

Madagascar's wildfowl (Anatidae) in the new millennium

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Abstract

Ten wildfowl taxa are resident in Madagascar including four endemics: Madagascar White-backed Duck *Thalassornis leuconotus insularis*, Madagascar Teal *Anas bernieri*, Meller's Duck *A. melleri* and Madagascar Pochard *Aythya innotata*. These endemic duck taxa were amongst the last wildfowl forms to be described in Africa and are undoubtedly currently the rarest in this region. The history of our knowledge of these birds follows four easily definable stages: discovery, understanding, protection and the future. The new millennium has started with a much more detailed understanding of the four ducks' ecology than ever before, the protection of several key sites and the re-discovery in 2006 of the Madagascar Pochard. The next few years will tell if the ducks have a more secure future and, while not yet safe, Madagascar's ducks are perhaps now among the better known of Africa's endemic wildfowl.

Key words: endemic, Madagascar, protection, status review, wildfowl.

Madagascar has ten extant species of wildfowl (Anatidae) with a further two species (of sheldgeese) *Centronis majori* and *Alopochen sirabensis* known only from sub-fossil remains (Table 1) (Young *et al.* 2003; Young & Kear 2006). The extant taxa include three full endemic species and an endemic subspecies with varied geographical origins: two species – Madagascar Teal *Anas bernieri* and Madagascar Pochard *Aythya innotata* – are of

Australo/Asian origins, and two others – Meller's Duck *Anas melleri* and the Madagascan subspecies of the White-backed Duck *Thalassornis leuconotus insularis* – are of African origin (Young & Kear 2006). The remaining, non-endemic, species have an African or pan-tropical distribution (Table 1). All four endemic ducks are threatened with extinction, but have until recently been very poorly known and almost completely unprotected.

Table 1. Wildfowl of Madagascar.

Species		Date of description	Range (faunal region)	IUCN status 2013
Fulvous Whistling Duck	<i>Dendrocygna bicolor</i>	1816	Nearctic Neotropics Afrotropics Orient Madagascar	LC
White-faced Whistling Duck	<i>Dendrocygna viduata</i>	1766	Neotropics Afrotropics Madagascar	LC
White-backed Duck	<i>Thalassornis leuconotus</i>	1838	Afrotropics	LC
	<i>T. l. insularis</i>	1897	Madagascar endemic	EN ¹
Greater Madagascan ² Sheldgoose	<i>Centronis majori</i>	1897	Madagascar endemic	EX ^{3*}
Lesser Madagascan Sheldgoose ²	<i>Alopochen sirabensis</i>	1897	Madagascar endemic	EX in c. 1400 ⁴
Comb Duck	<i>Sarkidiornis melanotos</i>	1769	Neotropics Afrotropics Orient Madagascar	LC
African Pygmy Goose	<i>Nettapus auritus</i>	1783	Afrotropics Madagascar	LC
Madagascar Teal	<i>Anas bernieri</i>	1860	Madagascar endemic	EN
Meller's Duck	<i>Anas melleri</i>	1868	Madagascar endemic	EN
Red-billed Pintail	<i>Anas erythrorhyncha</i>	1789	Afrotropics Madagascar	LC
Hottentot Teal	<i>Anas bottentota</i>	1838	Afrotropics Madagascar	LC
Madagascar Pochard	<i>Aythya innotata</i>	1894	Madagascar endemic	CR

Sources: ¹TWSG (2006); ²Livezey (1997); ³Goodman & Ramanamanjato (2007); ⁴Goodman & Rakotozafy (1997). * Date of extinction of *Centronis* is unclear, but presumably > 1,000 years ago. Only one radio-carbon date (17,370 ± 90 BP) is available (see Burney *et al.* 2004). IUCN classification: LC = least concern; CR = critically endangered; EX = extinct.

Discovery

Madagascar's three endemic species (Fig. 1a,b,c) were among the last four species of ducks in Africa to be described, with Madagascar Pochard being the last (Table 1). The presentation to science of these ducks followed a traditional pattern with all – the Madagascar Teal (1860), Meller's Duck (1865), Madagascar Pochard (1894) and the subspecies of White-backed Duck (1897; Fig. 1d) – described in European or North American Museums from specimens sent back by travellers to the island (see species accounts in Kear 2005 for citations).

