The hippopotamus: nothing but a nuisance?

Chapter V: Hippopotamuses

After a general description of the hippopotamus, an overview of their past and present distribution is given. Reference is made to estimates of hippo numbers in different parts of Africa. These amphibious herbivores have specific environmental requirements, which are elaborated in the section on habitats. As mentioned earlier in chapter III, local people often regard hippos as destructive animals, particularly to crops. Hippo behaviour is discussed because such knowledge is required in conflict mitigation; a realisation of the significance of hippos in the wetland ecosystem may contribute to their conservation. The conservation status of hippos is discussed next. Hippos face several threats. Conflicts with humans certainly contribute to the decreasing trend in hippo numbers in certain parts of Africa.

V.1 A general description of the species

Presently, there are two closely related species that have adapted to different habitats: the smaller hippo (pygmy hippopotamus) inhabits forest areas, whereas the larger species occupies grasslands. This large species, which is the third largest land animal (only elephants and rhinoceros are larger), is known as the river hippopotamus or common hippopotamus (see figure V.1). Its scientific name is *Hippopotamus amphibius*. The word *hippopotamus* originates from two Greek words, namely *hippos* (horse) and *potamus* (river). *Amphibius* refers to the habitats of the species: both terrestrial and aquatic (Rensen-Oosting 1990). Scientific classification of animals (taxonomy) is done according to body characteristics. A phylum, a group of animals with the same characteristics, is divided into orders or classes. Hippos belong to the mammalian class. The classes are divided into orders, which, in their turn are divided into families and genera. Finally, genera are divided into species. Hippos belong to the order *Artiodactyla* (even-toed ungulates), suborder *Suiformes*. The family *Hippopotamidae* is divided into two genera, *Hexaprotodon (=Choeropsis)* and *Hippopotamus*, each with one surviving species: the *Choeropsis liberiensis* (the pygmy hippo) and the *Hippopotamus amphibius* (Groves & Grub 1993). In this thesis, the hippopotamus *amphibius* will be subsequently referred to as hippo.

Hippos can be characterised as “plump and thick-bodied, round-headed, short-legged, short-tailed four-toed ungulates with naked skin, very large tusk-like canines, small eyes and ears” (Haltenorth & Diller 1986, 32). Measurements of the head and body range from 300-505 cm (males) to 290-430 cm (females), whereas the height varies between 150-165 cm. Male hippos outweigh females: the average weight is respectively 1,475 kg (506 up to 3,200 kg) and 1,360 (655 up to 2,344 kg). The average measurements are highly prone to regional variation (Kingdon 1979, 256).

Hippos are aquatic, swimming and diving herbivores. Their body proportions and the location of the sense organs reflect their amphibious existence. The long supple back and kicking movements of the hindlimbs facilitate their motion in aquatic environments (Kingdon 1979, 257-260). The enormous
skull has elevated orbits: nostrils, eyes and ears are located on top of the head. Both nostrils and ears can be tightly closed when it submerges, which is usually not for longer than 5 minutes at a breath (Laws 1982). This is possible because the haemoglobin in its red blood cells tenaciously latches onto oxygen (Schwartz 1996). Whenever hippos wish to see and breathe without exposing themselves, they keep the protruding eyes and nostrils out of the water and remain submerged (Walker 1975). The older hippos get, the more capable they seem to be of remaining underwater without coming up for air (Kingdon 1979, 260). Their scent and sense of hearing are well developed. Hippos seem to be capable of hearing and emitting sounds above and below water, simultaneously² (Schwartz 1996). Underwater, the sight is adequate, but above water it is good (Haltenorth & Diller 1986; Kingdon 1979, 260).

Hippo’s jaws can open to 150° (Nowak 1991). The incisor teeth in both upper and lower jaws, and canine teeth (side teeth) are enlarged (Colbert 1984, 425). The canines grow throughout a hippo’s life (Holmes 1996); these dagger-like teeth are often developed into tusks (Happold 1987). The upper canines measure as much as 230 mm or more in circumference (Nowak 1991). “The lower canines are enormously enlarged and are exclusively used for fighting, being kept razor-sharp by wear against the upper teeth. In the male the lower canines reach a combined weight of 2½ kg but they grow to only half this size in the female. Their curved length is generally about 60 cm but less than half protrudes from the gum. The large incisors are used for digging for salt and other minerals” (Laws 1982, 949).

The thin epidermis, the protective outer layer of skin, makes hippos vulnerable to desiccation (Schwartz 1996). Considerable amounts of water can be lost directly through the skin (Field 1970). The sparsely haired skin is glandular and exudes a substance that contains pigment; light reflected from the skin through these droplets appears red, thus giving rise to the belief that a hippos ‘sweats blood’. The protective nature of this thick and oily substance allows these mammals to remain in water or in a dry atmosphere on land (Nowak 1991). Nevertheless, their skin will crack if exposed to air for too long, so it must remain moist (Eltringham 1993a). Especially over the back and rump, hippo’s skin is about 5-6 cm thick (Wolfsen-McColaugh 1989). It contains a 50 mm thick layer of fat (Nowak 1991). Generally, hippos are all identical by nature as they lack coat patterns. Sometimes differences in colour can be distinguished. “Upper surfaces of hippos are purplish-grey to blue-black, while the lower surfaces and skin around the eyes and ears tend to be brownish-pink in colour. Partial albinos have been seen, coloured bright pink with blotches of liver colour” (Kingdon 1979, 260). The identification of individual hippos grouping together in the water is difficult. However, they have marks that can be used for identification, such as “scars on their bodies from fights with each other, torn or cut ears and deformed tails” (Klingel 1983) or scars as a result of travelling through thorny thickets (Klingel 1995). Even when partly submerged, bulls can be recognised by their heavy build and massive neck, or by the size of the lower canines, which are thicker than in subadults or cows (Klingel 1995). Dominant males keep their ears cocked forward, unlike other group members, who tend to keep them angled back along their necks (Holmes 1996, 29).
V.2 Distribution and numbers of hippopotamuses.

**Distribution in prehistoric times**

According to the fossil record the hippo’s evolutionary history may have begun in the Oligocene (25 million years ago), with the extinct *anthracotheres*. From the Tertiary to the Pleistocene, different hippo-like species lived over a period of millions of years. The fossil record proves the change of the family *Hippopotamidae* into bigger species. This was visible in the different skull proportions and the teeth, which became adapted to grazing, not browsing (Klingel 1995). In Africa, hippos first appeared in the late Miocene (about 10 million years ago). In the Plio-Pleistocene (around 2 million years ago) they radiated out into Eurasia. During the Pliocene and Pleistocene different types of hippo species have dispersed over Asia, Europe and Africa (Honders & Klerks 1993), they inhabited what is now central Europe and England, and also colonised islands such as Madagascar and Mafia Island off the coast of Tanzania. At that time, the Lake Turkana basin of northern Kenya supported four species of hippos, all of the genus *Hippopotamus*. Only the hippopotamus amphibius survived the climatic and ecological changes of the Pleistocene (Klingel 1995).

Until 10,000 years ago, a species of dwarf hippo (*Phanourios minutus*) used to live in Cyprus and Crete (Honders & Klerks 1993, 7). In prehistoric times and at about the time of human settlement in Madagascar at least three species of dwarf hippo were present on the island. According to fossil records in Madagascar, a species of hippopotamus (*Hippopotamus lemerlei*) went extinct after humans arrived around AD 500 (Dobson 1996, 61). Its extinction was probably caused by hunting (Dobson 1996), or by fundamental climatic changes (Honders & Klerks 1993). In Roman times, hippos ranged over the Sahara, which at that time contained a number of permanent streams, lakes and grasslands. Climatic changes have caused the extinction of the hippo there (Honders & Klerks 1993, 24). The common hippo was once widespread in Africa, its range extending to the Nile Delta. Ancient Egyptian paintings show pharaohs hunting hippos on the River Nile. The animals were hunted because their large numbers endangered the harvest (Frädrich 1975, 114; Wolfsen-McColaugh 1989).

**Current distribution**

The general distribution of hippo is influenced primarily by the availability of water (Field 1970). Many hippo populations have been isolated due to “desiccation of the areas between the rivers and the consequent reduction of the water volume in the river systems and their tributaries” (Knappert 1987, 57-58). Secondary factors influencing population distribution include topography, herd structure, food supply and man (Field 1970). Indeed, people have greatly reduced the number of hippos and the size of the area in which they occur. The present distribution is but a fraction of the original range, because farmers strongly dislike hippo’s feeding habits while its meat, fat and ivory are other inducements to hunting (Kingdon 1979, 264). Human settlement expansion has contributed to this development as well (Knappert 1987). Nowadays, hippos are exclusively African animals (Macdonald 1984, 498-499): the
two surviving members of the *Hippopotamidae* are restricted to mainland Africa. The current number of pygmy hippos stands probably below 5,000 (Stuart & Stuart 1996, 132), and is restricted to Liberia, Guinea, Ivory Coast, Sierra Leone and Nigeria (Eltringham 1993a). Estimations for the common hippo range from 150,000 (Klingel 1995, 48) to 157,000, which encompass 70,000 hippos in eastern Africa, 80,000 in southern Africa and 7,000 in the western part of Africa (Eltringham 1993a).

