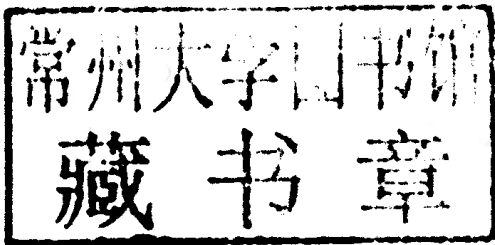


REVIEW OF THE STATE OF THE WORLD FISHERY RESOURCES: INLAND FISHERIES



**REVIEW OF THE STATE OF THE WORLD FISHERY RESOURCES:
INLAND FISHERIES**

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PREPARATION OF THIS DOCUMENT

This document represents the second revision of Fisheries Circular No. 942, and is a key document in the Food and Agriculture Organization of the United Nations (FAO) Fisheries and Aquaculture Department's efforts to provide accurate and timely information on fishery resources. It reviews global inland capture fisheries for food production. It also explores the increasingly important recreational fisheries sector (see Annex III), although there is no systematic reporting of this to the FAO or to any other organization with global scope. The objectives of this review are:

- to update and expand the scope of the 2003 Review of the State of World Fishery Resources: Inland Fisheries, Revision 1 (FAO, 2003);
- to place inland capture fisheries in the context of overall world fish production and other sources of animal protein;
- to review the status and trends of inland fisheries production at global, continental and subcontinental levels;
- to call attention to the importance of inland capture fisheries with respect to food security and human development; and
- to call attention to the main issues facing inland fisheries.

The present version differs from earlier versions of Circular No. 942, (Rev. 1) in the following ways:

- the continental analysis is refined to subcontinental regions;
- updating of FAO statistical information is through 2009;
- indicators of the importance of inland capture fisheries production have been added including:
 - per capita production;
 - production per unit area;
 - ten-year trends; and
 - comparisons with other animal protein sources.
- inclusion in the annex of an analysis of the effect of large changes in national reports of inland capture fisheries statistics on the global trend;
- inclusion of an annex on recreational fishing; and
- inclusion of boxes highlighting items of particular interest.

Welcomme, R.

Review of the State of the World Fishery Resources: Inland Fisheries.

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ABSTRACT

The fishery statistics reported to FAO by countries and maintained in the FishStat database are analysed for trends in quantity and composition of catches from 1950 to 2009. Catches have been increasing at a steady rate throughout the period. Fish from inland water capture fisheries are an important source of animal protein, especially in landlocked countries and for populations riparian to lakes and rivers. Finfish contribute about 90 percent of the catch together with some crustaceans and molluscs. The accuracy of reporting of catches by taxonomic group has improved with time and more groups are being reported in 2009 than in 1950. At the same time, the percentage of catches assigned to the generic "freshwater fishes NEI" category has declined. Trends in catches and taxonomic groups are analysed for subcontinental regions under a more general continental heading. The regions are divided mainly by geography, although in some cases economic and political considerations are used. Catches in the various regions of Africa, Asia and South and Central America have risen steadily over the period of the review, although there are local exceptions to the general trend. There is clear evidence that such increases are real in some individual fisheries, but generally the increases are attributed to improvements in reporting, whereby catches that were already there but previously ignored are now being incorporated into the reports. Catches in North America, and most of Europe, have declined in the same period, which is attributed to shifts in economic conditions that make fishing not longer financially viable, and a greater public demand for recreational fishing. Catches from eastern Europe and the Russian Federation declined from a maximum in the 1980s, but have shown some signs of recovery in the last decade. In general, the world's inland fisheries still appear viable although environmental pressures, such as damming, water abstraction and overexploitation, pose a potential threat to the maintenance of present levels of reproduction and recruitment, and hence, ultimately catch.