Following their initial description, the ducks were only occasionally reported thereafter during the late 19th and early 20th Century, typically in travellers' notes (see references in Dee 1986), and close inspection of some of these suggests that more recent reviewers and translators sometimes misidentified the species being described. Only Rand's (1936) and Delacour's (1932a, b) reports of the Franco-Anglo-American expedition to Madagascar in 1929–1931 give any real details of the species observed. Even then the Madagascar Teal was not seen by most expedition members, though two museum specimens were collected, acquired from villagers. Cecil Webb, a member of the Franco-Anglo-American expedition, collected live specimens (of Madagascar White-backed Duck, Meller's Duck and Madagascar Pochard) at Lake Alaotra in 1926, and returned to collect further ducks at the same site in 1935 (Webb 1936, 1953). However, beyond basic descriptions of habitat and perceived commonness Webb made few notes on the birds themselves.

There was little recognition of the species' status and of threats to the birds until late in the 20th Century. Johnsgard (1978: page 223) considered that it was likely that Meller's Duck, as a mallard, “will be able to survive indefinitely”, while Soothill & Whitehead (1978: page 217) stated that the Madagascar Pochard was “common” nearly 20 years after we now know that the last bird was reliably seen and the population crashed (Young & Kear 2006); bizarrely, Soothill & Whitehead (1978) omitted *A. bernieri* altogether! While the former species seem poorly known, the enigmatic Madagascar Teal was almost completely lost to science and, not seen for many years, was considered close to extinction until “rediscovery” in 1969 (Salvan 1970; Andriamampianina 1976), an event that signalled a renewed interest in the endemic ducks of this island. It is only recently that the Teal has been represented in book plates without a dark cap – a feature unknown in this species and depicted correctly in Philips (1923: Plate 36) before dark shading was added (possibly artistically) by Peter Scott in Delacour (1952: Plate VI), then becoming a distinct cap coloration in Madge & Burn (1988: Plate 28) and Del Hoyo *et al.* (1992: Plate 45) who presumably followed Madge & Burn.

With no idea of numbers until recently, the Madagascar Teal has always been considered rare and given the International Union for Conservation of Nature (IUCN) status of “Vulnerable” in the first Red Data Book (King 1978–1979) becoming, with no further information, “Endangered” in 1994 (Collar *et al.* 1994; BirdLife International 2000) (Table 2). Meller's Duck, although never surveyed but with large numbers at a few well-visited

