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Preparation of this document

This document draws on the findings of case studies coordinated and funded by the Food and Agriculture Organization of the United Nations (FAO) Fisheries and Aquaculture Department in the Gambia, India, Kenya, Mozambique, Peru and Sri Lanka, and by the FAO/United Kingdom Department for International Development (DFID) Sustainable Fisheries Livelihoods Programme (SFLP) in Benin, Ghana and Togo. In addition to the findings of the case studies, other studies and publications on beach seines were reviewed and used for the preparation of this document.

Robert Lee, Susana Siar, Hans E. Båge and Thomas Moth-Poulsen of the FAO Fisheries and Aquaculture Department coordinated the country case studies and provided technical and editorial advice.

The case studies on which this document is based were written by Amélie Gbagnidi (Benin); Asberr N. Mendy (the Gambia); Doris Yeboah (Ghana); Venkatesh Salagrama (India); Davide Signa, Paul Mboya Tuda and Melita Samoilys (Kenya); James Wilson and Julio Zitha (Mozambique); Carlota Estrella (Peru); Aloy W. Fernando (Sri Lanka); and Kossi Maxoe Sedzro (Togo). The FAO Fisheries and Aquaculture Technical Paper was prepared by Uwe Tietze, FAO Consultant.

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Abstract

This document provides a global overview of beach seine fisheries and identifies key issues relevant for the responsible use of beach seines and the sustainable livelihoods of beach seine fishers. It also provides guidelines for fisheries managers and other stakeholders on how best to address the issues of management processes and measures, which have the mutually beneficial goals of restoring and conserving the health of fishery resources and their habitats and safeguarding the livelihoods of fishers and their communities.

Chapter 1 provides introductory and background information. It gives a general description of the design and operation of beach seines and highlights that the long-term livelihoods and food security of small-scale fishing communities can only be ensured if responsible and sustainable fishing methods are employed. The challenge is how to balance the short-term food security requirements of coastal fishing communities with responsible and sustainable fishing methods.

Chapter 2 explains the coverage and focus of the country case studies as well as their field survey methodologies. Meanwhile, Chapter 3 contains a comparative analysis of the findings of the country case studies. The findings are complemented by the findings of the literature review. The chapter starts with a global overview of the operational and technical features of beach seining and its environmental impacts. This is followed by a comparison of the social and economic characteristics of beach seine owners and operators and their access to social and health services, education and infrastructure. Economic and financial aspects of beach seine fisheries operations are analysed, as well as post-harvest activities and fishers and beach seine operators' access to credit. An overview of fisheries legislation and management of beach seining and its compliance with fisheries management laws and regulations is also provided. The chapter also discusses the implications of the main findings of the case studies as they relate to the status of fishery resources and habitats and for food security and livelihoods of beach seine fishers. Global trends of beach seining are identified and the assessment of the studies regarding the future of beach seining is summarized.

Chapter 4 presents the recommendations of the authors of the country case studies for achieving well-regulated and well-managed beach seine fisheries.

Finally, Chapter 5 elaborates the topics raised by the case studies that are crucial for the formulation of recommendations and management guidelines. These topics include the approach to co-management and the use of fishers' ecological knowledge in resource management decision-making, the occupational diversification to other income-generating activities and livelihoods, and moving towards more selective and environmentally-friendly fishing methods. Also elaborated are improvements and modifications of beach seine gear and methods; opportunities for value addition and post-harvest improvements; microenterprise development; restoration of aquatic habitat by small-scale fishing communities; microfinance support; and the use of socio-economic indicators for the monitoring of the impact of management measures on the livelihoods of fishing communities.

The chapter concludes with guidelines for fisheries managers and other stakeholders on how to manage beach seine fisheries in a responsible and participatory manner. Key resource, economic and social issues that are addressed by the management guidelines are: (i) the poverty and vulnerability of beach seine fishers due to lack of other income/employment opportunities, low educational levels, and scarce medical and social services; (ii) the negative impact of beach seining on aquatic resources and sometimes

on habitats; (iii) the depletion of fishery resources and the degradation of habitat caused by fisheries other than beach seining and by land-based pollution and human activities; (iv) a lack of compliance with fisheries and environmental regulations; (v) conflict and competition with other users of the common fishery resources; (vi) a generally low value of beach seine catches; (vii) a lack of access to microfinance and insurance services; and (viii) safety-at-sea issues.

The findings of the country case studies are summarized in the annexes of the document for easy reference for readers who are interested in the features of beach seine fisheries in different countries. The annexes also contain designs of selected beach seines used in India, Mozambique and Peru.

