, Habiganj, Haor Basin, Mymensingh, Sundarbans (northern end) and Barisal. The total population of the White-rumped Vulture in suitable habitats across the country shows that numbers have drastically declined from 1,972 to 816 (nearly 60% drop) in four years. In two consecutive breeding seasons only 5 out of 32 and 8 out of 31 nests were successful in producing fledglings (one from each nest). The overall breeding success was very low (15.6–25.8%). The reason for such poor breeding success was sudden death or disappearance of parent birds, apparently due to poisoning by diclofenac, a veterinary drug used to treat livestock ailments. The project identified poisoning as the principal cause of vulture decline. Although the Government of Bangladesh banned use of veterinary diclofenac from 25 October 2010, 53% of the veterinary drug stores still sell it illegally. Awareness campaigns have made people aware of vulture conservation and the adverse effects of diclofenac.

INTRODUCTION

Historically, seven species of vultures—White-rumped *Gyps bengalensis*, Himalayan *G. himalayensis*, Griffon *G. fulvus*, Slender-billed *G. tenuirostris*, Cinereous *Aegypius monachus*, Red-headed *Sarcogyps calvus* and Egyptian *Neophron percnopterus*—have been recorded in Bangladesh (Khan 2008, Siddiqui *et al.* 2008). However, only the White-rumped Vulture, Himalayan Vulture and Cinereous Vulture have been seen in the last four years and only the White-rumped Vulture is now known to breed in Bangladesh.

Populations of the White-rumped Vulture and other resident *Gyps* vulture species have declined very rapidly since the mid-1990s across the Indian subcontinent (Prakash 1999, Gilbert *et al.* 2006, Prakash *et al.* 2007, Chaudhary *et al.* 2012). Declines in numbers of the White-rumped Vulture have exceeded 99.9% in India (Prakash *et al.* 2007) and the species is classified as Critically Endangered (BirdLife International 2001, BirdLife International 2012). If the rate of decline cannot be arrested, the species will disappear from the Indian subcontinent in the next few years. This species not only plays a key role as a scavenger but is also part of the heritage of the Bengal region. The people of Bangladesh are not hostile to vultures, but they have been almost totally unaware of the threats and dire situation that vultures are facing. A decade ago the White-rumped Vulture was a common and widely distributed bird in Bangladesh (Harvey 1990, Thompson & Johnson 1996). Recent studies in India, Nepal and Pakistan confirm that vultures are poisoned when they feed on the carcasses of cattle treated with the veterinary drug diclofenac shortly before their death (Green *et al.* 2004, Oaks *et al.* 2004, Shultz *et al.* 2004). This is also likely to be the main cause of the decline in the vulture population in Bangladesh, but there may be other factors contributing to the decline.

Because the White-rumped Vulture is a globally and nationally threatened species (BirdLife International 2001, BirdLife International 2012) it was necessary to take measures to save it from local extinction. Here the findings of a research-cum-conservation project focusing on this species, started in 2008, are reported. The aim was to understand the conservation status of the White-rumped Vulture in Bangladesh and to implement ways of reducing population decline. The specific objectives were to estimate the relative abundance of populations in different parts of the country, assess the population trend, identify important vulture 'hotspots' (where they nest and are frequently sighted), record breeding