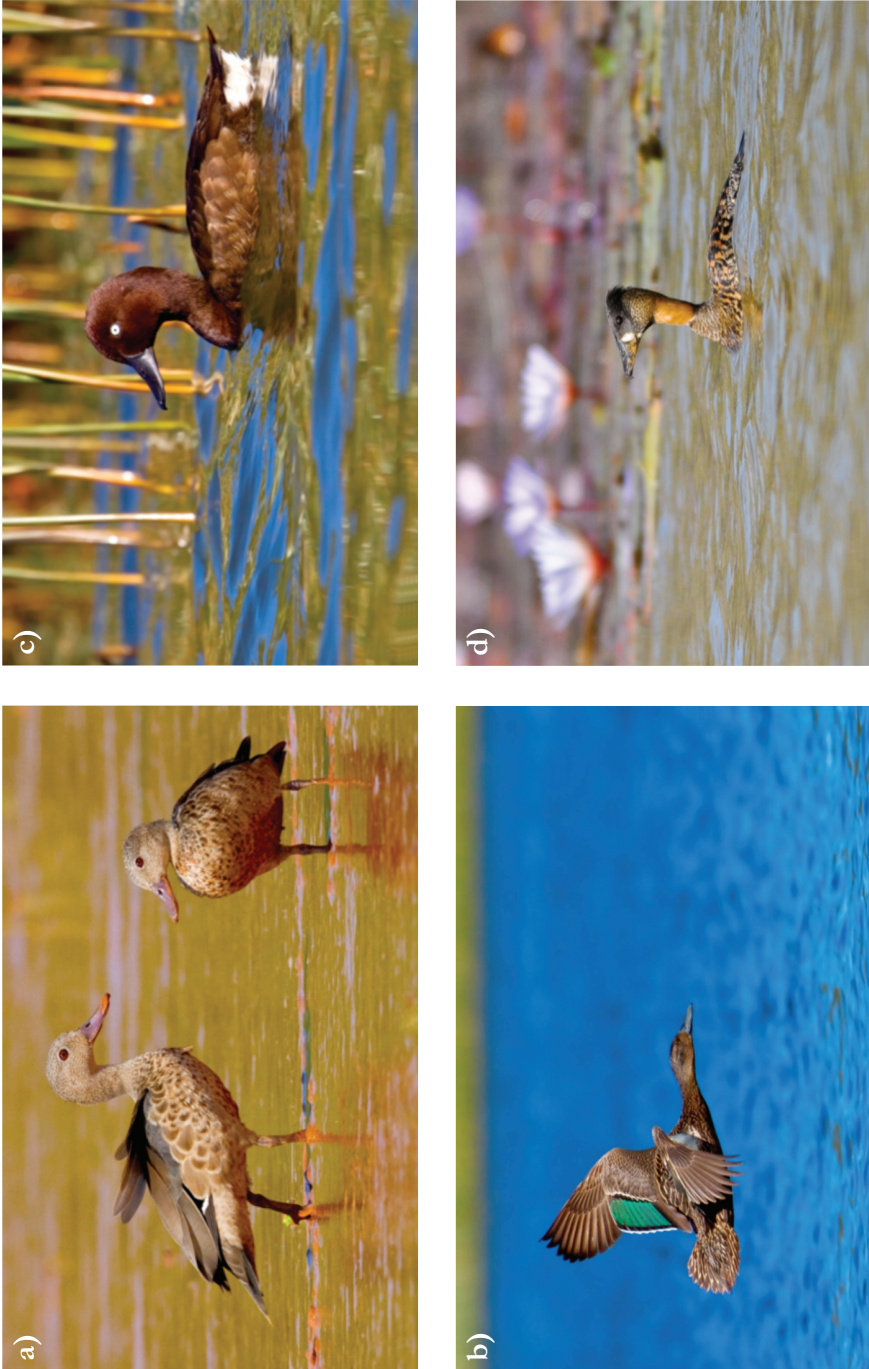


Figure 1. Madagascar's endemic ducks: (a) Madagascar Teal, (b) Meller's Duck, (c) Madagascar Pochard (photographs all by Dubi Shapiro), and (d) Madagascar White-backed Duck (photograph by Louise Jasper).

Table 2. Published status of Madagascar's endemic wildfowl (with total population estimate, if recorded) from 1978 to 2013. IUCN categories: NT = near threatened; VU = vulnerable; EN = endangered; CR = critically endangered.

Species	King 1978–79	Kear & Williams	Collar & Stuart 1985	Green 1992 ¹	Callaghan & Green 1993	Rose & Scott 1994	Collar <i>et al.</i> 1994	Scott & Rose 1996	BirdLife 2000	Delany & Scott 2002	BirdLife 2013 (mature individuals)
Madagascar White-backed Duck	-	-	-	-/EN	< 10,000	< 10,000	-	< 10,000	-	2,500–5,000	
Madagascar Teal	VU	VU	VU	VU/CR	> 20	EN	EN	500–1,000	EN	1,500–2,500	EN
Meller's Duck	-	*	**	-/VU < 10,000	EN 2,000–5,000	-	NT	2,000–5,000	EN 2,000–5,000	2,000–5,000	1,000–1,700 1,300–3,300
Madagascar Pochard	VU	VU	EN	EN/CR	0–10	CR	CR	0–10	CR	0–10	CR
											20–49

¹IUCN category listed by Green (1992), followed by a provisional new category recommended by the author.

*Kear & Williams (1978) list Meller's Duck but do not give a status category.

** Collar & Stuart (1985) list Meller's Duck as a candidate for future categorisation.

sites, was not included in the first bird Red Data Book. However, concerns for the species were already being expressed in the 1970s (see *e.g.* Kear & Williams 1978) and its status “progressed”, even in the absence of counts, from a candidate for the Red Data Book (Collar & Stuart 1985) to “Near Threatened” (Collar *et al.* 1994), “Vulnerable” (Green 1992) and eventually “Endangered” (BirdLife International 2000). Madagascar Pochard was listed as “Vulnerable” (King 1978–1979) well after the population crashed, but this was soon rectified and the species became “Endangered” (Collar & Stuart 1985) and then “Critically Endangered” (Collar *et al.* 1994). Although the pochard was considered extinct briefly (Young & Kear 2006), it remains on the “Critical” list. The Madagascar White-backed Duck, as a subspecies, has no IUCN classification (IUCN classifications being only to the species level); however, *T. leuconotus insularis* is recognised as “Endangered” by the Threatened Waterbird Specialist Group (TWSG 2006).

