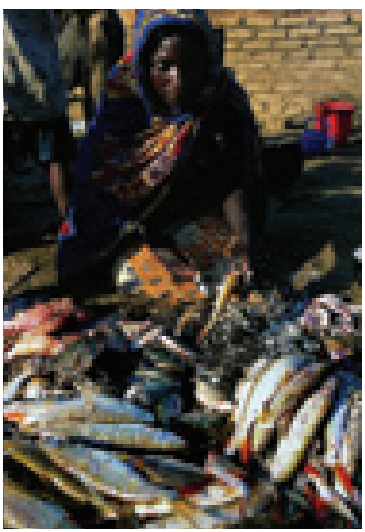
DANOUWANE VILLAGE (N'GUIGMI), THE NIGER

THE MAJORITY OF RURAL HOUSEHOLDS DERIVE THEIR INCOME FROM A COMBINATION OF FISHING, FARMING AND OTHER OCCUPATIONS

OCCUPATIONS AND FISHING INCOME

The majority of rural households participate in the fisheries of the Lake Chad Basin on a seasonal and part-time basis. Many so-called "fishing households" earn most of their income from a combination of fishing, farming and other occupations (Table 15). Within the fisheries specifically, catching fish is the major occupation. Catching is also usually linked to other occupations within the fisheries, including fish processing, fish trading, the transportation of fish and the supply of fishing gear and other inputs. For example, on the western shore of Lake Chad (Table 15), catching involves nearly all fishing households (94 percent); however, specialization in "catching only" involves less than 15 percent of households. The combination of catching, processing and trading is the most common one, involving about 30 percent of households in the fisheries. The transportation of fish is also an important occupation on the western shore, involving about 25 percent of fishing households.

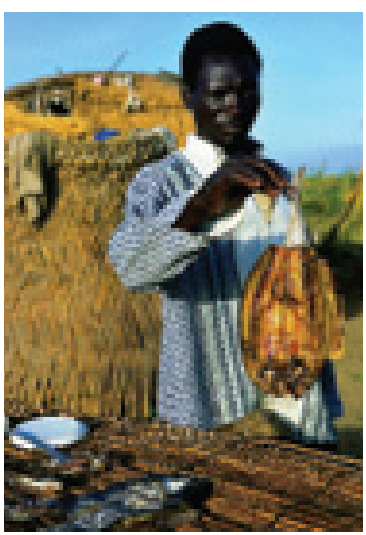


KINASSEROM ISLAND, CHAD

RETAIL SALE OF FISH IS OFTEN CARRIED OUT BY WOMEN

PORT OF BOSSO, THE NIGER

THE TRANSPORTATION OF FISH IS AN IMPORTANT OCCUPATION, INVOLVING 25 PERCENT OF FISHING HOUSEHOLDS



NEAR CHARI RIVER, CHAD

SUN DRYING OF FISH

TABLE 15 **INCOME SOURCES AND OCCUPATIONS IN THE FISHERIES OF THE LAKE CHAD BASIN (WESTERN SHORE, NIGERIA)**

Income sources for fishing households	**Contribution** (%)
Fishing	54
Farming	39
Labouring	1
Others	6
Total	(100 %)
Occupation*	**Households (%)****
Catching	94
Catching only	15
Catching, processing, trading and transport	26
Input supply	<15

* Occupations undertaken by fishing households within the fisheries sector as part of their livelihoods

** Percentage of fishing households involved in each occupation based on socio-economic surveys

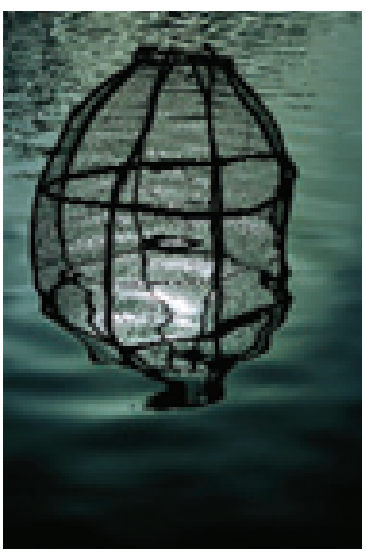
Source: A. E. Neiland *et al.*, 1994 [5.5]

FISHING METHODS

A total of 20 different types of fishing gear are used in the Lake Chad Basin. These can be classified into six major categories: active nets, static nets, traps, fish fences, hooks and others (see Table 16). In general, many types of fishing gear are based upon traditional designs but, increasingly, much of the gear, although manufactured locally, employs modern materials, such as nylon twine, or rope, in the case of nets, imported from elsewhere.