A questionnaire survey, conducted by the IUCN/SSC Hippo Specialist Group in 1989, confirmed the wide distribution of common hippos and their decreasing numbers in many areas (Eltringham 1993a). This survey covered countries where the species was known or thought to occur. Hippos are mainly found in eastern, central and southern Africa in lakes, rivers and marshy ponds (Dolan 1991; Simon 1993, 75). In general, hippo populations in the three African regions are secure, with substantial numbers in conservation areas. The country with possibly the most hippos is Zambia with an estimated 40,000; more than half of them live in the Luangwa Valley. The only great river systems where hippos still flourish in a wider area are the Congo-Lualaba territory in former Zaire and western Tanzania, and the Nile region to the north of it (Knappert 1987, 57-58). Hippos occur widely on the continent south of the Sahara, although their distribution is far from even. Their range is fairly impressive through most of sub-Saharan Africa (Klingel 1995).

At a first glance, the presented figures look healthy. “It must be remembered however, that what seem to be excessive numbers may actually represent populations unnaturally compressed into remnant areas of suitable habitat. The hippopotamus now occupies but a fraction of its overall original range” (Kingdon 1979). Indeed, the hippo has suffered major declines in West Africa and has disappeared from the lower Nile River and from all of South Africa except the far eastern areas. Hippos are extinct north of Khartoum and south of River Zambezi, with the exception of some animals in a few protected areas like Kruger NP (Burton & Burton 1976). Hippo numbers are declining in 18 countries; in eight countries their status is unknown. Increasing numbers only apply to Zambia and Congo (Eltringham 1993a). Declines in former Zaire and Uganda are of particular concern as these countries hold some of the largest hippo concentrations (Stuart & Stuart 1996, 130/31).

Especially in West Africa, where hippos live in scattered, fragmented groups, their number is believed to have decreased over the past few decades (Eltringham 1995). An earlier survey of the distribution of mammals in West Africa, which was conducted by Happold in 1985, found that hippos were present in most countries, with the exception of Guinea (no data available) and Mauritania, where they were not recorded and presumably absent due to lack of a suitable habitat (1987, 353). According to Eltringham (1993a), hippos are believed to be extinct in Liberia and Mauritania. Honders & Klers adhered to the idea of an overall decline in hippo numbers, although they cannot provide estimates for the whole of Africa. Hippos have been eradicated in many African rivers; virtually everywhere local hippo populations have disappeared or declined (Honders & Klers 1993).

The distribution map (figure V.2) compares the estimated current hippo distribution with the former one. It reflects a great reduction in hippos’ range in southern Africa (Eltringham 1993a). According to Kingdon (1979), hippo’s distribution is difficult to map, because of their widely wanderlust during the rainy season, their fast changing status, the lack of relative densities in reports and, the ability of individual hippos to survive in swamps even in densely settled areas. Even in the IUCN/SSC survey, the hippo population size has largely been estimated by extrapolation from partial counts or based on qualitative observations, because only few respondents gave actual numbers (Eltringham 1993a). One might expect that the most complete information on species would relate to larger species, which were hunted regularly for food and trophy purposes. This is far from true. Previously, it seemed unnecessary to keep records for animals that were common and widespread, for it was unthinkable that large game animals would ever become rare or extinct (Happold 1987, 307). As far as hippos are concerned, reliable recounts for the past are non-existent (Klingel 1995). Even today, estimates of the number of hippos in the three African regions must be regarded with scepticism, for they include a high proportion of guesswork (Eltringham 1993a).

Hippo censuses have only been undertaken occasionally in various parts of Africa. In Malawi, counts were done as part of a hippo management plan to alleviate hippo-human conflicts along the Shire River, where the hippo is regarded as a ‘major vertebrate pest’. From the early 1960s onwards, Zambia’s National Parks & Wildlife Service has been monitoring hippo populations in the River Luangwa. After hippos had been afforded full protection, they reached a stage of over-population and damaged the riparian habitat (Attwell 1963, in; Tembo 1987). Hippo populations in Uganda’s Queen Elizabeth NP have been studied in detail (Laws 1981). One of the aims was to determine the optimum grazing density for the area (Kingdon 1979). Sometimes censuses have been followed by large-scale hippo culling operations, as was the case in Queen Elizabeth NP (Simon 1993, 37).

**Distribution and numbers of hippopotamuses within Kenya**

Early accounts stated that hippos were abundant and widely distributed in rivers and lakes throughout Kenya. This can be exemplified by an observation of Percival, which was made in 1906. “The hippos were widely distributed in most of the large rivers, lakes and swamps. Numerous in Lake Victoria, on the coast, in the creeks and mouths of rivers…” (Percival 1906, in ROK 1980, 217; Simon 1962, 253). Little information was available about their ecology, status or population dynamics in Kenya.

Therefore a countrywide aerial survey, which was supplemented by ground observations and interviews, was conducted from June to September 1979. This census intended to generate information primarily on numbers, distributions and aspects of hippo behaviour that do not require long-term monitoring. It was confined to the major water bodies or those in which preliminary interviews with game wardens, conservationists and residents indicated or confirmed the presence of hippos or their recent existence. Counts were made from a light aircraft, which is a rapid, suitable, cost-effective...
method for surveying large areas. Figures for Lake Victoria were obtained through interviews with
game and fisheries wardens (due to disturbance from local people, the hippos did not emerge before
sunset). By using different correction factors for rivers, lakes and swamps, Kenya’s hippo population
was estimated at 9,800 hippos (see table V.1). The largest populations were found along sectors of
rivers in protected areas. Increasing or static hippo numbers have been recorded in several lakes, e.g.
Naivasha, Turkana and Ol Bolossat. In Lake Baringo and Lake Victoria, increased agricultural
activities and overgrazing by livestock have led to decreasing hippo densities (ROK 1980). Hippo areas
around Lake Victoria are indicated in figure V.3.

Table V.1: Densities in the number of hippos per kilometre

<table>
<thead>
<tr>
<th>Location</th>
<th>Distance (km)</th>
<th>Number observed</th>
<th>Corrected number</th>
<th>Estimated density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mara River</td>
<td>140</td>
<td>1,623</td>
<td>3,934</td>
<td>28.1</td>
</tr>
<tr>
<td>Tana River</td>
<td>555</td>
<td>717</td>
<td>1,951</td>
<td>3.5</td>
</tr>
<tr>
<td>Athi/Galana/Sabaki Rivers</td>
<td>374</td>
<td>82</td>
<td>208</td>
<td>0.6</td>
</tr>
<tr>
<td>Tana River/Minera Springs</td>
<td>90</td>
<td>151</td>
<td>582</td>
<td>3.5</td>
</tr>
<tr>
<td>Eburu Naro (South)</td>
<td>130</td>
<td>20</td>
<td>53</td>
<td>0.4</td>
</tr>
<tr>
<td>Eburu Naro (North)</td>
<td>150</td>
<td>24</td>
<td>61</td>
<td>0.2</td>
</tr>
<tr>
<td>Total for all rivers</td>
<td>2,659</td>
<td>2,027</td>
<td>6,319</td>
<td>4.0</td>
</tr>
<tr>
<td>Lake Baringo</td>
<td>65</td>
<td>3</td>
<td>22</td>
<td>0.4</td>
</tr>
<tr>
<td>Lake Naivasha*</td>
<td>65</td>
<td>135</td>
<td>358</td>
<td>5.5</td>
</tr>
<tr>
<td>Lake Ol Bolossat**</td>
<td>15</td>
<td>80</td>
<td>212</td>
<td>15.7</td>
</tr>
<tr>
<td>Lake Baringo</td>
<td>336</td>
<td>42</td>
<td>104</td>
<td>3.1</td>
</tr>
<tr>
<td>Total for all lakes</td>
<td>1,231</td>
<td>281</td>
<td>2,413</td>
<td>1.9</td>
</tr>
<tr>
<td><strong>Yala</strong></td>
<td>450</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><em><strong>Nyando</strong></em></td>
<td>250</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tana Delta</td>
<td>1,050</td>
<td>424</td>
<td>845</td>
<td>0.8</td>
</tr>
<tr>
<td>Lake Agano</td>
<td>350</td>
<td>8</td>
<td>18</td>
<td>0.5</td>
</tr>
<tr>
<td>Total for all swamps</td>
<td>1,790</td>
<td>424</td>
<td>845</td>
<td>0.5</td>
</tr>
<tr>
<td>Total national herd</td>
<td>6,193</td>
<td>5,919</td>
<td>9,817</td>
<td>1.2</td>
</tr>
</tbody>
</table>

* Hypothetical counts for repeated census circuits. ** Estimate obtained through interviews, no correction factor has been applied. *** Method used was not systematic sampling. Yala/Nyando estimates are included in Lake Victoria.


