# *Chapter 12*
# *Amphibian, Reptilian and Avian Fauna*

## AMPHIBIAN FAUNA

Toads (*Bufo regularis* Reuss, 1834), characteristic of the fauna of the River Valley, started to propagate very intensively and spread all over Lake Nasser in 1970. Population culminated in 1971-1972 with seasonal thousands of mature individuals per/km shoreline (Entz 1980b). In 1973 their numbers decreased rapidly and became almost extinct in 1974 probably because of lack of suitable food (Hussein 1976). However, it seems nowdays that toads are rare in Lake Nasser area. It is reported that *Bufo virdis viridis* Laurenti, 1768, is found in the vicinity of the High Dam (personal communication with Prof. Dr. Mostafa A. Saleh, 1997).

It is probable that at present, with flourishing of agricultural practices along the shores of the Lake, amphibian fauna may flourish. Urgent studies are needed on the amphibian fauna along the Lake on account of the scanty information at present.

## REPTILIAN FAUNA

Reptiles are represented in Lake Nasser by three species; the Nile crocodile (*Crocodylus niloticus* Laurentia, 1768), the Nile monitor (*Varanus niloticus niloticus* Linnaeus, 1766) and the Nile turtle (*Trionynx triunguis* Forskal, 1775).

### **The Nile crocodile** (Plates. 63-65)

The Nile crocodile ranked high in ancient Egyptian records, and it was worshipped in many parts of Egypt. In Ancient Egypt, the Greek historian Herodotus mentioned that some dwellers along the Nile treated 'crocodiles' with great kindness embalming and burying them in sacred tombs, when they died. Ancient Egyptians put gold bracelets on the animal's legs. An elaborate city, Crocodilopolis, was built, legend had it, in honour of a crocodile. When the Greek geographer Strabo visited Crocodilopolis, he saw priests open the jaws of a basking holy crocodile and put in roasted meat and cakes and pour in pitcherful of wine mixed with honey. Thousands of crocodile graves were unearthed near Tebtynis, each containing an embalmed crocodile family-male,

female and six young. The graves were prepared perhaps by pilgrims to gain supernatural power.

The Nile crocodile was found along the River Nile even in Rosetta Branch, at El-Rahmaniya village (Flower, 1933). The story of its disappearance in the Nile Valley began in the 1950's, when professional hunters, even from outside Egypt, decimated the stock, and the crocodile skins were sold as an important export item. This enormous destruction brought this species to near extinction. During the 1960's and 1970's only patchy distribution had been seen in some places of Upper Egypt only.

After the construction of the High Dam at Aswan and formation of Lake Nasser, it was a surprise for scientists to observe crocodiles were spreading in the Lake and increasing in number, year after year. This may be because the Lake is now banked on both sides by the desert, and the human population has been thinned, and the environment became suitable and favourable for living and breeding of crocodiles.

The fishermen at Lake Nasser claim that the number of crocodiles are increasing, especially in the southern region and in some of the khors, especially in Khor Korosko which probably contains the highest number, where their number ranges between 20 and 30 individuals per khor. Furthermore, these crocodiles cause damage to the nets and destroy about 100 m of the nets at every fishing operation. Furthermore fishermen, claim that a crocodile can eat about 50 kg of fish per day. For this reason a committee was formed in 1996 by the Egyptian Environmental Affairs Agency to study this problem. One of the goals of this committee was to verify the claims suggested by the fishermen, to find the role of crocodiles in carrying fish parasites as primary and secondary hosts, and to assess their impact on the fisheries of Lake Nasser.

In a recent survey (July-August, 1997) observations on the number and size of crocodiles gathered by fishermen at various khors of Lake Nasser, showed that some khors were preferred by crocodiles, where the number is higher than in other khors. The average number of crocodiles in each of these khors was 2-10 and their size ranged from one to six meters long. The following khors contain the highest numbers of crocodiles: Korosko, Dihmit, El-Soboui, Sayala East, Thomas, Wadi El-Arab and El-Madiq.

On account of the importance of the Nile crocodile to the fisheries of Lake Nasser and its recent spread in khors of the Lake, a detailed review is given on its behavior, growth, reproduction, food and feeding habits, food relations, population dynamics, impact on fisheries and fish-eating birds, as well as conservation.

The crocodilians have been around for nearly 200 million years. There are 21 species including the Nile crocodile. Crocodiles survived while their close kin the dinosaurs died out. Crocodiles have a far complex brain than other reptiles and can learn readily.

The Nile crocodile lives a sophisticated life. Crocodiles are not uricotelic (excreting uric acid) like terrestrial lizards, and so require water for urea excretion.

**Behaviour.** The Nile crocodile lives in large communities from a few dozens to few hundreds depending on their habitat. Although they live together, they engage in no group behaviour other than large feeding frenzies where all the crocodiles near a large prey converge on it and eat together with surprisingly little fighting.

Territory and ritual rule crocodilian lives. There is a social hierarchy in the crocodile community, and always a big male dominates a river colony. He even controls who basks and where on the beach. Any passing male must lift his head up out of the water and expose his throat, signaling submission, or else face the dominant male fury. When slapping the water with his head, it is one of the ways big males express mood and territoriality. Aggressiveness grows up at the time nearing for his mate to lay eggs.

Crocodiles communicate by their grunts, hisses, chirps and growls, each sound carries a specific message. They also use a "body language" of back arching, bubble blowing and other physical displays. Crocodiles may communicate underwater too, through low frequency warblings inaudible to us.

A big Nile crocodile is cunning enough to stalk a human, strong enough to bring down and dismember a water buffalo, yet gentle enough to crack open its eggs to release their young and carry them in its mouth after hatching. As weapons of offence the formidable fury of trenchant teeth with which the powerful jaws are armed, have not alone to be reckoned with by the victim assailed. The crocodile limbs and claws are relatively weak and incapable of aggressive mischief. The long, compressed tail possesses a terribly effective weapon, wherewith, one swift unexpected side-stroke, it will sweep a smaller animal into water, or deal a blow of sufficient power to fell or disable a man or bullock. Nile crocodiles have been observed, using their long powerful tails to corral a small school of fishes. This disorients the fish and the crocodile has an easy time for catching them. Surprise is one of the most used techniques where a crocodile waits for its prey to come down the water's edge for a drink, when it slowly swims to the shore and lies in wait with just its eyes above the water, a few feet from the animal's head. Then it suddenly lunges out of the water and

latches onto the animal's head with its powerful jaws. Then, the crocodile pulls its prey into deep water where it is drowned.

Crocodiles use their enormous, oar-like tail for swimming. Only their rear feet are webbed, and they are rarely used in movement underwater. On land, the crocodile walks on the short, seemingly weak legs. Nile crocodiles have been known to reach speeds up to 29 miles per hour.

Crocodiles, as might be inferred from the slitlike contour of the eye-pupil, as shown by daylight, are to a large extent nocturnal, displaying their greatest activity, and being in the habit of travelling long distances away from the river banks in search for food or in connection with their migratory or mating instincts, under the cover of darkness. A typical crocodile's day consists of resting, swimming and eating. Just before dawn, they often leave the water to bask in the sun with the mouth open, so that they can dissipate excess heat from inside their mouths in the same way as a dog pants. Near midday the crocodile returns to the water where it will feed if hungry. If upset-for example by the sound of a bullet or motor boat, etc.- a crocodile will go under water and boil the water with bubbles from his nostrils, or he might suddenly shoot half his body straight out of the water and slap his head soundly against the water. Guggisberg (1972) reported that crocodiles may aestivate by digging deep in the mud, to avoid high temperatures.

On rare occasions a lion or leopard pose a threat to adult crocodiles. However, many other enemies are known to crocodiles, raiders for eggs and young. These include the nest robbing Nile monitor lizard, mongooses and other small animals such as wading birds as the six-foot tall goliath heron which attacks the young (Plate 65).

