3.5. INTERNAL DELTA OF THE RIVER NIGER

by Henri J. DUMONT

1. Geology

The middle delta plain occupies a south-central position in the West African craton. It is conventionally delimited by the 280 m isohypse and is surrounded by sansdstone massifs. The plateau of Bandiagara (Dogonland) is situated to the East, the hilly country of Koutiala and of Banfora to the south, and the plateau of Mandingo to the West. To the North and North-west, huge dune areas of late Pleistocene age (the erg Ouagadou) block a former westward course of the river. The delta is probably of tectonic origin. The precambrian basement and overlying palaeozoic sandstone are locally hidden under a cover of pleistocene alluvia. They are folded downwards under the delta, and surface again west of it, where they form hills and shallow escarpments peaking at max. 70 m above the floodplain. A parallel fold further north contains the elongated Lake Faguibine (fig. 3.21). The deepest part of the subsidence of the delta is presently in the east, at the very foot of the Dogonland sandstone. This is also where the Niger is joined by its principal tributary, the Bani river. Whether the western part, the "body" of the delta has been progressively filled up with alluvial deposits, pushing the river eastward, or whether the present bed of the Niger corresponds to the deepest part of the subsidence, is still an unsettled question.

2. Climate (fig. 3.19)

The long axis of the delta is south-north oriented. It covers only 3° in latitude, but these cover the transition between a humid, Guinean climate, and a dry Sahel climate. At San (13°20'N), average rainfall is 750 mm a^{-1} (53 rain days), but around Niafounke (ca 15°50') only 300 mm a^{-1} falls, and north of Tonka, the yearly average falls below 250 mm. This latitudinal drop by a factor 3 is paralleled by a threefold variation between years. At Niafounke, which takes a median position, the annual average is 330 mm (1934-1962), and extremes recorded are 148 mm (1961) and 466 mm (1950). All precipitation falls between June and September, with a peak in August. There is virtually no rain between October and April. Local precipitation, in contrast to evaporation , is not, however, an important factor in the water balance of the delta (see below).

Because of its vast expanses of water and vegetation, relative humidity in the delta is fairly high. At San, it is even higher (79% average maximum, 32% average minimum) than at Bamako (73 and 33% respectively). At Faguibine, desertic conditions reign, and relative humidity is of the order of 20-30%.

Temperatures are strongly seasonal, but bimodal because of the cooling influence of the monsoon. This even holds true for the northern city of Tombouctou, although the average maxima are higher here. The latter fall in May (43°C in Tombouctou, 40°C in Mopti, 39.6°C in Segou). The coldest months are December-January. Although it never freezes, temperatures may drop to 3-6°C in the north of the delta.

The wind regime is dominated by trade winds from the N-NE-E sector during the dry season, from the SW-S sector during the rainy season. Wind speed is usually moderate (2-4 $m.s^{-1}$) to low (0-1 $m.s^{-1}$). The delta itself has a marked influence on the wind regime, especially during the floods, when an immense water surface is present. It then produces a micro-Hadley cell. During the day, the cooling influence of the flooded plain creates a subsidence of air masses above it. The centrifugal wind that results from this has a scattering effect on the incoming north-east trade wind. During the night, when the floodplain is warmer than its surroundings, a centripetal wind is generated, and the incoming trade wind is reinforced.

