# Small-scale capture fisheries: A global overview with emphasis on developing countries.

Small-scale fisheries are hard to measure, so their importance to food security and livelihoods is often underestimated; the **Big Numbers Project** works to fill the information gap

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# *SMALL-SCALE CAPTURE FISHERIES – A GLOBAL OVERVIEW WITH EMPHASIS ON DEVELOPING COUNTRIES*

A preliminary report of the Big Numbers Project

by
Food and Agriculture Organization of the United Nations (FAO)
And
World Fish Center

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Cover Photo: Pirogues unload their catch, St Louis, Senegal (Photo © hellio-van ingen)

# FOREWORD

Fisheries contribute greatly to the well-being of many millions of people on our planet. Fish is a highly nutritious food and the sector generates employment and economic values that are important to individuals, communities and national economies. The experience and development of the sector over the last few decades have however taught us that the world's fishery resources are not infinite and, if we are not careful, will not be able to continue supporting lives and livelihoods in the same way in the future.

Reducing poverty is a global priority and by adopting the United Nations Millennium Declaration in 2000, world leaders signed up to achieving several poverty reduction targets by 2015: the Millennium Development Goals (MDG). These goals concern fisheries directly in many ways, both with regard to the sustainable utilisation of natural resources and for fighting poverty. The small-scale fisheries sector is at the core of this, playing a vital part in providing nutritious food and employment, and constituting a safety net for many poor households in coastal communities in developing countries. However, monitoring, management and development efforts have tended to focus on large-scale marine fisheries and the small-scale sector has been left largely undocumented, unregulated and unsupported. To let this situation continue in a time when fish stocks are becoming increasingly depleted would be a great failure and could put the livelihoods of millions of people at risk.

The Big Numbers Project – a collaborative effort by FAO, WorldFish Center and World Bank – addresses the lack of accurate and accessible disaggregated information on small and large-scale fisheries, in inland and marine waters, currently experienced in the international fisheries arena. It aims at improving our knowledge on the characteristics of, contributions by and interactions among the different subsectors of the fisheries sector and at establishing procedures for regular analyses that can inform policy formulation for the benefit of small-scale fishing communities around the world.

This is a preliminary report of the Project, giving a summary of the results to-date of case studies carried out in a selected number of countries and providing a first analysis of the differences between marine and inland small and large-scale fisheries in developing countries. It has been prepared for distribution at the conference "Securing Sustainable Small-scale Fisheries: Bringing together responsible fisheries and social development" in Bangkok, Thailand, on 13-17 October 2008 and is intended for policy and decision makers and others with an interest in sustainable fisheries and poverty alleviation.

The report should be considered work-in-progress and comments and suggestions for improving and expanding the information and analyses are solicited.

*BNP Project Team FAO, WorldFish and World Bank*

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# EXECUTIVE SUMMARY

The importance of fisheries, especially small-scale fisheries, as a source of nutrition, employment and income for many of the world's coastal and rural poor can hardly be overestimated. Small-scale fishing is a key livelihood strategy for millions of households in coastal and rural communities in developing countries and plays an important part in food security and poverty alleviation. The growing threat to sustainable fisheries represented by overcapitalisation, overfishing and environmental degradation is a global concern but even more so for the many small-scale fishers and fish workers in developing countries who are dependent on fishery resources as a key component of their livelihood strategies.

However, disaggregated data showing the characteristics of the small and large-scale sectors – distinguishing also between marine and inland fisheries – are lacking and the specifics of the different fisheries segments are generally not clearly appreciated. Undereporting of catches and underestimates of socioeconomic contributions of in particular small-scale inland fisheries lead to misconceptions and hamper effective policy formulation with regard to fisheries management and poverty alleviation.

The Big Numbers Project (BNP) is a joint activity of FAO, World Bank and WorldFish Center aiming at providing disaggregated information on small and large-scale fisheries, at the global level and by specific countries. Case studies have been carried out in a selected number of developing countries where fisheries are important and this document presents a synthesis of the results of the analyses carried out so far. Estimates of key *Thomson table* indicators – i.e. assessments of the shares of small and large-scale fisheries, in marine and inland waters, in overall catches, local food fish supplies, employment and fossil fuel consumption – for developing countries constitute a main output of this initial project phase. The main findings include:

- While there exists a large diversity in fisheries and fishery systems in the world, there appears to be sufficient common features to allow for the use of small-scale and large-scale fisheries as two main distinguishable categories in global policy discussions and country-level monitoring efforts.
- Official fisheries data on catches and employment are not always reliable. This is likely to be the case for all types of fisheries but it is of particular concern with regard to small-scale fisheries.
- Due to their informal and dispersed characteristics, catches of and employment in inland fisheries tend to be greatly underreported. Both inland and marine small-scale fisheries in developing countries are often poorly regulated, or not regulated at all, and monitoring is weak. The prevalence of illegal, unreported and unregulated (IUU) fishing is hence a source of misreporting, both in small and large-scale fisheries.
- Over half of the catch in developing countries is produced by the small-scale sector. 90-95 percent of the small-scale landings is destined for domestic human consumption and the sector contributes greatly to local food supplies and food security.
- The small-scale sector employs 25-27 million fulltime and parttime fishers in developing countries. Another 68-70 million people are employed in post-harvest activities and the small-scale sector hence provides over 90 percent of all fisheries jobs. About half the total workforce are women.

- In addition to fulltime and parttime employment, the small-scale sector – in particular in inland waters – provides a source of food and income to millions of occasional fishers and fish workers. The sector plays an important role in food security and poverty prevention, constituting a security net for poorer populations both in inland water and coastal areas.
- Many small-scale fisheries in developing countries are vulnerable to both internal and external threats. The current volatility of fuel prices constitutes a particular concern in this respect since fuel typically constitutes a major part of overall costs in small-scale fishing in developing countries.

The lack of accurate information on small-scale fisheries is extremely unfortunate considering the urgent need to address the declining state of fishery resources, to make the most of the potential of fisheries to contribute to food security and poverty alleviation, and to ensure that the many vulnerable livelihoods dependent on the sector are not further threatened. Political will and innovative approaches are needed and both of these require knowledge and information. The ways data are collected and reporting carried out in the small-scale fisheries sector need to be rethought. This preliminary report of the Big Numbers Project contributes to this process. The initial results presented now need to be discussed and the work continued. The Big Numbers Project team invites colleagues and professionals from around the world to join in this effort.

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# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| BNP | Big Numbers Project |
| EEZ | Exclusive Economic Zone |
| EU | European Union |
| FCP | Fishery Country Profile (FAO publication) |
| GDP | Gross Domestic Product |
| GT | Gross tonnage |
| HP | Horse power |
| IDAF | Programme for Integrated Development of Artisanal Fisheries in West Africa |
| IPOA | International Plan of Action |
| IUU | Illegal, unreported and unregulated (fishing) |
| LSF | Large-scale fisheries |
| MDGs | Millennium Development Goals |
| MRAG | Marine Resources Assessment Group Ltd |
| MRC | Mekong River Commission |
| RFMO | Regional fisheries management organisation |
| SFLP | Sustainable Fisheries Livelihoods Programme |
| SSF | Small-scale fisheries |
| UBC | University of British Colombia |

# INTRODUCTION

### *WHY ARE ANALYSES OF SMALL AND LARGE-SCALE FISHERIES NEEDED?*

The importance of fisheries, especially small-scale fisheries, as a source of nutrition, employment and income for many of the world's coastal and rural poor can hardly be overestimated. Small-scale fishing is a key livelihood strategy for millions of households in coastal and rural communities in developing countries and plays an important part in food security and poverty alleviation. Fish is often an important source of protein in local diets and fishing and related activities provide jobs and income. Seasonal or occasional fishing can also provide a vital supplement to other livelihood activities, in times of difficulties or as a recurrent side-line activity (Béné *et al*, 2007).

Small-scale fishers often have a weak political voice – living in remote areas in communities with low literacy and organisational development levels – and lack the capacity to influence policy decisions (Béné *et al*, 2007). The ability to raise the profile of the important small-scale sector in policy-making is further compromised by the dearth of accessible and relevant information. Data on fisheries and its socioeconomic importance tend to focus on the macroeconomic level – GDP, foreign exchange earnings and state tax revenues – and not include household or individual level information. Fishery catch statistics are generally collected by countries and FAO routinely compiles and collates the information into a global database (FAO, 2008) but the data collected do in most cases not distinguish between large-scale and small-scale fisheries and the small-scale sector is often poorly covered in official statistics (FAO/FishCode-STF, 2005; Chuenpagdee *et al,* 2006; Johnson, 2006). This leads to chronic undervaluing of the sector, which in turn results in continued underinvestment in small-scale fisheries monitoring, management and development.

While efforts are being made to come to terms with these deficiencies and to improve fisheries management (FAO, 2007b; Agnew *et al,* 2008), these tend to focus on large-scale fisheries in developed countries. Small-scale fisheries in developing countries, which are often unregulated and suffering under the pressure of rapid population growth, receive less attention with less interest being directed towards their monitoring and management. Still, it is clear that overfishing, overcapitalisation and environmental degradation are global problems and that the situation looks precarious both to small and large-scale operators, often depending on the same or adjacent resources (Pauly, 2006; FAO, 2007). Illegal, unreported and unregulated (IUU) fishing is a topic currently attracting considerable attention in the global fisheries management arena and it is recognised that significant amounts of catches – both in small and large-scale fisheries – are not reported and hence do not appear in official statistics (MRAG, 2005; Agnew *et al*, 2008).

It is also increasingly recognised that open access fisheries – i.e. unregulated fisheries with no entry restrictions – lead to overfishing and that conventional centralised fisheries management frameworks do not always produce the desirable outcomes with regard to sustainability (FAO, 2007).The depletion of fish stocks and a collapse of the economic activities based on these resources will have far more severe consequences in small-scale fishing communities in developing countries, where there are few livelihood alternatives and social security systems are generally non-existent, than in more affluent areas of the world.

Small and large-scale fisheries interact, with regard to the resource base but also at the level of processing, marketing and other auxiliary activities, and there may be both synergies and competition within and between the two sectors (FAO/RAP/FIPL, 2004; Jacquet & Pauly, 2008). Small-scale fisheries in developing countries are vulnerable to such competition as well as to other internal and external threats. Due to the diversity and complexity of small-scale fisheries, and the way they are nested in and contribute to local economic development, food security and social safety nets, management and conflict resolution within this sector poses particular challenges. Small-scale fisheries assessment and management approaches need to be fundamentally different to those used in large-scale industrial fisheries and must address the particular vulnerability context of the small-scale sector; only then can long-term sustainable resource utilisation and livelihood outcomes be achieved (Garcia *et al*, 2008; Berkes *et al*, 2001; Andrew *et al,* 2007; Westlund *et al*, in press). However, typically, assessment methods adapted from high-value fisheries in developed countries are implemented for both marine and inland fisheries in developing countries. Creating the political will to invest in the capacity to develop and implement systems adapted to local situations and small-scale fisheries will depend on a more complete understanding of the scale and importance of this sector.

**Box 1: The Code of Conduct and small-scale fisheries**

The Code of Conduct for Responsible Fisheries – developed by FAO in response to the growing concerns regarding the sustainability of global fishery resources and adopted by Member States in 1995 – recognises the importance of small-scale fisheries in poverty alleviation and food security. One of the objectives of the Code is to "promote the contribution of fisheries to food security and food quality, giving priority to the nutritional needs of local communities" (Article 2 (f), FAO, 1995). It also acknowledges that the context of fisheries management includes "food security, poverty alleviation and sustainable development" (Article 6.2, FAO, 1995). Technical Guidelines to accompany the Code for "Increasing the contribution of small-scale fisheries to poverty alleviation and food security" are available (FAO, 2005). Direct reference is made in Article 6.18 to fishers and fish workers in the "subsistence, small-scale and artisanal fisheries" and their right to "a secure and just livelihood, as well as preferential access, where appropriate, to traditional fishing grounds and resources in the waters under their national jurisdiction" (FAO, 1995).

Hence, in spite of growing evidence that fisheries in less developed countries are grossly undervalued, there is still an apparent lack of global assessments of the overall socioeconomic importance and contributions of the different sub-sectors, due to a lack of accurate data and the absence of internationally agreed definitions. This lack of information and analysis of how the fisheries sector is structured and functions, hindering the formulation and implementation of urgently needed policies and actions for fisheries management and poverty alleviation has to to be addressed. Disaggregating data and looking at the roles of small-scale and large-scale fisheries separately – as well as how they interact – both in the marine and the inland environment, will help us understand how to best support the people dependent on fisheries for food and other livelihood outcomes.

***THE BIG NUMBERS PROJECT***

The Big Numbers Project (BNP) is a joint activity of FAO and WorldFish Center and funded through the World Bank's PROFISH[1] Partnership as well as contributions from the two organizations. It was conceived at the FAO/WorldFish Center Workshop on Interdisciplinary Approaches to the Assessment of Small-scale Fisheries in Rome, Italy, in September 2005 as part of a recommendation to develop a framework specially adapted for assessing small-scale fisheries[2].

BNP aims at improving the availability of disaggregated information on small and large-scale fisheries, at the global level and by specific countries. It focuses mainly on information related to food security at the household level as included in the so called Thomson table (Thomson, 1980 – see also page 12), e.g. employment and contributions to domestic food supplies, and less on macro-economic indicators such as economic growth and foreign exchange earnings. The first project milestone is to capture a snap-shot of the current situation based on most recently available statistics. However, the longer-term intention is to establish procedures allowing for regular analyses of statuses and trends for the benefit of policy formulation at the country level, and management advice at the global level.

During the data collection phase, the project worked closely with national counterparts and other fisheries professionals to carry out case studies in populous developing countries where fisheries are socially and economically important (see Box 2). The results from these case studies were analysed and, together with other available information, formed the basis for a first disaggregated review of the fisheries sector as a whole in developing countries. The case studies also provided valuable insight into what information is available on small- and large-scale fisheries – and that which is not – and how data can best be collected and analysed in the future. In several case-study countries the project served a capacity building function in bringing together stakeholder institutions to discuss concepts and definitions of small-scale fisheries, and highlight the paucity of information relating to this sector.

The project was designed and started before the current food and fuel prices crises. Within the present context, it would appear that what the project attempts to do – establishing a baseline of the current situation and highlighting ways to improve monitoring systems - has become even more urgent. Issues related to the efficiency of the different fisheries sectors and the implications of volatile fuel and product prices have become key for understanding likely future developments and impacts on livelihoods and food supplies.

[1] PROFISH is the World Bank's global program on fisheries. The partnership is financially supported by a consortium of donors including several Scandinavian countries, France and the Bank and is technically supported by FAO, IUCN and WorldFish Center.

[2] In parallel with the BNP, progress on the development of a small-scale fisheries assessment framework has been made, see "Towards integrated assessment and advice in small-scale fisheries. principles and processes" (Garcia *et al, in press*).

**Box 2: BNP country case studies**

Recognising the lack of disaggregated information as one of the main difficulties in analysing different fisheries subsectors, BNP commissioned a number of case studies in order to collect information and promote critical local analyses on small and large-scale fisheries in marine and inland waters. These studies were carried out in fifteen countries, together representing about 40% of reported global catches and over 50% of those from developing countries, and included Bangladesh, Brazil, Cambodia, China (three provinces), Ghana, India, Indonesia, Mozambique, Nigeria, Philippines, Senegal, Thailand, Vietnam and Lake Victoria (Kenya, Tanzania and Uganda).

The information collected concerned in particular estimated catches by different fleet segments, the contribution of catches to local supplies of fish for human consumption, numbers of fishers and other employment (disaggregated by gender), and costs of production and fuel consumption. The case studies also discussed definitions of small and large-scale fisheries and data was disaggregated for marine and inland waters in addition to small and large-scale operations using existing local definitions

Information was gathered from existing secondary sources, complemented where possible by primary data collection. Results were examined and cross-checked by local stakeholders and experts, in many cases in national workshops; this also facilitated discussions on methodologies and future possibilities for improving data systems. Depending on the availability of data and the scale and complexity of the local situation, different case studies generated results varying somewhat with regard to the level of detail and depth of analysis. In this report, the case study data and analyses have been used in combination with other sources of information.