The above figures have been aggregated for the Very Large Herbivore (VLH) Management Units (see
table V.2). The Lakes Management Unit consists of the lakes Ol Bolossat, Naivasha, Turkana, Baringo
and Victoria. The 1979 hippo population estimates for this unit were relatively high, but remained
below the figures presented for the Narok Unit and the Tana River/Eastern Kitui Unit (ROK 1980).

Table V.2: Hippo Population Estimates (June 1979), aggregated to VLH Management Units

<table>
<thead>
<tr>
<th>Management Unit: there are 16 units. Only units where hippos are present, have been indicated</th>
<th>Estimated population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laikipia / Samburu / Isiolo</td>
<td>61</td>
</tr>
<tr>
<td>Turkana / Eastern Kaisu</td>
<td>6,000</td>
</tr>
<tr>
<td>Tana River / Eastern Kaisu; total number</td>
<td>2,700</td>
</tr>
<tr>
<td>Lamu / southern Garissa</td>
<td>1,000</td>
</tr>
<tr>
<td>Merti / Upper Tana River</td>
<td>1,700</td>
</tr>
<tr>
<td>Amboseli</td>
<td>unknown</td>
</tr>
<tr>
<td>Taita / Chyulu Hills</td>
<td>600</td>
</tr>
<tr>
<td>Maasai / Ngong Hills</td>
<td>6</td>
</tr>
<tr>
<td>The Lakes, Ol Bolossat, Naivasha, Turkana, Baringo, Victoria</td>
<td>2,400 - 2,500</td>
</tr>
<tr>
<td>Not included elsewhere</td>
<td>6 - 60</td>
</tr>
<tr>
<td>Total known</td>
<td>9,800</td>
</tr>
</tbody>
</table>

Source: Hippo census, ROK 1980, 230
Kingdon’s map shows present and previous hippo populations in Kenya. Circle sizes indicate suitable hippo habitats and scattered relics of once abundant populations. Recently eliminated populations are depicted near Lorian Swamp, along parts of the Tana and Athi Rivers, and along tributaries to Winam Gulf, such as the Nzoia, Nyando and Sondu Rivers (Kingdon 1979, 264). According to Eltringham (1993a), hippos can be found in the northern, central and southern parts of Kenya. The most recent counts have been made in River Mara area (2,132 in 1980, this includes some hippos from over the border in Tanzania), Lake Naivasha (220 in 1988) and along a part of River Tana between Osako and Adamson’s Falls (220 in 1983). Between 1980-1982, Karstad & Hudson (1984) conducted five counts of hippos inhabiting a 124 km stretch of River Mara. They reported an annual rate of increase of hippo within the Masai Mara NR of 16.5% (1959-1971), 10.3% (1971-1980), and 0.9% (1980-1982); the upper reaches of the Mara were excluded because of the lack of historical data.

Hippo numbers fluctuate, for instance as a result of competition with livestock, changes in land use and hunting. Many rivers in Kenya pass through arid and semi-arid zones. Especially in the dry season, competition between hippos and livestock is prevalent along the narrow stretches of land bordering the rivers. When livestock was barred from grazing within the Masai Mara NR during a period of eight years (1971-1979), hippo numbers increased threefold (ROK 1980, 233/34).

Due to the absence of historical estimates of numbers, reliable analyses of the trends in populations or distributions are frequently out of reach (ROK 1980, 231). The need for regular hippo counts is stressed by various authors, like Eltringham (1993b) and Bhima, who argues that counts are needed to formulate sound hippo management strategies (1996, 85). The VLH-study recommended the monitoring of key hippo populations through periodic census, particularly in the Mara, Tana, Athi-Galana-Sabaki Rivers, Lake Victoria and the Rift Valley Lakes (ROK 1980, 76). In the early 1960s, Simon (1962, 253) already pointed at the drastic reduction in hippo numbers: “Nowhere in Kenya they are plentiful, although the species is not in danger of extermination at the present time”.

V.3 Habitats of hippopotamuses

Habitat requirement: water

As they are amphitropical, hippos are necessarily confined to aquatic habitats. This results in a patchy distribution. An essential habitat requirement is sufficient open water, in which hippos can submerge totally, and where territorial males have enough space. Hippos can survive in muddy wallows if open water is not available, but they need access to permanent water to which they can return in the dry season (Eltringham 1993a). The animals avoid forested banks and dense reed beds. They prefer gently sloping shores, which allow for easy access to their grazing areas (Holmes 1996). Females with young avoid strong currents and rocky shores (Haltenorth & Diller 1986). The temperature of the water should vary between 18-35 °C. Hippo habitats can be located up to an altitude of 8,000 ft (Dorst & Dandelot 1990). The species can be spotted on the seacoast as well (Haltenorth & Diller 1986).
Hippopotamuses generally prefer shallow standing water near sandy banks on which they can bask in the sun, especially in the cooler months. "If undisturbed, they will use these pools for many years, providing food supplies remain available to them within their range of normal movement. Seasonal flooding may cause them to move temporarily from the established resting pools but, providing this has not altered their condition seriously, they will return as the flood subsides. They will find new temporary resting places during flooding in oxbows or up the side tributaries of major rivers" (Skinner & Smithers 1990, 600).

Observations made in Queen Elizabeth NP (Uganda) made clear that hippos tend to stick to their favoured parts of lakes and channels. The park management had decided to remove all the animals from one area. Even though over 100 hippos were shot, hippos continued to return to that area. Hillaby (1962) expresses his surprise over the speed at which hippos infiltrate back into a specially favoured locality. Known individuals have held the same property for four years in rivers and at least eight years in lakes. Tenures of 20-30 years, that is the full adult life span, are possible (Honders & Klerks 1993).

**Habitat requirement: grazing grounds**

Hippos have a unique lifestyle: they spend practically the entire day in or near the water (either resting or sleeping), and undertake nightly foraging ventures on land. These herbivores generally prefer to feed on open areas of short green grass. Another ecological requirement constitutes of adequate grazing areas on open grassland within a few kilometres of the daytime resting sites, for hippos are obliged to travel for food (Eltringham 1993a). During these ventures, hippos follow trails inland to the ‘hippo lawns’ (short grass swards or close-grazed areas of short grasses). On average, grazing areas extend about 3.5 km from the shore, except when there are wallows that enable hippos to enlarge the range and travel further inland (Laws 1981). "The width of the grazing zone varies seasonally, increasing in the dry season as grazing quality deteriorates" (Laws 1982, 949). In general, where food is plentiful hippos tend to remain in the vicinity of the resting pool (Skinner & Smithers 1990) and do not venture far from the water (Burton & Burton 1976). The species as a whole has a narrow range around permanent water. Opinions about the size of the range obviously differ. Estimations given are: three to five km on average, and ten km at most (Kingdon 1979, 264); two to three miles or six miles at most (Walker 1975); eight to ten km or even more, especially when food is scarce locally (Skinner & Smithers 1990). According to Burton & Burton (1976), hippos may wander up to a distance of twenty miles.

Usually there are hippos present in the water throughout the night: some leave late at night, while others return after a few hours of intensive grazing. Before dawn, practically all animals return to the water (Eltringham 1993a). Klingel recorded their return to the water about midnight: "They returned to rest (on grassless, sandy ground inside thickets), not to stay. After a few hours, they climbed out on land again, and disappeared into the bushes. These sleeping retreats can be identified by an impression in the sand the size of a hippo and further characterised by a pile of dung at one end" (1995, 5-6). Figure V.4 indicates a heap of hippo dung, whereas figure V.5 shows a hippo footprint.
“Hippos reach their pastures along well-worn tracks, as is shown in figure V.6. Paths from the water to pastures start as broad roads but branch into inconspicuous secondary and tertiary tracks within a mile or two. The trails are punctuated by dung heaps which might be used as (chemical) landmarks in the dark (Laws 1982). “Hippos do not necessarily use the nearest well-worn exit path along the shore. Sometimes they travel almost a mile in the water parallel to the shore to an exit that was closer to the grazing area. Because many hippos use the same exit paths (especially if the river banks are steep), some of these bankside exits may be worn five or six feet deep, becoming almost tunnel-like. As the hippos file out, nearly nose to tail, they give the appearance of togetherness, but after moving some distance from the shore, they disperse: night-time grazing is not a social activity” (Klingel 1995, 55).

