

# Bycatch in small-scale tuna fisheries

A global study



***Cover photograph:***

A small-scale tuna vessel in Malta. This type of boat participates in a fishery that catches about 300 to 400 tonnes of fish annually using seine gear. The catch is mainly dolphinfish, with 10 percent other species, including juvenile bluefin tuna; photo courtesy of M. Camilleri.

# Bycatch in small-scale tuna fisheries

A global study

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by

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# Preparation of this document

Worldwide, a significant amount of work is being undertaken to quantify, understand and reduce bycatch. As part of the Food and Agriculture Organization of the United Nations (FAO) work programme related to bycatch, three studies of tuna fisheries bycatch have been commissioned: investigations covering the purse seine, longline and small-scale fisheries. This document presents the results of the work on small-scale tuna fishery bycatch and the associated issues. The study was commissioned in late 2009. The collection of information occurred in February and March, with analysis and writing in April 2010.

# Abstract

The aim of the study was to quantify catches of tuna and bycatch in small-scale pelagic fisheries. Additional goals were to identify on a global scale information gaps, major issues and management concerns associated with these fisheries and their bycatch.

The study made estimates of tuna and non-tuna catches in the small-scale fisheries of 181 ocean areas. The total amount of tuna produced by these fisheries was around 681 000 tonnes per year in the mid-2000s. About 753 000 tonnes of non-tuna was produced by those same fisheries.

The major priorities for improving our understanding of bycatch in small-scale pelagic fisheries are improved coverage of bycatch by the tuna regional fisheries management organizations (RFMOs) that collect such information, increased involvement of the other tuna RFMOs in small-scale pelagic fisheries, verification of the high reported catches from small-scale pelagic fisheries in Indonesia, and greater technical details on the small-scale pelagic fisheries that take sensitive species.

**Gillett, R.**

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# Abbreviations and acronyms

CARICOM	Caribbean Community
CRFM	Caribbean Regional Fisheries Mechanism
DFO	Department of Fisheries and Oceans
EEZ	exclusive economic zone
FAD	fish aggregating device
FAO	Food and Agriculture Organization of the United Nations
GFCM	General Fisheries Commission for the Mediterranean
GRT	gross registered tonnage
GT	gross tonnes
hp	horsepower
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
IMARPE	Instituto del Mar del Perú
IOTC	Indian Ocean Tuna Commission
MCS	monitoring, control and surveillance
NMFS	United States National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRIFSF	National Research Institute of Far Seas Fisheries
RFMO	regional fisheries management organization
SPC	Secretariat of the Pacific Community, formerly South Pacific Commission
Univ. of WI	University of the West Indies
WCPFC	Western and Central Pacific Fisheries Commission
WPRFM	Western Pacific Regional Fishery Management Council
WWF	World Wide Fund for Nature

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# Executive summary

Three studies of tuna fishery bycatch have been commissioned by FAO: investigations covering the purse seine, longline and small-scale fisheries. This document presents the results of the work on the small-scale tuna fishery bycatch and the associated issues. It is intended to summarize on a national level catch information of small-scale tuna fisheries and those small-scale fisheries that catch tuna. The document also aims to identify on a global scale data gaps, major issues and management concerns associated with these fisheries and their bycatch

## Bycatch

Bycatch from purse seining and longlining has been the subject of a considerable amount of research. Small-scale tuna fishing and the associated bycatch have received relatively little attention, and no work has been carried out to obtain a global overview. In addition, several recent studies link small-scale fisheries to bycatch of threatened species.

The various uses of the term “bycatch” cause considerable confusion, especially for a global study that encompasses several areas that use the term differently. Many fisheries specialists in the various regions of the world believe that their definitions of bycatch are universal (or at least should be).

The concept of bycatch may have limited relevance to small-scale fisheries in developing countries, where almost everything in the catch has economic value and can become a target.

This document attempts to avoid using the term “bycatch” when estimating national catches. It is replaced by the term “non-tuna species”. When “bycatch” is used, it is synonymous with “non-target species”, regardless of whether retained or discarded.

## Small-scale fisheries

In this document, “small-scale fisheries” is defined as “those fisheries that use vessels that are open or partially undecked, or vessels that use outboard engines or sails, or vessels that fish with handlines, rod-and-reel gear, harpoons or similar non-industrial gear”.

## Catch estimates

The study made estimates of tuna and non-tuna catches in the small-scale fisheries of 181 country ocean areas. The total amount of tuna produced by these fisheries was about 681 000 tonnes per year in the mid-2000s. About 753 000 tonnes of non-tuna was produced by those same fisheries.

### **Important production areas**

The East and Southeast Asia region produces about 72 percent of the world's tuna catches by small-scale fishing. The Indian Ocean produces about 21 percent. Comparisons between the non-tuna catches of the various regions are not very meaningful – much of the non-tuna catch is made by fisheries in which tuna is a minor component – and should not be construed to be the bycatch of the small-scale tuna fisheries of a region.

Indonesia's small-scale pelagic fisheries appear to produce about 390 000 tonnes of tuna and 519 000 tonnes of non-tuna. These estimates rely heavily on a recent World Wide Fund for Nature (WWF) report. Because this indicates that Indonesia is responsible for over half of the tuna caught by small-scale pelagic fishing in the world, efforts should be made to confirm the validity of that study.

Although some fisheries specialists contend that there are no small-scale fisheries that target tuna (i.e. there are only small-scale fisheries that take tuna as part of a catch), the study identified 15 small-scale fisheries that target tuna. These fisheries catch more than half of all tuna taken by small-scale fisheries.

### **Discarding**

Discarding in small-scale pelagic fisheries appears to be so low that it should not be considered a major problem or a priority for receiving management attention.

### **Bycatch reduction**

Most small-scale fisheries that catch tuna are true multispecies fisheries in which there are no discards and perhaps no sensitive species in the composition of the catch. In these situations, the general thrust of reducing/eliminating bycatch may not be appropriate. What is required in many small-scale pelagic fisheries is attention to any components of the catch that are over-exploited, threatened, or protected.

### **Sensitive species**

One of the most important issues in the bycatch of small-scale pelagic fishing is the capture of sensitive species, especially sea turtles and marine mammals. The targeted tuna fisheries are generally not problematic; most difficulties appear to occur with small-scale gillnets, a type of gear that rarely targets tuna, but that takes relatively large amounts of turtles and mammals.

There are a number of technical measures to decrease turtle bycatch in small-scale longline and gillnet fisheries. An important principle is that the development, design and implementation of turtle bycatch reduction measures should take into account the socio-economic aspects of fishers and fishing communities.

Information on techniques for reducing the incidental catch of marine mammals in small-scale pelagic fisheries is not as common as that for turtles. Much of

the current work consists of developing appropriate strategies, such as better documenting the extent of the threat, capacity building for national fishery officers and generating national political will to take action.

### **Priorities for improving information**

The major priorities for improving understanding of bycatch in small-scale pelagic fisheries are improved coverage of bycatch by the regional fisheries management organizations (RFMOs) that collect such information, increased involvement of the other tuna RFMOs in small-scale fisheries, additional information on the catch from small-scale pelagic fisheries in Indonesia, and greater technical details on the small-scale pelagic fisheries that are likely to be taking substantial quantities of sensitive species.



# 1. Introduction

## 1.1 BACKGROUND

Global awareness of bycatch in fisheries is increasing. *The State of World Fisheries and Aquaculture 2008* (FAO, 2009a) indicates that over the past few decades, a public consensus has developed on the view that bycatch can have significant consequences for populations, food webs and ecosystems. Worldwide, a significant amount of work is being undertaken to quantify, understand and reduce bycatch.

As part of FAO's work programme related to bycatch, three studies of tuna fisheries bycatch have been commissioned: investigations covering the purse seine, longline and small-scale fisheries. This document presents the results of the work on small-scale tuna fishery bycatch and the associated issues.

## 1.2 WHY STUDY THE BYCATCH OF SMALL-SCALE TUNA FISHERIES?

Several recent studies have highlighted the need to learn more about bycatch in small-scale fisheries in general. Two reports are especially helpful in explaining the rationale for this research:

- Small-scale fisheries occur primarily in developing nations, and their documentation and management are limited or non-existent. Although bycatch of industrial-scale fisheries can cause declines in migratory megafauna, including seabirds, marine mammals and sea turtles, the impacts of small-scale fisheries have been largely overlooked. Small-scale fisheries occur in coastal waters worldwide, employing over 99 percent of the world's 51 million fishers. Future research is urgently needed to quantify small-scale fisheries bycatch worldwide (Peckham *et al.*, 2007).
- Large-scale industrial fisheries have received the lion's share of bycatch attention, with research focusing on trawls, longlines and high-seas gillnets. These fisheries are more amenable to research due to the limited number of vessels involved (relative to artisanal and small-scale fisheries). Moreover, a few cases have been highly publicized (e.g. dolphins in the tuna purse seine fisheries, sea turtles in shrimp trawls, albatrosses in longlines). Nevertheless, several recent studies link artisanal fisheries to bycatch of threatened species. The reports of those studies suggest a bycatch of such a magnitude that mitigation efforts cannot overlook the effects of small-scale fisheries (Soykan *et al.*, 2008).