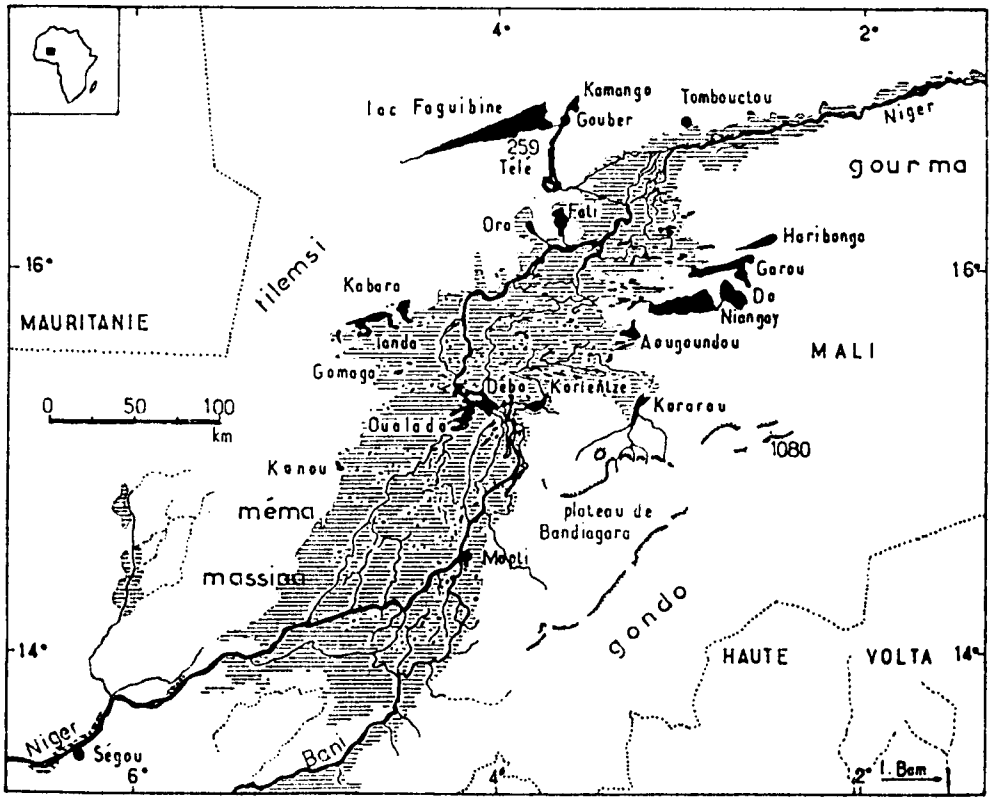


Fig. 3.21 The Inner Delta of the Niger: indicating principal areas of open water, the extent of the floodplain and the location of Lac de Bam.

3. Morphology (fig. 3.21)

To the west of the main inundation zone, which in total covers an area of about 17,000 km^2, a diverticle of the main river leads north into a fossil delta, north of Segou. At Diafaraoe the Niger branches; the main channel curves eastwards towards Mopti, where it is joined by the Bani; a western branch, the Diaka, flows north towards Lake Debo which it joins via a satellite lake, Oualaco. Many other branches of the main river (eg. Mayo Dembo and Mayo Raneo) also re-unite with the main stream in the eastern basin of

lake Debo. Only a minor part of the Niger waters by-pass L. Debo via the Koli-Koli arm and through Lake Korienze. The whole forms an intricate network of channels within which lie numerous swamps, pools of variable area, depth and duration, and intermittant river beds (marigots).

Lake Debo is a shallow lake that expands and contracts as the river level rises or declines. It is bounded to the north by the erg of Niafounke which consists of a row of low, wind-blown dunes that extend across the delta and cause it to widen. Two main branches of the Niger leave L. Debo, the Issa Ber (usually equated with the Niger proper) and the Bara Issa. The latter is rejoined by the Koli-Koli arm and is periodically connected with a series of lakes (Aougoundou, Niangay, Do) to the east. Other lakes in this region, such as L. Korarou, are largely independant of the Niger and are fed by run-off from the Bandiagara-Dyounce sandstone plateau via the Koleou river. The Niger also contributes little water directly to Lake Barou and its satellites (Lakes Gakorey, Titoladuine, Kabongo) or to Lake Haribongo. These elongated lakes lie in interdune valleys and may derive part of their water from the groundwater table.

The Issa Ber feeds several major lakes to the west such as L. Tanda and L. Kabara. The Bara Issa and the Issa Ber, anastomosing and meandering through a sandy depression, merge west of Tonka, but then divide again, and it is not until Tombouctou that the Niger withdraws into a single major channel.

Some lakes such as (H)Oro and Fati are broadly connected to the River, and thus rise and fall concurrently with the floods. Others, extending north of the delta, behind an (anticlinal ?) ridge that is flooded only at high river levels, are replenished during peak floods and later recede by evaporation and infiltration only. Examples are lakes Tale, Takara, Gouber, Kamongo and, the largest, Faguibine which occupies the floor of a tectonic fold north of the Niger valley. Thus, some lakes, depending on their area, depth and on the magnitude of the flood, may or may not dry out periodically. Lakes Gouber and Kamango dry out at irregular intervals, those situated in the depression south of lake Faguibine (the so-called Daouna's, e.g. Daouna beri, Daouna keino) are ephemeral. Lake Faguibine, an extensive east-west triangle of water, is the only lake in the delta with a reasonably deep basin (15 m in its eastern part). Its surface area, when the lake is full, amounts to 450 km^2. During the dry season, it shrinks back from the west to the east, and large parts of its western bed become exposed.