Most fishing households across the Lake Chad Basin tend to own and use the same set of simple and individual fishing gear, namely floating/sinking gillnets, small basket traps (Malian traps), hook lines, chamber traps, castnets and dipnets. However, larger and more expensive types of gear, such as dragnets or seine nets, tend to be owned by wealthy households and to be operated by larger groups of people. In general, wealthier households tend to have the largest number and diversity of fishing gear compared to less well-off households [7.11]. While many

NEAR LELEWA VILLAGE, THE NIGER



MALIAN TRAP CALLED *NDURUTU*

NEAR KANIRAM VILLAGE (MALAM FATORI), NIGERIA

SOME 20 DIFFERENT TYPES OF FISHING GEAR ARE USED IN THE LAKE CHAD BASIN. THIS CLAP-NET IS CALLED *HOMA* IN THE HAOUSSA LANGUAGE

NEAR DUMBA VILLAGE (BAGA), NIGERIA

TWO FISHERMEN SHOW THEIR BOULTER. A GOURD IS TRADITIONALLY USED AS A FLOAT ON SHALLOW WATER

TABLE 16 **CLASSIFICATION OF FISHING GEAR IN THE LAKE CHAD BASIN**

GEAR CATEGORY	Description
Active nets (e.g. seine net, or *taru*; dipnet, or *sakama*; clap-net, or *koma*; castnet, or *birgi*)	Nets of various sizes (mesh as small as 1 cm, usually multifilament) operated by a single fisherman or a team from the river/lakeside, boats or wading, usually in waters free of obstructions (e.g. weeds). Fish are often collected or entangled in a restricted section or bag (e.g. seine net, liftnet, clap–net, castnet).
Static nets (e.g. stake nets, or *kalli*)	Nets of various sizes, operated singly or by teams of fishermen, which can be set in most waters and left unattended for some time (hours, overnight, days). Some types of fishing gear are supported by sticks or poles (e.g. stake nets), others by floats, weights and ropes. Fish are usually entangled.
Traps (e.g. chamber traps, or *ndurutu*; pot traps, or *gura mali*)	Static gear often in the form of reed baskets (e.g. chamber trap) or net-covered, pot-like frames (e.g. Malian traps) of various sizes with single or multiple chambers, usually baited. Set and allowed to fish usually in shallow water and swampy areas.
Fish fences (e.g. fence of chamber traps, or *dumba*)	Fences of various designs and sizes, but often of reed mats and supporting poles, built across a river or stream to channel fish into a trap. No bait. Often built across seasonal rivers. Significant catch of juvenile fish.
Hooks (e.g. longline of hooks, or *kugoya*)	Large hooks (no. 2/3) used singly, or multiple smaller hooks (no. 12/14) on a longline (of various lengths), set baited or unbaited to snare fish. Set and left unattended in open water or swampy areas.
Others (e.g. fishing spears)	A large range of miscellaneous, often traditional gear specific to particular fishing conditions, areas and ethnic groups (e.g. various types of fishing spears).

Source: A. E. Neiland, *et al.*, 2000 [7.12]

NEAR DUMBA VILLAGE (BAGA), NIGERIA

FISH FENCES ARE USED TO CATCH FISH DURING THEIR MIGRATION FROM OPEN LAKE TO FLOODPLAINS. FISHERMEN KNOW FISH BREEDING CYCLES AND HAVE ADAPTED THEIR FISHING METHODS ACCORDINGLY

>> RIGHT: FISH TRAPS ARE MANUFACTURED LOCALLY ACCORDING TO TRADITIONAL DESIGN BUT THE USE OF MODERN IMPORTED MATERIALS SUCH AS NYLON TWINE AND ROPE IS INCREASING

households own small fishing canoes, these are not always needed for fishing, especially in floodplain areas. Indeed, many of the fishing sites are accessible from the shore or by wading through shallow water.