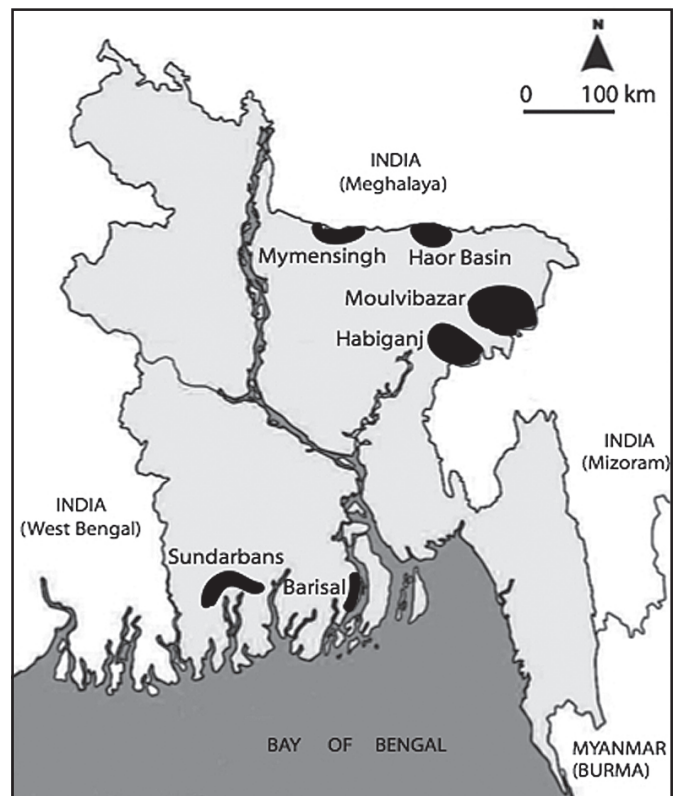
success and assess the threats (focusing mainly on the availability and use of veterinary diclofenac). Moreover, vulture conservation awareness programmes were conducted to spread knowledge of the dire situation faced by the vulture population and discourage the use of diclofenac to treat cattle.

METHODS

Study area

The project was implemented in different parts of the country, but focused on Greater Sylhet (north-east), Greater Khulna (south-west), Greater Mymensingh (north) and Greater Barisal (south)

Figure 1. Bangladesh showing hotspots (shaded black) for the White-rumped Vulture *Gyps bengalensis*.



where the White-rumped Vulture was known to nest and roost regularly (Figure 1). Geographically, Bangladesh is located between 20.567°–26.550°N and 88.017°–92.683°E. The total area of the country is 147,570 km², with a population of around 160 million people. The climate is tropical monsoon, characterised by marked seasonal variations. Abundant rainfall during the monsoon (July–October) is followed by a cool winter period (November–February), and then a hot and dry summer (March–June). Bangladesh can be divided into three main physiographic divisions—Tertiary hills, Pleistocene terraces and recent plains (Khan 2008).

Field methods

A small team of researchers carried out the surveys, but local people were also involved in most areas. Five members of the research team had been trained in different aspects of wildlife biology. The project team worked closely with villagers and labourers on tea plantations, since the vultures mainly occur and breed in and around villages and tea estates. Journalists, veterinarians and other professional people were also involved with various activities. The project team liaised closely with the Bangladesh Forest Department. Work was carried out from July 2008 to June 2012 (hence 2008–2009 is the period between July 2008 and June 2009, so that each breeding season falls in one slot), but not all the activities were carried out each year of the project. Some data were collected during 2005–2008 to confirm the relative abundance of vultures in different areas and find the hotspots.

Surveys to assess relative abundance and identify vulture hotspots

Between 2005 and 2008, vulture sightings by 50 local people were recorded every year in each of the seven administrative divisions (Dhaka, Chittagong, Sylhet, Rajshahi, Rangpur, Khulna and Barisal) so that division-wise the relative abundance of vulture populations could be estimated. In order to get the best output from the limited resources available for awareness and conservation activities, hotspots were identified on the basis of the occurrence of nesting sites and frequent sightings (where interviewees have seen vultures at least once in every two-month period).

Population surveys

To determine the population trend, the team selected potential survey areas throughout the country and systematically visited the known roosting sites in the morning and in the afternoon to count White-rumped Vultures in roosting colonies. Sightings of other vulture species were recorded during these surveys. The survey team interviewed local people about their vulture sightings and, in areas where interviewees claimed recent sightings of roosting vultures, the survey team stayed and counted the vultures when they returned to roost. In areas where the interviewees said that there were no recent sightings at roosting colonies, the survey team quickly moved on to new areas. The same roosts visited during 2008–2009 were visited again in 2009–2010, 2010–2011 and 2011–2012. Since the count was conducted in all the potential sites for vultures, although not in each and every part of the country, the annual counts can be considered as total counts for the country or a very close representation of it. More importantly, however, the count has been repeated in a standardised way so that the data are comparable year on year.

