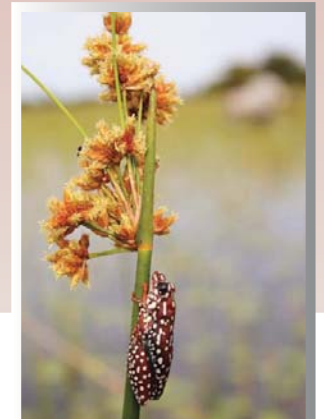




6

Animals: shifting consumers

More tourists are drawn to the Delta by its animals than by any of the wetland's other spectacular features.



Likewise, this wealth of wildlife also largely attracts and focuses the attention of international conservation groups on the environmental value of the Delta. And for local people, wildlife and fish are important as sources of food and revenue that pay salaries and royalties, and that boost the economy of Botswana. So when it comes to the question of what commands attention, what elicits sympathy, or what generates altruistic donations, wildlife wins hands down. Plants may well provide the habitats and food on which animals depend for their very existence, but they are simply not as sexy as hippos, lions, fish eagles, reed frogs or even damselflies.

Other chapters attempt to provide reasonably comprehensive overviews of various topics: the Delta's history (Chapter 2), sources of water (Chapter 3), functioning (Chapter 4), people (Chapter 7) and challenges (Chapter 8). Here we take a different approach by focusing on a few select groups of animals, each of which tells a different story about life in the Delta. For example, information on tiny crustaceans, which few people ever see (but may swallow unwittingly!) shows how different species respond to flooding and the roles they play in cycling energy from one level of a food web to another. Birds, more mobile than most creatures, provide glimpses of the challenges animals face in tracking sources of food when floodwaters mobilise nutrients into new cycles of biological production. Dragonflies and damselflies illustrate how life cycles are adapted to different flooding patterns, and show how species in the Delta relate to those in neighbouring areas of southern and central Africa.

These and other perspectives provided in this chapter paint cameos of the varied and fascinating strategies adopted by animals that inhabit this wetland. But before continuing, it is useful to recap on some of the fundamental aspects that define the 'playing field' on which the lives of the animals are played out.

The first fundamental is the great diversity of habitats, which broadly range from drylands (of different kinds), to wetlands (again, of different kinds), to very local levels where a patch of bush grows right next to a pool of water. As with

plants (see page 68), most animal species occur in the drylands, as the figures in the following table indicate:¹

	Reptiles	Birds	Mammals
Total number of species	64	444	122
Perennial swamp	7	112	3
Seasonal swamp	5	57	21
Dryland	52	275	110

Over long evolutionary periods, this diversity provides opportunities for specialization so that different species are adapted to different environments. On a day-to-day time scale, the habitats allow animals to enjoy a broad canvas of resources. A young elephant can, for example, indulge on phragmites stolons (see page 73) in the morning and mopane bark (see page 87) in the afternoon.

Secondly, the landscape is ever shifting over large areas of the Delta, particularly in the alluvial fan's seasonal swamps and occasional floodplains (see page 44). As waters come and go, so do food supplies, secure nesting sites, or safe resting places. Opportunism is key to exploiting these changes, and animals need ways of rapidly moving to choice areas, and of escaping those that offer diminished resources or looming danger. They must also be able to locate – and to choose – patches that can offer up the best prospects and rewards, and they need mechanisms to determine the most opportune times to make their movements.

Third, the diversity of species and the astounding numerical abundance of animals in the Delta are very much a consequence of its nutrient wealth. But other factors serve to make this Africa's last Eden.² One is the variety and close mix of habitats, as noted above. Another important feature is the availability of a perennial supply of water. Without it, only animals especially adapted to conserving water could exist here. Moreover, life in the Delta is particularly attractive because



Rather little is known about the Delta's frogs, even though many are abundant, brightly coloured and vociferous. All the species are dependent on water – at least for some part of their life cycle – but some spend long periods underground, waiting for flooding or the filling of rain water pools (see the photograph on page 39). Left column, from top: western olive toad (*Amietophrynus poweri*), russet-backed sand frog (*Tomopterna marmorata*), snoring puddle frog (*Phrynobatrachus natalensis*), southern foam nest frog (*Chiromantis xerampelina*), bubbling kassina (*Kassina senegalensis*). Right column, top: Angolan reed frog (*Hyperolius parallelus*), which occurs in a variety of patterns and colours. To the left: long reed frog (*Hyperolius nasutus*) and banded rubber frog (*Phrynomantis bifasciatus*).

animals have access to water for extended periods, with the summer rains being complemented by the spread of floodwaters during the winter months. In this Eden, wise humans have played a role by preserving the environment and its wildlife. Without their foresight, the Okavango Delta might now be known for its rice paddies or as a former place of glory, with the water drained to far-away mines and cities.