4. Hydrology

The main hydrological factor of the delta is the yearly flooding. Flood waters are contributed by the Niger, the Bani, and by a series of short rivers that drain the Dogonland plateau. The Niger enters the delta basin at 820 km from its origin and has a catchment area of 120,000 km^2. Its upper reaches in the Fouta Djalon mountains receive an average precipitation of 1,600 $mm.a^{-1}$. All this rain falls entirely during the four summer monsoon months (June -

September). It reaches the delta in September. Peak floods arrive between 20-30 September. A total volume of $50.10^9 m^3$ is discharged into the delta annually.
The Bani, formed by the merger of the Baoule (700 km) and the Bogoue (850 km) drains hilly country in the north-west of the Ivory Coast, and has a catchment area of 101,500 km^2. Mean rainfall on this basin is only 1,250 mm, and therefore its total discharge into the delta is only $20.10^9 m^3$, with an average of 670 $m^3.sec^{-1}$. Maximum discharge is slightly later than the Niger's and occurs between 10-20 October.

Compared to these two major sources, the Dogonland rivers are dwarfs. The largest of them, the Yame, has a catchment area of 4,650 km^2 and contributes some 250-500 $10^6 m^3 a^{-1}$. All the other ones are even smaller and periodical. Their importance lies in the fact that they supply a significant amount of water to the lakes east of the northern delta, such as Lake Korarou.

Once the rivers reach the delta, their slopes drop to an average of 5 cm km^{-1}. Coupled to a lateral expansion, this causes the flood to slow down from a predeltaic propagation rate of 60 $km.d^{-1}$ to 5 $km.d^{-1}$ inside the delta. Thus, the flood takes 5 days to cover the distance between Koulikoro and Ke-Macina, but a month to reach Mopti, 160 km downstream, and another month to reach lake Debo. Here the maximum is reached in early December. At Gao, finally, peak floods occur in January.

Concurrently with this retardation, the flood peak levels off, while its duration increases. At the entrance to the delta (Ke-Macina), the level rises by 5.3 m at peak floods (corresponding to a discharge of 6,200 $m^3 sec^{-1}$), while at the confluence of the Niger and the Bani at Mopti, the rise is only 3 m (3,000-3,500 $m^3 sec^{-1}$), but the level does not drop significantly until late in January. By that time, the river at Ke-Macina has almost returned to summer levels. North of Lake Debo, peak levels reach only 2,500 mm (2,300 $m^3 sec^{-1}$), but it takes until April for the flood to recede. The duration of flooding increases from 50 days in the south to 120 in the north (Gallais 1967).

Of the $70.10^9 m^3$ that enter the delta, only some $35.10^9 m^3$ leave it. This is due to a combination of evaporation, evapotranspiration by the aquatic vegetation, and infiltration. Yearly evaporation shows a weak S-N trend, with 1.8 $m.a^{-1}$ at the entrance of the delta (San), 2 m at Mopti, and 2.25 m at Lake Faguibine. Infiltration charges the groundwater table, which almost touches the surface in the central part of the delta, but slopes downwards in a north-western direction, plunging deep under the erg Ouagadou. As a result, at very low summer discharges (50-60 $m^3.sec^{-1}$), the river level drops to below the top of the groundwater table. Inside the delta, water is thus actually restituted to the river at that time. This is the reason why some of the delta lakes and the centre of the major pools and swamps never dry out.

5. Aquatic biotopes

Blanc et al. (1955) distinguish 6 types of aquatic environment:

a) the rivers Niger and Bani and their main arms.
b) the floodplain
c) the marshy pools
d) lakes (or pseudo-lakes)
e) the marigots (two-way periodical river channels)
f) the irrigation networks.

a) The rivers and their main branches, bounded by raised banks, fluctuate strongly in water level each year, but do not usually dry out at any time. Rocky substrates are found at the delta entrance only. Sands are the most common type of substrate, but muddy bottoms are also important.

b) The floodplains: These are lowlands situated on either side of the river channels, behind the raised banks. When the rivers rise, they spill over their banks and flood the lowlands. Only some small hills (Taguere), often the site of fishing villages, remain above water. At low water levels, these plains dry out completely. They have a clay or sandy-clay bottom that cracks deeply when dry. Daget (1954) subdivides the floodplain into a zone immediately behind the river banks, where some deeper cuvettes are found, and a monotonous, flat area further away from the river.