**Territorial areas**

Hippo territories vary in size, depending on the seasons and the type of water. Along the shore of a river less space is needed (33 hippos can inhabit a stretch of 100 m) than along a lake, where the same distance is appropriate for merely 7 hippos (Honders & Klerks 1993; Laws 1984). The length of these areas is respectively 50-100 m and 250-500 m (Laws 1984). They consist of a narrow strip of water and adjacent land, which is being used either by just a solitary male or by a dominant bull plus a group of females and young, and sometimes one or more subordinate males (Laws 1984). In Klingel’s research
(1995), about 10% of the adult bulls dominated all other hippos, male or female. However, a bull’s dominance was limited to a particular, restricted place along the shore, a so-called mating territory. In that area, the dominant male has exclusive mating rights, although these are open to challenge (Kayanja 1989). Other bulls are only tolerated if they behave submissively (Laws 1984) and respect the dominant status and mating privileges of the dominant bull. Possession of a territory is a prerequisite for access to females; non-territorial bulls are excluded from reproduction (Klingel 1983).

Both territory size and length of a bull’s tenure vary (Klingel 1983; Klingel 1995). When ecological conditions change, the quality of a territory is likely to change as well, thereby influencing its attractiveness to females and the frequency of their visits. Cows prefer shallow, slow running or stagnant water, and flat sandy banks (Klingel 1983). However, near-perfect territories in one season can become untenable in another due to changes in the water level (Holmes 1996), e.g. in rivers where floods regularly alternate with periods of low water. Klingel has witnessed such changes in Uganda: “At low water, some of the territories fell dry, and their owners either started a new territory elsewhere or joined bachelor groups. When the water level rose, new places became suitable and were occupied, sometimes by bulls new to me, sometimes by bulls that had held territories previously, and sometimes by territorial bulls extending their domain. When the river was in flood and the water running fast, all the hippos moved out of my study area” (1995, 53). At low water, a solitary territorial male has several options: he may either look for a group of females and young when the water levels rises, or abandon his territorial riverine area if levels fall excessively (Nowak 1991). At the onset of the dry season, when rain-filled pools dry up, solitary males are forced to leave: they may either join a “school” and respect the supremacy of the territorial bull, or join a bachelor group (Kayanja 1989).

**Social groups**

Territories are deserted during the night. When hippos are grazing on land, social groups are not apparent. However, during daytime two kinds of social groups can be observed. The first group, a school, which is dominated by an adult male bull that holds the territory, contains females and calves, as well as adult and juvenile males. The second group is the bachelor group, consisting mainly of males (Kayanja 1989) but possibly with a few cows as well (Klingel 1983). “Group composition is variable: some groups consist only of bulls, but possibly with a few cows as well; others are mainly composed of cows and young with one or a few bulls. Some of the hippo bulls are territorial, each with a well defined area in the water and with a narrow strip of shoreline” (Klingel 1983, 25).

The basic social unit is the mother and her offspring: they are the only ones with long-standing bonds (Klingel 1983; Kingdon 1979; Holmes 1996). Any structuring of social groups above the basic social unit is likely to be of a temporary nature: each animal is ‘free to move anywhere and at any time’. The groups or schools are by no means based on individual bonds. However, they may contain the same individuals for considerable periods of time, since hippos are fairly sedentary (Klingel 1983) and tend to utilise the same stretch of water for a long period of time (Happold 1987, 206).

A group territory is made up of a central crèche, occupied by females and juveniles, with separate areas (refuges) around its perimeter, each occupied by an adult male. The crèche is located on a sandbar midstream or an elevated bank of a river or lake (Burton & Burton 1976). “Females seem to form schools with their young, and around the bulls are settled according to the hierarchy, the dominant adult bulls being the nearest” (Dorst & Dandelot 1990, 171). Rensenbrink & De Groeve (1982, 73) agree: all male hippos have their own, definite area in the water (either close to or far from the female hippos), from where they try to attract females in the mating season. The dispersal of herds in the water relates to a certain organisation and a preference for particular spots.

In general, young male hippos and females without young stay on one side, while females with young stay on the other side. Old and mature solitary males move around the nuclei (see figure V.7). Boundaries of nuclei are not always rigorously maintained though (Rensenbrink & De Groeve 1982). Honders & Klerks (1993, 10) present a nearly identical image of hippo groups. They argue that the groups are led by a male hippo that patrols his territory during the day. The leader demands obedience from the solitary young males, who just await the moment they can take over the lead. The solitary males on the periphery may be juveniles or males that have lost a territorial fight (Nowak 1991).

![Figure V.7: hippo nuclei](Image)

**Figure V.7: hippo nuclei**

1= Young males and females without young
2= Females with young

*Source: Rensenbrink & De Groeve 1982, 74*

The adult female and their offspring live in a territory fiercely guarded by a resident male. It is a mating territory, in which the females are free to come and go as they please. When females come into oestrus, the owner of the territory she is in will be the only one to mate with her. Subordinate males are allowed to stay as long as they behave in a subordinate way (Holmes 1996).
The social organisation of hippos is a controversial issue. While many observers are convinced that the master bull is responsible for the entire group, there are others who argue that, contrary to the general opinion, hippo herds are dominated by matriarchal groups instead of the largest, most ferocious male (Burton & Burton 1976; Rensenbrink & De Groeve 1982). The following examples may indicate the existence of a matriarchy. (1) When a young male leaves the crèche, he is forced to move beyond the ring of refuges lying on the perimeter of the crèche. Fighting his way to an inner refuge entitles him to mate with one of the females. In case the young male is over-persecuted by the senior males, he can re-enter the crèche for sanctuary. The combined weight of the females provides protection (Burton & Burton 1976). (2) Matriarchal groups determine the position of male hippos in the water up to a certain extent. When a male hippo approaches females outside the mating season, he has to behave in a non-aggressive, almost subordinate way. If he does not stick to the ‘code of conduct’, a massive attack of the adult females will chase the intruder away (Rensenbrink & De Groeve 1982).

Hippo schools generally consist of about 10-20 animals (Wolfsen-McColaugh 1989; Klingel 1983; Laws 1982), although there may be 100 (Laws 1982) or 150 and more (Klingel 1983). Schools of 50-100 animals have been seen in East Africa, but have never been recorded for West Africa (Happold 1987). Several aspects influence group sizes. There is a distinct tendency for hippos to aggregate into large groups in response to intense hunting or poaching pressure (Kingdon 1979, 267). Disturbance (disruption of social behaviour) can be manifested by the formation of exceptionally large hippo schools (Laws 1981). Earlier, Field (1970) observed a similar tendency in a cropping scheme in Queen Elizabeth NP (Uganda), where the final 200 individuals congregated in a few large schools in an inaccessible lagoon. The current of the water may also affect school sizes: males often prefer wallows, while lactating females tend to be segregated in areas with slow running water and gently sloping shores (Field 1970). In times of drought hippos tend to congregate in the remaining pools. The temporary concentration of hippos disrupts the hierarchical system (Wolfsen-McColaugh 1989) and leads to high levels of aggression (Kingdon 1979).

An aggregation of hippos regularly consists of a number of adult males, but there are also many solitary peripheral males, who have found refuge in less favoured localities. In a dense population, their return to the water may possibly be blocked by the larger males, which gives the inferior animals no choice but to draw back to puddles in the vicinity. Dung deposits of dominant males along the foreshore and on exit paths might be regarded as a deterrent to keep the subordinate males from re-entering the water (Kingdon 1979). Hediger drew one of the first sketches of the pear-shaped territories on land. The drawings were based on his observations of hippo populations near River Rutshuru, in former Zaire. The territories have an inland extension; towards the shoreline they are shaped like a cone (see figure V.8). All territories converge in the common pool. The adult male, who owns the territory, deposits dung at strategic positions in order to demarcate its boundaries (Hediger 1951, in Rensenbrink & De Groeve 1982). According to Kingdon (1979, 266), Hediger saw the dung deposits as “evidence for terrestrial territories and mistakenly imagined that the hippo paths radiating from the water defined the pear-shaped territory boundaries”.

Hippo dung may have different functions though. As Eltringham (1993a) says: “The male hippo, rarely the female, spreads its dung by wagging its tail vigorously while defecating, both in the water and on land, where it is thought to have a signalling rather than a territorial function. The dung piles may serve for orientation”. According to Kingdon (1979), male hippos drop their at particular landmarks along the pathways. Apart from the dominant male’s ‘dung spraying’ on land, nearly all defecation takes place in the water. It seems likely that the dung deposits on the foreshore serve two purposes: they assist the male in familiarising himself with his home range, and inform other hippos of his presence (Kingdon 1979, 266). Nowak argues that “hippos regularly mark certain land portions of their territory, eventually forming huge dung heaps” (1991, 1350).
meticulously guards his territory. Territorial fights are common and always start with an aggressive ‘yawning’ display at the water’s edge or in the water (Laws 1982). The oldest and strongest males exhibit territorial behaviour in the water and at the exit-entry points, but not in the grazing areas on land (Wolfsen-McColaugh 1989). The territory around their water refuge seems to be the only spot actually defended (Dorst & Dandelot 1990, 172). However, the size and location of the defended area and the degree of intolerance may alter with local conditions and with the seasons (Kingdon 1979).