Monitoring breeding success

The breeding success of vultures was documented by periodically (at least once every two weeks) observing every known nest during the breeding season (dry season: October to March). Telescopes and binoculars were used for these observations. A commercially made camouflaged hide was often used so that the nesting vultures were not disturbed by the presence of observers. The main

information recorded was the fate of nests—if the nestling from a particular nest flew (fledged), the nest was treated as successful. Information on nesting trees (species, nest height from the ground) was also recorded.

Surveys for diclofenac

The availability of veterinary diclofenac and other non-steroidal anti-inflammatory drugs (NSAIDs) was assessed in two ways. First, undercover surveys (posing as buyers) of the veterinary drug stores throughout the country were undertaken (70 drug stores every year), from 2008–2009 to 2011–2012. Second, the use of diclofenac was recorded by interviewing local cattle-owners (86 individuals in total) in different areas of the country. This was done openly (since the cattle-owners were not as secretive as the veterinary drug salesmen) by using a standard questionnaire that also included a question on what the cattle-owners do with dead cattle.

RESULTS

Based on sightings of the White-rumped Vulture during 2005–2008 surveys by local people in suitable habitats of the seven administrative divisions, the highest relative abundance was found to be in Sylhet (5.1 sightings/interviewee/year) and the lowest in Chittagong (0.7 sightings/interviewee/year) (Table 1). This gives an average for the country of 2.8 sightings/interviewee/year. Based on nesting sites and frequency of sightings, a total of six hotspots were identified: the areas of Moulvibazar, Habiganj, Haor Basin, Mymensingh, Sundarbans (northern end) and Barisal (Figure 1).

Table 1. Relative abundance of the White-rumped Vulture in suitable areas of seven divisions of Bangladesh.

Division	Total no. of sightings during 2005–2008 by 50 interviewees	Average no. of sightings/interviewee/year
Dhaka	645	3.2
Chittagong	141	0.7
Sylhet	1,022	5.1
Rajshahi	443	2.2
Rangpur	420	2.1
Khulna	640	3.2
Barisal	466	2.3

Survey data from 2008–2009 to 2011–2012 demonstrate that the White-rumped Vulture declined by nearly 60% over the four-year study period throughout the country, and that other species of vultures are extremely rare. The total population of the White-rumped Vulture in suitable habitats across the country (which can be treated as the total Bangladesh population) shows that the population drastically declined from an estimated 1,972 in 2008–2009, 1,456 in 2009–2010, 991 in 2010–2011 and 816 in 2011–2012.

Other than the White-rumped Vulture there were 16 sightings of Himalayan Vulture from Moulvibazar (north-east), Sunamganj (north-east), Habiganj (north-east), Jamalpur (north), Sirajganj (west) and Rangpur (north-west). All sightings were between October and March indicating that they were winter visitors. Most of the sightings were small flocks, but the largest roosting flock of 21 birds was sighted in a tall Silk Cotton *Salmaal* sp. tree at Dawrachara Tea Estate, Moulvibazar, on 3 March 2012. Himalayan Vultures were seen roosting, soaring, or feeding with White-rumped Vultures six times. There were only four sightings of Cinereous Vulture from Rajshahi (north-west), Madhupur Tract (central), Narshingdi (north-east) and Moulvibazar (north-east). All were solitary birds, including two juveniles, sighted at different seasons, indicating that they were probably vagrant individuals.

Table 2. Breeding status of the White-rumped Vulture in seven divisions of Bangladesh

Division	Number of nests observed		Unsuccessful (nesting birds died/vanished)		Status of breeding		Breeding success (%)	
	Season-1	Season-2	Season-1	Season-2	Season-1	Season-2	Season-1	Season-2
	Dhaka	8	6	7	5	1	1	12.5
Chittagong	0	0	–	–	–	–	–	–
Sylhet	14	13	12	10	2	3	14.3	23.1
Rajshahi	0	0	–	–	–	–	–	–
Rangpur	0	0	–	–	–	–	–	–
Khulna	10	9	8	7	2	2	20.0	22.2
Barisal	0	3	–	1	–	2	–	66.7
Total/Overall for Bangladesh	32	31	27	23	5	8	15.6	25.8

NB. Season 1 (October 2009–March 2010) and Season 2 (October 2010–March 2011) were the two consecutive breeding seasons of vultures.