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Abbreviations and acronyms

BMU	beach management unit
BOBP	Bay of Bengal Programme for Fisheries Development
CARDER	Centres for Regional Action for Rural Development
CBFMC	Community-based Fisheries Management Committee
CCG	fisheries co-management committee
CCP	community fisheries council
CMFRI	Central Marine Fisheries Research Institute
CMZ	Coastal Management Zone
CPUE	catch per unit effort
CORDIO	Coastal Oceans Research and Development in the Indian Ocean
CRZ	Coastal Regulation Zone Notification
DFID	United Kingdom Department for International Development
DFMC	District Fisheries Management Committee
EEZ	exclusive economic zone
FRP	fibre reinforced plastic
GHC	Ghanaian cedi
hp	horsepower
ICAT	Institut de Conseil et d'Appui Technique (Institute of Technical Advice and Support)
IDPPE	National Institute for the Development of Small-scale Fisheries
IEZ	Inshore Exclusion Zone
IMARPE	Instituto del Mar del Perú/Marine Institute of Peru
INFOPESCA	Centre for Marketing Information and Advisory Services for Fishery Products in Latin America and the Caribbean
INFOPÊCHE	Intergovernmental Organization for Marketing Information and Cooperation Services for Fishery Products in Africa
INFOSA	Marketing Information and Technical Advisory Services for the Fisheries Industry in Southern Africa
INFOFISH	Intergovernmental Organization for Marketing Information and Technical Advisory Services for Fishery Products in the Asia and Pacific Region
INR	Indian rupee
ISO	International Organization for Standardization
IUCN EARO	Eastern Africa Regional Office of the International Union for Conservation of Nature
IUU	illegal, unregulated and unreported
KES	Kenyan shilling
LKR	Sri Lanka rupee
LVFO	Lake Victoria Fisheries Organization
MCS	monitoring, control and surveillance
MDG	Millennium Development Goal
MFRA	Marine Fishing Regulation Act
MZM	Mozambique metical
NCF	net cash flow
NCF/TE	net cash flow to total earnings
NCO	National Centre for Oceanography

NGO	non-governmental organization
NSW	New South Wales
PA	polyamide
PE	polyethylene
ROI	return on investment
SFLP	Sustainable Fisheries Livelihoods Programme
SHG	self-help group
USD	United States dollar
XOF	West African CFA franc

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1. Introduction and background

Beach seine nets have been used in fisheries for several thousand years and on every continent (Gabriel *et al.*, 2005). The ancient Phoenicians and Romans employed beach seining to catch fish in the Mediterranean.

A typical beach seine has weights attached to the leadline at the bottom of the net and buoys or floats attached to the floatline at the top of the net. The downward force of the weights counteracted by the buoyancy of the floats keeps the net open vertically when it is pulled through the water to entrap fish. A beach seine is often set from shore to encircle a school of fish. Beach seines can also be set at some distance from and parallel to the shore, though still in shallow water, and then hauled onto a boat. This latter method evolved historically into the development of what are now called purse seines, lampara and ring nets.

The general design of the beach seines used and their modes of operation are similar in the countries studied. Typically, two types of beach seines were used: beach seines with codend and those without codend. In the case of beach seines without codend, the central section of the seine consisted of loose netting. The typical beach seine consists of a seine body (or central section) and codend, to which anterior and posterior wings are attached. The gear has a head rope (also referred to as floatline) with floats to keep the upper part of the seine on the surface, and a footrope (also referred to as leadline) with sinkers to keep the gear on or close to the bottom and prevent fish from escaping from the area enclosed by the seine. Hauling ropes or warps are attached to both ends of the wings of the seine. The longer the hauling lines and the wings are, the larger is the fishing area that could be covered with the seine.

In most cases, non-motorized boats are used to set the seine; however, motorized boats are also used. When setting the beach seine, one of the hauling lines is fastened onto the shore, and the shoreward wing, seine body and seaward wing are set out in a wide semi-circular arc. Once the entire net is in the water, the second hauling rope is brought back to the shore. The hauling ropes are then hauled in simultaneously to the beach. The hauling may be done either manually or by means of a tractor, vehicle or winch. The long hauling ropes and the wings of the seine herd fish into the centre part of the seine body. Target species include pelagic as well as demersal species.