In the tuna fisheries, bycatch from purse seining and longlining has been the subject of a considerable amount of research. Small-scale tuna fishing and the associated bycatch have received relatively little attention and no work has been carried out to obtain a global overview.

Another reason for studying the bycatch of small-scale tuna fisheries emerged during the study. Several fishery specialists interviewed felt that the bycatch from very small-scale tuna fisheries had special significance. They contend that, unlike longline and purse seine fisheries, management interventions to alter or reduce the bycatch from these tiny fisheries are difficult or not possible, so it is important to know the amount of tuna and bycatch in these “semi-unmanageable” fisheries. This concept will be revisited in Section 9.1.

This document is intended to summarize on a national level catch information of small-scale tuna fisheries and those small-scale fisheries that catch tuna. It also aims to identify on a global scale data gaps, major issues, and management concerns associated with these fisheries and their bycatch.

### **1.3 THE STUDY**

This study was commissioned in late 2009. The collection of information occurred in February and March, with analysis and writing in April 2010.

It is important to note the limited nature of this study: the budget allowed for 18 days of travel and 18 days for analysis and writing the document. As such, it was only possible to consult with regional agencies and with fishery specialists with regional perspectives. There was only limited contact with national-level specialists, mainly in those countries where small-scale tuna fishing is especially important and where information is scarce. The information used for the national catch estimates was largely limited to RFMO data and the readily available literature (i.e. that provided by regional agencies and specialists or that was available on the Internet).

### **1.4 SOME DEFINITIONS AND CONVENTIONS USED IN THIS DOCUMENT**

#### **1.4.1 Bycatch**

The various uses of the term “bycatch” cause considerable confusion, especially for a global study that encompasses several areas that use the term differently. Many reports on bycatch appropriately begin with a precise definition of bycatch.

In addition to the term “bycatch” having several meanings, there is the additional difficulty of applying the concept of bycatch to small-scale fisheries. “Bycatch” and “target” can be relatively clear in large-scale fisheries of developed countries – where there is an objective of capturing certain high-value fish – but these concepts become increasingly irrelevant in the progression to small-scale fisheries in developing countries, where almost everything in the catch has economic value and can become a target.

Many of the small-scale fisheries that capture tuna are truly multispecies – with the “target” being almost any type of fish. Alternatively, for some of the other fisheries covered in this document, there are specific targets, but they are not tuna (i.e. tuna could be considered a bycatch).



For these reasons, the present study attempts to avoid using the term “bycatch” when estimating national catches. It is replaced by the term “non-tuna species”. When “bycatch” is used, it is synonymous with “non-target species”, regardless of whether retained or discarded. It is recognized that “non-tuna species” and “non-target species” may sometimes be inexact, as in some countries undersized fish and shark-damaged fish of the target species are considered bycatch.

#### 1.4.2 Small-scale

“Small-scale” is another term that causes considerable difficulty for a global study. There are a large number of schemes used to delineate the lower end of the fishing spectrum (“small-scale”, “artisanal”, or other terms). According to Gillett (2005), these include:

- Tonnage of vessel used in fishing – “municipal fisheries” in the Philippines are defined as those operations that use fishing vessels of three gross tonnes or less.
- Distance offshore – Taiwan Province of China small-scale/artisanal fisheries refer to the production obtained without any fishing boat or using non-powered fishing boats within three nautical miles of the coast.
- Size of vessel – in the former Netherlands Antilles, artisanal fishing is that which is carried out on vessels of less than 7 metres. In Chile, artisanal swordfish fishing is that which is carried out on vessels of less than 28 metres.
- Carrying capacity – in Iran (Islamic Republic of), artisanal fishing is that which is carried out on fishing craft that carry between 1 and 100 tonnes of fish.
- Water depth – in Suriname, fishing operations in depths less than ten metres are considered artisanal.
- Horsepower – artisanal fishing in Guinea-Bissau is that which is carried out on fishing craft up to 60 hp.
- Gear – small-scale fisheries in Thailand are those that use gillnet fisheries (except Spanish mackerel and mackerel encircling nets), plus cast net and scoop fisheries and collecting shellfish.
- Combination of features – in China, Hong Kong Special Administrative Region (Hong Kong SAR), artisanal production is that from vessels less than 40 feet (equivalent to 12.2 metres) fishing along coastal waters 15–25 fathoms deep (equivalent to 27.4–45.7 m).
- Other schemes for partitioning the small-scale/artisanal sector involve how the catch is disposed of, length of voyages, labour intensity, and the degree of mechanization of fishing gear or catch storage.

An appropriate definition of “small-scale” for the present study should result in identifying and separating out fisheries in such a way so that there is substantial management significance. Following this logic, there is great difficulty in managing

many of the very small-scale fisheries that catch tuna, and it is important to know the amounts of tuna and non-tuna those fisheries take. Accordingly, this study uses the following definition to describe these small fisheries:

“Small-scale” refers to those fisheries that use vessels that are open or partially undecked, or vessels that use outboard engines or sails, or vessels that fish with handlines, rod-and-reel gear, harpoons or similar non-industrial gear.

In many of the documents used in estimating the national catches of tuna, it was not possible to determine if the gear used was small-scale. For those cases:

- unless there is reason to believe the contrary, pelagic gillnets are not considered small-scale; and
- unless there is reason to believe the contrary, “hand”, handline and troll are considered small-scale.

Fixed tuna traps – because of their large physical size – are not considered to be small-scale. This is consistent with Di Natale *et al.* (2006) who state that the use of this type of gear was the first industrial fishery in the Mediterranean.

### 1.4.3 Other terms

Unless otherwise stated, “tuna” is defined as being the principal market species of tuna: skipjack, yellowfin, bigeye, albacore, Atlantic bluefin, Pacific bluefin and southern bluefin.

*Coryphaena hippurus* is the common dolphinfish, but it is also known in English as mahi-mahi and dorado. In this document, it is mainly referred to as simply dolphinfish, but in the national/regional sections the name customarily used in that area is used here (e.g. “dorado” off Central America).

There are small-scale tuna fisheries (i.e. tuna is the sole or primary target) and there are small-scale fisheries in which tuna are caught (i.e. as a minor component of the catch). Having made this distinction, for simplicity, the latter is often referred to as “small-scale pelagic fisheries” in this document; however, it is acknowledged that sometimes tuna are caught inshore of the true pelagic environment.

“Sport fishing” here is intended to cover several types of activities, including personal recreation, commercial sport fishing (mainly for tourists), and sport/competition fishing. All of these are taken to be “small-scale”. Not included in the document’s usage of “sport fishing” (and not considered “small-scale”) are the long-range charter boats, such as the vessels that take fishers from south California, United States of America, into tropical Mexico.

## 2. Regional findings

Appendixes 1 to 9 give the estimates of tuna and non-tuna catches by small-scale pelagic fisheries in 181 “country ocean areas”. Costa Rica, for example, would be covered by two ocean areas, the Pacific coast and the Caribbean coast. These areas are grouped into nine regions:

1. Eastern Pacific
2. Caribbean
3. Non-Caribbean areas of the Western Atlantic
4. West Africa
5. Northeast Atlantic
6. Mediterranean
7. Indian Ocean
8. East and Southeast Asia
9. Oceania

The following sections discuss the major features of each region with respect to several topics: total tuna and non-tuna landings by small-scale fisheries; any small-scale fisheries actually targeting tuna; the quality of data available; any regional fishing patterns to emerge; the major components of the non-tuna catch; any “hot bycatch issues” associated with small-scale pelagic fisheries; and concerns related to the bycatch of species of special interest, such as turtles and marine mammals.

### 2.1 EASTERN PACIFIC

Appendix 1 gives the readily available information on small-scale tuna fishing in the Eastern Pacific.

The appendix shows that in the entire Eastern Pacific region small-scale fishing in recent years has produced somewhere around 9 000 tonnes of tuna. About 30 000 tonnes of non-tuna species are caught annually by the small-scale fisheries that catch tuna.

In the small-scale fishing activity in which tuna are caught, one of the major features of this region is that there are actually only a few small-scale fisheries that could be considered directed tuna fisheries – that of Ecuador and, to a lesser extent, that of Peru. Most of the other small-scale fishing that catches tuna is either directed at dorado or is a multispecies fishery – in both of these cases tuna is a minor component of the catch.

In terms of gear, only directed small-scale tuna fisheries use longlines. Gillnets and handlining are generally multispecies fisheries in which small amounts of tuna are caught. Trolling appears most important in sport fishing.

Data on small-scale fisheries that catch tuna in the Latin American countries are generally poor, but there are a few exceptions (for example, Ecuador and Peru). Many countries lack a statistical system covering pelagic artisanal fisheries. Consequently, the tuna and non-tuna catch information in Appendix 1 is mainly derived from educated guesses by individuals familiar with the national fishery situations.