Breeding success of the White-rumped Vulture for all nests in all the known breeding areas in Bangladesh was documented. In Season 1 (October 2009 to March 2010), a total of 32 nests were observed of which only five birds from five nests successfully fledged (clutch size is one), giving an overall breeding success of 15.6% (Table 2). In Season 2 (October 2010 to March 2011), a total of 31 nests were observed from which eight birds fledged (25.8% success rate). At unsuccessful nests the parent birds were found dead, either on the ground near the nest ($n = 11$) or on/beside the nest ($n = 4$), or the parent birds just vanished suddenly ($n = 35$), indicating that they had probably died elsewhere. Although no post-mortems were undertaken, the dead vultures were apparently in good health, indicating sudden death that can be caused by poisoning. It was observed that, whether the nest had an egg or nestling, one parent almost always attended the nest to guard against crows (House Crow *Corvus splendens*, Large-billed Crow *C. macrorhynchos*) and other raptors (Pallas's Fish Eagle *Haliaeetus leucorhynchus*, Steppe Eagle *Aquila nipalensis*). The parents take shifts so that both can feed and bring food for the nestling.

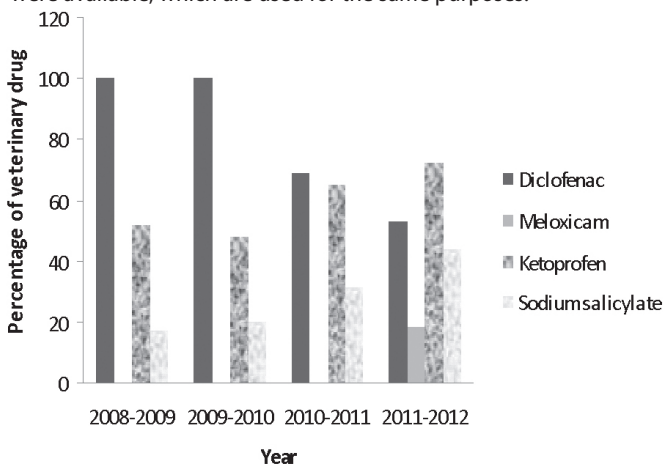
Vulture nests were found in the following trees: *Albizia lebbek*, *Albizia procera*, *Anthocephalus chinensis*, *Bombax ceiba*, *Borassus flabellifer*, *Cocos nucifera*, *Ficus benghalensis*, *Ficus religiosa*, *Mangifera indica*, *Swietenia mahagoni*. Vultures had no preference for nesting tree species, but all nesting trees were large. Nests were constructed at heights ranging from 7 to 17 m.

The veterinary drug stores were surveyed for four years, from 2008–2009 to 2011–2012, and it was found that the availability of diclofenac in stores has decreased from 100% to 53% and the availability of three other NSAIDs (meloxicam, ketoprofen and sodium salicylate) had increased (Figure 2). This is in response to the ban on production of veterinary diclofenac from 25 October 2010 and the banning of the use of veterinary diclofenac from six

months after the banning of production (25 April 2011). Diclofenac is most commonly used in the form of injection vials, but it is also available as a suppository and tablet. Each 30-ml vial costs Taka 80 (US\$1). Today, meloxicam, the safe alternative to diclofenac (introduced after the diclofenac ban), is available in the market, but diclofenac is still illegally sold in veterinary drug stores (Figure 2, 2011–2012). Other than NSAIDs, paracetamol and dexamethasone are also available in veterinary drug stores as anti-inflammatory drugs. Various steroids and ureas for cattle fattening are also available, which are normally used before the cattle are sold, so the highest use is before the Eid-ul-Azha when many cattle are ceremonially slaughtered by Muslims.

During 2008–2009, i.e., before the diclofenac ban, cattle-owners from different areas were interviewed and it was found that 57% of them used diclofenac when the cattle suffered from fever or at the early stage of any disease. Except in remote areas, and areas where cattle are scarce (in Chittagong Hill Tracts and parts of Chittagong and Cox's Bazar), diclofenac was found to be the most commonly used cattle medicine. In 59% of cases the cattle owners said they use diclofenac on their own without following a veterinarian's prescription. Although other similar drugs are available, diclofenac is more popular because people believe that it is a more effective cure. This medicine was used throughout the year, but most commonly in early monsoon (April–May) when cattle diseases are common.