Distribution of endemic wildfowl taxa

Madagascar's endemic wildfowl taxa are very specific in their habitat requirements and vary accordingly in their distribution across the island (see distribution maps in Fig. 2, and also Safford & Hawkins 2013, for detailed records of each duck). Ecologically, Madagascar has at least three distinct sub-regions, principally: a dry west region, a humid eastern region and an arid area in the southwest of the country (Wilmé 1996). The Madagascar White-backed Duck is a bird of quiet, well-vegetated (especially with water lilies *Nymphaea* sp.) wetlands and is

fairly nomadic, moving from seasonally drying wetlands in the western region. This duck was probably once the one with the widest distribution in Madagascar; however, today it almost only found in the west. Madagascar Teal is a mangrove specialist and, with little mangrove in the east, is only known to nest in littoral mangrove and is found almost exclusively within a few kilometres of the coast or along larger estuaries. Subfossil remains of *A. bernieri* at inland sites (Goodman & Rakotozafy 1997) suggest a formerly wider distribution or greater dispersal than today. Meller's Duck is territorial and is a specialist of the many streams and small rivers of the extensive eastern drainage of rain forest and humid areas. Often nesting in thick forest, non-breeding Meller's Ducks may collect on larger lakes on the High Plateau such as Lake Alaotra. Madagascar Pochard is only known from lakes and marshes of the humid regions of the High Plateau.

Subfossil remains of Madagascar's two extinct sheldgeese have been found at several sites across the island (Goodman & Rakotozafy 1997; Goodman & Ramanamanjato 2007), but particularly in the arid southwest, suggesting that this region was formerly more hospitable to waterbirds (Goodman 1999).

A new understanding

While very little was known about any aspect of the wild ducks even in the latter half of the 20th Century, this can in part be explained by a shortage of local and visiting ornithologists and difficulties in accessing large parts of the island, particularly in the wet season, the waterbird breeding season.