There are some distinct subregional fishing patterns:

- In the south of the region, small-scale longlining for tuna is important in Ecuador and Peru, but the readily available summary information (Appendix 1) lumps the tuna/billfish/shark fishery with the dorado fishery, so the tuna-directed nature of the former is less evident.
- In Central America, several types of small-scale fisheries catch tuna: gillnetting, longlining and handlining. There appears to be little targeting of tuna. Tuna seems to be a relatively minor portion of the catch by these three fishing methods.
- From central Mexico northward almost all small-scale catches of tuna are by recreational fishing. This is mainly by commercial sport-fishing boats in Mexico close to resorts and by private vessels in California, United States, and, to a lesser extent, in the states of Oregon and Washington.

Appendix 1 shows that the composition of the non-tuna portion of the catch has considerable variation between countries. Most of the non-tuna catch is dorado and various species of sharks. These species are often targeted and are not generally considered by the fishers to be “bycatch”. The available information suggests that discarding (except for rays) rarely occurs.

By far, the most important bycatch issue associated with the small-scale tuna fisheries of the region and other small-scale fisheries that catch tuna concerns turtles. Longlining targeting dorado appears to catch a substantial number of turtles and, although this fishing does not target tuna, the concerned vessels often switch seasonally to target tuna. Few data are readily available from government fishery agencies on the bycatch of turtles, but the non-governmental organization (NGO) environment literature has much information on this topic.

The region appears to have a few management measures related to reducing bycatch in these small-scale fisheries. Mexico attempts to reduce dorado capture by commercial fishing in order to increase the abundance of this fish for sport fishing. Some countries promote the use of “circle hooks” in longlining to reduce the capture of turtles (M. Hall, Inter-American Tropical Tuna Commission [IATTC], personal communication, March 2010).

## **2.2 CARIBBEAN**

Appendix 2 gives the readily available information on small-scale tuna fishing in the Caribbean. The information shows that small-scale fishing in the region has produced around 3 500 tonnes of tuna annually in recent years. About 8 500 tonnes of non-tuna species are caught per annum by the various fisheries that catch tuna.

In the small-scale fishing activity in which tuna are caught, one of the major features of this region is that only one country, Grenada, has a significant small-scale fishery that targets tuna. Several factors could contribute to the successful development of small-scale longlining in Grenada, including substantial technical assistance from Cuba and its having deep water close to shore. In the other countries, tuna is not the major component of the catch of any of the small-scale fisheries. In many cases tuna is not the most valuable component of the catch, but rather it is a species such as dolphinfish.

In terms of gear, there is substantial small-scale tuna longlining in Grenada, with much lesser amounts of such longline activity in a few other countries. In most other parts of the Caribbean region there is small-scale trolling (increasingly around fish aggregating devices [FADs]), with tuna not a dominant component of the catch, or in gillnet fisheries (especially off the Central and South American coasts), with tuna a very minor component of the catch. Commercial sport fishing (mostly with rod-and-reel gear) is significant where there is a large tourism industry, but the catch is dominated by marlins and dolphinfish and tuna is not often a dominant component of the catch.

Data on small-scale fisheries that catch tuna are poor in most places. Many of the countries of the region furnish data on pelagic fishing to the International Commission for the Conservation of Atlantic Tunas (ICCAT), but collecting/reporting the data is not perceived as a priority by many countries, especially the smaller ones. A problem for the study is that ICCAT data do not cover some of the important species for small-scale pelagic fishing, such as dolphinfish and rainbow runner. The non-tuna catch of small-scale pelagic fishing is therefore underrepresented in ICCAT data and in the country estimates of the present study for which the only data that are readily available are from the ICCAT. In addition, in many cases it is not possible to identify in ICCAT data that portion of the catch from small-scale fishing activities. On the other hand, there are several individuals who are familiar with fisheries across the Caribbean region and who are able to provide information that can complement, clarify or correct the ICCAT data on the catch of tuna by small-scale fisheries.

There are some distinct subregional small-scale fishing patterns. In general, where there is deep water just off the coast (i.e. pelagic fishing accessible to small boats), the catch of tuna by small-scale fisheries is greatest. An example of this is Grenada. Where governments support active FAD programmes, the catches of tuna by small-scale fisheries are also large. An example of this is Martinique. Conversely, where there is a large influence of river systems or where there is a maze of offshore reefs, the catch of tuna is relatively small. These river/reef conditions often occur on the Central and South American coasts.

Appendix 2 shows that the composition of the non-tuna portion of the catch has considerable variation between countries. This is reflected in the common fishing techniques of the various countries:

- Dolphinfish, wahoo, blackfin and *Scomberomorus* are the main non-tuna species where there is trolling, especially in the small islands of the eastern Caribbean.
- *Scomberomorus* are especially common where there is gillnetting, especially on the Central and South American coasts.
- Marlins are an especially important component where there is sport fishing.

There do not appear to be many “hot bycatch issues” in the small-scale fisheries of the Caribbean that catch tuna. In general, the government fishery officers of the region and the general public do not pay much attention to bycatch and associated issues of small-scale pelagic fishing. This could be due to the fact that in many of these fisheries, there is no clear distinction between target species and bycatch. Also, there is very little, if any, discarding of anything that is caught. With the exception of turtles, there is the perception that the major components of the catch of small-scale pelagic fisheries are not threatened species.

Concerning turtle bycatch, trolling (the most important small-scale technique in the region for capturing tuna) rarely catches turtles. Although gillnetting often catches turtles, it is a technique that does not produce much tuna. Small-scale longlining does catch turtles, but this technique is not widespread in the Caribbean. It should also be noted that in some countries of the region, the capture of turtle is legal. With respect to shark, most fishery officers do not appear to be familiar with the conservation concerns. According to regional fishery specialists, almost all of the attention to sharks comes from international NGOs and other outside agencies.

### 2.3 NON-CARIBBEAN AREAS OF THE WESTERN ATLANTIC

Appendix 3 shows that in the non-Caribbean parts of the Western Atlantic, small-scale fishing in recent years has produced around 5 500 tonnes of tuna. About 10 000 tonnes of non-tuna species are caught annually by the small-scale fisheries that catch tuna.

These estimates are very dependent on ICCAT data. Presumably, the data furnished by Canada and the United States to the ICCAT are of high quality, but there is a problem for the present study with the non-tuna catch. As for the Caribbean (Section 2.2), the ICCAT data do not cover all of the important species for small-scale pelagic fishing. The non-tuna catch of small-scale pelagic fishing is therefore underrepresented in ICCAT data in terms of both number of species and in tonnage.

In Canada and the United States of America, the catch of tuna by small-scale fishing is dominated by sport fishing. On the east coast of Canada, in the three-year period 2006–08 about 85 percent of tuna taken by small-scale fishing was by sport fishing. For the east coast and the gulf coast in the United States, the figures are 80 percent and 90 percent, respectively. On the other hand, in Brazil, the capture of tuna by sport fishing is relatively unimportant.

In Canada and in the United States, management attention to bycatch in tuna fisheries is focused on the large-scale fisheries. Resource concerns associated with small-scale fisheries that catch tuna appear to be oriented to the condition of the bluefin tuna resource. Bycatch is an issue in sport fishing for tuna, but it mainly involves how the bycatch of commercial longlining affects sport fishing. For example, blue marlin, white marlin and sailfish are landed by United States recreational rod-and-reel fishers but are a discard of the United States commercial tuna and swordfish longline fisheries (Department of Commerce, 2009). One of the reasons that bycatch in small-scale tuna fishing is not a large issue may be related to the perceived selectivity of sport fishing gear.

As the United States east coast small-scale fisheries that catch tuna are largely sport fishing, it is not surprising that the non-tuna catch of those fisheries is dominated by a fish that is also a target of sport fishing, *Scomberomorus*. On the east coast of Canada, the non-tuna catch of small-scale fisheries that catch tuna is dominated by swordfish. In Brazil, the major non-tuna component of these fisheries are species of tuna other than the seven principal market species of tuna (e.g. *Auxis*, *Euthynnus*). This information on non-tuna catches is subject to the caveat mentioned above – it does not include species that are not covered by the ICCAT.

A study of hook-and-line commercial fisheries in southeastern Brazil (Bugoni *et al.*, 2008) shows a significant amount of seabirds and turtles captured by fishing activity that is apparently small-scale (although vessel details are not given in the document). Capture rates were higher for the surface longline for dolphinfish (0.15 birds/1 000 hooks and 1.08 turtles/1 000 hooks); slow trolling for bigeye tuna (0.41 birds/day); and handlining targeting yellowfin tuna (0.61 birds/day). In the present study, this is one of the few mentions encountered in the literature of the capture of seabirds by small-scale tuna gear – but it should be noted that the area in which this Brazilian fishery operates extends to 35 degrees south latitude.

## 2.4 WEST AFRICA

Appendix 4 gives the readily available information on small-scale tuna fishing in West Africa.

The appendix shows that small-scale fishing in the region has produced around 8 500 tonnes of tuna annually in recent years. About 16 000 tonnes of non-tuna species are caught per annum by the various fisheries that catch tuna.

A few comments should be made about the quality of the catch estimates:

- While the information on small-scale tuna fishing in some countries of the region is good, in a few countries where such fishing may be significant there was a complete lack of readily available data for the present study. Gabon and Ghana are included in this category. Corrections to the catch information given in Appendix 4 for the situation in countries such as Ghana/Gabon could substantially alter the regional summary.