**Growth.** Crocodile growth is most rapid in early life, showing a mean annual increment during the first seven years of about 265 mm. Thereafter the growth rate decreases progressively, to about an average of 35 mm, per annum at twenty-two years of age. The maximum size attained differs widely according to locality. Specimens appear to attain a maximum length of at least 20 feet.

**Reproduction**. The Nile crocodile reaches sexual maturity at 8-12 years of age and when around 2.9 -3.3 m in the male and about 2.4 -2.8 m in the female. Cott (1961), however, pointed out that females do not attain sexual maturity until they are at least 19 years old. The breeding season begins in August-October to December-January. Male crocodiles perform elaborate mating displays, much like birds do, and then approaches any respective female. During copulation, which lasts for a minute or two, the pair sinks to the bottom of the lake or river. The female is ready to lay her eggs about two months later. Eggs are usually

laid when water levels are falling. Before laying the eggs, the female chooses a suitable dry sand-bank near the lake's or river's edge, in which it excavates a hole of about two feet deep, and having deposited about 20- 60 eggs, therein, it covers the nest with organic debris creating a constant temperature of about 95°F (35 °C) until they hatch. The mother remains near, or even mounts the top of the nest guarding it without taking any food, may be once a prey coming near it. The mother leaves the area for brief periods to cool during the hottest hours. Both parents jealously guard the nest and repel all intruders until the eggs are hatched. The eggs of the Nile crocodile are small, in the size of the chicken egg, encased in a hard porous calcareous shell. The incubation period lasts for 80 to 90 days. When hatching starts, young crocodiles call from underground. These calls prompt the mother to dig the nest open, cracks the eggs and frees the youngs. The mother waits till all eggs hatch, and then carries the young inside her mouth to a selected place in the river or lake, which is used as a nursery ground. It is believed that the Nile crocodile protects its young for up to two years, after which they are independent, but have to avoid larger crocodiles, which may try to eat them.

Newly hatched crocodiles are weak and fall victims to vultures, hawks, ichneumons and all birds and beasts. They are most vicious and irascible in deposition, hissing and snapping at or laying hold with bull-dog tenacity of a finger or other seizable object. They feed on flies and other insects, then speedily extend to frogs, lizards, fishes or any small animal, which frequent the marches of river or lake banks. Their increased appetites and dimensions requisite such larger prey as sheep, goats, deer, horses or even humans. The hatched young crocodile is about 26-34 cm long and it grows so fast during the first seven years of life, at a rate of about 26.5 cm/year under favourable conditions, then the growth rate decreases progressively.

**Food and feeding habits.** The diet of crocodiles is extremely varied, and it changes markedly and progressively with the predator's age (Cott 1961). The young feed in shallows and ashore on insects, spiders and frogs. In middle life underwater prey, notably crabs, gastropods and fish, form the main food, old crocodiles feed increasingly upon reptiles and mammals. Corbet (1960) examined 851 crocodiles and found that in specimens up to about one meter in length, which are largely insectivorous, fishes comprise only about 10% of the food, in specimens one to two meters in length fish comprise 30% of the food, and that individuals two to three meters in length rely on fishes for about 60% of their food, with increase in size the importance of fishes gradually declines as other vertebrates become more important. In the whole sample of 851 crocodiles 393 fishes were found in 265 stomachs. The amount of food consumed by crocodiles has been exaggerated in the past. Rough estimates,

based both on field data and on food consumption in zoos indicate that crocodiles just over two meters in length and weighing about 45 kg, at the fish-eating stage, consume their own weight in about 120-160 days. As this weight is not made entirely of fishes, and cichlids usually comprise only a small proportion of those eaten, the effect of crocodiles on the cichlid population of a large lake as Victoria was probably always small (Fryer & Iles, 1972).

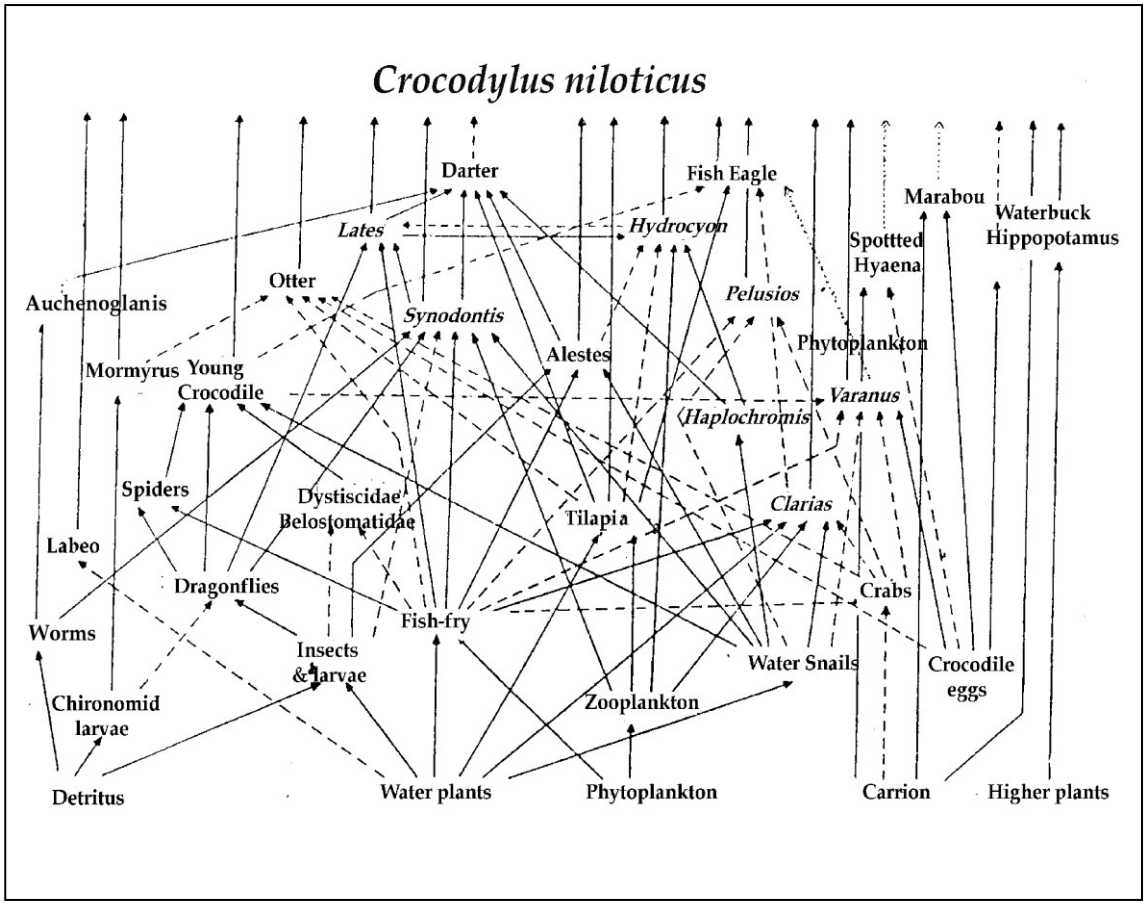


***Fig. 255*** **Diagram showing the food relations of *C. niloticus* to various other members of the fauna: Uganda below Murchison Falls. (Cott 1961).**
**[**——: links in chains observed in the locality, **- - - - -**: links known to occur elsewhere, **……:** unformed but probable links].

In a recent survey in 1998, six crocodiles were caught from Lake Nasser, ranging in length from 115 to 467 cm, and their weight ranged from 3.94 to 775 kg. The weight of stomach contents ranged from 0.046 to 8.2 kg. Thus, it seems that food consumption of large crocodiles was overestimated by the fishermen, as the net weight of tilapia fish found in the stomach of the largest crocodile was about 7 kg only.