A particular feature of fishing in the Lake Chad Basin is the construction of complex fish fences across drainage channels and small river courses leading from floodplain areas. Here, large catches of juvenile fish are taken during the receding flood. The design and construction of these fences is based on long-established traditional knowledge and patterns of social organization and cooperation within particular riparian communities.

In the *yaéré* floodplains (in northern Cameroon and southern Chad), during the recession season, a large number of fish fences are set up across the channels connecting the floodplain areas to the main river (Logone) and its tributaries (Logomatia or Petit Goroma in Cameroon, Salamat in Chad). These fences aim to catch migratory fish leaving the flooded plains, especially *Alestes* spp. One example of this type is the Malian fence (or *barrage*) on the Ba-Illi tributary of the River Logone in Chad. The local fishermen (from the Kotoko ethnic group) set up a dam made of wooden fences across a channel or shallow part of the river. Just in front of these fences (upstream) are fixed 400–500 large Kotoko traps, attached to tall wooden sticks fixed in the river bed. The traps, with a mouth oriented downstream, will catch the fish that turn back when trying to escape the fences. One interesting point to notice is that the traps closer to the fences (which will catch the largest proportion of the fish) usually belong to the most important and richest families. The traps belonging to other villagers take a secondary position.

Downstream, behind the fences, a series of pirogues are positioned. These will catch the few *Alestes* and *Hydrocynus* that manage to escape the traps and try to jump over the fences. Usually the yield of these fishing barriers is remarkably high. Several

NEAR DUMBA VILLAGE (BAGA), NIGERIA

tonnes per day can be caught during the peak period, and a catch of 30 tonnes per week was reported to be common in the late 1950s [7.13]. Obviously these massive structures preclude the use of other fishing gear on the same fishing grounds.

Interestingly, along the western shore of Lake Chad in Nigeria, a new form of fish fence, called a *dumba*, has appeared in recent years [7.14]. A *dumba* is a row of Malian fishing traps. These small chamber traps (up to 1 m high and 500 cm in diameter) consist of a wooden frame and a net covering, with a small side entrance and a larger hole at the top for retrieving the catch and are similar to a lobster pot. They can be baited or unbaited. Typically, a *dumba* is strung across shallow channels, usually at the end of the dry season (to catch or sieve both adult and juvenile fish moving into and out of the floodplains, depending on the seasonal flow). The *dumba* fishing technique was introduced to the region by Malian fishermen and is currently the most profitable technique used in the area. The siting of the *dumba* is crucial and the selection of sites requires key local knowledge of water channels, water movements and fish movements. There are comparatively few good *dumba* sites on the western shore of Lake Chad, and the most important have already been claimed either by a single fisherman or groups of fishermen. All *dumba* are licensed by local authorities for a flat fee of $200. More recently, attempts have been made to outlaw *dumba* fishing, since it is considered to be a "destructive fishing method" by government administrators. *Dumba* catch a high proportion of juvenile fish and they may have an impact on fish-stock recruitment, although this has not yet been investigated by scientists.

DELTA OF CHARI RIVER, CHAD

FISH FENCES ARE TYPICALLY PLACED ACROSS WATER CHANNELS

BALATUNGUR VILLAGE (BOSSO), THE NIGER

BOATS ARE NECESSARY TO REACH THE FISHING GROUNDS, WHICH MAY BE LOCATED SEVERAL KILOMETRES AWAY FROM THE SHORE

TRANSPORT

The need to own a fishing canoe, and an outboard engine, is becoming more important in the river deltas and, most important, in the open-water areas of Lake Chad. In these areas, a boat is necessary to access the fishing grounds, which may be located on the fringes of small islands or shallow banks several kilometres from the shore. In these vast lake environments, fishing is both challenging and often hazardous (there are many reported incidents of drowning during stormy weather on the open lake).

The open waters of Lake Chad have long been the domain of professional and full-time fishermen from ethnic groups such as the Buduma. The fishermen, often accompanied by their families, travel great distances to fish and they use longlines and gillnets in the open waters. They make temporary camps on floating islands of vegetation, where they dry their catch before returning to key island markets, such as Kinasserom. In some places, fish traders either own or hire large motorized canoes to transport fish from the fishing grounds back to the markets and also to supply various goods to distant fishing camps.