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1. INTRODUCTION

Current views on inland fisheries are contradictory. There is the “inland fisheries are doomed” view (see Friend *et al.*, 2009), which assumes that the numerous threats to aquatic ecosystems posed by man’s activities will inevitably lead to a decline of aquatic resources. This view is supported by many individual studies and reports from all continents, which allege that catches are falling, species disappearing, and that there are many of the symptoms of chronic overfishing at the level of individual species or whole communities (see, for example: Thorpe *et al.*, 2009, for Kyrgyzstan and other countries of the former Union of Soviet Socialist Republics (USSR), and Aps, Sharp and Kutonova, 2004, for Central and Eastern Europe; other examples see footnote¹). The foundation of this view is the large number of threats to inland aquatic systems, including:

- Bad or inexistent fishery management – including uncontrolled and excessive fishing, fishing with inappropriate or illegal mesh sizes, and introductions of exotic and invasive species.
- 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 the Niger and another for a main stem dam across the Congo River. The impacts of such dams on the fish fauna downstream have usually not been assessed as it is believed all too often that the creation of the reservoir upstream of the dam has a compensatory effect through the creation of new fisheries in this reservoir. However, this effect does not offset 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 wastewater treatment systems 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.

In contrast to this pessimistic view of the present status and future of inland fisheries resources, catches are still recorded as rising at an apparently linear rate of increase of about 3 percent per year globally. There is also widespread expert opinion that much of the catch from inland fisheries is unrecorded. As a result, inland fishery catches are generally underestimated, and in some of the most productive fisheries seriously so. 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, 1976) and has not generally been rectified, although it is admitted by several countries. Specific examples include the general omission 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 in Bangladesh and Cambodia, reported catches have increased. Similarly, under-reporting may occur in the regular collection of statistics. For example, in Africa, Braimah (2000, 2001, 2003) estimated that the catches from Lake Volta are considerably underestimated. In Asia, Lymer *et al.* (2008a) review the inland and marine statistics reported by Thailand and note that considerable underestimation of inland waters may be occurring, and Van Zahlinge *et al.* (2004) and Hortle (2007) increased the estimates on production from the lower Mekong basin by a factor of about three. More recently, the Big Numbers Project estimated that inland fishery catches were about 14 million tonnes.

¹ See, for example: www.bowdoin.edu/news/archives/1academicnews/004631.shtml for Lake Mweru in Africa; and <http://news.bbc.co.uk/1/hi/world/africa/6261447.stm> for Lake Chad in Africa.

Inland fishery statistics are generally submitted to the Statistics and Information Service (FIPS) of the Fisheries and Aquaculture Department of FAO by national correspondents in the appropriate ministry of Member Countries. Data reported by countries are carefully checked, and when the figures are questionable the national correspondent is consulted for clarification. The statistics made available by the national authorities can be complemented or replaced if better data from other origins are available. If a country does not report its catches despite several reminders, or if those provided are considered not to be reliable, FAO estimates the missing data and marks them in the database with an “F”. In 2009, FAO estimated catches in 38 percent of countries (see Table 1). However, the quality of the FAO statistics depends upon the accuracy and reliability of the data collected nationally and provided to FAO. The data compiled are stored in the FishStat database and are available for analysis. Catches for all countries reporting catches over the last ten years are listed in Annex 1.

Table 1: Number of countries for which the FAO had to estimate inland catches in 2009

Continent	Countries with inland fish catches	Countries for which catch was estimated (No.)	Countries for which catch was estimated (%)	Tonnage reported	Tonnage estimated	Total tonnage estimated (%)
Africa	43	22	51.16	2 502 570	1 134 880	45.35
Asia	31	9	29.03	6 740 366	58 014	0.86
Europe, including the Russian Federation	40	8	20.00	403 355	11 670	2.89
North America	2	0	0.00	55 644	0	0.00
Oceania	7	4	57.14	17 786	15 706	88.31
South and Central America	22	12	54.55	500 908	405 486	80.95
Total	145	55	37.93	10 220 629	1 625 756	15.91

The accuracy of inland fisheries statistics has long been questioned; see, for example, Coates (2002), in his discussion on the deficiencies of inland catch recording for Southeast Asia, as well as the comments in FAO Fisheries Circular No. 942, Rev. 1, and the annotations in the *The State of World Fisheries and Aquaculture* (SOFIA) sections on inland fisheries (FAO, 2002, 2004, 2007, 2009). Recent studies (World Bank, 2010; Mills *et al.*, 2011) conclude that world inland fish catch is between 11 and 14 million tonnes/year, and the FAO Big Numbers Project supported the larger of these estimates. Thus, some of the increases registered appear to be through better reporting of data and the inclusion of the so far unreported fisheries, such as floodplains and rice fields, in the statistics, consistent with this higher estimate.

