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AN AUDIT OF INLAND CAPTURE FISHERY STATISTICS – AFRICA

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AN AUDIT OF INLAND CAPTURE FISHERY STATISTICS – AFRICA

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PREPARATION OF THIS DOCUMENT

This Fisheries and Aquaculture Circular is intended to critically review the nominal inland fisheries catch statistics reported by African countries to FAO. It forms part of an initiative to refocus on inland capture fisheries after several years of relative neglect and to assess the current status of inland fishery resources of the continent. It also identifies critical issues emerging from the nominal catch statistics that affect understanding of the status of African inland capture fisheries and the capacity to manage them in the face of competing uses of water and the natural environment. It supplements the information on African inland capture fisheries presented in Vanden Bossche and Bernacsek (1990). Mr Robin Welcomme wrote this document in cooperation with Mr David Lymer who worked as Associate Professional Officer (APO), Fishery Statistics, at the FAO Regional Office for Asia and the Pacific.

Welcomme, R., Lymer, D.
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ABSTRACT

Catches from African inland capture fisheries are rising at about 3.7 percent per year. The combined reported catches in 2007 were 2 463 975 tonnes. Catch reports from the 20 highest producing countries (representing more than 94 percent of the total catch) are analysed for consistency by a subjective evaluation based on the form of the data set, knowledge of trends in climate, predicted yield patterns from models of similar fisheries and the results of independent research. The other African countries are examined in less detail. The audit shows that 37 percent of countries reported catches as still rising, 28 percent as falling and 35 percent as stable. The reported catch from about 72 percent of countries is judged to need some clarification before these trends can be fully understood. Particular clarification is needed for the Sahelian zone countries as catches are reported as rising there despite negative climatic conditions. Clarification is also needed for the Congo basin where a historic lack of data collection makes it impossible to estimate the true production and any trends in catch. The regional trend is probably misrepresenting the historical catch levels and hence caution should be used when referencing to the increasing catch figure. In addition, the relatively stable catch per person depicted by this trend should also be referenced with care and could even have been decreasing in the last decades. In conclusion, the potential and future development of inland capture fisheries of Africa cannot be fully assessed until clarification is given on the above mentioned areas relating to the reported statistics. Hence, there is a need for further information to interpret the trends in inland fisheries in Africa and to resolve the paradox of apparently threatened resources and ever growing catches.

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1. BACKGROUND

Currently, there is a paradox in the diagnosis of inland capture fisheries in Africa which is limiting the effectiveness of national and international managers in their management of inland fish stocks. The nominal catch statistics indicate a constantly growing catch (FAO FishStat, 2009). However, anecdotal evidence (e.g. interviews with fishermen) and data from occasional scientific papers and technical reports (FAO, Web sites and others) seem to indicate falling catches from individual water bodies and decreasing catch per fisher. Further a growing detrimental impact of environmental degradation, dam building, river training, land (floodplain) reclamation and water abstraction can be observed in African water bodies. These two views become difficult to reconcile and make formulation of management policy difficult because the raw capture statistics say nothing about the state of the stocks or the water bodies in which they live. Furthermore, little is known as to the origins of the constantly increasing catch and this might, to some extent, come from the use of intensively managed wild stocks enhanced by stocking and other methods and could also partly be explained by increased quality in reporting. Information is urgently needed for the formulation of management policies and to assess environmental impacts, to qualify and verify the nominal statistics, to establish the precise status of the stocks in various member countries and determine the impacts of other uses of water and landscape impacting of the fisheries.

Africa was selected for this audit for a number of reasons. Firstly, it is in line with current priorities of the Fisheries and Aquaculture Department and FAO. Secondly, Africa represents more of a coherent fish fauna and geography than the other continents/regions of the world. This report is based on the figures 1950–2007 as reported in the FAO global capture fisheries data-set available through FishStatJ (www.fao.org/fishery/statistics/software/fishstatj/en).

2. GENERAL OBSERVATIONS

2.1 General concepts

The audit examines the following three general concepts, which are often contradictory: (a) the "inland fisheries are doomed" view; (b) inland fisheries catches are still reported as rising; and (c) more fish are being caught than are recorded.

(a) The "inland fisheries are doomed" view

There is a general pessimistic view of the future of inland fisheries in the face of the numerous threats to aquatic ecosystems posed my man's activities. This view is supported by many individual studies and reports from all continents including Africa. Catches are alleged to be falling, species disappearing and many of the symptoms of chronic overfishing at the level of individual species or whole communities are being reported (Allan *et al*., 2005). This "inland fisheries are doomed" paradigm (Friend, Arthur and Keskinen, 2009) favours a sense of hopelessness that leads to the neglect of the sector as a whole and a policy making process under which inland fisheries have to make do with what is left after other sectors have satisfied their needs. As a result the beneficial contribution of wild caught inland fish to food security has been largely ignored, priorities for study have been switched to other sectors and aquaculture has been promoted as the mechanism to sustain catches in the face of the inevitable decline and eventual disappearance of freshwater fish stocks. This view is prominent in many African countries, and elsewhere, and has led to a lack of resources assigned to inland fisheries, a lack of intelligence on many aspects of the resource as well as an apparent failure to adequately incorporate inland fisheries interests into administrative structures.

The foundation of this view in Africa, as elsewhere, is the large number of threats to inland aquatic systems. Principle among these are:

- **Bad fishery management** – including uncontrolled and excessive fishing and introductions of exotic species (e.g. invasives).
- **Water abstractions** – There is a growing trend in Africa for river flow to be diverted for irrigation either directly or from reservoirs.
- **Land drainage** – There is an increasing trend to drain wetlands and separate floodplains from the river channel. This results in a loss of living area and threats to many guilds of fish.

- **Dam construction** – With the fuel crisis facing the World there has been an increase in proposals for construction of large dams. For example, there is a project for the construction of a major dam at Ayourou in Niger and another for a mainstem dam across the Congo River. The impacts of such dams on the fish fauna downstream have usually not been assessed although there is often a compensatory effect with the creation of new fisheries in the reservoirs upstream, however this effect only rarely offsets the negative effect of the damming.
- **Pollution/eutrophication** – Pollution has important local effects in rivers and in lakes. In lakes, eutrophication is an increasing threat from the growing levels of human population around their shores and a lack of proper waste water treatment system in place in many areas.
- **Climatic variability/change** – Climatic variation has always been a severe problem especially in the drought prone belts of the Sahel and southern African region. These effects are likely to become more severe as global warming progresses.

(b) Inland fisheries catches are still reported as rising

In contrast to the pessimistic view of the present status and future of inland fishery resources presented above, catches are still recorded as rising at a linear rate of increase of about 2.4 percent per year globally and 3.7 percent per year in Africa (Figure 1). The lack of intelligence noted above makes it extremely difficult to evaluate the fisheries data sets for their relevance to the actual situation in the countries and to reconcile this divergent view of the resources. This audit examines some examples of the statistical record to try and shed more light on this issue.

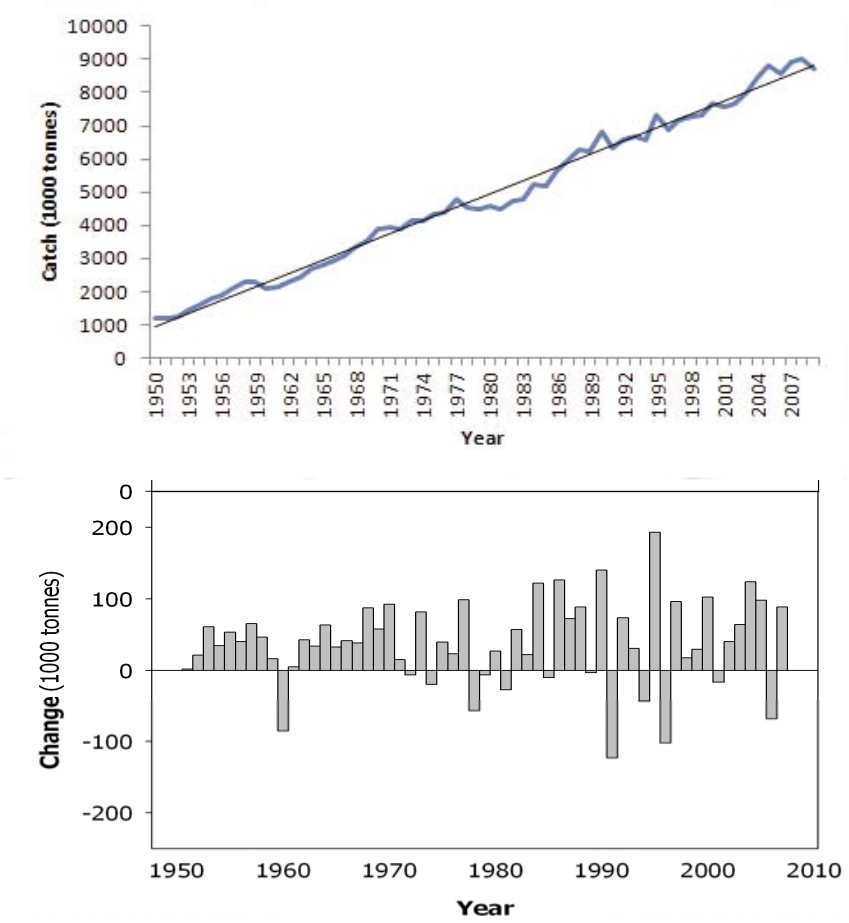

Figure 1. Total inland capture fisheries catch for Africa 1950–2007 with the regression line y = 133777x + 794525 and total regional change for inland capture fishery catches 1950–2007

(c) More fish are being caught than are recorded

There is a widespread opinion that much of the catch from inland fisheries is unrecorded. This is mainly because of the diffuse and small scale nature of individual fisheries where there are no definable landings and much of the catch goes directly into domestic consumption. Typical examples of such catches are the fisheries on the numerous low order rivers and streams which together may contribute a considerable amount of fish. This was noted by Welcomme as early as 1976 (Welcomme,

1979). This concept was later developed by Coates (2002) in his discussion on the deficiencies of inland catch recording for South East Asia. A further example is that of wild fish catches in rice fields. Studies such as that of Hortle, Troeung and Lieng (2008) show production levels for rice fields to be high and given their total area the accumulative fish production is very significant. Indeed where rice fish yields have been incorporated into the statistics such as Cambodia and Bangladesh reported catches have increased. Although it is not as common as in Asia, rice culture is practised in parts of Africa, such as Mali and the Sudan where extensive areas are irrigated. A third area where under reporting may occur is in the regular collection of statistics. For example in Africa, Braimah (2003) estimates that the catches from Volta Lake are considerably underestimated and challenge existing yield models from some lakes.

3. APPROACH

In this audit, the various countries of the African continent are broadly assigned to subcontinental regions that share many characteristics, mainly of climate and geography, as a means of identifying common problems and trends. The regions are generally amalgamations of the more detailed freshwater ecoregions of the world as defined by Freshwater Ecosystems of the World (www.feow.org). The designation of some countries may be fairly arbitrary as they lie within more than one ecoregion. For example, Nigeria lies partly in the Sahel and partly in the Guinean coastal region; Ethiopia lies partly in the Nile and partly in the Great lakes region and Central African Republic lies partly in the Sahel and partly in the Congo.

- North Africa
- Nile River basin
- Eastern Africa coastal basins
- Great lakes
- Southern Africa
- Congo basin
- Sahel
- Western Africa coastal basins
- Madagascar

The main inland fish producing countries in Africa are shown in Table 1. The total catch reported for Africa is 2 463 975 tonnes. Twenty-two countries account for over 95 percent of the catch.

Table. 1 Catches of finfish, molluscs and crustacea[1] in tonnes from the inland waters of the countries of Africa (2007)

Country	Catch (2007)[t]	% of total	Cumulative %
Uganda	500 000	20.29	20.29
Tanzania, United Rep. of	284 346	11.54	31.83
Egypt	241 743	9.81	41.64
Congo, Dem. Rep. of	230 000	9.33	50.98
Nigeria	227 107	9.22	60.20
Kenya	124 317	5.05	65.24
Mali	100 000	4.06	69.30
Ghana	75 000	3.04	72.34
Cameroon	74 380	3.02	75.36
Chad	70 000	2.84	78.20
Malawi	66 500	2.70	80.90

[1] All catches are of finfish, molluscs and crustacea and exclude crocodile, reptiles, amphibians and mammals.

Zambia	65 000	2.64	83.54
Sudan	59 810	2.43	85.97
Senegal	50 000	2.03	88.00
Madagascar	32 630	1.32	89.32
Congo, Republic of	30 120	1.22	90.54
Niger	29 728	1.21	91.75
Mozambique	24 081	0.98	92.73
Benin	22 560	0.92	93.64
Angola	15 000	0.61	94.25
Central African Republic	15 000	0.61	94.86
Mauritania	15 000	0.61	95.47
Burundi	14 000	0.57	96.04
Sierra Leone	14 000	0.57	96.60
Ethiopia	13 253	0.54	97.14
Zimbabwe	10 500	0.43	97.57
Burkina Faso	10 200	0.41	97.98
Gabon	9 500	0.39	98.37
Rwanda	9 050	0.37	98.74
Ivory Coast	6 499	0.26	99.00
Togo	5 000	0.20	99.20
Gambia	4 865	0.20	99.40
Guinea	4 000	0.16	99.56
Liberia	3 500	0.14	99.70
Namibia	2 800	0.11	99.82
Morocco	1 210	0.05	99.87
Tunisia	1 084	0.04	99.91
South Africa	900	0.04	99.95
Equatorial Guinea	700	0.03	99.98
Somalia	200	0.01	99.98
Guinea Bissau	150	0.01	99.99
Botswana	123	0.00	100.00
Swaziland	70	0.00	100.00
Lesotho	48	0.00	100.00
Réunion	1	0.00	100.00
Algeria		0.00	100.00
Cape Verde		0.00	100.00
Comoros		0.00	100.00
Djibouti		0.00	100.00
Eritrea		0.00	100.00
French Southern Territories		0.00	100.00
Libya		0.00	100.00
Mauritius		0.00	100.00
Saint Helena		0.00	100.00
Sao Tome and Principe		0.00	100.00
Seychelles		0.00	100.00
TOTAL	2 463 975		

3.1 Possible sources of error

There are several possible sources of error in fish catch statistics. Among these are:

- **Inadequate data collections systems:** Many countries do not have the financial or human resources to establish adequate sampling systems. As a result data are absent or misreported.
- **Selective data collection:** A related issue is where data is collected only from commercially significant sites such as major landings or markets. This frequently means that minor fisheries on small rivers and lakes or on whole sectors such as subsistence, artisanal and recreational fisheries are excluded from the estimates.
- **Double counting of landings:** This may occur when the same fish are presented at a number of landings or markets and is especially a problem in international waters where the same catch may pass though more than one country.
- **Confusion with aquaculture:** Because the interface between capture and culture fisheries is not clear catches from one may be recorded as the other. This is a risk especially in stocked, enhanced or culture-based fisheries. Effectively, fisheries enhanced through simple stocking should be recorded as capture fisheries but are often reported as aquaculture.
- **Political pressure:** There are often political pressures to inflate catches either to meet centrally dictated quotas or to raise the profile of the sector. Here, countries that have consistently reported higher catches, can not easily revise their estimates downwards. There is sometimes an opposing pressure to downplay the role of fisheries in areas that are being considered for development through river damming, water abstractions, etc.

3.2 Tools

In addition to the basic errors in reporting there is generally a lack of intelligence to enable the statistics to be interpreted.

3.2.1 Sources of statistics

- **Direct sampling of catches**: We need to know more about the methods countries are using for their direct sampling of catches at landings and markets to be able to interpret the degree to which the figures that are collected are representative of the country as a whole.
- **Indirect assessment of catches through consumption surveys**: An increasingly used method although not widespread in Africa (See example of Mekong – Hortle, 2007).

3.2.2 Intelligence

The commonest source of intelligence assisting in the interpretation of fishery statistics is where there have been studies of the fishery either by projects, by national and international fishery research or academic organizations, thus giving a body of research and literature on which to assess the statistics. Furthermore, simple inspection and evaluation of the reported catch time series is useful as an indicator as to the regularity and general reliability of statistics reported. Constant values reported over a number of years, regular percentage increments in catch, sudden rises in reported yield, etc. are all basis for suspicion.

3.2.3 Indicators

A number of indicators can be used to assess the compatibility of the statistics with a more generalized concept of the order of production expected. These models include the morpho–edaphic index (mei) as applied to lakes and reservoirs (MRAG, 1995) and generalized yield models from rivers based on river length or floodplain areas (Welcomme, 2001). There is always a possibility that these models will need updating should further information become available.

The fishing down process

A further guide to judge the status of individual fisheries is the fishing down process (Welcomme, 1999). This process is based on the serial reduction in the sizes of individual fish and fish species as fishing pressure increases. At the same time, the catch from the fishery rises and the remains steady as smaller, faster growing, more productive species replace larger, slower growing, less productive ones. In addition, as many fish eating predators are among the larger species, these too disappear, favouring

species lower in the food chain. Eventually, the fishery may become less stable and eventually decline, although this is more likely to occur in lake fisheries than in rivers.

The changes that occur in the population and the fishery include:

- fall in total catch;
- excessive fall in catch per unit effort (CPUE);
- fall in mean length of fish caught;
- reduction in mesh size of gear;
- rise and then fall in number of species in catch;
- fall in predator/prey relationships;
- shift from long lived low productivity species (K selected) towards short lived, productive species (R selected);
- response time to floods in rivers shortens.

many of which can be used as indicators of the exploitation status of the fishery.

In Africa many fisheries are reported to be at the extreme left hand end of the process – i.e. catches characterized by small sized fish (often 0+ age class), disappearance of largest species from the fishery if not the waterbody, declining catches and declining catches per unit of effort. The degree to which the statistics reflect this may also indicate the appropriateness of some of the elements reported.

Adjustments to statistics to compensate for apparent irregularities of reporting

In order to adjust for the effects of irregularities in reporting by individual countries on regional trends, the year to year changes in catch (per country) were analysed by looking at the percentage change since the previous year, in a method modified from Lymer and Funge-Smith (2009). This method used two criteria to detect large irregularities in reporting:

- Criterion 1 was any year-on-year change greater than 30 percent change which is considered a significant change from the previous year, and
- Criterion 2 which compared the individual country changes to the regional average change for Africa 1950–2007 of 99 794 tonnes and were deemed significant if they were more than 30 percent of the change.

Catches for countries that were selected using criterion 2, together with those showing reports of large negative changes of more than 30 percent (absolute value) of the average regional increase, were adjusted. This adjustment smoothed out the individual large increases backwards across the data series to remove the effect of single large increases or decreases creating a new back-adjusted data-set using the formula:

Back-adjusted $Catch_{year\ x}$ = Original $Catch_{year\ x}$* (1+$Change_{Criterion\ 2\ year}$)

Where $Change_{Criterion\ 2\ year}$ = (Original $Catch_{Criterion\ 2\ year}$ - Original $Catch_{Criterion\ 2\ year-1}$)/Original $Catch_{Criterion\ 2\ year-1}$

4. AUDIT

This audit examines catches reported by the 20 major inland fish producers in Africa as classified by their nominal catch statistics (FAO FishStat) in greater detail than fisheries that contribute less than 15 000 tonnes/year. Because of a long term failure in the systematic interpretation of such statistics for Africa, as for the rest of the world, some inconsistencies appear in the records that merit clarification. The following classification is assigned to each country based on such factors as: whether there have been recent research projects or a research institute, the correspondence of the figures to existing models or literature reviews and the form of the reported statistics.

A = acceptable, not in need of detailed qualification;
B = some clarification needed for some aspects of the statistics;
C = large number of questions need to be answered (usually because of lack of reference material).

Judgements here are subjective by the author, based on the criteria listed above, and are not necessarily meant to imply that any reported figure is wrong but merely that more information might be useful in interpreting what has been reported.

4.1 North Africa

The North Africa region is largely desert with some coastal lagoons and short seasonal rivers.

4.1.1 Morocco

Morocco reported a catch of 1 210 tonnes in 2007. There were highly variable year-on-year catches with a rise to 2 130 tonnes in 1999 and a subsequent decline (Figure 2).

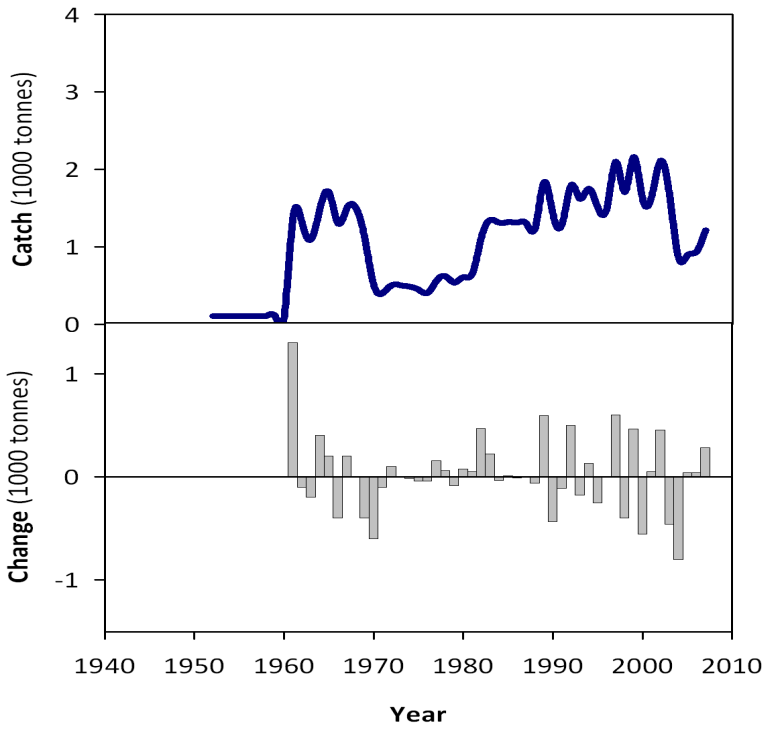

Figure 2. Catch history in Morocco 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

The catch reporting appears consistent with the type of variation that would be expected.

Eight changes were above 30 percent on the previous year, corresponding to a total of 4 300 tonnes (Figure 2). These changes were not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **A**

4.1.2 Algeria

No reported catch except for occasional years in which 100 tonnes were recorded.

4.1.3 Libya

No reported catch except for occasional years in which 100 tonnes were recorded.

4.1.3 Tunisia

Tunisia reported a constant catch of 100 tonnes until 1992when there was an irregular rising trend to 1 264 tonnes in 2006 falling to present values of 1 084 (Figure 3). Catch trends appear reasonable although the rapid rise in reported catches after 1992 needs clarification.