The wildlife of the Delta is therefore not to be taken for granted.³ Neither should its pools of nutrients, the pulsed flows of water through Namibia from Angola, and the benefits of good management.

Dragonflies and damselflies

In the tradition of bird-watchers, a growing number of people have taken to watching these colourful insects. Hovering and darting, they settle, the dragons with their ostentatiously outstretched wings, and the damselfly with theirs demurely folded. Perhaps because of their conspicuous beauty and the efforts of specialists,⁴ more is known about this group (called Odonata) of insects than about any other in the Delta. So far, 99 dragonfly species (which, hereafter, includes damselflies) have been found in the Delta. The highest numbers in the world of ten of these species occur in the Delta, endowing it with special value for the conservation of these populations.

The assemblage of species found in any one area is related to patterns of water availability and flooding. For example, dragonflies around temporary pools are typical of the species found at ephemeral rainwater pools in the dry Kalahari. Not surprisingly, their life cycles are rapid, with adults emerging only 30 days after the eggs have been laid. Species of the permanent swamps, by contrast, require water throughout the year.

The highest number of species occurs where permanent and temporary waters are close together. Assemblages of dragonfly species also change when patterns of inundation alter. For example, only species typical of temporary pools were found on the Thamalakane River when it received intermittent flows during the

early 2000s, but these were replaced by more 'perennial' species when the river received water year after year after 2005.

The protracted presence of water from rainfall and flooding allows some species to breed twice in one year. For example, the damselfly *Pseudagrion deningi* is very common between December and March, and then a second generation emerges in late July. Since dragonflies are less abundant in the cooler winter months, reduced competition from other species may be one advantage enjoyed by the second generation.

Of course, the main reason for so many dragonflies being here is the presence of a wetland, although not many people will know that this is because their larvae are aquatic predators. Most of the species found in the Delta also occur in other permanent waters nearby, the closest of these being the perennial wetlands of the Zambezi River and Kwando River catchment. This broad swathe of swamps, rivers, lakes and floodplains in eastern Angola and Zambia (which includes Lake Bangweulu in northern Zambia) is a hotspot of biological diversity and endemism for dragonflies and several other groups, including antelope, flowering plants and fish.⁵ The biological resemblances between the Delta and these northern wetlands reflect their similarities as perennial wetlands and historical linkages between them when water flowed more freely between the Okavango, Kwando and Zambezi (see page 25).

Crocodiles

These are usually retiring animals, slipping away into the water whenever people approach. Since not much hunting goes on in the Delta, one might assume the population of these giant reptiles to be in good health.

However, their reproduction suffers from considerable disturbance caused by people removing eggs or destroying their nests. In addition, nest sites are altered by burning, trampling by cattle and wakes from motor boats washing over nest sites on sandy beaches. Water monitor lizards often dig up nests to eat the eggs, as well. As a result of all these hazards, only 2% of all eggs laid hatch into young crocodiles.⁶

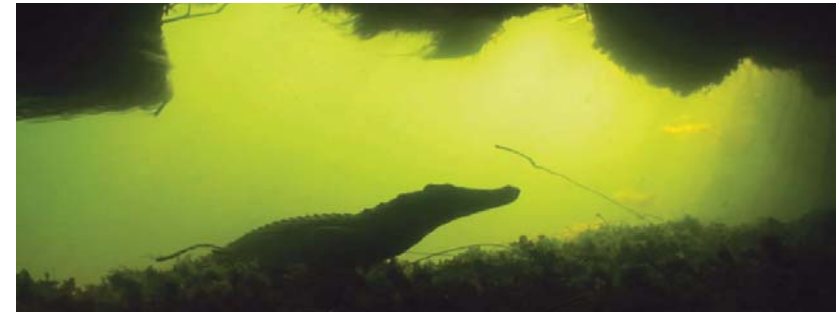


Dragonflies and damselflies are obvious, abundant and colourful animals of the Delta. For most of the time we see them flying about, seemingly without special regard for the wetlands. But the chief reason for there being so many is that they have to breed in water. In fact, much of their life cycle is spent in water as fierce larvae that eat other animals. Left column, from top to bottom: *Sympetrum fonscolombii*, *Pseudagrion rufostigma*, *Pseudagrion deningi*, *Pinheyagrion angolicum* and right top *Trithemis hecate*, bottom, left to right: *Ischnura senegalensis* and *Trithemis aequalis*.