Summary tables of key data for all the case studies are included in APPENDIX 2.

***THIS REPORT***

This preliminary report is the first consolidated output of the Big Numbers project and presents results to-date. It has been prepared for the conference on "Securing Sustainable Small-scale Fisheries: Bringing together responsible fisheries and social development" in Bangkok, Thailand, in October 2008. It is intended for conference participants, in particular policy and decision-makers, and others with an interest in sustainable fisheries and povery alleviation. The report attempts to clarify important concepts and give a first overview of the roles of small and large-scale marine and inland fisheries around the world with special emphasis on developing countries. While recognising the existing analytical limitations due to data availability and the lack of harmonised definitions, it provides estimates of a selected number of economic and social indicators, demonstrating differences between small and large-scale fisheries, in marine and inland waters, and their respective contributions and characteristics.

The report should be considered work-in-progress and the intention is to continue the collection of information and analyses. It is planned that an updated version of the present report be presented to the forthcoming FAO Committee on Fisheries in 2009.

## WHAT DO WE MEAN BY SMALL AND LARGE SCALE FISHERIES?

### *DEFINITIONS*

While the term "small-scale fisheries" is commonly used in international fisheries literature and discussions, this classification is rarely explicitly defined. This could be considered a significant oversight that relates to the fact that the conceptualisation of scale depends very much on context (Johnson, 2006); a fishing boat that would be considered small-scale in one place could be considered large-scale in another. Still, there are some general attributes that relate to the broad definition of scale; large-scale – or industrial fisheries[3] – are often associated with high capital costs and sophisticated technologies; small-scale fishing is perceived as using smaller craft, and more labour intensive and low-technology fishing methods. Small-scale fisheries have often been seen as an activity of low productivity, low yield rates and low value product for household and local consumption. This is not always the case however, as modern small-scale fisheries can be economically efficient and produce high value products for international markets. Technological developments, in particular motorisation, and the availability of navigation and communication equipment, as well as globalisation and market integration have changed the way many small-scale fisheries operate; the diversity within the sub-sector is enormous and increasing. An FAO Working Group on small-scale fisheries that convened in Bangkok, Thailand, in 2003 concluded that it is not be possible or useful to attempt to formulate a universal definition of small-scale fisheries considering their diversity and dynamism. Accordingly, the following description of the sub-sector was agreed upon:

> *Small-scale fisheries can be broadly characterized as a dynamic and evolving sector employing labour intensive harvesting, processing and distribution technologies to exploit marine and inland water fishery resources. The activities of this sub-sector, conducted full-time or parttime, or just seasonally, are often targeted on supplying fish and fishery products to local and domestic markets, and for subsistence consumption. Export-oriented production, however, has increased in many small-scale fisheries during the last one to two decades because of greater market integration and globalization. While typically men are engaged in fishing and women in fish processing and marketing, women are also known to engage in near shore harvesting activities and men are known to engage in fish marketing and distribution. Other ancillary activities such as net-making, boatbuilding, engine repair and maintenance, etc. can provide additional fishery-related employment and income opportunities in marine and inland fishing communities. Small-scale fisheries operate at widely differing organizational levels ranging from self-employed single operators through informal micro-enterprises to formal sector businesses. This sub-sector, therefore, is not homogenous within and across countries and regions and attention to this fact is warranted when formulating strategies and policies for enhancing its contribution to food security and poverty alleviation.*
> (FAO, 2004, quoted in Béné, Macfadyen and Allison, 2007, p 7)

[3] It should be noted that the term "industrial fisheries" is sometimes used for "fisheries which do not target species for direct human consumption, i.e. the capture of fish for reduction into fish meal and fish oil" (see, for example, *www.fishonline.org/information/glossary/).* However, in this report the term is used with reference to scale and synonymous with large-scale fisheries.

Although the concepts of small and large-scale fisheries are not definite at the global or aggregate level, they are often used at local and national levels with more preciseness. Many countries divide their fisheries into several categories and small-scale fisheries are generally one. However, the terminology varies and the classification can also include a wider range of categories. The terminology often includes artisanal, traditional, recreational or subsistence fisheries depending on how the categories have been defined (see Box 3).

**Box 3: Terminology and sub-categories of small-scale fisheries**

In addition to small-scale and large-scale, there are several other terms used for describing the different fisheries subsectors. *Artisanal fishery* is commonly used when describing a traditional fishery, e.g. the canoe fisheries off West Africa. It is a term of Latin origin with a socio-economic foundation and "tends to imply a simple, individual (self-employed) or family type of enterprise [...], most often operated by the owner" (FAO, no date). It also tends to refer to the use of low levels of technology rather than the scale of the activity. However, the terms artisanal fisheries and small-scale fisheries are often used interchangeably and also in this report, artisanal fisheries have generally been interpreted as being the same as small-scale fisheries.

A *subsistence fishery* is "a fishery where the fish caught are shared and consumed directly by the families and kins of the fishers rather than being bought by middle-(wo)men and sold at the next larger market" (FAO, no date). Pure subsistence fisheries are rare since excess production would be sold or exchanged for other products or services even in the smallest fishery; strictly speaking, all fisheries (except perhaps recreational – see below) are commercial. Still, when referring to subsistence fishing, a more household centred than commercial activity is implied. Subsistence fisheries are a subset of small-scale fisheries.

*Recreational fishing*, also called sport fishing, is fishing for pleasure or competition, with a possible second objective to catch fish for own consumption. It is a popular activity and pastime in many developed countries around the world, e.g. Canada, Italy, Spain and the United States of America, and has also increased in developing countries as a tourist attraction. Recreational fishing is by definition not a commercial activity, i.e. the catch is not sold, but the sector can contribute substantially to local and national economies. Recreational fisheries can be seen as part of the small-scale sector and, as for the rest of small-scale sector, data on recreational catches are often lacking. It is however becoming increasingly recognised that they could have a significant impact on fish stocks (FAO, no date b; Sutinen and Johnston, 2003; Cooke and Cowx, 2005).

Small-scale fishing boats can be motorised or non-motorised. While traditional craft were often powered by wind or paddles, there has been an important increase in motorisation during the last few decades. It should also be noted that there are small-scale fisheries taking place without boats by using shorebased or handheld gear. In 2002, it was estimated that the world fishing fleet consisted of some 4 million vessels. About two-thirds of these were undecked (and generally less than 10 m) whereof 65 percent non-motorised, i.e. approximately 1. 8 million. Large vessels over 24 m (or larger than 100 GT) represent only about 1 percent of the total fishing fleet (FAO, 2007).

Often the small-scale fishery classification criteria include a technical consideration, in particular the size of the vessel. Chuenpagdee *et al* (2006) found that this was the case in 65 percent of the 140 countries included in their study on marine small-scale fisheries. The gear type is another deciding factor. Fishing grounds and operational distance from shore could be other criteria, especially if there are different management regulations for the different fleet segments. It should be noted that many countries consider all inland water operations small-scale and that monitoring and management efforts also in the marine sector tend to

be focused on the large-scale and marine fleet segments. In some countries, this constitutes an incentive for fishers to be considered as small-scale because there are less restrictions for this part of the fleet than for large-scale vessels (e.g. Nicargua, see FAO/FishCode-STF, 2008). Moreover, the structure of the sub-sector and its ownership as well as conceptual considerations could be used as criteria. The following examples of criteria and characteristics were found in the BNP case studies (see also Table 1):

- **Technical criteria**: Vessels of less than 5 GT in Thailand and with an engine power of less than 50 HP in Cambodia. In Senegal, the vessel type is the decisive criterion and all canoes ("pirogues") are considered artisanal, i.e. small-scale.
- **Fishing ground and management factors**: In the Philippines, vessels smaller than 3 GT require registration at the municipal government level and are allowed to fish in the 0-15 km coastal area. They are called 'municipal fisheries' and considered small-scale.
- **Conceptual considerations**: According to the glossary of the *Indonesian National Act No. 31/2004 concerning the Fisheries*, small-scale fishers are defined as those who their livelihood do fishing for their daily life or daily necessity.

**Table 1: Examples of definitions of small-scale marine fisheries from case study countries**

| ***Country (area)*** | ***Size of vessel / engine*** | ***Other criteria*** | ***Sub-categories*** | ***No of vessels*** |
|---|---|---|---|---|
| Brazil | < 18 m | | "Small boats" < 12m (with and without engines); "middle-sized boats" 12-18 m. | 99 100 |
| Cambodia | < 10 HP | Largely subsistence fishing | Motorised; non-motorised | 5 400 |
| Ghana | Canoes | Low level of mechanisation | According to gear types: Ali/Poli/Watsa; set net; hook and line; drift gillnet; beach seine. | 11 200 |
| India | Non-mechanised | | Motorised; non-motorised, and type of boat: kattumarams; plank-built craft; FRP and other craft; ring seiners; dugouts. | 179 000 |
| Philippines | < 3 GT | Operating in coastal area < 15 km and under management of local municipalities | Motorised *bancas*; non-motorised *bancas* | 469 800 |

*Source: BNP case studies.*

The exact criteria to use for defining fishery categories – and hence the subset of boats and operators that is included – should depend on the purpose for which the classification is made. The social and economic importance of the small-scale sector is often underestimated due to a lack of information. If the role of the small-scale fisheries in poverty reduction and food security is to be strengthened, more information may be needed on the socioeconomic characteristics of the sub-sector as well as on its overall development context in order for governments to formulate effective policies and actions. When defining the sub-sector, consideration may then need to be given to ownership

structures and its importance to local economies. For resource management purposes, criteria related to fishing areas, target species and gear are likely to be relevant (see Box 4).

**Box 4: Small-scale coastal fisheries in the EU**

Within the European Union (EU) there has been no harmonised definition of small-scale fisheries although member countries do use the term generally to describe fleet segments of smaller boats fishing in national coastal waters. The sub-sector is overall considered of particular importance to employment and as having a lower impact on resources. Within the context of developing recommendations for the management of fisheries exploited by European small-scale coastal fleets, a recent study suggested that the EU bases its operational definition of small-scale fisheries on three criteria: vessel size, gear used and geographic range of activities. Accordingly, small-scale coastal fishing would generally include vessels of less than 12 meters – possibly up to 18 meters in certain areas with coastal fisheries by larger boats (the Mediterranean) – predominately using passive gear and operating in inshore areas. It was also noted that the importance of sub-sector, both in terms of production and employment, was often underestimated and that more knowledge on the structure and functioning of the sub-sector would be necessary for its efficient management (IFREMER, 2007).

***LINKS AND INTERACTIONS***

The discussion above has focused on definitions of fishing operations, i.e. the actual act of catching fish at sea (or in a lake or river). However, a fishery consists of not only primary production but is a larger system including up and downstream activities among which fish processing and marketing are of major importance. As for fishing operations, the definition of what are small and large-scale land-based post-harvest activities is somewhat ambiguous. The picture is further complicated by the fact that small-scale fishers may supply fish to industrial processing plants and vice versa (see Box 5). Generally small-scale processing is labour intensive and uses a minimum of technology. In developing countries, the aim is commonly to preserve the fish and extend its shelf-life. Throughout the tropics, drying is widely practiced. Salting and fermenting are common in Asia, and smoking is mainly used in Africa. Large-scale processing can take place on board factory vessels or at shore-based plants. Freezing is globally the most common method of processing fish, followed by canning. Frozen fish is also the most common fish commodity for export from developing countries (FAO, 2007).

Vertical integration of large-scale fishing and processing industry, combined with important investments, has become common in many developed countries during the last few decades (e.g. Iceland, New Zealand – see Fishery Country Profiles (FCPs), FAO , *No date c*). In the small-scale sector, vertical coordination is also common through, for example, fish traders pre-financing fishing trips or inputs in exchange for a guaranteed supply of fish. In Bangladesh, the *dadandar*, i.e. the fish trader cum money lender is the traditional source of credit for fishers. The credit conditions vary from location to another but generally the borrower – who may have taken a loan to finance fishing equipment – would be obliged to sell his fish to the *dadandar* at a price below the market price (NRI, 2003).

**Box 5: Nile perch from Lake Victoria**

After a trawl ban in 2000, all fishing on Lake Victoria is carried out by small-scale operators and Nile perch is caught by gillnet and longline. The bulk of the catches, approximately 230 000 tonnes in 2001, is exported and generally only rejects (small size or damaged fish) and remains after filleting are consumed locally.

There is a total of 31 large-scale processing plants in the three countries – Kenya, Tanzania and Uganda – surrounding the lake. The fish arrives at the plants via middlemen and fish agents; the middlemen acquiring their fish directly on the lake, while the fish agents purchase their fish at authorized landing sites. In some cases, fish is also delivered to the processing companies by directly fishers. Often there are agreements between a company and groups of fishers with regard to supplying fish. In return, the company provides the fishers with nets and other essential materials.

The employees of the companies are specially trained to maximize product quality. A company with an average processing capacity of 40 tonnes raw material per day has approximately 350 permanent and temporary employees.

*Source: BNP case study Lake Victoria 2008.*

As illustrated by the example in Box 5, this type of links can also exist between large-scale processing and the small-scale fishing sub-sector. For small-scale fishing communities, such arrangements can be both beneficial and unfavourable. Larger scale operators may have access to markets in a way that the small-scale fishers do not, and can in this way provide a lucrative distribution channel. In the case of Nile perch processing and export from Lake Victoria, the BNP case study found that the direct effects of the marketing arrangements were generally positive for the local fishing communities with regard to economic development and food (fish) supplies. This was partly thanks to an industrial trawl ban in 2000 which supported a growth in small-scale fishing units. Another contributing factor to this situation is that the processing industry has largely remained in the hands of local fish processing companies ensuring that the added-value created benefit the local economy. Moreover, other fish species are available for local consumption, and are being fished and landed by other segments of the small-scale fishing fleet (BNP case study Lake Victoria). In other situations, however, the situation may be different with large-scale fisheries competing with the small-scale sector for access and control over both resources and markets (FAO, 2003).

There are also interactions at the horizontal level between the small and large-scale fishery sub-sectors. In some countries, canoe fishers collect bycatch from industrial trawlers. In the Gambia, fishers who initially were disadvantaged and effectively displaced by the presence of shrimp trawlers worked out informal agreements with the crew and made a business of collecting bycatch and selling it through various outlets on shore (Clucas, 1997). This type of bycatch collection also takes place in a number of other countries (see also section on BYCATCH AND DISCARDS below).

Due to overfishing and increasingly scarce resources, the general competition for fishery resources has increased. While many countries reserve inshore marine areas and inland waters for small-scale operators, there are other situations where both fleet segments compete for the same fishery resources (FAO/RAP/FIPL, 2004; Jacquet & Pauly, 2008). Also, it is not unusual that, for example, industrial trawlers encroach on inshore fishing grounds. In addition to impacting on the resources available for the small-scale sector (see also section on ILLEGAL, UNREPORTED AND UNREGULATED (IUU) FISHING below), this may increase the risk of accidents and collisions. In a study undertaken by the Programme for Integrated Development of Artisanal Fisheries in West Africa (IDAF) in seven West African countries in 1991-1994, incidents with industrial vessels getting their trawls entangled in fishing nets and dragging them away while canoes are fishing were among the main causes for accidents at sea (Gallène, 1995). Also ten years later, the Sustainable Fisheries Livelihoods Programme (SFLP) found through communications with fishing communities in Congo, Guinea and Gabon that infractions by larger vessels in the small-scale fishing area and safety at sea were major concerns among small-scale fishers (Njock, 2007).