Five changes were above 30 percent on the previous year, corresponding to a total of 1 167 tonnes (Figure 3). These changes were not of a magnitude equivalent to more than 30 percent of the average regional increase

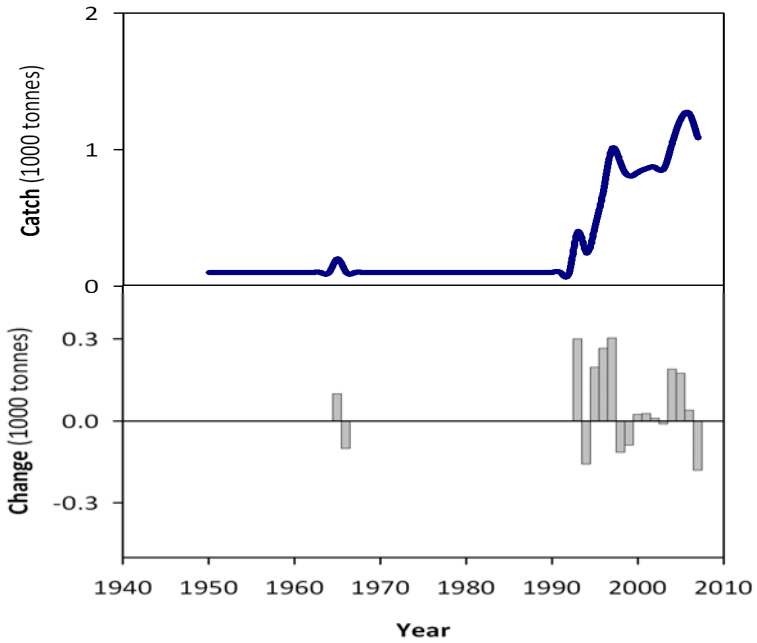

Figure 3. Catch history in Tunisia 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

Confidence level: Before 1992 **C**; after **B**

4.2 Nile River Basin

Blue Nile, White Nile, Sudd, Lake Nasser/Nubia, minor reservoirs, Egyptian coastal lagoons. The White Nile rises in the great lakes region and downstream it receives discharge from the climatically unstable Ethiopian highlands by the Blue Nile. The whole of the middle course is influenced by the Sahelian climatic regime and the lower course lies in the desert so the primary concern is the stability of water supply with the aim to avoid fluctuations of water flow and levels. Sudan and Egypt generate no water of their own and is completely dependant on flow from upstream. There are, therefore, concerns as to climate induced flow variation and an increasing abstraction of water for agriculture.

4.2.1 Ethiopia

Ethiopia is a transition zone between the Nile basin to the North and the Great Lakes region to the south. It also contains the upper reaches of the Ganale-Doria and Shibele systems that flow to the East Coast, and the Awash River that flows to the Gulf of Aden.

Main water bodies

- Lake Tana (3 500 km^2) and Upper Blue Nile
- Awash River
- Ganale-Dorya River
- Shibele River
- Lake Abaya (1 161 km^2)
- 19 other lakes and reservoirs of which some rift valley lakes are very saline

Nominal catches

The nominal catches for Ethiopia shown in Figure 4. Ethiopia reported fluctuating catches with a rapid rise to 31 000 tonnes in 1999 and a decline and renewed rise to 24 638 tonnes in 2007. Ethiopia did not report catches prior to 1964.

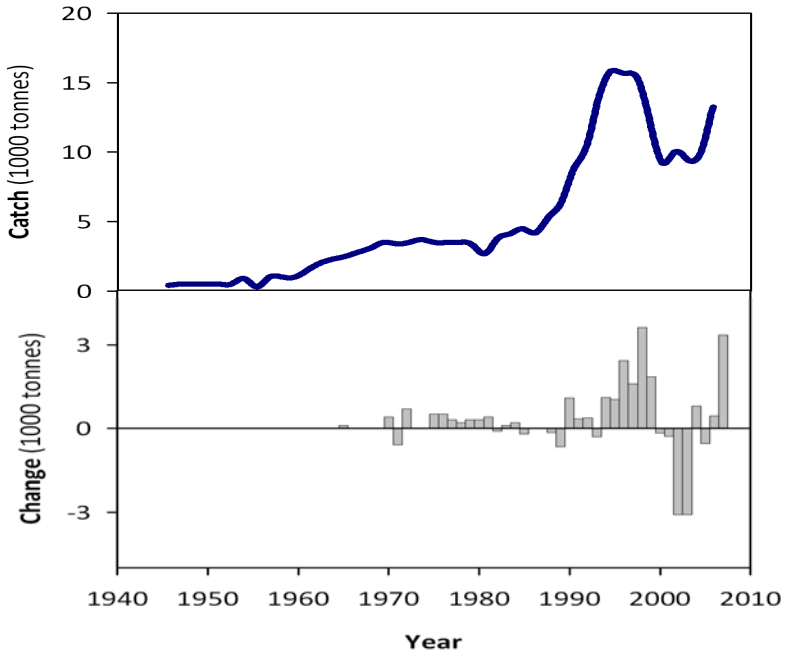

Figure 4. Catch history in Ethiopia 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

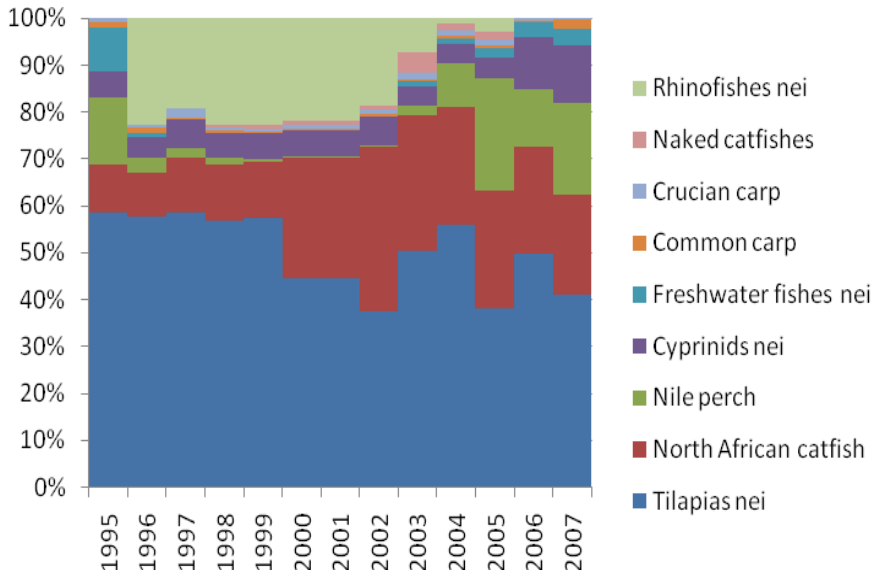

Figure 5. Species records from Ethiopia 1995–2007

Species composition

Ethiopia did not report catches by species until 1994. After that date clearer reporting shows that the catches have been dominated by tilapias although the proportion of these has declined over the period (Figure 5). Catches of Nile perch have risen, possibly indicating an expanded fishery on Lake Turkana and some of the previously common species groups, such as the rhino fishes, have declined.

Comments

Reported catches seem reasonable on basis of what is known of the resource, although Olssen (2009) lists total catch as about 13 253 tonnes in 2007 somewhat less than the figure reported by Ethiopia. Figures for fishery potential as high as 28 000 to 40 000 tonnes/year were estimated by the European Union funded Lake Fisheries Development Project (LFDP) (1981–87).

Eight changes were above 30 percent on the previous year, corresponding to a total of 12 632 tonnes (Figure 4). These changes were not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **A**

4.2.2 Egypt

Main water bodies

Egypt has about 8 700 km^2 of inland waters including:

- River Nile
- Lake Nasser/Nubia (part 5 000 km^2, 81 percent)
- Bardawil lagoon (600–750 km^2)
- Burullus lagoon (470–560 km^2)
- Edku lagoon (130 km^2)
- Manzalla lagoon (900 km^2 approx.)
- Several smaller coastal lagoons

Nominal catches

The nominal catches for Egypt are shown in Figure 6. Egypt reports a steadily rising curve to about 313 000 tonnes in 2003 with a decline since that date.

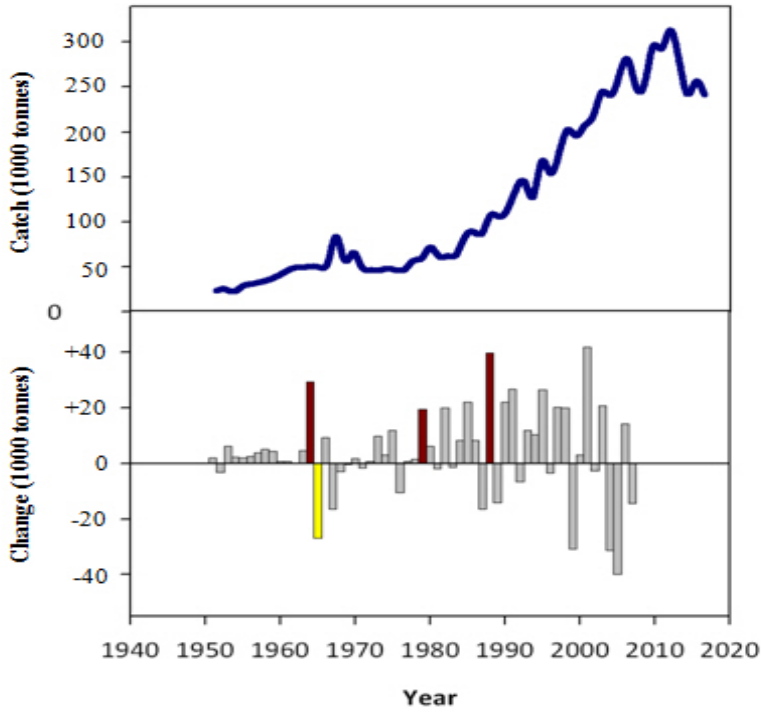

Figure 6. Catch history in Egypt 1950–2007 as total catch and change (year to year). Coloured bars indicate increases (red)/decreases (yellow) larger than 30 percent of previous year country total catch and more than 30 percent of the average regional increase (37 512 tonnes)

Species composition

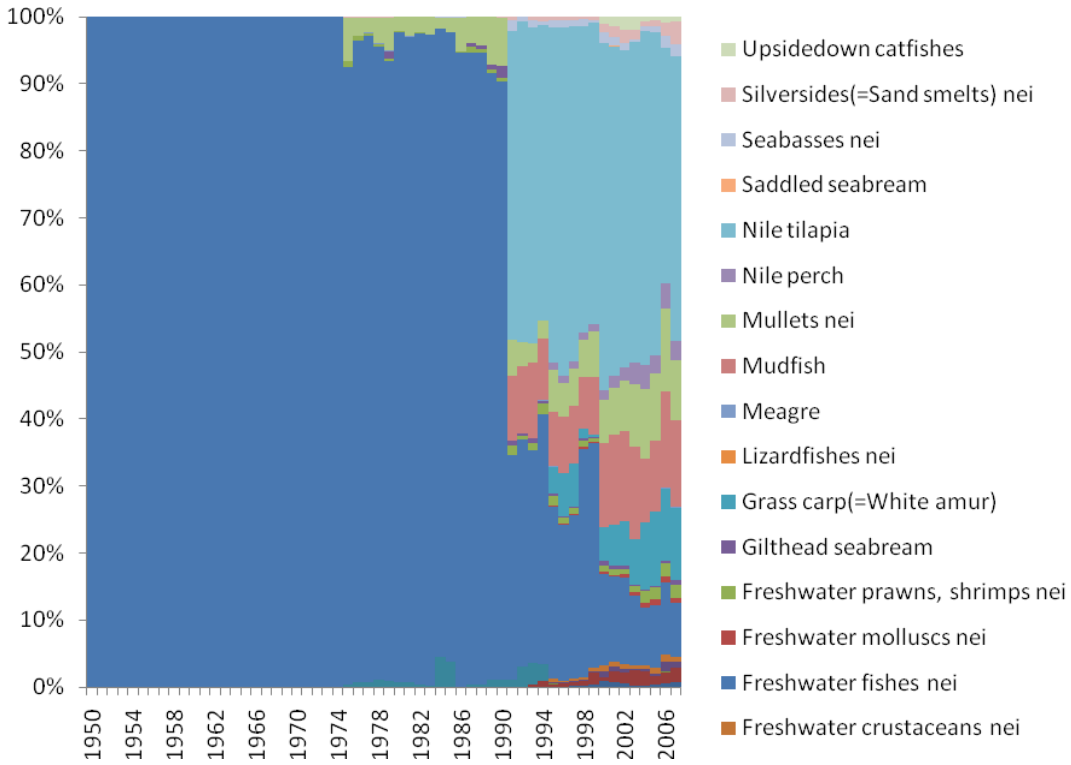

Figure 7. Species records from Egypt 1950–2007

Comments

The reported catches represent a maximum production of about 356 kg/ha declining to the present value of around 278 kg/ha. Egyptian fisheries, especially those of the coastal lagoon systems have been fairly extensively studied. The catch from lake Nasser was about 12 500 in 2005, having fallen from a peak yield of 34 200 tonnes in 1981. The current yield is equivalent to about 25 kg/ha (see Craig, 2000), although (Khalifa *et al*., 2000) did not consider this to be reliable because of extensive illegal and unrecorded fishing in the lake. Catches from the Nile River in Egypt were estimated at about 225 kg/ha or about 22 000 tonnes/year in 1982. As catches from the reservoir and river are somewhat limited, the bulk of the catch is most probably coming from the coastal lagoon systems. It is known that these are intensively managed by stocking and the environments also support intensive aquaculture. Relatively high levels of productivity could, therefore be expected. The present reports are, however, considerably higher than the mean of 57 kg/ha from the lagoon systems reported in 1982 (Vanden Bossche and Bernacsek, 1990). Some clarification of how this increase has been achieved would be interesting.

Three changes were above 30 percent on the previous year, corresponding to a total of 88 525 tonnes (Figure 6). All of these changes were also equivalent to more than 30 percent of the average regional increase. There was one negative change that was significant at the regional level.

Egypt reports fairly complete data on species composition of catches (Figure 7). Until 1990 reporting was under the general classification of freshwater species *nei* but was improved after that date. In 2007, 42 percent of the catch were Nile tilapia, 12 percent mudfish (*Clarias*), 11 percent grass carp and 9 percent mullet. The remaining 25 percent was reported under 17 categories. Given that the majority of production apparently comes from coastal lagoons the fact that only 15 percent of the catch consists of brackish water and marine species appears strange and would need documentation.

Confidence level: **A**

4.2.3 Sudan

Main water bodies

- Lake Nubia (part of Lake Nasser 1 140 km^2, 19 percent)
- Jebel Aulia reservoir (600–1 500 km^2)
- Khashm el Girba reservoir (125 km^2)
- Roseires reservoir (290 km^2)
- Sennar Reservoir (150 km^2)
- White and Blue Nile Rivers (2 084 km)
- Sudd floodplain of Nile (about 15 000 km^2 during flooding depending on flood intensity)

Nominal catches

The nominal catches for Sudan are shown in Figure 8. A steady, almost linear increase has been recorded since the beginning of reporting to present levels of about 60 000 tonnes (Figure 8).

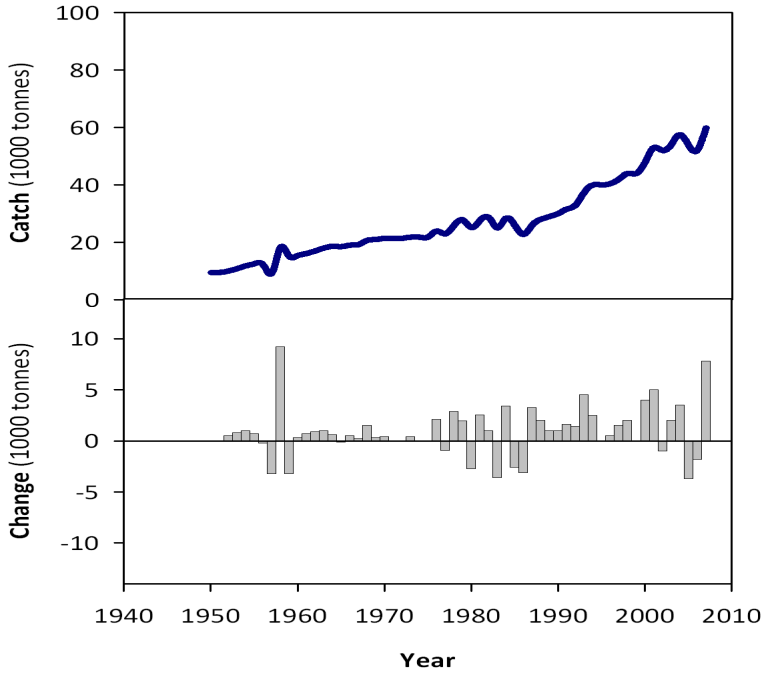

Figure 8. Catch history in Sudan 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

Species composition

No information available.

Comments

It would be valuable to know what the origin of the fish caught is. Sudan is subject to frequent climatic disturbances. The major reservoir fisheries have never been that productive and the Lake Nasser Development Authority, Aswan records the Lake Nasser catches as declining to levels of only about 12 000 tonnes/year and Olssen reports a maximum of 6 000 tonnes as coming from this area. The only possible source of the increase is the Sudd but this has never been regularly sampled and Olssen (2009) estimates at most 32 000 tonnes from this source. The potential yield from the country is possibly in excess of the 60 000 tonnes reported but the situation needs clarification.

One change was above 30 percent of the previous year, corresponding to 9 200 tonnes (Figure 8). This change was not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **C**

4.3 West Coast

4.3.1 Somalia

Reporting of catches by Somalia began in 1981 and rose to a sharp peak of about 900 tonnes in 1990. Since then catches have declined to about 200 tonnes (Figure 9).

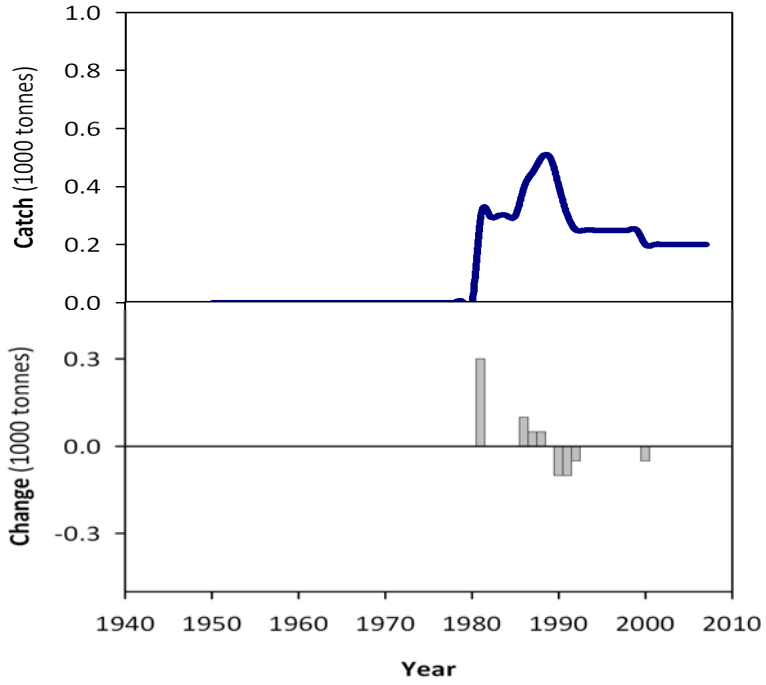

Figure 9. Catch history in Somalia 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

It is doubtful that meaningful statistics can be generated in a country with the administrative and security problems of Somalia.

One change was above 30 percent on the previous year, corresponding to 100 tonnes (Figure 9). This change was not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **C**

4.4 Great lakes

This region includes the countries of the rift valley whose fisheries centre of the series of great (*Lake Turkana, Lake Victoria, Lake Kivu, Lake Tanganyika, and Lake Malawi)* and lesser lakes. The resource is primarily lacustrine although a few minor rivers and reservoirs are also present. The climate ranges from dry northern (North Kenya and Uganda) through equatorial, to warm temperate southern (Malawi) but is reasonably constant in all except the northern most parts. The major concerns are pollution and eutrophication form the rising riparian populations and overfishing. There are also local concerns associated with invasive species, and the environmental modification of inflowing and outflowing rivers in some lakes.

4.4.1 Burundi

Statistics reported by Burundi give a very jagged, time-catch line around a mean of about 12 000 tonnes since 1965 with a peak value of 24 000 tonnes in 1992, and a value of 14 000 tonnes in 2007 (Figure 10).

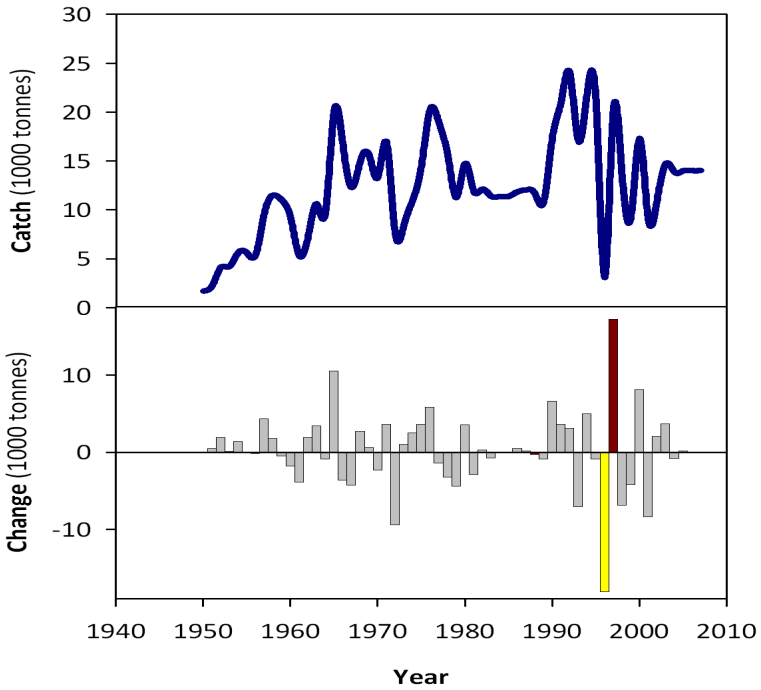

Figure 10. Catch history in Burundi 1950–2007 as total catch and change (year to year). Coloured bars indicate increases (red)/decreases (yellow) larger than 30 percent of previous year country total catch and more than 30 percent of the average regional increase (37 512 tonnes)

Although Burundi has had assistance through several FAO and bilaterally funded projects, it is difficult to account for the extreme year-on-year fluctuations reported from 1992 onwards.

Thirteen changes were above 30 percent on the previous year, corresponding to a total of 71 969 tonnes (Figure 10). Of these changes, one (17 255 tonnes) was of a magnitude equivalent to more than 30 percent of the average regional increase. There was one negative change that was significant at the regional level.

Confidence level: **B**

4.4.2 Kenya

Main water bodies

The main water bodies in Kenya are situated in the rift valley and Lake Victoria. However, some minor river (Athi and Tana) flow to the East Coast and discharge into the Indian Ocean.

- Lake Victoria (part 4 100 km^2, 6 percent)
- Lake Turkana (7 570 km^2)
- Lake Naivasha (125 $km^{2)}$
- Lake Nakuru (52 km^2)
- Other minor lakes, rivers and reservoirs

Nominal catches

The nominal catches for Kenya are shown in Figure 11 and they show that the catch levels have risen from 1950 until 2001, since when they have declined somewhat.