Such disturbances would be less of a problem if patches of flat sand suitable for nesting were more widely available. However, few good nesting areas are available, and these are only along certain stretches of channels in the Panhandle (Figure 31). Unfortunately, these areas are generally populated by cattle and people (see page 115, and Figure 37) and only 43% of areas suited to crocodile nesting is relatively free of human disturbance.

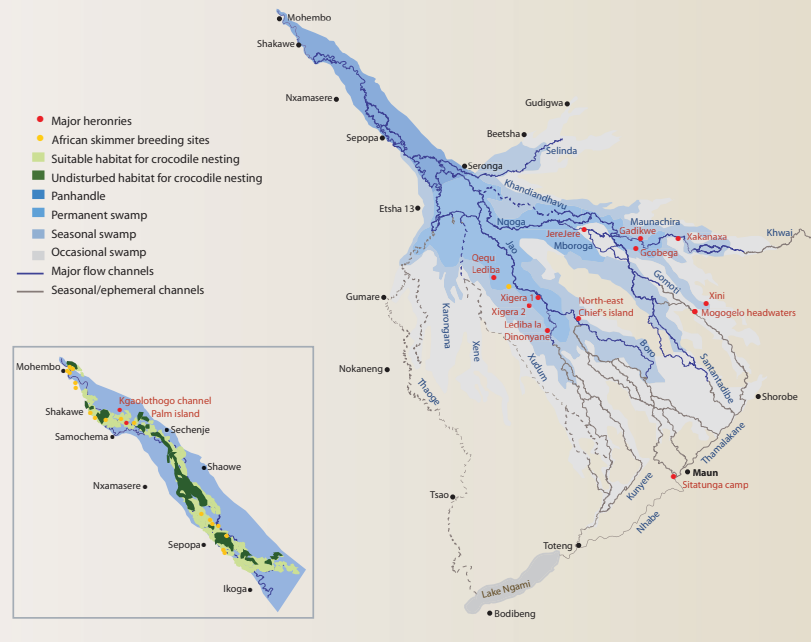
The great majority of crocodiles live in the Panhandle and upper reaches of the Permanent

Swamps. Counts over several years indicate that there are about 2,600 crocodiles in the Panhandle, of which close to one quarter are adults. Their food varies according to size, and so the youngest, smallest animals feed on insects and small fish, while the biggest crocodiles take proportionately larger prey. Overall, however, fish form much of their diet in the Delta. In addition to the presence of suitable nesting grounds, the greater abundance of adult fish in the permanent swamps and Panhandle (see page 101) further explains the concentration of crocodiles in these areas.



Crocodiles lay clutches of 40 to 80 eggs in nests excavated in flat sandy areas next to large channels. The nests are guarded by females until the hatchlings emerge after about 90 days of incubation. Interestingly, the temperature of the nest determines the sex of young, so that males are produced under warm conditions and females when nests are cooler.

Figure 31 | Areas of nesting habitat suitable for crocodiles, and remaining areas where they can nest with little disturbance. The map also shows places where African skimmers breed, and the major breeding colonies for water birds in the Delta. The Panhandle has been enlarged to show more detail of the nesting areas.



Birds

For much of the time, populations of birds subsist in the Delta, each individual ticking over from day to day. Daily routines start with a period of warming in the rays of the rising sun. Then follows a bout of feeding before a long period of mid-day rest. Another stint of foraging may follow the siesta, before the bird settles down for the night in a secure roost.

But then there are times when the Delta hums with two kinds of productive activity. One is breeding, which boosts the pool of genes, and the other is voracious feeding, which boosts body reserves. Birds of course feed every day, but these are the times when food is super-abundant. Moreover, the feeding events are episodic and they occur in widely separated places. The most important, or at least well known of these spells are:

- emergences of fat-laden termite alates (winged adults), on which vast numbers of birds of many species gorge themselves;
- concentrations of zooplankton and fish fry in seasonal swamps and occasional floodplains which attract flocks of wading egrets, herons and storks; and
- concentrations of large fish trapped in drying pools to which pelicans, storks, fish eagles and other piscivores are drawn (see the photograph on page 63).