V.4 Behaviour of hippopotamuses

Addressing hippo related problems requires knowledge of their behaviour on a daily or seasonal basis. Animal responses relate to the presence of physical forces in its habitat, such as weather conditions, space, social pressure from the herd, and availability of food. In the wet season for instance, the abundance of food makes for less competition (Laws 1989). Animal behaviour is modified in response to stimuli that promote its survival and reproduction (Fogiel 1987, 1017).

Aggression and display

Male as well as female adult hippos can be aggressive. A female is particularly aggressive when she has a young calf, while a male may attack (or even kill) any intruder in his territory at times when ‘his’ females are oestrus (Kingdon 1979, Nowak 1991). Aggressive behaviour can be related to territorial maintenance (Holmes 1996), the competitive nature of the social organisation, and intense competition for water during the dry season (Sleeper 1982). Male and female hippo skins both carry scars from battles; the skins of the adult males in particular show severe wounds and scars (Laws 1984).

When defending their territory or establishing their status in a social order, same-species males are usually aggressive. However, most of the fighting consists of a “display of ritualised, exaggerated movements or sounds which convey the attack motivation of the contestants. The animal often changes the shape of certain body parts in an attempt to make itself appear as large as possible. Aggression is a type of bluff: the two contestants are rarely seriously hurt. Display behaviour allows the ‘would-be loser’ to escape and establish a territory or acquire a mate elsewhere” (Fogiel 1987, 1010).

Male territorial boundary meetings are highly ritualised: both males stop, stare, show their rear ends and defecate, before they return to the centre of their territories (Laws 1984). When a larger hippo challenges a male, he can either flee or appease his superior by prostration. The lowering of the head and body indicates submissive behaviour. When the challenge comes from a male of the same size, it is more likely to be taken up. This may account for the high incidence of fighting in overpopulated areas (Kingdon 1979). Fights can be vicious and may last two hours. During a confrontation, bulls slam their lower jaws together and use their large canines (Nowak 1991).

Hippo display consists of several movements, such as rearing up and splashing down, opening the jaws, dung scattering, throwing water (using the mouth as a bucket), blowing water through the nostrils, forward rushes and dives, vocalisations - emission of a ‘wheeze-honk” sound and grunts (Laws 1984; Nowak 1991). Bulls have a loud roar that can be heard over a great distance (Nowak 1991). Hippos have an ‘early morning call’ - a nasal wheeze and subsequent guttural honks - which probably indicates them taking position in the water. In the evening, when the animals prepare to leave the water, sounds can be heard as well (Kingdon 1979). The jaw display can be described as “a visual advertisement of willingness to fight” (Kingdon 1979, 269).

Herbivorous animals

Hippopotamuses are entirely herbivorous animals. They feed on grasses, like Themeda, Heteropogon and Panicum, and aquatic plants like water cabbage (Pistia stratiotes). Hippos have been found eating fruits of the sausage tree, Kigelia pinnata (Dorst & Dandelot 1990, 172). According to Honders & Klerks (1993), hippos are choosy in their diet: they eat grasses like Panicum, Urocholora, and Cyndon, but do not touch upon Spirobolus. Their preferences reflect local availability (Skinner & Smithers 1990). Soft short grass is their main meal, to which fallen fruits and water vegetation are occasionally added (Haltenorth & Diller 1986). Holmes (1996) has recorded hippos in Zambia’s Luangwa Valley eating the fruits of the sausage tree: “Hippopotamuses devour the heavy, 45-cm fruits”. Field’s research of stomachs of shot hippos typified hippos as non-selective feeders: there was no seasonal change in the proportions of different plants eaten (Field 1972, in Laws 1989). According to Laws however, hippos are regarded as “selective close grazers on short grasses” (1982, 950).

Surprisingly, hippos have a modest appetite, which is correlated with their highly economical expenditure of energy and slow rate of digestion (Kingdon 1979, 250). A hippo grazes 5-6 hours per night, the remaining time it rests in the water. Its daily consumption is only about 1-1.5% of its body weight, as compared with about 2.5% for most other hoofed mammals (Laws 1984). Although hippos are non-ruminants with simple digestive systems, the process of digestion resembles that of ruminants and is nearly as efficient (Field 1970). Hippos have a relatively low metabolic rate (Nowak 1991). “The average individual night time consumption of grass is about 70 kg and at very high densities 5-6 tons of grass is consumed by the population per sq. mile (2.7 km²) each night” (Laws 1982, 950). According to Haltenorth & Diller 1986, an average meal consists of 40-60 kg.

Reproduction

“Hippopotamus are quite capable of regulating their populations without human assistance. Their reproductive rate is correlated with environmental conditions, and in high density populations conception rates may be as low as 5% as opposed to 36% in more favourable situations” (Klingel 1983, 27). The correlation between mating peaks and dry spells, at which time the hippopotamus population is most concentrated, is confirmed by Laws & Clough (1965) and Kingdon (1979), whereas Laws (1984) presents similar figures for the proportion of females pregnant in relatively dry or wet years. Pairing can occur all year.
The average two-year cycle in the female hippo consists of “8 months gestation, 12 months lactation, 4 months anoestrous; this pattern is correlated with the mean monthly rainfall (Laws & Clough 1965; Kingdon 1979). Contrary to the adult male hippo, who shows no evidence of sexual fluctuations, the adult female demonstrates a seasonal reproductive cycle (peak ovulations and conceptions occur towards the end of the dry seasons). Most calves are born during high rainfall months (Laws & Clough 1965); this results in a double peak of births in East Africa (Laws 1984). Twins are rare; the sex ratio at birth is 1:1. The birth takes place either in shallow water or on land, in which case the female hippo makes a grass or reed bed, away from the herd. The mother is very protective; she defends her young against any threat. After 10-14 days she and her offspring will rejoin the herd (Laws 1984). The young hippo, weighing about 42 kg, is suckled for one year (Haltenorth & Diller 1986). Sexual maturity is attained at an average of 7 years (range 4-11 years) in males and 9 years (range 7-15 years) in females (Laws 1984). At that time, young males may become rivals for the adults (Honders & Klersk 1993).

V.5 The meaning of hippopotamuses in the African ecosystem
The hippo is regarded as ‘the king of the African swamps’ (Huxley 1980). “Many waterways would be virtually lifeless if it were not for hippos - or, more exactly, their dung” (Schwartz 1996). By contributing to the transportation of nutrients from land to water, hippopotamuses play a role of crucial importance in wetland ecosystems. The animals are almost exclusively terrestrial grazers, but they mostly defecate in the water (Dugan 1990). Due to the cellulose containing components of their diet, they produce huge quantities of dung (Fridrich 1975, 123). This dung, rich in nitrogen, enriches the bottom of a watercourse (Rensenbrink & De Groeve 1982) and stimulates the growth of microscopic plant life (Stuart & Stuart 1996). Large amounts of transported vegetation form the nutrient base of a food chain that begins with micro-organisms and culminates in fish, crocodiles and predatory birds (Holmes 1996; Rensenbrink & De Groeve 1982; Schwartz 1996).

The reference to fish species is significant, for fish is a vital source of protein to local people (Kayanja 1989). Laws (1982, 1950) argued that the fishery based on Uganda’s Lake George is among the most productive in the world, mainly “due to the very large hippo populations along its shore”. Fish populations particularly benefit from the presence of hippos. Hippo faeces provide a continuous supply of nutrients. Dominant males have a habit of rapidly rotating their short tail to spread their dung in the water. This habit contributes to the dispersal of organic material in the water. Because of hippo movements, mud is stirred up and nutrients are released into the water. Microscopic plants and fish feeding on them flourish. When resting, hippos are often surrounded by *Labeo velfier*, a fish species which feeds on hippo excreta and the micro-organisms and algae deposited on hippo’s skin (Rensenbrink & De Groeve 1982; Hoppold 1987, 207). In some areas, the presence of fish populations in the proximity of hippos can be observed easily (Hoppold 1987).

Hippo schools more or less safeguard fish species, for out of fear for hippos, fishermen are reluctant to enter the fish breeding grounds (Hillaby 1962). The following statements are indicative of the correlation between the two. “In fishing areas where hippo populations have been seriously depleted, the fish have disappeared along with them” (Wolfsen-McCoolaugh 1989, 50). “The protection of the hippo seems essential to a continued heavy yield of fish” (Dorst & Dandelot 1990, 172). And last, but not least: “no hippos, no fish” (Bond 1989).

Apart from fish, other species are affected. Hippos feed on *Pistia stratiotes* (water cabbage), which develops due to the hippo’s excrement. The leaves are inhabited by numerous water snails, *Pila ovata*, which are -in their turn- eaten by the open-bill stork, a water bird which is known as *Platelia alba* (Huxley 1980; Rensenbrink & De Groeve 1982). Hippos play host to several aquatic birds, such as cormorants and wagtails, who in return for the offered resting place on the hippo’s back, remove insects and larvae from their host’s skin (Fridrich 1975, 128; Dorst & Dandelot 1990, 172).