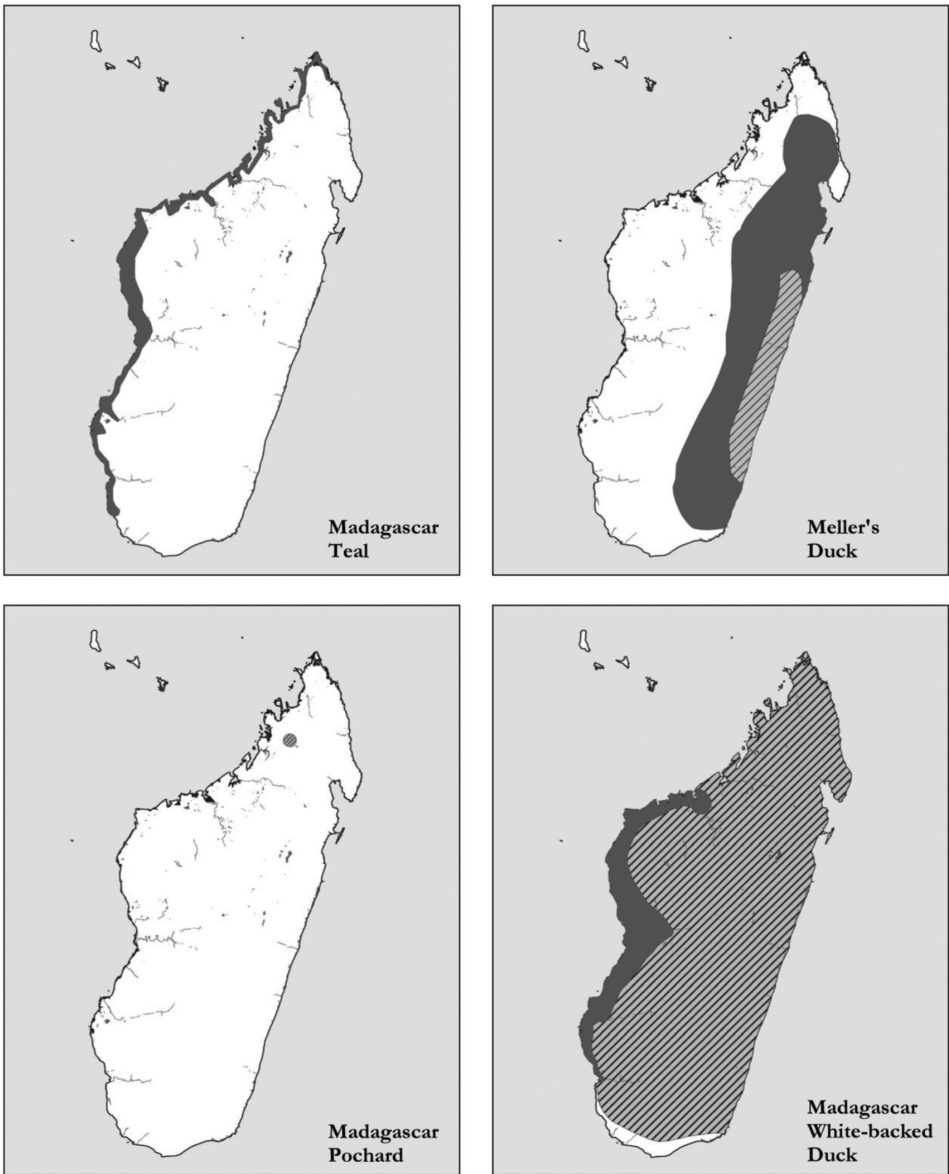


Figure 2. Distribution maps for Madagascar's endemic duck species. Solid area is current known distribution, grey area is where dispersive birds may occur. Maps modified from Safford & Hawkins (2013).

However, it is also surprising that the birds were not better studied in captivity. Meller's Duck was first kept in 1894 and first bred in

1931, with Madagascar White-backed Duck first breeding in 1931 (Ezra 1931). Madagascar Pochard bred in several

European collections between the two World Wars but none survived the second (Delacour 1959). Madagascar Teal was, before 1993, only represented in captivity by one female acquired in 1927 (Delacour 1929). Of these ducks only *A. melleri* elicited any real interest, and was included in Konrad Lorenz's treatise on duck behaviour originally published in 1941 (see translation: Lorenz 1971). Lorenz, observing birds bred by him in captivity, believed that females of the drab Madagascan species when put in the company of the bright males of Mallard *A. platyrhynchos* would instinctively be attracted to them, thus showing the species' recent origins and isolation on the island of Madagascar. Lorenz's views on Meller's Duck went untested until recently, however, and this ecologically unique endemic species therefore was not accorded the concern it deserved. Johnsgard (1962) further detailed dabbling duck displays and included several displays that Meller's Duck does not in fact have, so that in this author's later work (Johnsgard 1965) he questioned this duck's status as a full species.

Meller's Duck was introduced to the Durrell Wildlife Conservation Trust (Durrell) headquarters in Jersey in 1978 (from the population introduced into Mauritius) and in common with other animals at Durrell became the subject of intense research. It was quickly apparent that the Madagascan species had no interest in the local Mallards, and that even female Meller's Ducks were aggressive towards both sexes, chasing them away (thus raising the possibility that perhaps Lorenz made observations on Meller's ducks that had been foster-reared by Mallards). Study of

the species' displays showed significant differences in both repertoire and execution of the components (Young 1999). Meller's Duck also showed a degree of territoriality rarely seen in dabbling ducks and generally was more akin to the river-dwelling African Black Duck *A. sparsa* (Young 1995). Genetic studies confirmed the Meller's Duck's taxonomic integrity as an older species than the Mallard, which had previously been assumed to be its "ancestor" (Young & Rhymer 1998; Johnson & Sorenson 1999). Studies have shown this unique duck to be a specialist of the extensive drainage systems of eastern Madagascar that may have once been abundant in the many forested streams and rivers running off the high plateau.

The first specific study of any Madagascan duck in the wild took place in 1974 with the Wildfowl Trust (now the Wildfowl & Wetlands Trust: WWT) expedition to lakes south of Antsalova (coastal, western Madagascar) in 1973 to study the Madagascar Teal (Scott & Lubbock 1974). However, there remained many gaps in knowledge of this species' basic biology and it was not until the Durrell/WWT 1992 expedition to the same lakes, and the later capture of *A. bernieri* for a captive breeding programme, that this bird could be studied closely (Green *et al.* 1994; Young 2002). The first nests in the wild were found in 1997 and the first eggs were found in 1998 (Young *et al.* 2001); nesting in the west coast wet season (Dec–Mar) was also confirmed. The first description of downy ducklings was made in 2004 (Young & Brayshaw 2004). Genetic studies again showed the uniqueness of this species and its affinities to the Australo/Asian grey teal group (five species, see

Young *et al.* 1997). Studies of captive and wild birds have now outlined the species' ecology and shown it to be a mangrove specialist migrating short distances between highly seasonal mangrove lagoon areas, estuaries and the coast (Young 2002, 2006). Madagascar Teal have been ringed during moult at Lake Antsamaka since 1997 making this species possibly the only one in Madagascar with a long-term bird ringing programme (Razafindrajao *et al.* 2012).