c) The pools: occupy the deepest parts of the plains. They have a clay or mud bottom, and many are found within the river beds themselves. They communicate with or are absorbed by the rivers at high levels, but isolated at low levels. Pools may have different degrees of permanence. Some are periodical, others are semi- or fully permanent. All fluctuate considerably because of evaporation. They are replenished to some degree by local precipitation before the flood arrives.

d) The lakes: Blanc et al. (1955) call the vast expanses of open water of the delta pseudo-lakes, because of their shallowness. When full, they reach the 280 m level. Some are, in fact, hardly more than enormous dilatations of the Niger (Lake Debo, Lake Korientze). Others communicate directly with the river (Horo, Fati) and therefore rise and decline concurrently with the flood. Some lie behind ridges, are flooded only at peak water levels, but do not restitute water to the river when its level drops (Faguibine). A few are fed by the Niger at high levels, by its groundwater table at low levels, and by run-off from the Dogonland-plateau (Korarou).

e) The Marigots are channels that link the river or its main branches with the floodplains and its pools and lakes. They show a characteristic two-way flow pattern: from the river to the floodplain at flood levels, from the floodplain to the rivers at declining levels. At a later stage, they become stagnant pools, become fragmented, and may eventually dry out completely.

f) The irrigation network: For the development of irrigated agriculture (rice, cotton), a double network of canals starts from south of Markala Dam. A branch (Canal du Sahel) extends north into the fossil delta, and another one extends east towards Kolongotomo. Other irrigation networks are found along the lower Bani (at San, at Safara), near the confluence at Mopti and in the western delta at

Tenenkou, Oguere-Koumbe and elsewhere. They provide an artificial type of environment, where water fluctuations are greatly damped. The maximum level may actually occur while the delta itself is at its lowest level (e.g. rice cultures require most water in June).

6. Physical properties

Temperature: The water temperatures of the Niger reach an average maximum of 30°C between mid-April and mid-October, with a very slight drop during the monsoon. During winter, the average declines to 21°C and minima even drop to 19°C. There is some vertical stratification during low water, of the order of 1°C between the surface and the 1 m layer (Blanc et al. 1955). Diurnal variations at the surface reach an amplitude of 2°C. The minimum occurs at 6-7 a.m., and the maximum around 3-4 p.m. There are no studies about the pools and the lakes, but pools should get hotter than the river. In stagnant sections and dead arms, temperatures as high as 36.2°C have been measured (Blanc et al. 1955). The deep eastern end of Lake Faguibine is likely to become persistently stratified in summer.

Turbidity: The waters of the Niger are moderately turbid throughout the year. They carry a stable suspension of fine clay particles that settle very slowly. The average sediment load of the Niger is 0.3 $g.l^{-1}$. Secchi disc transparency is of the order of 0.9 m, and varies little with time and place. The sedimentation rate of the Niger is, consequently, remarkably low. The pools are usually very turbid, especially those without vegetation. Secchi disk reading of less than 3 cm are common. The irrigation canals have the clearest water, with Secchi values of up to 2.5 m. In the lakes, heavy algal blooms tend to reduce transparency to levels close to those of the pools.

7. Chemical properties

The waters of the Niger are low in minerals. They have a slightly acidic to neutral reaction. An analysis during the 1950s gave following result (in $meq.l^{-1}$):

Na	K	Ca	Mg	HCO_3	Cl	SO_4	conduct. $10^{-6}S.\ cm^{-1}$
0.13	0.05	0.2	0	0.4	0.02	0	32.4

The upper catchment consists of insoluble precambrian granites and schists. However, while the water levels drop, evaporation concentrates the ions in the lakes and pools, and even in the river itself. Analyses carried out on samples collected during the dry season of 1976 and 1980 are presented by Dumont et al (1981). These samples were transported overland to Europe, and evaporative loss of water may have produced an overestimation of the ions. Still, the mineral content is significantly in excess of that three decades earlier. Increased human influence on the river, topped by the droughts of the 1970s are probably responsible. The human factor was particularly clear at Mbouna, a village on the shore of Lake Faguibine, where a "banco" extraction pit communicating with the lake had a conductivity as high as $1658.10^{-6}S.cm^{-1}$. The shoreline water still had 409 $10^{-6}S.cm^{-1}$, and the open water $186.10^{-6}S.cm^{-1}$.