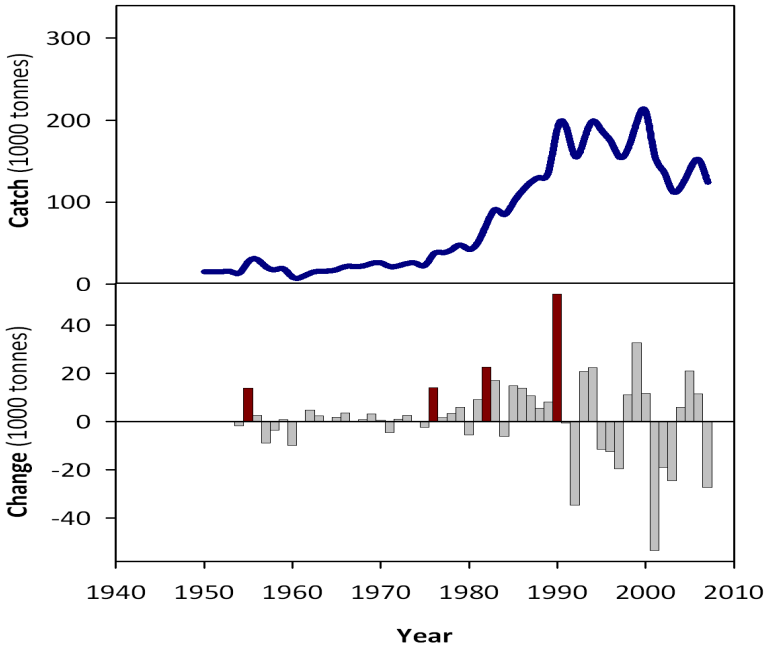

Figure 11. Catch history in Kenya 1950–2007 as total catch and change (year to year). Coloured bars indicate increases (red)/decreases (yellow) larger than 30 percent of previous year country total catch and more than 30 percent of the average regional increase (37 512 tonnes)

Species composition

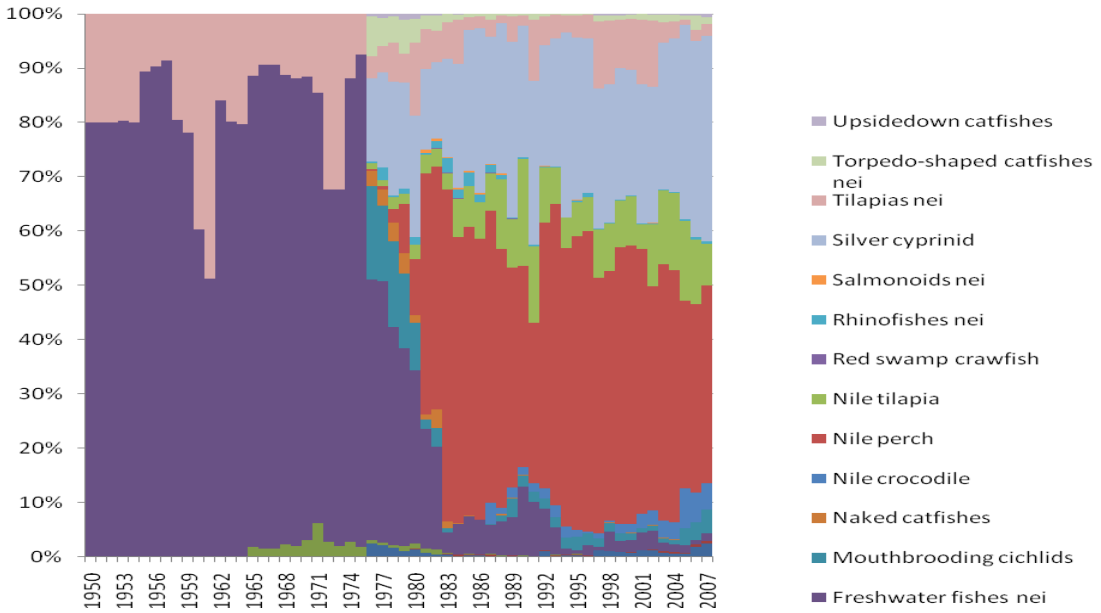

Figure 12. Species records from Kenya

The species data (Figure 12) shows the rise of Nile perch and the dagaa (silver cyprinid) catches in Lake Victoria. It also shows a decline in freshwater fishes nei associated with the international and national project activities from 1980 onwards. These figures appear reasonable what is known from recent studies by the Lake Victoria Fisheries Organization of the evolution of the fisheries of the largest fishery (Lake Victoria – see also Table 2).

Comments

The catch history is consistent with the fact that Kenya's inland fisheries are largely centred on Lake Victoria (see Table 2) where the stocks on Nile perch have diminished since 2001.

Five changes were above 30 percent on the previous year, corresponding to a total of 108 338 tonnes (Figure 11). Of these changes, four were of a magnitude equivalent to more than 30 percent of the average regional increase. The total of these changes was 103 538 tonnes.

Table 2. Catch by water body in Kenya (2003) (from Olssen, 2009)

Water body	Catch (t)
Lake Victoria	132 561
Lake Turkana	4 328
Lake Naivasha	110
Lake Jipe	96
Tana River Dams	673
Other areas	934

Confidence level: **A**

4.4.3 Malawi

Main water bodies

- Lake Malawi (Malawi part 25 000 km^2, 79 percent)
- Lake Chilwa (260–2 590 (750) km^2)
- Lake Chuita (Malawi part – 160 km^2)
- Lake Malombe 390 km^2
- Shire River and associated Elephant and Ndinde marshes (1 000 km^2 in rainy season)

Nominal catches

The nominal catches for Malawi are shown in Figure 13.

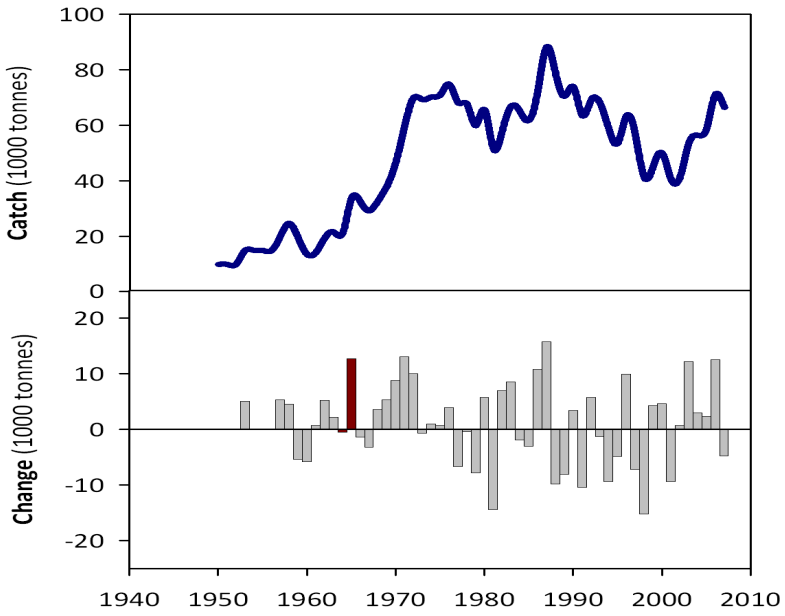

Figure 13. Catch history in Malawi 1950–2007 as total catch and change (year to year). Coloured bars indicate increases (red)/decreases (yellow) larger than 30 percent of previous year country total catch and more than 30 percent of the average regional increase (37 512 tonnes)

The fishery shows a rise to a maximum of 89 000 tonnes in 1987 with a decline to 2002 and an increase to 2006 all with considerable year-on-year variation (Figure 13).

Species composition

No useful analysis.

Comments

The majority of the catch comes from Lake Malawi where successive stocks have come under exploitation. The lake has been well studied by a number of FAO and bilateral projects and its history of successive fishing down of various cichlid species flocks is well known (see for example Turner, 1999).

Four changes were above 30 percent of the previous year, corresponding to a total of 28 200 tonnes (Figure 13). Of these changes, one (12 700 tonnes) was of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **A**

4.4.4 Rwanda

Rwanda reported a flat catch-time line with a sustained steep increase for 1996 onwards to 9 000 tonnes in 2007 (Figure 14).

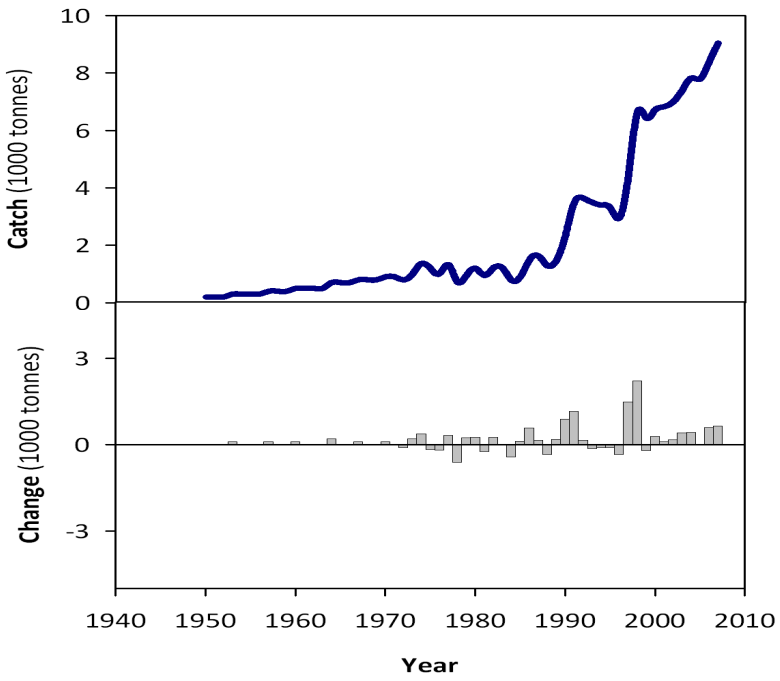

Figure 14. Catch history in Rwanda 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

The present level of production reported is not unreasonable considering the resources in the country (Lake Kivu and many minor lakes).

Eleven changes were above 30 percent on the previous year, corresponding to a total of 7 623 tonnes (Figure 14). These changes were not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **B**

4.4.5 Tanzania

The main water bodies in Tanzania are situated in the rift valley and the Great Lakes. However, some minor river flow to the East Coast and discharge into the Indian Ocean.

Main water bodies

- Lake Tanganyika (Part – 13 500 km^2)
- Lake Victoria (Part – 33 700 km^2)
- Lake Nyasa/Malawi (Part – 5 569 km^2 area accessible to Tanzania)
- Numerous small lakes and reservoirs

Nominal catches

The nominal catches for Tanzania are shown in Figure 15 and the catch levels rise steadily to 1990, since when they have fluctuated around a mean of about 300 000 tonnes.

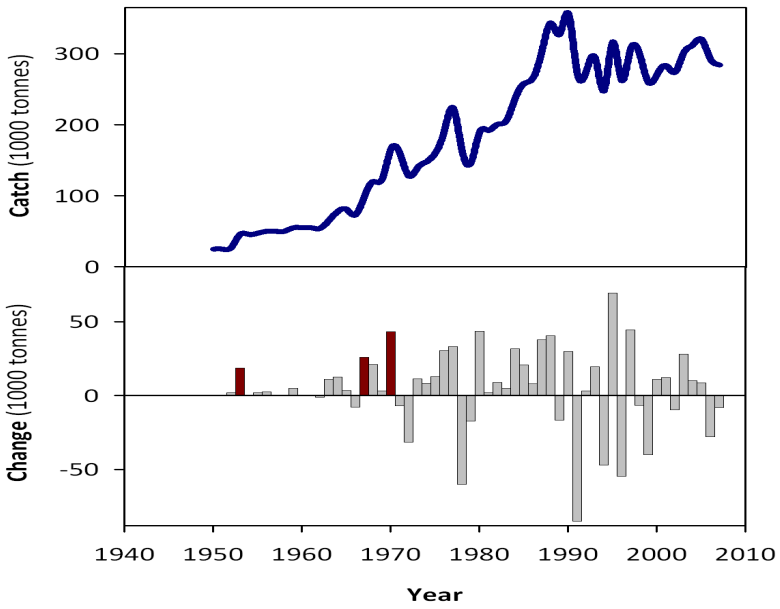

Figure 15. Catch history in Tanzania 1950–2007 as total catch and change (year to year). Coloured bars indicate increases (red)/decreases (yellow) larger than 30 percent of previous year country total catch and more than 30 percent of the average regional increase (37 512 tonnes)

Species composition

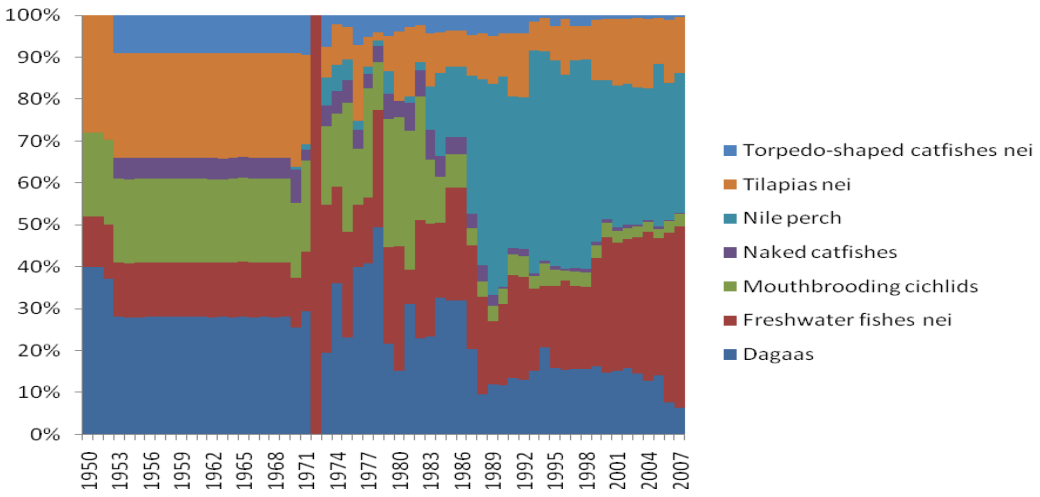

Figure 16. Species records from Tanzania

Species composition

The species data (Figure 16) shows the rise of Nile perch, particularly in Lake Victoria. It also shows a decline in dagaa species, presumably because of shortfalls in Lake Tanganyika as catches of dagaa are rising in Lake Victoria. There is also a rise in species nei (not elsewhere indicated).

Comments

The catch figures appear reasonable given the extent of the Tanzanian inland water resources and what is know from recent studies of the evolution of the fisheries of the largest (Lake Victoria – see also Table 3).

Three changes were above 30 percent on the previous year, corresponding to a total of 87 800 tonnes (Figure 15). All of these changes were of the magnitude equivalent to more than 30 percent of the average regional.

Confidence level: **A**

4.4.6 Uganda

Main water bodies

Uganda is exceptionally rich in lakes but has few river resources. Its major fisheries are:

- Lake Victoria (Ugandan part – 31 000 km^2)
- Lake Albert (Ugandan part – 6 270 km^2)
- Lake Edward (Ugandan part – 670 km^2)
- Lake George – 250 km^2
- Kyoga Lake complex 4 716 km^2 including both lakes and swamps
- Minor lakes – numerous
- Victoria and Albert Nile (Ugandan part – 605 km)

The Lake Victoria fishery is the major single fishery in Africa although it is shared between the three riparian countries – Kenya, Tanzania and Uganda. This fishery has been well studied first by the East Africa Freshwater Fishery Research Organization (EAFFRO) then a series of United Nations projects and more recently by two European Union (EU) funded projects to assess the fishery through catch assessment surveys, trawl surveys and acoustic surveys. Work on the lake continues through the Lake Victoria Fisheries Organization as well as national fishery departments. In addition, Uganda also has a number of other lakes some of which are of significant size. In most of these the fisheries have not been assessed to any great degree.

Nominal catches

The nominal catches for Uganda are shown in Figure 17. Catches in Uganda follow the general trends of the other riparian countries of Lake Victoria (Kenya and Tanzania) until 2003, subsequent to which increases in catch of nearly 200 000 tonnes are reported. We know from project work and Lake Victoria Fisheries Organization records that the Lake Victoria fisheries were beginning to decline at this time.

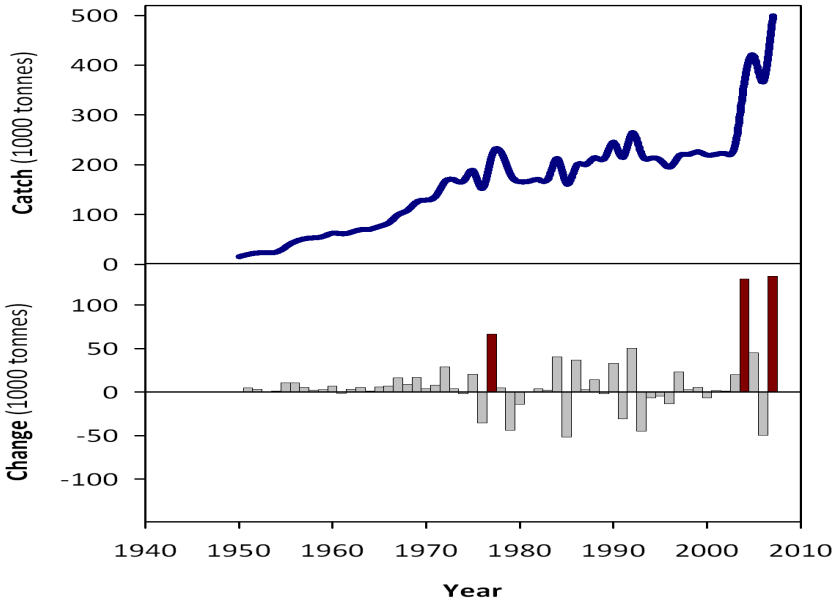

Figure 17. Catch history in Uganda 1950–2007 as total catch and change (year to year). Coloured bars indicate increases (red)/decreases (yellow) larger than 30 percent of previous year country total catch and more than 30 percent of the average regional increase (37 512 tonnes)

Species composition

Recording by species (Figure 18) is reasonable and reflects the changes indicated by the studies. However, they fail to record the increase in catches of the small pelagic cyprinid *Ratrineobola* also know in the lake as "dagaa" or "mukene" recorded by the Lake Victoria Fisheries Organization (see Figure 19). Failure to distinguish among water bodies makes it difficult to interpret these data.

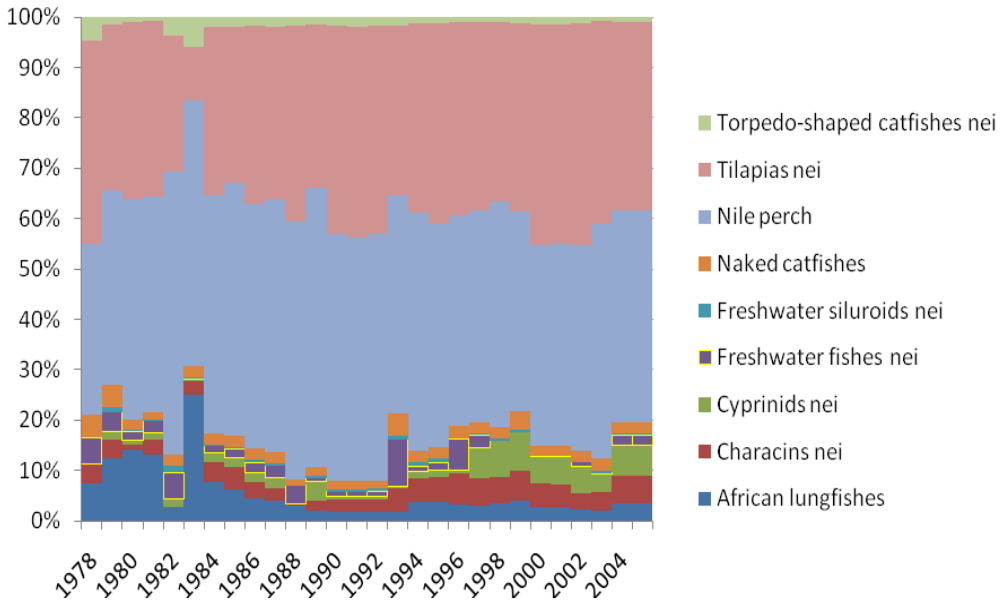

Figure 18. Species records from Uganda

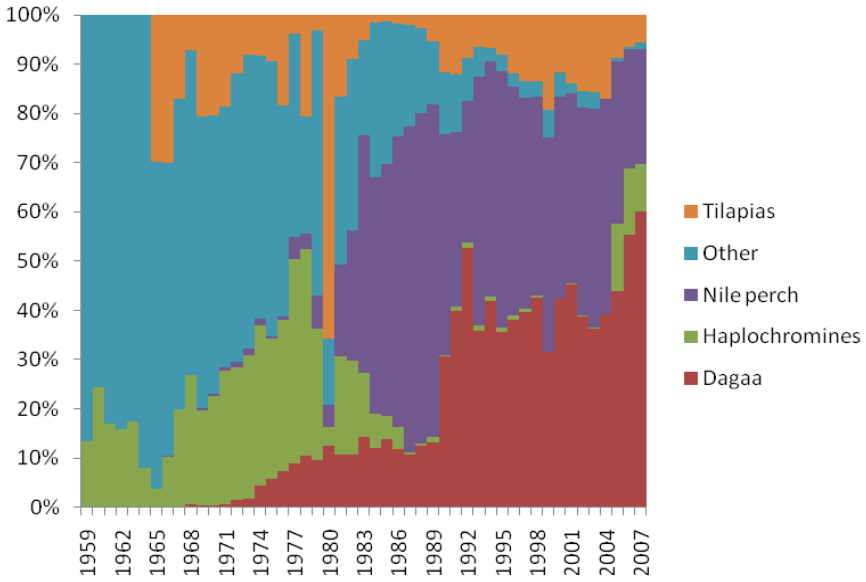

Figure 19. Species records from Lake Victoria showing growth in 'Mukene' *Rastrineobola argentea* catches as a proportion of total catches

Comments

Conclusions from the Uganda figures are that they improve after 1968 due to project support. The trends in catch agree with results of UN and EU projects and the reporting of species abundance indicates changes in fishery. However, dagaa (mukene) and haplochromine fisheries are possibly under reported. The question remains as to why Uganda is the only one of the Lake Victoria countries to record increases in catch 2002–2005. However, there are severe discrepancies between the Lake Victoria Fisheries Organization figures for Nile perch catches from Lake Victoria (Table 2) and those reported by the Uganda Government. The catches in Table 2 are from the three countries, but those of Kenya and Tanzania are consistent with these trends and are the only source of Nile perch reported in those countries, thus the discrepancies must arise from Uganda. Maybe this is because of improved recording as a result of the various projects or maybe new figures are being reported from the fisheries of the other lakes such as Kyoga or Albert (see Table 3). If this is the case the magnitude of the reported catches seems high in the light of previous studies on those lakes (see Vanden Bossche and Bernacsek, 1990). Although Olssen in her draft report suggests that catches of up to 185 000 tonnes of dagaa are now being landed in Lake Albert the increases in catch by Uganda since 2002 are being reported as Nile perch. Furthermore, doubts are being expressed in the press as to the viability of the mukene fishery because of the damage it is causing other species. The annotation in the FAO Yearbook of Fishery Statistics 2005 that the increased catch is due to improved coverage of the data collection system acknowledges the increase but does not fully account for it. Furthermore, the combined catches reported by Olssen (625 000 tonnes) amount to more than the 500 000 tonnes reported in the nominal catch statistics for the same year (2007).

Six changes were above 30 percent on the previous year, corresponding to a total of 355 800 tonnes (Figure 17). Of these changes three were of a magnitude equivalent to more than 30 percent of the average regional increase. The total of these changes was 329 700 tonnes.