- As with the Western Atlantic region, the major source of information – ICCAT data – does not cover all of the important species for small-scale pelagic fishing. The non-tuna catch of small-scale pelagic fishing is therefore under-represented in ICCAT data and in this document. Unlike the Western Atlantic, there are not many readily available sources of information to complement the ICCAT catch data. Several fisheries specialists with broad experience in West Africa were contacted, but their knowledge is largely restricted to the industrial tuna fisheries of the region.

Although there is some logic in summing up the small-scale catches of tuna across the region to obtain a total for West Africa, there is less justification for doing so with the non-tuna catch. In reality, most of the non-tuna catch is made by fisheries in which tuna is a minor component – and should not be construed to be the bycatch of the small-scale tuna fisheries of the region.

Bearing in mind the above information limitations, some regional patterns emerge:

- There are only a few small-scale fisheries of the region that could be considered as targeting tuna. These include the Cape Verde handlining, the Morocco handline fishery and the South Africa commercial rod-and-reel fishery.
- In other countries, two general situations are dominant: (i) countries that have substantial offshore small-scale fishing (mostly troll, handline, gillnet) but where catches of tuna are relatively minor (e.g. Senegal); and (ii) countries in which most small-scale fishing targets nearshore species (e.g. Nigeria).
- Sport fishing is of growing importance in several countries (Cape Verde, the Gambia, Senegal, South Africa), but there is little information available on the magnitude of the tuna catch.
- Unlike many other regions of the world, there is no major small-scale longline fishery that targets tuna.
- Kebe *et al.* (2006) examine the situation in eight West African countries (Angola, Cape Verde, Côte d'Ivoire, Gabon, Guinea, Equatorial Guinea, Sao Tome and Principe, and Senegal) and point out a feature they believe is notable: “the quasi absence of artisanal fisheries directed at small tuna and billfish”.

The major non-tuna catch of what could be considered as the three small-scale fisheries in the region targeting tuna (i.e. those in Cape Verde, Morocco and South Africa) show great differences between the countries: mostly wahoo in Cape Verde, mostly *Sarda* in Morocco, and almost no non-tuna catch by the small-scale tuna fishery in South Africa. Responsible factors for the observed intercountry differences could include the presence of a continental shelf (Cape Verde vs Morocco) or gear type used (Côte d'Ivoire vs South Africa). Compared with other regions of the world, dolphinfish does not seem very significant in the small-scale pelagic fisheries of West Africa. As almost all information readily available on the non-tuna catches of small-scale tuna fisheries of West Africa comes from the



ICCAT, the limitations of the ICCAT data (i.e. not all species that are commonly captured are covered by ICCAT data) should be acknowledged. This may distort the real situation.

There is a notable absence of mention in the literature of any discarding associated with small-scale tuna fishing in the region. Similarly, there appear to be few documented “hot bycatch issues” dealing with the small-scale fisheries that catch tuna. The only possible exception is the effects of other types of fishing – there is concern that bycatch in some industrial fisheries may reduce the overall catch in some of the small-scale fisheries that catch tuna.

The capture of sea turtles is reported from a few countries of the region. With regard to small-scale fishing, this appears to be mostly in fisheries in which tuna are a relatively minor component of the catch, rather than by the small-scale fisheries that target tuna.

## 2.5 NORTHEAST ATLANTIC

Appendix 5 gives the readily available information on small-scale tuna fishing in the Northeast Atlantic.

The appendix shows that small-scale fishing in the region produces very little tuna (about 300 tonnes per year). There is very little information available on non-tuna catches of those fisheries, but it is likely to be close to zero. The reality is the readily available information on small-scale tuna fishing in the Northeast Atlantic is largely limited to the ICCAT database – and there is great difficulty in using that data to identify catches made by small-scale fishing. Information on the non-tuna catches of those fisheries is even more scarce and more assumptions need to be made in any analysis. Furthermore, assuming that handlining and trolling (and no other techniques) are indeed small-scale could be an erroneous assumption.

The information in the table in Appendix 5 shows that not much non-tuna was taken by small-scale fisheries that capture tuna. This could be an artefact of the data collection/categorization, or it could mean that handlining and trolling for tuna in the Northeast Atlantic are generally quite selective.

Given the above limitations, it is difficult to draw many conclusions on the non-tuna catch of small-scale tuna fisheries of the Northeast Atlantic region. It can be stated that there is not much tuna being landed by these fisheries. What attention there is on bycatch in tuna fisheries of the region seems to be focused on the larger-scale tuna fisheries (i.e. longlining). No documentation of relevance to the non-tuna catch of small-scale tuna fisheries could be located during this study.

## 2.6 MEDITERRANEAN

Appendix 6 gives the readily available information on small-scale tuna fishing in the Mediterranean.

The appendix shows that small-scale fishing in the region produces only a small amount of tuna each year: a total of about 300 tonnes is given in the table.

The table in Appendix 6 also indicates that about 500 tonnes of non-tuna species are caught per annum by the various fisheries that catch tuna.

A few comments should be made about the quality of the catch estimates:

- The very small catch of tuna by small-scale gear is likely to be an artefact of incomplete reporting by some countries to the ICCAT. There are reports of significant catches of tuna by small-scale gear in some countries (e.g. handlining in Spain), but this is not apparent in the ICCAT catch data.
- For a few of the Mediterranean countries, the ICCAT catch data appear to show either great variability or inconsistency of reporting catches by small-scale fishing. Algeria, France and Italy seem to be in this category.
- As indicated earlier in this document for West Africa and the Western Atlantic regions, the only major source of non-tuna catch information, ICCAT data, does not cover all of the important species for small-scale pelagic fishing. The non-tuna catch of small-scale pelagic fishing is therefore underrepresented in ICCAT data and in this document.
- There is the view that in the Mediterranean region, when dealing with species that are subject to catch quotas (e.g. bluefin), reports to the ICCAT tend to underestimate landings as the quotas are approached (A. Srour, FAO, personal communication, March 2010).

The situation of Malta reinforces the above sentiments concerning data quality. Over half of the non-tuna catch listed for the 18 countries given in Appendix 6 comes from this small country where there is a small fishery with apparently good data.

Bearing in mind the above information limitations, some regional patterns emerge:

- Small-scale fisheries specifically targeting tuna only exist in a few Mediterranean countries (e.g. Algeria, Morocco). Other such fisheries could exist but for various reasons (see Box 1) are not apparent in a rapid review of the fisheries literature of the region.
- The catch of tuna by sport fishing is significant. Such fishing shows up, in either the ICCAT data or in a regional study of sport fishing (Gaudin and De Young, 2007), in more than one-third of the countries covered. Some of the sport fishing appears to target bluefin.

The catch of tuna by small-scale fishing in the Mediterranean as per Appendix 6 is very small compared with catches of small tunas by such fishing – as given in a regional study on small tunas in the Mediterranean (Di Natale *et al.*, 2009). Because the results of that study could mirror the true situation for the catch of the larger species of tuna (the subject of this document), the main results of that study are given in Box 1.

Little of the non-tuna catch of the small-scale fisheries that catch tuna (about 500 tonnes according to Appendix 6) is produced by fisheries that target tuna. Most of the 500 tonnes is caught by fisheries that catch small amounts of tuna. In the ICCAT data, much of the non-tuna catch is made up of small tunas and swordfish.

## BOX 1

**Summary of the regional study on small tunas in the Mediterranean**

The study reverses the widespread perception that these fishing activities were almost irrelevant, either in terms of catches or revenues. Indeed, it was commonly believed that these fisheries were mostly subsistence activities. On the contrary, important production levels can be achieved. The fleet catching small tunas is scarcely defined or not identified in most of the countries studied, but it is generally known that thousands of small- and medium-sized vessels engaged in small-scale, artisanal or recreational fisheries are carrying out activities that also target small tuna species. In addition, catches are also obtained as a bycatch in other fisheries. Many Mediterranean and Black Sea countries are not reporting any catches or, in the case of a few countries, only a small number of landings are declared. Nevertheless, fishery production data related to the small tuna species show a total official reported landing of 83 386 tonnes in 2005. The under-reporting is believed to be significant because landing sites are scattered all along the coastline and the islands – where many thousands of small- and medium-sized vessels operate – and the catches are often directly marketed. Moreover, catches from recreational fisheries in many countries are seldomly reported. Under such circumstances, the total landings could possibly be estimated to be a minimum of about 150 000 tonnes.

*Source:* Di Natale *et al.* (2009).

There is no mention in the readily available fisheries literature of the region of discarding by the small-scale fisheries that catch tuna. Kelleher (2005) indicates discarding by the pelagic gillnet fisheries (which obviously catch tuna), but it is difficult to determine the amount of this fishing (if any) which is small-scale.

In the Mediterranean, most concern over fisheries bycatch appears to be associated with those fisheries that catch sea turtles and/or marine mammals. Ancha (2008) states that more than 60 000 sea turtles and a substantial number of marine mammals are caught annually due to Mediterranean fishing practices.<sup>1</sup> The information in that study suggests that the fishing techniques that are sometimes used to target tuna (from the present study: handlining, sport fishing) do not appear to catch significant numbers of turtles or marine mammals.