### *CLASSIFYING DIVERSE AND COMPLEX FISHERIES*

From the above discussion, it can be concluded that a fishery can be defined according to several different dimensions – biological, technological, economic, social, cultural and political – and that a multi-dimensional approach is needed for understanding the exact attributes of different small and large-scale fisheries and fishery systems. Table 2 gives an overview over some of the main characteristics and how they can schematically be described for small-scale – divided into subsistence and other (see Box 3) – and large-scale fisheries. It should be remembered that the categories are not mutually exclusive; a specific fishery could fall into different categories depending on which characteristic is examined. Moreover, it could be said that, generally in the world, there is a shift over time from the left to the right of table, i.e. from small-scale towards large-scale, but this trend is not linear or irreversible (Berkes *et al,* 2001; Johnson, 2006*)*. Nevertheless, there appears to be sufficient common features to allow for the use of small-scale and large-scale fisheries as two main distinguishable categories in global data and policy discussions (Chuenpagdee *et* al, 2006; Jacquet and Pauly, 2008).

**Table 2: Categories and characteristics of fisheries**

| ***Characteristics*** | ***Categories of fisheries*** | | |
|---|---|---|---|
| | ***Small-scale*** | | ***Large-scale*** |
| | ***Subsistence*** | ***Other small-scale*** | |
| *Size of fishing craft/vessel and engine* | Non or small (5-7 m; < 10 GT), usually non-motorised | Small (< 24m; <50 GT)) with low power engine (<400 HP) | Large (>24m; >50 GT) with high power engine (>400 HP) |
| *Type of craft/vessel* | Canoe, dinghy, wooden boat, boat with no deck | | Steel hull boat, trawlers, factory vessels |
| *Fishing unit* | Individuals, or family or community groups | Small groups, some specialisation and division of labour; importance of household and community | Smaller and larger groups; specialisation and division of labour |
| *Ownership* | Craft/gear owner-operated | Usually owned and operated by senior operator; some absentee ownership | Concentration of ownership, often by non-operators; cooperative ownership |
| *Time commitment* | Mostly parttime/occasional | Fulltime or parttime | Usually full time |
| *Fishing grounds* | On or adjacent to shore; inland or marine | Inshore/coastal; inland or marine | All marine areas |
| *Disposal of catch* | Primarily household consumption but some local barter and sale | Sales to local, national and international markets; household consumption | Primarily sale to organised markets |
| *Utilisation of catch* | Fresh or traditionally processed for human consumption | Fresh or processed – generally traditionally – for human consumption. | Mostly processed; large share for reduction for non-food products |
| *Knowledge and technology* | Premium on skills and local knowledge; manual gear | High skills and knowledge needs; manual and mechanised gear; some electronic equipment | Skills and experience important but supported by technology; mechanised gear; automation and electronic equipment |
| *Integration into economy* | Informal, not integrated | Partially integrated | Formal, fully integrated |

*Source: Adapted from Berkes et al, 2001; Chuenpagdee, 2006 and Johnson, 2006.*

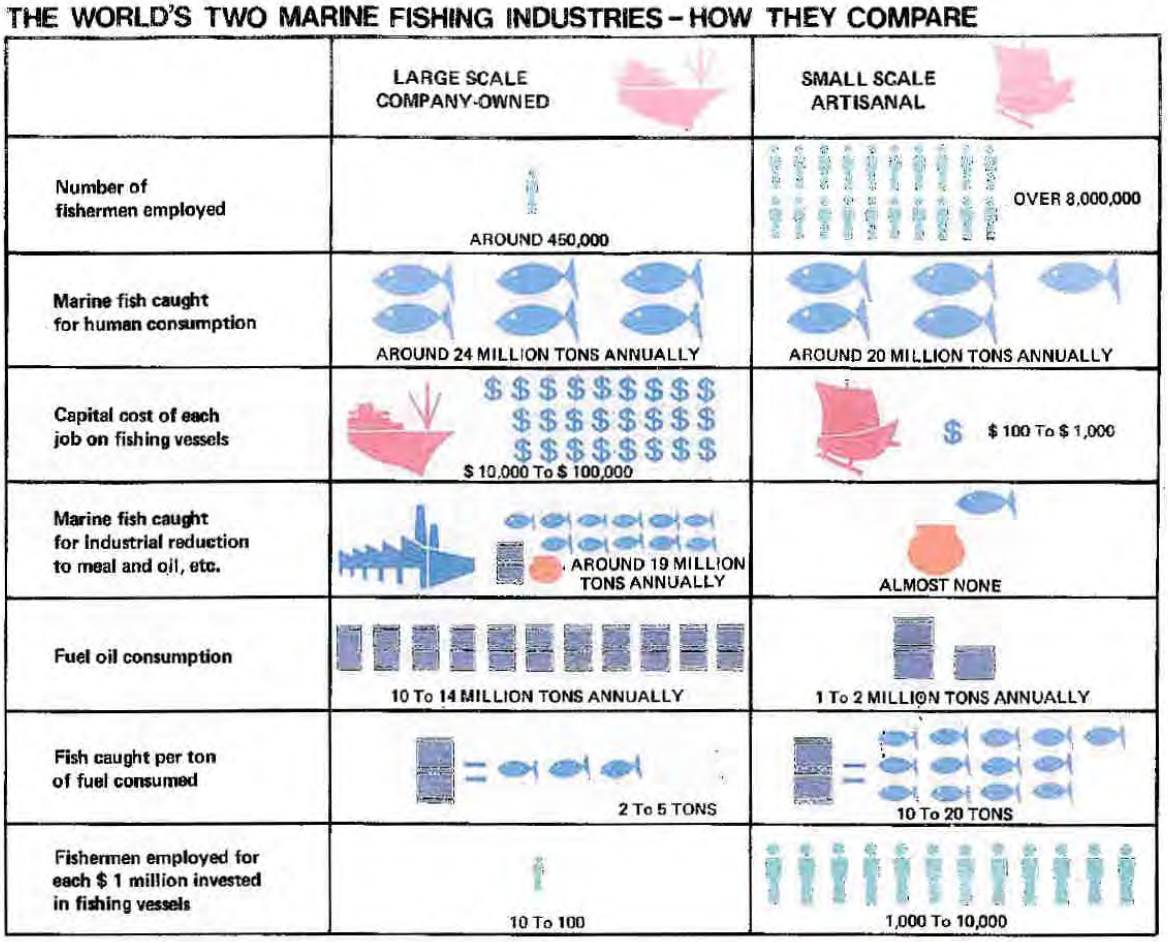
## COMPARING SMALL AND LARGE-SCALE FISHERIES AT THE GLOBAL LEVEL

### *THE THOMSON TABLE*

Although the previous chapter discussed the difficulties in clearly defining small and large-scale fisheries in a way that can be applied worldwide – and emphasized the importance of recognising the diversity and complexity of fisheries – this section seizes upon the conclusion that it is still useful and possible to talk about two general broad categories of fisheries and attempts to paint an overall picture of their respective roles in a global perspective, paying special attention to developing countries. Such attempts have been made already; global numbers for employment, annual catches, fuel consumption, etc, in small and large-scale marine fisheries were first calculated in 1980 and presented in what has become known as the *Thomson table* (see Box 6, Thomson, 1980).

The Thomson table has been updated on several occasions (Lindquist, 1988; Berkes *et al*, 2001; Pauly, 2006) and the key indicators of the different versions are summarised in Table 3.

**Box 6: The original *Thomson table***




The original Thomson table was published in the ICLARM Newsletter in July 1980 in an article by David Thomson on Conflict within the fishing industry, arguing for the need to protect inshore fishing grounds and support small-scale fishers (Thomson, 1980).

**Table 3: Thomson tables: global small and large-scale (marine) capture fisheries**

| ***Benefits*** | ***Thomson 1980*** | | ***Lindquist 1988*** | | ***Berkes et al 2001***[4] | | ***Pauly 2006*** | |
|---|---|---|---|---|---|---|---|---|
| | ***SMALL-SCALE*** | ***LARGE-SCALE*** | ***SMALL-SCALE*** | ***LARGE-SCALE*** | ***SMALL-SCALE*** | ***LARGE-SCALE*** | ***SMALL-SCALE*** | ***LARGE-SCALE*** |
| *Annual catch for human consumption (tonnes)* | 20 million | 24 million | 24 million | 29 million | 20-30 million | 15-40 million | About 30 million | Same: about 30 million |
| *Annual catch reduced to meals and oils (tonnes)* | Almost none | About 19 million | Almost none | About 22 million | | | Almost none | 20-30 million |
| *Fish and other sealife discarded at sea (tonnes)* | | | none | 6-16 million | | | Very little | 8-20 million t |
| *Number of fishers employed* | <8 million | About 450 000 | >12 million | 500 000 | 50 million | 500 000 | >12 millions | About ½ million |
| *Annual fuel consumption (tonnes)* | 1-2 million | 10-14 million | 1-2.5 million | 14-19 million | 1-2.5 million | 14-19 million | About 5 million t | About 37 million |
| *Catch (tonnes) per tonne of fuel consumed* | 10-20 | 2-5 | 10-20 | 2-5 | 10-20 | 2-5 | 4-8 | 1-2 |

*Source: Selected data rearranged based on the sources cited in the table headings above.*

It is noteworthy that all the Thomson tables, except for Berkes *et al* (2001), only include marine fisheries. Disappointingly, this is generally not highlighted in the text accompanying these tables, and as a result the numbers depicted have often been cited as representing 'global fisheries'. Still, even without the important inland fisheries component, the small-scale sector is shown to be of major importance in local food supplies and for employment. It is also apparent that small-scale fisheries generate less wastage in the form of discards and that the sector consumes less fuel, both overall and for producing the same amount of fish.

### *DEVELOPING COUNTRIES*

The socioeconomic importance of the fisheries sector is particularly pronounced in many coastal communities in developing countries. It has been estimated that 90 percent of those dependent on fisheries for their livelihood outcomes – working as fishers, processors, traders or in other ancillary activities – live in developing countries (Béné, Macfadyen and Allison, 2007). Over 70 percent of the world's total reported catch is from developing countries; in inland waters the developing country share is 95 percent (FAO, 2008).

[4] All versions refer only to the marine sector expect for Berkes *et al, 2001,* that incorporates both marine and inland fisheries.

Based on the information generated by the BNP case studies, new tentative estimates for key Thomson table indicators were calculated for developing countries, adding inland fisheries to the marine sector included in the original table. These estimates are presented in Table 4[5]. Some indicators may not be directly comparable with Table 3 due to differences in definitions, but the general trends are reinforced; the major part of the small-scale production is destined for local human consumption and the small-scale fisheries sector is important for employment, providing some 95 million jobs, fulltime and parttime in fishing, processing and marketing. Discards are generally insignificant and, overall, the small-scale sector is more fuel efficient. In the following sections, the various estimates included in Table 4 will be discussed further, i.e. reported landings and catch estimates, utilisation of fish landings, employment and fuel consumption, in small and large-scale fisheries in developing countries.

## DATA AVAILABILITY AND UNDERREPORTED CATCHES

### *THE CASE OF INLAND FISHERIES*

As mentioned in the introduction, data on small-scale fisheries are often not fully included in official statistics. Case studies and independent estimates regularly show that in particular catches in inland fishery resources are greatly underreported. Coates (1995) suggested that actual catches from inland sources could be – on a global average – twice as high as officially reported to FAO. Individual examples suggest that the underreporting in many cases could be even more important. Consumption studies in the Lower Mekong River Basin have shown important differences when compared with official landings data and so have alternative estimates in several other Southeast Asian countries (Coates, 2002; Hortle, 2007). Official inland catches in Ghana averaged 75 000 tonnes per year 2004-2006 (FAO, 2008) but the BNP case study, based on information from Yeji fish market surveys, estimated catches from Lake Volta alone to be 346 000 tonnes. Examples of underreported inland water catches transpiring from the BNP case studies are presented in Table 5[6]. On an average, in all the BNP case study countries, inland water catches appeared to be underreported by some 40 percent.

Inland fisheries are often informal and dispersed over large areas without any particular landing points, making data collection and reporting difficult. Fisheries management regulations are few or not enforced. Fish does often not enter formal marketing and distribution channels and it is common that a major part of the catches is consumed domestically or within the local fishing community (Coates, 2002). The BNP case studies indicated that 95 percent of the catch from small-scale inland fisheries is consumed in country, i.e. not exported or used as animal feed.

[5] The methodologies used for the estimates are described in APPENDIX 1.

[6] The table includes all BNP case study countries showing a difference greater than 10 percent (smaller differences may be due to differences in reporting years). It should be noted that the BNP study for China indicated inland catches to be 10 percent *less* than the officially reported figure (not included in the table).

Table 4: Tentative update of Thomson table for developing countries

| | **SMALL-SCALE FISHERIES** | | | **LARGE-SCALE FISHERIES** | | | ***TOTAL*** |
|---|---|---|---|---|---|---|---|
| | MARINE | INLAND | *TOTAL* | MARINE | INLAND | *TOTAL* | |
| ***PRODUCTION AND UTILISATION*** | | | | | | | |
| TOTAL ANNUAL CATCH *) | 28-30 million MT | 9-13 million MT | *37-43 million MT* | 31-34 million MT | Very little | *31-34 million MT* | ***68-77 million MT*** |
| ANNUAL CATCH FOR DOMESTIC HUMAN CONSUMPTION | About 25 million MT | About 10 million MT | *About 35 million MT* | About 15 million MT | Very little | *About 15 million MT* | ***About 50 million MT*** |
| ANNUAL CATCH FOR DOMESTIC HUMAN CONSUMPTION AS SHARE OF TOTAL CATCH | About 90% | About 95% | *90-95%* | About 45% | N/A | *About 45%* | ***About 70%*** |
| DISCARDS (SHARE OF CATCHES) | About 0.5% | Negligible | *About 0.5%* | About 2% | N/A | *About 2%* | ***About 1%*** |
| ***EMPLOYMENT*** | | | | | | | |
| NUMBER OF FISHERS **) | 11-12 million | 14-15 million | *25-27 million* | 1-2 million | Very few | *1-2 million* | ***26-29 million*** |
| NUMBER OF JOBS IN PROCESSING AND MARKETING ***) | 32-33 million | 36-37 million | *68-70 million* | 5-6 million | Very few | *5-6 million* | ***73-76 million*** |
| *TOTAL* | *43-45 million* | *50-52 million* | *93-97 million* | *6-8 million* | *Less than 0.5 million* | *6-8 million* | ***99-105 million*** |
| % OF WOMEN IN TOTAL WORKFORCE ***) | About 50% | About 55% | 50-55% | About 70% | About 30% | About 65% | ***About 50%*** |
| TOTAL NUMBER OF PERSONS EMPLOYED PER 1 000 TONNE FISH CAUGHT | 1,500 | 4,600 | 2,400 | 200 | Few | 200 | 1,400 |
| ***FUEL EFFICIENCY*** | | | | | | | |
| FISH CAUGHT PER TONNE OF FUELCONSUMED ****) | 1-10 MT | 5-15 MT | 2-12 MT | 1-5 MT | N/A | 1-5 MT | 2-10 MT |

NB: *Developing countries* are defined according to the FAO FishStat Plus database (FAO, 2008).

*) The term *catch* should generally be used to refer to the "gross catch", i.e. everything that is captured. *Landings* are the part of the catch that is brought ashore and *discards* what is discarded at sea (dead or alive) (Kelleher, 2005). In practice, however, the terms catch and landings are often used interchangeably and so is the case also in this report in which some data are based on local estimates that have not always been clearly defined as one or the other. In the context of this table, this is of less importance since the discard rate is relatively low.

**) Fulltime and parttime only (i.e. not occasional). For definitions, see APPENDIX 1 on methodologies.

***) Includes fulltime and parttime employment in the post-harvest sub-sector.

****) Preliminary results based on limited data; see section on COSTS OF FISHING – THE IMPORTANCE OF FOSSIL FUEL for a discussion.