Table 3. Catches of Nile perch from Kenya, Tanzania and Uganda compared with those from Lake Victoria (Lake Victoria Fisheries Organization)

Year	FAO FishStat Total	Lake Victoria Fisheries Organization Total	Difference
2000	287 072	199 068	-88 004
2001	263 415	247 166	-16 249
2002	241 130	227 947	-13 183
2003	266 479	227 947	-38 532
2004	312 036	227 947	-84 089
2005	351 851	268 152	-83 698
2006	305 546	264 069	-41 476
2007	352 918	233 941	-118 977

Table 4. Uganda catches by waterbody (after Olssen 2009)

Water body	Recorded catch
Lake Victoria	255 000
Lake Kyoga	70 000
Lake. George	15 000
Lake Edward	15 000
Lake Albert	205 000
Smaller lakes	35 000
River/floodplains	30 000
TOTAL	625 000

Confidence level: **A** until 2000; **B** after

4.5 Southern Africa

Zambezi system, Lakes Kariba and Cahora Bassa, Okavango and other river systems. This zone consists of a series of rivers and reservoirs that are subject to climatic variations similar to those in the Sahel and are particularly associated with the southern hemisphere climate osculation related to the "El Niño" cycle.

4.5.1 Angola

Main water bodies

There are no large lakes in Angola, but there are numerous smaller bodies of water associated with the floodplains of river systems in the south and east of the country.

The country is, on the whole, well watered by rivers draining the central highland plateau which may be assigned to five main basins corresponding to zoogeographical regions:

(a) The Zaire River basin, where major tributaries include the Kasai and Kwango Rivers;
(b) The Zambezi River basin with the headwaters of the Zambezi and its tributaries and Lungue and Cuando Rivers, with some 20 000 km^2 of floodplain;
(c) The Okavango River basin, with the Cuito and Cubango Rivers;
(d) The northern coastal rivers, chief of which is the Cuanza River; and
(e) The Cunene River basin, including 15 000 km^2 of the Ovambo floodplain.

The major river channels total over 10 000 km in length and there are a large number of small lakes and impoundments; the largest being at Gove (140 km^2) on the Cunene, and Kiminha (50 km^2) on the Bengo. Additionally, several large reservoirs are projected for the future.

Nominal catches

The nominal catches for Angola are shown in Figure 20 and show that a sharply rising trend in catch has been reported since 2001, reaching 15 000 tonnes in 2007.

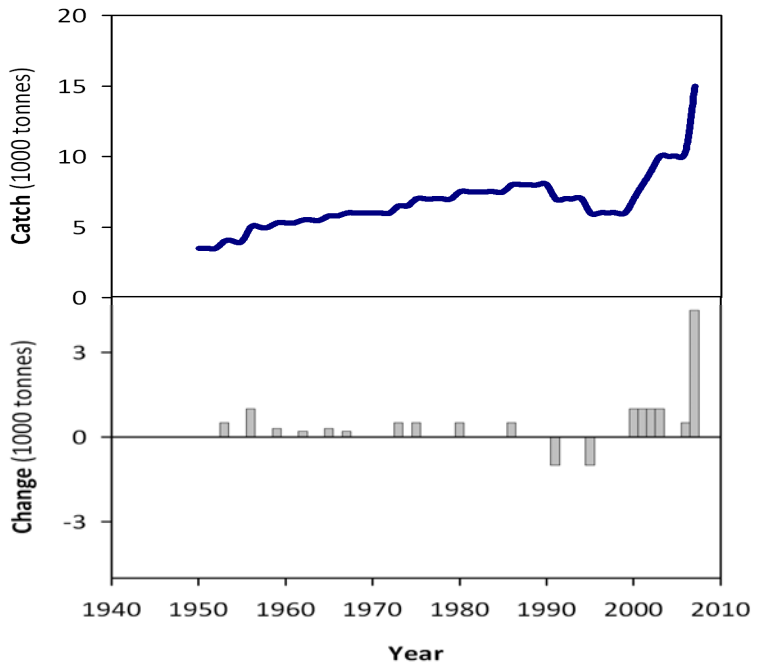

Figure 20. Catch history in Angola 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

Species composition

No breakdown by species has been reported.

Comments

The nature of the curve drawn from the reported data implies sporadic reporting based on poor collection of data. Given the extent of the inland aquatic resource in Angola the estimate is probably low, although it is recognized that access to many areas may be hampered by landmines and security. There appears to be considerable potential for expansion of fisheries in the country.

There was one change above 30 percent on the previous year, corresponding to a total catch of 4 500 tonnes of (Figure 20). This change was not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **C**

4.5.2 Botswana

Statistics reported by Botswana indicate a slow rise to 1993 and a subsequent decline to 443 tonnes (Figure 21).

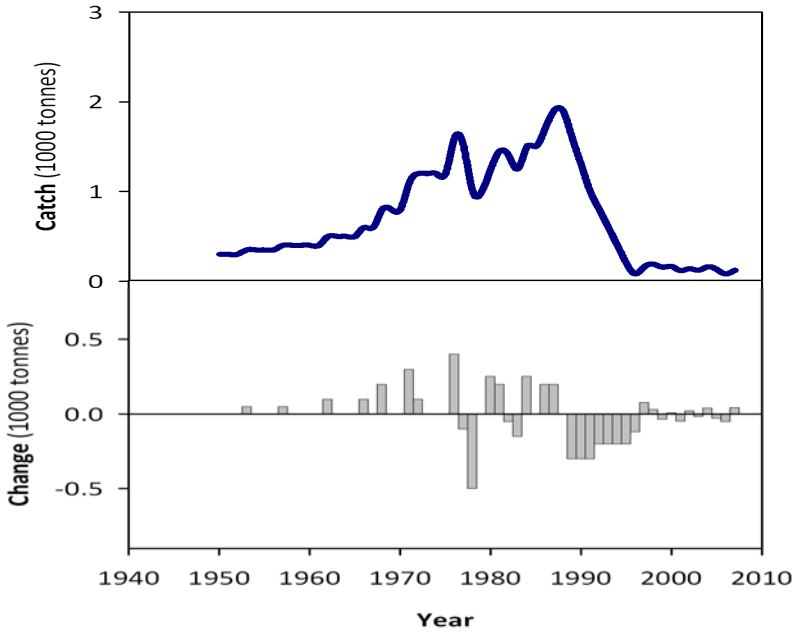

Figure 21. Catch history in Botswana 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

A much greater yield than the 400 tonnes reported would be expected from an aquatic environment as large as the Okavango swamps.

Six changes were above 30 percent on the previous year, corresponding to a total of 1 060 tonnes (Figure 21). None of these changes was of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **C**

4.5.3 Lesotho

A slight rise in catch is reported from the beginning of records in 1989 and a subsequent slow decline to the present low level (Figure 22).

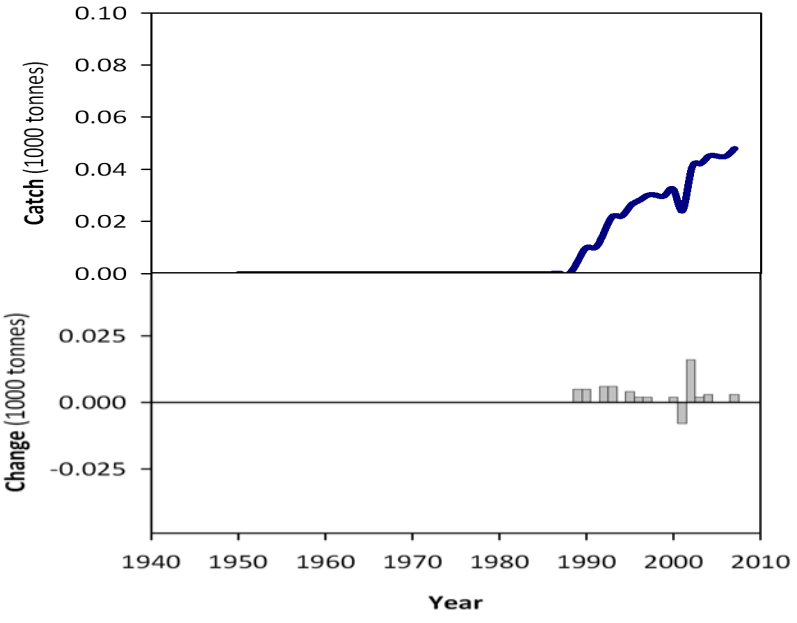

Figure 22. Catch history in Lesotho 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

The reported figures appear totally artificial.

Four changes were above 30 percent on the previous year, corresponding to a total of 33 tonnes (Figure 22). None of these changes were of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **C**

4.5.4 Mozambique

Main water bodies

- Lake Malawi (Mozambican part 6 400 km^2, 21 percent)
- Lake Chilwa (Mozambican part – 29 km^2)
- Lake Chuita (Mozambican part – 40 km^2)
- Lake Cahora Bassa (2 665 km^2)
- Zambezi River (Part)
- Many minor lakes, rivers and coastal lagoons

Nominal catches

The nominal catches for Mozambique are shown in Figure 23. A steeply rising curve until a fluctuating stabilization level of around 22 500 tonnes was reached in 2002.

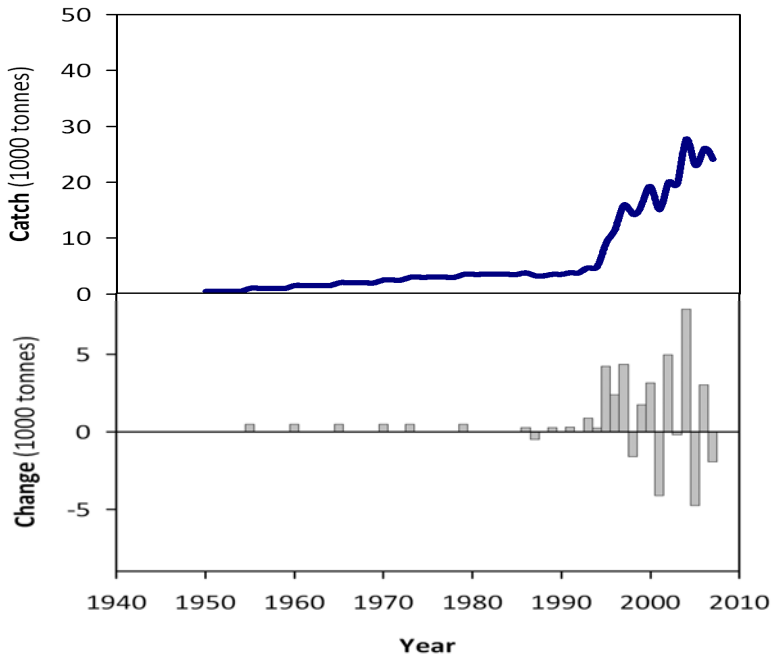

Figure 23. Catch history in Mozambique 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

Species composition

Species composition not reported, although a division between freshwater fishes nei and kapenta (dagaa) does give useful indications as to the magnitude of the catch.

Comments

There appears to be no recent information on how the inland fisheries statistics were obtained. Given the area of Mozambique and the aquatic resources the reported tonnage is probably low relative to potential values. Some indication is given by the kapenta figures which reached 18 000 tonnes in 2004 (68 percent of the catch) but have since declined to 8 000 tonnes in 2007 (representing 33 percent of the catch). As Lake Cahora Bassa, the main source of kapenta in the country, is relatively well monitored, these provide the only reasonably secure statistics.

Seven changes were above 30 percent on the previous year, corresponding to a total of 22 985 tonnes (Figure 23). These changes were not of a magnitude equivalent to more than 30 percent of the average regional increase

Confidence level: **C**

4.5.5 Namibia

There is a rise to a maximum of 3 200 tonnes in 2005 and a subsequent slight fall to 2007 value of 2 800 tonnes (Figure 24). No catch was reported prior to 1974.

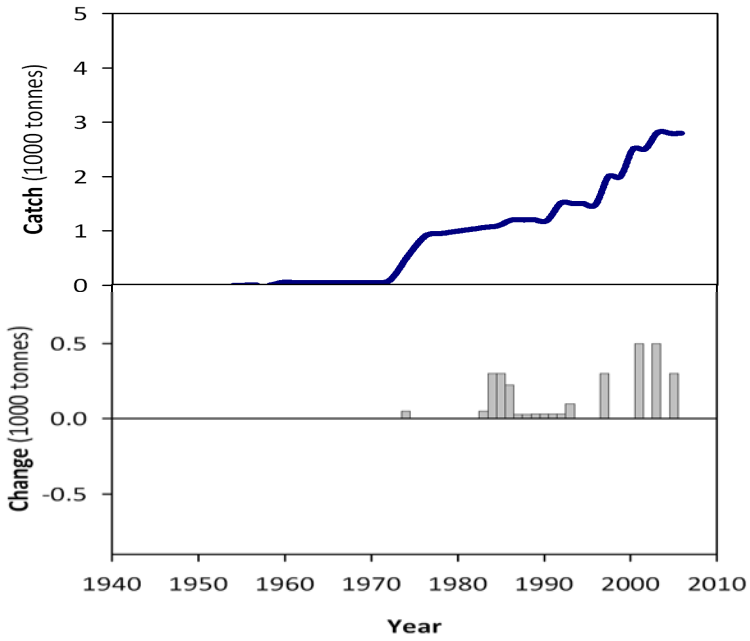

Figure 24. Catch history in Namibia 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

There appears to be no recent information on how the statistics were obtained. Despite its arid nature, Namibia has some important inland fishery resources so the present reported catch may be low.

Five changes were above 30 percent on the previous year, corresponding to a total of 1 373 tonnes (Figure 24). These changes were not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **B**

4.5.6 South Africa

A highly artificial history is reported rising to a high of 1 150 tonnes from 1970–1981 and later falling to 900 tonnes (Figure 25).

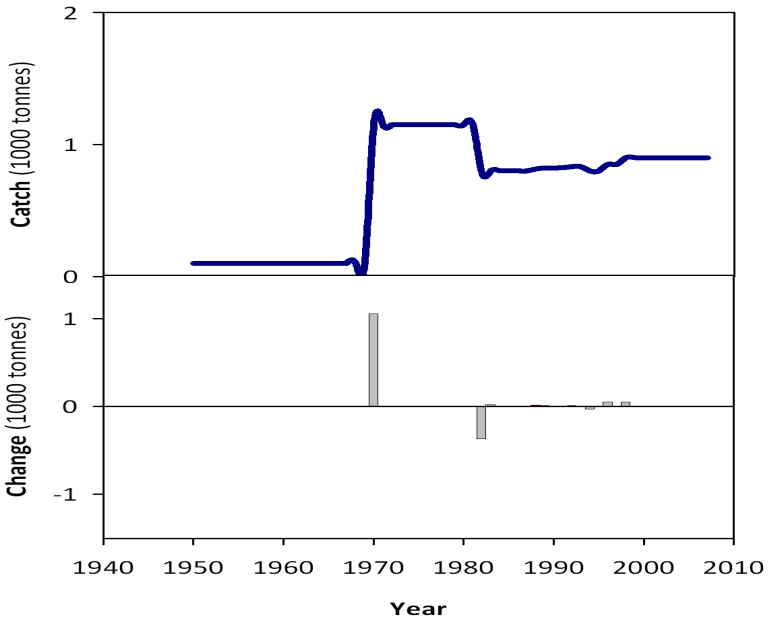

Figure 25. Catch history in South Africa 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

The reported figures appear totally artificial and are probably under reported.

One change was above 30 percent on the previous year, corresponding to 1 050 tonnes (Figure 25). This change was not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **C**

4.5.7 Swaziland

No catches were reported for Swaziland before 1977. Since that date there has been a slight rise in catch and a subsequent slow decline to the present low level of 70 tonnes/year (Figure 26).

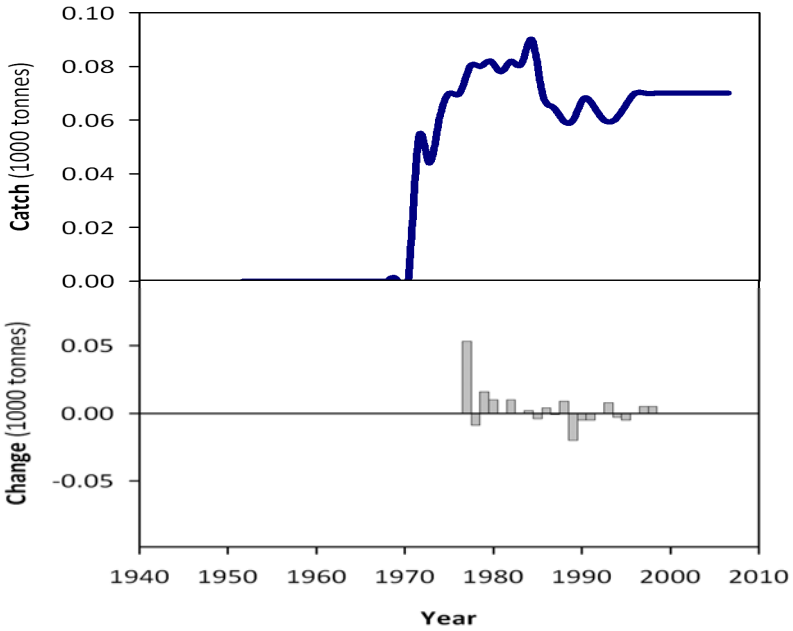

Figure 26. Catch history in Swaziland 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

The reported figures appear artificial.

One change was above 30 percent on the previous year, corresponding to 16 tonnes (Figure 26). This change was not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **C**

4.5.8 Zambia

Main water bodies

Zambia has a wide number of resources based on lakes and the Zambezi River and its tributaries. These include:

- Lake Tanganyika (Zambian part – 2 000 km^2)
- Lake Mweru (Zambian part – 2 700km^2)
- Lake Mweru Wa n'tipa (highly variable – up to 1 600 km^2 lake and 1 200 km^2 swamp)
- Bangweulu swamps and lake (highly variable Lakes 2 735 km^2; swamps and seasonal floodland 12 271 km^2)
- Zambezi River – Barotse floodplains 7 800 km^2 during floods)
- Lake Kariba (Zambian part – 2 412 km^2)
- Kafue River floodplains (4 340 km^2 when flooded and Lake ItezhiTezhi 360 km^2)
- Many minor river, lakes and reservoirs

Nominal catches

Figure 27 shows the nominal catches from 1950–2007. It is difficult to say, without further information, what the actual status of the fisheries is. The catches have been reported as rising steadily to about 70 000 tonnes in 1986 since when they have been relatively stable indicating all water bodies may be fully exploited.

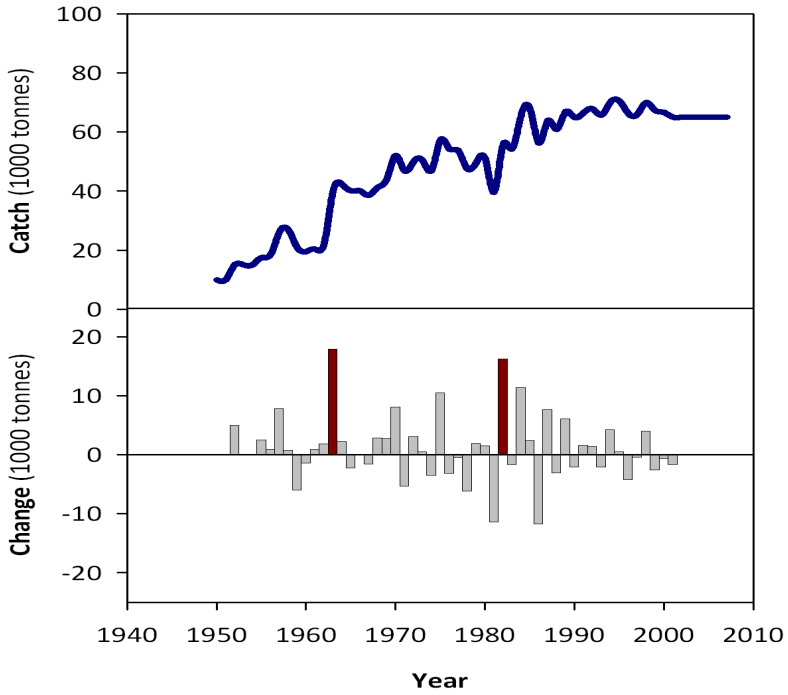

Figure 27. Catch history in Zambia 1950–2007 as total catch and change (year to year). Coloured bars indicate increases (red)/decreases (yellow) larger than 30 percent of previous year country total catch and more than 30 percent of the average regional increase (37 512 tonnes)

According to Vanden Bossche and Bernacsek (1990) catches were distributed as in Table 5.

Table 5. Zambia – catches by water body in the 1980s

Water body	Reported catch (tonnes)
Bangweulu lakes complex	11 006
Lake Mweru	7 900
Lake Mweru wa Ntipa	10 979
Lake Tanganyika	14 000
Zambezi River floodplains	5 950
Lukanga swamp	2 600
ItezhiTezhi and Kafue flats	9 300
Kariba Reservoir	3 500
Other fisheries	1 200
TOTAL	66 491

Species composition

Reporting of species composition is limited in view of lumping together of a varied fish fauna with the exception of individual reporting of kapenta (dagaa) which contributed about 13 percent of the catch in 2007.

Comments

Zambian inland fisheries have been extensively studied since the 1950s through to the 1980s by a series of bilateral and FAO/UNDP projects. These projects set up a Central Fisheries Research Institute which now does not appear to have a Web site. A Bibliography of Fisheries and Aquaculture in Zambia was produced by FAO in 1989.

Concern was already being expressed about individual stocks of fish in the 1980s with the disappearance of some larger and migrant species from some fisheries.

Trends in reporting of catches are probably good at a country level but are of little use in interpreting trends in the fisheries as no information on individual water bodies is available.

Four changes were above 30 percent on the previous year, corresponding to a total of 46 956 tonnes (Figure 27). Of these changes, two were of a magnitude equivalent to more than 30 percent of the average regional increase. The total of these changes was 34 156 tonnes.

Confidence level: **A** to 2001; **C** thereafter.

Further study and clarification of catches for individual water bodies and fisheries would be desirable.

4.5.9 Zimbabwe

A steep rise in catch to 25 000 tonnes in 1990 and a subsequent decline to 10 500 tonnes in 2007 (Figure 28).

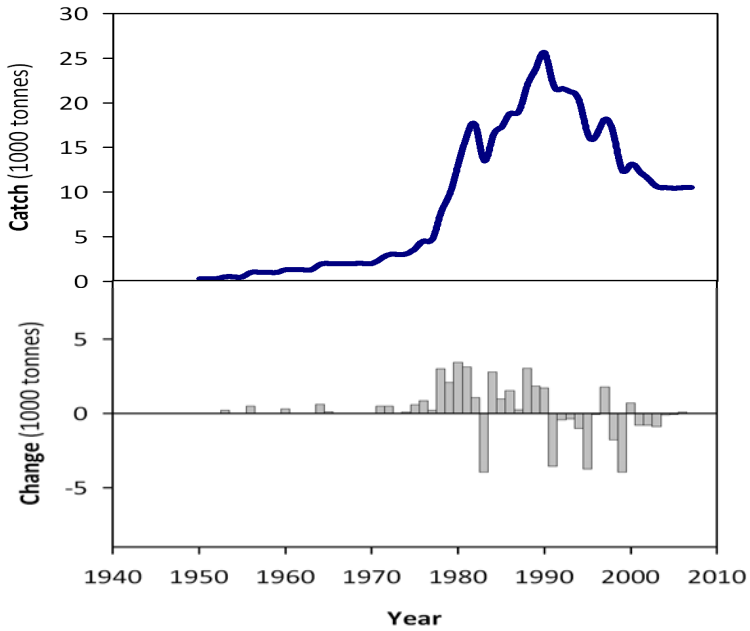

Figure 28. Catch history in Zimbabwe 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

The reported figures seem reasonable in view of the social conditions.