Lake	Na	K	Ca	Mg	HCO_3	Cl	SO_4	conductivity $10^{-6}S.cm^{-1}$
Kabara	0.40	0.37	1.30	0.56	1.70	0.48	0.37	190
Tanda	0.70	0.43	1.80	0.72	2.18	0.64	0.56	282
Tonka	0.16	0.08	0.31	0.24	0.28	0.24	-	76
Horo	0.64	0.33	1.72	0.96	1.01	0.48	2.07	259
Fati	0.24	0.12	0.32	0.56	0.50	0.24	0.30	119
Tele	0.32	0.29	0.45	0.32	0.64	0.48	0.32	113
Faguibine								
shore	1.60	0.83	1.54	0.72	2.32	0.48	0.53	409
open water	1.04	0.47	0.96	0.48	1.81	0.48	0.18	186
Korarou	0.56	0.03	3.20	-	3.60	0.24	0.07	-
pool at E. Dyabali	0.24	0.08	0.16	0.16	0.14	0.48	0.37	79
pool at Dyabali	0.32	0.14	0.29	0.16	0.47	0.24	-	97
pool at Ndukala	0.16	0.04	0.29	0.08	0.14	0.48	0.44	75
Niger at Markala	0.24	0.14	0.54	0.32	0.64	0.24	-	119

8. Macrophytes

The delta is the range limit for quite a few species of trees, and often northern species are replaced by others in its southern half. Examples are the palm trees Borassus aethiopicum, which occurs in the south of the delta, and Hyphaene thebaica, the dum-palm, which is found in its northern part. A phytosociological anomaly occurs in the fossil delta, where more Sahelian than Sudanian species are found (e.g. Cenchrus biflorus, the well-known cram-cram grass), in spite of precipitation which is in excess of their optimum.

The different biotopes of the delta can be identified by their specific vegetation. Along the rivers, a typical scrub of Mimosa asperata and Salix chevalieri is found, accompanied by undergrowth of Cyperus maculatus. The floodplains are under water too briefly and too shallow to have a true aquatic plant cover. Amphiphytes dominate here: Vetiveria nigritiana, Oryza barthii, Andropogon gayanus, Echinochloa stagnina, E. pyramidalis, Acroceras amplectens and others. The pools are of two types. Some, that have very turbid water, are totally devoid of submerged macrophytes. At best, there may be some floating leaves of Nymphaea lotus. These pools usually contain a high density of fish, and are found in the main river beds. As they dry out and shrink, fringing meadows of Echinochloa stagnina, the bourgou and of Polygonum senegalense appear. These constitute good summer grazing. Permanent pools outside the river banks are rarer, but much richer floristically. Ceratophyllum demersum is the dominant submerged macrophyte. Pools of this type are found near Mopti and at Dyabali (Blanc et al. 1955; Dumont et al. 1981).

The lakes are mainly surrounded by Echinochloa stagnina, E. pyramidalis, Vossia cuspidata. In Lake Debo, the bourgou is so abundant that it forms a specific sociological unit, termed bourgoutiere (Chevalier 1932). Lake Faguibine has an extensive reed swamp on its southern side. Phragmites stands are also found along some other lakes (Horo, Kabara...). The irrigation channels are fairly rich in water plants (Ceratophyllum) and Typha australis is particularly noted here.

9. Algae

Algal studies have been conducted by Bourrelly (1957), Coute & Rousselin (1975) and Maillard (1975). The microfloral assemblages are varied and of Sudanian nature. The shallow lakes used to be dominated by diatoms until 1950s (Daget 1954). Today, the droughts have attracted so many cattle to the delta that eutrophication has resulted, and heavy blue-green blooms occur.

10. Invertebrates

Numerous invertebrate groups have, over the years, been given some attention, but it is not possible in all cases to decide whether species are restricted to any particular environment within the delta. Freshwater medusae have been found only in the Niger itself, and not in the lakes. 8 species of sponges are known, 6 of which are restricted to the river at sites where oyster reefs occur (Topsent 1932). Two, however, also occur in the floodplain. Potamolepis leibnitziae even appears to be endemic to the Niger floodplain. A series of papers by Decloitre (1948-1957) on Protista deals with Thecamoebid Rhizopods. Mollusca are fairly well documented (Daget 1962, 1964; Brown 1980; Van Damme 1984). The only probable endemic is Mutela franci, but it may also be a mere fluviatile form of Mutela rostrata. In the sandy riverbeds, Corbicula consobrina, Mutela rostrata, Caelatura aegyptica, Cleopatra bulimoides are most typical. On muddy river substrates, the reef-building Aetheria elliptica, and Aspatharia spp., Mutela dubia, Bellamya unicolor are more common. The floodplain is poorest in species, and only Bulinus senegalensis is regularly found. The permanent pools, conversely, have a great variety of species: Afrogyrus coretus, Lymnaea natalensis, Bulinus spp., Aspatharia spp., Mutela spp., Cleopatra bulimoides, Caelatura aegyptica, Bellamya unicolor and others.