The “hot bycatch issue” for small-scale fisheries that catch tuna appears not to be related to the targeted tuna fisheries, but rather to the small-scale fisheries that catch small amounts of tuna and some turtles and mammals – primarily by gillnetting or driftnetting.

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<sup>1</sup> A specialist on small-scale fishery bycatch believes that this amount is too large and may have been obtained by extrapolating data from a fishery with a high turtle catch rate compared with other fisheries (S. Beverly, SPC, personal communication, May 2010).

## 2.7 INDIAN OCEAN

Appendix 7 gives the readily available information on small-scale tuna fishing in the Indian Ocean.

The appendix shows that small-scale fishing in the region has produced nearly 140 000 tonnes of tuna annually in recent years. About 190 000 tonnes of non-tuna species are caught per annum by the various fisheries that catch this tuna. Nine country ocean areas catch more than 5 000 tonnes of tuna by small-scale fishing: the Comoros, India, Indonesia (Indian Ocean portion), Iran (Islamic Republic of), Madagascar, Maldives, Oman, Sri Lanka and Yemen. By contrast, in none of the countries in the Central/Eastern Pacific, Atlantic or Mediterranean does the catch exceed this amount.

Compared with other regions, identifying “directed tuna fisheries” is more difficult in the Indian Ocean. There are likely to be several factors that are responsible, including a reduced flow of information from several countries and the related difficulty of language. The handline fishery of Maldives could be considered a fishery that specifically targets tuna, but some vessels that participate are much larger than “small-scale”. Longline fishing from skiffs for yellowfin/bigeye in Sri Lanka appears to be very targeted.

Another feature of the region is that several countries have large fisheries that are just slightly larger than what is considered “small-scale” in the present study. If a study were to use a broader definition of “small-scale” (e.g. “artisanal” as used by the Indian Ocean Tuna Commission [IOTC]), those fisheries could easily be considered small-scale. An example of this would be the gillnetters of Pakistan.

In terms of gear, gillnetting and trolling produce most of the tuna caught by small-scale gear. Small-scale longlining appears to be only significant in one country, Sri Lanka. This, however, could be an artifact of IOTC gear nomenclature. According to IOTC staff, the gear type “hand” can include small-scale longlining, whereas “longline” mainly refers to industrial longlining. Sport fishing for tuna appears relatively insignificant in the Indian Ocean.

Data on small-scale fisheries that catch tuna are poor in most places. Many of the estimates in Appendix 7 are educated guesses by outside fishery specialists. Even where good data are reported to the IOTC, partitioning that data into the category of small-scale is often semi-arbitrary. Countries that have large small-scale pelagic fisheries with poor data could easily distort the regional picture. For example, in the Indian Ocean portion of Indonesia, the difference between the estimate of tuna caught by small-scale fishing based on information furnished to the IOTC and an estimate by the World Wide Fund for Nature (WWF) (Ingles *et al.*, 2008) is much greater than the estimate of the present study for the *entire* Indian Ocean.

The present study assumed that, unless there is reason to believe the contrary, gillnets are not considered to be small-scale. The rationale is that pelagic gillnets are often long and bulky and mostly require larger and/or decked vessels. In countries where this assumption is not true, the small-scale catch of tuna would be underestimated.

In the non-tuna catch of the small-scale fisheries that catch tuna, out of necessity, most of the information is from IOTC data. As with the ICCAT in the Atlantic, the IOTC data do not cover all of the important species for small-scale pelagic fishing.<sup>2</sup> The non-tuna catch of small-scale pelagic fishing is therefore under-represented in IOTC data and in this document. Mindful of this data deficiency, some observations on the non-tuna catch can be made:

- *Scomberomorus commerson* (narrow-barred Spanish mackerel) is by far the most important species. In many places (e.g. India, Pakistan) the catch of this species exceeds that of tuna.
- *Euthynnus affinis* (kawakawa) is also quite important across the Indian Ocean region, from Jordan to Indonesia.
- *Thunnus tonggol* (longtail tuna) is a significant component of the catch of small-scale pelagic fisheries on the north and east rim of the Indian Ocean, from Yemen to Australia.
- *Coryphaena hippurus* (common dolphinfish) does not appear very significant in the catch. To some extent, the IOTC reporting system could be a factor – but the species is not prominent in the other sources of information on the small-scale fisheries of the region.

In terms of important bycatch issues in the tuna fisheries of the Indian Ocean, the catch of marine mammals and sea turtles is often mentioned, especially in the gillnet fisheries. In this regard, the gillnet fishery in Sri Lanka often receives attention for capturing large numbers of cetaceans. It should be pointed out, however, that pelagic gillnetting in Sri Lanka (and generally in most of the rest of the region) is of a scale larger than the “small-scale” of the present study.

In this study, no mention of discarding in small-scale pelagic fisheries was encountered in the literature or in discussion with regional fishery specialists.

The general view of small-scale pelagic trolling and handlining, as expressed by a fishery manager with wide experience in the Indian ocean, is that these fisheries are “clean”: there are no discards, all fish caught are eaten, few sharks are taken, and there is no catch of turtles, marine mammals or seabirds (D. Ardill, personal communication, April 2010).

Along with turtles and cetaceans, there is some concern about shark bycatch, mainly in the gillnet fisheries. The degree to which it is an issue in small-scale pelagic fisheries in the Indian Ocean is difficult to ascertain. Although some countries report shark catches to the IOTC, sharks are not among the 16 species specifically covered by the IOTC. Another difficulty in trying to gauge the severity of the impact of gillnets on species of special concern in the Indian Ocean, as well as in other regions, is expressed by Northridge (1991): “For most of the gillnet fisheries of the world, information on catch rates is too poor to make any reasonable estimate of total catches of non-target species”.

<sup>2</sup> The 16 species covered by the ICCAT are: yellowfin tuna, bigeye tuna, skipjack tuna, albacore, southern bluefin tuna, swordfish, black marlin, blue marlin, striped marlin, indo-Pacific sailfish, longtail tuna, kawakawa, frigate tuna, bullet tuna, narrow-barred Spanish mackerel and Indo-Pacific king mackerel.

## 2.8 EAST AND SOUTHEAST ASIA

Appendix 8 gives the readily available information on small-scale tuna fishing in East and Southeast Asia.

The appendix shows that small-scale fishing in the region has produced around 490 000 tonnes of tuna annually in recent years. About the same amount of non-tuna species is caught by the various fisheries that catch this tuna. These estimates should be considered as “educated guesses”.

In the small-scale tuna fishing activity, one of the major features of this region is that Indonesia and, to a lesser extent, the Philippines dominate. Over 98 percent of the tuna catch by small-scale gear in the region is made by these two countries.

The fisheries that actually target tuna (i.e. the pump-boat handline fisheries of Indonesia and the Philippines) are responsible for about one-third of the catch of tuna by small-scale gear in this region. Two-thirds of the catch is made by what could be considered as multispecies fisheries (i.e. without specific targets). Overall, trolling and handlining are responsible for nearly 90 percent of the small-scale tuna catch.

Of the 13 East and Southeast Asian countries examined in this study, nine make no significant catch of tuna by small-scale gear. Factors that are responsible for this include (i) the absence of principal market species of tuna off the coast of some countries due to the adjacent shallow sea (e.g. Cambodia); and (ii) economic conditions, such that more attractive alternative employment exists (e.g. Taiwan Province of China). In developed countries of other regions of the world, there is a substantial amount of sport fishing for tuna. Such fishing appears relatively unimportant in East and Southeast Asia – or at least information on sport fishing for tuna in the region is not readily available, as is the case in North America and Europe.

Data on small-scale fisheries that catch tuna appear to be poor in Indonesia, the country that is responsible for most of this fishing. Gillett (2006) states that Indonesia’s tuna statistics in particular suffer from many problems. Although there have been several attempts to improve national fishery statistics in Indonesia in the last two decades, the basic system remains largely unchanged since its inception. Because it is generally acknowledged that the official Indonesia statistics underestimate tuna catches (especially for eastern Indonesia and for small-scale fishing), the study used the results of a recent WWF study, which was focused on obtaining a detailed overview of the various tuna fishing activities in Indonesia. The catch data of that study should be considered a substantial improvement over the official statistics, but considering Indonesia’s large size and the complexity of the tuna fishing activity, there is probably significant scope for improvement on the WWF estimates. A 10 percent difference in Indonesia’s small-scale tuna catch equates to 37 500 tonnes – a much larger amount than any of the small-scale tuna fisheries in other regions of the world.

Tuna catch data from Viet Nam are non-existent; the estimates used in this study come from a short visit of a tuna specialist. The Philippines catch data, while better than that of Indonesia, still needs considerable improvement, hence the Indonesia and the Philippines (Tuna) Data Collection Project.