How do birds track and find such ephemeral sources of food? This is one of the 'big' questions of biology. The

ability to do so makes the difference between idling and recharging body reserves which enable birds to launch themselves into the other form of (re)production.

While great feeding orgies are often unpredictable, most of the spectacular reproductive events occur annually in well-established breeding colonies. The biggest colonies are shown in Figure 31. There are 14 major heronries in the Delta, where spoonbills, pink-backed pelicans, sacred ibises, yellow-billed, openbill and marabou storks, African darters, reed cormorants and several other species can be found breeding. Hundreds of pairs may breed simultaneously, but the total at each colony also varies from year to year. Unfortunately, there are indications that the total number of aquatic birds breeding in the Delta has declined in recent decades. Human disturbance, especially by tourists venturing too close to the breeding birds, is considered to be the main reason for this loss.⁷

These colonies deserve the highest levels of protection, as do the nesting sites of African skimmers and bee-eaters in the Panhandle. The skimmers nest on sandy islands along the main channels, while carmine and white-fronted bee-eaters breed in colonies in vertical sand banks where the main channel has eroded into layers of Kalahari sand. Numbers of breeding skimmers have also declined, largely as a result of the same kinds of disturbance suffered by nesting crocodiles.



An example of how much concentrated food can be available. Up to 5,200 white pelicans have been counted at Lake Ngami, alongside many other fish-eating species.⁸ Each of the pelicans would consume just less than a kilogram of fish each day, which means that 5,200 of them would harvest about 5 tonnes of fish daily. White pelicans nesting at the Nata River delta in the Makgadikgadi Pans make return journeys over 600–700 kilometres every day to collect fish trapped in pools in the Delta. They leave the Pans in the morning and return with belly-cans of fish in the afternoon which they disgorge to feed their chicks.



The Delta has very special conservation value for slaty egrets (left) and wattled cranes (right). The approximately 1,200–1,450 cranes in the Delta constitute the largest single population of this globally threatened species, while an estimated 75–80% of all slaty egrets in the world live in the Delta. This species, too, is classified as globally threatened. In addition, more than 1% of the global populations of 25 other bird species occurs at this Ramsar site (see page 121), while another 12 species have more than 0.5% of their populations here. The Okavango Delta Ramsar Site extends across three of Botswana's important bird areas (IBAs) which are the Okavango Delta, Lake Ngami and the Linyanti Swamps/Chobe River.



Of over 450 species of birds recorded in the Delta, about 112 are aquatic birds that feed by diving, wading or swimming, or feed in the vicinity of water. Many of them feed largely on fish which means that they are piscivorous species. This is a selection of fish-eaters. Top, left to right: African fish eagle, yellow-billed stork; middle, left to right: saddle-billed stork, giant kingfisher, goliath heron; Bottom, left to right: Pel's fishing owl, pied kingfisher and green-backed heron.

Zooplankton

This is the collective name for a variety of tiny animals that float or swim, while phytoplankton is the equivalent name for small floating plants, many of which are algae and diatoms (see page 83). The majority of zooplankton in the Delta's waters are crustaceans that belong to groups called Cladocera and Copepoda. Most of them are filter-feeders, sieving out bacteria, small phytoplankton and other minute organisms. Much of what is known about zooplankton in the Delta – and described below – concerns cladocerans, however.⁹

A study of cladoceran diversity found there to be relatively few species in the open waters of channels and lagoons, where their densities were also low. Somewhat more species, some



Three of the cladoceran species that are common in the seasonal swamps in the Delta: *Bosmina longirostris* (top), *Chydorus sphaericus* (bottom left) and *Ceriodaphnia reticulata* (bottom right). These names are much longer than the animals themselves, most of which measure less than a millimetre in length or breadth. Cladocerans are commonly called water fleas.

of them in moderate densities, were recorded in the permanent swamps, but the real centre of cladoceran diversity and abundance was in the seasonal swamps.

