Part V Primates in Freshwater Flooded Forests

Chapter 30

Primates of Africa's Coastal Deltas and Their Conservation

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Introduction

There is little information on the non-human primates (hereafter 'primates') of Africa's deltas, or on the importance of these deltas to the conservation of primate diversity on the continent. This chapter is concerned with the conservation of Africa's ten largest coastal deltas and their importance to the maintenance of primate diversity. This chapter also draws attention to (1) the need for much more research on the distribution, abundance and conservation status of the primates that inhabit Africa's large coastal deltas, and (2) the fact that the biological values of most of these large coastal deltas are being rapidly degraded and are in dire need of targeted conservation actions.

Deltas

Definition

A 'delta' is a tract of alluvial land, often more-or-less triangular in shape, enclosed or traversed by the diverging mouth of a river (Shorter Oxford English Dictionary 2007). Big rivers that flow over large expanses of ground where there is little altitudinal gradient form complex divergent drainage systems at their mouth. This causes the water flow to slow and sediments to be deposited into expanses of wetlands and shallow water, creating a delta. Deltas may be 'inland', where the river flows into a swamp and/or lake, or 'coastal', where the river meets the sea.

Africa's Inland Deltas

Large, inland bodies of water in Africa, such as the Okavango (Botswana; *c.* 16 000 km^2), Sudd (South Sudan; *c.* 30 000 km^2), and Inner Niger (Mali; *c.* 38 000 km^2) all display large triangular (or fan-shaped) geological features that are the result of deposits from their primary rivers and, therefore, can be referred to as 'deltas'. In the case of the Sudd and Inner Niger, their deltas are not immediately apparent as each occurs within a vast area of swamp, marsh and floodplain. The Okavango, Sudd and Inner Niger are Africa's three largest inland deltas. All, however, rank low in terms of their importance to the conservation of Africa's primate diversity as none supports more than four primate species, not one of which is globally threatened (i.e. all are 'Least Concern'; IUCN 2017). The reasons for the relatively low primate species richness in these inland deltas are, no doubt, related to the fact that all lie well outside Africa's Rainforest Biotic Zone (Happold & Lock 2013). Although inland deltas are important for the regional and national primate diversity they hold (for example, the Okavango is a stronghold for all three of Botswana's species of primate), no inland delta is vital to the maintenance of the continent's primate diversity. As such, this review is confined to coastal deltas.

Africa's Coastal Deltas

Coastal deltas are comprised of a complex mixture of marine, freshwater and terrestrial environments, as well as gradients and transition zones among these environments. This complexity is enhanced by daily tides, storm tides, seasonal influxes of freshwater, nutrients from rivers, and other events. Coastal deltas are, therefore, extremely variable and dynamic, both in space and time, and in terms of their structures, habitats and biotas. Coastal deltas support habitat mosaics that may include lagoons, estuaries, lakes, rivers, marshes, swamps, swamp forests, mangroves, floodplains, *terra firma* forests, woodlands, savannas, bushlands, dunes, beaches and other habitats. These yield a dense array of ecotones that further add to the complexity of coastal deltas. Not surprisingly, coastal deltas often support a relatively high biological richness and typically have considerable conservation value (Hughes & Hughes 1992; Ramsar 2015).

Approach and Methods

The primate taxonomy followed in this chapter is that presented in Butynski *et al.* (2013), with the following exceptions: (1) three species of potto *Perodicticus* are recognized (Oates 2011; Stump 2005); (2) the genus *Piliocolobus* is recognized (Groves 2001, 2007); and (3) the Niger Delta Red colobus *Piliocolobus epieni* is elevated from a subspecies (Groves 2007b; Oates 2011; Oates & Werre 2009). The information presented derives from a detailed review of the literature, extensive correspondence with colleagues, and our own work in the Tana Delta, Kenya, and along the Lower Rufiji River, near the inland apex of the Rufiji Delta, Tanzania.

Surprisingly, no authoritative list or database of Africa's coastal deltas exists. The several sources found (e.g. Hughes & Hughes 1992; ProtectedPlanet 2015; Ramsar 2015; World Delta Database 2015) were either incomplete and/or held errors. This study, therefore, reverted to a review of all of Africa's larger rivers to assess whether they support one of the continent's

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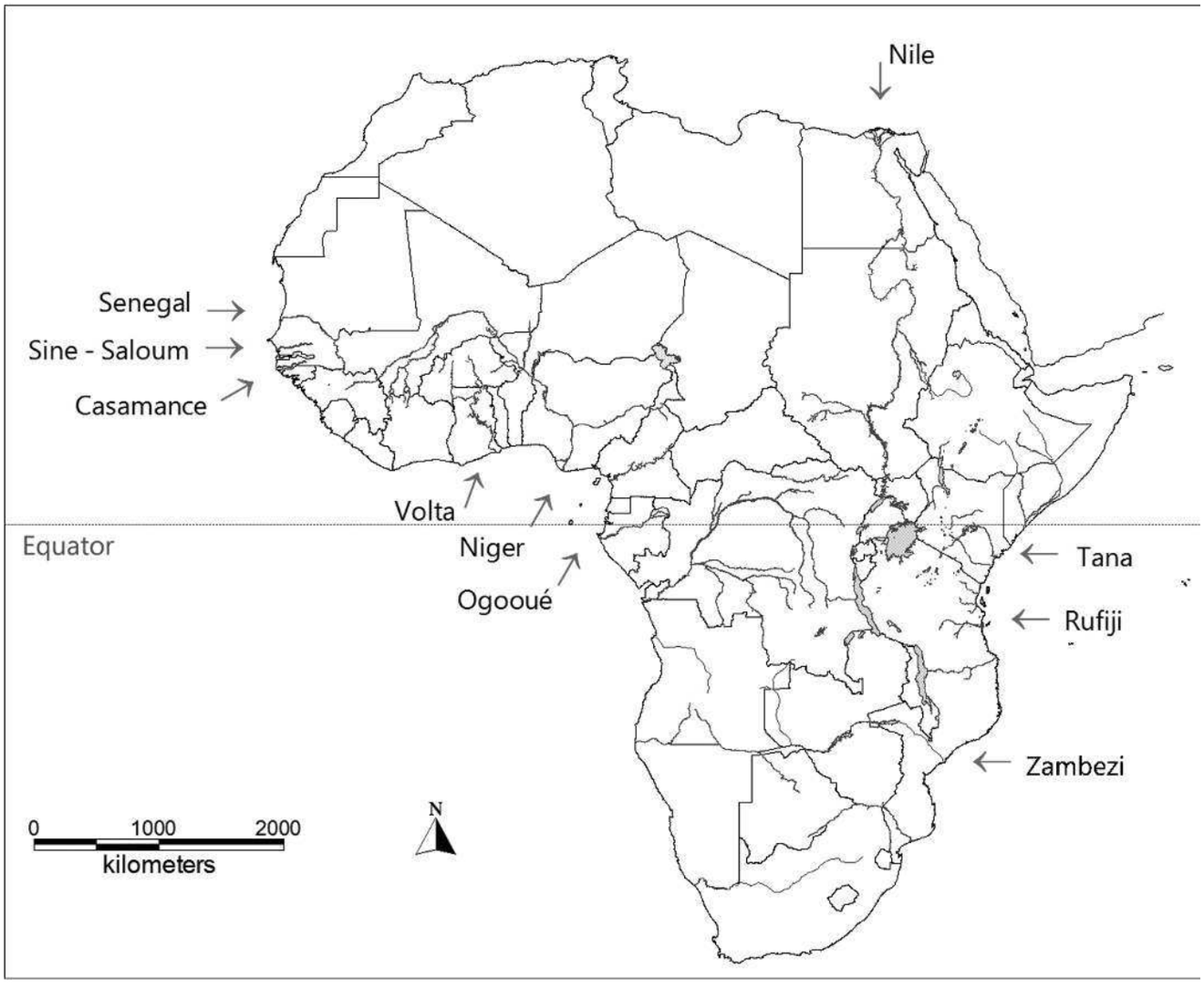

Figure 30.1 Africa's ten largest coastal deltas. Map by Yvonne de Jong & Tom Butynski. (A black and white version of this figure appears in some formats. For the colour version, please refer to the plate section.)

ten largest deltas (i.e. deltas > 700 km²). From an initial set of purported coastal deltas for Africa, the number was reduced to the ten largest (Figure 30.1; Table 30.1). The following 24 large rivers (listed clockwise around the coast of Africa, beginning with Somalia) either do not terminate in a delta or, if they do, their delta is < 700 km²: Shabeelle-Jubba, Sabaki, Pangani, Wami, Ruvu, Rukwa, Limpopo, Maputo, Pungwe (Pungue), Mkhuze, Orange, Cunene, Cubango, Congo (= Zaire), Campo, Mbini (= San Benito), Muni, Sanaga, Cross, Ouémé, Sassandra, Gambia, Bandama, and Comoe.