## Food relations of Nile crocodiles

Cott (1961) presented the web of food relationships in which the crocodile plays an essential part (Figs. 255 and 256), which indicated links in the chains. Examination of that part of the food web which primarily concerns

reptiles and amphibians alone reveals sufficient complications, including cases of interspecific competition and reciprocal predation. Thus, the turtle *Pelusios nigricans* and the monitor *Varanus niloticus* both feed extensively upon ampulariid gastropods such as *Lanistes* and *Pila*, which in some localities form a main item in the crocodile's menu at all ages. These three reptiles also prey

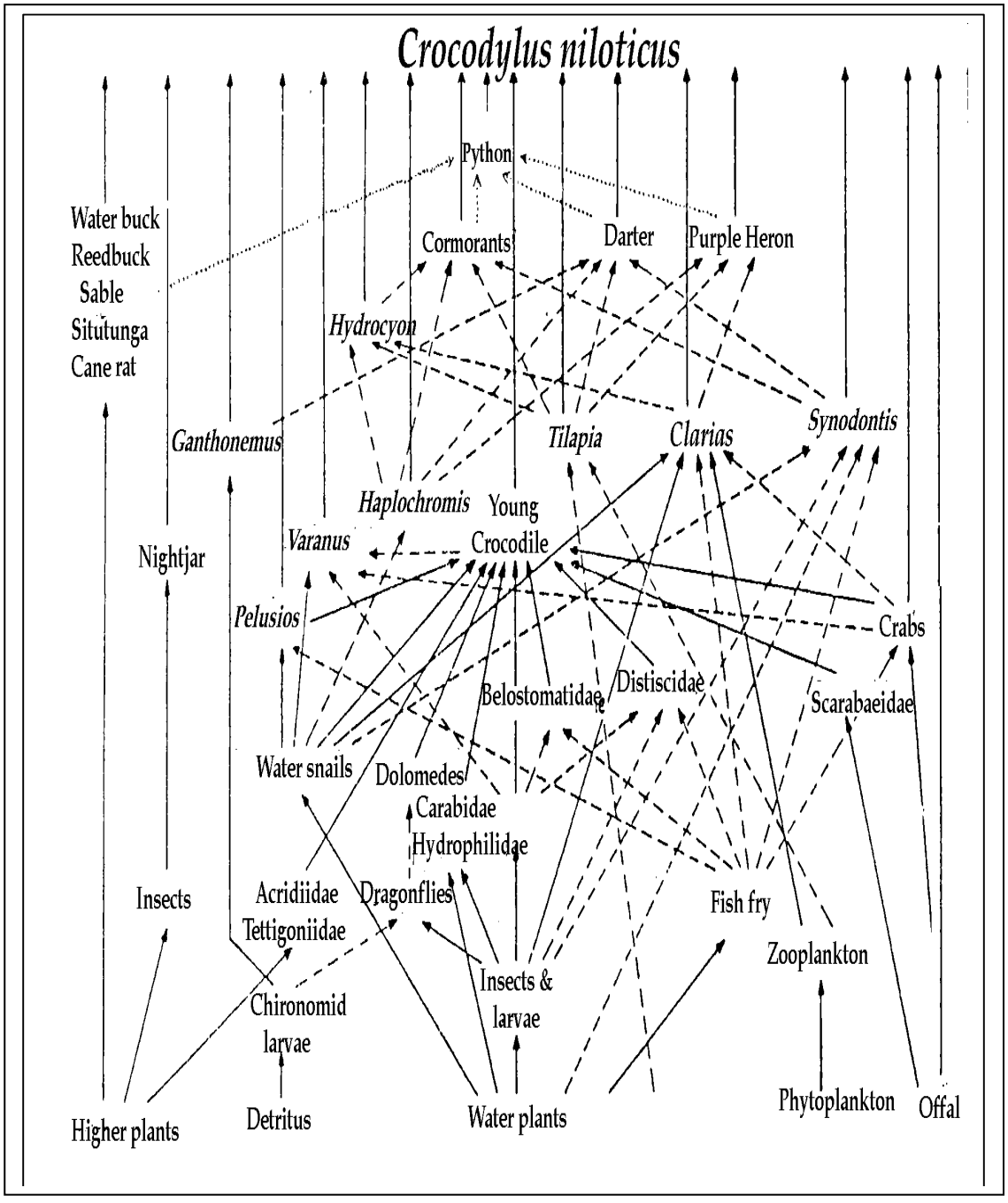


***Fig. 256* Diagram showing the food relations of *C. niloticus* to various other members of the fauna: Upper Zambesi, Barotseland (Cott 1961).**

[——: links in chains observed in the locality, -----: links known to occur elsewhere, …….. : unformed but probable links].

upon the freshwater crab *Potamonautes.* Young crocodiles, and monitors, also eat toads and frogs, and the turtle takes tadpoles, while *Potamonautes* almost certainly includes anura in its generalised diet. Various snakes such as *Naia melanoleuca* and *Chlorophis hoplogaster,* themselves frog-eaters, are also preyed upon by the crocodile. The crabs and crocodiles are both scavengers, readily feeding upon carcasses including those of the crocodile itself. *Varanus* destroys crocodile eggs wholesale, also despoiling the nest of *Trionyx* and (presumably) of *Pelusios. Trionyx* is reputed to prey upon crocodile eggs and newly-hatched young. The crocodile in turn preys upon its enemy *Varanus,* and upon *Pelusios* and *Trionyx*. It also eats the eggs both of the turtles and of its own kind. It rounds off these activities as a cannibal. Fig. 257 indicates a part of the web.

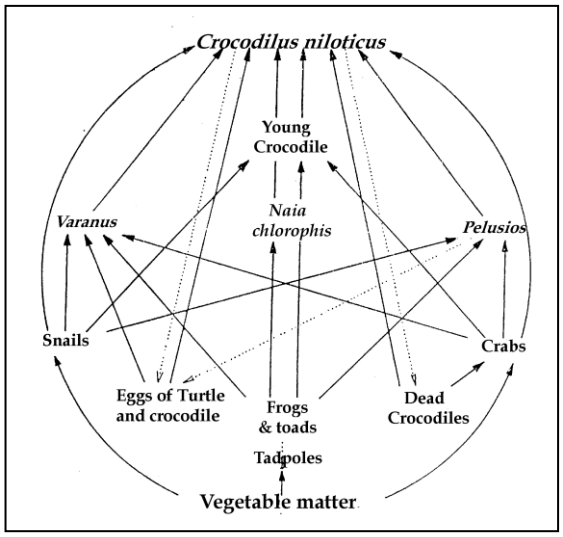


***Fig. 257*** **Food relations of crocodiles to various other reptiles (Cott 1961).**

Similar complexities are seen at all levels of the food web. Thus, the feeding habit of young crocodiles reveals an intricate network of relationships - the reptiles preying extensively upon secondary predators such as belastomatid bugs and dytiscid and hydrophilid beetles, which in turn take tertiary predators such as dragonfly nymphs, young frogs and fish fry. Young crocodiles also take pisaurid water-spiders whose victims include fish fry and dragon flies- including *Crenigomphus rennei* and *Brachythemis leucosticta* - as observed at Kaiso, Lake Albert. These Odonata are themselves predatory upon other members of the insect fauna, and the situation is further complicated by the crocodile's penchant both for larval and adult dragonflies (Cott 1961).

**Parasites**: Cott (1961) found that 66% of the crocodiles examined from Uganda harbour nematodes, whose percentages differ according to length groups. Two species of nematodes i.e. *Multicaecum agile* and *Dujardinascaris dujardini* were recovered from the stomach. *Contracaecum* sp. found in certain specimens seems to be derived from fish eaten by the crocodiles, while the other nematodes are specific to crocodiles.

In a recent study during 1998, examination of stomach contents of six crocodiles from Lake Nasser - ranging from 115 to 467 cm length, indicated the presence of some nematode parasites probably *Amplicaecum* spp. (Plate 66); males and females. Some of the fertilized eggs were left to hatch and the larvae were obtained. These parasites are now under investigation for the identification of the species.