Of course, these animals are not present when the seasonal swamps are dry, but the first eggs hatch soon after the floodwaters arrive. Up to 50,000 cladoceran eggs per square metre have been recorded, all of them lying dormant in the dry sediments. Each egg is enclosed in a thick-shelled ephippium or casing which offers protection during the months – or even years – the egg might lie waiting for water.

Different species in the seasonal swamps hatch at different times, timing their emergence and development to capitalise on the wave of food made available by flooding. Much of the food for cladocerans is provided by vast quantities of phytoplankton, algae and bacteria which decompose particles of plant matter that have lain there since the last flooding.

Moreover, the wealth of production is usually made possible by abundant phosphorous being released into the water, with much of this phosphorous probably coming out of dried mammal droppings. (Accumulations of dried droppings can be as high as 500–700 kilograms per hectare!) In essence, all these constituents of life – the cladoceran eggs, bacterial and algal spores, and then also the plant detritus and phosphorous – remain dormant on the surface or in the sediments until the floodwaters arrive.

Although different species hatch at different times, most of them congregate in the shallowest waters on the edges of the seasonal swamp. This is where nutrient releases are greatest, their food most abundant, and where the cladocerans are best protected from predators, such as fish. Some remarkable densities of cladocerans have been recorded, as many as 100,000 individuals being counted in one litre of water, and in such concentrations that their crustacean odour was distinctly recognisable in the air above the water. Under these conditions, fish, various predatory insects and birds enjoy a veritable feast that does much to replenish their stocks of energy and genes.

Fish

Productive booms in the seasonal swamps (and the occasional floodplains when they get water) do not escape the attention of the Delta's fish, especially those that will benefit from an abundance of zooplankton and lush vegetation.

During dry periods when most water is confined to the Panhandle and permanent swamps, adult fish are likewise limited to standing water in channels, lagoons and reed beds. But as the pulse of inflowing water passes, the fish follow, migrating downstream into areas that are to be temporarily inundated. There, many of the fish spawn as quickly as possible so that the young fry have time to make the most of the seasonal or short-lived food that becomes available in the swamps.¹⁰

The adults of at least 19 species also remain in these temporary waters to regain body reserves, and to grow larger so that they are more competitive and attractive as mates.

Fish eggs generally hatch within a few days, and the young larval fry then begin the business of feeding and growing as quickly as possible. Most of the fry eat zooplankton and plant matter, since these are the most abundant kinds of food. Indeed, many begin by feeding on cladocerans and copepods when they are small, and later switch to being herbivores when they grow larger.

Under reasonably normal conditions, seasonal swamps hold water for four to six months, during which time sedges and other aquatic plants offer the young fish protection as they grow and grow. For example, species of tilapia can reach lengths of 10–12 centimetres during these few months, each additional centimetre of size reducing their chances of falling prey to predators, such as piscivorous birds (see page 99) or African pike.

As a result, growth and survival rates of young fish are directly related to the extent and duration of flooding. Prolonged flooding also provides adults with more opportunities of spawning in the first place, and of growing larger themselves. Thus, in years with little or no flooding, the Delta's fish populations remain static, whereas the highest levels of recruitment occur when flooding is most extensive. The same effects of flooding on fish populations have been found in many other freshwater wetlands.¹¹



About 20 fish species in the Delta care for their eggs and fry, such as the red-breasted tilapia (*Tilapia rendalli*) with its young (top). This has particular value where predators are abundant and oxygen levels are low, such as in the seasonal floodplains where microbes deplete the water of oxygen (see page 75). The aerial foam nests of African Pike (*Hepsetus odoe*) are thus guarded by the parents while the nests provide an oxygen-rich environment for the embryos (above). African pike are the predators of the alluvial fan, whereas tiger-fish (*Hydrocynus vittatus*) predominate in the Panhandle. The pike are ambush predators, relying on dense vegetation for cover while waiting for prey, while tiger-fish chase down their prey in open water.



The nests of three-spot tilapia (*Oreochromis andersonii*) have diameters of 70–190 centimetres, and depths of up to 50 centimetres. Males construct the nests after which the females select the best nests and the largest and most colourful males for breeding. The eggs are laid in the nests where they are fertilised by the males and then picked up by the females who hold and protect them in their mouths for up to three weeks.