With the exception of the Tana Delta and the Sine-Saloum Delta, authoritative lists for the primate taxa present in each of the largest deltas were not found. When lists were available, they had mistakes and/or omissions. In particular, lists for the strepsirrhine fauna were either not available or incomplete/incorrect. The lists presented in Table 30.2 are, therefore, derived through a detailed review of the literature and extensive consultation with colleagues. Despite these efforts, a number of questions remain as to which taxa occur in several of the deltas. These questions cannot be resolved without additional field work.

The ten largest coastal deltas were ranked according to their importance for the conservation of Africa's primate diversity (Table 30.3). The conservation rating system used followed the approach of Oates (1996), which is based on 'degree of threat' and 'taxonomic distinctiveness'. Unlike Oates (1996), however, the rating system applied here uses the degree of threat category presented in the current *IUCN Red List of Threatened Species* (IUCN 2017). Species were given a numerical point value based on their current degree of threat status as follows: 'Least Concern' or 'Near Threatened' = 1 point; 'Vulnerable' = 2; 'Endangered' = 3; 'Critically Endangered' = 4. Taxonomic distinctiveness was assessed on a 2-point scale. A species received 2 points if it has no more than one close relative (i.e. a member of the same species-group, subgenus, or genus). All other species received 1 point.

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Table 30.1 Overview of Africa's 10 largest coastal deltas. Main sources: Hughes & Hughes (1992), ProtectedPlanet (2015), Ramsar (2015), and World Delta Database (2015).

Delta (km^2)	Main supporting river(s)	Country	Non-Ramsar protected areas that include at least part of the delta or are adjacent to the delta (km^2)	Ramsar Sites that include at least part of the delta, year of listing, and size (km^2); Montreux Record listing also noted
Nile (22 000)	Nile	Egypt	None	Lake Burullus: 1988 (462). Placed on Montreux Record in 1990.
Tana (1636)	Tana	Kenya	None. Tana River Primate National Reserve *c.* 40 km up-river of delta	Tana River Delta: 2012 (1636)
Rufiji (720)	Rufiji	Tanzania	Mangrove-Rufiji Forest Reserves	Rufiji-Mafia-Kilwa: 2004 (5970)
Zambezi (12 000)	Zambezi	Mozambique	Marromeu Complex Game Management Area	Marromeu Complex: 2004 (6880)
Ogooué (5500)	Ogooué	Gabon	None Proposed: Ogooué National Park (centred on lakes Onangué, Oguémoué, Evaro, Ezanga)	Bas Ogooué: 2009 (8627). Does not include the marine delta or mangroves. Includes a long stretch of the Ogooué R. and part of Abanga R. (H. Rainey, pers. comm.; J.-P. Vande Weghe, pers. comm.).
Niger (46 420)	Niger	Nigeria	Upper Orashi Forest Reserve Lower Orashi Forest Reserve Edumanom Forest Reserve Apoi Creek Forest Reserve Ikebiri Creek Forest Reserve Egbedi Creek Forest Reserve Taylor Creek Forest Reserve Nun River Forest Reserve Osomari Forest Reserve Olague Forest Reserve Kwale Forest Reserve	Upper Orashi Forests: 2008 (252) Oguta Lake: 2008 (6) Apoi Creek: 2008 (292)
Volta (1925)	Volta	Ghana	Songor UNESCO-MAB Biosphere Reserve	Anlo-Keta Lagoon Complex: 1992 (1278) Songor Lagoon: 1992 (287)
Casamance (2500)	Casamance	Senegal	National Park de Basse Casamance Forêt de Boukitingo Forest Reserve Forêt d'Oukout Forest Reserve Forêt de Diantene Forest Reserve Forêt Classée des Narangs Forêt Classée des Kalounayes Forêt Classée des Bayottes	None
Sine-Saloum (1800)	Sine, Saloum	Senegal, Gambia	Saloum Delta National Park and Biosphere Reserve (Senegal) Niumi National Park (Gambia)	Delta du Saloum, Senegal: 1984 (730)
Senegal (4254)	Senegal	Senegal, Mauritania	Réserve spéciale de faune de Guembeul (Senegal) Forêt de Leybar Forest Reserve (Senegal) Forêt Classée de Maka Diama (Senegal) Langue de Barbarie National Park (Senegal) Diawling National Park (Mauritania) Delta du Fleuve Sénégal UNESCO-MAB Biosphere Reserve (Senegal and Mauritania)	Gueumbeul, Senegal: 1986 (7) Bassin du Ndiaël, Senegal: 1977 (100). Placed on Montreux Record in 1990. Djoudj, Senegal: 1977 (160). Place on Montreux Record in 1993 and removed in 2009. Chat Tboul, Mauritania: 2000 (155) Parc National du Diawling, Mauritania: 1994 (156) Placed on Montreux Record in 2002 and removed in 2009.

Results

In Africa, the diversity of primates, as with many other taxonomic groups, is inversely related to latitude (Cowlishaw & Hacker 1997; Harcourt 2006), with the Guineo-Congolian Lowland Rain Forest Zone (White 1983) supporting the highest diversity. This is followed by the tropical montane forests and then by the moist forests of coastal East Africa (Barnes 1992). As expected, primate diversity in Africa's coastal deltas varies greatly (from 0 to 17 taxa), generally declining with increasing

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Table 30.2 Primate taxa present in or near Africa's 10 largest coastal deltas. Main sources: Oates (2011) and Butynski *et al.* (2013).