These various factors make it difficult to determine whether there are actual increasing trends in the fisheries or whether the fisheries have been at a higher level of real production for some time and the trends are only a statistical artefact tending towards this higher estimate. Therefore, all discussions of trends in this document refer to the trends in the statistics appearing in FishStat and do not necessarily reflect actual increases or decreases in production.

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 by Lymer & Funge-Smith (2009) for the Indo-Pacific countries and by Welcomme and Lymer (2009) for Africa. This used two criteria to detect large irregularities in reporting:

- criterion 1: any year-on-year change greater than 40 percent, which is considered a significant change from the previous year; and
- criterion 2: individual country changes of more than 30 percent when compared with the regional average 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 to smooth out any individual large increases backwards across the data series. The adjusted trends at continental level are presented in the relevant section of this circular for comparison. An analysis of the effect of large changes in national reports of inland capture fisheries statistics on the global trends is presented in Annex 2.

In this fisheries circular, inland fisheries are taken to include finfish, molluscs and crustaceans, and exclude crocodiles,² other reptiles and mammals.

2. GLOBAL TRENDS IN INLAND CAPTURE FISHERIES

Global reported fish production from all sources (marine, aquaculture and inland) has been increasing at a linear rate of 3.78 percent per year from 1950 to the current (2009) level of 158 159 993 tonnes (Figure 1).

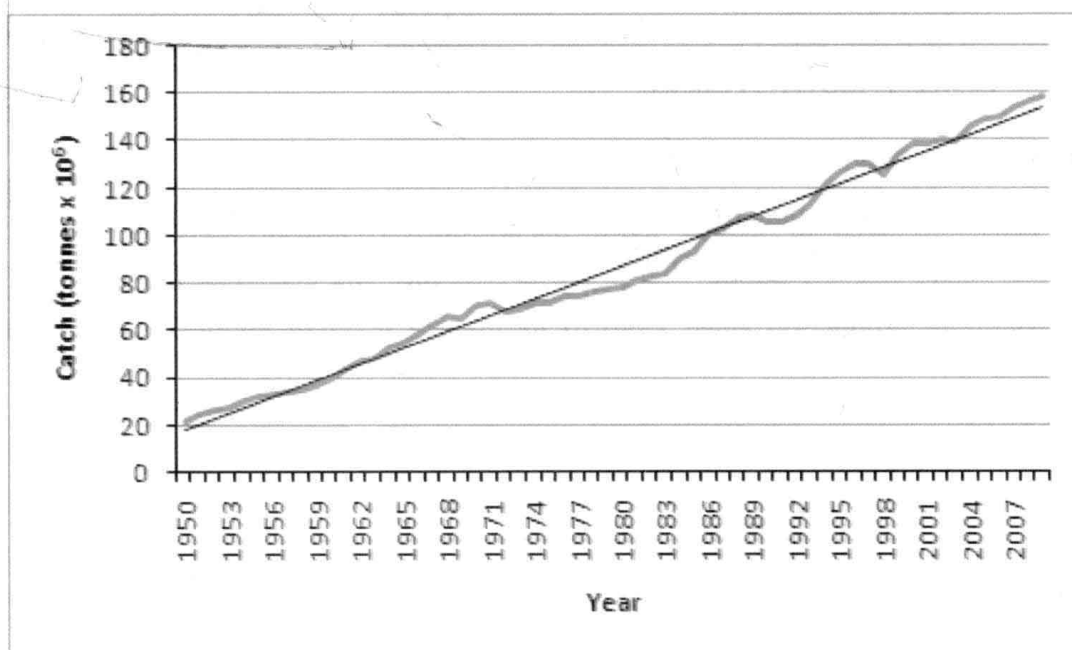


Figure 1: Global fish production from all sources (marine, aquaculture and inland) 1950–2009 with trend line $y = 2E+06x + 2E+07$

² Crocodile catches are the subject of a short note in Annex 4.