In developing countries, beach seines are an important source of income and employment and support the livelihoods of numerous coastal communities. Over the last two decades, however, fishing with beach seines has become controversial. Among other things, critics of beach seines have highlighted negative environmental impacts of beach seines on vulnerable aquatic habitats, such as nursery and breeding grounds, and negative impacts on fish stocks through the catching of juveniles. Many countries have introduced regulations and a few countries have banned fishing with beach seines altogether. The dilemma that policy-makers and fisheries managers are facing is how to balance peoples' livelihoods and food security needs with the need to protect and/or restore a healthy and well-functioning ecosystem that can maintain fisheries productivity for generations to come. However, this dilemma is not unique only to beach seine fisheries as it seems to be more and more common with increased fishing pressure.

The reduction of food insecurity and rural poverty and the promotion of sustainable rural livelihoods and more equitable access to resources are major strategies within FAO's Strategic Framework for 2000–2015. Small-scale fisheries are critical for food

security and poverty reduction as highlighted again by the FAO Committee on Fisheries at its Twenty-fifth Session. A high proportion of small-scale fishers are poor, including those involved in beach seining.

Because beach seining has such important livelihoods implications for many coastal communities, the FAO Fisheries and Aquaculture Department conducted a series of case studies on the technical, socio-economic and environmental features and impacts of beach seining. The case studies were undertaken by consultants in the Gambia, India, Kenya, Mozambique, Peru and Sri Lanka. Previous case studies were also conducted in Benin, Ghana and Togo under the Sustainable Fisheries Livelihoods Programme (SFLP) in West Africa.

In addition, information was gathered from other sources through Internet searches and literature reviews in the FAO Fisheries and Aquaculture Branch Library. The objective of preparing the case studies was to compile and present global information on practices in beach seining so that policy-makers, fisheries managers and other stakeholders can make better decisions on the responsible management and regulation of beach seine fisheries.

2. Methodology

COVERAGE AND FOCUS

In total, nine beach seine country case studies were conducted in four distinct regions of the world. In the Africa region, case studies from West Africa came from Benin, the Gambia, Ghana and Togo, and from Kenya and Mozambique in East Africa. The South Asia region studies came from India and Sri Lanka (desk study); and one case study was conducted in Latin America (Peru).

The case studies contain information on operational and technical features of beach seine fisheries, social characteristics of operators and owners of beach seines, economic and financial aspects of beach seining, environmental impact of beach seines, conflicts with other fishing methods and uses of the shoreline, and legislation and management aspects as well as the perceptions and views of the members of fishing communities on all these aspects of beach seining.

More specifically and, among other things, all case studies generated information on:

Biophysical aspects:

- importance of beach seining as a fishing method, technical dimensions of beach seines, and modes of operation;
- fishing seasons and catch composition;
- fishing boats and propulsion; and
- landing sites and infrastructure.

Socio-economic aspects:

- demographic characteristics;
- livelihoods strategies;
- sources of income and employment;
- labour and kinship relations;
- access to social services and infrastructure;
- vulnerability and food security;
- some aspects of investment and operating costs;
- some aspects of financial and economic returns and benefits;
- sharing of income;
- marketing links; and
- access to formal and informal credit.

Impacts, conflicts and governance aspects:

- impact of beach seines on aquatic habitat;
- impact of beach seines on fishery resources;
- conflicts of beach seining with other fishing methods and uses of the shoreline;
- effectiveness of existing regulations and management measures regarding beach seining; and
- opportunities for co-management and participation of fishers in policy formulation, implementation and monitoring.

While all the case studies covered similar topics and had similar or the same terms of reference, they differ in the depth and extent to which these topics were covered. Differences in their methodologies were also noted.

The first difference relates to the case study on Sri Lanka. While the other case studies collected data and information on beach seining through desk studies and literature reviews as well as field surveys and observations, the case study of Sri Lanka is solely based on the review of literature and reports and supplemented by consultation with the authors of publications and survey reports.

The second difference is that the case studies carried out in Benin, Ghana and Togo in 2000 and 2001 were under the guidance of the FAO/DFID Sustainable Fisheries Livelihoods Programme and the case studies carried out in 2007 and 2008 in the Gambia, India, Kenya, Mozambique and Peru were under the guidance of the FAO Fishing Technology Service.

The former case studies followed a standardized survey methodology agreed to by the three countries at a technical consultation, while the latter five case studies used different survey instruments; all however adopted participatory rural appraisal as the research strategy and analysed their data within the sustainable livelihoods assessment framework.