Delta	Primate taxa in and/or near the delta and category of threat (IUCN 2017)	Ecoregion (Olson *et al.* 2001)	Vegetation
Nile	No non-human primates	Nile Delta Flooded Savanna	Grassland, swamp, marsh (Baha El Din 1999).
Tana	Tana River red colobus *Piliocolobus rufomitratus rufomitratus* (Endangered) Tana River mangabey *Cercocebus galeritus* (Endangered) Northern yellow baboon *Papio cynocephalus ibeanus* (Least Concern) Hilgert's vervet *Chlorocebus pygerythrus hilgerti* (Least Concern) Pousargues's monkey *Cercopithecus mitis albotorquatus* (Vulnerable) White-tailed small-eared galago *Otolemur garnettii lasiotis* (Least Concern) Kenya lesser galago *Galago senegalensis braccatus* (Least Concern) Kenya coast dwarf galago *Galagoides cocos* (Least Concern)	Northern Zanzibar-Inhambane Coastal Forest Mosaic	Riverine forest, grassland, woodland, acacia bush, coastal forest, beach, dune, swamp, mangrove (De Jong & Butynski 2009; Hamerlynck *et al.* 2012; Robertson & Luke 1993; Tana River Delta 2015).
Rufiji	Peters's Angola colobus *Colobus angolensis palliatus* (Least Concern) Southern yellow baboon *Papio cynocephalus cynocephalus* (Least Concern) Reddish-green vervet *Chlorocebus pygerythrus rufoviridis* (Least Concern) Tanzania Sykes's monkey *Cercopithecus mitis monoides* (Least Concern) Miombo silver galago *Otolemur crassicaudatus monteiri* (Least Concern) Pangani small-eared galago *Otolemur garnettii panganiensis* (Least Concern) Matundu dwarf galago *Galagoides zanzibaricus udzungwensis* (Least Concern) Mozambique dwarf galago *Galagoides granti* (Least Concern)	East African Mangroves	Swamp, sand ridge, grassland, shrub, woodland, forest, mangrove (Ochieng 2002).
Zambezi	Southern vervet *Chlorocebus pygerythrus pygerythrus* (Least Concern) Samango monkey *Cercopithecus mitis erythrarchus* (Least Concern) Miombo silver galago *Otolemur crassicaudatus monteiri* (Least Concern) Mozambique dwarf galago *Galagoides granti* (Least Concern)	East African Mangroves Zambezian Coastal Flooded Savanna	Dry forest, *Acacia-Borassus-Combretum* woodland, riverine forest mosaic, acacia thicket and savanna, doum palm savanna, wetland pan, grassland, mangrove, swamp forest, papyrus swamp, cultivation, dune (Beilfuss *et al.* 2001).
Ogooué	Western lowland gorilla *Gorilla gorilla gorilla* (Critically Endangered) Central chimpanzee *Pan troglodytes troglodytes* (Endangered) Gabon black colobus *Colobus satanas anthracinus* (Vulnerable) Red-capped mangabey *Cercocebus torquatus* (Vulnerable) Mandrill *Mandrillus sphinx* (Vulnerable) Grey-cheeked mangabey *Lophocebus albigena* (Least Concern) Northern talapoin monkey *Miopithecus ogouensis* (Least Concern) Black-footed crowned monkey *Cercopithecus pogonias nigripes* (Least Concern)	Central African Mangroves Atlantic Equatorial Coastal Forests	Sand-dune, sandbank, alluvial plain, mangrove, mudflat, grassland, swamp, papyrus, flooded forest, forest, savanna, coastal *Dalbergia* thicket (Birdlife International 2015; Latour 2005; Ramsar 2015; J.-P. Vande Weghe, pers. comm.).

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Table 30.2 (*cont.*)

Delta	Primate taxa in and/or near the delta and category of threat (IUCN 2017)	Ecoregion (Olson *et al.* 2001)	Vegetation
	Eastern putty-nosed monkey *Cercopithecus nictitans nictitans* (Least Concern) Red-tailed moustached monkey *Cercopithecus cephus cephus* (Least Concern) Grey-tailed moustached monkey *Cercopithecus cephus cephodes* (Least Concern) Milne-Edwards's potto *Perodicticus edwardsi* (Least Concern) Golden angwantibo *Arctocebus aureus* (Least Concern) Gabon squirrel galago *Sciurocheirus gabonensis* (Least Concern) Southern needle-clawed galago *Euoticus elegantulus* (Least Concern) Demidoff's dwarf galago *Galagoides demidovii* (Least Concern)[a] Thomas's dwarf galago *Galagoides thomasi* (Least Concern)[a]		
Niger	Nigeria-Cameroon chimpanzee *Pan troglodytes ellioti* (Endangered) Olive colobus *Procolobus verus* (Near Threatened) Niger Delta red colobus *Piliocolobus epieni* (Critically Endangered) Red-capped mangabey *Cercocebus torquatus* (Vulnerable) Olive baboon *Papio anubis* (Least Concern) Common tantalus monkey *Chlorocebus tantalus tantalus* (Least Concern) Mona monkey *Cercopithecus mona* (Least Concern) Martin's putty-nosed monkey *Cercopithecus nictitans martini* (Least Concern) Sclater's monkey *Cercopithecus sclateri* (Vulnerable) White-throated monkey *Cercopithecus erythrogaster pococki* (Vulnerable) Milne-Edwards's potto *Perodicticus edwardsi* (Least Concern) Benin potto *Perodicticus potto juju* (Least Concern) Calabar angwantibo *Arctocebus calabarensis* (Least Concern) Cross River squirrel galago *Sciurocheirus alleni cameronensis* (Least Concern) Nigeria needle-clawed galago *Euoticus pallidus talboti* (Least Concern) Demidoff's dwarf galago *Galagoides demidovii* (Least Concern)[a] Thomas's dwarf galago *Galagoides thomasi* (Least Concern)[a]	Niger Delta Swamp Forest Central African Mangroves	Mangrove, freshwater swamp, swamp forest, freshwater forest, lowland forest, beach (Baker 2005; Bocian 1999; Ikemeh 2014a,b, 2015; Ikemeh & Oates 2017; Luiselli *et al.* 2015; Petrozzi *et al.* 2015; Powell 1993; UNDP 2011; Werre 2000, 2001a,b; Werre & Powell 1997; Chapter 40).
Volta	Olive baboon *Papio anubis* (Least Concern) Common tantalus monkey *Chlorocebus tantalus tantalus* (Least Concern) Mona monkey *Cercopithecus mona* (Least Concern) Thomas's dwarf galago *Galagoides thomasi* (Least Concern)[a]	Central African Mangroves	Savanna, grassland, mudflat, mangrove, riverine forest (Olson *et al.* 2001; Ramsar 2015).
Casamance	King colobus *Colobus polykomos* (Vulnerable) (extirpated) Temminck's red colobus *Piliocolobus badius temminckii* (Endangered) Sooty mangabey *Cercocebus atys* (Near Threatened) (extirpated) Guinea baboon *Papio papio* (Near Threatened) Western patas monkey *Erythrocebus patas patas* (Least Concern)	Guinean Mangroves Guinean Forest-savanna Mosaic	Mangrove, gallery forest, swamp forest, savanna woodland, palm-pandan swamp, reed swamp, grassland, forest (Birdlife International 2015; ProtectedPlanet 2015; Ramsar 2015).

Table 30.2 (*cont.*)

Delta	Primate taxa in and/or near the delta and category of threat (IUCN 2017)	Ecoregion (Olson *et al.* 2001)	Vegetation
	Green monkey *Chlorocebus sabaeus* (Least Concern) Campbell's monkey *Cercopithecus campbelli* (Least Concern) Senegal lesser galago *Galago senegalensis senegalensis* (Least Concern) Thomas's dwarf galago *Galagoides thomasi* (Least Concern)[a]		
Sine- Saloum	Temminck's red colobus *Piliocolobus badius temminckii* (Endangered) Guinea baboon *Papio papio* (Near Threatened) (introduced species) Western patas monkey *Erythrocebus patas patas* (Least Concern) Green monkey *Chlorocebus sabaeus* (Least Concern) Senegal lesser galago *Galago senegalensis senegalensis* (Least Concern)	Guinean Mangroves Guinean Forest-savanna Mosaic	Mangrove, dune forest, dry forest, dry woodland, gallery forest, savanna (Galat-Luong & Galat 2005; Ramsar 2015).
Senegal	Western patas monkey *Erythrocebus patas patas* (Least Concern) Senegal lesser galago *Galago senegalensis senegalensis* (Least Concern)	Sahelian Acacia Savanna	Savanna, acacia shrub, beach, salt flat, dune (Ramsar 2015; World Delta Database 2015).

[a] *Galagoides demidovii* and *Galagoides thomasi* are similar species that are broadly sympatric. As such, they have often been confused, both in the field and in the literature. While the best information available has been used to designate these two species in this table, their presence needs to be validated for all four deltas for which they are listed.

Table 30.3 Summary of the significance for primate conservation of Africa's ten largest coastal deltas.