BALATUNGUR VILLAGE (BOSSO), THE NIGER

MOST OF THE FISH IS PACKAGED AND TRANSPORTED BY ROAD TO THE URBAN MARKETS OF SOUTHERN NIGERIA

OPEN LAKE (BOL), CHAD

IN THE VAST LAKE ENVIRONMENT, FISHING IS CHALLENGING AND OFTEN HAZARDOUS

FISHING PATTERNS AND OTHER ECONOMIC ACTIVITIES

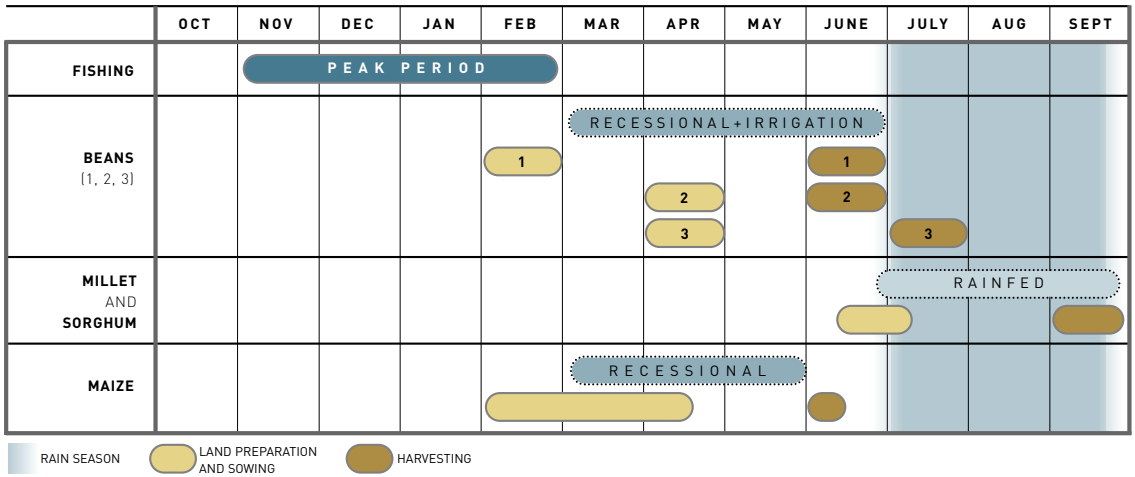
The seasonal and interannual hydrological patterns in the Lake Chad Basin have a major influence on the economic activities pursued by rural households. In general, the mixture and diversity of activities are adapted to the local flood regime which, of course, varies according to the location within the basin.

WESTERN SHORE

Along the western shore of Lake Chad, in villages such as Dabar Shatta Kwatta (see Table 17), the peak fishing period is between November and February, on both the open waters of the lake and the floodplains and associated channels. (This is a period of significant fish migration as the flood builds, peaks and then recedes.) Some permanent pools on the floodplain may be fished all year round.

Farming is also undertaken throughout the year, using both recessional and rainfed cropping systems. Usually the first planting of maize and beans starts in February, as Lake Chad starts to recede; harvesting then takes place in June with the onset of the rains. A second planting of rainfed crops occurs in June, with a harvest three months later in September, at the beginning of the dry season. Many households also tend to keep a small number of cattle, goats and sheep.

TABLE 17 **ACTIVITY CALENDAR FOR DABAR SHATTA KWATTA VILLAGE, LAKE CHAD (WESTERN SHORE, NIGERIA)**



Source: A. E. Neiland *et al.*, 1994 [5.5]

SOUTHERN SHORE

Along the southern shore of Lake Chad, in Chad and Cameroon, fishing is practised throughout the year on the lake itself and also in the Chari River and its tributaries and permanent ponds. Periods of activity and yields vary as follows: high levels of fishing activity and catch during water recession and low waters (from January to April); reduction of fishing activity and lower catches during the flood period (from July to September); and even lower catches during periods of high water, when fish are widely dispersed on to floodplains (from October to November). In seasonal floodplain ponds left behind by receding waters, fishing continues from September to December, depending upon the size of the fish and their location.

Fishing households also farm in this region. Cultivation of recessional floodplain areas is common and takes place close to the permanent waters of Lake Chad and the Chari River. Farming (cereals, legumes, vegetables, fruit and fodder) becomes the dominant household activity during certain hydrological phases, e.g. during the flood period (from August to October). Rainfed cropping systems (millet, sorghum, maize and legumes) are also widespread in the Chari Delta and last almost five months from the first sowing in July. Animal husbandry is limited to the stabling of cattle, sheep and goats throughout the year.