As mentioned earlier, not all hippo dung ends up in the water. Male hippo deposit dung heaps ashore, possibly for territorial demarcation. Termites of the family *Hodotermitidae* use dung particles...
to demarcate their own territories. The dung contains grass elements that have not been broken down completely. Termites decompose these elements and the released nutrients are brought back into the soil. Termites of the genus *Macrotermes*, which grow fungi, build termite nests in flooded areas. Decomposition of the nests (through erosion) enriches the soil. Grasses, rich in nutrients, grow here, on which the *Hodotermitidae* termites feed. In short: the recycling of nutrients involves hippos, termites and grasses, and leads to a gradual enrichment of flooded areas (Dugan 1990, 38).

**Hippos**

On land, hippos’ large bodies make trails through the vegetation, which facilitates access to the water for other animals. In the lagoons of Botswana’s Okavango Delta for instance, hippos cut paths through almost impenetrable reed thickets. These trails are beneficial to animals as well as local people, like fishermen in their canoes (Simon 1993, 72). In swamps, a hippo trail shows as “two deep ruts made by the feet with a dip in the middle made by the belly” (Burton & Burton 1976, 448).

Hippos improve water flow by keeping channels open (Stuart & Stuart 1996, 130). In the Nile Valley for instance, the water is regularly covered with masses of floating plants. An accelerated growth of these weeds at the onset of the rainy season enables larger plants to grow on top of them. Contrary to the bottom layer, these plants have firm roots. Eventually, they may develop into floating mattresses of plant material which can hamper the water flow. During the process of creation however, the plant material may be torn loose by the strong and heavy hippos (with the help of the current). In this way, an entire blocking of watercourses is prevented (Rensenbrink & De Groeve 1982).

**Fire prevention**

Hippos take grasses by a plucking action of the horny edges of the broad lips (Laws 1982) and an upward movement of the head (Skinner & Smithers 1990). They pull up the more loosely rooted grass species, which may lead to a change of the species composition of the grassland, and eventually a dominance of firmly rooted and unpalatable species (Laws 1982). Close croppers like hippos can graze on grass areas until they are of ‘lawn-like appearance’ (Skinner & Smithers 1990). There may be no dead grass left to catch fire. The trimming of grass may reduce the fire hazard, or prevent spread of fire (Haltenorth & Diller 1986; Goddard 1970; Kingdon 1979).

The existence of ‘fireproof’ zones enables the growth of certain wood species, with the possible result that grazing grounds become overgrown with trees and shrubs. A similar situation has occurred along the shores of the Mara, Kenya. However, the lengthy interaction between hippos, grazing grounds, and woodlands may be difficult to recognise as such. In short: woodland growth chases chooey herbivores away, but attracts less chooey species like elephants, which leave the trees bare and prevent a further growth of woodland. Re-appearing grasses attract the hippos. The process has come full circle (Honders & Klerks 1993). Kingdon (1979) pointed at correlation between the distribution of deciduous thicket along the Victoria Nile and areas of high hippo density. However, the impact of hippos is limited to grasslands adjacent to rivers, lakes and wallows: grazing radiiuses range between distances of 3.5 km from the water (Klingel 1983). When food is scarce, distances travelled at night may be up to 10 km (Holmes 1996).

**The impact of large hippo populations on the environment**

Several elements of population dynamics have been distinguished in chapter I. Each animal population can be characterised by its own dynamic pattern. At different times of the year, the location, numbers, density or structure of most animal populations vary. The carrying capacity, which relates area to species, fluctuates as well. Whether or not hippos are regarded as beneficial to the environment depends on their number. At moderate densities (about 10-20 hippos/sq. mile) hippos have a positive impact on both habitat and other grazing animals, because they take care of productive short grass areas, create and maintain wallows and clear pathways in swamps (Laws 1982). However, the impact of mammals on their habitat is only partially indicated by their numbers. Assessing the food resources a population requires may best be done via biomass (kg/km²), or the mean adult weight multiplied by the number of individual animals in a given area. Both population numbers and biomass vary; changes are mainly associated with long-term changes in the ecosystem and seasonal variations. The total assessment of biomass of twelve species of herbivorous mammals by Happold (1987, 265/66) indicates a relatively low biomass for hippos, when compared to elephants, buffaloes and hartebeest.

Large numbers of hippos—beyond the carrying capacity of an area—may have a deteriorating effect on the habitat (Kayanja 1989), especially when their trampling and over-utilisation of grazing grounds causes soil erosion. When the compacted trails are regularly used by large numbers of hippos, they “inevitably evolve into drainage channels, and act as the precursors to various forms of serious gully erosion” (Goddard 1970, 8). Large hippo concentrations can contribute to reduced soil fertility for two reasons (Goddard 1970). First, they act as an ‘energy and nutrient sink’ from the land to the water (Laws 1981, Goddard 1970). Second, hippo skeletons are rarely found ashore, which suggests that death occurs mainly in the aquatic environment. The ecological effect of both aspects is to act as a ‘one-way drain of nutrients, for which no return cycle is known (Goddard 1970).

Hippos may be “extremely destructive to vegetation close to their aquatic habitat if they become too numerous, for they can eliminate the grass cover within a few kilometres of the water so there is no food for them nor for other grass-eating herbivores” (Happold 1987, 206). Control measures to reduce hippo numbers had to be carried out in various parts of Africa (Sleeper 1982, Skinner & Smithers 1990). One of the first large culling operations in East Africa was executed in Uganda’s Queen Elizabeth NP, where excessive numbers of hippopotamus were causing considerable damage to local vegetation (Coe 1980; Simon 1993). In fact, “large areas of grassland within 5 km of the shores had been overgrazed and turned into compacted earth: massive, deep erosion gullies had formed.”
The common hippo is not mentioned on the WWF's "1994 Ten Most Endangered List". However, it is considered to be on the list of 'runners-up', for hippo populations are believed to be in serious decline. The IUCN Red List of Endangered Animals is much stricter and less quick to include animals over a decade. The trend towards a diversity decline by extreme single-species dominance was thus halted and reversed (Laws 1989). At that time the optimal grazing density for hippos proved to be about 8/km², if vegetation and mammal densities were to be maintained (Laws 1981).

V.6 The conservation status of the hippopotamus

The status of the hippopotamus in Africa

An overview of the conservation status of hippos in protected areas, based on the results of the 1989-1990 African Suiform Questionnaire Survey, assigns a status category 2 to the common hippo (see supplement II). This indicates a widespread distribution and a relatively secure existence². In the survey, hippo populations are treated on a geographical rather than a taxonomic basis, for the validity of the classification in subspecies is highly questionable (Eltringham 1993a). Any reference to a division in subspecies is beyond the scope of this thesis and thus ignored.

Historical data on hippo populations is rarely available. Incidental reports indicate a decline in many areas. Highest hippo densities are found within national parks and reserves, which might be regarded as critical to the survival of the hippo. In spite of the apparent decline, hippos can still face a relatively secure future. Whenever competition and harassment are reduced or eliminated, hippos quickly recover and their number increases (ROK 1980, 235/6).

There is not much unity in international legal documents concerning threatened species (Heijnsbergen 1997, 96/8). According to Eltringham, the river hippo has been added recently to CITES-Appendix II° -trade in the species must be regulated- whereas the pygmy hippo is on Appendix I (Eltringham 1995). On the CITES-website (1999), both the Hexaprotodon liberiensis (pygmy hippo, first listing 7/1/75) and Hippopotamus amphibius (common hippo, first listing 2/26/76) are listed on CITES-Appendix II. The common hippo is not mentioned on the WWF’s “1994 Ten Most Endangered List”. However, it is considered to be on the list of ‘runners-up’, for hippo populations are believed to be in serious decline², irrespective of their wide distribution in most of sub-Saharan Africa (Envirolink 1997).

The IUCN Red List of Endangered Animals is much stricter and less quick to include animals in the endangered category than CITES. According to Heijnsbergen (1997, 96/8), the hippo is not mentioned on the Red List. According to the WCMC (1999) however, the 1996 IUCN Red List of Threatened Animals includes two hippo species in the category 'vulnerable'. It concerns a common hippo species (Hippopotamus amphibius tschadensis) in Chad and Niger, and a pygmy hippo species in several West-African countries. In addition, the Hexaprotodon liberiensis heslopi (a pygmy hippo species) is regarded as ‘critically endangered’.

Threats facing hippos

People have hunted hippos for centuries in order to obtain meat and trophies. Apart from man, hippos have few enemies. On land, a lion may attack a hippo by jumping on its back, but this is rare (Burton & Burton 1976). Sometimes groups of lions hunt after solitary hippos (Haltenorth & Diller 1986). Hippo calves may be preyed on by hyenas (Kingdon 1979; Hillaby 1962), or lions and crocodiles (Dorst & Dandelot 1990); the latter being especially dangerous when in water (Haltenorth & Diller 1986). The mother meets all dangers that calves are facing: female hippos are exceptionally aggressive and willing to protect their young from predators and male hippos in particular (Kingdon 1979). When a male hippo has won a new territory, he is automatically surrounded by a group of females. If these females are lactating, they refuse to mate. The male hippo will then try to kill the calves, in order to impregnate the females. Calves sometimes manage to escape by scrambling ashore (Kingdon 1979). The death rate among young hippos is relatively high: 45% in the first year, 15% in the second. From then onwards (until the age of 30), the annual loss per age group is about 4% (Honders & Klerks 1993; Laws 1984).