The “burning issue” in fishery bycatch in Southeast Asia concerns trawling – which seems to overshadow tuna fishery bycatch issues. In Indonesia and the Philippines, concern about tuna fishery bycatch is mainly focused on the industrial-scale fisheries, with one apparent exception. In the Ingles *et al.* (2008) study an important tuna fishery bycatch issue (which is applicable to small-scale fisheries) is the catch of juvenile tuna (Box 2). For example: “Troll lines catch a substantial amount of juvenile tunas up to 10–50 percent in Padang West Sumatra, 10–20 percent in Sorong, West Papua”. It is difficult to determine if this concern over juvenile tuna is widespread, or if the issue is associated with a single study.

In the non-tuna catch of the small-scale fisheries that catch tuna, some information is available from the WWF Indonesia tuna study (Ingles *et al.*, 2008). These are informal estimates by the study leader of the percentage of non-tuna by gear type (J. Ingles, WWF, personal communication, March 2010). Specialists with broad experience in Indonesian fisheries indicate that they are unaware of other information on the catch composition of small-scale pelagic fisheries (J. Pet and P. Mous, personal communication, March 2010). Good data are available on the major handline fishery in the Philippines.

The tuna handline fisheries of the region catch mainly tuna. The handline fishery in the Philippines catches about 15 percent other species, mainly marlins, sailfish and swordfish. For Indonesia, there is considerable variation between areas; the non-tuna component of handlining ranges from 8 to 45 percent and is mostly billfish and sharks. The pole and line catch, according to the limited WWF sampling, is over 99 percent tuna. Information is not readily available on the composition of the Indonesian troll/net fisheries that catch tuna. The catch by small-scale pelagic trolling in Japan is about 25 percent tuna.

#### BOX 2

### The catch of juvenile tuna in Indonesia

Very often, juvenile tunas of yellowfin and bigeye swim with skipjack schools. This explains why fishing gear such as the purse seine, pole and line, small-scale handline and troll fishing that target the skipjack often have significant bycatch of juvenile yellowfin and bigeye tunas. Why juvenile yellowfin and bigeye tunas often mix with skipjack schools of similar sizes is unclear but is the subject of extensive research. The volume of juvenile bycatch has significantly increased due to the proliferation on the use of fish aggregating devices. Catching tuna before they reach mature sizes contributes to growth overfishing, a situation where fish are caught before they can grow to an optimal size (highest yield per recruit), i.e. where the combination of growth potential and mortalities are taken into consideration. The contamination of catch by juvenile tunas differs between fishing gears. On catch by species, 56.6 percent for skipjack, 70.8 percent for yellowfin and 75 percent for bigeye are immature individuals.

*Source:* Ingles *et al.* (2008).

## 2.9 OCEANIA

Appendix 9 gives the readily available information on small-scale tuna fishing in Oceania.

The appendix shows that small-scale fishing in the region has produced around 24 000 tonnes of tuna annually in recent years. About 8 000 tonnes of non-tuna species are caught by the various fisheries that catch this tuna. As there are few reliable sampling programmes in most of the countries, the estimates in Appendix 9 should be considered as “educated guesses”.

The various small-scale fishing activities that catch tuna can be placed mostly in three categories:

1. Fisheries that target tuna: alia longlining in Samoa, drop-stoning in many locations, bonitier fishing in French Polynesia and ika-shibi fishing in Hawaii, United States.
2. Fisheries that target pelagic fish in general: trolling in Niue, sport fishing in Tonga.
3. Fisheries that are more general in nature, opportunistically trolling, handlining and net fishing: fishing from banana boats in Papua New Guinea and from fibreglass outboard fleets in Fiji and Solomon Islands.

The tuna catches by small-scale fishing in Kiribati are disproportionately large. Over half of the catch in the entire region is made by fishers from this country – even though they make up just 1 percent of the population of the Pacific Island countries. Contributing factors include access to a large tuna resource and scarce alternatives with respect to employment and protein.

An important regional pattern in small-scale tuna fishing is that the small islands, especially those that lack substantial areas with fertile soil and/or that are associated with only small lagoons, have the most small-scale tuna fishing activity. These resource-poor islands are most often found in Micronesia and Polynesia, in the north and east of the region, respectively. Other regional patterns are:

- Small-scale longlining has developed only where there is easy access to a tuna cannery. Despite alia-type longlining being attempted in several countries (e.g. Tonga, the Marshall Islands), it has only been successful close to the major canneries in American Samoa.
- Unlike Asia and the Indian Ocean, there is little gillnetting that would catch pelagic fish.
- Sail-powered small-scale tuna fishing occurs only in the very isolated areas.
- Trolling for tuna is most prevalent near urban areas (with markets that pay high prices) or around FADs (where catch rates are highest).
- Commercial sport fishing is important where there are high concentrations of tourists: Fiji, French Polynesia, Guam, Northern Mariana Islands, Palau and Tonga. Recreational sport fishing is important where local residents are relatively affluent: French Polynesia, Guam and New Caledonia.

Data on small-scale fisheries that catch tuna are poor in most places. A few locations have fisheries statistical systems that cover these fisheries, for example French Polynesia and the United States territories, but in most



other areas the situation for data on small-scale tuna fishing is as described in Box 3. Catch information used in this documents comes from statistical systems (e.g. Guam), specialized surveys (e.g. Niue), information in the 2003 global review of non-industrial tuna (Gillett, 2005), comments from national fishery specialists (e.g. Papua New Guinea), and the author's knowledge of the region. Nevertheless, all estimates should be considered as indicative rather than accurate. Catch composition estimates appear quite good for the Cook Islands, Nauru and Niue – because of the projects undertaken by the Secretariat of the Pacific Community (SPC).

The percentage of tuna in the catch of the various small-scale pelagic fisheries shows considerable variability. These generally reflect the three categories of small-scale pelagic fishing in the region stated above. The percentage of tuna in the catch ranges from above 90 percent (e.g. small-scale longline fisheries, pump boats) to the opportunistic skiff fishing of Melanesia where the non-tuna catch can be several times as much as the tuna catch. In general, small-scale pelagic fishing in the Oceania region has a higher content of tuna than in the other regions.

The major non-tuna species are wahoo, dolphinfish, sharks, billfish, rainbow runner and barracuda. The species content of the non-tuna catch is similar to other regions, with a few exceptions. *Scomberomorus* is common in the catches of small-scale fisheries in most areas of the world, but in Oceania this genus is found only in Australia and in Melanesia, not in Micronesia or Polynesia. In addition, neritic tunas (e.g. *Euthynnus*) are less common in this region because of the lack of shelf areas off the coasts of most islands.

The SPC has done some comparative work dealing with the species composition of three types of small-scale tuna fishing in two countries over a period of several years. The results are given in Table 1. It can be seen that: (i) the tuna component of the catch of trolling near FADs and in mid-water FAD fishing is high; and (ii) the tuna component of the catch of trolling in open water is low. Overall, the tuna component of the catch was quite different between the two locations, even though they are located at a similar latitude and not very far apart.

### BOX 3

#### Fisheries statistics in the Pacific Islands

For coastal fisheries, the quality of fisheries statistics furnished to FAO by national governments is generally not very good. In fact, the estimation of the production from coastal fisheries by government fishery officers in about half of the Pacific Island countries is largely guesswork. Typically, government fisheries agencies give low priority to estimating the amount of coastal catches. In general, the smaller the scale of the fishing, the less is known about the production levels, with quantitative information being especially scarce for the subsistence fisheries in most countries.

Source: Gillett *et al.* (2010b).

TABLE 1  
Tuna catch composition

	Niue catch			Rarotonga (Cook Islands) catch		
	Tuna (kg)	Non-tuna (kg)	% tuna	Tuna (kg)	Non-tuna (kg)	% tuna
Trolling near FADs	15 057	9 438	61.5	30 239	3 882	88.6
Open water trolling	4 572	21 152	17.8	6 507	9 102	41.7
Mid-water FAD fishing	2 124	849	71.4	3 859	1 208	76.2
<b>Total</b>	<b>21 753</b>	<b>31 439</b>	<b>40.9</b>	<b>40 605</b>	<b>14 192</b>	<b>74.1</b>

Source: Secretariat of the Pacific Community (2008).

With regard to important bycatch issues, it is necessary to distinguish between the Pacific Island countries and the more developed metropolitan areas of the Oceania region. In the latter (Australia, New Zealand and areas where United States fishery management is applicable: American Samoa, Guam, Hawaii and Northern Mariana Islands), the fisheries management systems are complex and there are financial and human resources to address issues other than those of the very highest priority. In those locations, at least some attention has been focused on the non-tuna catch of small-scale tuna fisheries, with examples being:

- “Although no specific fishery interactions have been observed or reported for the [tuna] troll fishery in New Zealand fishery waters, anecdotal reports and expert opinion consider that some albatross species are at risk of capture from this method” (Ministry of Fisheries, 2008).
- The Hawaiian night-time ika-shibi fishery occasionally encounters sharks, for which management regulations are applicable, including a prohibition of the finning of those sharks.