**Population Dynamics.** The Nile crocodile has no clearly defined mode of subsistence. Being a versatile opportunist, it maintains itself and meets varying circumstances with extreme flexibility of behaviour. Its ability to thrive, as an adult, upon prey ranging from crustaceans, molluscs and fish, to waterfowl, reptiles and large mammals, and upon carrion, gives it a unique status in its environment. Apart from the general role it plays as a master predator, it occupies no single niche, but rather many niches - both on land and in the water. Thus, it seems unlikely that food shortage can normally be an important factor in limiting its numbers. Should one food becomes temporarily scarce, the crocodile can turn to another, and in so doing it will exercise a differential pressure upon the shore and freshwater community. Moreover, the marked divergence in prey, feeding habits and habitat of young and old crocodiles – which is even more marked than that often found in a group of congeneric species (Gauss's principle) – must tend to reduce intraspecific competition.

While the crocodile's place at the head of an elaborate system of food chains is unquestioned, heavy mortality, due to predation, nevertheless takes effect in the egg, newly hatched young and immature stages. The maturing population also contains its own internal means of regulation, through cannibalism. Cannibalism also provides an explanation of the segregation of age groups, for the habit tends to keep the young away from open water and basking grounds, among weedy shallows.

**Crocodiles and fisheries.** Many fishes including the genera: *Protopterus, Barbus, Clarias, Synodontis, Bagrus, Alestes, Hydrocynus, Lates* spp. and others are at some stage predatory on fish, fry, or fish eggs. The aforementioned fish genera together with tilapias are included in the diet of crocodiles (Cott 1961). Thus, it appears that the destruction of crocodiles would be unlikely to benefit fishery interests, and might well be harmful. It is suggested that crocodiles should be maintained to limit the numbers of unwanted cannibal fish such as barbel (*Heterobranchus*). Where crocodiles had been reduced in the Belgian Congo (Zaire), barbel rapidly multiplied (Douglas Hay-cit. Cott 1961).

The importance of the crocodile in relation to the tilapia fishery is clearly seen in the conditions pertaining in Mweru Wa Ntipa, where the reptiles are very plentiful and strictly protected. In this Lake, they tend to be monophagous, feeding extensively upon *Clarias mossambicus,* but apparently not upon tilapiine species which is the main producer of animal protein from vegetable matter, and the important commercial fish. *Clarias* spp. prey heavily upon tilapiine species and in so far as the crocodile keeps *Clarias* spp. in check there can be

little doubt it is beneficial. If, owing to a change of policy, unrestricted hunting were to be permitted, crocodiles would speedily be exterminated, and the consequences might well be disastrous to the fishery.

Young crocodiles play a useful role in the freshwater economy. During the early years of life, crocodiles prey extensively upon giant water-bugs (Belostomatidae), adults and nymphs of dragonflies (Gomphidae, Libellulidae), voracious water beetles (Dytiscidae, Hydrophilidae), freshwater crabs (*Potamonautes*) and upon aquatic spiders (*Dolomedes*). All these invertebrates feed, either as larvae or adults, upon fish fry. Here again the benficial role of crocodiles may be presumed, especially in Uganda, where genera such as *Hydrocynus* and *Limnogeton* are destroyed wholesale. The omnivorous crabs, which form an important part of the young crocodile's diet in the Kafue and Upper Zambezi Rivers, also take their toll of fish. In parts of Zimbabwe, where crocodiles have been shot out of existence, crabs (*Potamonautes*) appear to have increased and reported to be feeding on the nests of tilapia (Cott 1961). Fryer (1959) pointed out that in Malawi *Potamonautes* will readily feed on fishes entangled in gill nets - to which it sometimes causes considerable damage.

**Crocodiles and fish-eating birds.** Table 180 contains an analysis of prey, by genera, recovered from 246 of fish-eating birds, which were shot in the same waters from which crocodiles were also examined. Figures in Table 181 provide a comparison, in terms of occurrence and number of prey, of the fish-eating habits of waterbirds and crocodiles.

Cott (1961) came to a surprising conclusion that the overall average daily fish consumption of an individual crocodile is less in bulk than that of a White-breasted Cormorant (which consumes at least one kilogram of fish per day). Fish were found in only about one third of the crocodiles, which contained food of any kind, the birds are almost exclusively fish eaters. The mean number of fish per stomach is ten times greater in *Phalacrocorax lucidus* and *Anhinga rufa* than in the crocodile. In the light of these observations, it must be remembered that cormorants and darters themselves constitute the main avian prey of the crocodile in most waters where the reptile's habits have been studied.

## Impact of crocodiles on Lake Nasser

Cott (1961) discussed the economic importance of crocodiles as consumers for fish. Although crocodiles eat large amounts of fish, they also prey on other organisms which themselves are predators of fish, and they even eat carcasses. Hence, the crocodile status as major competitors of man for fish is somewhat obscure (Welcomme 1985). Crocodiles play an important role in the ecology of tropical waters (Fittkau 1970, 1973, Fittkau & Klinge 1973) since they are able to maximize the storage and recycling of nutrients of allochthonous origin. Therefore, in places where crocodiles have been eliminated, decline in fish production has been recorded, possibly because of a drop in the primary production based on excreted nutrients (Welcomme 1985).

*Table 180* **Prey of White-breasted Cormorant, Pigmy Cormorant and African Darter, in Uganda: (a) Lake Victoria and Victoria Nile above Murchison Falls, (b) Lake Albert and Victoria Nile below Murchison Falls (Cott 1961).**

| | *Phalacrocorax lucidus* | | *Phalacrocorax africanus* | | *Anhinga rufa* | | **Total** |
|---|---|---|---|---|---|---|---|
| **Locality** | **a** | **b** | **a** | **b** | **a** | **b** | |
| **No. of stomachs** | **87** | **--** | **61** | **48** | **40** | **10** | **246** |
| ***Protopterus*** | - | - | 1 | - | - | - | 1 |
| **Mormyridae** | 11 | - | - | - | 1 | 3 | 15 |
| ***Hydrocynus*** | - | - | - | 2 | - | - | 2 |
| ***Alestes*** | - | - | - | 8 | - | 5 | 13 |
| ***Barbus*** | 4 | - | - | 1 | - | - | 5 |
| ***Labeo*** | 2 | - | - | 1 | - | - | 3 |
| ***Engraulicypris*** | 355 | - | 7 | 6 | - | - | 368 |
| ***Discognathus*** | - | - | - | - | 1 | - | 1 |
| ***Bagrus*** | - | - | 2 | 3 | - | 3 | 8 |
| ***Auchenoglanis*** | - | - | - | 2 | - | 1 | 3 |
| ***Clarias*** | - | - | - | - | 1 | - | 1 |
| ***Synodontis*** | 3 | - | - | 12 | - | 2 | 17 |
| ***Lates*** | - | - | - | 13 | - | 6 | 19 |
| ***Tilapia*** | 2 | - | - | 5 | 13 | 7 | 27 |
| ***Haplochromis*** | 398 | - | 139 | 159 | 293 | 47 | 1,036 |
| ***Astatoreochromis*** | 1 | - | - | - | - | - | 1 |
| ***Mastacembulus*** | - | - | 1 | 1 | - | - | 2 |
| **Total** | **776** | | **363** | | **383** | | **1,522** |

More detailed studies are needed on the Nile crocodile in Lake Nasser especially on the biology of reproduction and feeding behaviour as well as population dynamics and to assess its impact on the fisheries of the Lake. It is known in some African lakes, such as Lake Kariba, that the crocodile population consumes about 225 tons of fish per year, amounting to about 10 % of the yield of the fishery (Games 1990).

## Conservation

Extensive crocodile population surveys in some areas have contributed to sustainable-yield management programmes, mainly in southern and eastern African countries. Central and western countries have seen much fewer population surveys conducted, and in general most countries have very little information regarding status. After a population decline around the middle of the century due to over-hunting, legal protection has resulted in significant recoveries in several areas, and large populations can now be found (e.g. Botswana, Ethiopia, Kenya, Zambia, Zimbabwe). Humans came into conflict with the Nile crocodile in several areas and this therefore fuels the need to establish more sustainable- yield programmes.