Different percentages have been recorded as well. Figures given by Frädrich showed a decline from 20% (the death rate of hippos under 1 year of age) to 6% (for the age group 2-33). Huge losses in the first year can most probably be ascribed to accidents, predators or illnesses (Frädrich 1975, 129).

Even though hippos have hardly any natural predators and are not particularly susceptible to diseases, the species is potentially vulnerable because of its specialised ecological requirements -hippos cannot cope with a drying up of water courses or loss of grazing grounds (Eltringham 1993a). Drought³ seriously affects hippos (Klingel 1995; Curle 1929). Except for times of drought, there is usually no shortage of water for daytime retreats (Eltringham 1993a). Water is the natural refuge of hippos: once distressed, they will head for the water. This is confirmed by a group of authors, e.g. Corfield (1993) and Dorst & Dandelot (1990). In areas where interference is limited and grazing scarce, hippo grazing may last from dusk into the day. On cloudy nights, hippos generally leave the water at an earlier time than on bright nights. Young males go first, more mature males go ashore between 8-9 p.m. Around 4 a.m. most hippos have returned to the water (Frädrich 1975, 119). In areas where the animals are persecuted though, they only come out of their refuges late on dark nights for a short period of intensive grazing. On bright moonlit nights they may not show at all (Kingdon 1979).

Hippopotamus: nothing but a nuisance?  Aenne Post, University of Amsterdam.
The Hippopotamus: nothing but a nuisance? Aenne Post, University of Amsterdam.

Hippos have long been hunted for their meat and body parts, such as their teeth, bones, hide, tails and feet. Some items, like the fat, skin and gallbladder are used in traditional African medicine as well (Weiler et al. 1994); The hide -when made supple- can be used as a whip; the teeth yield a superior ivory\textsuperscript{14} which, unlike ivory from elephants, does not turn yellow in course of time; the meat, which is rich in protein, is highly appreciated by the population (Frädrich 1975, 121). Several authors have stressed hunting for meat (e.g. Eltringham 1995, Kingdon 1979, Kayanja 1989). Particularly in times of war\textsuperscript{13} and turbulence, hippo meat provided a good alternative to meat from domestic stock (Kayanja 1989). In order to feed the soldiers, raffles were introduced in systematic hippo hunts (Rensenbrink & De Groeve 1982). Although illegal hunting takes place, this seems to be more of a localised than a general threat. The species is highly vulnerable to hunting pressure though. When hippos are perceived as a threat to either people or their activities, or the demand for meat or ivory increases, a hippo population can be wiped out in a short time (Stuart & Stuart 1996, 130/31).

The international trade in the hippo's upper and lower ivory incisors and canines is substantial (Weiler et al. 1994). Poaching for hippo tusks seems to be increasing, possibly due to the ban on elephant ivory, which 'forced' dealers and carvers of ivory to look for substitutes. From 1988 until 1991, African exports of raw hippo ivory more than quintupled (Schwartz 1996). The export figure increased from 5,640 pounds in 1988 (the trade in ivory was banned in 1989) to 30,100 pounds three years later (Eltringham 1995). Consequently hippo populations have decreased. The 1994 aerial census in former Zaire for instance showed only 11,000 animals where 23,000 had lived in 1989 (Schwartz 1996). Many hippo tusks (especially the lower canines of males) have entered the market: the size matches elephant tusks, the resemblance is stunning (particularly when carved) and the colour does not yellow with age. Intensified efforts to prevent trade in elephant ivory could thus trigger the onslaught the slaughter of hippos (Nowak 1991). If such a 'substitute-trade' were to develop, hippos would be at serious risk (Eltringham 1993a). It remains to be seen whether hippopotamuses will outlive the pressures that confront them (Klingel 1995).

V.7 Hippo-human conflicts

Loss of habitat, through destruction or modification is undoubtedly the most serious threat facing hippo populations (Eltringham 1993b; Nyeki 1993). This is primarily the result of conflicts with agricultural interests (Eltringham 1993b; Honders & Klerks 1993; Nowak 1991) and increasing livestock numbers (Stuart & Stuart 1996). The reduction in hippo grazing grounds has been reported in Kenya (as part of the Safiorn Survey earlier mentioned), though it most probably exists in many more African countries. It is not always recognised as such, because the average person rarely sees nocturnal grazers like hippos on land (Eltringham 1993a).

During the IUCN/SSC survey in 1989, hippo-human conflicts were reported from several countries (Eltringham 1993a). Most records referred to: crop damage (in Botswana, Malawi, The Gambia, Niger, Sierra Leone and Somalia), and attacks on fishermen (especially in Gabon). In Malawi for instance, where human-hippo conflicts include loss of human life and crop losses, hippos are considered as major vertebrate pests: the raid frequency on maize and rice is high, 41.2% and 37.8% respectively (Deodatus & Sefu 1992, in: Mkanda 1994). For a proper assessment of the severity of the problem, Mkanda has recorded frequencies of calls in several geographical locations. Significantly more calls were made in areas with large hippo populations. People have also concentrated their activities in these areas, which are important to both agriculture and fisheries (Mkanda 1994, 78).

According to statistics in several African countries (e.g. Uganda), hippos are the most reported animals in terms of causing human deaths (Rensenbrink & De Groeve 1982). They are often mentioned for top honours: “hippos are certainly more deadly than many feared predators” (Schwartz 1996, 98).

On the one hand people may feel threatened by hippos, on the other the animals may be threatened by expanding human populations. This has been perceived as such in the Ivory Coast, while disturbance from the timber and fishery industries were cited as threats in Equatorial Guinea. In parts of Zimbabwe, hippo populations may be at risk because they ‘interfere’ with a large-scale irrigation scheme. These development-related threats have been reported in the IUCN/SSC research, but undoubtedly there are other threats that were not recognised by correspondents (Eltringham 1993a).

Types of conflict

In chapter I, true wildlife-human conflicts have been described in terms of direct interaction between people and animals. This type of interaction is twofold: either wildlife threatening human beings and destroying their possessions, or people threatening the existence of wildlife through hunting, poaching and habitat destruction. Nyeki (1993) distinguishes major hippo-human conflict categories, like crop destruction and attacks and/or killings of human beings when hippos feel threatened by them. Hippos also interfere with fisheries, by destroying fishermen’s nets or attacking their canoes. Usually, these attacks occur as a result of wounding (Dorst & Dandelot 1990), or whenever boats come too near and are regarded as a threat (either to herd or young). However, a fisherman is not the only person facing the risk of a hippo encounter. When a woman goes to a river/lake to fetch water or wash clothes, she has to be very alert. If the route she follows lies between the shoreline and the resting spot of a hippo, it is not always recognised as such, because the average person rarely sees nocturnal grazers like hippos on land (Eltringham 1995). Consequently hippo populations have decreased. The 1994 aerial census in former Zaire for instance showed only 11,000 animals where 23,000 had lived in 1989 (Schwartz 1996). In order to feed the soldiers, riffles were introduced in systematic hippo hunts (Rensenbrink & De Groeve 1982).

pressed, it either charges or gets its backside into a bush and threatens with its jaws” (1979, 273). Sleeper confirms this: “Both male and female hippos threaten by throwing back their heads and opening their mouths in a yawn-like display of tusks. This innocent looking yawn is the best indication that a hippo is getting agitated. Following the yawn, they repeatedly open and close their mouths with low grunts and more head bobbing. If the warning is not heeded a hippo may attack” (1982, 27).

Conflicts between hippos and livestock consist of attacks, competition over grazing grounds, and transfer of diseases. In Kenya, deadly confrontations occur incidentally (ROK 1980, 523). Where competition with domestic stock is prevalent, competition or ‘exchange ratios’ can be used to assess the opportunity costs of VLH. Utilisation of these ratios according to prevailing ecological conditions is helpful in identifying areas where VLH numbers significantly reduce the grazing potential of domestic stock. However, in many management units with livestock potential in Kenya, the number of VLH is too small to pose a severe competitive threat to livestock (ROK 1980, 516/18).