The annual wave of floodwaters which arrives in the lower Panhandle each March and April flushes out water that has been standing in the reed beds for months. This relatively stagnant water contains very little oxygen because it has been used by bacteria that decompose peat (see page 54). Great numbers of fish are killed when this water is pushed into lagoons, such as the one at Guma, because there is too little oxygen for them to breathe.



The famous barbel or catfish run in the Panhandle usually occurs between August and September when many smaller fish return to the permanent beds of papyrus and phragmites after breeding in the seasonal swamps. Packs of sharp-tooth (*Clarias gariepinus*) and silver catfish (*Schilbe intermedius*) move along the main channels, hunting down the smaller fish concentrated along the margins of the channels. These frenzied runs of feeding catfish are followed by tiger-fish, large bream, aquatic birds and other predators which snap up morsels and prey that escape the catfish.

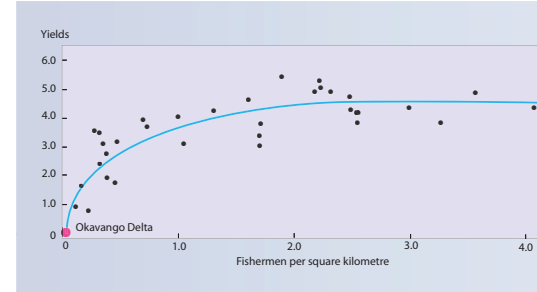


Figure 32 | Fishing effort (as reflected by the density of fishermen on the x-axis) is generally dependant on yield (y-axis, kilograms per hectare per year), as shown by this analysis for 31 African lakes. Each lake is represented by a dot. Yields and efforts are smallest in the Delta, largely because fish populations are low as a result of the nutrient-deficient waters (see page 53).¹³

Fishing and fishermen

Most of the 71 fish species in the Delta are too small and uncommon to be exploited, but there are a number of fish that are large and tasty, and that provide a good contest for recreational anglers. The most highly-prized for consumption are tilapia, the three-spot, red-breast and the green-head tilapia (*Oreochromis macrochir*), and they are targeted by commercial fishers who sell their catches to customers in and around the Delta. Anglers are usually after tiger-fish, which have a reputation for offering a sporting fight, as well as the large nembwe (*Serranochromis robustus*).

The number of recreational anglers is not known. Neither is the number of fish nor the weight of fish that they remove, although most people agree that these are not substantial. Commercial fishing operations are concentrated in the northern areas of the Panhandle, where syndicates of fishermen have cold-storage facilities at Samochima, Mohembo West and Ngarange. There are now about 40-50 commercial fishermen in the area, operating mainly from motor boats and using nets.

A much greater number of people fish for subsistence purposes. Most of them are women and young girls who use baskets (see page 8), or young boys with hooks and line, or men with spears and barrage traps. The total number of families who fish is estimated to be about 3,000, and most of them live alongside the Panhandle, particularly around the Etsha villages.¹² While fish usually supplement other, more staple foods, such as that obtained from cash purchases and farming, fishing can be a valuable safety-net, especially for very poor families. Interestingly, many more families turned to

fishing during 1996 when all the cattle in Ngamiland were killed as a result of an outbreak of lung sickness (see page 119).

The question of whether the Delta is over-fished or under-fished is often debated, sometimes hotly so. Accusations often include claims that there are too few fish to go round or that the Delta is being over-fished. For example, commercial fishermen complain of being excluded from tourism concession areas because there are too few fish in areas in which they normally operate. In turn, tourism operators counter by objecting to fishing by commercial and subsistence fishers in their concessions, because they claim that the local fishermen will deplete stocks available for angling tourists.