**Table 5: Inland capture fishery production – reported and estimated catches**

| *Country* | *Officially reported landings* | *BNP case study estimates* | *Ratio estimate / officially reported landings* | *Year of case study data* |
|---|---|---|---|---|
| Bangladesh | 849 000 | 985 000 | 1.2 | 2005/2006. |
| Cambodia | 332 000 | 438 000 | 1.3 | 2006 |
| Ghana | 75,000 | 398,000 | 5.3 | 2006 |
| Senegal | 50 000 | 64 000 | 1.3 | 1999/2000 |
| Thailand | 200,000 | 1,060,000 | 5.3 | 2004 |
| Viet Nam | 143,000 | 1,108,000 | 7.7 | 2003 |

*Source: FAO, 2008 (FISHSTAT Plus, average 2004-2006) and BNP case studies.*

While parttime fishing is common, especially in the context of combined farming/fishing livelihoods, data on parttime and occasional activities, including subsistence and recreational fishing, are rarely collected in a regular and systematic manner. This may lead to the misconception and assumption that the quantities caught and their importance for income and local food supplies are relatively insignificant, which in turn results in continued limited efforts with regard to monitoring.

Along with underreported catches, it is likely that official figures on the number of fishers and other fish workers are misreported as well as and that the socioeconomic importance of the inland fishery sector is undervalued. Coates (2002) compared an estimate of the world's inland fishers of 4.5 millions, made by FAO in 1999 based on officially reported data, with numbers from independent scientifically based surveys in eight Southeast Asian countries[7] and found that the "official" global figure was superseded by the countries in his study region alone. In the BNP case study countries, there were more inland water fulltime and parttime fishers than marine fishers. It should be noted that these numbers exclude occasional fishers, i.e. those for whom fishing represents less than 30 percent of their livelihoods[8]. This is potentially a large group of inland water fishery resource users for whom the activity is likely to be a significant component of their livelihood strategies (see also the sections on UTILISATION OF CATCHES and THE PEOPLE WORKING IN SMALL AND LARGE-SCALE FISHERIES below).

With a few exceptions, large-scale fisheries exist only in marine waters and most countries consider all operations in lakes, river systems and other inland water bodies to be small-scale. Among the BNP case studies, only three countries (Brazil, Cambodia and Mozambique) reported large-scale inland fishing and their contribution to overall inland catches represented a considerably smaller share – 27 percent on average for the three countries[9] – than the small-scale sector. Hence, underestimating the importance of inland fisheries influences in particular assessments of the small-scale fisheries sector.

[7] Cambodia, Indonesia, Lao DPR, Malaysia, Myanmar, the Philippines, Thailand and Viet Nam.
[8] See definitions in APPENDIX 1.
[9] Brazil 11 percent; Cambodia 36 percent; Mozambique 36 percent.

### *ILLEGAL, UNREPORTED AND UNREGULATED (IUU) FISHING*

Many marine small-scale fisheries in developing countries have evolved from having been mainly subsistence and regulated by local traditional management systems to economically integrated fisheries generating important values, managed by governments. However, a large proportion of these small-scale fisheries remain open access and *de facto* unregulated and governments in many developing countries lack the capacity to enforce those management regulations that do exist (Drammeh, 2000; Johnson, 2006). Population pressure can aggravate the situation with overcapacity and overfishing as the result. Coastal areas in Southeast Asia are typically heavily populated with large numbers of poorer household being dependent on the fishery resources. Declining resources and environmental degradation lead to conflicts over resource access which, if unresolved, may lead to threats to food security and livelihoods (Salayo *et al,* 2008). As in inland fisheries, reporting on unregulated or poorly regulated small-scale marine fisheries is likely to be inadequate.

In addition to underreporting of catches in informal and unregulated fisheries, another reason for catch statistics to show too low levels is the prevalence of illegal fishing . While illegal fishing occurs in all types of fishing, both in marine and inland waters, it tends to be motivated by financial gains and be more common where the risk of apprehension is relatively low compared to the returns that can be made from such fishing and where the potential penalties are insufficient to deter the action. Fishers with vessels that are not subject to effective flag State control are also more likely to be involved in illegal fishing than those operating under stricter management regimes (FAO, 2004).

**Box 7: What is IUU fishing?**

According to the International Plan of Action (IPOA) to prevent, deter and eliminate Illegal, Unreported and Unregulated (IUU) fishing, the term IUU refers to fishing activities that are in violation of international or national laws, or of regulations of regional fisheries management organisations (RFMOs), or that are conducted in a manner inconsistent with State responsibilities under international law regarding the conservation and management of living marine resources (FAO, 2001). Fishing in areas where there are no management controls or reporting requirements is also part of IUU fishing.

IUU fishing takes place both in national Exclusive Economic Zones (EEZ) and in the high-seas and includes, for example, vessels fishing without a licence or fishing with a licence but not reporting all the catch, vessels operating in closed areas or across borders without authorisation, vessels from non-member states fishing in an RFMO area, or fishers taking part in an unregulated fishery. Many small-scale fisheries – since they are unregulated – would hence be considered IUU fishing. However, often when the term IUU is used it refers to its illicit aspect, including unlawful misreporting, but not to unregulated activities. Estimates of total IUU fishing catches, including discards, added to reported landings would give an estimation of the total extraction of marine organisms and this information would be vital for evaluating the true impact of fishing on the resources (Pitcher *et* al, 2002).

IUU fishing has become of increasing concern and the underreporting of catches it entails seriously undermines the sustainable management of capture fisheries by distorting the information on which management decisions are taken. It also represents significant economic losses for governments and those fishers competing with illegal fishing vessels (MRAG, 2005; Sumaila, Alder and Keith, 2006).

Data on illegal fishing are – perhaps not surprisingly – scarce. Nonetheless, work at country and regional levels has been accomplished (see, for example, Pitcher *et al,* 2001; Ainsworth & Pitcher, 2005), referring to illegal, unreported and unregulated fishing (IUU) fishing (see Box 7). With regard to global estimates, a study carried out recently by the Marine Resources Assessment Group Ltd (MRAG) and the Fisheries Centre of the University of British Colombia (UBC) identified key IUU fisheries[10] to include large-scale international fishing for high-value species, e.g. tuna and tuna-like fish (large pelagics), sharks, groundfish (cod, redfish) and abalone. Extrapolating the results from case studies to the level of world catches, it was estimated that IUU fishing represented between 11 and 26 million tonnes in 2003 (Agnew *et al*, 2008). This should be compared to total global catches which amount to some 93 million tonnes[11]. In some fisheries, IUU fishing could equal up to 30 percent of total catches. IUU fishing by distant-water fleets fishing for tuna and by foreign and domestic fleets engaged in mixed fisheries and violating zoning regulations, i.e. encroaching into coastal zones reserved for small-scale artisanal boats, have been found to provoke particularly significant environmental impacts and economic losses to developing countries in Africa (MRAG, 2005).

While the magnitude of illegal fishing appears to be more significant in large-scale industrial fisheries, the phenomenon exists also in the small-scale sector. Illegal fishing practices that are found in small-scale fisheries include the use of explosives and poison, and destructive gear and techniques such as small mesh size nets. Increased competition for resources and intensified demand for products in international markets create incentives for unlawful practices, in particular in situations where management regulations are not strictly enforced.

Only limited information on IUU is available from the BNP case studies. In Ghana, it was found that both the small and large-scale sectors are involved in IUU fishing. More than half of the catch of the Ali/Poli/Watsa[12] marine canoe fleet is presumed to come from IUU fishing. In the industrial trawl fishery, it was estimated that IUU fishing represents almost 25 percent of total catches. Other studies on IUU fishing in the case study countries includes a survey of three types of fisheries – shrimp trawls, fish trawl-nets and bottom long line – in the Arafura Sea in Indonesia. It was found that the volume of illegal, misreported and discarded catch for the three gear types combined represented some 664 00 tonnes, 374 000 tonnes and 241 000 tonnes, respectively, on average per year in the period 2001-2005. While representing a decline compared to earlier years, the amounts are still significant considering that officially reported landings averaged 244 000 tonnes per year for the same period. The bottom long line fishery showed the highest rate of unreported catch: 95 percent. The fishery includes an important number of smaller boats, i.e. below 5 GT, spread out over a larger area which makes catch reporting particularly difficult (Waggey *et al*, *in press*).

[10] IUU fishing in the context of this study was defined to include "catches taken within an EEZ which are both illegal and retained, and which are usually unreported, and all unreported catches taken in high seas waters subject to an Regional Fisheries Management Organisation's (RFMO) jurisdiction" (page 3, Agnew *et al*, 2008).

[11] Average world catch 2004-2006 according to Fishstat Plus (FAO, 2008).

[12] Ali/Poli/Watsa are local names referring to different net types: the Ali is a drifting gillnet for catching sardinella, and the *Poli* and *Watsa* are purse seines. Poli has smaller mesh size and is commonly used for anchovy while Watsa targets larger pelagics.

### *BYCATCH AND DISCARDS*

Although the amount of fish discarded at sea has declined globally during recent years – thanks to increased utilisation of bycatch, in particular in Asia, the use of more selective gear, less intense fishing for species that tend to have high bycatch rates and more efficient bycatch management – discards continue to represent significant waste in some fisheries. It has been estimated that, on a global average, the discard rate is 8 percent of total recorded landings, i.e. around 7 million tonnes annually (Kelleher, 2005). Tropical shrimp trawl fisheries account for the highest discard rates, followed by other shrimp and finfish trawl fisheries. Small-scale fisheries tend to have less discards than large-scale and fishing methods such as purse-seine, handline, jig, trap and pot fisheries show relatively low rates (Kelleher, 2005).

**Box 8: Defining bycatch and discards**

Bycatch includes in its broadest sense "all non-target animals and non-living material (debris) which are caught while fishing" (page 5, Eayrs, 2007). Bycatch can also include "animals and non-living material that interact with the fishing gear but do not make to the deck of the fishing boat" (page 5, Eayrs, 2007), but more commonly the term refers to catch retained or captured by the fishing gear (but not necessarily brought onboard the vessel) (Kelleher, 2005).

"Discards, or discarded catch is that portion of the total organic material of animal origin in the catch, which is thrown away, or dumped in the sea for whatever reason. It does not include plant materials and post harvest waste such as offal. The discards may be dead, or alive." "The discard rate is the proportion (percentage) of the total catch that is discarded." (Kelleher, 2005, page 3). It should be noted that discards are not a subset of bycatch since target species may be discarded as well (Kelleher, 2005).

The BNP case study countries showed low discard rates: on an average, the discard rate was estimated to be 0.5 percent in the small-scale sector and just under 2 percent for large-scale fisheries[13]. Small-scale inland fisheries showed almost no discards at all, while the existence of tropical shrimp trawl fisheries in some countries (e.g. Indonesia, Mozambique, Nigeria and Senegal) influenced the higher discard rates noted for the large-scale sector. In general, in Asia – including China – discards are negligible since bycatches to a large extent are used, either for local human consumption or as animal feed. Bycatch collection at sea by small-scale operators takes place in many countries, including Ghana, India, Mozambique, Nigeria, Senegal and Thailand (Béné, Macfadyen and Allison, 2007).

**Box 9: Bycatch collection in Mozambique**

In Mozambique, bycatch collection from shrimp trawlers by artisanal fishers has existed since the 1970s. According to artisanal fishers in Nampula and Zambezia provinces, the collection is realized on the basis of an exchange: shrimp caught by the artisanal fishers are given to the semi-industrial or industrial vessel, and the fishers receive bycatch in return. Many fishers in the two provinces believe that the main fish processors also acquire their fish products through this exchange system and that the activity is more profitable than fishing.

*Source: Mozambique BNP case study.*

[13] Based on BNP case study data and the FAO discards data base (Kelleher, 2005).

### *REESTIMATING INLAND AND MARINE CATCHES*

The developing country Thomson table above is based on a number of data sources. As the starting point for the calculations, officially reported catch data were used. However, referring to the catch data shortcomings discussed above, these data were compared with figures provided by the BNP case studies and other sources of information and new estimates were calculated. Accordingly, Table 4 includes low and high catch scenarios for the different subsectors. The former represents officially reported annual landings according to FAO FishStat database (average landings 2004-2006), i.e. about 9 million tonnes in inland waters and 59 million tonnes in the marine sector (small and large-scale fisheries combined).

The new estimate for inland fisheries gives a total of 13 million tonnes for all developing countries combined, of which virtually all is produced by the small-scale sector. In marine fisheries, catches have been estimated to reach – when adjusting for assumed underreporting and IUU fishing[14] – 30 million tonnes in the small-scale sector and 34 million tonnes in large-scale fisheries, totalling 64 million tonnes for all developing countries as a group (see Table 4).

## UTILISATION OF CATCHES

### *HOW DO FISHERIES CONTRIBUTE TO POVERTY ALLEVIATION AND FOOD SECURITY?*

The fisheries sector contributes to poverty alleviation and food security in several different ways. *Poverty alleviation* takes two different forms: poverty reduction and poverty prevention. Fisheries contribute to *poverty reduction* through wealth creation at the household level, as a rural development engine at the community level and by generating economic growth at the national level, including contributions to GDP, government tax income and foreign exchange earnings. The role of fisheries in *poverty prevention* refers to how the sector can help people stay out of or not fall further into poverty by providing a minimum standard of living and a safety-net function (Béné, Macfadyen and Allison, 2007). This role is particularly important for small-scale fisheries in developing countries (see Box 10).

*Food security* is "when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FSN Forum, 2007). Fishing contributes to food security directly – by producing highly nutritious food, i.e. fish – and indirectly, through the generation of revenues that can be used for buying food[15].

[14] Discards are not explicitly considered; see also footnote *) of Table 4.
[15] The role of fisheries with regard to employment is discussed in the next chapter.

**Box 10: Fisheries as a safety-net for the poor**

"While small-scale fisheries contribute to poverty reduction by providing employment to a large number of established fishers and fish workers, it probably plays an even more important role in poverty prevention. There is evidence suggesting that, in many developing countries, fishing and associated activities may not generate high incomes for the households involved but rather help them sustain their livelihoods and stop them from falling deeper into poverty. If access to fishing grounds is relatively free and access to other capital (e.g. financial through credits) and production factors (e.g. land) is restricted, poor people are more likely to turn to the common fishery resources for their livelihoods. Moreover, in a situation where the normal means of income generation have been disrupted, e.g. the household head has lost his or her job or in a more widespread disaster situation, fishing may provide a safety-net function also to vulnerable population groups who were not previously poor.

These poverty prevention mechanisms are socially important – providing a "welfare" system that may not be available otherwise – although perhaps less attractive from an economic point of view. The open access regime, which is the basis for the system to function, also raises other important questions. Many fishery resources suffer from high fishing pressure and there are arguments for controlling access to ensure the sustainability of these resources and their ability to provide livelihoods for coastal populations and small-scale fishers in the longer term. The trade-off between critical *poverty prevention* and sustainable longer term *poverty reduction* is a political dilemma that requires further thought and attention."

*Source: From Westlund et al, 2007, page 15 (based on FAO, 2005).*

### *FISH CONSUMPTION*

According to Food Balance Sheets prepared by FAO based on data officially reported by member countries, the average apparent per capita fish consumption in the BNP case study countries was 16.5 kg/year (2005), covering a range from 4.6 kg in Mozambique to 32.6 kg per person and year in the Philippines (Laureti, 2007)[16]. The average reported per capita fish consumption in all developing countries as a group has been calculated to be 14.4 kg per person and year (2005), compared to 23.9 kg annually in developed countries (Laureti, 2007). However, considering the earlier discussion on underreported landings data, in particular in the small-scale inland capture fisheries sector (see the section on DATA AVAILABILITY AND UNDERREPORTED CATCHES above), it is likely that the importance of fish is greater than what these reported estimates reveal. Data compiled by the Mekong River Commission (MRC) on fish consumption in the Lower Mekong Basin show that the average consumption of fish (inland and marine) and other aquatic animals in the basin is about 50 kg per person and year (Hortle, 2007). This can be compared with the total average apparent fish consumption for the four countries concerned as calculated in the Food Balance Sheets: 28 kg/person/year (Laureti, 2007).