Five changes were above 30 percent on the previous year, corresponding to a total of 7 715 tonnes (Figure 28). These changes were not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **A**

4.6 Congo basin

Congo, Ubangi and associated river basins. Extensive river basin with some reservoirs that also borders on the great lakes to the east. The basin is climatically stable but is generally inaccessible and isolated with local security problems so is very little studied. There are rising concerns about the increasing deforestation and resulting environmental change.

4.6.1 Cameroon

Main water bodies

The northern part of Cameroon lies with the Sahel where it forms part of the Lake Chad basin so shares the concerns about periodic droughts ad water abstractions. To the South, the country forms part of the equatorial forested Congo basin.

The main water bodies are:

- Lake Chad (Cameroonian part – 1 800 km^2 during high phase at present contains about 30 percent (500 km^2 of the area remaining)
- Logone River and Yaeres floodplain (Cameroonian part – total area 6,000 km^2 in wet years. Recently much reduced due to poor rainfall and water abstraction)
- Benue River
- Sanaga and Sangha rivers. Forested rivers of relatively low productivity (about 11kg/ha (Brummett and Teugels 2004)
- Bamendjing reservoir (250 km^2)
- Lagdo reservoir (700 km^2)
- Maga reservoir (360 km^2)
- Numerous small lakes and dams

Nominal catches

The nominal catches for Cameroon are shown in Figure 29. The reported figures show a steeply rising curve since 1993 to a maximum of 74 380 tonnes in 2006.

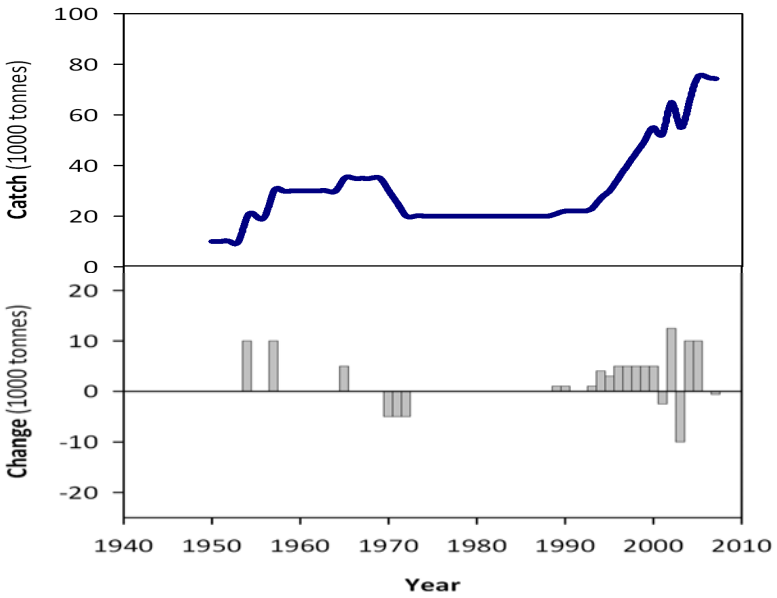

Figure 29. Catch history in Cameroon 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

Species composition

Catches are not reported by species group.

Comments

The form of the reported time series implies sporadic reporting based on poor collection of data. Furthermore it is difficult to reconcile the rapidly increasing catches from the 1990s with the situation in the North of the country. Historically, much of the Cameroonian catch has come from Lake Chad and the associated Chari/Logone system and its floodplains. All of these have been negatively affected by the Sahelian drought, by water abstractions for irrigation and by the operations of the Maga dam.

Thirteen changes were above 30 percent on the previous year, corresponding to a total of 71 969 tonnes (Figure 29). Of these changes, one (17 255 tonnes) was of a magnitude equivalent to more than 30 percent of the average regional increase. There was one negative change that was significant at the regional level.

Confidence level: **C**

4.6.2 Central African Republic

Central African Republic lies within two regions. To the North it forms part of the Sahelian Chad basin. To the South it lies in the extensive headwater basin of the largest tributary of the Congo system, the Ubangi, which covers the majority of the country.

Main water bodies

North flowing rivers:

- Bahr Aouk
- Bar Kameur
- Ouham River

Congo basin rivers:

- Bangui (Ubangi) River and numerous tributaries
- Kotto River
- Sangha River

Nominal catches

The catch-time line shows a stepwise increase with few fluctuations to 15 000 tonnes in 2007 (Figure 30).

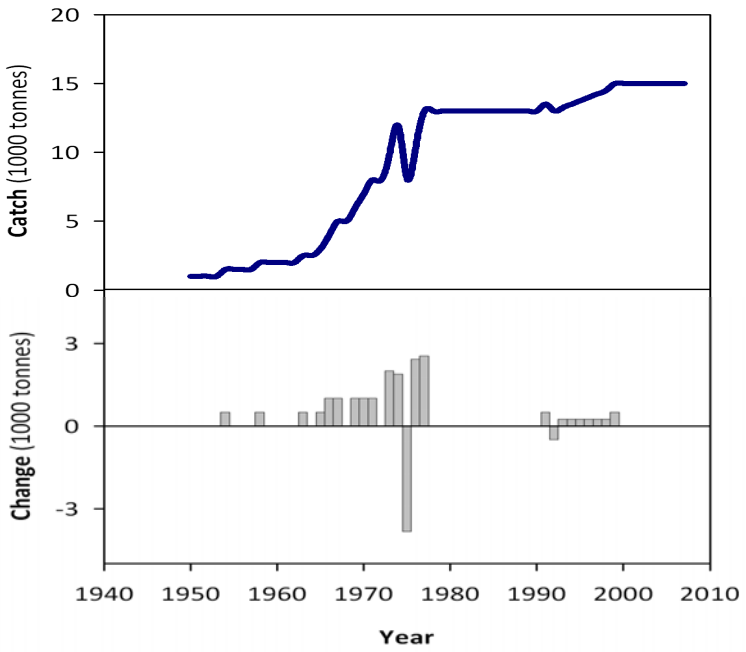

Figure 30. Catch history in Central African Republic 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

Species composition

Central African Republic do not report catches by species or species groups.

Comments

The fisheries of this area were studied by FAO in the 1990s. The stepwise form of the time-catch line and constant values over several years leads to the suspicion that statistics are submitted sporadically and are not well collected. However, the figures reported are within the range given in Vanden Bossche and Bernacsek(1990) and are even somewhat lower than the estimated potential.

Four changes were above 30 percent on the previous year, corresponding to a total of 4 421 tonnes (Figure 30). These changes were not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **C**

4.6.3 The Democratic Republic of the Congo

Main water bodies

The Democratic Republic of the Congo lies across the equator and includes a wide range of waters. It has the most extensive inland water system in Africa including:

- Lake Albert (Congolese Part – 2 420 km^2 – 46 percent)
- Lake Edward (Congolese Part – 1 630 km^2 – 71 percent)
- Lake Kivu (Congolese Part – 1 370 km^2 – 58 percent)
- Lake Tanganyika (Part – 14 800 km^2 – 45 percent)

- Lake Mweru (Congolese part 1 950 km^2 – 42 percent)
- Lake Tumba (765 km^2)
- Lake Upemba (530 km^2)
- Flooded forests (37 870 km^2 permanent and 22 800 seasonal))
- Congo and Ubangui Rivers: mainstem (17 000 km^2) and tributaries (17 000 km^2)

Nominal catches

The nominal catches for the Democratic Republic of the Congo are shown in Figure 31. A slowly rising and fluctuating curve was recorded, reaching a plateau at about 230 000 tonnes since 2001.

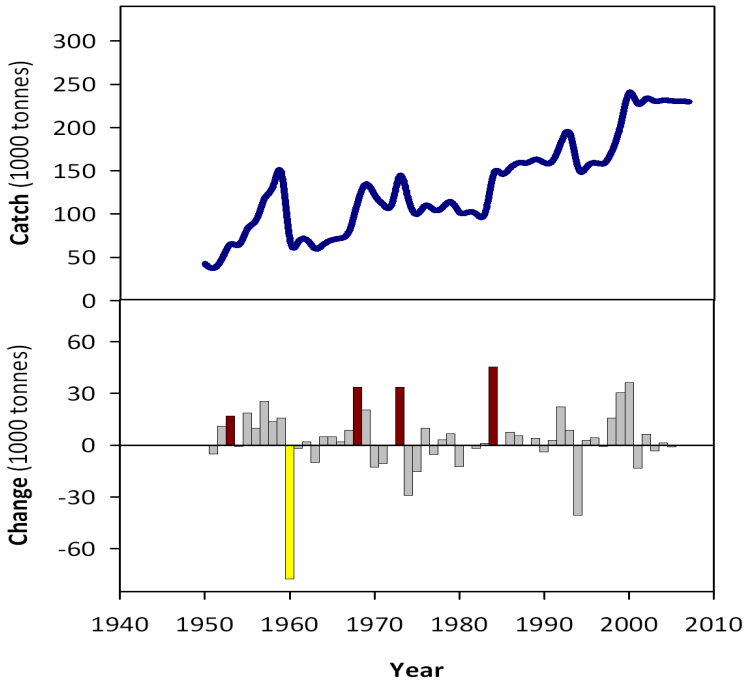

Figure 31. Catch history in the Democratic Republic of the Congo 1950–2007 as total catch and change (year to year). Coloured bars indicate increases (red)/decreases (yellow) larger than 30 percent of previous year country total catch and more than 30 percent of the average regional increase (37 512 tonnes)

Species composition

Catches are not reported by species group.

Comments

The situation regarding statistics collection in the Congo basin is far from clear so it is difficult to say how these figures were derived. It appears that because of its inaccessibility and low security much of the country has not been studied and thus represents one of the major unknown areas in the continent. In view of the extent of the aquatic resource, the nominal figures may well be low, particularly as the Congo is a river in a similar class to the Mekong or the Amazon who's potential and actual catches are estimated to be much higher. Some of the lake estimates may also be low. For example Uganda is reporting 180 000 tonnes of *Mukene* as being caught from Lake Albert, but no similar quantity is reported a being landed in Congo.

Four changes were above 30 percent on the previous year, corresponding to a total of 129 219 tonnes (Figure 31). All of these changes were also equivalent to more than 30 percent of the average regional increase. There was one negative change that was significant at the regional level.

Table 6 gives the catches from the various water body types as given by Vanden Bossche and Bernacsek (1990).

Table 6. The Democratic Republic of the Congo – catches by water body type in the 1980s

Water body type	Annual catch (min)	Annual catch (max)
Lakes	42 525	60 625
Floodplain forests	12 000	13 000
Reservoirs	3 220	3 430
Rivers	77 500	105 000
TOTAL	130 000	180 000

Confidence level: **C**

4.6.4 The Republic of the Congo

Main water bodies

- Cuvette Congolaise marshlands 45 000 km^2 shared with Congo, Democratic Republic
- Numerous large rivers associated with the swamp system including the reaches of the Congo, Ubangui, Sangha, Likouala and Likouala aux herbes
- Numerous small lakes
- Conkouati, Loubi and Malonda coastal lagoons

Nominal catches

The nominal catches for Congo are shown in Figure 32 as a sustained gradual rise in reported catch until 1986, a sharper rise until 1991 and an irregular rise with some fluctuation to 30 120 tonnes in 2005 and thereafter declining until 2007.

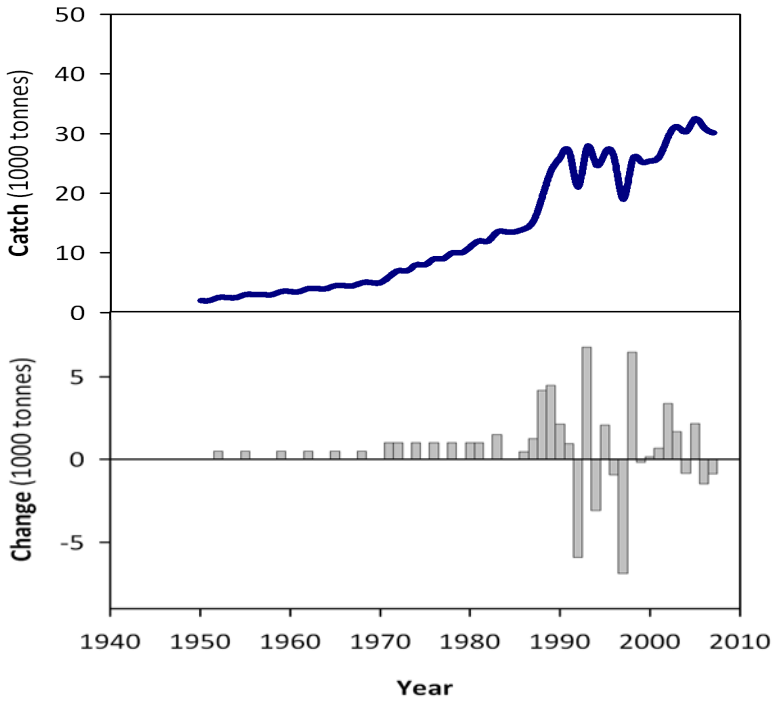

Figure 32. Catch history in the Republic of Congo 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

Species composition

Catches are not reported by species group.

Comments

FAO surveyed the fisheries of the Congo Republic in the early 1990s mainly by market surveys in Brazzaville. The fisheries resources of the Cuvette Congolaise are very poorly studied so their potential is unknown. However, even at yield levels as low as 10 kg/ha this resource should produce 45 000 tonnes/year so the recorded catches here may be low. The resource is located in a highly inaccessible area with very low population densities so difficulties may be experienced in transferring any catch to markets. Equally the area is very difficult to sample and to collect statistical catch records so the main source of information will probably remain the marketing infrastructure.

Two changes were above 30 percent on the previous year, corresponding to a total of 13 269 tonnes (Figure 32). These changes were not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **C**

4.6.5 Gabon

There was a steep rise in catches from 1993 onward to about 10 000 tonnes and fluctuations about that value thereafter to 9 500 tonnes in 2007 (Figure 33).

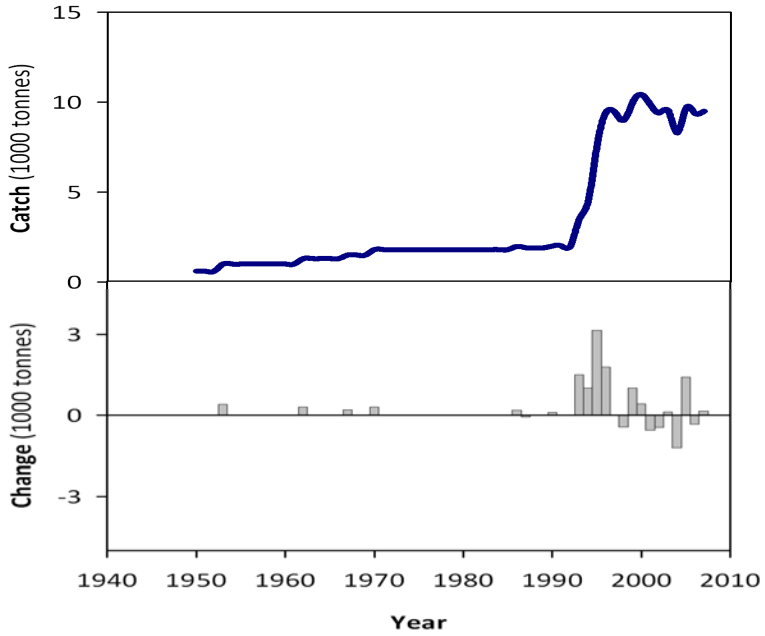

Figure 33. Catch history in Gabon 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

There is no information on origin of the Gabon statistics, although overall level of catch suggests reasonable reporting.

Three changes were above 30 percent on the previous year, corresponding to a total of 5 048 tonnes (Figure 33). These changes were not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: Before 1992 **C**; after **B**

4.7 Sahelian rivers and lakes

The major waterbodies in this ecoregion are *Niger, Senegal, Chari, Logone Rivers* and *Lake Chad.* Rivers and lakes in this area are subject to great year-to-year variations in precipitation with prolonged dry periods interspersed with wetter years. This is associated with the Atlantic Multidecadal Oscillation. Figure 34 illustrates years of above and below average rainfall in the Sahel

region. This shows that the earlier years (1950–1970 were relatively wet but there has been a prolonged shortfall in precipitation from 1970 onwards.

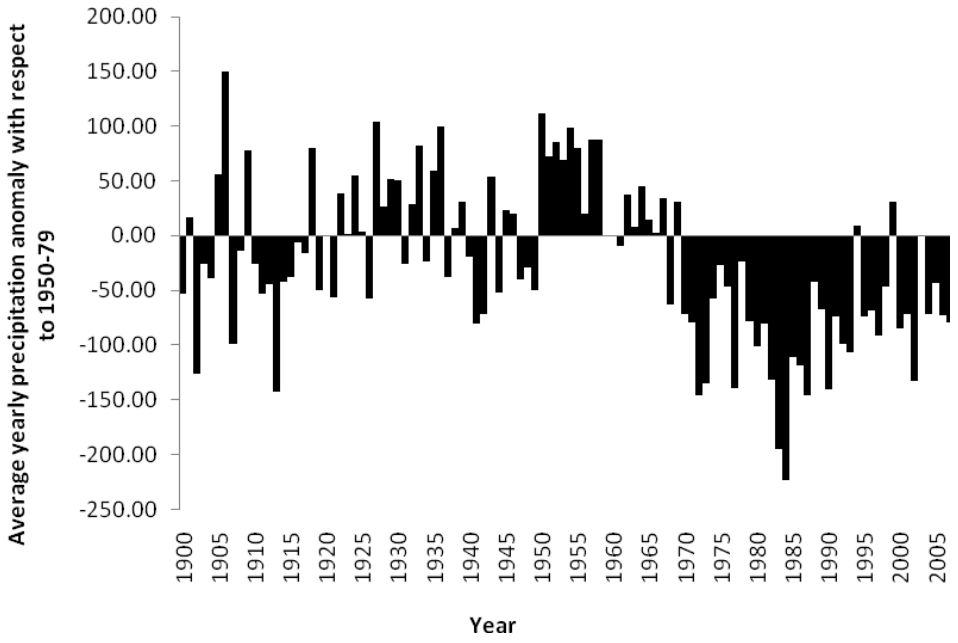

Figure 34. Years of above and below average rainfall in the Sahel region based on deviations from 1950–2008 mean (source http://jisao.washington.edu/data/sahel/)

The general drying out of the climate and the abstraction of water for agriculture means that many notable hydrological features are disappearing. This includes some large floodplains such as the Yaeres in Chad and Cameroon and some floodplain lakes in the central delta of the Niger, such as Lake Faguibine. Most extreme of these is the desiccation of Lake Chad which has declined in area from 26 000 km^2 in the 1960s to 1 500 km^2 in 2000 and 1 425 in 2003 (Figure 35).

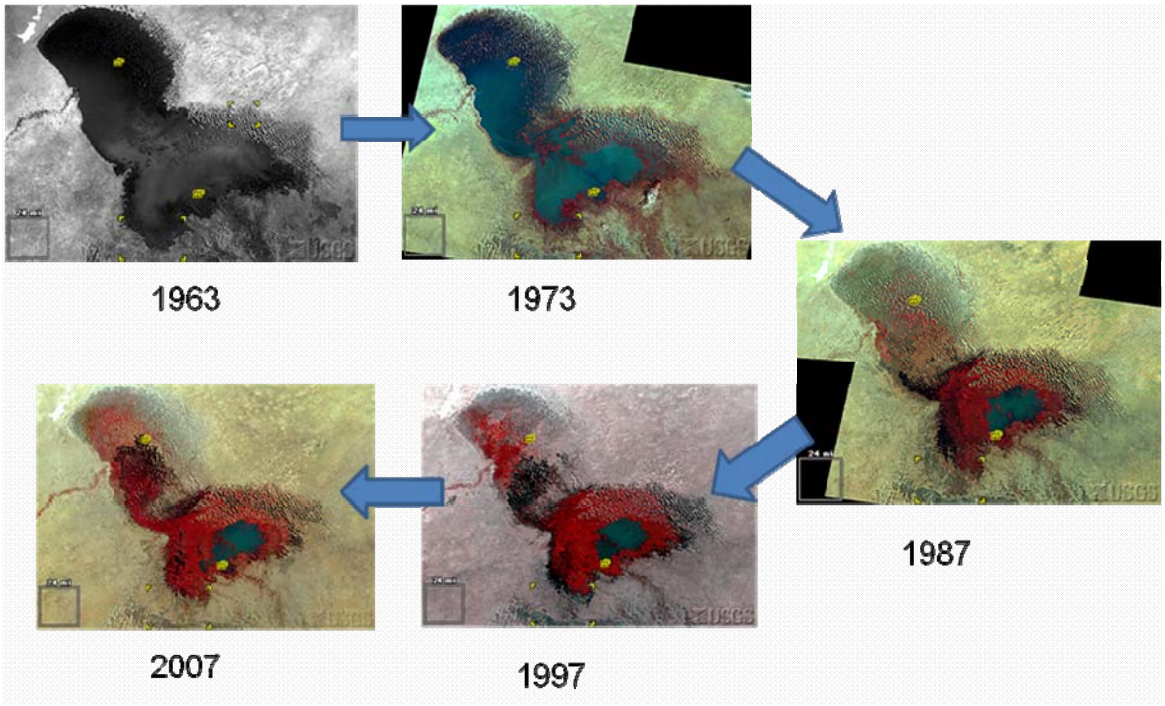

Figure 35. Evolution of Lake Chad 1963–2007

4.7.1 Burkina Faso

A steady rise in production was recorded to 10 200 tonnes with some year-to-year fluctuations over the whole reporting period (Figure 36).

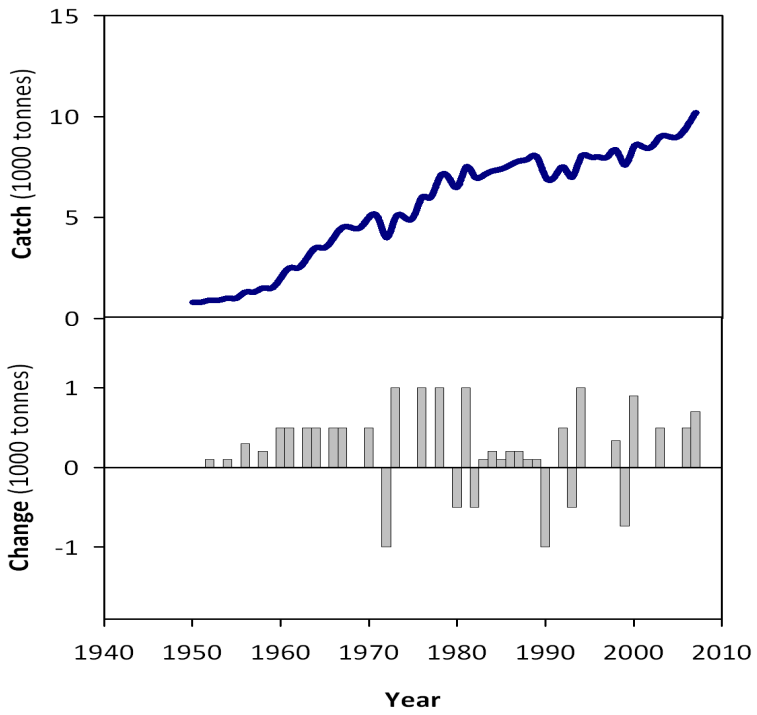

Figure 36. Catch history in Burkina Faso 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

The steady rise in catch is difficult to account for given the limited nature of the aquatic resource and the fact that Burkina lies within the Sahelian area. Maybe there has been some enhancement of the reservoir fisheries following FAO projects.