Table 2 shows the contribution of the various sources of animal protein to world consumption in 2009. This places fish from all sources as the major single source of animal protein worldwide, accounting for over one-third (37.42 percent) of global production in 2009. In reality, not all of this fish is directly eaten by humans, as much of the marine catch is transformed into fishmeal for use in agricultural and aquacultural feeds. The contribution of fish to overall animal production varies considerably by continent.

Table 2: Global production of animal protein by source in 2009 (aquatic plants are excluded from the aquaculture figures)

Protein source	Catch (tonnes)	%
Pig meat	106 069 157	23.68
Marine fish (capture fisheries)	88 942 948	19.86
Chicken meat	79 595,987	17.77
Aquaculture fish (all sources)	68 348 943	15.26
Cattle meat	61 837 770	13.80
Freshwater fish (capture fisheries)	10 323 905	2.30
Sheep meat	8 109 219	1.81
Turkey meat	5 319 748	1.19
Goat meat	4 938 655	1.10
Duck meat	3 845 443	0.86
Buffalo meat	3 307 818	0.74
10 other categories	7 301 670	1.63
Total	447 941 263	100.00

Source: FAOSTAT; FishStat.

2.1 Fish supply by origin

Figure 2 shows the trends in production classified by the origin of the fish produced for 1950–2009. This indicates clearly that marine catches have stabilized around their 1996 peak of about 87 million tonnes to the present (2009) value of just over 89 million tonnes. It also shows the rapid growth of aquaculture production since 1990 to its present level of about 36 percent of the total production (Table 3).

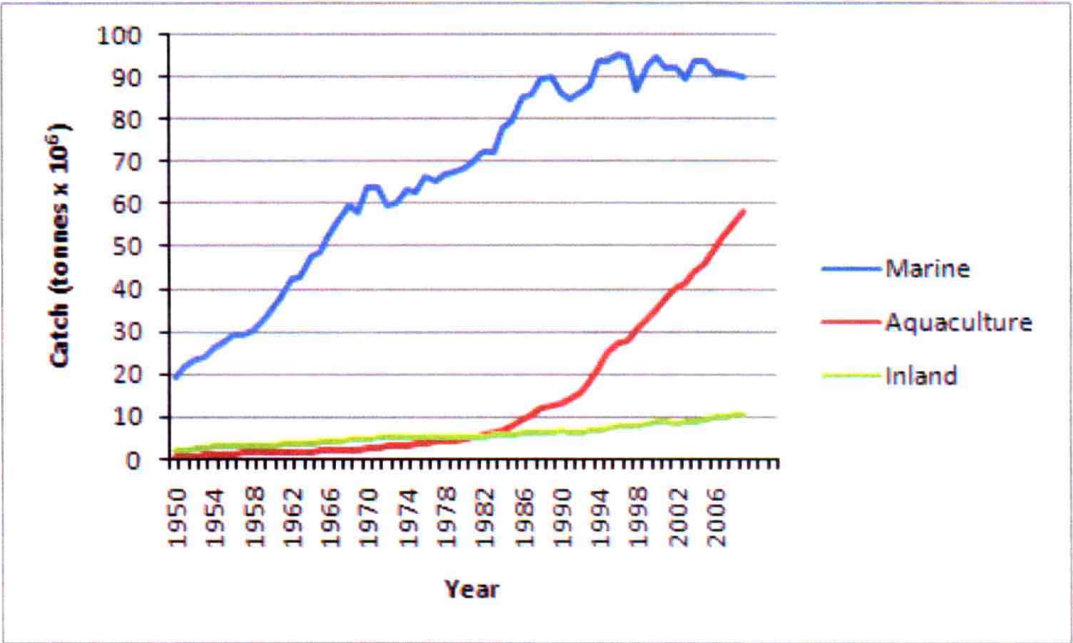


Figure 2: Trends in fish production from the major sources from 1950 to 2009 (aquatic plants are excluded from the aquaculture figures)

Table 3: Global fish production in 2009 by source

Sector	Catch (tonnes)	%
Marine capture	89 848 004	56.81
Freshwater aquaculture	33 833 863	21.39
Marine aquaculture	20 179 876	12.76
Inland capture	10 323 905	6.53
Brackish-water aquaculture	4 231843	2.68
Total	158 159 993	100.00

It is worth noting that fish from all inland sources (capture and aquaculture combined) make up about 28 percent of all fish produced as against the combined production of capture and culture from marine waters of 69 percent. The remaining 3 percent comes from brackish-water aquaculture. It is, perhaps, legitimate to combine the inland sources because of the many practices that are intermediate between capture and culture in inland waters, including various types of enhancement, gears such as fish parks, capture-based aquaculture, culture-based capture fisheries, and fisheries in rice fields and in small dams and reservoirs, that may be reported either as culture or capture dependent on local usage.