[16] *Apparent per capita consumption* equals the *per capita food fish supply* in the Food Balance Sheets calculated on a country basis as *(production – non-food uses + imports – exports +/- stock variations) / population*. The calculation includes production both from capture fisheries and aquaculture.

However, these numbers are not entirely comparable since not the whole countries are part of the Lower Mekong River Basin. In Table 6, the apparent per capita fish consumption derived from the Food Balance Sheets for Thailand and Vietnam has been recalculated using the catch estimates provided in the BNP case studies. Recalling the inland capture production figures from Table 5, these estimates were significantly higher than the officially reported data. Per capita consumption figures for Cambodia and Lao PDR have been included in the table as estimated by Hortle (2007) since 95 percent of the population of Cambodia are residents of the Lower Mekong River Basin and 93 percent in Lao PDR. The differences in apparent consumption compared to the FAO reported estimates are considerable (see Table 6). It can be noted that the estimated overall average per capita fish consumption for the four countries arrived at in this exercise is the same as calculated by Hortle (2007), i.e. 50 kg per person and year. However, this average masks differences for Thailand and Vietnam; the Hortle estimates are higher for Vietnam and lower for Thailand than what is shown in Table 6.

It should be noted that also relatively low annual fish consumption levels can be of vital importance for nutrition and health. Because of its highly nutritious value – including proteins, micronutrients and essential fatty acids – fish constitutes an excellent supplement to otherwise perhaps lower quality diets. Moreover, per capita food fish supplies data do not explain the relative importance of fish in animal protein intakes. In some small island developing states, as well as in, for example, Bangladesh and Ghana, fish provides at least half of the total animal protein intake (FAO, 2007; Laureti, 2007). In the Lower Mekong River Basin, the contribution of fish to the nutritional level of the average diet is high---inland fish and other aquatic animals alone contribute 47-80% of animal protein consumption in the four countries (Hortle, 2007).

**Table 6: Apparent per capita fish consumption in Cambodia, Laos, Thailand and Vietnam in the Lower Mekong Basin – comparison MRC study and FAO Food Balance Sheets**

| | ***Cambodia*** | ***Lao PDR*** | ***Thailand*** | ***Vietnam*** | ***Total / average*** |
|---|---|---|---|---|---|
| | ***Kg/capita/year*** | | | | |
| ***MRC Consumption study (Cambodia and Lao PDR) and estimates based on BNP catch data (Thailand and Vietnam)*** | *52.4* | *43.5* | *53.8* | *48.7* | *49.6* |
| ***FAO Food Balance Sheets (average 2003-2005)*** | *23.4* | *18.7* | *32.6* | *25.4* | *27.7* |

*Sources: Hortle, 2007; Laureti, 2007, and BNP case studies (Thailand and Vietnam).*

***DIFFERENT USES OF SMALL-SCALE AND LARGE-SCALE PRODUCTION***

Although there are important differences at the local level, the Thomson tables above reveal that, at the aggregate level, small and large-scale fish production have different utilisation patterns. Referring to Table 3 and the 2006 estimates of annual marine catches used for human consumption and for production of meals and oils, the global marine small-scale sector production (here estimated to be about 30 million tonnes) is almost entirely used directly as food while up to half the catch of the large-scale sector (50-60 million tonnes) is processed into fish meal and oil, typically used for animal feed products (20-30 million tonnes/year). Table 4 on developing countries shows a similar pattern; 90-95 percent of the total production of the small-scale sector in developing countries is for domestic human consumption while only 45 percent of the large-scale sector production ends up in local food markets. Small-scale inland fisheries production tends to be almost entirely for local human consumption and hence plays an important direct role in food security.

With the exceptions of China, Thailand and Vietnam, fish production in the BNP case study countries is generally used directly as food, either locally or for exports. In China, a major part of the large-scale fisheries production is used for fish meal and other non-food purposes and also 18 percent of the catch of the small-scale sector is used for animal feed. In Thailand and Vietnam, some 20 to 30 percent of the total fish production is destined to non-food uses (Laureti, 2007; BNP case studies).

Developing countries have increased their share in food fish exports during the last few years and represent as a group 51 percent of the world export volume[17]. Considering its importance to domestic food supplies, only a minor part of the export products originate from the small-scale sector; the large-scale fisheries sector is the main contributor to foreign exchange earnings. Since large-scale fisheries are predominantly marine, most export products are thus from marine waters but there are a exceptions, e.g. among the BNP case studies the Nile perch exports from lake Victoria, freshwater fish and prawn exports from Cambodia and *kapenta* (Tanganyika sardine) exports from Mozambique are noted.

[17] 2004; including aquaculture products (FAO, 2007).

## THE PEOPLE WORKING IN SMALL AND LARGE-SCALE FISHERIES

### *EMPLOYMENT IN FISHING AND POST-HARVEST ACTIVITIES*

Most people employed in fisheries work as small-scale operators. The 2006 Thomson table indicates that there are more than 12 million marine fishers in the small-scale sector globally compared to only some 500 000 in the large-scale marine fisheries (see Table 3). In the BNP case study countries alone, there are almost 20 million small-scale fishers. More than half of these are found in inland waters. Based on the BNP case study information, it is estimated that the total number of small-scale fishers in all developing countries reaches some 25-27 million. The large scale sector employs much fewer; only 1-2 million people (see Table 4). Globally, the fisheries sector is likely to employ some 30 million fulltime and parttime fishers of which 90 percent are in developing countries[18].

While fishing itself is an important source for employment, auxiliary activities – in particular with regard to marketing and processing – are even more important. The BNP case studies showed that, for each person employed as a fisher, on an average, there are 2-3 people employed in post-harvest activities. This brings the number of people employed in the fisheries sector in developing countries to some 100 million of which the majority are in the small-scale sector (see Table 4). The sector also generates employment upstream, i.e. with regard to input supplies such as boat building, engine and gear manufacturing and repairs, as well as providing various support services in harbours and at landing sites. These jobs are not as numerous as in the post-harvest sector but still constitute a non-negligible workforce. BNP case study information from Ghana and Senegal indicated that employment in backward linkages could add another 5-10 percent to the total number of people employed, fulltime and parttime, in fisheries.

### *OCCASIONAL FISHERS AND COMPLEX LIVELIHOODS*

In the Thomson table on developing countries (Table 4), the estimates of number of fishers include fulltime and parttime employment. The definitions used for these categories are explained in APPENDIX 1 and in essence mean people receiving at least 30 percent of their income from fishing or related activities; others fishing but with less than 30 percent of their livelihoods depending on the activity are considered occasional fishers (or fish workers). These definitions may appear fairly clear but when it comes to collecting data and making estimates of the number of people in the small-scale sector in developing countries where poor people often use a combination of various livelihood strategies to cover for their needs, it becomes difficult to distinguish between the different categories. As noted before, many households involved in inland fisheries – in particular occasional, subsistence and recreational fishers – are unaccounted for in official statistics (see section above on DATA AVAILABILITY AND UNDERREPORTED CATCHES). The BNP case studies included several examples of occasional fishing activities, e.g. subsistence and rice field fishing without boats

[18] FAO estimates that there are some 35 million fulltime and parttime fishers in the world (FAO, *in press.).* However, this figure includes a considerably higher estimate of Chinese fishers than the BNP case study data.

in Cambodia and seasonal and subsistence fishing in Bangladesh (see Box 11). It should be noted that this type of fishing activities can play a major role in local livelihoods, e.g. as a means of poverty prevention (see Box 10 above) and in local food supplies diets, and involve many millions of people that may are not officially considered fishers . National population and economic census methods being used in many countries only record primary occupational category, not secondary or tertially occupations, misrepresenting the nature of rural agricultural livelihoods combining many different income generating activities (Keskinen, 2003; BNP case study Indonesia).

**Box 11: Seasonal and subsistence fishing in Bangladesh**

Bangladesh is the delta of a vast river basin complex made up of Ganges-Brahmaputra-Meghna River system. This area includes 4.5 million hectares of water-bodies including rivers, *haors*[19], *beels*[20] and large, medium and small seasonal flood plains. Flood plains are low-lying areas flooded during monsoons. Fish move into these plains which are connected to river systems. These plains are food-rich breeding, nursery and growth areas for many fish species. Comprising all these components, the total inland open water fisheries contribute 14 percent of total countries fish production. Floodplains contribute about 31 percent to the total fish production, followed by rivers, estuaries and beels. The Sundarbans mangrove forest fishery area on the Bay of Bengal coast and the Kaptai lake, a large man-made reservoir, contribute a little less than 1 percent each.

The inland openwater fisheries of Bangladesh are common property and share two characteristics; it is costly to exclude potential users from gaining access to the resource, and each person's use of the resource subtracts from the potential welfare of others. In inland fisheries more than half of the fishers exclusively fish for their own household; very few fishers deliver more than half of their catch to the market. During the monsoon, when a large part of the country gets flooded and fish becomes abundant in the floodplains, it is estimated that almost two-thirds of all rural households get involved in fishing.

*Source: BNP cases study Bangladesh.*

***GENDER IN FISHERIES***

Conventionally, the most common picture of gender roles in fisheries portrays men as fishers – going out on boats to catch the fish – and women as fish sellers and processors on land. While this generalisation of the professional roles of men and women is largely correct, a closer examination of gender in fisheries reveals a more complex situation according to countries and cultural contexts. In some countries, like Benin, Cambodia, Congo, Mali, and Thailand, women fish or collect fish on the lake in their own boats. In other countries, e.g. Uganda, it may even be a taboo for women to be on board a fishing vessel but they can own boats and hire men as crew. As fish buyers, it is not unusual that women finance the working capital for fishing trips against a guaranteed supply of fish when the catch is landed (Holvoet, *in press*; Westlund, *in press*). In Bangladesh, fishing was traditionally a low caste Hindu occupation and only men in fishing communities were engaged in catching fish. While still relatively few women work in fisheries today – an

[19] Deeply flooded saucer shaped depression in the northeast region of Bangladesh.
[20] Deepest part of the floodplain, often with permanent area of water.

estimated 3 percent of the total female workforce is involved in the fisheries sector – significant numbers of poor women are catching shrimp fry in coastal areas, irrespective of their religion, age or marital status (BNP case study Bangladesh).

Estimates of women's participation in the fisheries workforce in case study countries showed that there are almost as many women as men employed in the fisheries sector when also including post-harvest activities (see Table 7). If excluding China, the average proportion of women fishers and fish workers approaches 60 percent. This is true both for the small and large scale sectors with somewhat higher numbers of women in marine fisheries than in inland (see Table 4) and women are mainly employed in the post-harvest sector. However, surveys in the Lower Mekong Basin show that women are often involved subsistence fishers or collectors of aquatic animals and plants in inland waters but that this information – as with other data on inland fisheries – is not always reported (FAO/RAP, 2003). The conventional division of labour is also often less strict than in marine fisheries with more women and children involved in small-scale fishing (ODI, 2002).

Data on fisheries employment in Europe shows that, also in developed countries, very few women work onboard vessels. Still, they represent a third of the total sector workforce of some 400 000 people (fulltime and parttime) and they are mostly employed in the fish processing industry (Salz *et al,* 2006).

**Table 7: Share of women in total fisheries workforce (fulltime and parttime; fishing and postharvest activities) in selected BNP case study countries**

| *Country/case study* | *Total workforce* | *Percentage women* |
|---|---|---|
| Bangladesh | 3 250 000 | 5% |
| Brazil | 430 000 | 13% |
| Cambodia | 1 640 000 | 57% |
| China | 12 080 000 | 22% |
| Ghana | 370 000 | 40% |
| India | 10 000 000 | 72% |
| Mozambique | 260 000 | 4% |
| Nigeria | 6 500 000 | 73% |
| Senegal | 130 000 | 9% |
| *Total / average* | *34 660 000* | *46%* |

*Source: BNP case studies.*

## COSTS OF FISHING – THE IMPORTANCE OF FOSSIL FUEL

The major part of the fish catching sector is dependent on fossil fuel to operate. While an important part of the small-scale sector still includes fishing with non-motorised vessels (see Box 3), e.g. subsistence fishing in inland waters in Cambodia, or without vessels such as shore operated lift nets common in some Asian countries, fisheries have become increasingly mechanised and also most artisanal canoe fisheries in developing countries are now motorised.

It has been estimated that the capture fishing fleet globally consumes some 42-45 million tonnes of fuel per year (Pauly, 2006 – see also Table 3; Tyedmers, 2005; Smith/FAO, *in prep.*). Putting this in relation to the total reported landings gives that the global capture fishing sector catches, on an average, somewhat less than two tonnes of fish per tonne of fuel consumed[21]. However, there is a great variety between the many existing types of fisheries and also among regions and countries. Active demersal fishing gears (e.g. dredging, bottom trawling, beam trawling and Danish seining) represent energy intense fishing methods while passive fishing gears (hook and line, gill nets, traps, etc) require less energy. Active pelagic fishing with, for example, mid-water trawls, purse seines and ring nets, tends to be moderately energy intense.

Small-scale fisheries more often use passive gear and would hence be likely to be more fuel efficient than the large-scale sector. However, due to the great diversity of the subsector, this is not a firm rule and the average estimated fuel efficiency rates calculated on preliminary BNP case study data[22] showed in some cases similar levels for small and large-scale marine fishing. However, data were only available from five case study countries and the estimates between different types of vessels and gear varied greatly. Small-scale fishing in inland waters, on the other hand, appears to be less energy intense (see Table 8). Fishing with un-motorised craft or with hand held gear is obviously the most efficient method with regard to fossil fuel consumption.

There is evidence that in particular industrial fisheries are using increasingly more fuel to catch the same amount of fish due to the declining state of many fish stocks and a growing number of powerful fishing boats (Tyedmers, 2004). A comparison of the energy efficiency rates calculated in the Thomson table of 2006 with those of the original shows a clear decline in volume of fish caught per unit of fuel used. In 1980, it was estimated that small-scale catches were 10-20 tonnes per tonne of fuel consumed and in the large-scale sector 2-5 tonnes. In 2006, these figures had decreased to 4-8 tonnes and 1-2 tonnes for small and large-scale fishing, respectively (Table 3). The estimates included in the new Thomson table of this report show a similar pattern indicating that the decline in fuel efficiency is also valid for developing countries where small-scale fisheries are particularly important. With increased competition for scarce resources, more fishers need to spend more time at sea or travel further to find fish, and some invest in boats with more powerful engines to be able to do so.

[21] Based on 2000 catches: 80.4 million tonnes (Tyedmers, 2005).

[22] Data on selected fleet segments were provided in the BNP case studies from Ghana, Bangladesh, Cambodia, China and Senegal.

**Table 8: Fuel efficiency estimates: examples from BNP case studies**

| *Country* | *Environment / location* | *Type of vessel/fishing* | *Fish caught (tonnes) per tonne of fuel used* |
|---|---|---|---|
| Bangladesh | Marine | Small-scale:<br>Average motorised vessels | 0.3 |
| Bangladesh | Marine | Large-scale:<br>Vessels<150GT | 1.4 |
| Cambodia | Marine | Small-scale:<br><10HP | 3.1 |
| Cambodia | Marine | Large-scale:<br>Average trawlers, seiners and other off-shore boats | 1.2 |
| China | Inland/Hubei province | Small-scale:<br>Hooking boats <5.5kW | 14.3 |
| China | Marine/E China Sea | Small-scale :<br>Gill-netters >72kW | 0.9 |
| China | Marine/E China Sea | Large-scale:<br>Purse-seiners (average 400GT) | 3.3 |
| Ghana | Inland/Lake Volta | Small-scale:<br>Motorised decked canoe | 6.2 |
| Ghana | Marine | Small-scale:<br>Ali/Poli/Watsa | 1.4 |
| Senegal | Marine | Small-scale:<br>average all “pirogues” | 9.7 |
| Senegal | Marine | Large-scale:<br>Off-shore tuna | 3.9 |

The price for fuel for the fisheries sector does generally not vary between countries as much as for the road sector since it tends to be less taxed but there are still variations, both due to government policies as well as to currency exchange rate fluctuations. Overall, fossil fuel prices have increased considerably during the last few years and have been particularly volatile recently. Table 9 shows how diesel prices expressed in US$ have increased by some 156% during the last five years.