One change was above 30 percent on the previous year corresponding to a total of 4 500 tonnes (Figure 36). This change was not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: C

4.7.2 Chad

Main water bodies

The main resources of Chad are:

- Lake Chad (Chadian Part – 11 000 km^2 [50 percent] during the high Chad phase when the water level was higher than today; about 1 000 km^2 [70 percent] during the present low water phase
- Logone River and Yaeres floodplains (4 600 km^2) shared between Chad and Cameroon)
- Chari River, its tributaries the Bahr Salamat and Bahr Aouk and floodplains (about 90 000 km^2 during wet years probably considerably reduced during drought years)

Nominal catches

The nominal catches for Chad are shown in Figure 37. Catches from Chad are highly variable and rose steadily to about 80 000 tonnes in 1977, fell abruptly to about 30 000 tonnes in 1982. They increased once again to a peak of 100 000 tonnes in 1996 and have oscillated around 70 000 tonnes since.

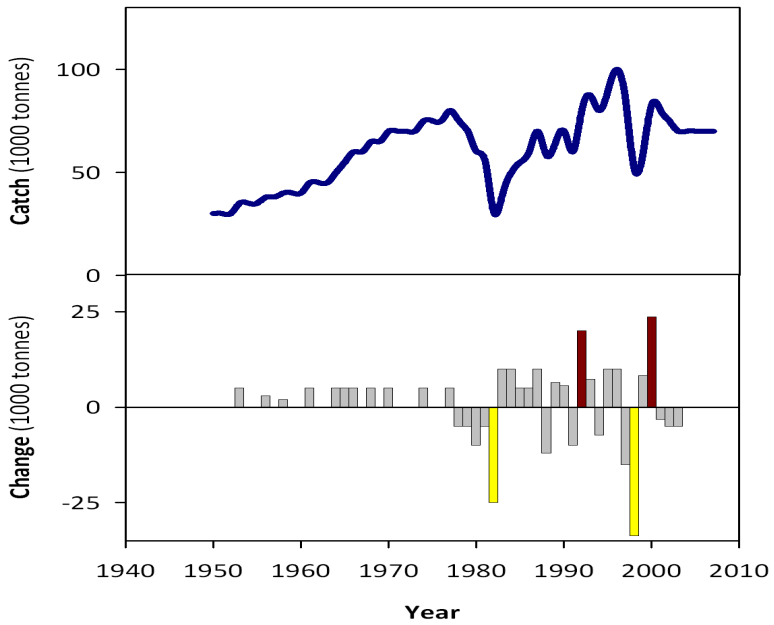

Figure 37. Catch history in Chad 1950–2007 as total catch and change (year to year). Coloured bars indicate increases (red)/decreases (yellow) larger than 30 percent of previous year country total catch and more than 30 percent of the average regional increase (37 512 tonnes)

Species composition

Catches are not reported broken down by species.

Comments

The trends in catch statistics are difficult to explain. The initial rise to 1977 is consistent with the increases in catch associated with the shrinking of Lake Chad during the 1970s drought as is the collapse in catch in 1982. What is less easy to explain is the subsequent rise in catch during a period when the Lake continued to shrink and the Yaeres floodplain became increasingly desiccated. More information is needed on the current situation of the Lake Chad fishery and of the associated floodplains.

Three changes were above 30 percent on the previous year, corresponding to a total of 53 600 tonnes (Figure 37). Of these changes, two were of a magnitude equivalent to more than 30 percent of the average regional increase representing a total of 43 600 tonnes. There were two negative changes that were significant at the regional level.

Confidence level: **A** to 1983; **C** thereafter

4.7.3 Mali

Main water bodies

The fisheries of Mali are based mainly on

- The Central Delta of Niger (minimum area 3 500 km^2. Flooded area between 25 000 and 54 000 km^2)
- Niger River and its upstream tributaries
- Selingue reservoir (409 km^2)
- Manatali reservoir (600 km^2)

In general much concern is expressed in the press and Internet on the future of fisheries in the Upper Niger.

Nominal catches

The nominal catches for Mali are shown in Figure 38. Catches have fluctuated considerably over the period reaching a maximum of 132 000 tonnes in 1996.

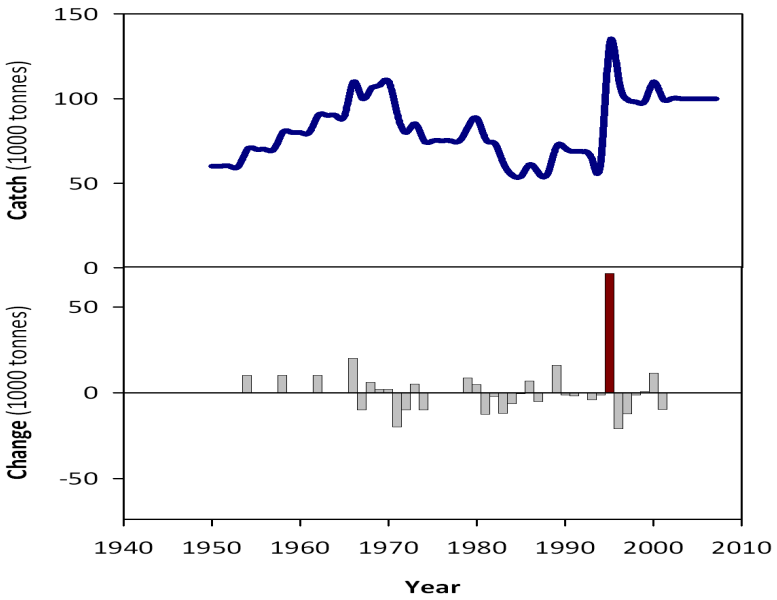

Figure 38. Catch history in Mali 1950–2007 as total catch and change (year to year). Coloured bars indicate increases (red)/decreases (yellow) larger than 30 percent of previous year country total catch and more than 30 percent of the average regional increase (37 512 tonnes)

Species composition

Reporting by species (Figure 39) has maintained a strict proportionality throughout the whole period and indicates that proper data has not been collected. There is, for example, no indication of the changes in species composition from floodplain spawning species to river channel spawning species, and the disappearance from the catch of some larger species that are recorded as having occurred by the ORSTOM projects (Lae, 1995). Data on species lengths in the catch reported on the Observatoire de la Pêche dans le Delta Interieur du Niger (Figure 40) shows that catches are still of small size fish and species with some 70 percent being below 17 cm corresponding to year 0+ fish.

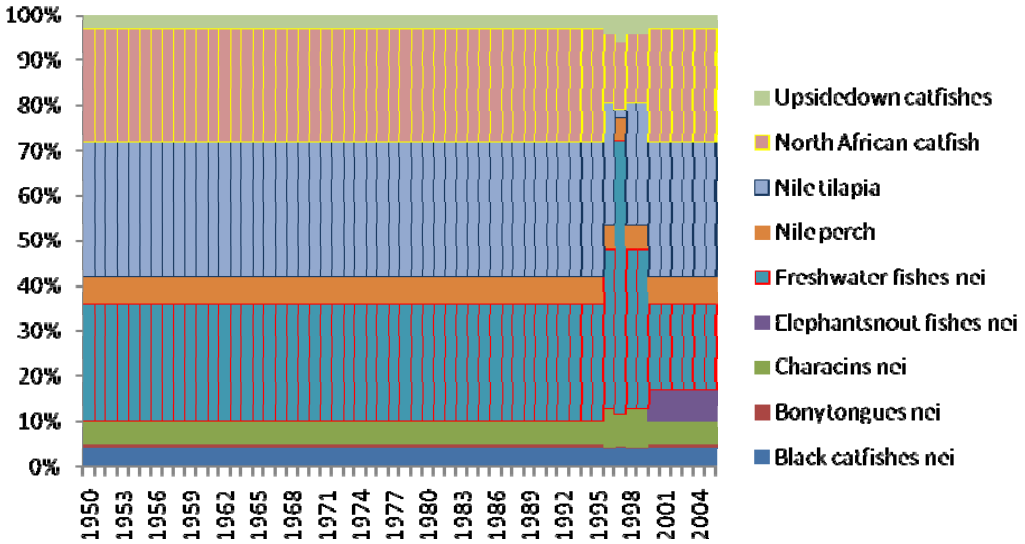

Figure 39. Species composition as reported in Mali nominal catches

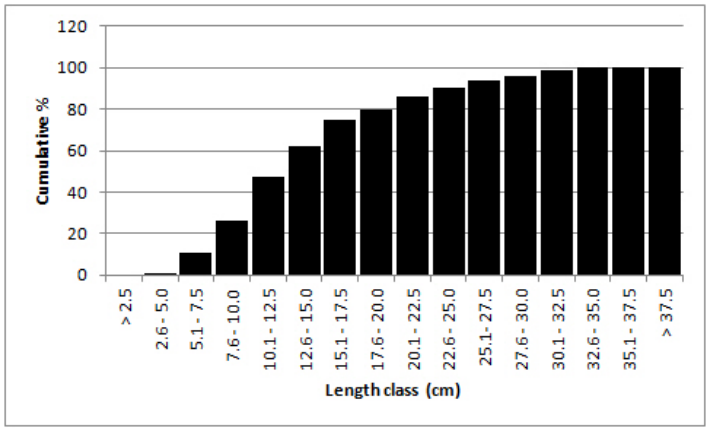

Figure 40. Length frequencies of all species reported by the Observatoire de la pêche dans le delta intérieur du Niger from the catches in Mopti

Comments

The fisheries of the Central delta were studied extensively by a series of French (ORSTOM and IRD) projects from the 1950s to the 1990s. The ORSTOM project (Quensiere ed., 1994) found that:

- The fish population was very heavily fished
- A large proportion of the catch consisted of 0+ fish
- There was a strong correlation between flooding and catch with greater catches following years of heavy flooding
- There were radical changes in year-to-year species composition in response to flood strength

The catch history reflects movements in hydrology until 1990 (Figure 41) so it is possibly a clear indicator of trends to that date. However, recent records of sustained high catch are not fully consistent with continued low precipitation and the constant reporting of 100 000 tonnes/year from 2001 indicate breakdown in data collection and reporting. Furthermore the reported species composition is strictly proportional throughout, indicating recording deficiencies.

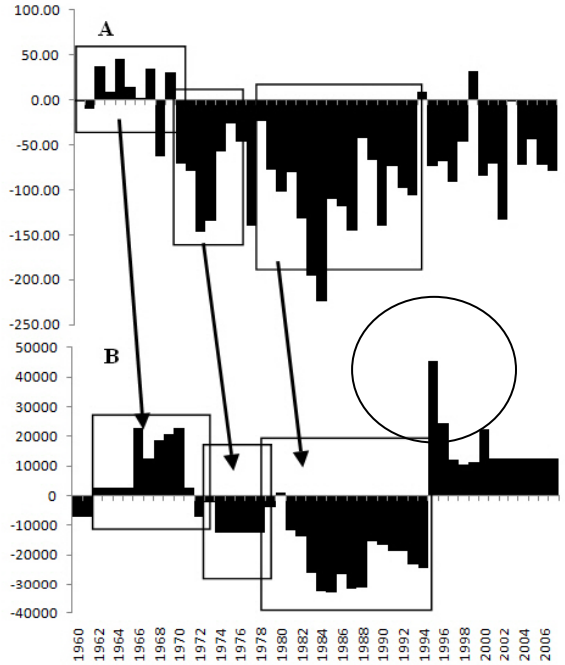

Figure 41. Comparison of fish catch and rainfall between 1960 and 2007. A. Years of above and below average rainfall in the Sahel region – relative to 1950–2008 mean. B. Years of above and below average catch – relative to the 1960–2007 mean

One change was above 30 percent on the previous year, corresponding to 70 050 tonnes (Figure 41). This change was also of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **A** until 1990 **C** for 1990 onwards; Merits further study of species changes and relation of catch to hydrology.

4.7.4 Mauritania

Mauretanian statistics give a step wise catch-time line indicating poor data recording. After 1994, a rapid rise to present values of 14 500 tonnes.

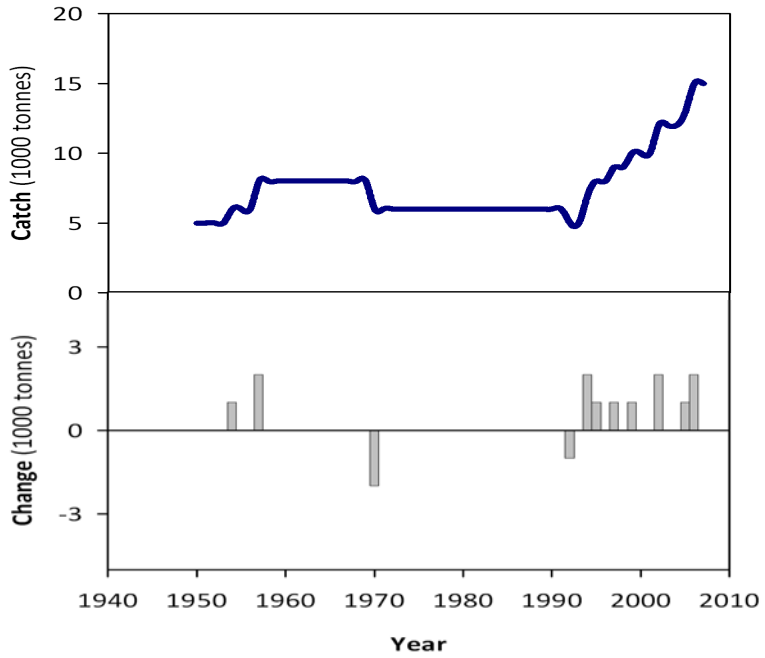

Figure 42. Catch history in Mauretania 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

It is difficult to justify this catch record in the light of the persistent Sahelian drought and the flow modification and loss of floodplain following the damming of the Senegal River – the only inland fishery resource in the country.

Two changes were above 30 percent on the previous year, corresponding to a total of 4 000 tonnes (Figure 42). These changes were not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **C**

4.7.5 Niger

Main water bodies

The Niger River fisheries are based on:

- A not very productive stretch of the River Niger comprising some 600 km^2 of channel and floodplain
- A 3 898 km^2 sector of Lake Chad during the greater Chad phase that dried out in the late 1980s (Figure 19)
- A number of small arid lakes that may desiccate seasonally

The Niger River fisheries were studied by FAO projects in the 1970s and 1980s.

Nominal catches

Figure 43 shows the nominal catches from 1950–2005. Catches have been relatively stable around a mean of 5 500 tonnes from the period 1950 to 2000. From that date they increased rapidly to 56 000 tonnes and subsided to 30 000 tonnes thereafter.

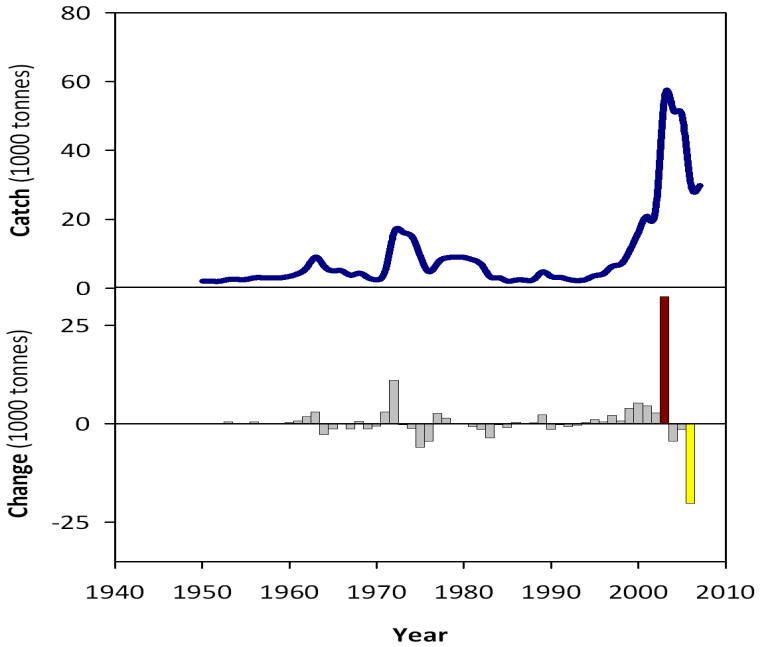

Figure 43. Catch history in Niger 1950–2007 as total catch and change (year to year). Coloured bars indicate increases (red)/decreases (yellow) larger than 30 percent of previous year country total catch and more than 30 percent of the average regional increase (37 512 tonnes)

Species composition

Niger did not report by species.

Comments

The Niger catch statistics are hard to interpret. Firstly, examination of the reporting sheets indicates that the high yields between 2003 and 2005 may be the result of errors in reporting. There is seemingly no way that such a significant increase in catch could have been obtained over such a short time by natural means or even improvements in the collection of statistics. Secondly, the source of the higher yields since 1998 needs elucidating. Production for the river has been consistently low (about 5 000 tonnes max.) as estimated from successive FAO projects. This is unlikely to have changed as the river is in a low phase and the yields per unit area are relatively high. The only other source of fish could be from Lake Chad which no longer lies within Niger territory, (although the peak in yield in 1972–74 could have originated from the same drying process as caused rising catches in Chad in the late 1970s). Some fish could be entering from Chad overland however. There appear to be questions involving all the countries of the Lake Chad basin and as this is one of the major fisheries of Africa it would seem to be of high priority to clarify the situation regarding catches from this lake.

Eleven changes were above 30 percent on the previous year, corresponding to a total of 68 509 tonnes (Figure 43). Out of these changes, one (32 300 tonnes) was of a magnitude equivalent to more than 30 percent of the average regional increase. There was one negative change that was significant at the regional level.

Confidence level: **A** until 1994; **C** for 1990 onwards; Needs further study and clarification.

4.7.6 Senegal

Much of the Senegal River floodplain has been lost due to the operations of the Manantali dam upstream which has resulted in a decrease in flooded area to about 6 000 km^2. The operations of the Diama barrage at the mouth also interrupt communications between the sea and the delta.

Main water bodies

- Lake Guiers (300 km^2)
- Senegal River and floodplain (12 000 km^2)
- Senegal delta (5 800 km^2)
- Gambia, Casamance and other rivers

Nominal catches

The nominal catches for Senegal are shown in Figure 44. Catches remain reasonable steady at about 15 000 tonnes from 1950 to 1990. They then rise rapidly to a peak of 80 000 tonnes in 1997 and decline to about 50 000 tonnes thereafter.

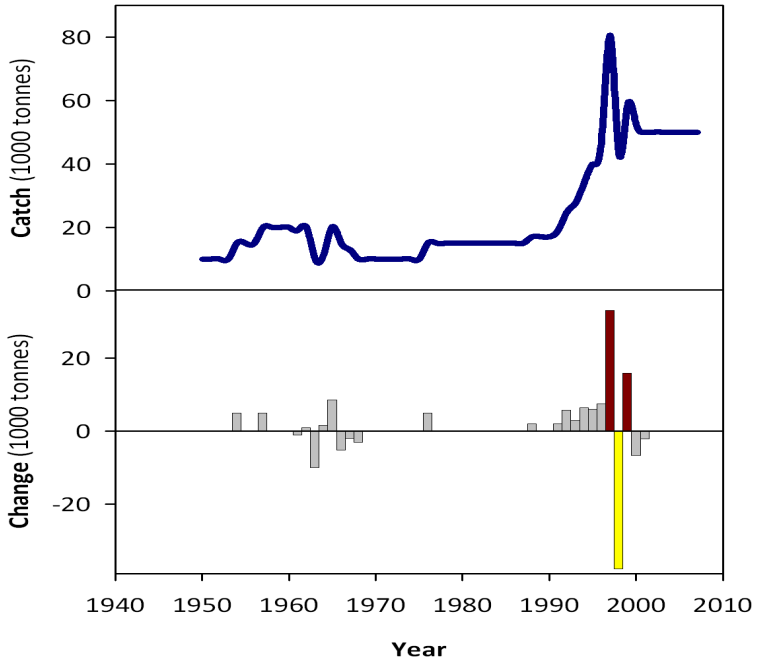

Figure 44. Catch history in Senegal 1950–2007 as total catch and change (year to year). Coloured bars indicate increases (red)/decreases (yellow) larger than 30 percent of previous year country total catch and more than 30 percent of the average regional increase (37 512 tonnes)

Species composition

Fishery statistics are not reported broken down into species.

Comments

It is extremely difficult to accept these figures. The Senegal River fishery was only yielding at most 18 000 tonnes before it was modified. It has since been dammed at the mouth and upstream to modify the flow regime and lose a considerable portion of the floodplain. It is, therefore, difficult to account for the rise in production subsequent to 1990. Furthermore, the form of the time series, especially with the constant 50 000 tonnes/year reported after 2001, gives the impression that data collection is now unreliable.

Seven changes were above 30 percent on the previous year, corresponding to a total of 78 303 tonnes (Figure 44). Of these, two were of a magnitude equivalent to more than 30 percent of the average regional increase. The total of these changes was 48 953 tonnes. There was one negative change that was significant at the regional level.

Confidence level: **A** until 1990; **C** subsequently

4.8 Guinean coastal rivers

The Guinean coastal rivers generally flow southwards to Atlantic. In their upper courses they are sensitive to climatic variation in the dryer regions bordering on the Sahel. To the south, they flow

through stable equatorial forests. Populations are very dense in the coastal zone resulting in risks of overfishing, pollution and rising sedimentation due to deforestation and conversion of land to agriculture. There are also a large number of reservoirs on the rivers.

4.8.1 Benin, Republic of

Benin is a long narrow country lying between the Sahelian zone in the North and the Guinean zone in the South.

Main water bodies

- Oueme River (700 km) and its delta (2 000 km^2)
- Mono River (360 km)
- Extensive coastal lagoon complex Lake Aheme (85 km^2); Lake Nokoue (140 km^2) and other lagoons (42 km^2)
- Niger River with Niger and has several North flowing tributaries of that river
- The North West of the country also lies within the Upper Volta basin – Pendjari River

Nominal catches

Figure 45 shows the nominal catches from 1950–2005. These indicate that the catch has fluctuated around a value of about 35 000 tonnes since 1968 with a possible slight decline from 1997 onwards. This corresponds to the value found by FAO (Welcomme, 1971) in the 1971 report (see Table 6). There is perhaps a slight declining trend consistent with reports of overfishing in the Oueme. Unfortunately, the Benin fisheries are extremely difficult to sample due to their very diffuse nature and the large number of fishermen-farmers involved in the sector – in common with many other river based fisheries throughout the world.