In the Pacific Islands region, there appear to be few major issues associated with the non-tuna catch of small-scale pelagic tuna fisheries. The major non-tuna species captured are not threatened, with the possible exception of sharks. A few of the countries have national plans of action dealing with sharks, and some of those, such as that of the Marshall Islands, mention small-scale tuna fishing. Most of those plans (including the Marshall Islands plan) have not been implemented.

Discarding from any small-scale fishery in the Pacific Islands is almost unheard of – and certainly very rare for large pelagic fish. In the developed countries of the region the situation is different. The sport fisheries that catch tuna have some discards. For example, a survey of recreational fishing in New South Wales and Queensland, Australia, indicates the capture of 107 tonnes of “tuna/bonitos”, about half of which were released/discarded (BRS, 2000). Some sharks are discarded in the ika-shibi fishery of Hawaii, United States.

In a recent literature review of Pacific Island fisheries and interactions with marine mammals, seabirds and sea turtles (Aylesworth, 2009), it was stressed that the lack of documentation prevented a thorough understanding of the situation for the small-scale fisheries of the Pacific Islands. During this study, the consensus of opinion of several individuals with a detailed knowledge of these fisheries is that

interactions between small-scale tuna fishing and mammals/seabirds/turtles are rare. One exception is in the Samoan alia longline fishery, which has captured sea turtles, albeit rarely. In a more general sense, when small-scale tuna fishing craft transit between port and fishing grounds, turtles are occasionally sighted – and the boats could conceivably divert temporarily to hunt a turtle.



## 3. Some general issues

### 3.1 DATA QUALITY

The general quality of catch data in each of the nine regions is given in Sections 2.1 to 2.9. Overall, it can be concluded that data on small-scale fisheries that catch tuna are poor in most places. The comment on data quality in the Eastern Pacific (Section 2.1) is applicable to all regions:

Although there are a few exceptions, data on small-scale fisheries that catch tuna are generally poor. Many countries lack a statistical system covering pelagic artisanal fisheries. Consequently, the tuna and non-tuna catch information in the appendixes are mainly educated guesses by individuals familiar with the national fishery situations.

In the countries where the data appear relatively good, this is often because: (i) the national importance of the fishery is such that there are considerable government efforts to collect data; or (ii) specialized studies have been conducted. The latter is often catalyzed by concerns over protected species, usually turtles.

Some additional observations can be made on the quality of catch data in small-scale pelagic fisheries. In general, the data on tuna catches are better than on non-tuna catches. In those countries where this study estimated the non-tuna catch using ICCAT or IOTC data, those estimates are probably too small because ICCAT/IOTC data do not cover some of the important species for small-scale pelagic fishing, such as dolphinfish and rainbow runner. Having stated this, the accuracy of estimates on the non-tuna catch (amount, species composition) of the ICCAT/IOTC countries is probably superior to those in many countries where estimates were made by educated guesswork.

Information on the capture of protected or endangered species (e.g. turtles) by small-scale pelagic fisheries is generally not available from government fishery statistical systems. Although there are a large number of studies on the capture of turtles and mammals by fishing gear in most regions (often by NGOs), difficulties were encountered in using that information. This consisted of difficulties in determining whether the cited fishery was a pelagic fishery (i.e. that the fishery catches tuna and therefore within the scope of the present study) or whether it was an inshore coastal fishery. An example of this are the statements giving the number of turtle or marine mammals captured by “gillnet fishing”. Another difficulty of using those studies concerns the anecdotal nature of much of the information. For example, the fact that a dead turtle was observed being unloaded from a

small-scale longliner is not especially useful in gauging the number of turtles taken in that fishery per year or the magnitude of the turtle bycatch problem.

### **3.2 WHY BYCATCH OCCURS**

In small-scale pelagic fisheries, bycatch occurs for several reasons. At the simplest level, it is because the species distribution overlaps with the gear use. At a more detailed level, the reasons are more complex and depend on:

- the appeal of the bait (for handlining, trolling, longlining) to the species in question;
- the ability of the species in question to avoid entanglement (for gillnet); and
- the ability or desire of the fisher to avoid the species in question.

From a different perspective, there are some conceptual issues that are relevant to the question of why bycatch occurs. Section 1.4.1 of this document indicates the irrelevance of the concept of bycatch in small-scale fisheries of developing countries, where almost everything in the catch has economic value and can become a target. In this situation, if one focuses on any worthless species, although rarely captured in small-scale pelagic fisheries, some insight into the reasons why bycatch occurs can be obtained. Generally, the reason for the capture of worthless species is the inability to avoid their capture while simultaneously maximizing the capture of desired species.

The view can be taken that the concept of bycatch is only applicable to those small-scale pelagic fisheries that are targeted on a group of fish (see Chapter 5). In the small-scale targeted tuna fisheries (e.g. longlining in Samoa, handlining in Maldives), bycatch occurs for the same reason cited above (i.e. the inability to avoid capture of the bycatch species while maximizing the capture of tuna), but there is the added factor that the bycatch has value – a disincentive for avoiding the bycatch.

## 4. Comparisons between regions and countries

A summary of the estimates of small-scale catches of tuna and non-tuna in the nine regions is given in Table 2, bearing in mind the data quality limitations (as discussed in Section 3.1).

TABLE 2  
Summary of the estimates of small-scale catches of tuna and non-tuna

Region	Number of country ocean areas covered	Amount of small-scale tuna catch (Tonnes)	Amount of non-tuna captured with the small-scale tuna catch (Tonnes)
East and Southeast Asia	13	490 000	490 000
Indian Ocean	33	140 000	190 000
Oceania	25	24 000	8 000
Eastern Pacific	19	9 000	30 000
West Africa	24	8 500	16 000
Non-Caribbean Western Atlantic	8	5 500	10 000
Caribbean	31	3 500	8 500
Mediterranean	18	300	500
Northeast Atlantic	10	300	0

Although there is some logic in summing up the small-scale catches of tuna within each region to obtain a regional total, there is less justification for doing so with the non-tuna catch. In reality, much of the non-tuna catch is made by fisheries in which tuna is a minor component – and should not be construed to be the bycatch of the small-scale tuna fisheries of a region.

The total world tuna catch by small-scale fisheries is estimated by the present study to be about 681 000 tonnes per year in the mid-2000s. This is very close to twice the small-scale tuna catch estimated in Gillett (2005) for the early 2000s. This study has a larger estimate primarily due to the Indian Ocean (140 000 vs 52 000 tonnes) and to East and Southeast Asia (490 000 vs 185 000 tonnes). The Indian Ocean estimate of this study had the benefit of considerable attention from IOTC staff. Similarly, the East and Southeast Asia estimate had the benefit of a recent reassessment of tuna catches in Indonesia, the country (both Indian and Pacific Ocean areas) that produces 60 percent of the world's small-scale tuna catch.

The country ocean areas that produce the most tuna from small-scale fishing are given in Table 3. Also given are the amounts of non-tuna produced by small-scale fisheries that catch tuna.

TABLE 3

The major producing areas: country ocean areas that produce more than 1 000 tonnes per year

Country ocean area	Tuna (Tonnes/year)	Country ocean area	Non-tuna (Tonnes/year)
United States West Coast	1 000	Papua New Guinea	1 475
French Caribbean	1 000	Brazil	1 500
Fiji	1 000	United States (Gulf of Mexico portion)	1 594
Hawaii, United States	1 018	Kiribati	1 714
Cape Verde	1 409	Japan	2 250
French Polynesia	1 454	Côte d'Ivoire	2 733
United Republic of Tanzania	1 513	Pakistan	2 919
South Africa	1 664	Costa Rica	3 000
Solomon Islands	1 826	French Caribbean	4 000
Micronesia (Federated States of)	1 957	United Republic of Tanzania	8 626
Papua New Guinea	2 050	Oman	5 799
Mexico	3 000	Maldives	6 182
United States Northwest Atlantic	3 382	The Comoros	5 827
Viet Nam	4 250	United States (Northwest Atlantic portion)	6 993
Côte d'Ivoire	4 568	Senegal	11 206
Oman	7 233	Madagascar	12 000
Madagascar	9 788	The Philippines	18 458
Maldives	10 357	Indonesia Indian Ocean portion	18 885
The Comoros	10 965	Sri Lanka	20 000
Kiribati	12 570	Ecuador	22 084
Sri Lanka	15 000	Yemen	24 747
Indonesia (Indian Ocean)	15 008	India	53 238
Yemen	17 882	Indonesia (FAO Area 71 portion)	500 000
India	18 098		
Iran (Islamic Republic of)	26 208		
The Philippines	108 839		
Indonesia (FAO Area 71 portion)	375 000		

Note: The non-tuna catch of some countries is unknown (and not given in the table) but likely to be substantial (e.g. Mexico, Solomon Islands).

As with the regional totals mentioned above, there may not be much significance in intercountry comparisons of the amounts of non-tuna taken by small-scale fisheries that catch tuna. In many of the countries with a large amount of such non-tuna catch, it simply means that there are major multispecies fisheries in which at least some tuna is taken.