Yaéré

In the *yaéré* floodplains, although fishing is a year-round activity, the intensity varies according to the type of waterbody. The peak period along the Logone River occurs from July (as the water rises) until March, while along the Logomatia (a major tributary) it takes place from August to December. Fishing activity on the floodplain itself, which is less intense than on permanent waterbodies, follows the floods in September and ceases in February. In permanent ponds, fishing is carried out during the dry season (from October to April) until the Logone and Logomatia rivers offer more attractive fishing grounds.

As far as agriculture is concerned, millet is sown after the rains in June, while rice is planted in July. These crops are then harvested in October and December respectively, after the rains cease. As in the other parts of the Lake Chad Basin, many households also keep cattle, sheep and goats. Cattle exploit the free grazing around villages during the dry season, but are kept within the village at other times of the year.

KANIRAM VILLAGE (MALAM FATORI), NIGERIA

MAKING A TRADITIONAL TRAP (*N'DURUTU*) FROM DUM PALM FIBRE

PRODUCTION

Fisheries production (or fish caught/landed) in the Lake Chad Basin during the year 2000/2001 was estimated at 68 784 tonnes wet weight (Table 18). This estimate is based on a monitoring system covering all the main fish markets and trade routes within the riparian countries of the Lake Chad Basin. The largest of these markets is Baga-Doro in Nigeria, followed by much smaller markets at Kinasserom and N'Djamena in Chad. The calculation of fisheries production takes careful account of the quantity of fish marketed, the fish consumed locally and the loss of weight caused by drying in the case of dried/smoked fish.

Although there are relatively few accurate statistics on fisheries production in the Lake Chad Basin, the current estimates, when taken together with previous data, indicate that fisheries production is probably increasing at the moment. The lowest level of production (21 704 tonnes in 1982) coincided with a reduced discharge of the Chari River and a reduction of fishing because of the civil war in Chad. The highest production (220 000 tonnes in 1974) was attributable to intensive fishing during a period of drought and concentration of fish stocks in Lake Chad [7.15].

CONSUMPTION

Fish are an important part of the diet of most people in the Lake Chad Basin and constitute an essential source of protein. Earlier research found that rural fishing-farming households in the Lake Chad Basin (western shore in Nigeria) retained 19 percent of their total catch per year for domestic use [5.5]. This was equivalent to one tonne of fish per year which was not sold commercially at that time. Although

LELEWA VILLAGE (N'GUIGMI), THE NIGER

FISH PRODUCTION IN THE YEAR 2000/2001 WAS ESTIMATED AT OVER 68 000 TONNES

TABLE 18 **FISHERIES PRODUCTION IN THE LAKE CHAD BASIN, 1969–2001 (IN TONNES, BASED ON TRADE ROUTES MONITORING)**

Year	Baga-Doro	Other markets	TOTAL
1969	20 000	8 800	28 800
1970	46 800	18 700	65 500
1971	86 300	28 700	115 000
1972	123 400	42 300	165 700
1973	153 600	37 900	191 500
1974	172 600	47 400	220 000
1975	84 500	44 400	128 900
1976	68 500	39 700	108 200
1977	37 200	14 800	52 000
1978	70 698	30 299	100 997
1979	67 817	29 064	96 881
1980	64 886	27 808	92 694
1981	58 222	24 852	83 174
1982	15 193	6 511	21 704
1983	21 379	9 162	30 541
1984	28 446	12 191	40 637
1985	21 934	9 400	31 334
1995/96	32 627	32 627	65 254
2000/01	58 730	10 053	68 784

Source: T. Jolley *et al.*, 2002 [7.10]

there is no current information on household food consumption patterns, local reports indicate that a high proportion of the retained fish is consumed within the household (Bukar, personal communication). Of course, some care must be taken with these global and average values. There is also no doubt that fish from the Lake Chad Basin contribute to the food supply in many urban centres, particularly in Nigeria. Information on the socio-economic impact of fisheries, including food security, is provided below.