Delta	Primate conservation rating and (rank)	Number of primate taxa	Country endemic primate taxa	Threatened primate taxa (IUCN 2017)*	Main threats to the delta
Nile	0 (10)	0	None	None	Rapid human population growth and unsustainable use of natural resources. Dams; water diversion; habitat loss to agriculture (Baha El Din 1999; Hughes & Hughes 1992).
Tana	22 (3)	8	*Piliocolobus rufomitratus rufomitratus* *Cercocebus galeritus*	*Piliocolobus rufomitratus rufomitratus* (Endangered) *Cercocebus galeritus* (Endangered) *Cercopithecus mitis albotorquatus* (Vulnerable)	Rapid human population growth and unsustainable use of natural resources. Forest degradation and loss due to extraction of forest products, invasive species (especially *Prosopis juliflora* [Leguminosae]), river-edge agriculture and expansion of irrigation; poaching; reduction in flooded area due to five hydroelectric power dams and a sixth planned dam (Hamerlynck *et al.* 2012; Mbora & Butynski 2009; Wieczkowski & Butynski 2013).
Rufiji	18 (4)	8	*Cercopithecus mitis monoides*	None	Rapid human population growth and unsustainable use of natural resources. Harvest of mangrove and other wood products; clearance of mangrove for fish and prawn farming and agriculture; industrial and agricultural pollution; increased siltation; changes in flood hydrographs through hydropower dam development; water extraction (Birdlife International 2015; Burgess *et al.* 2004; Duvail *et al.* 2014; Ochieng 2002).

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Table 30.3 (*cont.*)

Delta	Primate conservation rating and (rank)	Number of primate taxa	Country endemic primate taxa	Threatened primate taxa (IUCN 2017)*	Main threats to the delta
Zambezi	9 (7)	4	None	None	Rapid human population growth and unsustainable use of natural resources. Disturbed annual flood cycles due to dams (e.g. Kariba Dam, Cahora Bassa Dam); construction of roads, railways, factories and dykes; loss of habitat to agriculture (particularly sugarcane plantation) and settlement; hunting; fishing (Beilfuss *et al.* 2001; Ramsar 2015; World Delta Database 2015; WWF 2015; K. Tinley, pers. comm.).
Ogooué	46 (1)	17	*Cercopithecus cephus cephodes*	*Gorilla gorilla gorilla* (Critically Endangered) *Pan troglodytes troglodytes* (Endangered) *Colobus satanas anthracinus* (Vulnerable) *Cercocebus torquatus* (Vulnerable) *Mandrillus sphinx* (Vulnerable)	Very low human population density (probably < 0.02 people/km^2). Relatively few threats. Some over-hunting (e.g. *C. satanas, L. albigena*) (Latour 2005; Ramsar 2015; J.-P. Vande Weghe, pers. comm.).
Niger	45(2)	17	*Piliocolobus epieni* *Cercopithecus sclateri* *Cercopithecus erythrogaster pococki*	*Pan troglodytes ellioti* (Endangered) *Piliocolobus epieni* (Critically Endangered) *Cercocebus torquatus* (Vulnerable) *Cercopithecus sclateri* (Vulnerable) *Cercopithecus erythrogaster pococki* (Vulnerable)	Rapid human population growth and unsustainable use of natural resources. Dams and their impact on the hydrological balance; hunting; deforestation due to agriculture, logging and settlement; invasive species; oil exploration, extraction and pollution (Baker 2005; Blench 2007; Bocian 1999; Ikemeh 2014a,b, 2015; Ikemeh & Oates 2017; James *et al.* 2007; Kadafa 2012; Luiselli *et al.* 2015; Moffat & Lindén 1995; Oates & Werre 2009; Oates *et al.* 2004; Petrozzi *et al.* 2015; Phil-Eze & Okoro 2009; Powell 1997; UNDP 2011; Werre 2001a,b; Werre & Powell 1997; Chapter 40).
Volta	6 (8)	4	None	None	Rapid human population growth and unsustainable use of natural resources. Salt mining; harvesting of mangroves; habitat loss due to extraction of forest products and agriculture; fishing; hunting (Ramsar 2015).
Casamance	Historic: 22 Present: 16 (5)	7 (was 9 but 2 species extirpated)	None	*Colobus polykomos* (Vulnerable) (extirpated) *Piliocolobus badius temminckii* (Endangered)	Rapid human population growth and unsustainable use of natural resources. Harvesting of mangrove; habitat loss to agriculture; dams; greatly increased salinity; hunting (Birdlife International 2015; Blesgraaf *et al.* 2006; Ramsar 2015; A. Galat-Luong & G. Galat, pers. comm.).
Sine-Saloum	13 (6)	5 (1 species introduced)	None	*Piliocolobus badius temminckii* (Endangered)	Rapid human population growth and unsustainable use of natural resources. Habitat loss to agriculture; exploitation of wood products; hunting; fire (Galat-Luong & Galat 2005; Oates 2011; Ramsar 2015).
Senegal	5 (9)	2	None	None	Rapid human population growth and unsustainable use of natural resources. Diama Dam (at river mouth) and Manantali Dam; invasive plants; increasing salinity; habitat loss to agriculture; fishing (Birdlife International 2015; Hamerlynck & Duvail 2003).

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distance from the equator (Table 30.3): e.g. Ogooué Delta (*c.* 100 km south of equator; 17 primate taxa), Niger (*c.* 500 km north of equator; 17 taxa), Rufiji (*c.* 900 km south of equator; 8 taxa), Zambezi (*c.* 2100 km south of equator; 4 taxa), and Nile (*c.* 3500 km north of equator; 0 taxa).

Africa's coastal deltas provide habitat for a wide range of primates, from tiny (< 70 g), arboreal, nocturnal and omnivorous primates (e.g. Demidoff's dwarf galago *Galagoides demidovii*), to one of the world's largest primates (> 190 kg), the semi-terrestrial, diurnal and herbivorous western gorilla *Gorilla gorilla*. No fewer than 57 primate taxa (47 species) occur (or did occur) in Africa's ten largest coastal deltas (Table 30.2). Of Africa's 95 primate species, 49% are (or were) represented in the ten largest coastal deltas. Of Africa's 25 primate genera, 20 (80%) are present in at least one of these ten deltas. None of these deltas supports the same array of primate taxa. Four deltas (Tana, Rufiji, Ogooué and Niger) support one to three (seven total) 'nationally endemic' primate taxa. Some of these seven taxa are endemic to the delta, or to the delta and the river from which the delta derives (Table 30.2). Five deltas support at least one threatened primate species (Table 30.3). The Ogooué Delta holds the largest number of threatened primate species at five. A total of 12 threatened primate taxa occur in the ten largest deltas. The number was 13, but king colobus *Colobus polykomos* was extirpated from the Casamance Delta, Senegal, prior to 1988 (A. Galat-Luong & G. Galat, pers. comm.).

Coastal deltas and their supporting rivers may serve as absolute or partial barriers to the movement of some primate taxa (Booth 1958; Butynski *et al.* 2013; Grubb 1982; Harcourt & Wood 2012; Oates 2011; Oates *et al.* 2004). For example:

- The Rufiji River and Delta (Tanzania) appear to be the southern limit for Peters's Angola colobus *Colobus angolensis palliatus* (Figure 30.2; Rodgers 1981; W. Jubber, A. Perkin & O. Hamerlynck, pers. comm.), Matundu dwarf galago *Galagoides zanzibaricus udzungwensis*, and Uganda lesser galago *Galago senegalensis sotikae*, and the northern limit for Mozambique dwarf galago *Galagoides granti* (Butynski *et al.* 2006, 2013; De Jong 2012).
- The Zambezi River and Delta (Mozambique) represent the northern limit of grey-footed chacma baboon *Papio ursinus griseipes* (Cowlishaw 2013), and southern limit of southern yellow baboon *Papio cynocephalus cynocephalus* (Altmann *et al.* 2013).
- The Niger River and Delta (Nigeria) serve as the western limit of Sclater's monkey *Cercopithecus sclateri* (Baker & Olubode 2008; Oates & Baker 2013), Calabar angwantibo *Arctocebus calabarensis* (Oates & Ambrose 2013), and Milne-Edward's potto *Perodicticus edwardsi*, and as the eastern limit of Benin potto *Perodicticus potto juju* (Oates 2011). The western limit of Nigeria needle-clawed galago *Euoticus pallidus talboti* is the eastern edge of the delta (Ambrose & Oates 2013). Although white-throated monkey *Cercopithecus erythrogaster pococki* occurs on both sides of the Niger River and in the Niger Delta, it is absent from the east sector of the delta (Baker 2005; Oates 2011, 2013; Oates *et al.* 2004). The Niger Delta is also at, or very near, the eastern limit of olive colobus *Procolobus verus* in southern Nigeria, although this species occurs slightly to the east of the Niger River in central Nigeria (Anadu & Oates 1988; Oates 2013).