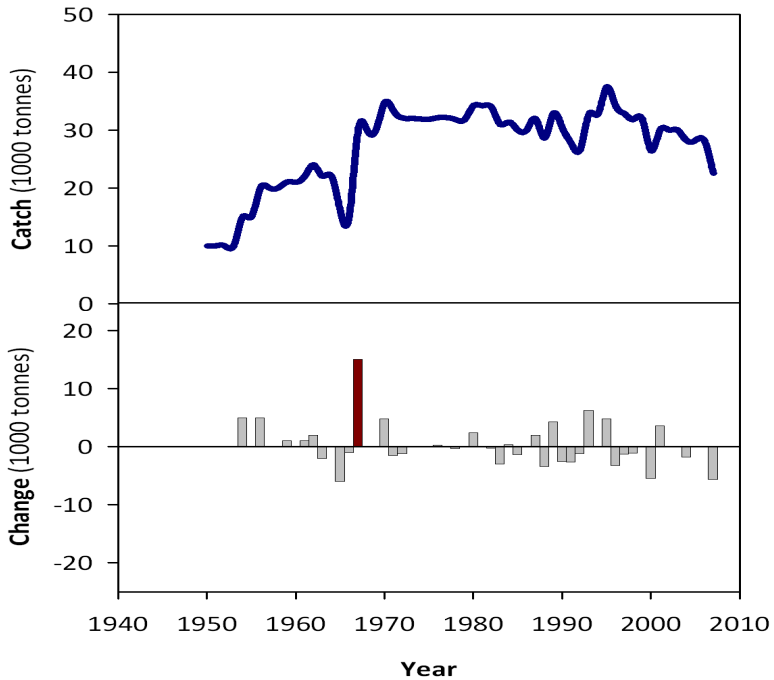

Figure 45. Catch history in Benin 1950–2007 as total catch and change (year to year). Coloured bars indicate increases (red)/decreases (yellow) larger than 30 percent of previous year country total catch and more than 30 percent of the average regional increase (37 512 tonnes)

Table 7. Benin catches by water body in the 1970s

Water body	Catch
Lake Aheme	8 151
Oueme River and delta	6 483
Lake Nokoue	5 238
Coastal lagoons	610
Niger River	1 173
Other	900

Species composition

Benin reports in detail on the species composition of the catch (Figure 46).

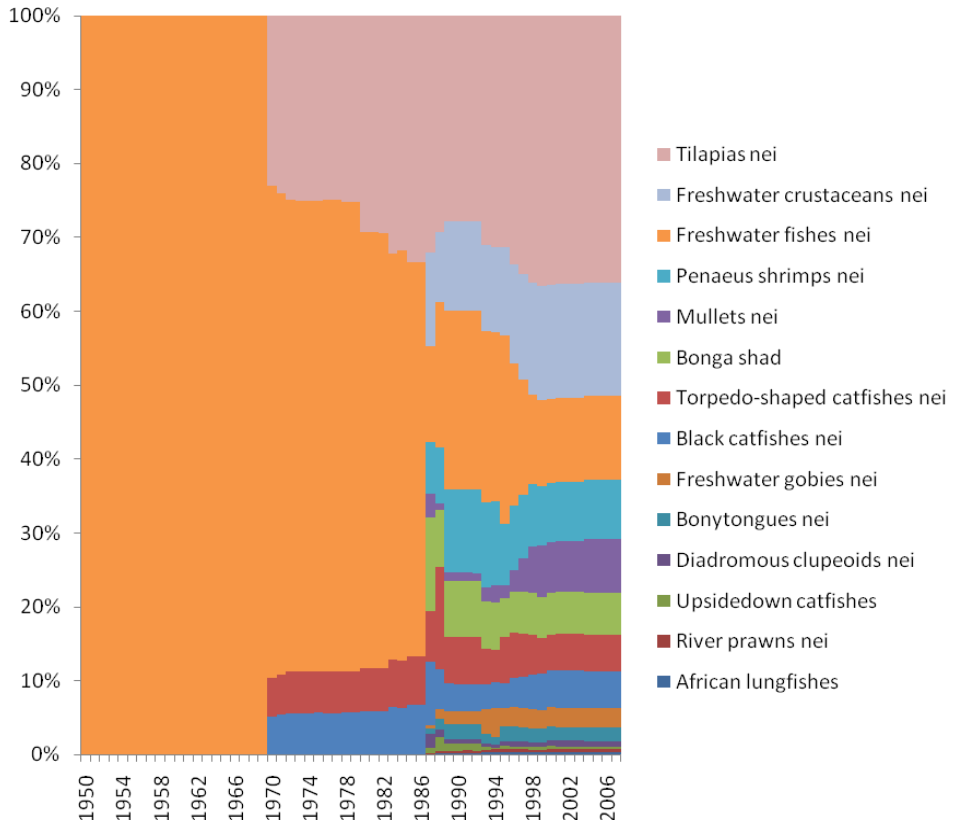

Figure 46. Changes in species composition of the catch from the inland and brackish water lagoons of Benin

Comments

The fisheries of the Republic of Benin were studied by ORSTOM projects in the 1960s and by an FAO project in the late 1960s. There is a fisheries department at the University of Godomey (Cotonou). That freshwater catch peaked in 1983 and has since declined slightly is consistent with reports from University of Godomey and is possibly due to overfishing or to the effects of the prolonged lack of rainfall in the upper (Sahelian) part of the Oueme basin. There have been some variations possibly due to climatic variation. Catch levels appear to be sustained by brackish water/marine elements – bonga and mullets. The increase in proportion of freshwater shrimps is a possible indicator of overfishing of fish stocks. The decline in Freshwater fishes nei possibly indicates loss of diversity and many species from the fishery.

Three changes were above 30 percent on the previous year, corresponding to a total of 25 000 tonnes (Figure 45). Out of these changes, one (15 000) tonnes was of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **A**

4.8.2 Equatorial Guinea

A rapid rise to 1 100 tonnes in 1994 and an equally rapid decline to 700 tonnes in 2007 were reported. There were no catch records before 1984 (Figure 47).

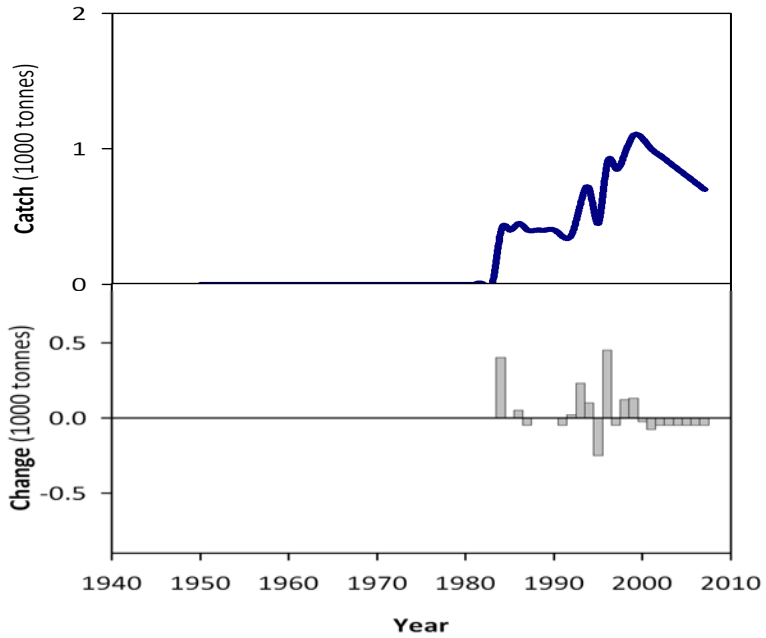

Figure 47. Catch history in Equatorial Guinea 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

The collection systems and activities of the Fishery and Aquaculture Department are not apparent.

Two changes were above 30 percent on the previous year, corresponding to a total of 680 tonnes (Figure 47). These changes were not a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **C**

4.8.3 Gambia

Sustained reports of less than 300 tonnes/year until 2002 and a steep rise subsequently to 4 865 tonnes in 2007 (Figure 48).

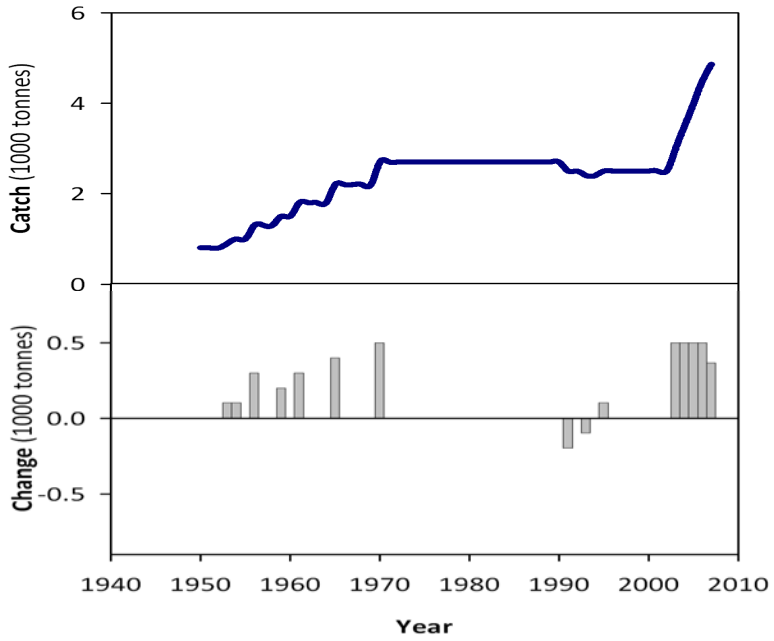

Figure 48. Catch history in Gambia 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

The form of reported data suggests sporadic reporting. Catch levels consistent with what is known as to the potential of the resource.

No changes were above 30 percent on the previous year, nor any that were significant at the regional level (Figure 48).

Confidence level: **C**

4.8.4 Ghana

Like many West African states Ghana is influenced by Sahelian conditions to the North and lies in the tropical equatorial rainforest belt to the South. It is, therefore sensitive to the climatic variations of the sub-Sahelian region as many of its rivers originate there.

Main water bodies

- Lake Volta (8 290 km^2)
- Several smaller reservoirs
- Volta River systems
- Several minor south flowing rivers and reservoirs
- Abi-Tendo-Ehy lagoon complex (410 km^2)
- Keta lagoon (330 km^2)
- Several minor coastal lagoons

The inland fisheries of Ghana are mainly influenced by the Volta Lake.

Nominal catches

The nominal catches for Ghana are shown in Figure 49. Ghana reports a progressive stepwise increase with some fluctuations to the present level of 75 000 tonnes. The steep rise in catches from 1968–1971 is coincident on the opening of the Volta Reservoir fishery.

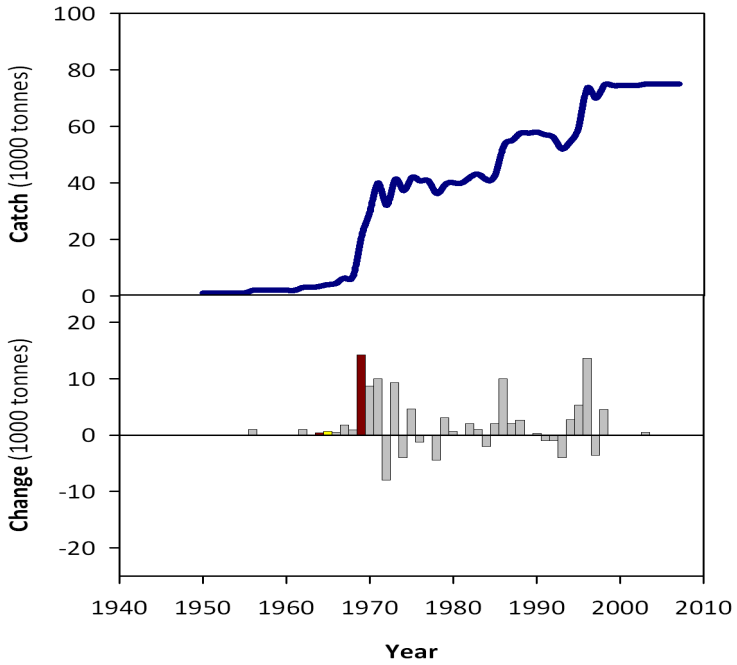

Figure 49. Catch history in Ghana 1950–2007 as total catch and change (year to year). Coloured bars indicate increases (red)/decreases (yellow) larger than 30 percent of previous year country total catch and more than 30 percent of the average regional increase (37 512 tonnes)

Species composition

Ghana does not report catches broken down into species groups.

Comments

Lake Volta has been exhaustively studied through a series of international and national projects, although the other Ghanaian inland and lagoon fisheries are less well known. There is also a competent fisheries institute and Department of fisheries. Catch levels are probably reasonable although Braimah (2000, 2001, 2003) concludes that catches from Lake Volta should be much higher at between 110 000–270 000 tonnes than the total reported for all fisheries. This indicates that the statistics have not been fully updated in line with the latest research – an impression reinforced by the fact that the nominal catch has been reported at a constant 74 500 tonnes between 1998 and 2002, and 75 000 tonnes between 2003 and 2007.

Six changes were above 30 percent on the previous year, corresponding to a total of 36 614 tonnes (Figure 49). Of these changes, one (14 174 tonnes) was of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **A** to 1998; **C** to present.

4.8.5 Guinea

An irregular, stepwise increase to a stable level at about 4 000 tonnes after 1998 was reported (Figure 50).

Nature of reporting suggests sporadic collection of records. No information seems to exist on how these figures are collected.

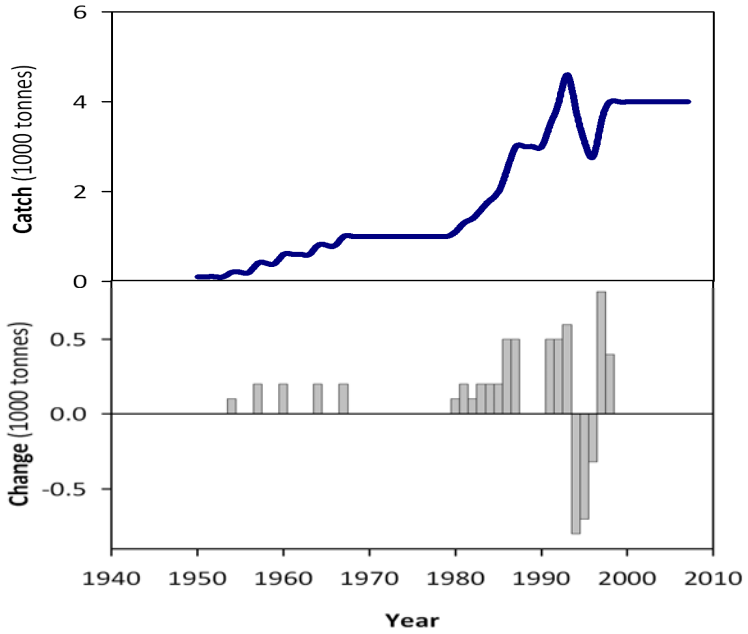

Figure 50. Catch history in Guinea 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

Four changes were above 30 percent on the previous year, corresponding to a total of 700 tonnes (Figure 50). These changes were not a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **C**

4.8.6 Côte d'Ivoire

Catches show a steep rise to a peak in 1998; with a subsequent decline to 6 499 tonnes in 2007 and a brief resurgence in 2002–2003 (Figure 51).

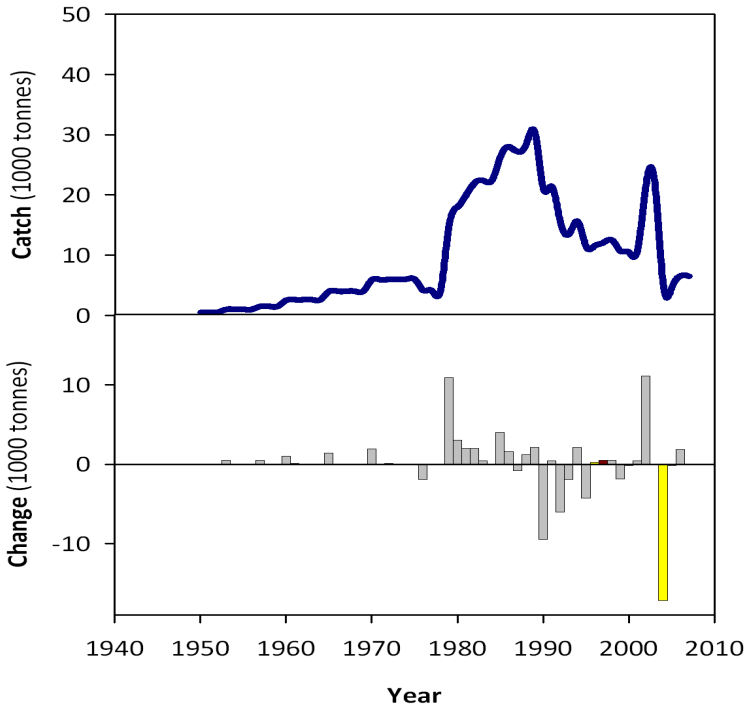

Figure 51. Catch history in Côte d'Ivoire 1950–2007 as total catch and change (year to year). Coloured bars indicate increases (red)/decreases (yellow) larger than 30 percent of previous year country total catch and more than 30 percent of the average regional increase (37 512 tonnes)

Vanden Bossche and Bernacsek(1990) estimate about 27 000 tonnes from Côte d'Ivoire's rich resource of reservoirs, rivers and lagoons. There appears to be little explanation for the recent drastic loss of catch.

Eight changes were above 30 percent on the previous year, corresponding to a total of 29 136 tonnes (Figure 51). These changes were not of a magnitude equivalent to more than 30 percent of the average regional increase; however there was one negative change that was significant at the regional level.

Confidence level: **B**

4.8.7 Liberia

A prolonged flat record of 4 000 tonnes was recorded by Liberia lowering to 3 500 in 2007 (Figure 52).

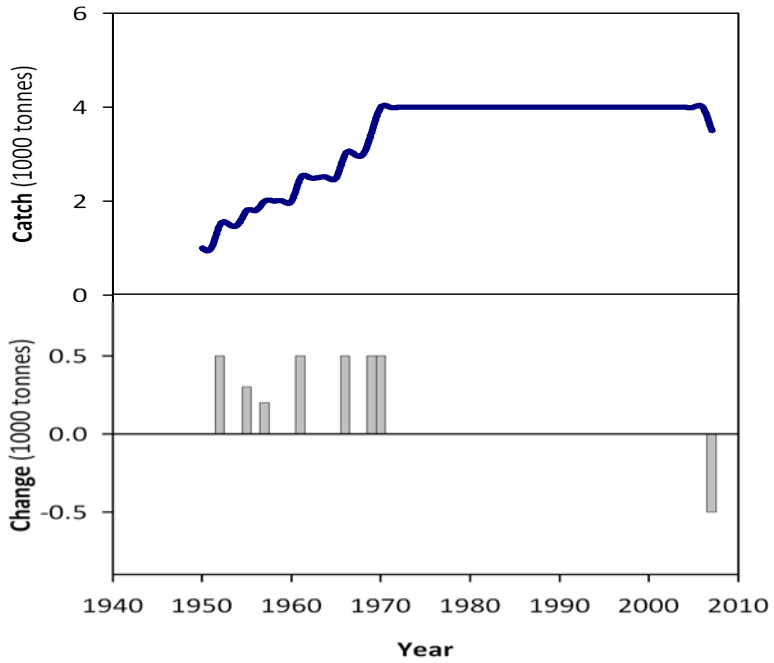

Figure 52. Catch history in Liberia 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

Data are obviously estimated and approximate.

One change was above 30 percent on the previous year, corresponding to 500 tonnes (Figure 52). This change was not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **C**

4.8.8 Nigeria

Nigeria lies partly in the Sahelian zone to the North and the Equatorial Guinean zone to the South.

Main water bodies

- Lake Chad (Part in greater Chad regime 5 500 km^2 [25 percent]: present low water regime Nigerian sector dry
- Benue River and floodplain (1 290 km^2 dry and 3 100 km^2 flooded)
- Niger River and floodplain (1 800 km^2 dry: 4 800 km^2 flooded)
- Niger River delta (9 700 km^2)
- Cross River (485 km)
- Kaduna River (590 km)
- Kainji Reservoir (1 290 km^2)

- Tiga Reservoir (178 km^2)
- Many minor lakes, reservoirs, coastal lagoons and rivers amounting to over 275 527 ha (see Vanden Bossch and Bernacsek1990 for detailed lists)

Nominal catches

The nominal catches for Nigeria are shown in Figure 53. Catches rose until 1971 when they reached a period of stability or even slight decline at around 100 000 tonnes/year from 1971 to 1998. A sharp rise was recorded from 1998 to the present peaks of about 225 000 tonnes/year.

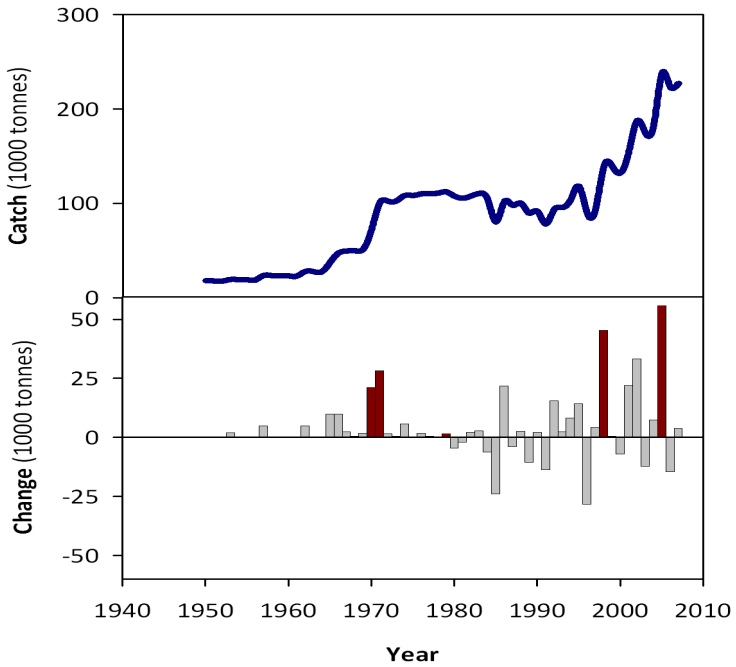

Figure 53. Catch history in Nigeria 1950–2007 as total catch and change (year to year). Coloured bars indicate increases (red)/decreases (yellow) larger than 30 percent of previous year country total catch and more than 30 percent of the average regional increase (37 512 tonnes)

An approximate distribution of catches among water bodies in the 1980s (Vanden Bossche and Bernacsek, 1990) is shown in Table 8.