Inland capture fisheries currently contribute 6.5 percent to total fish production, which is only about 2.3 percent of the global protein production; they differ somewhat from other fisheries in that all produce is eaten either fresh as some form of salted or dried product or as a variety of fish sauces and pastes that are essential ingredients to many local cuisines. With few exceptions, such as the Amazonian large boat fishery, the Lake Victoria fisheries, the “sábalo” fishery of Argentina and the fishery concessions of the Mekong and Ayerwaddy, inland fisheries are small scale, involving large numbers of artisanal or subsistence fishers, and their products are usually marketed and consumed locally at the point of capture.

2.2 Global trends in inland fisheries

2.2.1 Trends in catches

Catches of fish and other organisms from inland water appear to have increased linearly by 2.93 percent per year since 1950 (Figure 3) to the present (2009) total of 10 323 905 tonnes.

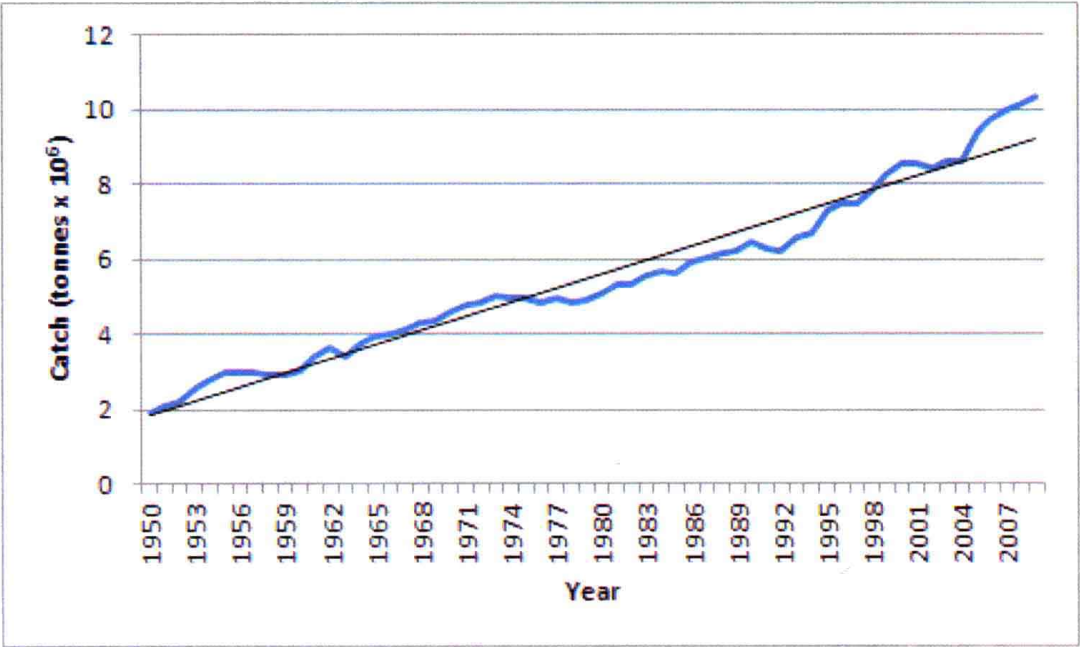


Figure 3: Global inland fish production 1950–2009 with trend line $y = 12592x + 2E+06$

2.2.2 Significance of inland fisheries in the human diet in 2007

Production of fish by capture from inland water remains relatively low compared with other sources of fish at 6.46 percent of the total. However, it is still the sixth major supplier of animal protein globally (Table 2). This global figure conceals considerable local variation, and in some countries fish caught