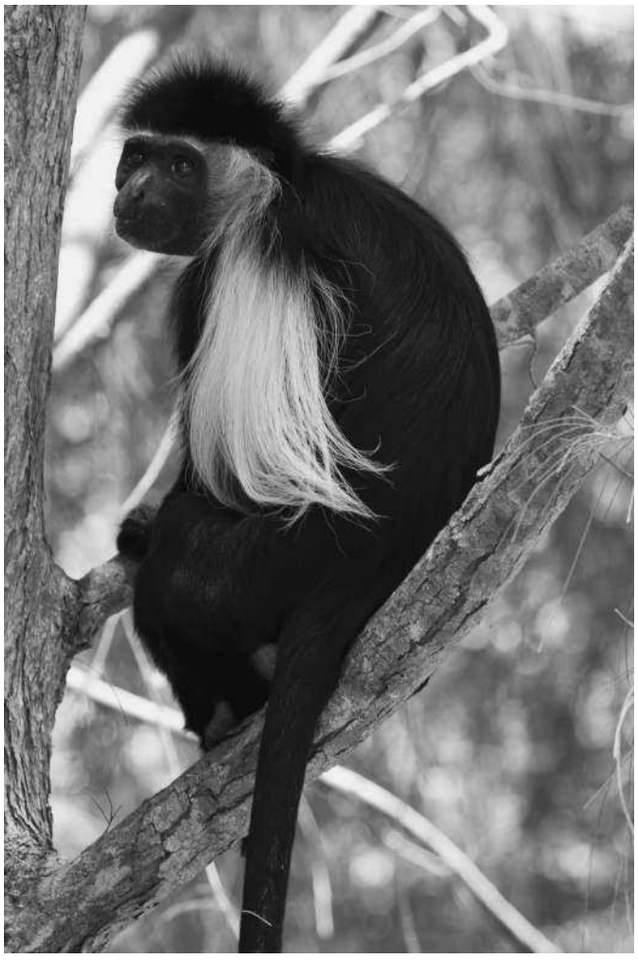

Figure 30.2 Adult male Peters's Angola colobus *Colobus angolensis palliatus*. This eastern Africa endemic subspecies is not known to occur south of the Rufiji River and Rufiji Delta, Tanzania. Photo: Yvonne de Jong & Tom Butynski, wildsolutions.nl. (A black and white version of this figure appears in some formats. For the colour version, please refer to the plate section.)

Primate Conservation in Africa's Coastal Deltas

As highly productive ecosystems, coastal deltas are important for both the biodiversity they maintain and the ecosystem services that they provide. Nonetheless, people often unsustainably exploit deltas for water, agriculture, fish, bushmeat, wood products, oil and other resources (Hughes & Hughes 1992; Ramsar 2015). Coastal deltas are also negatively affected by invasive species, pollution, climatic change, and upstream dams that affect both the overall flow of water and the annual flood regime. The situation is often made worse as a result of corruption and inadequate governance, planning, management, security and law enforcement. The main threats to each of Africa's ten largest coastal deltas are summarized in Table 30.3.

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The relative importance (i.e. rank) of each delta for African primate conservation is also presented in Table 30.3. Of the ten coastal deltas included in this review, the Niger, Ogooué, Tana, Rufiji, and Casamance Deltas are, in that order, of greatest importance for the conservation of Africa's primate diversity. Although the Niger and the Ogooué Deltas attained the same rating (i.e. 46), the Niger Delta is ranked higher because it supports three country-endemic primate taxa, whereas the Ogooué Delta supports only one (Table 30.3). The Niger Delta also supports the only African primate that is endemic to a delta, *P. epieni*. The Casamance Delta would have ranked third (tied with the Tana Delta), if not for the extirpation of two species (*C. polykomos* and sooty mangabey *Cercocebus atys*) as a consequence of hunting and habitat loss (A. Galat-Luong & G. Galat, pers. comm.). Of the ten coastal deltas considered in this chapter, the Ogooué Delta is, by far, the least degraded and least threatened by human activities.

The Tana and Niger Deltas are presented here as case studies to illustrate the importance of large coastal deltas for conserving primate diversity, and as examples of the threats that typically affect Africa's large coastal deltas and their biodiversity. Of the ten largest coastal deltas in Africa, these two deltas are the best studied in terms of their primate faunas and threats.

Kenya's Tana Delta

The Tana Delta covers an area of *c.* 1636 km² (Figure 30.1) and is part of the Coastal Forests of Eastern Africa Biodiversity Hotspot. The inland apex of this delta lies 3 km south of Garsen at Idsowe Bridge. From here to the Indian Ocean is *c.* 41 km. This delta extends *c.* 50 km along the coast from Kipini in the northeast to Mto Kilifi in the southwest (UNESCO 2013). See maps in Duvail *et al.* (2012) and Tana River Delta (2015).

The Tana Delta supports a fine mosaic of riverine forest, woodland, bushland, grassland, mangrove, estuary, dune and beach. Characteristic trees include *Ficus* spp. (Moraceae), *Phoenix reclinata* (Palmae), *Acacia robusta* (Mimosaceae), *Populus ilicifolia* (Salicaceae), *Blighia unijugata* (Sapindaceae), *Sorindeia madagascariensis* (Anacardiaceae), *Diospyros mespiliformis* (Ebenaceae), and *Mimusops obtusifolia* (Sapotaceae) (Robertson & Luke 1993; UNESCO 2013).

The Tana Delta and delta fringe support eight primate taxa (Butynski & Mwangi 1994; De Jong & Butynski 2009, 2012), of which three (38%) are threatened and two are endemic to the region (Table 30.3).

The 'Endangered' Tana River red colobus *Piliocolobus rufomitratus rufomitratus* (Figure 30.3) is endemic to a stretch of *c.* 60 km of highly fragmented evergreen forests along the lower Tana River and into the northern Tana Delta. Fewer than 1000 individuals remain (Mbora & Butynski 2009), occupying an area of < 13 km² (Butynski & Hamerlynck 2016; Butynski & Mwangi 1994; Hamerlynck *et al.* 2012).

The 'Endangered' Tana River mangabey *Cercocebus galeritus* (Figure 30.4) is also endemic to the forests of the lower Tana River and northern Tana Delta. About 2000 individuals occupy *c.* 26 km² (Butynski & Hamerlynck 2016; Butynski & Mwangi 1994; Hamerlynck *et al.* 2012; Wieczkowski & Butynski 2013).