Table 8. Nigeria catches by water body in the 1980s

Water body	Annual catch (tonnes)
Lake Chad	31 000
Benue River	9 570
Niger River	13 450
Niger delta	18 992
Kainji Reservoir	6 000*
Other fisheries	20 000
TOTAL	99 012

**Data from Crul and Roest (1995)*

Species composition

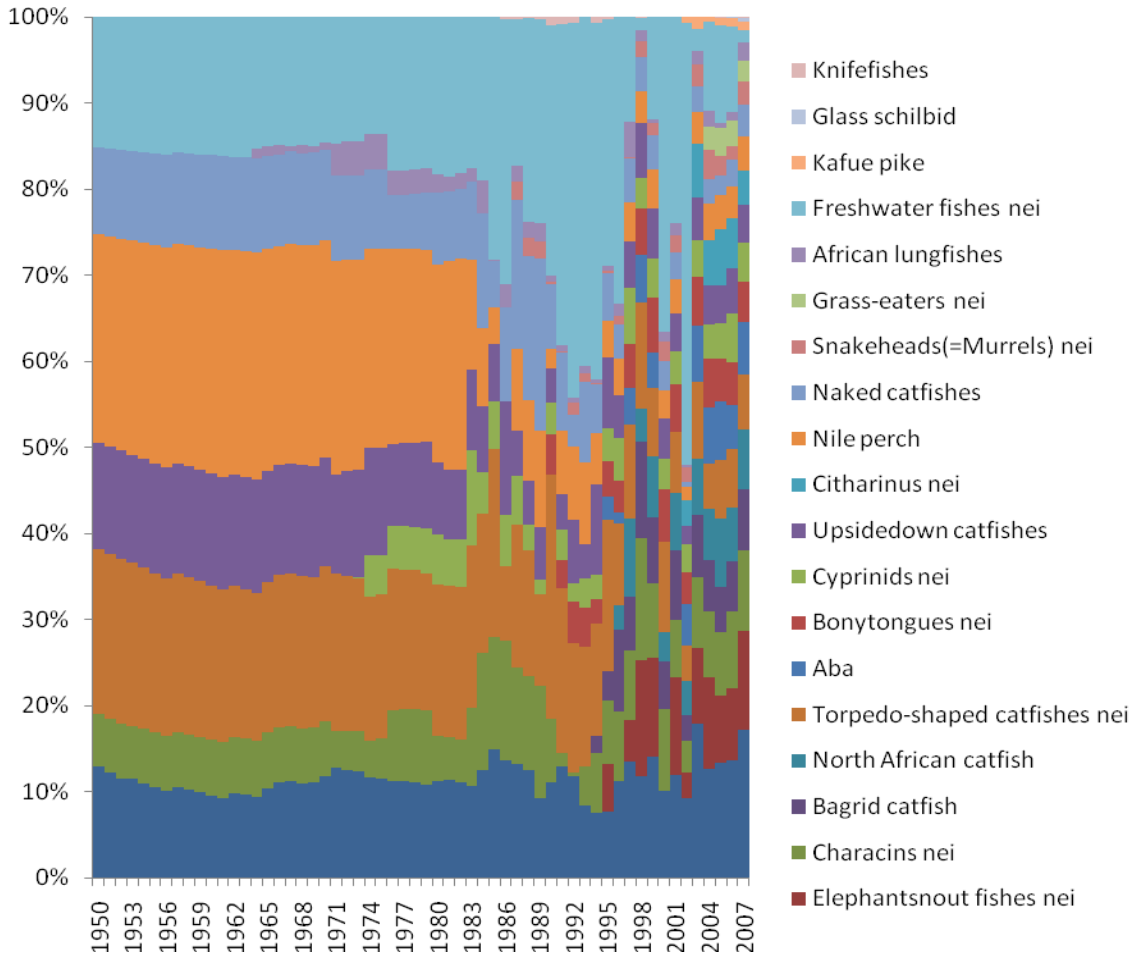

Figure 54. Changes in species composition of the catch from Nigerian waters 1950 to 2007

Nigeria records catches by species group. However, as these come from a wide range of waters no distinct pattern seems to emerge with no dominant group (Table 8).

Comments

It could be anticipated that reporting for Nigeria should be reasonable. However, it is difficult to account for the sharp rise in catches since 1998 (catches have more than doubled in 10 years) during a time of increasing stress because of the Sahelian drought and the desiccation of Lake Chad. As Nigeria is one of the highest producers of inland fish on the continent, the records would benefit from clarification as to from where this additional production is coming.

Five changes were above 30 percent on the previous year, corresponding to a total of 160 365 tonnes (Figure 54). Of these changes, four were of a magnitude equivalent to more than 30 percent of the average regional increase and a total of 150 529 tonnes.

Confidence level: **B**

4.8.9 Sierra Leone

Sierra Leone recorded a sustained period of low catch until 1977, followed by a rise in catches to about 17 000 tonnes in the 1980s and a slight fall to present levels of around 14 000 tonnes in 1980 (Figure 55).

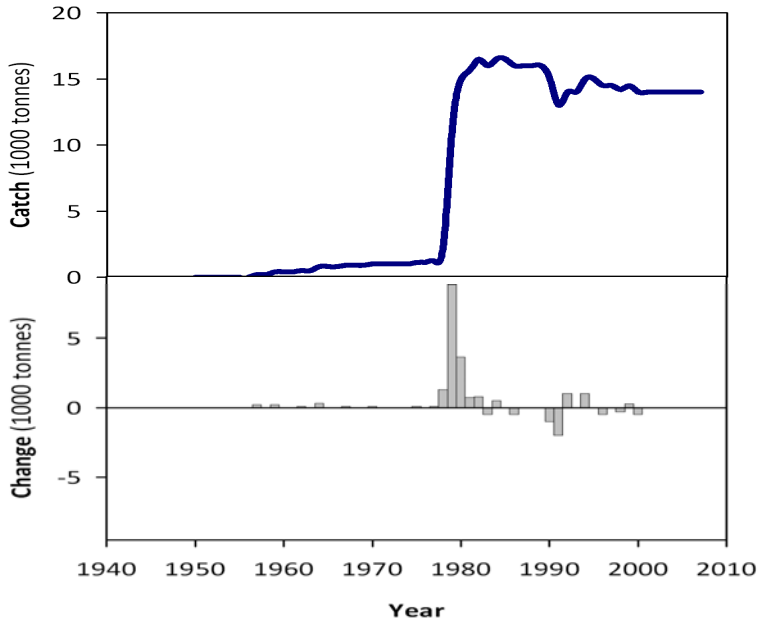

Figure 55. Catch history in Sierra Leone 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

It is doubtful as to how these statistics are collected as the fisheries department ceased to be functional since the troubles. Nevertheless the levels estimated appear of the right order and could even be higher.

Five changes were above 30 percent on the previous year, corresponding to a total of 14 282 tonnes (Figure 55). These changes were not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **C**

4.8.10 Togo

Catch records from Togo show an almost flat 5 000 tonnes since a slight peak in 1993 (Figure 56).

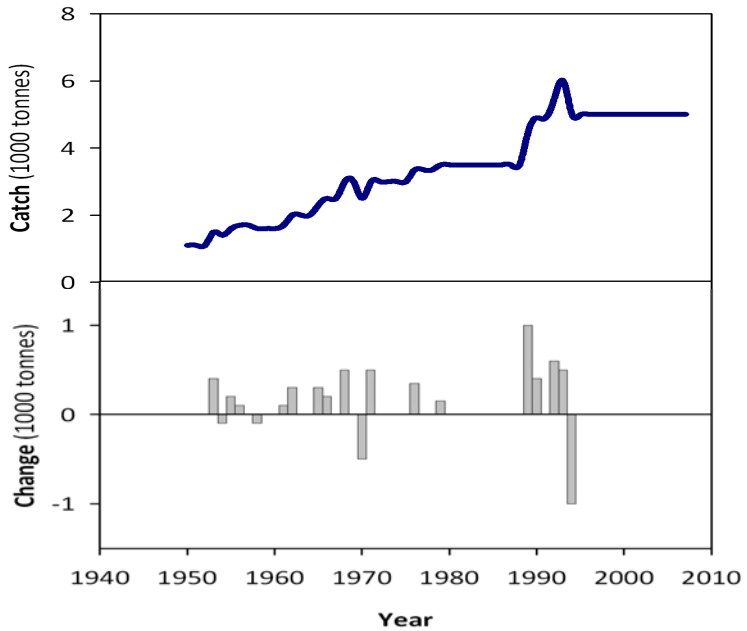

Figure 56. Catch history in Togo 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

There is every reason to assume that the Togolese inland fisheries are not monitored and controlled.

One change was above 30 percent on the previous year, corresponding to 400 tonnes (Figure 56). This change was not of a magnitude equivalent to more than 30 percent of the average regional increase.

Confidence level: **C**

4.9 Madagascar

Madagascar is an island and as such its fisheries are quite separate from those of the mainland. There is considerable population pressure leading to overfishing and environmental degradation.

Main water bodies

- Lake Alaotra (200 km^2 of open water; 1 000 km^2 of seasonal swamps)
- Lake Kinkony (139 km^2)
- Lake Ihotry (94 $km^{2)}$ in rainy season
- Lake Itasy (35 km^2)
- Pangalanes lagoon complex (180 km^2)
- Loza lagoon (156 km^2)
- Several rivers, smaller lakes, dams and lagoons

Nominal fish catches

Madagascar reports rising but variable catches up to 1968 with a subsequent period of variable but slightly declining catches around a mean of 40 000 tonnes until 1987. Subsequent to 1987, a more or less constant figure of 30 000 tonnes has been recorded (Figure 57).

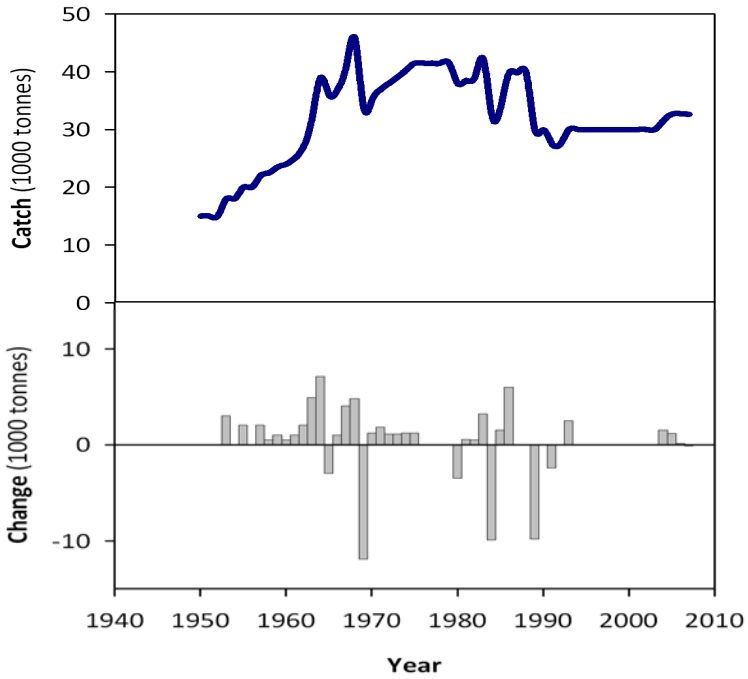

Figure 57. Catch history in Madagascar 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

Species composition

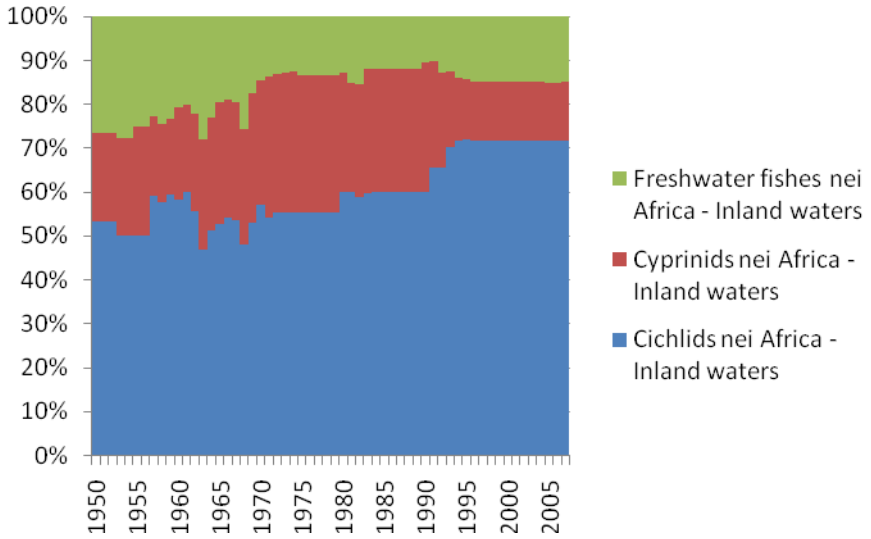

Figure 58. Changes in species composition of the catch from Madagascan waters 1950 to 2007

Species are only recorded in three major groupings (Figure 58). These indicate the importance of the introduced common carp (cyprinids nei) and tilapias in the fisheries economy of the country.

Comments

Reporting appears to have been consistent up to 1992 with a convincing amount of annual variation in catches. Subsequent to that date reporting of a constant 30 000 tonnes/year seems to indicate that data collection and reporting systems have broken down.

No changes were above 30 percent on the previous year nor were any changes significant at the regional level (Figure 57).

Confidence level: **A** up to 1992; **C** 1992 to present

5 GENERAL CONCLUSIONS

5.1 Trends

Within the overall continent wide increase of about 3.74 percent per year between 1950 and 2007 some countries are apparently faring better than others. Table 9 shows the overall trends of the 43 countries declaring catches in 2007. All countries reported rising catches from 1950 until the 1980s consistent with the expansion of the inland fisheries sector as a response to the increasing population pressure. Over the last ten years, 16 countries reported that catches to continued rising. Twelve countries reported falling catches, either as a smooth decline or with year-on-year variability. In fifteen countries trends in catch levels remained relatively stable although here too there may have been year-on-year variability.

Table 9. Trends in fish catch over the last ten years for the 43 African countries declaring inland fish catches

Trend	Number	%
Rising	16	37.21
Falling	12	27.91
Stable	15	34.88
TOTAL	43	100.00

One hundred and eighty four changes were above 30 percent increase on the previous year (Criteria 1), corresponding to a total of 1 576 100 tonnes (Table 9). Out of these changes 33 were of the magnitude that they also are equivalent to more than 30 percent of the average regional increase (Criteria 2) and the total of these changes was 1 177 499 tonnes.

Table 10. The percentage contribution of the change (only increases) for the countries remaining after the different cut-offs (Criteria 1 and 2)

	Sum of change/increase 1950–2007 [t]	Change/ regional increase
World increase	8 105 691	
Regional increase	2 138 188	
Criteria 1 change	1 576 100	73.7%
Criteria 2 change	1 177 499	55.1%

The 184 criteria 1 changes explain almost 74 percent of the increase in the regional trend and more than 55 percent can be explained by the 33 criteria 2 changes. Hence, it is clear that the increasing regional trend is largely driven by large changes in individual countries. These changes are most likely due to re-estimations or changes to the statistical data collection system at country level (Lymer and Funge-Smith, 2009), although the possibility of misreporting should not be excluded; hence the historical data probably reflect the real situation poorly.

The events identified at regional level are evenly distributed throughout the whole time period. The 33 increased production events are due to changes in only 27 percent of the African countries. This is unsurprising, since to qualify under the criteria used for this analysis, the national production needs to be of a scale that would significantly affect the regional total. In addition to the 33 events identified with increasing catch, eight occurrences of large negative change were identified (see country production graphs).

For the regional data, the 33 increases and the eight negative events were adjusted backwards (based on the assumptions and method described above) to better reflect the historic regional trend in inland water capture fisheries production in African. The adjusted data set shows that the initial production in 1950 was around 681 116 tonnes, which is 109 percent greater than the original total from reported data (Figure 59). In the calculated data in 1975 the production was already almost 1 900 000 tonnes, a level not reached until 1995 in the original data.

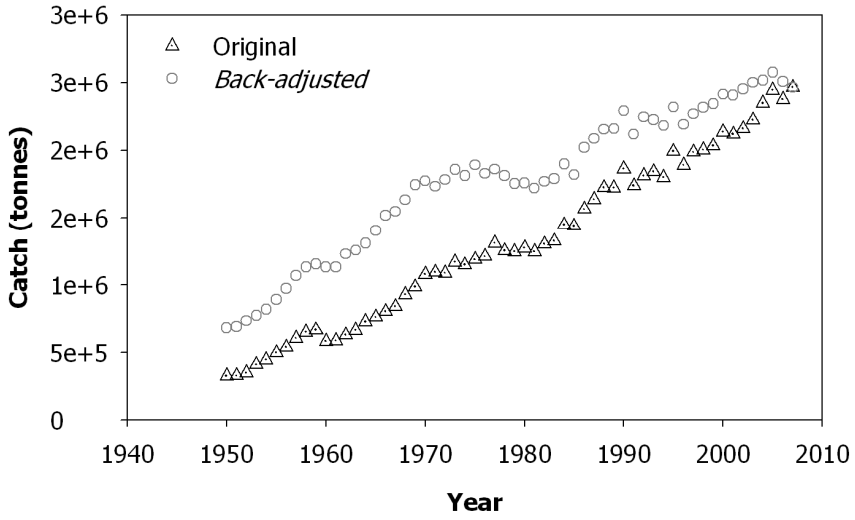

Figure 59. Historically modeled data of inland water capture fisheries catch in Africa based on the changes identified using Criteria 2 (calculated) and the original inland water capture statistics

The evolution of the back-adjusted catches over time described in Figure 60 probably corresponds better to what is known of African inland fish catches than the original reported catch statistics. Catches from nearly all the major water bodies appeared to be at their maximum potential as estimated by then existing models by the time Vanden Bossch and Bernacsek (1990) reviewed the literature, which were mostly drawn from surveys and reports for the 1970s and 1980s. This implied a period of relatively stable catches until the 1990s when the fish production from the continent was raised by the development of the Nile perch and dagaa fisheries in Lake Victoria, which, at 1 000 000 tonnes, now represent about 40 percent of the continental total. Furthermore, the increases in estimates from the Congo River fisheries since 1985 and improved reporting on subsistence fisheries from some countries would also contribute to the upward trend since 1990.

Dividing production by the African population[2] as an indicator of *per capita* inland fish consumption on the continent also shows a very different trend between the original data and the adjusted data[3]. The highest production/person calculated from the original data was in 1977, however, using the back adjusted data, the highest production per person occurred in 1969 (Figure 58). Even more importantly, the stable production in catch per person shown by the original data does not occur in the back adjusted data, which shows a general rise up to the 1970's and then a consistent decline thereafter until 2007.

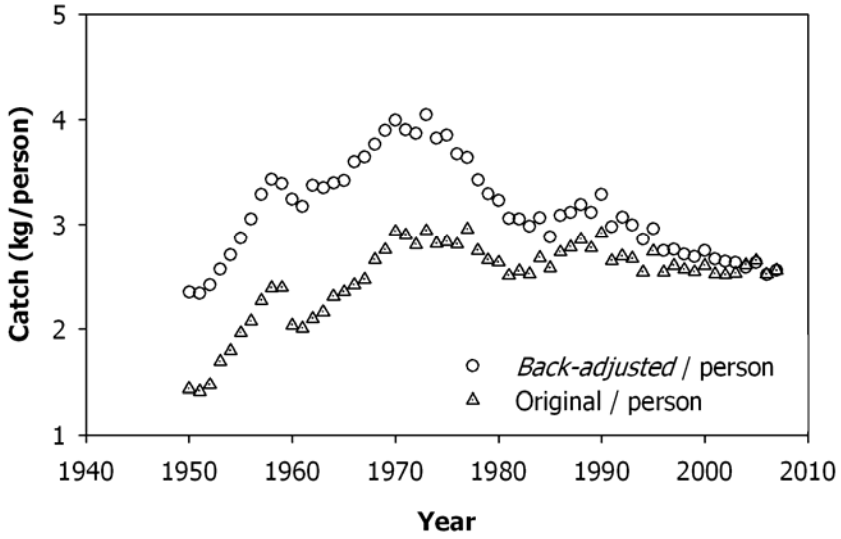

Figure 60. Historically modeled data of inland water capture fisheries catch/capita in Africa based on the changes identified using Criteria 2

5.2 Nature of information

There is a general lack of information on inland fisheries in Africa. Apart from a few countries with ongoing projects or well established national fisheries institutes the level of research is extremely low. Even in well researched countries information may be contradictory and need further study.

The quality of overall catch statistics is very variable. Table 11 shows the subjective confidence level assigned to the data set by country based on the form of the data set, knowledge of trends in climate, predicted yield patterns from models of similar fisheries and the results of independent research. In some countries, the fact that expected trends are present indicates that the statistics might be reliable. In others the nominal statistics appear open to question and steps may be needed to clarify aspects of the collection system or even the nature of the resource.

[2] Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2008 Revision, http://esa.un.org/unpp, Thursday, August 27, 2009; 8:27:50 PM.

[3] It should not be assumed that all fish caught on the continent is consumed locally. The catch from the Nile perch fishery of Lake Victoria for example was largely exported to Europe.

Table 11. Levels of confidence in the inland fisheries statistics reported by 43 African countries

Confidence level	Major fish producing countries	Minor*fish producing countries
A	6	2
B	2	4
C	6	13
A→B	1	
A→C	7	
C→B		2

**Countries producing less that 15 000 tonnes in 2007*

It is evident that most of the countries with higher confidence levels in their reporting either had colonial inland fisheries research institutes that continued after independence or were associated with national and internationally funded research projects. It is especially evident that the seven cases where confidence in the statistics has declined in recent years are correlated with externally funded projects that ceased to operate. From this it may be concluded that national support for inland fisheries infrastructure is lacking in many cases and that the statistical collection and reporting suffers as a consequence. This conclusion is reinforced by the fact in Table 11 that countries with major fisheries tend to have a greater level of confidence in their statistics than minor fish producing countries. This is entirely understandable, as poor countries with a small inland fisheries sector are less liable to be able to afford the costs involved in an adequate statistical collection system.

In the absence of clarifications it is extremely difficult to account for the continuing rise in reported catch. This does not mean that the trends are not true but that they need clarification before they are accepted.

5.3 Limitations of the statistics

The interpretation of overall trends in Africa is limited by the failure to report yields for individual water bodies. This means it is impossible to track the history of catches by major river basin or by international lake or reservoir.

The lack of reporting of effort (or fishermen number) also limits scope for interpretation. Many countries report considerable increases in numbers of fishermen over the reporting period, and even over the last ten years in supplementary literature. In many cases this increase seems to be associated with linear increase in extrapolated catch which is impossible to verify.

Reporting by species group is poor and largely irrelevant as it does not allow any interpretation of the fishing-down species replacement model. The main failing here is the failure of countries to record even the most limited of species information, either not responding or overusing the “other species nei” category. Only 15.7 percent (6 out of 38) of countries can be judged to respond adequately to this category.

Even were the countries to respond to this adequately the level of integration of the species data is such that little useful information can be drawn from it, other than the most general statements of the relative significance of cyprinids v characins for example.

5.4 Need for future action

There is insufficient information either from the nominal fishery statistics, or at the administrative or academic level through reports, and scientific papers either to interpret the trends in inland fisheries in Africa or to resolve the paradox of apparently threatened resources and ever growing catches.

The lack of intelligence to interpret the statistics and the more general lack of up to date information on the inland fisheries means that further study needed to elucidate situation in many countries. In particular:

1. There seems to be considerable confusion as to what is happening in the Sahel (Lake Chad basin, Upper and middle Niger and Senegal rivers) where almost all riparian countries (Senegal, Mali, Niger, Chad, Cameroon, Nigeria) are reporting increasing catches despite an apparently deteriorating aquatic environment.
2. The situation in the Congo basin remains far from clear. This area has never been studied adequately due to remoteness, difficulty of access and security. It is doubtful that this situation can be resolved any time soon but studies on Congo Democratic Republic, Congo Republic and Central African Republic are urgently needed to shed more light on what is probably the major inland fisheries resource of the continent.
3. Improved information is urgently needed to evaluate of the impact of dams both with regard to upstream reservoir fisheries and to the impacts on river catches downstream. This is especially urgent in view of the possible resurgence in interest in large scale hydroelectric projects.

Should all or some of the trends be verified this indicates that inland fisheries are much more productive and resilient than was previously thought. The existing Morpho–Edaphic Index (mei) (Henderson and Welcomme, 1979) and river models (Welcomme, 1985) used for assessment of yields were mostly derived in the 1970s and 1980s on the basis of the exploitation patterns and fishing pressures of that time. Many countries worldwide are reporting consistent increases in fishermen numbers and higher yields than the models would predict. There may, therefore, be a need to revisit the models and even the basic ecology of African (and global) inland water systems. However, such revisions can only be made on the basis of good data.

The importance of inland fisheries for food security and employment coupled with the lack of knowledge and the low priority given to inland fisheries in national development policies calls for a renewed effort to study and manage these resources. In doing this the need for specialized knowledge must be acknowledged if the statistics are to be interpreted correctly. In many cases trained specialists are rare both internationally and nationally. Thus training and coordination are needed at all levels from the study of the biology and ecology of the resource to the collection of statistics on the fishery.

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