Disappointingly, and in contrast to the dabbling ducks (above), there have until recently been no equivalent ecological studies of the pochard and white-backed duck. The Madagascar Pochard was not seen reliably after 1960 until a single bird was surprisingly caught alive in 1991 (Wilmé 1993; Young & Kear 2006). Despite several thorough surveys (Young & Smith 1989; Pidgeon 1996), a further 15 years passed before a small population of pochards was discovered in 2006 and the species' survival confirmed (Rene de Roland *et al.* 2007). Genetic studies did confirm the close relationship of *A. innotata* to the Australasian Hardhead *A. australis* (Young & Kear 2006). A project to determine the ecology of the Madagascar Pochard and to obtain a better understanding of the reasons for the species' decline commenced in 2010.

Madagascar White-backed Duck has only once been the subject of study (Woolaver & Nichols 2007), and this species' distribution and status in Madagascar remains unclear (Young *et al.* 2007).

There have been no systematic island-wide wildfowl surveys, mostly because of the sheer size of Madagascar and its individual wetlands, logistical constraints and the

limited numbers of observers available to undertake the work. Counts have been submitted to the African Waterbird Census (see *e.g.* Scott & Rose 1996). Projet ZICOMA (1999) analysed 101 sites (all biotypes including wetlands) and there have been a small number of regional surveys (*e.g.* Young *et al.* 2005; Razafimanjato *et al.* 2007) and surveys of individual wetland sites (*e.g.* Rabarisoa *et al.* 2006). Estimates of the population of each endemic duck taxa were made in 1994 (Rose & Scott 1994) and revised by H.G. Young in 2002, through an overall understanding of the current status of Madagascar's wetlands and collaboration with local and international colleagues over many years (Delany & Scott 2002). The 2002 estimates have been repeated (*e.g.* Delany & Scott 2006) and, with the exception of the subspecies *T. leuconotus insularis* (which is not included), and Madagascar Pochard (rediscovered in 2006), modified by BirdLife International (BirdLife 2013). At publication, the estimated populations are (BirdLife International 2013 unless otherwise stated): Madagascar White-backed Duck (1,000–2,000; Wetlands International 2013); Madagascar Teal 1,500–2,500 individuals, Meller's Duck 2,000–5,000 individuals and Madagascar Pochard 20–49 mature (wild) individuals (see Table 2 for history of published estimates and changes in threat status over the period 1978–2013). Young *et al.* (2006) suggest that the population of *T. leuconotus insularis* should be considered as < 1,000 birds.

Protection at last

With almost no understanding of the distribution and ecology of Madagascar's

ducks until recently, it is perhaps unsurprising that management plans have not yet been developed for the species. Moreover, of greater concern, none of the species were legally protected (see Dee 1986) until new laws were passed protecting the endemic taxa in 2006. Although a statutory hunting season existed for wildfowl in Madagascar this was rarely enforced and practically impossible to police in a country where subsistence hunting represents a far greater threat to ducks than sport hunting (Young 1996).

Wetlands too were poorly protected with almost none of any note within Madagascar's original network of reserves and national parks (Langrand & Wilmé 1993; Langrand & Goodman 1995; Young 1996). Very small numbers of Madagascar Teal and Meller's Duck have been found in protected areas (*e.g.* *A. bernieri* in Kirindy Mitea National Park and *A. melleri* in Ranomafana NP and Zahamena NP; H.G. Young pers. sources; Table 3 and Fig. 3) but this is more by luck than judgement. From the 1990s onwards there was pressure from many sources to try to redress this imbalance in protected areas. Important progress was made when Madagascar joined the Convention on Wetlands of International Importance especially as Waterfowl Habitat (the "Ramsar Convention") in 1999 and subsequently designated nine Ramsar sites (Ramsar 2013; Table 3). While Ramsar designation may not provide wildfowl at a site with direct protection, the process is indicative of a desire by Madagascar to improve the status of wetlands and their natural inhabitants.