**Table 9: Yearly average diesel fuel prices (current)**

| | *2003* | *2004* | *2005* | *2006* | *2007* | *2008 (6 months)* | *Increase on 2003 prices* |
|---|---|---|---|---|---|---|---|
| US$ | 39.77 | 47.39 | 63.42 | 71.60 | 75.86 | 101.96 | 156% |
| EUR | 35.26 | 38.06 | 51.23 | 57.00 | 55.22 | 66.46 | 88% |
| AU$ | 61.41 | 64.40 | 83.33 | 95.04 | 90.33 | 109.91 | 79% |

*Source: Smith/FAO, in prep., page 36.*

A series of studies carried out by FAO on the economic performance of marine capture fishery fleets[23] show that fishing vessels in developing countries have relatively higher fuel costs than vessels in developed countries[24]. When expressed as a percentage of the revenue of the fish landed, fuel costs were almost twice as high in developing countries as in developed. This difference was even more pronounced for vessels using passive gears; the studies showed that developing country fishers using passive gears spend three times as much on fuel – expressed as a proportion of revenues – than their counterparts in developed countries. Overall – not surprisingly considering the fuel price increases – the relative importance of fuel costs has increased and is estimated to represent about 37 percent of gross revenues globally, and 20 percent and 43 percent in developed and developing countries, respectively (see Table 10 – FAO, 2007).

**Table 10: Fuel costs as share of revenue from fish landed**

| | ***1995-1997*** | ***1999-2000*** | ***2002-2003*** | ***2005 (estimated)*** |
|---|---|---|---|---|
| Global average | *15%* | *17%* | *19%* | *37%* |
| Developed countries | *11%* | *10%* | *10%* | *20%* |
| Developing countries | *19%* | *21%* | *22%* | *43%* |

*Source: FAO, 2007, page 132.*

The BNP case studies provide some information on the relative weight of fuel costs, supporting the above mentioned average for developing countries. Although the data are insufficient for calculating exact proportions, the studies seem to indicate that fuel represents a larger percentage of gross revenues in the marine small-scale sector than in marine large-scale fisheries. Considering the current volatility of fuel prices, this could be of significant concern for the future viability of small-scale fisheries and related livelihoods in some of these countries.

[23] See Le Rey, Prado and Tietze, 1999; Tietze *et al*, 2001; Tietze *et al*, 2005. The studies included both developed and developing countries and covered small and large-scale fisheries. In the most recent study (Tietze *et al*, 2005), fleets in Antigua, Argentina, Barbados, France, Germany, India, Norway, Peru, Republic of Korea, Senegal, South Africa, Thailand, and Trinidad and Tobago were surveyed.

[24] This situation is not specific for the fisheries sector but is general for all industries. The energy intensity, measured as the amount of energy needed to produce a unit of GDP, tends to decrease in maturing economies (FAO, 2007).

## FINAL REMARKS

In this report, estimates of key Thomson table indicators have been presented for the small- and large-scale fisheries sectors, in inland and marine environments, in developing countries. These estimates were based primarily on data collected through dedicated BNP case studies carried out in a selected number of developing countries.

While recognising the wide variety of fisheries in the world, evidence suggests that there are enough common attributes to usefully distinguish small-scale fisheries from large-scale fisheries. Moreover, the data collected and the estimates presented reconfirm the importance of this small-scale sector in developing countries. The report also supports the growing body of evidence that the contribution of inland fisheries to food security and poverty alleviation has been massively undersold and that data and assessments are generally not available to clarify this situation.

The lack of accurate information on small-scale fisheries is extremely unfortunate considering the urgent need to address the declining state of fishery resources, to make the most of the potential of fisheries to contribute to food security and poverty alleviation, and to ensure that the many vulnerable livelihoods dependent on the sector are not further threatened. Political will and innovative approaches are needed and both of these require knowledge and information. The ways data are collected and reporting carried out in the small-scale fisheries sector need to be rethought. This preliminary report of the Big Numbers Project contributes to this process. The initial results presented now need to be discussed and the work continued. The Big Numbers Project team invites colleagues and professionals from around the world to join in this effort.

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**APPENDIX 1: Methodologies – Thomson table for developing countries (Table 4)**

Definition of small and large-scale fisheries:
In the case studies, local definitions of the sectors were used and these were not the same in all countries. The Thomson table for developing countries, being based mainly on extrapolations of case study data, does therefore not hold a set definition.

Estimates of total production small-scale fisheries (SSF) / large-scale fisheries (LSF) – inland/marine:
**Basis:** average 2004-2006 inland and marine catches (excluding mammals, turtles, seaweeds, etc) by country (divided developed/developing countries) from FAO FishStat Plus (extracted on 15 July 2008).

**Two scenarios for catches were developed:**
Low catch scenario: FishStat Plus data according to above except for when case studies have given lower estimates (China, India, Nigeria, Philippines).

High catch scenario: Case study country data as given (except when FishStat Plus data showed greater values). All other countries increased by 10% marine and 40% inland according to average case study differences between estimated catch and officially reported catch.

**Split SSF-LSF:** Case study country data as given. Other countries according to average of case studies, i.e. 70% SSF in marine sector (except some 'semi-industrialised' countries – S. Korea, Malaysia, Mexico, Taiwan, Turkey – for which data were not found and a 30/70 split was assumed between SSF and LSF) and 98% in inland. Exceptions: for marine catches, countries with catches > 200,000 (according to FishStat Plus data), split verified with other available data (mainly from FAO Fishery Country Profiles), e.g. Chile 15% SSF and 85% LSF. Some of these numbers were further changed when estimates of number of fishers were added (from FAO FCPs when available) and the catch rates seemed too high in marine SSF according to the first calculation.

**Share of production for domesticl consumption:** Case study country data as given, where available. Other countries: SSF 90% of marine, 95% of inland; LSF 40% of both marine and inland (approximately according to case study average, although no information on LSF inland but negligible in the bigger picture).

**Discards:** Based on averages from case studies supplemented with information from the discards database (see Kelleher, 2005).

Estimates of number of fishers and other employment:
DEFINITIONS[25]:

- Full-time fishers: receiving at least 90% of their livelihood or spending at least 90% of their working time from fishing.

[25] These definitions are from FAO, 1999.

- Part time fishers: fishers receiving at least 30%, but less than 90% of their livelihood from fishing or spending at least 30% but less than 90% of their working time in that occupation.

Occasional fishers (those receiving less than 30 percent of their income from fishing or spending less than 30 percent of their working time on fishing) have not been included.

**Direct employment** – i.e. fulltime and parttime fishers – estimated using a combination of the following methods:

- For Africa and Asia; 3 scenarios were developed:
  - Number of fishers calculated using the average annual catch rate (mt/fisher) for all case studies (SSF marine 2.2 mt/fisher/year; SSF inland 0.8 mt/fisher/year; LSF marine 11.1 mt/fisher/year). Case study countries included with their individually estimated numbers.
  - Number of fishers calculated using the average annual catch rate (mt/fisher) for the case study countries of the particular region. Case study countries included with their individually estimated numbers.
  - Estimates based on FAO FCP data.
- Americas and Oceania:
  - Number of fishers calculated using the average annual catch rate (mt/fisher) for all case studies (SSF marine 2.2 mt/fisher/year; SSF inland 0.8 mf/fisher/year; LSF marine 11.1 mt/fisher/year) in relation to an average of the low and high catch level scenarios. Case study countries included with their individually estimated numbers (only Brazil).
  - For countries with more important fish catches (> 100,000mt/year), data from FAO FCPs were used, when available. In some cases, alternative estimates were made, e.g. when the number of fishers (in particular in inland fisheries) appeared very low compared to the reported/estimated catch. When only a total number of fishers was given for a country, this number was divided between the different sub-sectors, assuming a more or less proportional relationship with the catch level and average case study catch rates.

**Employment in processing and marketing**: average multipliers (for SSF / LSF – marine / inland) from case studies used. Other employment (upstream activities) excluded (due to limited data).

**% of women:** based on estimates on selected case study data (Bangladesh, Brazil, Cambodia, China, Ghana, India, Mozambique, Nigeria and Senegal).

Fuel efficiency:

**Fish caught per tonne of fuel consumed:** Estimates based on averages from case studies (Bangladesh, Cambodia, China, Ghana and Senegal).

## AFRICAN BIG LAKES - VICTORIA (KENYA, TANZANIA, UGANDA)

| | SMALL-SCALE FISHERIES | | | LARGE-SCALE FISHERIES | | | TOTAL | Remarks |
|---|---|---|---|---|---|---|---|---|
| | MARINE | INLAND | TOTAL | MARINE | INLAND | TOTAL | | |
| ***DEFINITION*** | | | | | | | | |
| Since trawl ban in 2000, all fishing is considered small-scale but there are large-scale fish processing plants for export of Nile perch (and fish meal as by-product). | | | | | | | | |
| ***EMPLOYMENT*** | | | | | | | | |
| NUMBER OF FISHERS | N/A | 196,426 | 196,426 | N/A | | - | 196,426 | 2006. Only fulltime fishers. |
| NUMBER OF OTHER JOBS | N/A | 5,200 | 5,200 | N/A | 25,000 | 25,000 | 30,200 | Processing and marketing. |
| Ratio | | N/A | | | | | 0.2 | |
| *TOTAL* | - | *201,626* | *201,626* | - | *25,000* | *25,000* | *226,626* | |
| WOMEN | | 16,000 | *16,000* | - | 3,000 | 3,000 | 19,000 | Women as fishers and in marketing/processing. |
| MEN | - | 185,626 | 185,626 | - | 22,000 | 22,000 | 207,626 | |
| ***PRODUCTION AND UTILISATION*** | | | | | | | | |
| TOTAL ANNUAL CATCH (MT) | N/A | 600,000 | 600,000 | N/A | | | 600,000 | |
| % OF CATCH USED FOR DOMESTIC HUMAN CONSUMPTION | N/A | 80% | | N/A | | | | |

Figures are for 2006-2007.

Production figures are estimates and differ from officially reported data.

## BANGLADESH

| | SMALL-SCALE FISHERIES | | | LARGE-SCALE FISHERIES | | | TOTAL | Remarks |
|---|---|---|---|---|---|---|---|---|
| | MARINE | INLAND | TOTAL | MARINE | INLAND | TOTAL | | |
| ***DEFINITION*** | | | | | | | | |
| All inland fisheries are small scale. In the marine sector, small-scale are artisinal fisheries meaning all boats less than 18m / 17 GT (inluding mainly gill nets, long-line and set bag nets). Inlcudes both mortorised and non-motorised vessels as well as set bag-nets and push-nets (without boats) used to catch shrimp fry. | | | | | | | | |
| ***EMPLOYMENT*** | | | | | | | | |
| NUMBER OF FISHERS | 554,029 | 1,003,500 | 1,557,529 | 18,211 | - | 18,211 | 1,575,740 | Includes parttime but not occasional |
| NUMBER OF OTHER JOBS | 422,712 | 1,190,873 | 1,613,585 | 63,320 | - | 63,320 | 1,676,905 | Includes parttime but not occasional |
| Ratio | 0.8 | 1.2 | 1.0 | 3.5 | | 3.5 | 1.1 | |
| *TOTAL* | *976,741* | *2,194,373* | *3,171,114* | *81,531* | - | *81,531* | *3,252,645* | |
| WOMEN | 94,746 | 58,811 | *153,557* | - | | - | 153,557 | 5% |
| MEN | 881,995 | 2,135,562 | 3,017,557 | 81,531 | - | 81,531 | 3,099,088 | |
| ***PRODUCTION AND UTILISATION*** | | | | | | | | |
| TOTAL ANNUAL CATCH (MT) | 454,552 | 985,387 | 1,439,939 | 36,632 | - | 36,632 | 1,476,571 | |
| VALUE (m US$) | 668 | 844 | 1,512 | 81 | | 81 | 1,593 | |
| VALUE US$/MT | 1,470 | 857 | 1,050 | 2,205 | | 2,205 | 1,079 | |
| CONTRIBUTION TO DOMESTIC ANIMAL PROTEIN INTAKE | 6% | 24% | 18% | 0.4% | | 0.4% | 18% | |
| % OF CATCH USED FOR DOMESTIC HUMAN CONSUMPTION | 96% | 93% | 94% | 83% | | 83% | 94% | |
| CATCH/FISHER (MT) | 0.8 | 1.0 | 0.9 | 2.0 | | 2.0 | 0.9 | |
| FISH CAUGHT (MT) / FUEL USED (T) | 0.8 | | | 0.8 | | | | Inland fisheries are non-motorised or without boat. |
| DISCARDS (% OF LANDINGS) | 0.7% | 1.0% | 0.9% | 6.5% | | 6.5% | 1.0% | |

Figures from 2005/2006 (July 2005 - June 2006).

Production figures are estimates and differ from officially reported data.

**BRAZIL**

| | SMALL-SCALE FISHERIES | | | LARGE-SCALE FISHERIES | | | TOTAL | Remarks |
|---|---|---|---|---|---|---|---|---|
| | MARINE | INLAND | TOTAL | MARINE | INLAND | TOTAL | | |
| ***DEFINITION*** | | | | | | | | |
| Small-scale fisheries 'small boats' and 'medium-sized boats' < 18 m. In the inland subsector, all fishing is small-scale except a fishery for 'Piramutaba' with 18-24 m trawlers. | | | | | | | | |
| ***EMPLOYMENT*** | | | | | | | | |
| NUMBER OF FISHERS | 118,013 | 148,744 | 266,757 | 51,490 | 5,522 | 57,012 | 323,769 | Fulltime and parttime (not including occasional). Division between marine/inland calculated using average catch/fisher rates for other countries and assuming this relation between the two subsectors. |
| NUMBER OF OTHER JOBS | 37,346 | 47,071 | 84,417 | 16,294 | 1,747 | 18,042 | 102,459 | Estimate based on data from *FAO Fishery Country Profile Brazil* (ratio fisheries+aquaculture primary/secondary sectors 790,000/250,000). |
| Ratio | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | |
| *TOTAL* | *155,359* | *195,815* | *351,174* | *67,784* | *7,269* | *75,054* | *426,228* | |
| WOMEN | 19,838 | 25,004 | *44,842* | 10,774 | | 10,774 | 55,616 | 13% |
| MEN | 135,521 | 170,811 | 306,332 | 57,011 | 7,269 | 64,280 | 370,612 | |
| ***PRODUCTION AND UTILISATION*** | | | | | | | | |
| TOTAL ANNUAL CATCH (MT) | 316,302 | 219,926 | 536,228 | 250,389 | 27,000 | 277,389 | 813,617 | Large-scale fishery inland from *FAO Fishery Country Profile Brazil (piramutaba fishery)*. Total inland catches 47,636mt replaced by average 2004-2006 from FishStat Plus. |
| VALUE (m US$) | 343 | 275 | 617 | 327 | 35 | 363 | 980 | Exchange rate 2006: 1 BRL=0.46 US$. |
| VALUE US$/MT | 1,083 | 1,248 | 1,151 | 1,307 | 1,307 | 1,307 | 1,204 | |
| CONTRIBUTION TO DOMESTIC ANIMAL PROTEIN INTAKE | | | | | | | | |
| % OF CATCH USED FOR DOMESTIC HUMAN CONSUMPTION | 92% | 100% | 95% | 87% | 0% | 79% | 90% | Calculated according to available figures in table. |
| CATCH/FISHER (MT) | 2.7 | 1.5 | 2.0 | 4.9 | 4.9 | 4.9 | 2.5 | |
| FISH CAUGHT (MT) / FUEL USED (T) | | | | | | | | |
| DISCARDS (% OF LANDINGS) | 1.5% | 0.1% | 0.9% | 13.5% | 12.0% | 13.3% | 5.2% | For *piramutabla fishery* from discards database (FAO FTP 470). |

Figures generally for 2006.