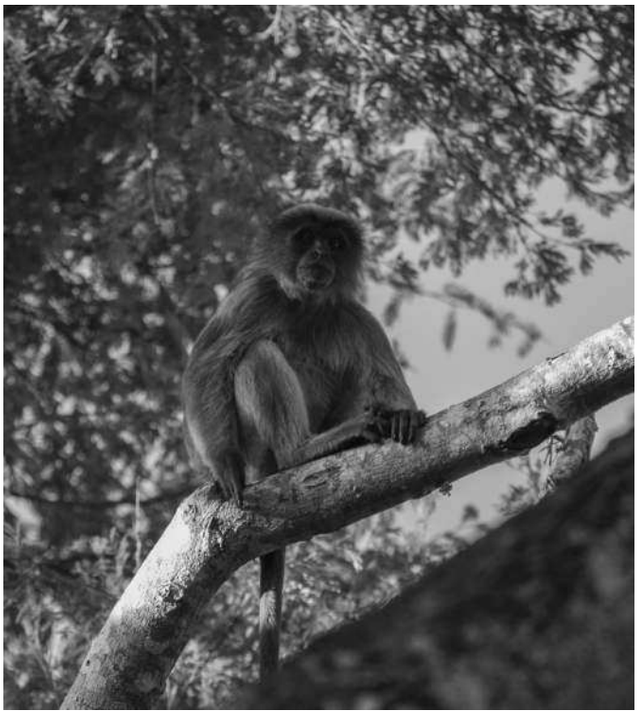

Figure 30.3 Adult male Tana River red colobus *Piliocolobus rufomitratus rufomitratus*. Fewer than 1000 individuals remain of this 'Endangered' subspecies, which is endemic to the forests of the lower Tana River and Tana Delta, Kenya. Photo: Yvonne de Jong & Tom Butynski, wildsolutions.nl. (A black and white version of this figure appears in some formats. For the colour version, please refer to the plate section.)

The 'Vulnerable' Pousargues's monkey *Cercopithecus mitis albotorquatus* (Figure 30.5) is endemic to forest along the north coast of Kenya (probably extending up the south coast of Somalia), the Tana Delta, and along the Tana River upstream to Kora National Park and Meru National Park off the northeast side of Mt. Kenya. The Extent of Occurrence of *C. m. albotorquatus* is roughly 10 250 km². This subspecies is common at many sites (De Jong 2012; De Jong & Butynski 2011). The northern yellow baboon *Papio cynocephalus ibeanus* is one of the eight species of non-human primate in the Tana Delta (Figure 30.6).

Three, perhaps four, species of strepsirrhine (Figures 30.7, 30.8 and 30.9) are present, making this site as rich as any in Kenya for strepsirrhines (De Jong & Butynski 2012). None of these species is threatened.

Due to the small area of forest, serious threats, high primate diversity, and presence of two endemic 'Endangered' primate taxa, the forests of the Tana Delta and lower Tana River represent the most important site in East Africa for primate conservation actions (De Jong & Butynski 2012). These forests face serious threats from the five upstream hydroelectric dams, a rapidly growing human population, unsustainable exploitation of wood products, clearance for agriculture and settlements, oil exploration, corruption, inter-ethnic violence, and insecurity (De Jong & Butynski 2012; Duvail *et al.* 2012; Hamerlynck *et al.* 2012; Mbora & Butynski 2009; Wieczkowski & Butynski 2013). The threats continue to mount, particularly

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Figure 30.4 Adult female Tana River mangabey *Cercocebus galeritus*. Fewer than 2000 individuals remain of this 'Endangered' species, which is endemic to the forests of the lower Tana River and Tana Delta, Kenya. Photo: Julie Wieczkowski.

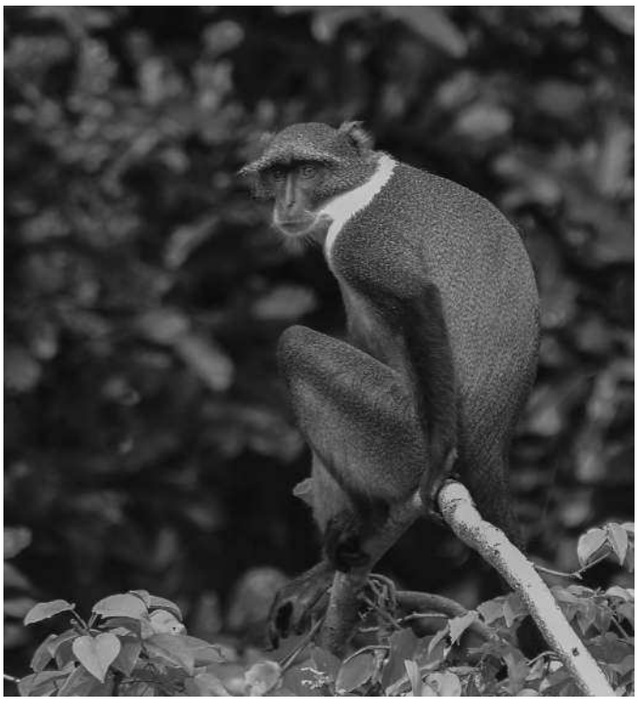

Figure 30.5 Adult male Pousargues's monkey *Cercopithecus mitis albotorquatus*. This 'Vulnerable' subspecies is present in the forests of the lower Tana River and Tana Delta, Kenya. Photo: Tom Butynski & Yvonne de Jong, wildsolutions.nl. (A black and white version of this figure appears in some formats. For the colour version, please refer to the plate section.)

from poorly conceived, unsustainable, major 'development' projects. None of these projects has received adequate review and inputs from the local communities, the conservation community or the Government of Kenya. Here are some examples of development projects approved or proposed that will affect the Tana Delta: construction of a sixth hydroelectric dam on the Tana River (the High Grand Falls Dam will be the biggest on the Tana River); a 300 km² sugarcane plantation by Mat International; a 400 km² rice, maize and sugarcane plantation by the Tana River Development Authority; and a 400 km² fruit and vegetable plantation by the State of Qatar (Duvail *et al.* 2012; Tana River Delta 2015).

There is, however, some recent good news. Beford Biofuels, a Canadian company seeking to establish a 640 km² biofuels plantation (mostly *Jatropha curcas* [Euphorbiaceae]) in the delta has, after great opposition, aborted its plan (Tana River Delta 2015). Similarly, G4 Industries is pulling back from its plan to place 280 km² of the delta under oil seeds production.

In 2012, the Tana Delta became a Ramsar Site (Convention on Wetlands of International Importance), 'an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources' (Ramsar 2015). Otherwise, the Tana Delta holds no legally protected area or protection status.

The widely recognized importance of this region has led to various conservation initiatives that aim to enable local people to conserve the biodiversity, improve livelihoods, rehabilitate degraded areas, and establish sustainable income-generating projects, including ecotourism. Several conservancies, all founded and managed by local communities, have been established in the region. The Kenya Wildlife Service, Kenya Forests Working Group, Nature Kenya, East Africa Wildlife Society, A Rocha Kenya, Kenya Wetlands Forum, Royal Society for the Preservation of Birds, World Wildlife Fund, Northern Rangelands Trust, and others, have been active in promoting the conservation of the Tana Delta, facilitating local involvement in conservation initiatives, and in limiting unsustainable, environmentally and socially damaging 'development' projects.

Nigeria's Niger Delta

The Niger River drains much of West Africa's water into the Niger Delta, by far Africa's largest delta (46 420 km²; Figure 30.1)

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Figure 30.6 Adult female northern yellow baboon *Papio cynocephalus ibeanus* with infant. This is one of the eight species of non-human primate in the Tana Delta, Kenya. Photo: Yvonne de Jong & Tom Butynski, wildsolutions.nl.

Figure 30.7 Adult white-tailed small-eared greater galago *Otolemur garnettii lasiotis*. This is one of at least three species of galago present in the Tana Delta, Kenya. Photo: Yvonne de Jong & Tom Butynski, wildsolutions.nl.

and the third largest contiguous area of mangrove in the world (6700 km²) (Hughes & Hughes 1992; Spaulding *et al.* 2010; Ramsar 2015). This delta, extending *c.* 500 km along the coast, from the Benin River in the north to the Imo River in the east, incorporates *c.* 65% of Nigeria's coastline. Here, the Niger Delta is taken to include the deltaic plain and floodplain of the lower Niger River (see maps in Baker 2005; Ikemeh 2014a, b; Luiselli *et al.* 2015; Chapter 40).