**Table V.3: Competition rates between VLH and domestic livestock**

<table>
<thead>
<tr>
<th>Species</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plains game</td>
<td>0.2</td>
</tr>
<tr>
<td>Cattle</td>
<td>1.0</td>
</tr>
<tr>
<td>Buffalo</td>
<td>1.9</td>
</tr>
<tr>
<td>Blinn</td>
<td>4.6</td>
</tr>
<tr>
<td>Figer</td>
<td>9.1</td>
</tr>
<tr>
<td>Elephant</td>
<td>13.7</td>
</tr>
</tbody>
</table>

*Figures are based upon an index with domestic cattle (domestic cattle equals one).*

When livestock grazes along the shore or enters the water, there are chances of encounters with hippo. Since the animals use the same grazing grounds, there may be a possible transfer of diseases like rinderpest or anthrax. Rinderpest is probably the most lethal and potentially dangerous infectious disease that affects the order Artiodactyla, which includes hippos (Smith & Hearn 1988). It belongs to a ‘fast spreading’ class of viruses, which can hop from one species to another. It is spread by food or water that has been contaminated by the dung of sick animals. Especially buffaloes and other ungulates are very susceptible to rinderpest. In domestic cattle it can be controlled by vaccination. The disease has now spread throughout the southern half of Kenya (Packer 1997, 40).

Plowright et al. found rinderpest-neutralising antibody in serum samples collected from hippos in Uganda’s Queen Elizabeth NP. The antibody was distributed between several age groups: it was most likely acquired as a result of an infection with rinderpest virus during epizootics that occurred in the area in the years 1920-21, 1931-33, and 1944-45. The stability of the antibody level was relatively high, it persisted for many years (Plowright at al. 1964). Even though the hippo blood contained antibodies from rinderpest, there was no real evidence that the disease was fatal (Kingdon 1979, 273), although widespread mortality has been suspected (Eltringham 1993a). Even today, disease must remain a potential risk (Eltringham 1993a).

Hippos attract leeches and ticks as well; hippo parasites include stomach and liver flukes, intestinal worms and protozoa (Kingdon 1979, 273). However, compared to other ungulates, hippos are not very susceptible to diseases (Wolfsen-McColaugh 1989, 50; Kingdon 1979, 273). “There have been reports of deaths from anthrax. This disease is contracted by both ungulates and carnivores and the hippo is exposed to it because the chief source of infection is watering places” (Kingdon 1979, 273). Hillaby also recorded an incidental outbreak of anthrax among hippos, although the rate of mortality was not particularly high (1962, 588). Anthrax is more difficult to control than rinderpest. It can survive in the soil for years; the bacteria can’t be eradicated by halting the wave of active infection. Anthrax kills animals only when they are above the carrying capacity, for instance during a drought or at high population densities, when the animals’ immune system is weakened by nutritional stress. The death rate is related to population densities. According to Kock, a veterinary advisor to the KWS, anthrax is important for maintaining population sizes. Survivors of an epidemic will breed again, the animals will ‘bounce back’ (resilience). Without a reduction in population numbers, animals could permanently damage their environment and destroy their future. Yet a disease like rinderpest can have a severe impact, for natural defences are lacking. “A healthy animal can hold off anthrax, but a severe strain of rinderpest can take out even the healthiest animals in a herd” (Kock 1997; in Packer 1997, 41).

**V.8 Conclusion**

This chapter can be regarded as an introduction to hippos, as it presents basic knowledge of the species with respect to its habitat and behaviour. As such this kind of data refers to the first set of questions that was mentioned in chapter II. Little scientific attention has been devoted to hippos; the bulk of research has concentrated on elephants and rhinos. This lack of interest might be attributed to hippos’ habitat and behaviour. Hippos inhabit wetland areas, during most of the day they remain in the water, while at night they go ashore in order to look for forage. It is questionable whether their significance as a key-species in the ecosystem is fully realised. Even though hippos are legally protected species, most of the areas they live in are not. Their range of distribution showed a considerable decline. Hippos are threatened by the degradation and modification of their habitats. Yet these wetlands are of utmost importance to man as well, as they supply man with water and food (certain fish species e.g. thrive where hippos stay). The current situation is not sustainable: it would be in the best interest of both hippos and man to resolve conflict situations.

Knowledge of the way hippos behave on a daily or seasonal basis is required in order to fully address hippo related problems. It involves an understanding of the physical forces in its habitat, and relates e.g. to the extent of their common range and distribution pattern, based on food availability, spatial requirements, social pressure, security etc. Herbivores like hippos have a well-defined social order, more or less predictable movement patterns and preferred habitats. This type of information is required when trying to define an approach to resolve conflicts between people and hippos.
NOTES CHAPTER V

1 Artiodactyla are either non-ruminants or ruminants, "those that do not and those that chew the cud" (Colbert 1984, 419). Pigs and babirusa, peccaries and hippopotamuses belong to the mammalian Order Artiodactyla (even-toed ungulates). Three major lineages are ranked as a suborder: the Suiformes, Tylopoda, and Pecora. Of these, the Suiformes are the only non-ruminants. Within the Suiformes there are three living Families: Hippopotamae (hippopotamuses), Dicotylidae (peccaries) and Suidae (pigs). (Groses & Gubb 1993, 1).

2 "Much of hippo social life takes place when the animals are completely underwater, a submerged hippo can produce an impressive array of underwater sounds, which are part of its communication system. Some sounds -grunts, growls, and screams- are underwater versions of noises hippos make when their heads are out of the water" (Barklow 1995, 33).

3 Correction factors 1.15, 2.65 and 3.14 respectively refer to undercounting of groups in water, out of water and in lakes.

4 The west bank of the river lies within the Tana River / Eastern Kitui MU; the east bank forms the southern boundary of the Meru/Upper Tana River MU and the western boundary of the Lamu/Southern Garissa MU.

5 There are occasional records of large mammals surviving relatively long sea passages, for example the adult male hippo from mainland Africa that arrived on the island of Pemba -50 km offshore- in the severe floods of 1961 (Simon 1993). Apparently, hippos have been capable of crossing inlets, for they are present on oceanic islands as well. viz. Mafia Island (East-Africa) and Bijagos in West-Africa (Haltenorth & Diller 1986; Houders & Klerks 1993). According to Dugan (1990), hippos, adapted to life in saline water, can be spotted near beaches in the tidal zone of Bijagos, which constitutes of mangroves and tidal plains.

6 There are occasional reports of hippos breaking 'the herbivore code of practice'. Hippos devoured an impala in Zimbabwe's Hwange NP, which could be probably ascribed to severe nutritional stress, caused by prolonged drought (Aitken 1997).

7 Sometimes hippos travel without an obvious explanation. This was the case with Huberta, a famous hippo that wandered from Zululand to Cape Province, a journey of thousand miles which took her three years (Burton & Burton 1976).

8 Seasonal fluctuations in the carrying capacity can follow the same pattern of variation for many years. Wildlife populations respond to changes in the weather conditions. Their carrying capacity will fluctuate around a general level, provided that key habitat elements do not change significantly -otherwise carrying capacity will reflect the trend of habitat changes. Especially long-term changes, like changes in land use, may have a strong impact. This type of knowledge is useful when trying to increase the production and yield from a wildlife population, or when reducing the number or productivity of a population causing problems is the prime objective. A method of direct control frequently requires continued effort, while a reduction in the carrying capacity through habitat change may be more cost-effective (Taber 1971, 60-65).

9 According to Eltringham, it is possible that "future reviews of the species' taxonomy will reveal regional genetic characteristics that merit sub-specific attribution and that one or more subspecies or geographically distinct populations should be accorded a more threatened status category" (1993a).

10 Appendix II includes: "all species which although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilisation incompatible with their survival; and other species which must be subject to regulation in order that trade in specimens of those species may be brought under effective control" (CITES 1999).

11 The current hippo population is estimated at 160,000. Hippos are vulnerable to heavy hunting pressure. The increase in trade may well be a result of a growing use of hippo ivory as a substitute for elephant ivory. Since 1989, when African elephant ivory was banned from international trade, there has been a noticeable increase in hippo teeth trade (Envirolink 1997).

12 Cucu (1929) reported of hippos 'driven insane by suffering in the Lorian Swamp, Kenya. The failure of the spring rains and the consequent drying up of the swamp, forced around 30 hippos to keep under the mud, albeit with indifferent success.

13 Corfield (1993) describes drugs, such as Ethopine (M99), which are used for narcotising hippos. A narcotised hippo should be captured rapidly. Hippos flee to the water once scared. If their head is not kept above water, they may drown.

14 Around the turn of the 18th century, hippo teeth were used to make artificial teeth. Hippo canines provide ivory of a superior quality, which does not turn yellow after a number of years (unlike tusks of elephants). Because of this, ivory has been used for artificial teeth for many years (Dolan 1991, 246; Wolfsen-McColaugh 1989, 50). After the invention of porcelain enamel the market for hippo tusks dwindled. It has recently taken an unexpected and unwelcome turn upward (Schwartz 1996).

15 Both poaching and the civil war in Uganda have taken their toll of the hippo population in the Queen Elizabeth NP. Its number has decreased from 14,000 in 1957 to 3,000 in 1989 (Bond 1989). Fishermen, living within the park boundaries, were heavily involved in the poaching. They killed hippos on a commercial basis. The meat was sold to local people in the nearby Ruvensori mountains, at prices which undercut the prices of beef, goat or chicken (Bond 1989).