The skin from the Nile crocodile is considered to be 'classic' skin, in that high-quality leather is obtainable without blemish-causing osteoderms reducing its value. It is made into handbags, belts, boots and other accessories.

In Lake Nasser, the increasing number of Nile crocodiles necesssiates management programmes by adopting ecological research on population dynamics, which should provide valuable information for sustainable-yield programmes. Countries which still have certain quotas that can be harvested from the wild are moving towards establishing their own ranching programmes (e.g. Madagascar).

***Table 181*** **Comparison, in terms of occurrence and number of prey, of the fish-eating habits of waterbirds and crocodiles (*C. niloticus*) [Cott, 1961].**

| Locality | Predator | Stomachs containing food of any kind | Stomachs containing fish | Percent. stomachs containing fish | No. of fish prey | No. of fish prey per stomach |
|---|---|---|---|---|---|---|
| **Uganda** | *P. lucidus* | 87 | 87 | 100.0 | 776 | 8.92 |
| **Uganda** | *P. africanus* | 109 | 109 | 100.0 | 363 | 3.33 |
| **Uganda** | A. *rufa* | 50 | 50 | 100.0 | 383 | 7.66 |
| | **Total** | 246 | 246 | 100.0 | 1522 | 6.19 |
| **Uganda** | *C. niloticus* | 124 | 44 | 35.5 | 81 | 0.65 |
| **N. Rhodesia** | *C. niloticus* | 549 | 212 | 38.6 | 296 | 0.54 |
| **Zululand** | *C. niloticus* | 28 | 9 | 32.1 | 16 | 0.57 |
| | **Total** | 701 | 256 | 37.8 | 393 | 0.56 |

## The Nile monitor (Plate 67)

The Nile monitor (*Varanus niloticus niloticus* Linnaeus, 1766) is found mostly in the more uninhabited areas of the Lake shores. The adult attains 170 cm or more in length. Although, more or less, aquatic in its habits, it is frequently seen hunting for its food along the banks of the Lake and can move long distances overland and during periods of drought in some khors of the Lake. The Nile monitor is carnivorous and the young feed on insects and frogs, while the large individuals feed mainly on fish, young crocodiles and their eggs. From the strongly carnivorous instinct, which it manifests in confinement, eating rats and mice with avidity, it probably preys on the field-rat, the burrows of which are so plentiful along the shores of the Lake, and may likewise devour some lizards such as *Mabuia* sp. and *Chalcides ocellatus,* which are found in similar situations. Recently, Saleh (1997) pointed out that the Nile monitor is a highly aquatic species, never found far from water. The latter author mentioned that it feeds on fishes, but may venture out of water to feed on rodents, snakes, lizards and birds.

However, little reliable information has yet been placed on record regarding the habits of this lizard, and more detailed studies are needed especially on its reproduction, population dynamics and feeding behaviour.

## The Nile turtle (Plate 68)

The Nile turtle; *Trionynx triunguis* (Forskal, 1775), used to inhabit the Nile, but is much more numerous south of Aswan (Saleh 1997). It is usually caught in Lake Nasser -mostly from the southern region - and is sold in the fish market. It feeds on fish, Nile crabs and possibly snails. Eggs are usually deposited in spring on sand banks, possibly of the khors, and left to hatch by the suns' heat. Until now no detailed study on its ecology, distribution and population density is carried out in Lake Nasser. Such studies are urgently needed.

## AVIFAUNA (Plates 69-78)

The bird fauna of Aswan region is much poorer than in the north towards the Delta, or in the south towards Sudan. This, may be, because Aswan area is extremely hot and arid, and it is believed that only very adaptable species can live there, but the fact is that there are also waterbirds in the Nile and its islands and on the shores of Lake Nasser. Moreover, Aswan area is an important route of migrating birds coming from Europe in autumn, either to stay in the area and "enjoy" the winter sun, or to go further south in deep Africa. However, many investigators have reported that migrant birds, especially waterbirds, use now the water of Lake Nasser and its adjoining khors to a greater extent than before the High Dam construction.

Meinenger & Mullié (1981) recorded 19 species of waterbirds from Lake Nasser (Table 182). Later on Meinenger and Atta (1994) surveyed the Lake during winter 1989/90 and they recorded 47 species in the Lake khors based on observations made only from the shores (Table 183). Abdel-Azeiz (1993) recorded 122 species of birds during 1988-1991 in the Nile Islands and Wadi Allaqi.

Records of birds other than waterbirds include the Egyptian Vulture (*Neophron percnopterus*), Marsh Harrier (*Circus aeruginosus*), Ospery (*Pandion haliaetus*), Eagle Owl (*Bubo bubo*), Pallid Swift (*Apus pallidus*) and Martin (*Riparia riparia*).

Meinenger & Atta (1994) mentioned that the number of birds seen in the northern part of Lake Nasser was surprisingly low. Many birds can be missed because of the dendritic shoreline and the locally dense vegertation. Resident breeding species include the Egyptian Goose, Kittlitz's Sand Plover, Spur-winged Plover and African Skimmer. Vast numbers of migratory palaearctic waterbirds were observed during winter months making it of global importance for some species of waterfowl. There is also a smaller influx of African waterbirds during summer months.

Meinenger & Atta (1994) pointed out that the orinithological importance of Lake Nasser is only partially known and more data are urgently needed. The Lake holds potentially important orinithological areas. Lake Nasser might well

be an important staging area for many species during migration, e.g. White Pelican *Pelecanus onocrotalus* and White Stork *Ciconia ciconia.* Lake Nasser area is the only area where African Skimmer (*Rynchops flavirostris* ) and African Pied Wagtail (*Motacilla aguimp*) are known to breed in Egypt (Baha El Din 1999). The area's original breeding bird community which probably included African Palm Swift *Cypselus parvus,* and Fulvous Babbler *Turdoides fulvus,* disappeared after filling of the Lake started.

***Table 18*2 Number of waterbirds recorded at Lake Nasser by Meinenger & Mullié (1981)**

| Species | Number |
|---|---|
| ***Phalacrocorax carbo*** | 2 |
| ***Bubulcus ibis*** | 21 |
| ***Egretta garzetta*** | 160 |
| ***Ardea cinerea*** | 55 |
| ***Alopochen aegyptiacus*** | 38 |
| ***Anas crecca crecca*** | 20 |
| ***Anas acuta acuta*** | 5 |
| ***Anas clypeata*** | 4 |
| ***Fulica atra atra*** | 61 |
| ***Charadrius hiaticula tundrae*** | 1 |
| ***Charadrius pecuarius allenkbi*** | 8 |
| ***Charadrius alexandrinus alexandrinus*** | 1 |
| ***Hoplopterus spinosus*** | 2 |
| ***Calidris minuta*** | 22 |
| ***Charadrius / Calidris* sp.** | 38 |
| ***Tringa totanus totanus*** | 1 |
| ***Actitis hypoleucos*** | 1 |
| ***Larus ridibundus*** | 865 |
| ***Chlidonias niger niger*** | 118 |

## Impact of waterbirds on fisheries.

Mekkawy (1998) pointed out that predation of birds may affect fish populations indirectly through competition for food, or directly through piscivory. Thus, invertebrates constitute an important component of diet of adult dabbing ducks, black ducks, divers, herons, smews, gulls and kingfishers (Danell & Sjoberg 1980, EIFAC 1989). Erickson & Kautsky (1992) observed that the African Open-billed Stork (*Anastomus lamelligerus*) feeds on molluscs during the period of low water level in shallow regions. During this period, the storks are distributed in relation to the sites where *Mutela dubia*, the most preferred mussel, is abundant. Studies on the avifauna of Lake Nasser (Meinenger & Mullié 1981, Meinenger & Atta 1990, 1994, Abdel-Azeiz 1993) showed that all the above mentioned groups of fish and invertebrate eating birds are represented in the Lake and its vicinity except divers and smews. Mekkawy (1998) emphasized the importance of competition of these birds in the highly productive Lake Nasser in spite of the fact postulated by EIFAC (1989) that the relative importance of invertebrates in the diet of birds increases with Lake productivity.