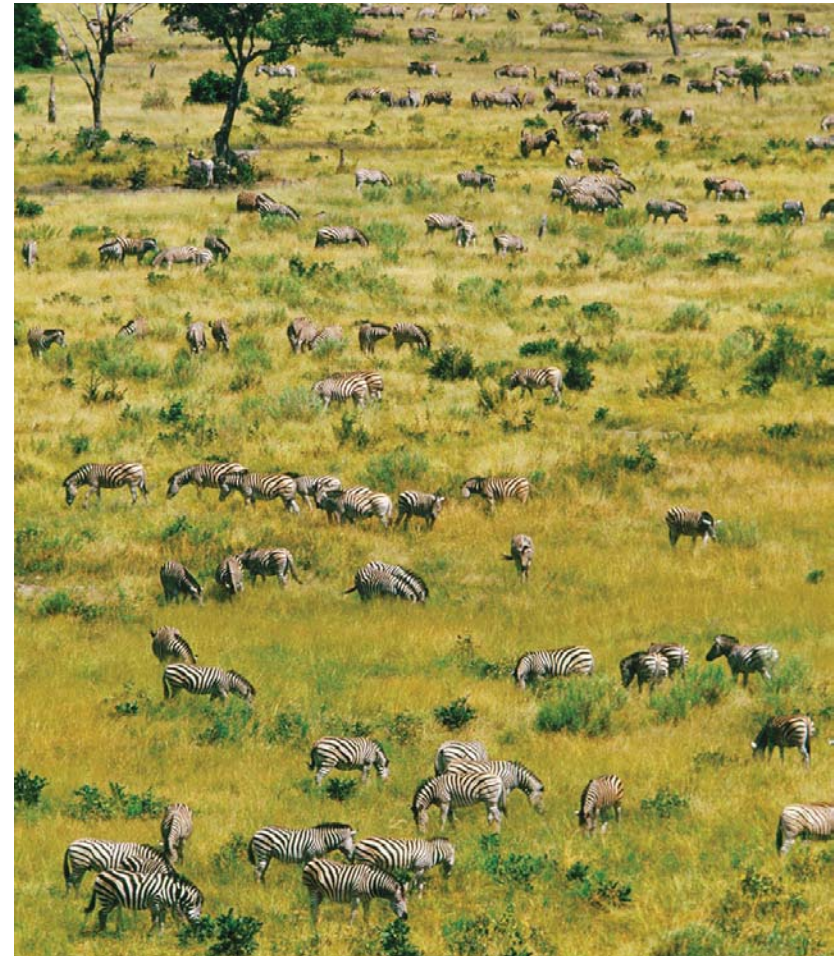
Such debate actually revolves more around rights to resources and land (see page 122) than the abundance of fish. Nevertheless, fishing off-take has dropped significantly over the past 20 years, from about 3,000 tons per year to less than 1,000 tons.¹⁴ This is perhaps because more people have access to cash incomes and/or because public funds were previously used to subsidise equipment for commercial fishermen and the purchase of their catches.

Over-exploitation certainly occurs locally, for instance in confined lagoons isolated from the easy interchange of fish populations with other waterways in the Delta. However, most research suggests that the Delta's fish are in good health, largely because so few people actually catch fish (Figure 32) and because there are large areas where there is no fishing. These are places where fishing is prohibited or that are too far from human settlements.

Large mammals

Everyone would agree that the Delta is full of large mammals, but why, and how many are there? The first question was discussed in Chapter 4 (*see page 58*) where it was reported that the Delta holds about 10 times more large mammals than would be expected in an area of similar annual rainfall if the underlying soils were also Kalahari sands. And so the key feature that sets the Delta apart in providing sustenance to so many mammals is its nutrient base. Not only do the nutrient rich soils enable forage to grow rapidly and in abundant quantities, but much of the forage is also much more nutritious in quality than it would be on poorer sandy soils.

Answering the second question about how many mammals live here is harder. First, what area are we talking about: the permanent and seasonal swamps (which cover about 6,900 square kilometres) or the occasional floodplains as well (which add another 6,500 square kilometres). Or do we include the larger area of nutrient rich sediments that is now usually dry but which received water flows over tens of thousands of years (*see page 24*)? Another confounding problem is that many mammals move around, spending some months in the heart of the Delta and others far away in the Kalahari sands or around the Makgadikgadi Pans, for example.



Browsing mammals, such as kudu and giraffe (*opposite*), are much more sedentary than grazers, such as buffalo, wildebeest and Burchell's zebra (*above*). Trees tend to produce similar amounts of foliage each year, whereas the abundance of grass varies greatly in relation to rainfall. Grazers thus need to move to places where good rains have fallen. Unfortunately, these movements are often blocked by veterinary fences (*see page 120*).