Rotifers, nematodes and other worm groups have only been studied casually. Numerous papers relate to aquatic insects: Diptera, Hemiptera, Odonata and Coleoptera are well documented. The fauna is diverse and entirely afrotropical. The river, temporary pools and floodplain are poorest in species. The weedy pools are richest, but endemism is low. The lakes, too, have a rather impoverished insect fauna.

Decapod Crustacea are represented by the widespread Caridina africana and by one or more species of crabs. The latter have not been well investigated in the area. Only Potamonautes (Rotundopotamonautes) berardi berardi seems to be reasonably widespread. At least one or two species of Sudanonautes should also occur. The planktonic Crustacea were recently studied by Dumont et al. (1981). Cladocera, but above all Copepoda were found to be plentiful in the pools and lakes. Up to three species of Tropodiaptomus, a Thermodiaptomus,

several Thermocyclops and Mesocyclops can co-occur in a single lake, besides one or two Daphnia-species, a Bosmina, Moina, Ceriodaphnia and Diaphanosoma. This species richness is a combination of Saharo-Sahelian and Guinean species. There appear to be more species than niches present, and this was regarded (Dumont 1982) as a sign of long-term instability of the biocenoses. In some of the lakes to the north-east of the delta, evidence for subspeciation in Tropodiaptomus is apparent (Dumont & Verheye 1984). These populations may have started diverging from the riverine ones some 6000 years ago. In the weedy ponds, there is a diversity of small afrotropical cyclopoids, chydorids and macrothricid cladocerans. Endemism is rare.

11. Vertebrates

Between 100 and 120 species of fish occur in the delta (Daget 1954, 1957) and many are of commercial importance. It is remarkable that one of the few endemics to the delta is a clupeid, Microthrissa miri and planktivorous. Numerous species show adaptations to the cycle of flooding and drying, such as the lungfishes (Protopterus, Polypterus) and the air-breathing catfishes (Clarias spp.), so that they can survive longer than other species, and eventually aestivate. Such adaptations are, however, widespread in floodplain areas throughout Africa. At high water levels, many riverine species penetrate onto the floodplain. Alestes, Tilapia s.l. Schilbe, Distichodus, Clarias, all Cyprinodonts and Mormyrids reproduce here. Gymnarchus niloticus and Heterotis niloticus build nests among flooded grasses. In the river itself, the fish fauna is different according to the nature of the bottom. Rocky sectors, found at the entrance to the delta, have Garra waterloti, Chiloglanis, Labeo parvus, Eleotris sp., and the endemic Gobiocichla wonderi, but the latter is much more common in the rapids upstream. On sandy bottoms, Alestes spp., Barilius spp., Sarotherodon galilaeus, Coptodon zillii, and Hydrocyon spp. dominate. On muddy bottoms, Mormyrus spp., Cytharinus spp., Auchenoglanis spp., Synodontis spp. and Aureochromis niloticus replace them. Permanent pools have a distinctive fauna too, in which Gnathonemus senegalensis elongatus, Marcusenius isodori, Petrocephalus bovei, Gymnarchus, Heterotis, Ctenopoma, Parophiocephalus, Polypterus, Synodontis, Clarias, Hepsetus, Auchenoglanis and Heterobranchus stand out. Blanc et al (1955) found that some pools conserve an individually recognisable species assemblage through time, in spite of the yearly flooding. Muddy pools tend to have depigmented individuals, and a species assemblage different from the weedy pools.

The fauna of the lakes and marigots is similar to that of the river. The period of flooding corresponds to rising temperatures and, as stated above, is the breeding season of most species, which migrate laterally into the floodplain for that purpose. Two exceptions are Microthrissa miri and Barilius niloticus. Both breed in the river itself, and during winter.

Widespread amphibia in the delta are Ptychadena occipitalis and several closely related species of the Bufo regularis-complex. Crocodiles are common in rivers, pools and some of the lakes. They migrate between pools during the night. Aquatic turtles (Trionyx, Pelomedusa, Pelusios) show the same behaviour.