The Niger Delta is part of the Guinean Forests of West Africa Biodiversity Hotspot (Oates *et al.* 2004). This delta is comprised of four major ecological zones: coastal barrier islands, mangrove forest, freshwater swamp forest, and lowland forest (Ikemeh 2015; Luiselli *et al.* 2015; Moffat & Lindén 1995; Petrozzi *et al.* 2015; Powell 1993, 1997; Werre 2001a). The freshwater swamp forest zone covers *c.* 11 700 km² and is the second largest swamp forest in Africa. More than 80% of the delta is seasonally flooded (Moffat & Lindén 1995). Historically, the entire lower delta plain was covered by mangrove forest, while the seasonally inundated portion was covered by freshwater forest. Common trees in the freshwater forest include *Ctenolophon englerianus* (Linaceae), *Uapaca staudtii* and *Uapaca heudelotii* (Euphorbiaceae), *Hallea*

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Figure 30.8 Subadult Kenya lesser galago *Galago senegalensis braccatus*. This is one of at least three species of galago present in the Tana Delta, Kenya. Photo: Yvonne de Jong & Tom Butynski, wildsolutions.nl.

Figure 30.9 Juvenile Kenya coast dwarf galago *Galagoides cocos*. This is one of at least three species of galago present in the Tana Delta, Kenya. Photo: Yvonne de Jong & Tom Butynski, wildsolutions.nl. (A black and white version of this figure appears in some formats. For the colour version, please refer to the plate section.)

ledermannii (Rubiaceae), *Alstonia boonei* (Apocynaceae), *Symphonia globulifera* (Clusiaceae), *Pycnanthus marchalianus* (Myristicaceae), *Xylopia staudtii* and *Hexalobus crispiflorus* (Annonaceae), and *Klaineanthus gaboniae* (Euphorbiaceae). Palms (Palmae) are common (e.g. *Raphia vinifera, Raphia hookeri* and *Elaeis guineensis*) (Bocian 1999; Werre 2000, 2001b; J. Oates, pers. comm.).

Figure 30.10 Adult female and juvenile Sclater's monkeys *Cercopithecus sclateri* in Lagwa, Imo State, Nigeria. This 'Vulnerable' species is endemic to southern Nigeria. This is one of 17 species of non-human primate present in the Niger Delta. Photo: Lynne R. Baker. (A black and white version of this figure appears in some formats. For the colour version, please refer to the plate section.)

The Upper Guinea (West Africa) fauna and the Lower Guinea (Central Africa) fauna converge in the Niger Delta. One result is an exceptionally rich primate community of 17 species (Table 30.2). Of these, two species (*P. epieni* and *C. sclateri*) and one subspecies (*C. e. pococki*) are endemic to Nigeria (Table 30.3). Furthermore, *P. epieni*, is endemic to the delta (Grubb & Powell 1999; Oates 2011). Five (29%) of the 17 primate species are threatened (Table 30.3).

The 'Critically Endangered' *P. epieni* is restricted to a small area of freshwater swamp forest in Bayelsa State, central Niger Delta (Ikemeh 2014a, 2015; Oates & Werre 2009; Werre 2000, 2001a). Habitat degradation, loss, and fragmentation as a result of farming and logging, together with hunting, led to an estimated population decline of > 80% between 1979 and 2009 (Oates & Werre 2009; Werre 2001a). This decline has continued, if not accelerated (Ikemeh 2014a). Estimated at > 10 000 individuals in 1996, with a geographic range of 1500 km² (Oates & Werre 2009; Werre 2000; Werre & Powell 1997), surveys conducted in 2013 suggest < 1000 *P. epieni* survive and that the range has declined to *c.* 78 km² (Ikemeh 2015; Ikemeh & Oates 2017).

Cercopithecus sclateri (Figure 30.10) is a 'Vulnerable' species endemic to southern Nigeria, from the eastern Niger Delta to the Cross River (Baker & Olubode 2008; Oates *et al.* 2004). This species persists in secondary lowland, gallery, riverine, and swamp forests, and at several sites with a mix of agriculture, degraded forest, and fragmented forest. Their small size, cryptic behaviour, and non-preferred status among hunters (relative to other monkeys) have benefited this species (Baker & Olubode 2008; Oates & Baker 2013).

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Figure 30.11 White-throated monkey *Cercopithecus erythrogaster pococki* in Okomo National Park, Nigeria. This 'Vulnerable' subspecies is endemic to southwest Nigeria. This is one of 17 species of non-human primate present in the Niger Delta. Photo: Noel Rowe. (A black and white version of this figure appears in some formats. For the colour version, please refer to the plate section.)

Cercopithecus e. pococki (Figure 30.11) is a 'Vulnerable' subspecies that is endemic to southwest Nigeria (Oates *et al.* 2004). While *C. e. pococki* is sometimes common in lowland forest, including human-modified habitats, it is now absent or rare in many areas due to habitat loss and intense hunting (Oates 2011, 2013).

The 'Vulnerable' red-capped mangabey *Cercocebus torquatus* is patchily distributed in the delta in freshwater forest and mangrove. This species has been extirpated from many sites and is now rare in the eastern sector (Baker 2005; Oates *et al.* 2004; Petrozzi *et al.* 2015; Powell 1995).

The 'Endangered' Nigeria-Cameroon chimpanzee *Pan troglodytes ellioti* is rare in the Niger Delta, with recent, confirmed records only for the eastern floodplain of the lower Niger River and within and around Edumanom Forest Reserve in the southeast sector (Baker 2005; Bocian 1999; Ikemeh 2014b; Luiselli *et al.* 2015; Oates *et al.* 2004; Petrozzi *et al.* 2015; Powell 1993, 1995; Chapters 40 and 43). Habitat loss and hunting are the major threats for *P. t. ellioti* (Ikemeh 2014b; Oates 2011).

Seven species of strepsirrhine, belonging to five genera, occur in the Niger Delta (Jewell & Oates 1969; Oates 2011; Pimley 2009; J. Oates, pers. comm.; Table 30.2). For its size, the Niger Delta may hold the highest diversity of strepsirrhines in Africa. All seven species are able to survive in degraded, secondary and fragmented forest habitats in farmland mosaics. In addition, all are small (< 2 kg), cryptic, nocturnal and of little interest to hunters. As such, none of these strepsirrhines is threatened.

The Niger Delta is comprised of all of Bayelsa State, much of Rivers State, and a small part of Delta State (Chapter 40). The delta supports a high human population density; in 2006, there were 181 people/km² in Bayelsa State and 498 people/km² in Rivers State (National Population Commission 2010). The central part of the delta, however, has a relatively low human population density as it is remote, without roads, and once received pronounced and erratic floods (now reduced by dams, particularly the Kainji Dam in western Nigeria).

Despite the abundance of forest, fish, and oil in the Niger Delta, the region is one of extreme poverty (Moffat & Lindén 1995; UNDP 2011). The main socioeconomic activities in the Niger Delta are fishing, farming (including oil palm plantations), trading, removal of wood products, and oil extraction (Blench 2007; Ikemeh 2014a,b, 2015; Moffat & Lindén 1995; Werre 2000, 2001a,b; Werre & Powell 1997; Chapter 40). The Niger Delta is the centre of the Nigerian oil industry (the tenth largest in the world) and is criss-crossed by oil and gas pipelines. In 2006, 11 oil companies operated 159 oil fields and 1486 oil wells in the delta (Kadafa 2012). There were many more oil fields offshore and four oil tanker ports (Hughes & Hughes 1992; UNDP 2011). Oil spills have had a major negative impact on the natural vegetation, crops, aquaculture, and people of the delta (Egberongbe *et al.* 2006; Ikemeh 2014b, 2015; Kadafa 2012; Maiangwa & Agbiboa 2013). The Niger Delta is one of the world's five most severely oil-affected ecosystems. Nine to 13 million barrels (or 1.5 million tons) of oil are estimated to have spilled into this delta during 1956–2006. This is the equivalent of one *Exxon Valdez* oil spill each year. One result is tens of billions of dollars of environmental damage. Additional environmental damage from oil operations has resulted from road construction, forest clearance, dredging and filling, canalization, gas flaring, and increased population pressure from immigration to the region.