Alarming, a very high proportion (61%) of cattle-owners said that when cattle died they skinned them, sold the hide and buried the body in order to control the smell. In the past, the smell would not reach human habitations because there were many distant open areas, but today there are very few areas as such where dead cattle can be disposed in the open. Some cattle owners (9%) also use the dead cattle as food for prawn and catfish. Therefore, it is likely that a reduction in vulture food supply has also taken place. In some of the areas that were surveyed there were very few large trees suitable for vultures to nest, but this scarcity did not appear critical in limiting the breeding of vultures.

Figure 2. Availability of different NSAIDs in veterinary drug stores in Bangladesh. N.B. Other than NSAIDs, paracetamol and dexamethasone were available, which are used for the same purposes.

DISCUSSION

Previous reports on the status of the White-rumped Vulture mainly quote the sizes of flocks that were regularly sighted at particular roosting and nesting areas (Sarker 1983, 1987, Harvey 1990, Thompson *et al.* 1993, Khan 2009, 2011), so it is difficult to compare the present population or relative abundance with those of the past. However, based on the scattered records mentioned above it is certain that the present population, estimated to be around 816 birds, is considerably less than the population of 20 years ago. Sarker (1987) arbitrarily estimated that the population density in the Sundarbans was 0.03 to 0.91 individuals/km², which is higher than the inferred density today. It is not surprising that the lowest

relative abundance was estimated in the Chittagong division. Mountfort & Poore (1968) had reported that vultures are common in all areas except the Chittagong hills. This is probably because there are fewer cattle in the hilly areas of Chittagong.

Areas like the Sundarbans interior and Aricha (Manikganj), where vultures used to breed (Sarker 1983, 1987), were checked and it was found that they are no longer resident there. Vultures were reported to breed colonially (Sarker 1987, Ali & Ripley 1989, Grimmett *et al.* 1998), but during this survey it was found that they nest either alone or there are just a few nests in an area, but not very close together (except in one case). This is probably simply the result of the severe decline in the population. Like the previous reports (Sarker 1987, Ali & Ripley 1989, Grimmett *et al.* 1998), it was found that the White-rumped Vulture traditionally uses trees for nesting and the breeding peak is October to March. Even in the 1980s the breeding success of vultures was reported to be low (Sarker 1983), but this might be the result of a limited field survey.

The slowing of the rate of decline of the White-rumped Vulture population appears to be the result of lower availability of diclofenac in veterinary drug stores (Figure 2) following the ban. Similar results were found in India (Cuthbert *et al.* 2011a,b). Following the decrease in availability of diclofenac, however, the availability of other NSAIDs, including ketoprofen that is also known to be poisonous for *Gyps* vultures (Naidoo *et al.* 2009, Taggart *et al.* 2009), has increased. Sodium salicylate is believed to be harmless, but it has never been tested on vultures. It is now very well established that diclofenac poisons and causes the death of *Gyps* vultures (Green *et al.* 2004, Oaks *et al.* 2004, Shultz *et al.* 2004, Cuthbert *et al.* 2011c), so based on wide availability, even after the ban, it can be concluded that veterinary diclofenac is the biggest threat to vultures in Bangladesh. Although steroids and urea are widely used for cattle fattening, these are not known to be poisonous to vultures (although not tested thoroughly), and the fattened cattle are mainly consumed by humans, so these are not major problems for vultures even if the fattening doses have adverse effect on vultures.

The manufacturers of diclofenac for cattle have been against the ban and have argued in different meetings that vultures might have declined for other reasons such as food shortage. Our evidence shows that illegal production (information gathered from some drug stores suggested that small factories illegally produce diclofenac for veterinary use), sale and use are still going on, and veterinary diclofenac is still available despite the ban. The support of the media is crucial to stop the use of veterinary diclofenac. It is important, however, that the media employees are properly motivated and informed so that they can convey the right message. Moreover, proactive government support is needed to take legal action against those who violate the ban on veterinary diclofenac.