There is a rich avifauna in the delta, consisting of a majority of fish and insect eating species (Duhart & Descamps 1963; see also Viellard 1981). Among mammals, two piscivorous otter species occur. The major herbivorous species is Hippopotamus amphibius, but there is also a lamanatee (Trichechus senegalensis), which feeds on Polygonum and Pistia. Wild bovids and hippos have regressed considerably in recent decades. Their place is now taken by cattle.

12. **Human activity and management**

Around 1960, the delta was inhabited by c. 370,000 people. While the Peul are by far the dominant ethnic group, at least 7 other significant tribal entities occur. Human pressure on the delta has increased considerably during the droughts of the 1970s but, because of its fertility, the delta has been a centre of human habitation since prehistory.

Traditional uses of the delta include:

a) Cattle raising: As the flood recedes, good grazing becomes available. This occurs at a time when grasslands outside the delta tend to get exhausted, and a seasonal migratory movement results. The social aspects of this periodical migration are subtle and manifold and are discussed at length by Gallais (1967).

b) Fisheries: These used to be mainly in operation during the flood season, but fishing in the river and on the main lakes (Faguibine is especially productive) has now become perennial.

c) Since the construction of a dam at Markala in 1946, the fossil delta has been irrigated. More and more areas within the delta are also managed for rice and cotton cropping. One of the problems with rice culturing in the area is fish damage. Herbivorous species such as Coptodon zillii, Alestes baremoze, Distichodus brevipennis are particularly destructive to young rice plants. Another problem with irrigated agriculture is the spreading of Bulinus and Biomphalaria. The incidence of Bilharzia is up to 90% of the rural population. Malaria is another health hazard of the area.

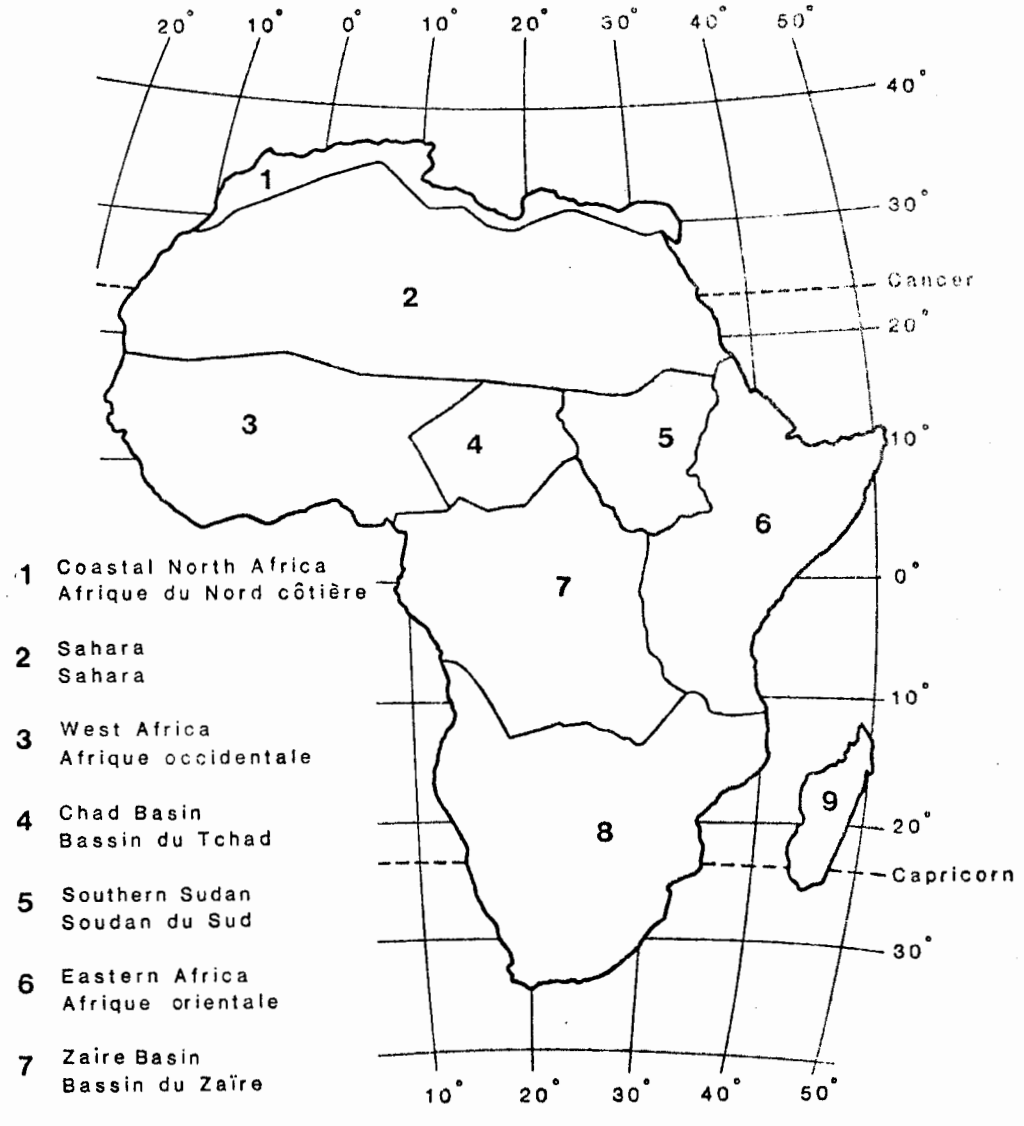
A special activity of the Niger is the exploitation of the oyster-reefs as a source of lime. In view of the scarcity of calcium in the area, this is even the major source of this mineral locally.