*Table 183* **Counts of waterbirds and raptors in Lake Nasser, winter 1989/90 (Meinenger & Atta 1994).**

| Species | English name | Total | Old Dam Lake 20+22/1 | Island of Kalabsha 24/12+27 | Garf Hussein 29/1 | W. Allaqi | | Turgimi 25/1 | Abu Simbel 21/1 |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | SE 24/1 | SW 25/1 | | |
| *Tachybaptus ruficollis* | Little Grebe | 10 | - | - | 10 | - | - | - | - |
| *Podiceps nigricollis* | Black-necked Grebe | 117 | 20 | 3 | 90 | - | 4 | - | - |
| *Phalacrocorax carbo* | Cormorant | 1 | - | - | - | - | - | - | 1 |
| *Plecanus onocrotalus* | White Pelican | 1 | - | - | 1 | - | - | - | - |
| *Ardeola ralloides* | Squacco Heron | 6 | - | - | - | 2 | 4 | - | - |
| *Bubulcus ibis* | Cattle Egret | 25 | 15 | - | - | 10 | - | - | - |
| *Egretta garzetta* | Little Egret | 79 | 50 | 1 | 10 | - | 15 | 3 | - |
| *Ardea cinerea* | Grey Heron | 31 | 5 | 5 | 13 | 3 | 3 | 2 | - |
| *Ardea purpurea* | Purple Heron | 4 | - | 1 | - | - | 3 | - | - |
| *Plegadis falcinellus* | Glossy Ibis | 27 | 26 | - | 1 | - | - | - | - |
| *Platalea leucorodia* | Spoonbill | 68 | - | - | 35 | 32 | - | 1 | - |
| *Alopochen aegyptiacus* | Egyptian Goose | 88 | - | 20 | 50 | 5 | 9 | 4 | - |
| *Anas penelope* | Wigeon | 2600 | 1700 | - | 900 | - | - | - | - |
| *Anas crecca* | Teal | 330 | - | - | 100 | 120 | 100 | 10 | - |
| *Anas platyrhynchos* | Mallard | 10 | 10 | - | - | - | - | - | - |
| *Anas acuta* | Pintail | 220 | 20 | - | 150 | 30 | 20 | - | - |
| *Anas clypeata* | Shoveler | 750 | 400 | 150 | 100 | 80 | 15 | 5 | - |
| *Aythya ferina* | Pochard | 2250 | 1600 | - | 220 | 320 | 100 | 10 | - |
| *Aythya nyroca* | Ferrugineous Duck | 10 | 4 | - | - | - | 6 | - | - |
| *Aythya fuligula* | Tufted Duck | 2740 | 1400 | 120 | 1000 | 170 | 50 | - | - |
| *Milvus migrans* | Black Kite | 105 | 50 | 20 | 3 | 2 | - | - | 30 |
| *Neophron percnopterus* | Egyptian Vulture | 44 | - | 13 | 3 | 20 | - | - | 8 |
| *Circus aeruginosus* | Marsh Harrier | 7 | - | - | 2 | 3 | - | 2 | - |
| *Buteo rufinus* | Long-legged Buzzard | 1 | 1 | - | - | - | - | - | - |
| *Pandion haliaetus* | Osprey | 2 | 1 | 1 | - | - | - | - | - |
| *Falco tinnunculus* | Kestrel | 5 | - | 2 | 1 | - | 1 | - | 1 |
| *Faclo peregrinus* | Peregrine | 1 | 1 | - | - | - | - | - | - |
| *Gallinula chloropus* | Moorhen | 16 | 6 | - | - | 10 | - | - | - |
| *Fulica atra* | Coot | 950 | 400 | - | 100 | 300 | 150 | - | - |
| *Himantopus himantopus* | Black-winged Stilt | 59 | - | - | 25 | 20 | 4 | 10 | - |
| *Cursorius cursor* | Cream-coloured Courser | 8 | - | - | 8 | - | - | - | - |
| *Characrius dubius* | Little Ringed Plover | 36 | 30 | - | - | - | 6 | - | - |
| *Charadrius alexandrinus* | Kentish Plover | 18 | 16 | - | 2 | - | - | - | - |
| *Hoplopterus spinosus* | Supr-winged Plover | 15 | - | 1 | - | 14 | - | - | - |
| *Chettusia leucura* | White-tailed Plover | 6 | - | - | - | - | 6 | - | - |
| *Calidris minuta* | Little Strint | 170 | 150 | - | 20 | - | - | - | - |
| *Gallinago gallinago* | Common Snipe | 1 | - | - | - | 1 | - | - | - |
| *Limosa limosa* | Black-tailed Godwit | 5 | 5 | - | - | - | - | - | - |
| *Tringa erythropus* | Spotted Redshank | 2 | - | - | - | - | 2 | - | - |
| *Tringa nebularia* | Greenshank | 9 | 3 | - | 6 | - | - | - | - |
| *Tringa ochropus* | Green Sandpiper | 2 | - | - | - | 2 | - | - | - |
| *Actitis hypoleucos* | Common Sandpiper | 13 | 10 | 3 | - | - | - | - | - |
| *Stercorarius pomarinus* | Pomarine Skua | 1 | - | 1 | - | - | - | - | - |
| *Larus ridibundus* | Black-headed Gull | 1750 | 500 | 500 | 700 | - | - | - | 50 |
| *Larus fuscus* | Lesser Black-backed Gull | 1 | - | 1 | - | - | - | - | - |
| *Chlidonias hybrida* | Whiskered Tern | 300 | - | - | 300 | - | - | - | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| *Ceryle rudis* | Pied Kingfisher | 1 | - | 1 | - | - | - | - | - |

***Table 184*** **Estimates of amounts of fish (kg) consumed by pelicans in the Ruwenzori National Park during 1969 (Din & Eltringham 1972).**

| | White Pelican | Pink-backed Pelican | Total (kg) |
|---|---|---|---|
| **Lake Edward** | 436825 | 143817 | 580642 |
| **Lake George** | 374561 | 131785 | 506346 |
| **Lake Nyamusingire** | 22623 | 19190 | 41813 |
| **Kazinga Channel** | 12069 | 21559 | 33628 |
| **Breeding Area** | -- | 63190 | 63190 |
| **Nestlings** | -- | 22173 | 22173 |
| **Total (kg)** | **846078** | **401714** | **1247792** |

Previous studies on the indirect impact on fish populations indicate that it is potentially very large and that studies in Africa and Europe show that the amount of fish taken by birds may surpass the amount taken by the fishery (Welcomme 1985, EIFAC 1989). Thus, in Senegal River, Reizer (1974) showed that cormorants and pelicans consumed 70,000 ton/year as compared to a fish catch of about 50,000 ton/year. Estimates of amounts of fish consumed by pelicans in the Ruwenzori National Park during 1969 in kg are presented in Table 184 (Din & Eltringham 1972).

Din & Eltringham (1972) pointed out that the food of pelicans is exclusively fish. The white pelican takes mainly large *Tilapia*, and *Haplochromis* spp. and fish fry to a lesser extent. The Pink-backed Pelican feeds largely on fish fry, but *Tilapia* and *Haplochromis* spp. are frequently taken and by weight are more important than the fry. However, the tilapias are smaller than those taken by the White pelican. Ecological separation between the two species is achieved through these differences in their feeding behaviour.

The latter authors estimated that the White Pelican takes 1201 g and the Pink-backed Pelican 776 g of fish each day. The total amount of fish eaten by both species from Lake George during 1969 was calculated to be 591 and 709 kg. This is small (3 %) compared with the estimated total fish production of the Lake but quite appreciable (12.7 %) as a proportion of the total fish caught by man.