In 2003, the President of Madagascar,

Marc Ravalomanana, promised to increase his country's protected areas from 1.7 million to 6.0 million ha (Norris 2006) – the "Durban Vision". This increase will see the development of several new National Parks and has already included the newly protected areas of Menabe Antimena, the Manambolomaty Complex and the Kinkony Mahavavy Complex, which all hold significant numbers of waterbirds including breeding and non-breeding *A. bernieri* (Table 3, Fig. 3). Several leading non-government organisations (NGOs) are currently establishing plans for further protected areas with the Madagascar government.

Since its rediscovery in 2006, the precarious survival chances of the tiny remnant population of Madagascar Pochard has prompted the establishment of wide-ranging programme of conservation initiatives coordinated by a partnership of local and international specialists (Durrell, WWF, The Peregrine Fund, Asity Madagascar and the Government of Madagascar). This programme has included establishment of the lakes and surrounding forest near Bemanevika as a New Protected Area (an initial level of protection in the process of fully ratifying the protection of site) (Table 3, Fig. 3) by The Peregrine Fund, the establishment of a field-based research team (including Malagasy PhD projects), a regional education awareness programme and development of a local captive-breeding programme. Three clutches of eggs were collected in the wild in October and November 2009 (Donald *et al.* 2010) and the first captive-bred duckling from this project hatched in September 2011 at a purpose-

Table 3. Ramsar sites and important protected wetlands in Madagascar and endemic wildfowl present at site. Site numbers refer to map (Fig 3).

Site no.	Site name	Ramsar site no. ¹	Year designated ¹	Size (ha)	Madagascar realm ²	Endemic wildfowl	Approx. duck numbers (* = breeds)	Site characteristics
1	Lake Tsimanampetsotsa (24°07'S 043°45'E)	962	1998	45,604	Southern	Madagascar Teal	One record (Safford & Hawkins 2013)	A shallow lake with open water and mudflats.
2	Manambolomaty lakes complex (19°01'S 044°24'E)	963	1998	7,491	Western	Madagascar Teal	*20+ 118 caught for ringing at Lake Antsamaka in 2000 (Razafindrajao <i>et al.</i> 2012).	The complex consists of three permanent freshwater lakes and one brackish lake; all four lakes are surrounded by the Tsिमembo forest.
3	Lake Alaotra (17°28'S 048°31'E)	1312	2003	722,500	Eastern	Madagascar White-backed Duck Meller's Duck	*20+ (Durrell unpubl. data) *200+ (<i>e.g.</i> 260 in 1989; Young & Smith 1989)	Large lake (<i>c.</i> 20,000 ha), surrounded by 23,500 ha of marsh, 117,000 ha of rice plantations, and including > 500,000 ha of the surrounding catchment and water.
4	Torotorofotsy Marsh (18°52'S 048°22'E)	1453	2005	1,100	Eastern	Madagascar Pochard Meller's Duck	Not seen since 1960 (Young & Kear 2006) *10+ (Durrell unpubl. data)	A near-natural permanent marsh and temporary marshes with their catchments of primary rainforest, fragmented by agricultural zones and secondary forest.

Table 3 (continued).

Site no.	Site name	Ramsar site no. ¹	Year designated ¹	Size (ha)	Madagascar realm ²	Endemic wildfowl	Approx. duck numbers (* = breeds)	Site characteristics
5	Parc de Tsarasaotra (18°52'S 047°32'E)	1464	2005	27	Eastern	Meller's Duck	Occasional	Small lake (Lake Alarobia) close to the capital (Antananarivo), important for providing a refuge and nesting site in an urban environment for waterbirds inhabiting the highlands in central Madagascar.
6	Lake Bedo (19°57'S 044°36'E)	1686	2007	1,962	Western	Madagascar Teal	*c. 50 in area. 17 on lake, Oct 2004 (Durrell unpubl. data)	Wetland complex adjacent to forests, consisting of the shallow, open Lake Bedo, its surrounding marshes, and a permanent river flowing into the lake.
7	Nosivolo River (20°03'S 48°07'E)	1916	2010	4,467	Eastern	Meller's Duck	Unknown	Comprises 130 km of river, with lakes, pools and irrigated lands. Has the highest concentration of endemic freshwater fish in Madagascar.
8	Lake Kinkony (16°08'S 045°49'E)	2048	2012	13,800	Western	(Madagascar Teal in Mahavavy-Kinkony Protected Area)	*10 (BirdLife 2013)	Permanent freshwater lake. Included in Mahavavy-Kinkony Protected Area.
						Madagascar White-backed Duck	Unknown	