During the field surveys few dead cattle were found and interviewees have reported that dead cattle are often buried or used as food in shrimp farms, suggesting that food shortage might also be contributing to the decline of vultures. Food shortage as a cause of vulture decline has also been pointed out by others (Round & Chantrasmī 1985, Sarker 1987), and in Bangladesh wild mammal carcasses are a very scarce food resource for vultures (Sarker 1987). Even a decade ago, the human population density of the country was much lower and there were many open areas and extensive wetlands where the dead cattle could be disposed of in the open. People should be encouraged to leave their dead cattle and dogs (which have not been treated with diclofenac or ketoprofen) in the open so that vultures can eat them.

Large trees suitable for nesting were rare in some areas and disturbance of vultures by people was rarely reported, and probably neither of these factors have made a significant contribution to the rapid decline of vultures. In the Sundarbans the scarcity of nesting trees was reported by Sarker (1987), but was probably exaggerated since we found that the Sundarbans have many trees suitable for

vultures to nest. Other potential threats like poisoning by insecticides (Sayer & Han 1983, Rahmani 1998, Ghatak 1999), disease (Risebrough 2000, Prakash & Rahmani 2000) and nest predation (Sarker 1987) might also contribute to the decline of vultures in Bangladesh, but these could not be assessed and are certainly less immediate threats than diclofenac. The existing nesting trees should be preserved and, in areas where large trees are scarce, some trees should be allowed to grow so that vultures and other large birds can make nests.

Since vultures mainly occur outside designated protected areas, i.e. areas not protected under the Bangladesh Wildlife Act, and often outside natural forests and wetlands, thus, outside the jurisdiction of government departments, and usually make their nest in large trees on private properties, it is difficult to ensure their protection and control human activities. The only way forward is through mass motivation and awareness in the vulture hotspots, which we began and succeeded in gaining some public support. We approached and convinced a few key people in the locality and with their help we reached the mass community. This approach was efficient and successful, because these few key people in the locality are more trusted by the vast majority living there than are outsiders such as ourselves.

Both formal and informal awareness programmes were conducted to educate people (especially children, cattle owners, journalists and veterinarians) about the adverse effect of diclofenac, and actions that can help vultures, such as not disturbing nesting birds. Awareness programmes included popular lectures, interactive discussions, quizzes, drawing contests for children and posters and other material were distributed. An informative book with photographs of vultures has also been published (Khan 2012).

In response to our (together with other bird-lovers and concerned people) repeated appeals in the media (television and newspapers) and meetings, the government banned veterinary diclofenac formulations, although there is the risk that human formulations might be used instead, as in India (Cuthbert *et al.* 2011b). More challenging, however, will be the full implementation of this ban, because more than 50% of the veterinary drug stores still illegally sell diclofenac, which probably has been produced illegally in Bangladesh by small-scale manufacturers. The interviews that were given on local television channels and in newspapers have helped bring about the reduction in the use of diclofenac.

Monitoring of vulture numbers and breeding, at least in vulture hotspots, should be continued so that the population trends are known. The identified hotspots should be declared vulture sanctuaries or more precisely, following the guidelines of Saving Asia's Vultures from Extinction (SAVE 2012), as Vulture Conservation Areas, in order to attain Vulture Safe Zone status in the future. Special measures should be taken for collaborative management involving local communities. Moreover, regular monitoring should take place on the use of different cattle medicines, including the illegal use of diclofenac and use of the safe alternative meloxicam. Proactive measures by the government authorities will be required to ensure that diclofenac and any other similar drugs that are likely to be dangerous to the vultures are removed from veterinary practice. We also need to work on developing captive breeding capacity of vultures at Dhaka Zoo, where a small captive population already exists and one pair often breeds successfully without any special assistance. Wider involvement of institutions and individuals is urgently needed to take up actions to conserve vultures. A national committee should be formed in order to draw up a Bangladesh Vulture Action Plan, and coordinate and advise on activities related to vulture conservation and management in Bangladesh. This committee can function as the coordinating body, guiding the relevant governmental and non-governmental activities. Moreover, regional initiatives should be taken so that vulture populations can be monitored and conserved across the region. Thankfully, the

process has already been started and the governments of Bangladesh, India, Nepal and Pakistan signed the Regional Declaration on the Conservation of South Asia's Critically Endangered Vulture Species in May 2012.

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