TRADE

The commercial trade in fish originating from the Lake Chad Basin is very important in West Africa. In 2001, the total volume of fish products passing through the key regional markets was 57 320 tonnes (wet weight) and this was valued at $23 471 698 (first sale). Most of the fish is traded in various dried and smoked forms, and is eventually packed into sacks or boxes for road transport. The largest fish market in the Lake Chad Basin is Baga-Doro in Nigeria, near the lakeshore. This handled about 48 942 tonnes (wet weight) of fish, valued at about $20 million, in 12 months (2000/2001).

Most of the fish that is packaged and traded in the fish markets of the Lake Chad Basin is transported by road (a journey of three to four days) to the urban markets of southern Nigeria. For example, the principal destinations from Baga-Doro are Enugu (23 percent total traded fish weight), Onitsha (22 percent), Lagos (11 percent) and Ibadan (11 percent). A smaller proportion of the fish is traded locally within the Lake Chad Basin itself, although no data on local trade routes or quantities are currently available.

NEAR CHARI RIVER, CHAD

FISH REPRESENT AN ESSENTIAL SOURCE OF PROTEIN FOR MOST INHABITANTS OF THE LAKE CHAD BASIN

BALATUNOUR VILLAGE (BOSSO)

MOST OF THE FISH IS TRADED IN VARIOUS DRIED AND SMOKED FORMS AND PACKED IN SACKS OR BOXES FOR TRANSPORT

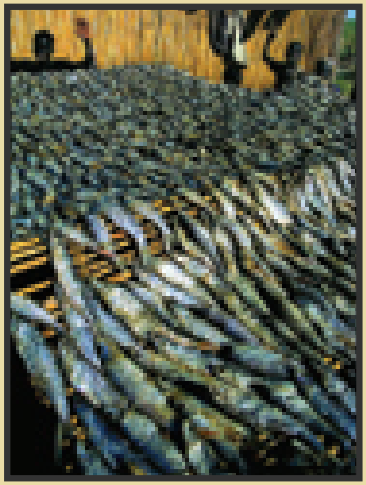
Artisanal fish-processing and fish-packaging methods

Over 80 percent of the fish catch in the Lake Chad Basin each year is traded. A small amount of fresh fish (sometimes on ice) is transported to N'Djamena and Maiduguri. The larger proportion is processed and packaged, using artisanal methods, ready for shipment by road to urban markets in southern Nigeria.

There are four main processing methods.

1. Sun-drying of small whole fish, such as *Alestes* species, laid out on the ground sometimes on grass mats; bigger fish can also be dried in this way, when eviscerated and laid flat. The product of this process is called *salanga*.
2. Smoking of fish pieces (larger fish cut into pieces, scaled and eviscerated) using local wood in a simple smoking kiln (1-3 m square x 0.5-1 m high) constructed of mud bricks overlaid with a metal grating to hold the fish, and topped with corrugated metal sheeting or matting to retain the smoke. Sometimes the kiln has two separate chambers: one for the fire and one for smoking. The resulting product is called *banda*.
3. Smoking in a kiln of large *Clarias* catfish (the most common local fish) coiled and tied head-to-tail, then skewered with a pointed stick, to produce *tonkoso*.
4. Charburning of fish pieces or small, whole fish by laying them on a loose mat of dried grass, then sun-drying for a week (this method is very common in the fishing camps located on the floating islands of Lake Chad where wood is scarce and costly).

Fresh fish for processing, or fish already processed, is brought to major markets, such as Baga-Doro in Nigeria, and packed into sacks or cardboard cartons for road shipment. Within the market, there are groups of artisans who specialize in particular activities, including sack or carton construction, fish packing, rope making and sack/carton tying, and the loading of fish lorries. Each market destination in southern Nigeria has its own "signature" fish sack or fish carton.



KINASSEROM ISLAND, CHAD

SUN-DRYING OF SMALL WHOLE FISH ON THE ISLANDS WHERE WOOD IS SCARCE AND COSTLY

KANIRAM VILLAGE (MALAM FATORI), NIGERIA

CLARIAS CATFISH BEING SMOKED IN A KILN ON THE MAINLAND, WHERE WOOD (MAINLY FROM *PROSOPIS*) IS ABUNDANT

>> RIGHT: THE FISH-SMOKING KILN IS MADE OF MUD BRICKS, OVERLAID WITH A METAL GRATING TO HOLD THE FISH AND TOPPED WITH CORRUGATED METAL SHEETING TO RETAIN THE SMOKE

NEAR CHARI RIVER, CHAD