

AN AUDIT OF INLAND CAPTURE FISHERY STATISTICS – AFRICA

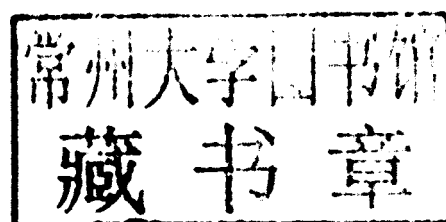


AN AUDIT OF INLAND CAPTURE FISHERY STATISTICS – AFRICA

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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.

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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 by 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.

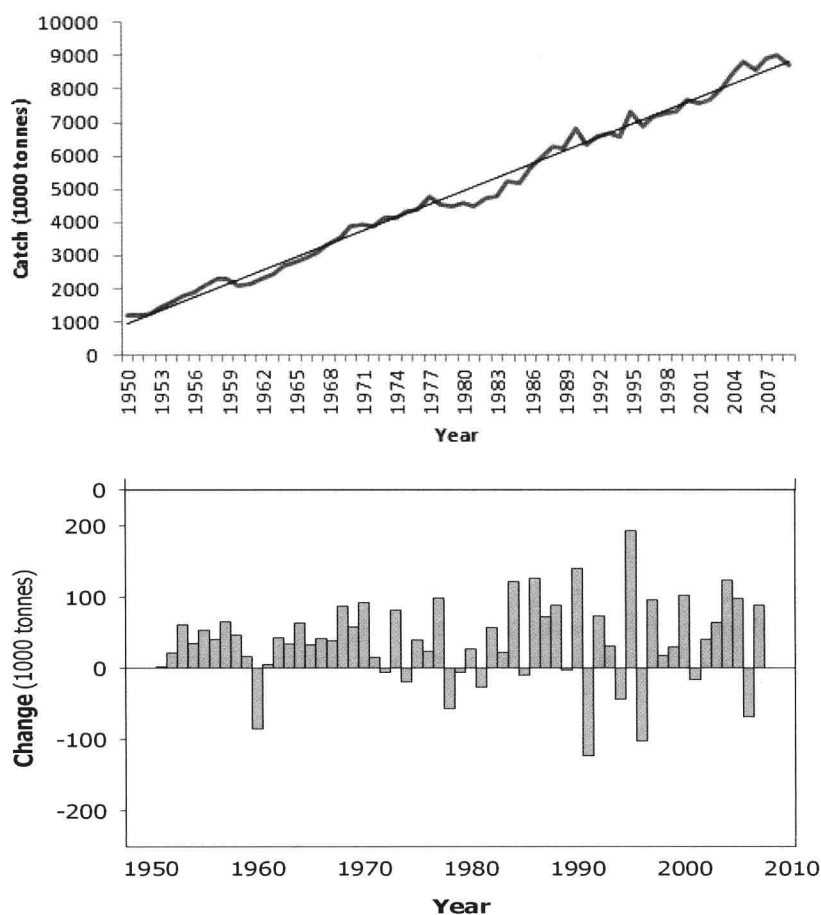


Figure 1. Total inland capture fisheries catch for Africa 1950–2007 with the regression line $y = 133777x + 794525$ and total regional change for inland capture fishery catches 1950–2007

(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 crustacea¹ 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.

	4		
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 through 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 – Hurtle, 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:

$$\text{Back-adjusted Catch}_{\text{year } x} = \text{Original Catch}_{\text{year } x} * (1 + \text{Change}_{\text{Criterion 2 year}})$$

$$\text{Where } \text{Change}_{\text{Criterion 2 year}} = (\text{Original Catch}_{\text{Criterion 2 year}} - \text{Original Catch}_{\text{Criterion 2 year-1}}) / \text{Original Catch}_{\text{Criterion 2 year-1}}$$

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).

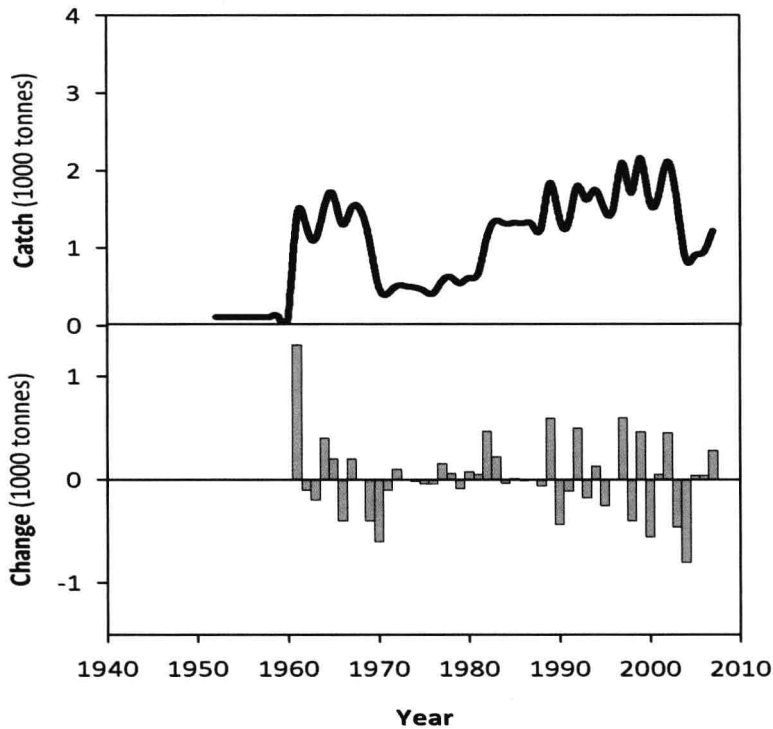


Figure 2. Catch history in Morocco 1950–2007 as total catch and change (year to year). No annual changes were greater than 30 percent

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.