Another difference between these two groups of case studies is that the respondents of the first group of studies at village level were randomly selected following a frame survey. This was not the case with the second group of studies. The random selection of individual respondents is likely to reduce the sources of bias and increases the reliability and validity of findings mainly with reference to their individual perceptions and opinions. It is not likely to significantly affect other findings of the field surveys that are based on observations, measurements and group discussions rather than on individual interviews, such as findings related to the operational and technical features of beach seining, landing sites and infrastructure, general socio-economic characteristics of beach seine fishers, access to social services and infrastructure, economic and financial aspects, and environmental and resource impacts of beach seining.

For both groups of studies, the sites of the field surveys – the villages and fishing camps where the field surveys were carried out – were chosen purposely and not as randomly selected samples according to specific criteria relevant to the use of beach seines and to the problems and circumstances associated with the practice, which depended on the special situation and conditions prevailing in a particular country.

One more difference between the two groups of studies is that the case studies on Benin and Togo only provide limited or no information on the technical dimension of the fishing gear and craft used in beach seine fisheries and their impact on aquatic habitat. Likewise, they provide little or no information on the financial and economic performance of beach seine fisheries. These deficiencies cannot be attributed to the survey methodologies as the participatory rural appraisals were carried out with a multidisciplinary approach and the survey teams incorporated expertise in the field of fishing gear and fisheries. The focus of these studies was more on the socio-economic aspects and less on production technologies, processes and their economic performance.

As far as the history and regional particularities of beach seining are concerned, these aspects are covered in great depth in the case study on India, which could draw on rich sources of literature on this subject. The above differences in coverage and methods of the country case studies are reflected in the presentation of their key findings in an annex to this document. Studies that contain more specific and original information that might be of interest to fisheries managers, scientists, researchers, as well as fishers and their associations, are more prominently featured than others.

FIELD SURVEY METHODOLOGIES

Benin, Ghana and Togo

The information presented in the three case studies on Benin, Ghana and Togo, conducted under the guidance of the FAO/DFID Sustainable Fisheries Livelihoods Programme, is based on data collected in 2000 and 2001. These three case studies follow a similar survey methodology, which was agreed upon in a technical consultation with the three countries in Ghana from 12 to 16 November 2000.

Following desk research and compilation and analysis of available quantitative data and statistics, the three studies identified primary data needs and sources and designed data collection instruments. Advice was also sought from fisheries researchers as well as fisheries and other public administrators. A combination of qualitative and participatory appraisal methods and socio-economic sample surveys was used to gather primary data.

The field survey was carried out by a multidisciplinary team that incorporated expertise on fisheries science, fishing gear technology and socio-economics and was implemented in two phases. The first phase consisted of a frame survey, which was conducted in all fishing villages selected. When selecting villages and fishing camps for the field survey, the three main criteria were to include coastal regions where beach seining is practised, to include both rural and urban areas, and to take into consideration the spatial concentration/distribution of beach seines. A field guide and a questionnaire were used for the frame survey. Semi-structured focus group discussions were held with groups of adults, youth and children of both sexes. Guided walks and observations in fishing communities were undertaken and maps and diagrams were prepared of physical facilities, natural environment, seasonal activities and other features.

During the frame survey, the various vocational groups and their numbers were identified for each village. These groups were made up of owners and operators of beach seines and fishing craft, fish mongers, fish smokers, fish dryers, carpenters, mechanics and other operators. The data were then used for determining the random sample for the second phase of the survey – the socio-economic survey.

The socio-economic survey was conducted in selected fishing camps according to a sampling plan that took into account the number of days available for investigation, the composition of the team of investigators and the results of the frame survey. Fishers, owners of beach seines and persons involved in processing and marketing of fish caught by beach seines, as well as carpenters and mechanics involved in manufacturing or repair of fishing craft and gear, were randomly selected and interviewed with special questionnaires for each category. The interviews were conducted in the presence of an informal group of two to five persons. This provided an opportunity to clarify and compare the individual responses with other views.

The socio-economic survey took place mainly on the beach, at fish landing sites, or at the workplace in the case of fish smokers, dryers, carpenters and mechanics. In addition to answering the questions of the survey team, the respondents were invited to raise their own questions and views on the topics. The coverage of the field survey differed between the three countries.

In Benin, 10 fishing villages located in the Atlantic and Mono Departments were surveyed. In all, the Atlantic Department had 41 fishing communities and Mono had 17 fishing communities. In Ghana, one fishing community in each of the four coastal regions, i.e. Volta, Greater Accra, Central Region and Western Region, was surveyed, and in Togo, 10 out of the 13 fishing villages were surveyed.