Production figures are estimates and differ from officially reported data.

## CAMBODIA

| | SMALL-SCALE FISHERIES | | | LARGE-SCALE FISHERIES | | | TOTAL | Remarks |
|---|---|---|---|---|---|---|---|---|
| | MARINE | INLAND | TOTAL | MARINE | INLAND | TOTAL | | |
| ***DEFINITION*** | | | | | | | | |
| Small-scale in marine waters include subsistence non-motorised boats and motorised boats (<10HP); trawlers, seiners and offshore fishing vessels are large-scale.In inland waters, there are three categories of fishing: family fisheries, medium scale or commercial fishing and industrial fishing. Inland small-scale fisheries would include family fishing with boats <5HP and <10m length but the data here only include fishing with non-motorised boats as small-scale fisheries. | | | | | | | | |
| ***EMPLOYMENT*** | | | | | | | | |
| NUMBER OF FISHERS | 15,147 | 496,091 | 511,238 | 24,387 | 100,911 | 125,298 | 636,536 | Includes fulltime and parttime fishers. |
| NUMBER OF OTHER JOBS | 28,147 | 921,853 | 950,000 | 9,732 | 40,268 | 50,000 | 1,000,000 | Processing and marketing. Fulltime and parttime. |
| Ratio | 1.9 | 1.9 | 1.9 | 0.4 | 0.4 | 0.4 | 1.6 | |
| *TOTAL* | *43,294* | *1,417,944* | *1,461,238* | *34,119* | *141,179* | *175,298* | *1,636,536* | |
| WOMEN | 26,089 | 854,473 | *880,562* | 9,978 | 41,287 | 51,265 | 931,827 | Women as fishers (5% of total) and in marketing/processing (90%). |
| MEN | 17,204 | 563,472 | 580,676 | 24,141 | 99,892 | 124,033 | 704,709 | |
| ***PRODUCTION AND UTILISATION*** | | | | | | | | |
| TOTAL ANNUAL CATCH (MT) | 22,879 | 281,008 | 303,887 | 68,148 | 156,617 | 224,765 | 528,652 | |
| VALUE (m US$) | | | - | | | - | - | |
| VALUE US$/MT | - | - | - | - | | - | - | |
| CONTRIBUTION TO DOMESTIC ANIMAL PROTEIN INTAKE | | | | | | | | |
| % OF CATCH USED FOR DOMESTIC HUMAN CONSUMPTION | 97% | 97% | 97% | 85% | 85% | 85% | 92% | Approximately 8% of total fishery production is exported according to *FAO Fishery Profile Cambodia* (2003). |
| CATCH/FISHER (MT) | 1.5 | 0.6 | 0.6 | 2.8 | 1.6 | 1.8 | 0.8 | |
| FISH CAUGHT (MT) / FUEL USED (T) | 3.1 | | | 1.2 | 3.9 | | | Calculations made only for certain segments of the fleet. Small-scale inland fisheries are generally non-motorised or without boat. Large-scale inland fishing show high fuel efficiency: 21mt/t (Lot fisheries) and 64mt/t (Dai fisheries). |
| DISCARDS (% OF LANDINGS) | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | Marine: from discards database (FAO FTP 470). Inland: assumed 0. |

Figures from 2006.

Production figures are estimates and differ from officially reported data.

## CHINA

| | SMALL-SCALE FISHERIES | | | LARGE-SCALE FISHERIES | | | TOTAL | Remarks |
|---|---|---|---|---|---|---|---|---|
| | MARINE | INLAND | TOTAL | MARINE | INLAND | TOTAL | | |
| ***DEFINITION*** | | | | | | | | |
| All inland fisheries are considered small-scale. In marine fisheries, boats with engine power of <440kW are considered small-scale (most small-scale fishing boats have engine power <44kW); these operate in coastal waters. | | | | | | | | |
| ***EMPLOYMENT*** | | | | | | | | |
| NUMBER OF FISHERS | 2,748,542 | 748,000 | 3,496,542 | 25,627 | - | 25,627 | 3,522,169 | Includes parttime but not occasional. |
| NUMBER OF OTHER JOBS | 8,030,000 | 475,000 | 8,505,000 | 50,847 | - | 50,847 | 8,555,847 | Processing and marketing. Includes parttime but not occasional |
| Ratio | 2.9 | 0.6 | 2.4 | 2.0 | | 2.0 | 2.4 | |
| *TOTAL* | *10,778,542* | *1,223,000* | *12,001,542* | *76,474* | - | *76,474* | *12,078,016* | |
| WOMEN | 1,990,796 | 636,200 | *2,626,996* | 15,254 | | 15,254 | 2,642,250 | Inland: based on figures for Hubei province. % small-scale women fishers = average Zhejiang & Guangdong. 20% of post-harvest in small-scale marine sector are women. |
| MEN | 8,787,746 | 586,800 | 9,374,546 | 61,220 | - | 61,220 | 9,435,766 | |
| ***PRODUCTION AND UTILISATION*** | | | | | | | | |
| TOTAL ANNUAL CATCH (MT) | 11,483,051 | 2,160,000 | 13,643,051 | 1,101,695 | - | 1,101,695 | 14,744,746 | Marine: South China Sea and East China Sea. Yellow Sea and other areas calculated proportionally according to FAO Fishery Country Profile information 1). |
| VALUE (m US$) | 13,033 | 3,387 | 16,420 | 1,248 | | 1,248 | 17,668 | |
| VALUE US$/MT | 1,135 | 1,568 | 1,204 | 1,133 | | 1,133 | 1,198 | |
| CONTRIBUTION TO DOMESTIC ANIMAL PROTEIN INTAKE | 22% | 4% | 19% | 3% | | 3% | 18% | |
| % OF CATCH USED FOR DOMESTIC HUMAN CONSUMPTION | 75% | 85% | 77% | 90% | | 90% | 78% | |
| CATCH/FISHER (MT) | 4.2 | 2.9 | 3.9 | 43.0 | | 43.0 | 4.2 | |
| FISH CAUGHT (MT) / FUEL USED (T) | 0.9 | 10.9 | 2.5 | 1.5 | | 1.5 | 2.4 | |
| DISCARDS (% OF LANDINGS) | 0.5% | 0.0% | 0.4% | 0.5% | | 0.5% | 0.4% | Marine: from discards database (FAO FTP 470). Inland: assumed 0. |

Figures from 2006.

Production figures are estimates and differ from officially reported data.

1) According to FAO Fishery Country Profile 2006 for China, the different marine areas contribute the following production:

South China Sea: 25%

East China Sea: 34%

Yellow Sea: 22%

Other: 19%

## GHANA

| | SMALL-SCALE FISHERIES | | | LARGE-SCALE FISHERIES | | | TOTAL | Remarks |
|---|---|---|---|---|---|---|---|---|
| | MARINE | INLAND | TOTAL | MARINE | INLAND | TOTAL | | |
| ***DEFINITION*** | | | | | | | | |
| All inland fisheries are considered small-scale. In the marine sector, small-scale (or artisanal) are fisheries in which traditional canoes are used with no mechanization involved in fishing operations. | | | | | | | | |
| ***EMPLOYMENT*** | | | | | | | | |
| NUMBER OF FISHERS | 124,219 | 72,391 | 196,610 | 8,490 | - | 8,490 | 205,100 | Includes parttime but not occasional. |
| NUMBER OF OTHER JOBS | 123,039 | 41,378 | 164,417 | 2,532 | - | 2,532 | 166,949 | Processing and marketing. Includes parttime but not occasional. Some processing of industrial landings take place in the artisanal sector. |
| Ratio | 1.0 | 0.6 | 0.8 | 0.3 | | 0.3 | 0.8 | |
| *TOTAL* | *247,258* | *113,769* | *361,027* | *11,022* | - | *11,022* | *372,049* | |
| WOMEN | 110,735 | 37,240 | 147,975 | 2,279 | - | 2,279 | 150,254 | Assuming 90% of postharvest workers are women. |
| MEN | 136,523 | 76,529 | 213,052 | 8,743 | - | 8,743 | 221,795 | |
| ***PRODUCTION AND UTILISATION*** | | | | | | | | |
| TOTAL ANNUAL CATCH (MT) | 231,681 | 398,344 | 630,025 | 119,828 | - | 119,828 | 749,853 | |
| VALUE (m US$) | | | - | | | | - | |
| VALUE US$/MT | - | - | - | - | | - | - | |
| CONTRIBUTION TO DOMESTIC ANIMAL PROTEIN INTAKE | | | | | | | | |
| % OF CATCH USED FOR DOMESTIC HUMAN CONSUMPTION | 84% | 100% | 100% | 41% | | 41% | 91% | |
| CATCH/FISHER (MT) | 1.9 | 5.5 | 3.2 | 14.1 | | 14.1 | 3.7 | |
| FISH CAUGHT (MT) / FUEL USED (T) | 1.5 | 6.1 | 4.4 | 0.9 | | 0.9 | 3.8 | Small-scale marine: average for different types of gear on dugouts (span 1.3-4.3mt/t). Small-scale inland fisheries: planked and decked motorised canoes on Lake Volta. Marine large-scale: average for different vessel types (span 0.1-4.1mt/t) |
| DISCARDS (% OF LANDINGS) | 0.5% | 0.0% | 0.2% | 1.2% | | 1.2% | 0.3% | Marine: from discards database (FAO FTP 470). Inland: assumed 0. |

Figures from 2006.

Production figures are estimates and differ from officially reported data.

Artisanal processors also use production from industrial fleet.

## INDIA

| | SMALL-SCALE FISHERIES | | | LARGE-SCALE FISHERIES | | | TOTAL | Remarks |
|---|---|---|---|---|---|---|---|---|
| | MARINE | INLAND | TOTAL | MARINE | INLAND | TOTAL | | |
| ***DEFINITION*** | | | | | | | | |
| Marine large-scale fisheries includes 'mechanised' vessels (trawlers, gillnetters etc) and small-scale are 'motorised' and 'non-motorised'. All inland are assumed to be small-scale. | | | | | | | | |
| ***EMPLOYMENT*** | | | | | | | | |
| NUMBER OF FISHERS | 514,643 | 1,106,199 | 1,620,842 | 379,158 | | 379,158 | 2,000,000 | Marine: only fulltime (but parttime/occasional negligible). Inland fisheries assumed to be only small-scale and number of fisheries calculated as difference between total fulltime and parttime fishers in *FAO Fishery Country Profile India* and total marine fishers. |
| NUMBER OF OTHER JOBS | 2,058,572 | 4,424,796 | 6,483,368 | 1,516,632 | | 1,516,632 | 8,000,000 | Processing and marketing; fulltime and parttime. |
| Ratio | 4.0 | | 4.0 | 4.0 | | 4.0 | 4.0 | |
| *TOTAL* | *2,573,215* | *5,530,995* | *8,104,210* | *1,895,790* | - | *1,895,790* | *10,000,000* | |
| WOMEN | 1,852,715 | 3,982,316 | *5,835,031* | 1,364,969 | - | 1,364,969 | 7,200,000 | Estimated as 90% of processing and marketing jobs. |
| MEN | 720,500 | 1,548,679 | 2,269,179 | 530,821 | - | 530,821 | 2,800,000 | |
| ***PRODUCTION AND UTILISATION*** | | | | | | | | |
| TOTAL ANNUAL CATCH (MT) | 857,138 | 743,093 | 1,600,231 | 1,754,279 | | 1,754,279 | 3,354,510 | Inland water catch according to FishStat Plus, average 2004-2006: 743,093 MT. |
| VALUE (m US$) | 959 | | 959 | 2,080 | | 2,080 | 3,040 | Values from 2005 and 2007. Exchange rate 2006; 1 INR = 0.0222 US$. |
| VALUE US$/MT | 1,119 | - | 600 | 1,186 | | 1,186 | 906 | |
| CONTRIBUTION TO DOMESTIC ANIMAL PROTEIN INTAKE | | | | | | | | |
| % OF CATCH USED FOR DOMESTIC HUMAN CONSUMPTION | | | | | | | | |
| CATCH/FISHER (MT) | 1.7 | 0.7 | 1.0 | 4.6 | | 4.6 | 1.7 | |
| FISH CAUGHT (MT) / FUEL USED (T) | | | | | | | | |
| DISCARDS (% OF LANDINGS) | 0.7% | 1.0% | 0.8% | 1.8% | | 1.8% | 1.3% | Small-scale fisheries assumed same as in Bangladesh. Large-scale fisheries based on discards database (FAO FTP 470). |

Production data from 2004.

Production figures are estimates and differ from officially reported data.

## INDONESIA

| | SMALL-SCALE FISHERIES | | | LARGE-SCALE FISHERIES | | | TOTAL | Remarks |
|---|---|---|---|---|---|---|---|---|
| | MARINE | INLAND | TOTAL | MARINE | INLAND | TOTAL | | |
| ***DEFINITION*** | | | | | | | | |
| All inland fisheries are considered small-scale. In the marine sector, boats <5GT are considered small-scale. | | | | | | | | |
| ***EMPLOYMENT*** | | | | | | | | |
| NUMBER OF FISHERS | 1,692,899 | 555,000 | 2,247,899 | 149,010 | | 149,010 | 2,396,909 | Inland fishers: average 2003-2005. Fulltime only? |
| NUMBER OF OTHER JOBS | 721,000 | 382,000 | 1,103,000 | 63,000 | | 63,000 | 1,166,000 | Estimated according to ratios from FAO Fishery Country Profile. |
| Ratio | | | 0.5 | 0.4 | | 0.4 | 0.5 | |
| *TOTAL* | *2,413,899* | *937,000* | *3,350,899* | *212,010* | - | *212,010* | *3,562,909* | |
| WOMEN | | | | | | - | - | |
| MEN | 2,413,899 | 937,000 | 3,350,899 | 212,010 | - | 212,010 | 3,562,909 | |
| ***PRODUCTION AND UTILISATION*** | | | | | | | | |
| TOTAL ANNUAL CATCH (MT) | 2,707,315 | 293,921 | 3,001,236 | 1,804,876 | | 1,804,876 | 4,806,112 | Marine catch divided between small-scale and large-scale using 60-40 ratio. |
| VALUE (m US$) | | | - | | | - | - | |
| VALUE US$/MT | - | - | - | - | | - | - | |
| CONTRIBUTION TO DOMESTIC ANIMAL PROTEIN INTAKE | | | | | | | | |
| % OF CATCH USED FOR DOMESTIC HUMAN CONSUMPTION | 85% | 99% | 86% | < 60% | | < 60% | 76% | |
| CATCH/FISHER (MT) | 1.6 | 0.5 | 1.3 | 12.1 | | 12.1 | 2.0 | |
| FISH CAUGHT (MT) / FUEL USED (T) | | | | | | | | |
| DISCARDS (% OF LANDINGS) | 1.0% | 0.0% | 0.9% | 2.0% | | 2.0% | 1.3% | Marine: from discards database (FAO FTP 470). Inland: assumed 0. |