Another major threat to the Niger Delta is the construction of dams along the course of the Niger River, particularly the Kainji Dam. These have, over the past 50 years, greatly disrupted water flow regimes and sediment deposition. This has led to increased riverbank and coastal erosion, increased damage to crop-lands and infrastructure, and declines in fishery productivity and human health (Moffat & Lindén 1995). Three additional major dams are under construction at this time: Fomi in Guinea, Taoussa in Mali, and Kandjadji in Niger.

Some of the other threats to the delta include over-fishing, logging, hunting, conversion of forest to agriculture, inadequate farming practices, poorly planned infrastructure development, urbanization, invasive species (e.g. water hyacinth *Eichhornia crassipes* [Liliidae] and Nypa palm *Nypa fruticans* [Palmae]), and global warming (Baker 2005; Blench 2007; Giosan *et al.* 2014; Ikemeh 2014b, 2015; James *et al.* 2007; Moffat & Lindén 1995; Phil-Eze & Okoro 2009; UNDP 2011). There are no effectively protected conservation areas in the delta (Oates *et al.* 2004; UNDP 2011; WWF 2015; Chapters 40 and 43), although three Ramsar Sites and at least 11 forest reserves have been designated (Table 30.1).

The legacy of environmental degradation, together with the long-standing poverty, insecurity, corruption, ethnic conflict, and political instability (Kadafa 2012; Maiangwa & Agbiboa

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2013), have combined to have a heavy negative impact on the delta's primates. All primate taxa face some form of threat, and all diurnal primates are in decline (Ikemeh & Oates 2017; Werre 2001a; Werre & Powell 1997). As the Niger Delta is the delta with the highest priority for primate conservation in Africa, it is essential that (1) the remaining primate habitats are effectively protected; (2) corridors between key primate sites are established; (3) public awareness is raised for the environment and biodiversity; (4) logging and hunting are sustainably managed; and (5) the oil and gas industry implements best practices for biodiversity conservation and provides significant financial support for environmental protection and ecosystem restoration.

Some improvement to the present situation and trend might be achieved by more government and community participation in conservation projects (Ikemeh 2014b; Phil-Eze & Okoro 2009; UNDP 2011), particularly those that integrate the improved livelihoods of local people with ecosystem restoration. This might be funded by the big oil companies. One such initiative is the 'Sustainable Livelihoods and Biodiversity Project' (implemented by Wetlands Africa, Living Earth Nigeria Foundation, Nigerian Conservation Foundation, and Shell). In addition, the United Nations Development Program (UNDP) and the Global Environmental Facility (GEF) have established the 'Niger Delta Biodiversity Project' (UNDP 2011). This 5-year (2013–2017), US$14 million, project established the 'Niger Delta Biodiversity Trust'. Some of the funds required for this ambitious project are coming from the oil and gas industry, which is expected to contribute substantially to the Trust.

Some Observations

Some drivers that may affect efforts to conserve coastal deltas and their biodiversity, including their primates, are mentioned above. Three of these seem to be of particular relevance:

- The high human population growth rate over much of Africa, particularly in the coastal deltas, is seldom mentioned in the literature. This study never found reference to the 'need' to curb this growth, let alone suggestions or recommendations for 'how' to curb this growth. Given that people in and around most of Africa's largest coastal deltas are already living in extreme poverty, and that these sites are often considered the 'poor house' of their respective nations, it is difficult to see how the situation for the people, or for the biodiversity, of these sites will be better in 20 years when the human population has more than doubled. In short, the root-cause for the biodiversity crisis in Africa's largest coastal deltas has been, and is being, ignored.
- Although most deltas have at least one Ramsar Site (Table 30.1), it is surprising how little mention is given to the Ramsar Sites in the literature related to the conservation of the ten deltas reviewed in this chapter. This suggests that at least some Ramsar Sites are not having the positive impact on the conservation of deltas that one might assume or hope for. The nation state is the only authority for the implementation of the Ramsar Convention at Ramsar Sites within its territory. Every 3 years, during the Conference of Contracting Parties, there is the opportunity to express concern and to list threatened or destroyed Ramsar Sites on the Montreux Record (Ramsar 2017). 'The Montreux Record is a register of wetland sites on the List of Wetlands of International Importance where changes in ecological character have occurred, are occurring, or are likely to occur as a result of technological developments, pollution or other human interference. It is maintained as part of the Ramsar List' (Ramsar 2017). By placing a Ramsar Site on the Montreux Record, the Conference requests the country to 'take swift and effective action to prevent or remedy such changes'. Some deltaic Ramsar Sites in Africa (e.g. Bassin du Ndiaël in the Senegal Delta, and Lake Burullus in the Nile Delta) have been on the Montreux Record for over two decades (Table 30.1). In many cases, the major change in ecological character is linked to changes in the water supply and flooding pattern due to the construction of dams or increased water abstraction upstream – far from the Ramsar Site.
- It appears that most of the effective initiatives for improving the livelihoods of people living in and around coastal deltas – for sustainable development, environmental protection, and conservation of biodiversity – are coming from local individuals or communities, often with support from national and international conservation non-governmental organizations (NGOs). Governments, with all their power to take the lead and to do good, appear to be primarily involved with facilitating the unsustainable use of natural resources and with approving, if not promoting, 'development' and growth activities that further impoverish the people and the environment. Similarly, big companies, particularly those representing the oil, gas, logging, and agricultural industries, have yet to act responsibly towards either the people or the environments of Africa's coastal deltas.

Conclusions

Africa's coastal deltas are of major importance as sites for the maintenance of the continent's primate diversity. Africa's ten largest coastal deltas hold (or did hold) at least 57 primate taxa, 49% of Africa's 95 primate species and 80% of Africa's 25 primate genera. Seven of the taxa are endemic to a delta and its up-river forests, and 12 are threatened. Those coastal deltas nearest the equator hold the highest number of primate taxa, endemic primate taxa, and threatened primate taxa. Most significant among these are the Niger, Ogooué, Tana, Rufiji, and Casamance Deltas. The Ogooué Delta is the least threatened and most undisturbed large delta in Africa. This is attributed to the relatively low human population density in the region. Primate populations in all ten deltas (including the Ogooué Delta) have been reduced and fragmented. Two species of primate have already been lost from the Casamance Delta.

With the exception of the Ogooué Delta, the conservation values of the ten largest coastal deltas in Africa are in rapid

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decline as they all lack an effective protected area system, remain under extreme threat, and can expect their human populations to double before 2038. In the wake of the World Commission on Dams (see WCD 2000), there is some reluctance by the 'traditional' major multilateral and bilateral donor agencies to fund large dams. With the advent of new donors/builders (e.g. China, India, Brazil, and oil-rich countries), however, the standards and recommendations for maintaining downstream ecosystems, particularly in deltas, have not been incorporated into national policy, nor into private sector or donor guidelines (Duvail *et al.* 2014; Fujikura & Nakayama 2009). At this time, new dams are planned for almost all major river systems in Africa, including the Tana and Niger. This entails a major risk of further losses of deltaic habitats and the biodiversity they support (Chapter 36). As such, the long-term survival of the primate faunas of nine of Africa's ten largest coastal deltas seems bleak unless much more attention is given to their conservation by local people, national governments, the international community, and those big companies that are exploiting their resources.

If there is hope, it appears to lie in grassroots initiatives led by those who recognize that environmental conservation and sustainable use of natural resources is a prerequisite for development, if not for survival. There is some indication that the awareness necessary for a significant surge in the number of local conservation actions is afoot for at least some of the ten coastal deltas covered in this chapter, and that those institutions, agencies, and companies with the power, expertise and monies necessary to support these actions may now be willing to do so.

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