Various authors assessed the food consumption by different species of birds (Geiger 1957, Tjomlid 1973, Din & Eltringham 1974, Nilsson & Nilsson 1976, Cook 1978, Meyer 1980, Linn & Campbell 1986). According to such assessments, consumption can vary almost 100-fold between small birds (such as adult

Kingfisher with an average 36 -46 g weight), which consume about 18 g of fish per day, and large birds as the White Pelican (with a weight up to 11 kg) which can consume 1600 g of fish per day (EIFAC 1989).

Reizer (1974) pointed out that the daily ration of fish consumption is 500 - 1000 g for a heron, 1000 -2000 g for a pelican and 250 g for a Kingfisher *Ceryle rudis*. McIntosh (1978) found that the European cormorant *Phalacocorax carbo* eats about 650 -700 g of fish per day. The Pelican (*Pelecanus onocrotalus*) is known as the heaviest predator to any species of fish, while the Cormorants *Phalacrocorax* sp. feeds mainly on *Barbus* sp. (Schulten & Harrison 1975).

Abdel-Azeiz (1993), in her study during 1988 -1991 recorded 122 species of birds in the Nile Islands and Wadi Allaqi. Most of the recorded species are migrants or birds of passage. Out of the 122 recorded species, only 32 species were previously recorded in Lake Nasser (Meininger & Mullié 1981, Meininger & Atta 1990, 1994, Kinzelbach 1990, Goodman & Meininger 1989). From the previous studies on the avifauna of Lake Nasser and its vicinity 17 bird species (Table 185A) are fish-eating -11 species were previously recorded in Lake Nasser. Mekkawy (1998) estimated roughly the diet impact of most of these species (with an average daily ration of 620 g of fish per day) to be about 2885.6 ton per year (Table 185A). This figure represents 8.3, 11.01, 14.65 and 14 % of the total fish production during 1981 (with the highest fish production), 1992, 1995 and 1996 respectively equivalent to a loss of about 536.4 kg per km of shoreline (total shoreline 5380 km at 160 m water level). Mekkawy's estimation (1998) needs to be verified taking in consideration that out of the 17 species of fish-eating birds recorded in the Lake and its vicinity, one species is a resident breeder, five are resident breeders and winter passage visitors, while 11 species are winter visitors. Furthermore, four bird species in Mekkawy's original list (1998) i.e. Little Bittern, Great White Egret, White Stork and Black-headed Gull are not fish-eating birds (Tharwat 1997). The latter author mentioned 44 species of birds in Lake Nasser area, 19 species are fish-eating (Table 185B & Plates 67-78).

The impact of piscivorous birds on fisheries of Lake Kariba was studied by Hustter (1991), who showed that about 12 -16 % of the commercial inshore fisheries is eaten by only two birds, the Reed Cormorant (*Phalacrocorax africanus*) and the Darter (*Anhinga melanogaster* ). They eat about 20 and 11 % of their body weight daily, respectively, and their prey is to a large extent made up of small-bodied fish species. In their survey of aquatic bird species in Lake Kariba Okaeme *et al* (1989) recorded 70 bird species, most of which inhabit the

littoral zone and open water with *Oreochromis niloticus* and *Sarotherodon galilaeus* and *Chrysichthys nigrodigitalis* forming part of their diet.

***Table 185 (A)*** **List of fish-eating birds of Lake Nasser and their estimated fish requirements (ton) per year in the whole Lake (Mekkawy 1998).**

| Family/ species | Common name | Status* | Fish required** |
|---|---|---|---|
| **Podicipedidae** | | | |
| *Tachybaptus ruficollis ruficollis* | **Little Grebe** | **RB-WV** | **42.0** |
| *Podiceps nigricollis nigricollis* | **Black-necked Grebe** | **WV** | **1.6** |
| **Phalacrocoracidae** | | | |
| *Phalacrocorax carbo sinensis* | **Cormorant** | **PV-WV** | **22.4** |
| **Ardeidae** | | | |
| *Botaurus stellaris stellaris* | **Bittern** | **WV** | **8.1** |
| *Ardea cinerea cinerea* | **Grey Heron** | **CP-PV-WV** | **120.2** |
| *Ardea purpurea purpurea* | **Purple Heron** | **PV-WV** | **16.0** |
| *Ardea goliath* | **Goliath Heron** | **RB-PV** | **1.6** |
| *Ardea ralloides* | **Squaccco Heron** | **RB-PV-WV** | **51.3** |
| **Ciconiidae** | | | |
| *Mycteria ibis* | **Yellow-billed Stork** | **PV** | **83.4** |
| *Ciconia nigra* | **Black Stork** | **PV-WV** | **9.6** |
| **Threskiornithidae** | | | |
| *Plegadis falcinellus* | **Glossy Ibis** | **PV-WV** | **1.6** |
| **Pandionidae** | | | |
| *Pandion haliaetus haliaetus* | **Osprey** | **RB-PV-WV** | **16.0** |
| **Gruidae** | | | |
| *Grus grus grus* | **Crane** | **PV-WV** | **12.8** |
| **Laridae** | | | |
| *Larus genei* | **Slender-billed Gull** | **RB-PV-WV** | **1.6** |
| **Sternidae** | | | |
| *Sterna repressa* | **White-cheeked Tern** | **MB** | **6.4** |
| **Alcedinidae** | | | |
| *Alcedo atthis atthis* | **Kingfisher** | **CB-WV** | **19.2** |
| *Ceryle rudis rudis* | **Lesser Pied Kingfisher** | **RB-WV** | **365.5** |

***Abdel-Azeiz (1993) : CB= causal breeder; MB= migrant breeder; PV= passage visitor; WV= winter visitor; AV= accidental visitor, RB=resident breeder (**Mekkawy, 1998).**

Mekkawy (1998) pointed out that in view of their social organization, roosting and feeding behaviour, gulls are probably the most important species, which play a role in influencing the trophic state of lakes and reservoirs (EIFAC 1989). In Lake Nasser, at least two species of gulls are recorded i.e. Black-headed Gull, *Larus ridibundus* and the Slender-billed Gull, *Larus genei,* both species are passage winter visitors, the latter, however, is a resident breeder. Tharwat (1997) pointed out that the former species feed on invertebrates and small animals. The assessment of the impact of populations of both species on Lake Nasser needs to be studied. Assessment of the effects of roosting gull populations on nutrient inputs has been studied by various investigators (Leentvaar 1967, McColl & Burger 1976, Gould 1977, Gould & Fletcher 1978, Beveridge *et al.* 1982). Impacts towards the increase of pH, conductivity, organic matter, BOD, nitrogen, phosphorous, coliform bacteria and plankton have been reported. The role of birds which nest and feed on water bodies, in determining

the nutrient status of a water body, depend on the feeding behaviour, seasonal abundance and community organization of the species.

Furthermore, other birds which congregate in large numbers for extended periods and which forage for fish in the immediate vicinity of the Lake, are most likely to have a marked effect on the nutrient status through importation of allochthonous materials.

Hence, the impact of the bird fauna - either those that inhabit the Lake or its vicinity - must be studied in detail. The relationships between species composition and abundance and the trophic status of the Lake must be assessed. Furthermore, there is a possibility that some bird species act as primary or secondary hosts for fish parasites, whose prevalence increased in recent years.

**THREATS.** There appears to be no major threats to birds in Lake Nasser area. However, some impact is known from both land reclamation for agricultural purposes and sport hunting. In addition, fisheries may cause some impacts. Shooting of waterbirds is reported to take place regularly during winter by visiting European hunters, who take both game and non-game (protected) birds (Baha El Din 1999).

**Legal Status**. Until now, Lake Nasser is not protected. However, a portion of Wadi El-Allaqi has been declared a protected area by Prime Minister's Decree in 1989.