MOZAMBIQUE

| | SMALL-SCALE FISHERIES | | | LARGE-SCALE FISHERIES | | | TOTAL | Remarks |
|---|---|---|---|---|---|---|---|---|
| | MARINE | INLAND | TOTAL | MARINE | INLAND | TOTAL | | |
| ***DEFINITION*** | | | | | | | | |
| Small-scale fisheries include small-scale commercial and subsistence fishing. i.e. shorebased boats generally of <12m, motorised or non-motorised (or no boat). | | | | | | | | |
| ***EMPLOYMENT*** | | | | | | | | |
| NUMBER OF FISHERS | 149,643 | 73,693 | 223,336 | 3,500 | 900 | 4,400 | 227,736 | Includes fulltime and parttime fishers as well as subsistence fishers. |
| NUMBER OF OTHER JOBS | 16,778 | 17,366 | 34,144 | 780 | 300 | 1,080 | 35,224 | Processing and marketing. Fulltime and parttime. |
| Ratio | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.2 | 0.2 | |
| *TOTAL* | *166,421* | *91,059* | 257,480 | *4,280* | *1,200* | *5,480* | *262,960* | |
| WOMEN | 4,198 | 4,920 | 9,118 | 125 | 75 | 200 | 9,318 | Women as fishers (5% of total) and in marketing/processing (90%). |
| MEN | 162,223 | 86,139 | 248,362 | 4,155 | 1,125 | 5,280 | 253,642 | |
| ***PRODUCTION AND UTILISATION*** | | | | | | | | |
| TOTAL ANNUAL CATCH (MT) | 57,693 | 15,200 | 72,893 | 25,066 | 8,461 | 33,527 | 106,420 | Includes discards by shrimp trawlers (estimated as 2 tonnes byctach per 1 tonnes shrimp). |
| VALUE (m US$) | 126,736 | 37,997 | 164,733 | 73,335 | 2,747 | 76,082 | 240,815 | |
| VALUE US$/MT | 2,197 | 2,500 | 2,260 | 2,926 | 325 | 2,269 | 2,263 | |
| CONTRIBUTION TO DOMESTIC ANIMAL PROTEIN INTAKE | | | | | | | | |
| % OF CATCH USED FOR DOMESTIC HUMAN CONSUMPTION | 98% | 98% | 98% | 66% | 73% | 68% | 88% | Approximately 98% of industrial fishery and 49% of semi-industrial fishery was exported in 2007 (semi-industrial and industrial fieshery composes the large-scale fisheries in Mozambique. From the marine artisanal fishery only 2% was exported. Commercial inland fishery (kapenta) exported about 50% of total catches in 2007. |
| CATCH/FISHER (MT) | 0.4 | 0.2 | 0.3 | 7.2 | 9.4 | 7.6 | 0.5 | |
| FISH CAUGHT (MT) / FUEL USED (T) | | | | | | | | In average semi-industrial vessels consume between 800 and 1000 liter a day (150 days of fishing), and industrial vessels between 1800 and 3000 liter a day. |
| DISCARDS (% OF LANDINGS) | 0.5% | 0.0% | 0.4% | 61.0% | 0.0% | 45.6% | 14.7% | Marine: from discards database (FAO FTP 470). Inland: assumed 0. |

Figures from 2007

Production figures and market value are officially reported data.

## NIGERIA

| | SMALL-SCALE FISHERIES | | | LARGE-SCALE FISHERIES | | | TOTAL | Remarks |
|---|---|---|---|---|---|---|---|---|
| | MARINE | INLAND | TOTAL | MARINE | INLAND | TOTAL | | |
| ***DEFINITION*** | | | | | | | | |
| All inland fisheries are considered small-scale (wooden boats and canoes). In marine water, artisanal fisheries are withing 5 nautical miles of the coast ("The craft employed are planked and dugout canoes, 3 to 13 m long, powered by outboard engines ranging from 15 to 25 hp. Some bonga outfits could be as big as 25 m in length with 45 hp outboard engines. The gear taken to sea are mainly set gillnets and cast nets, while in the estuaries hooks and traps are also used", *FAO Fishery Country Profile 2007*). | | | | | | | | |
| ***EMPLOYMENT*** | | | | | | | | |
| NUMBER OF FISHERS | 876,000 | 324,000 | 1,200,000 | 30,000 | | 30,000 | 1,230,000 | Includes parttime but not occasional. Total number of artisanal fishers divided between marine/inland according to ration 73%/27% (fm case study table: *Fisheries Statistics of Nigeria 3rd Edition 1985-1994*). |
| NUMBER OF OTHER JOBS | 3,650,000 | 1,350,000 | 5,000,000 | 270,000 | | 270,000 | 5,270,000 | All auxillary employment. |
| Ratio | | | 4.2 | 9.0 | | 9.0 | 4.3 | |
| *TOTAL* | *4,526,000* | *1,674,000* | *6,200,000* | *300,000* | - | *300,000* | *6,500,000* | |
| WOMEN | 3,285,000 | 1,215,000 | 4,500,000 | 243,000 | - | 243,000 | 4,743,000 | Assuming 90% of postharvest workers are women. |
| MEN | 1,241,000 | 459,000 | 1,700,000 | 57,000 | - | 57,000 | 1,757,000 | |
| ***PRODUCTION AND UTILISATION*** | | | | | | | | |
| TOTAL ANNUAL CATCH (MT) | 259,831 | 230,763 | 490,594 | 32,595 | | 32,595 | 523,189 | |
| VALUE (m US$) | | | - | | | - | - | |
| VALUE US$/MT | - | - | - | - | | - | - | |
| CONTRIBUTION TO DOMESTIC ANIMAL PROTEIN INTAKE | | | | | | | | |
| % OF CATCH USED FOR DOMESTIC HUMAN CONSUMPTION | 100% | 100% | 100% | 82% | | 82% | 99% | Only part of shrimp catch exported. |
| CATCH/FISHER (MT) | 0.3 | 0.7 | 0.4 | 1.1 | | 1.1 | 0.4 | |
| FISH CAUGHT (MT) / FUEL USED (T) | | | | | | | | |
| DISCARDS (% OF LANDINGS) | 0.5% | 0.0% | 0.3% | 5.8% | | 5.8% | 0.6% | Marine: from discards database (FAO FTP 470). Inland: assumed 0. |

Production figures offical data from 2005. Employment figures from 2005.

## PHILIPPINES

| | SMALL-SCALE FISHERIES | | | LARGE-SCALE FISHERIES | | | TOTAL | Remarks |
|---|---|---|---|---|---|---|---|---|
| | MARINE | INLAND | TOTAL | MARINE | INLAND | TOTAL | | |
| ***DEFINITION*** | | | | | | | | |
| Small-scale are defined as 'municipal fisheries' and fish in the coastal zone within 15k from the coast (motorised and non-motorised "bancas"). All inland fishing is municipal and hence small-scale. | | | | | | | | |
| ***EMPLOYMENT*** | | | | | | | | |
| NUMBER OF FISHERS | 1,371,676 | 226,195 | 1,597,871 | 16,497 | | 16,497 | 1,614,368 | Includes parttime but not occasional |
| NUMBER OF OTHER JOBS | | | | | | - | - | |
| Ratio | | | - | - | | - | - | |
| *TOTAL* | *1,371,676* | *226,195* | *1,597,871* | *16,497* | - | *16,497* | *1,614,368* | |
| WOMEN | - | - | | | | - | - | |
| MEN | 1,371,676 | 226,195 | 1,597,871 | 16,497 | - | 16,497 | 1,614,368 | |
| ***PRODUCTION AND UTILISATION*** | | | | | | | | |
| TOTAL ANNUAL CATCH (MT) | 988,240 | 143,806 | 1,132,046 | 1,133,976 | | 1,133,976 | 2,266,022 | |
| VALUE (m US$) | | | - | | | - | - | |
| VALUE US$/MT | - | - | - | - | | - | - | |
| CONTRIBUTION TO DOMESTIC ANIMAL PROTEIN INTAKE | | | | | | | | |
| % OF CATCH USED FOR DOMESTIC HUMAN CONSUMPTION | | | | | | | 91% | Estimate based on data for 2003 in *FAO Fishery Country Profile*. |
| CATCH/FISHER (MT) | 0.7 | 0.6 | 0.7 | 68.7 | | 68.7 | 1.4 | |
| FISH CAUGHT (MT) / FUEL USED (T) | | | | | | | | |
| DISCARDS (% OF LANDINGS) | 1.0% | 0.0% | 0.9% | 1.0% | | 1.0% | 0.9% | Marine: from discards database (FAO FTP 470). Inland: assumed 0. |

Figures from 2005.

## SENEGAL

| | SMALL-SCALE FISHERIES | | | LARGE-SCALE FISHERIES | | | TOTAL | Remarks |
|---|---|---|---|---|---|---|---|---|
| | MARINE | INLAND | TOTAL | MARINE | INLAND | TOTAL | | |
| ***DEFINITION*** | | | | | | | | |
| Small-scale marine fisheries include all canoes ("pirogues") and is referred to as artisanal fishery. All inland fisheries are small-scale. | | | | | | | | |
| ***EMPLOYMENT*** | | | | | | | | |
| NUMBER OF FISHERS | 42,107 | 39,962 | 82,069 | 2,530 | | 2,530 | 84,599 | Only fulltime? |
| NUMBER OF OTHER JOBS | 33,561 | 1,726 | 35,287 | 7,298 | | 7,298 | 42,585 | Processing and marketing, fulltime and parttime. NB. f*igure in FAO Fishery Country Profile of 650000 people in fisheries.* |
| Ratio | 0.8 | | 0.4 | 2.9 | | 2.9 | 0.5 | |
| *TOTAL* | *75,668* | *41,688* | *117,356* | *9,828* | - | *9,828* | *127,184* | |
| WOMEN | 32,456 | 1,622 | *6,455* | 4,861 | | 4,861 | 11,316 | 9% |
| MEN | 43,212 | 40,066 | 110,901 | 4,967 | - | 4,967 | 115,868 | |
| ***PRODUCTION AND UTILISATION*** | | | | | | | | |
| TOTAL ANNUAL CATCH (MT) | 406,980 | 63,992 | 470,972 | 57,157 | | 57,157 | 528,129 | Figures from 1999-2000. |
| VALUE (m US$) | | | - | | | - | - | |
| VALUE US$/MT | - | - | - | - | | - | - | |
| CONTRIBUTION TO DOMESTIC ANIMAL PROTEIN INTAKE | | | | | | | | |
| % OF CATCH USED FOR DOMESTIC HUMAN CONSUMPTION | 68% | 75% | 69% | 11% | | 11% | 63% | |
| CATCH/FISHER (MT) | 9.7 | 1.6 | 5.7 | 22.6 | | 22.6 | 6.2 | |
| FISH CAUGHT (MT) / FUEL USED (T) | 9.7 | | | 3.9 | | | | |
| DISCARDS (% OF LANDINGS) | 1.0% | 0.0% | 0.9% | 25.6% | | 25.6% | 3.5% | Marine: from discards database (FAO FTP 470). Inland: assumed 0. |

Production figures are estimates and differ from officially reported data.

## THAILAND

| | SMALL-SCALE FISHERIES | | | LARGE-SCALE FISHERIES | | | TOTAL | Remarks |
|---|---|---|---|---|---|---|---|---|
| | MARINE | INLAND | TOTAL | MARINE | INLAND | TOTAL | | |
| ***DEFINITION*** | | | | | | | | |
| All inland fisheries are considered small-scale. In the marine sector, boats <5GT are small-scale. | | | | | | | | |
| ***EMPLOYMENT*** | | | | | | | | |
| NUMBER OF FISHERS | 94,229 | 3,131,355 | 3,225,584 | 73,911 | | 73,911 | 3,299,495 | Only fulltime.. |
| NUMBER OF OTHER JOBS | | | | | | - | 391,426 | Processing and marketing, fulltime and parttime. |
| Ratio | | | - | - | | - | 0.1 | |
| *TOTAL* | *94,229* | *3,131,355* | *3,225,584* | *73,911* | - | *73,911* | *3,690,921* | |
| WOMEN | - | | | | | - | - | |
| MEN | 94,229 | 3,131,355 | 3,225,584 | 73,911 | - | 73,911 | 3,690,921 | |
| ***PRODUCTION AND UTILISATION*** | | | | | | | | |
| TOTAL ANNUAL CATCH (MT) | 188,216 | 1,060,000 | 1,248,216 | 2,662,329 | | 2,662,329 | 3,910,545 | Marine large-scale includes catches outside Thai waters. |
| VALUE (m US$) | | | - | | | - | - | |
| VALUE US$/MT | - | - | - | - | | - | - | |
| CONTRIBUTION TO DOMESTIC ANIMAL PROTEIN INTAKE | | | | | | | | |
| % OF CATCH USED FOR DOMESTIC HUMAN CONSUMPTION | 79% | 100% | 97% | 40% | | 43% | 60% | |
| CATCH/FISHER (MT) | 2.0 | 0.3 | 0.4 | 36.0 | | 36.0 | 1.2 | |
| FISH CAUGHT (MT) / FUEL USED (T) | | | | | | | | |
| DISCARDS (% OF LANDINGS) | 1% | 0% | 0% | 1% | | 1% | 1% | |

Figures for 2004.

## VIET NAM

| | SMALL-SCALE FISHERIES | | | LARGE-SCALE FISHERIES | | | TOTAL | Remarks |
|---|---|---|---|---|---|---|---|---|
| | MARINE | INLAND | TOTAL | MARINE | INLAND | TOTAL | | |
| ***DEFINITION*** | | | | | | | | |
| Small-scale fisheries are conducted without vessels or with vessels that are owner-operated, and have engines of less than 90 HP. Small-scale fisheries fall under provincial authority. All inland fisheries are small-scale. | | | | | | | | |
| ***EMPLOYMENT*** | | | | | | | | |
| NUMBER OF FISHERS | 474,400 | 2,834,238 | 3,308,638 | 132,700 | | 132,700 | 3,441,338 | Only fulltime? Number of fishers in small-scale inland fisheries calculated using average catch/fisher for Cambodia, Indonesia and Thailand (0.4 MT). |
| NUMBER OF OTHER JOBS | | | | | | - | - | |
| Ratio | | | - | - | | - | - | |
| *TOTAL* | *474,400* | *2,834,238* | *3,308,638* | *132,700* | - | *132,700* | *3,441,338* | |
| WOMEN | - | | | | | | - | 14% of total labour force are women, mainly involved in accessory activities. |
| MEN | 474,400 | 2,834,238 | 3,308,638 | 132,700 | - | 132,700 | 3,441,338 | |
| ***PRODUCTION AND UTILISATION*** | | | | | | | | |
| TOTAL ANNUAL CATCH (MT) | 1,458,783 | 1,107,911 | 2,566,694 | 1,125,529 | | 1,125,529 | 3,692,223 | Estimates for inland fisheries vary: 961,274-1,254,548 (average included here). |
| VALUE (m US$) | | | - | | | - | - | |
| VALUE US$/MT | - | - | - | - | | - | - | |
| CONTRIBUTION TO DOMESTIC ANIMAL PROTEIN INTAKE | | | | | | | | |
| % OF CATCH USED FOR DOMESTIC HUMAN CONSUMPTION | | | | | | | | |
| CATCH/FISHER (MT) | 3.1 | 0.4 | 0.8 | 8.5 | | 8.5 | 1.1 | |
| FISH CAUGHT (MT) / FUEL USED (T) | | | | | | | | |
| DISCARDS (% OF LANDINGS) | 0.5% | 0.0% | 0.3% | 0.5% | | 0.5% | 0.3% | Marine: from discards database (FAO FTP 470). Inland: assumed 0. |

Figures for 2003.

The Big Numbers Project addresses the lack of accurate and accessible disaggregated information on small- and large-scale fisheries, in inland and marine waters, currently experienced in the international fisheries arena. It aims to improve our knowledge on the characteristics of, contributions by and interactions among the different subsectors of the fisheries sector and to promote the establishment of procedures for regular analyses that can inform policy formulation for the benefit of small-scale fishing communities around the world.

This is a preliminary report of the Project, giving a summary of the results to-date of case studies carried out in a selected number of countries and providing a first analysis of the differences between marine and inland small and large-scale fisheries in developing countries. It has been prepared for distribution at the 2008 conference "Securing Sustainable Small-scale Fisheries: Bringing together responsible fisheries and social development" in Bangkok, Thailand, and is intended for policy and decision makers and others with an interest in sustainable fisheries and poverty alleviation.

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THE BIG NUMBERS PROJECT IS A WORK IN PROGRESS; YOUR COMMENTS AND SUGGESTIONS ARE WELCOMED!

REPORT | 1885


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