3.6. SIERRA LEONE

by Patrick DENNY & James GREEN

Information from: Gerrath and Denny (1979) and Green (1979)

There have been so few limnological studies in Sierra Leone that detailed descriptions of individual waterbodies are rarely possible and only a general account can be provided. There are numerous small waterbodies still to be investigated but Lake Sonfon (Fig. 3.22) has been studied in more detail. Efforts are being made to describe the algae of Sierra Leone (Gerrath & Denny 1979, 1980 a, b; Carter & Denny 1982). From one river alone, the river Jong, 240 species of diatoms have been recorded of which 38 are new to science and have been described for the first time.



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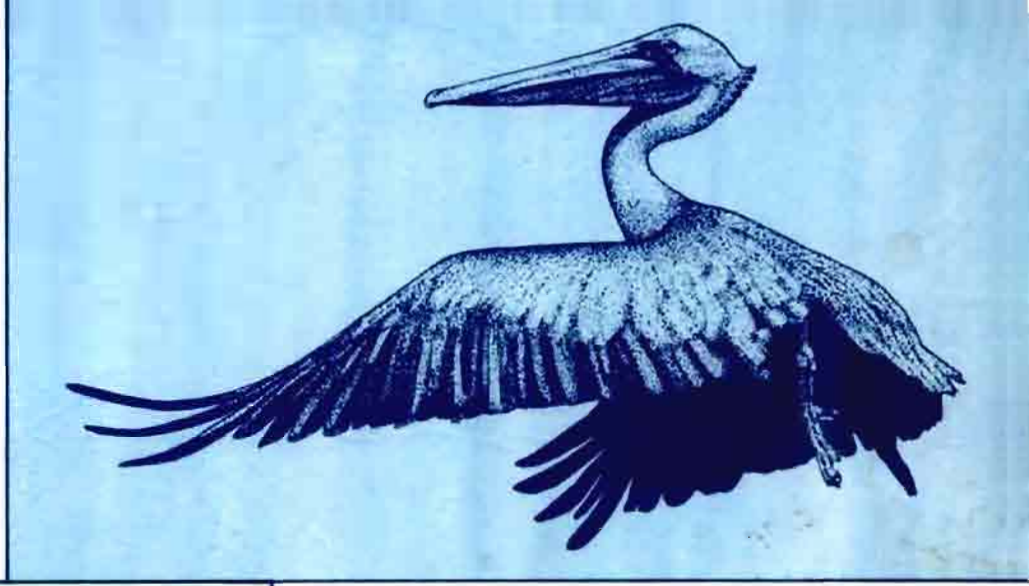

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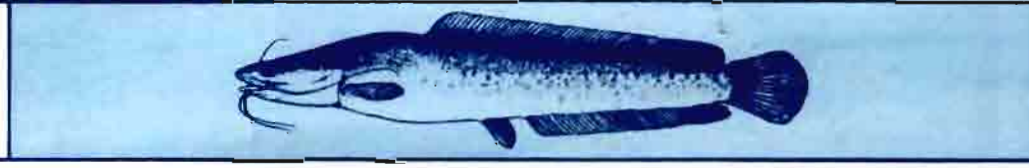

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