*Table 185 (B)* **Birds of Lake Nasser area recorded by Tharwat (1998). (Plates 69 - 78)**

| Species | English name | Arabic name |
|---|---|---|
| * ***Phalacrocorax carbo*** | Cormorant | غراب البحر |
| * ***Anhinga melanogaster*** | Darter | زق |
| * ***Plecanus onocrotalus*** | White Pelican | بجع أبيض |
| * ***Plecanus rufescens*** | Pink-backed Pelican | بجع رمادى |
| * ***Botaurus s. stellaris*** | Bittern | واق |
| ***Egretta ibis*** | Cattle Egret | أبوقردان |
| * ***Egretta garzetta*** | Little Egret | بلشون ض |
| * ***Mycteria ibis*** | Yellow-billed Stork | لقلق أصفر المنقار |
| * ***Ciconia ciconia ciconia*** | White Stork | لقلق أبيض |
| ***Threskiornis a. aethopicus*** | Sacred Ibis | أبو منجل قدس |
| ***Alopochen aegyptiacus*** | Egyptian Goose | وز مصرى |
| * ***Tadorna ferruginea*** | Ruddy Shelduck | أبو فروه |
| * ***Anas qurquedula*** | Garganey | شرشير صيفى |
| * ***Aythya ferina*** | Pochard | حمراى |
| * ***Milvus m. migrans*** | Black Kite | ح اية سوداء |
| * ***Haliaeetus vocifer*** | African Fish Eagle | عقاب السمك الأفريقى |
| ***Neophron p. percnopterus*** | Egyptian Vulture | رخمة مصرية |
| ***Micronisus gabar*** | Gabar Goshawk | باز جبار |
| * ***Gallinula c. chloropus*** | Moorhen | فرخة الماء |
| ***Fulica a. atro*** | European Coot | ر |
| ***Grus g. grus*** | Crane | كى رهو أو غرنو ) |
| ***Burhinus senegalensis inornatus*** | Senegal Thick-Knee | كردان سنغالى |
| ***Chettusia leucura*** | White-tailed Plover | زقزاق أبيض الذنب |
| ***Phalaropus lobatus*** | Red-necked Phalarope | فلاروب أحمر العنق |

*Table 185* **Cont.**

| | | |
|---|---|---|
| ***Larus ridibundus*** | Black-headed Gull | نورس أسود الرأس |
| ***Chlidonias n. niger*** | Black Tern | خطاف أسود |
| ***Pterocles c. coronatus*** | Crowned Sandgrouse | قطا متوج |
| ***Streptopelia s. senegalensis*** | Palm Dove | يمام بلدى |
| * ***Bubo bubo ascalaphus*** | Eagle Owl | بعفه |
| ***Athene noctua spilogaster*** | Little Owl | أم قويق |
| ***Caprimulgus a. aegyptius*** | Egyptian Nightjar | سد مصرى البخاخ ) |
| * ***Alcedo a. atthis*** | Kingfisher | صياد السمك |
| ***Alaemon alaudipes alaudipes*** | Hoope Lark | مكاء |
| ***Galerida cristata maculata*** | Crested Lark | قنبره متوجه |
| ***Ptyonoprogene o. obsoleta*** | Pale Crag Martin (Rock Martin) | سنونو الصخر الباهت |
| ***Motacilla aguimp vidua*** | African Pied Wagtail | أبو فصاده أبقع |
| ***Oenanthe l. leucopyga*** | White-crowned Black Wheatear | ابلق اسود ابيض الرأس |
| ***Oenanthe l. lugens*** | Mournig Wheatear | ابلق حزين |
| ***Oenahe monacha*** | Hooded Wheatear | ابلق أبو طاقيه |
| ***Prinia g. gracilis*** | Graceful Warbler | فصيه هازج ) |
| ***Rhodopechys g. githagineea*** | Trumpeter Finch | زمير زمار - طبال ) |
| * ***Ardea cinerea cinerea*** | Gray Heron | بلشه ن رمادى |
| * ***Ardea purpurea*** | Purple Heron | مالك الحزين حجنه ) |
| * ***Ardea goliath Cret.*** | Goliath Heron | بلشون جبار مر ) |

* Fish-eating birds.

## CONCLUSIONS

Nowadays amphibian fauna are rare in Lake Nasser area. However, it seems that with flourishing of agricultural practices along the shores of the Lake amphibian fauna may flourish, and so urgent studies on this fauna are needed.

Reptiles are represented in Lake Nasser by three species; the Nile crocodile (*Crocodylus niloticus* Laurentia), the Nile monitor (*Varanus niloticus niloticus* (Linnaeus) and the Nile turtle (*Trionynx triunguis,* Forsk.). During the 1950's professional hunters decimated the stock of crocodiles in the River Nile, that brought this species to near extinction. After formation of Lake Nasser, crocodiles spread in the Lake and are increasing in number, year after year, especially in the southern region and khors. Fishermen are claiming now that crocodiles cause damage to their nets as well as destroy tilapia nests in the Lake shores and feed on large amounts of fish, that may cause impact on the fishery of the Lake. Furthermore, the role of crocodiles in the Lake must be studied especially their population density, effect on primary production based on excreted nutrients and impact on fisheries..

The Nile monitor is found mostly in the more uninhabited areas of the Lake shore. It is carnivorous, feeds mainly on fish as well as young crocodiles and their eggs, lizards, snakes, rodents and even birds.

The Nile turtle used to inhabit the Nile, but now it is much more numerous in the southern region of Lake Nasser. It feeds on fish, Nile crabs and possibly snails.

With the increase in prevalence of infestation of common Lake fishes with parasites, there is a possibility that the Nile crocodile, the Nile monitor and Nile turtle may act as intermediate or final hosts of these parasites that may account for the increased prevalence of fish parasites. Further detailed studies for these species are needed, especially on their population dynamics, their distribution and feeding behaviour.

Since Lake Nasser filling, it began to be a suitable habitat for water-birds, especially that the area is an important route for migratory birds coming from Europe in autumn, either to stay or as a station to go further south in Africa. In 1981 Meinenger & Mullié recorded 19 species of waterbirds. During winter 1989/90 Meinenger & Atta (1994) recorded 47 species of birds. In 1988/91 Abdel-Azeiz (1993) recorded 122 species in the Nile Islands and Wadi Allaqi in the vicinity of the Lake, among them there were 17 species of fish-eating birds.Tharwat (1998) mentioned the presence of 44 species of birds in Lake Nasser area, among which 19 species are fish-eating birds.

Baha El Din (1999) pointed out that during January and February 1995 over 56,000 waterbirds were counted on about 20% of the Lake. Thus the total number of waterbirds wintering in the entire Lake could be in excess of 200,000, making it one of the most important wetlands in Egypt. Most abundant of these were: Black-necked Grebe, White Pelican, Tufted Duck, Northern Pochard, Northern Shoveler, Wigeon and Black-headed Gull.

Characteristic breeding birds in Lake Nasser include: Egyptian Goose, Black Kite, Senegal Thick-Knee, Kittilitz's Plover, Spur-winged Plover, Crested Lark and Graceful Prinia. Lake Nasser is the only area where African Skimmer and African Pied Wagtail are known to breed in Egypt. During the summer months there is a significant influx of Yellow-billed Stork and Pink-backed Pelican into Lake Nasser (Baha El Din 1999). The area's original breeding bird community which includes African Palm Swift, and Fulvous Babbler disappeared after filling the Lake.

Estimation of the amount of fish consumed by fish-eating birds amounted to 2885.6 ton per year (Mekkawy 1998, i.e. about 14% of the total Lake production in 1996). It seems that this figure is overestimated, especially some of the fish-eating birds with high fish consumption - included in this estimation do not eat fish; and most fish-eating birds are only winter visitors.

The impact of the avifauna on Lake Nasser must be studied in detail especially the relationship between species composition and the trophic status of the Lake. Furthermore, studies are needed to find out the possible relationship of the bird fauna and the fish parasites, probably some bird species may act as hosts for some fish parasites. The high prevalence of infection by the nematode *Contracaecum* (as larvae) of various fish species in Lake Nasser, is attributed to the increase of waterbirds in which the adult stage lives in the proventriculus. A thorough study of this parasite: its species, life cycle, effect on fish is needed.