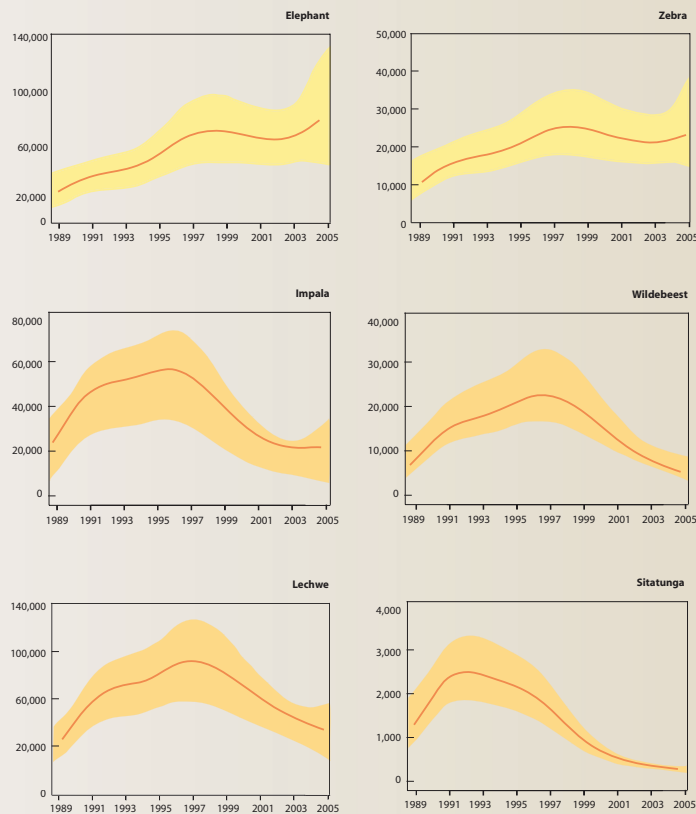


Figure 33 | Population estimates for large mammals obtained from aerial counts between 1989 and 2005. The thin red lines show the population estimates for each year, while the coloured bands above and below the lines are the 95% confidence limits for the estimates.



Two spotted predators testing their nerves: a leopard below and large spotted genet above.

Moreover, numbers of large mammals have been changing, and substantially so. For example, data from aerial surveys done by the Department of Wildlife and National Parks over an area of 20,000 square kilometres (which includes all of the proper wetlands of the Delta) indicates that populations of Burchell's zebra and elephant increased several times over a period of 16 years (Figure 33). By contrast, numbers of red lechwe, sitatunga, blue wildebeest and impala rose significantly during the 1990s and then declined by similar orders of magnitude. Rather similar changes were recorded giraffe and waterbuck, while numbers of sable, tsessebe, roan and eland declined more steadily over the same period.

And that begs another question: what causes the population changes? Clear answers are not available, and they may differ from species to species. However, one plausible explanation draws on the consequences of longer term high and low inflows from Angola and the ensuing flooding cycles (see page 44). As a result of the higher flows in most years after the late 1990s, larger areas

of the Delta have been flooded with deep water for longer periods. This may have limited the extent of floodplain grasslands, thus reducing the availability of nutritious forage for some grazers.¹⁵ This is one hypothesis, and clearly much more investigation is needed to understand factors that influence the population dynamics of these charismatic icons of the Delta.

KEY POINTS

1. The highest diversity of animals is in the drylands that surround the Delta, whereas the permanent and seasonal swamps are the preferred habitats for relatively few species.
2. Populations of fish (and many other animals) are directly dependant on the extent and duration of seasonal flooding because most recruitment occurs in the nutrient-rich seasonal swamps and occasional floodplains.
3. The Delta's populations of crocodiles, African skimmers and carmine and white-fronted bee-eaters breed mainly in the Panhandle where they often suffer from human disturbance.
4. Populations of several large mammals and also of aquatic birds breeding in heronries have declined in recent years, but the numbers of Burchell's zebra and elephant have increased, by contrast.
5. Most of the 99 species of dragonflies recorded in the Delta also occur in wetlands in the headwaters of the Kwando and Zambezi rivers, which is a centre of endemism for various groups of animals and plants.
6. Vast numbers of zooplankton hatch and 'ride waves' of production as floodwaters extend into and over seasonal swamps. In turn, adult fish migrate from permanent waters into the seasonal swamps to spawn where their fry feast on the zooplankton and other abundant food.
7. Per unit area, there are far fewer fishermen in the Delta than in other African wetlands because fishing yields are much lower than elsewhere.
8. Fish populations are relatively low because the nutrient base of the Delta's waters is small. By contrast, large herbivorous mammals are very abundant as a result of sediments and forage being rich in nutrients.