9	Mandirozo Wetlands (17°32'27"S 044°05'47"E)	2049	2012	15,145	Western	Madagascar Teal Madagascar White-backed Duck	*50+ (e.g. 67 in 1998; BirdLife 2013) Unknown	Permanent freshwater lake surrounded by marshes, irrigated rice farms, portions of dried forests, and savannah lands.
10	Kirindy Mireia National Park (20°49'S 044°13'E)			72,000	Western	Madagascar Teal	*25+ (20 on Lake Andio in Oct 2004; Durrell unpubl. data)	Dry forest with areas of spiny forest, shallow seasonal lakes, dunes and mangroves.
11	Ranomafana National Park (21°13'S 047°48'E)			41,601	Eastern	Meller's Duck	*10+ Pairs seen in NP and groups at nearby Vohiparara marshes	Rainforest including numerous forested streams and adjacent marsh.
12	Zahamena National Park (17°30'S 048°41'E)			64,370	Eastern	Meller's Duck	*10+ (Durrell unpubl. data)	Rainforest including numerous forested streams.
13	Bemanevika New Protected Area (14°22'S 048°32'E)			37,041	Eastern	Meller's Duck Madagascar Pochard ³	*25+ (Durrell unpubl. data) *20–25 (Safford & Hawkins 2013)	Rainforest including small crater lakes and marshes.

¹Ramsar 2013; ²Wilimé 1996; ³site holds the entire known world population of Madagascar Pochard.

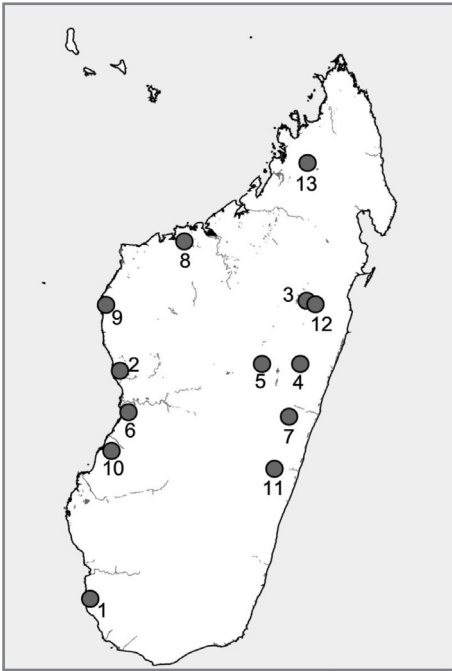


Figure 3. Map of wetlands within Madagascar where endemic duck species are known to occur. Numbers on the map refer to the sites listed in Table 3.

built facility in the town of Antsohihy, Sofia. By 2013, 38 ducklings had been hatched in captivity, and potential sites in Sofia for the future release of captive-bred birds were being sought, with restoration necessary at these sites being proposed.

The future

For many years amongst the least known birds in the world, Madagascar's endemic wildfowl are now surprisingly well understood and the chances of their survival into the future are brighter than they have been for some time. In the case of the two *Anas* species, these are probably

more studied than several mainland wildfowl species. For the first time too they have legal protection and some secure habitat. It is especially encouraging that there are a great many Malagasy scientists now involved in wildfowl study, including census and distributional surveys but also ecological studies. Since 1993 there have been seven university theses completed on Madagascar's ducks – five by Malagasy students. Five of these degrees were attained through Durrell, which has dedicated wildfowl personnel, but it is of further encouragement that most NGOs with offices and staff in Madagascar, notably The Peregrine Fund, WWF, BirdLife International, Wildlife Conservation Society and Conservation International, as well as Asity Madagascar (the local BirdLife partner), have actively been involved in wildfowl studies and protection.

We should not be complacent, as although protection of the short distance migrant *A. bernieri* and probably sedentary *A. innotata* may be feasible with adequate site protection, they remain vulnerable to major unforeseen habitat loss at key sites. The confiding but nomadic *T. leuconotus insularis* and the shy and low density, territorial, *A. melleri* may take a lot more effort to save from extinction, however, because they are thinly dispersed, are highly vulnerable to human activity, and there are no adequate safe sites identified where these birds can be protected.

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Photograph: Madagascar Teal, by Nicolas Cegalerba/Biosphoto/FLPA.