## 5. Identification of dedicated tuna fisheries

Of considerable interest are those small-scale fisheries that could be considered tuna fisheries (i.e. where tuna is the major target). Part of this interest relates to the fact that some fisheries specialists have expressed doubt that such tuna fisheries even exist. They are also noteworthy because the concept of bycatch (i.e. a situation where there is an objective of capturing certain high-value fish, with other fish having much less value) may be more relevant to small-scale fisheries that actually target tuna. Finally, in attempts at relating the non-tuna catch (or bycatch) to gear types, the targeted and non-targeted fisheries must be distinguished.

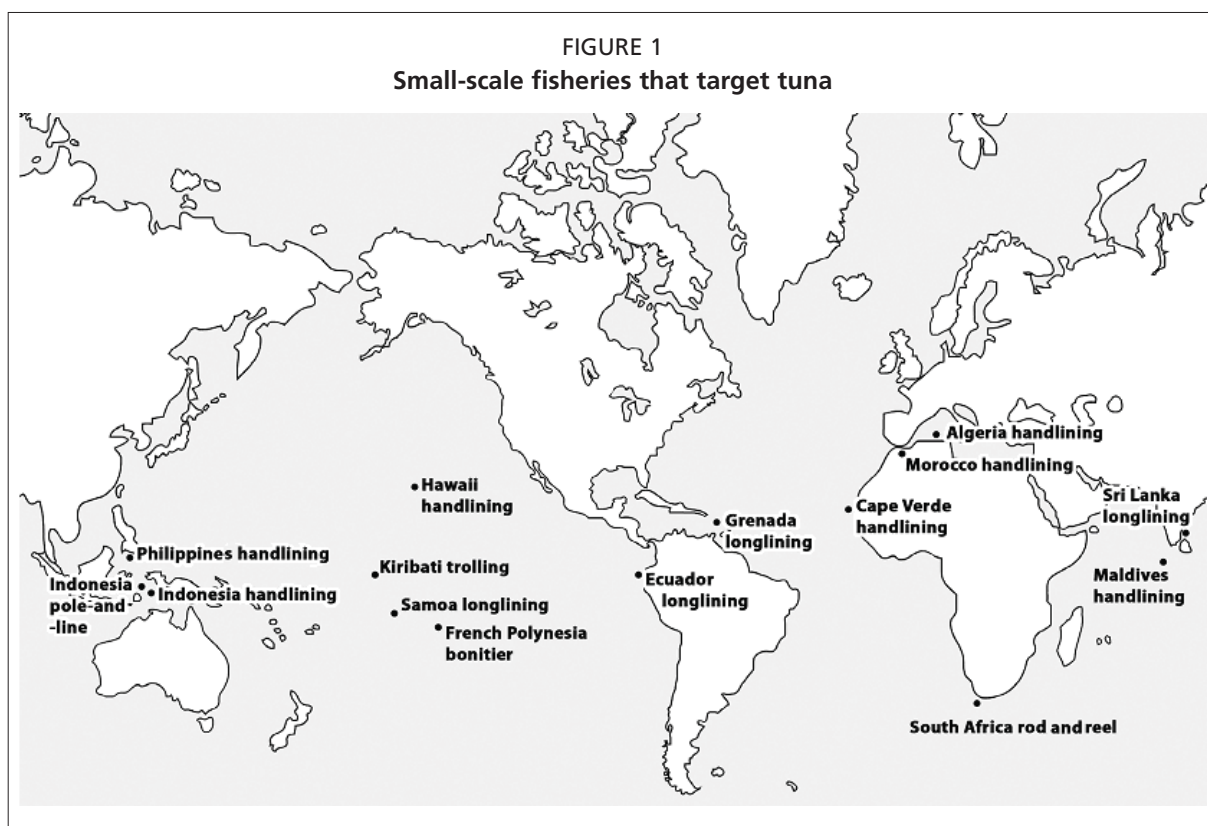
Features that distinguish a targeted tuna fishery are not always straightforward. It can be based on several factors, including a high percentage of tuna in the catch and economic features, such as which species produce most of the catch value. In many cases, these targeted tuna fisheries are export-oriented – and the tuna component receives a much higher price than the other catch components.

Identifying the small-scale fisheries that target tuna is sometimes difficult without good local knowledge, and some fisheries may fall somewhere between targeted tuna fisheries and multispecies pelagic fisheries. Others can seasonally target tuna. Nevertheless, some of the small-scale tuna fisheries identified in the present study are:

- bonitier fishing in French Polynesia (similar to pole and line);
- commercial rod-and-reel fishing in South Africa;
- handlining in Cape Verde;
- handlining fisheries of the Philippines;
- handlining in Morocco;
- handlining in Algeria;
- handlining in Maldives;
- handlining in Indonesia;
- handlining in many locations in the Pacific Islands (drop-stoning);
- handlining in Hawaii, United States (“ika-shibi” fishing at night, “palu ahi” fishing during the day, and jigging on FADs);
- longlining in Ecuador;
- longlining in Grenada;
- longlining in Sri Lanka;
- longlining in Samoa;
- pole-and-line fishing in Indonesia; and
- trolling in Kiribati.

Figure 1 shows the general locations of these fisheries. Other small-scale tuna fisheries could probably be added to the list of targeted fisheries with additional input from national fisheries fishery specialists.

Some of the features of this list include the high proportion of handlining and the absence of gillnetting. Another aspect is that, with the exception of Kiribati, trolling is not on the list. Most regions have one small-scale longline fishery that targets tuna.



## 6. Comparisons between gear types

Substantial amounts of tuna are taken by handlines, troll lines, longlines, gillnets, pole-and-line and rod-and-reel. The less common gear types include harpoon (Canada), purse seine (Malta) and beach seine (Dominica).

In comparing gear types with respect to quantities of non-tuna catch, it is important to distinguish the targeted tuna fisheries from the non-targeted fisheries. Comparisons between gear types that catch small amounts of tuna may have little significance.

Table 4 presents the data from the list of targeted fisheries mentioned above, less those fisheries where there are inadequate data for comparison.

TABLE 4  
Percentage of non-tuna in the catch

	Tuna (Tonnes)	Non-tuna (Tonnes)	% non-tuna of total catch
Commercial rod and reel in South Africa	1 164	1	0%
Pole-and-line fishing in Indonesia	61 000	610	1%
Longlining in Samoa	665	28	4%
Handlining in Hawaii, United States	368	48	12%
Trolling in Kiribati	12 570	1 714	12%
Handlining in the Philippines	108 839	18 458	14%
Bonitier fishing in French Polynesia	528	138	21%
Handlining in Cape Verde	1 409	435	24%
Longlining in Grenada	540	316	37%
Handlining in Maldives	5 838	3 754	39%
Handlining in Morocco	295	248	46%
Handlining in Indonesia	226 500	226 500	50%
Longlining in Sri Lanka	15 000	20 000	57%
Handlining in Algeria	23	113	83%
Longlining in Ecuador	3 716	22 084	86%

Some comments should be made about Table 4:

- Comparing dissimilar types of data can be misleading. Some fisheries listed in the table are official statistics (bonitier fishing in French Polynesia), others are rough estimates (e.g. longlining in Sri Lanka), while the accuracy of other fisheries have benefited from the results of specific studies (longlining in Samoa).

- Seasonality may mask the catch composition of targeted fisheries. The data for Ecuador are actually an aggregation of information from two fisheries, one directed at tunas, billfishes and sharks (May to October), and the other directed at dolphinfish (the other months of the year). The catch data given in the table are for both seasons combined – masking what is probably a high proportion of tuna in the May to October fishing.
- In some cases, the data listed in the table could be an aggregation of different fisheries that use the same gear. As an example, although several specialists recognize an Algerian tuna handline fishery, the data in the table appear to include the catches for handlining for swordfish as well. In comparing catches by gear type, defining discrete fisheries is an issue.
- In countries where the only source of information for this document is the ICCAT or IOTC data, the non-tuna catch listed in the table is likely to be an underestimate (e.g. commercial rod and reel in South Africa). This is because the ICCAT/IOTC data are mostly concerned with the species they have a mandate to deal with, and many of the important bycatch species are not included.

The above features of the data collected in this study suggest that it may not be possible to conclude much in comparing gear types with respect to the relative amounts of tuna and non-tuna in the catch.

On a more general level, a few observations on comparing the catch composition of small-scale gear types can be made.

- *Gillnetting*. The small-scale gillnet fisheries usually have a low percentage of tuna in the catch. This may be more related to the area where small-scale gillnets are used (closer to the coast, over a continental shelf), where there is greater species diversity, than the tuna catching ability of the gear. In many cases, small-scale gillnet fisheries are multispecies fisheries or fisheries that target non-tuna species (shark or *Scomberomorus*) in which tuna is a component, making up from a minimal amount to 50 percent of the catch.
- *Trolling*. Studies by the SPC show FAD trolling and non-FAD trolling have very different percentages of tuna in the catch (Table 1). FAD fishing produced from two to three times the percentage of tuna in the catch as open water trolling. Preston *at al.* (1987) show that the pelagic troll catch composition can vary considerably between fishing in open water, over seamounts, off barrier reefs and in reef passes.

In comparing catch composition by gear type, an important aspect are the relative amounts captured of protected and endangered species, especially turtle and marine mammals. The general subject of the capture of these animals by small-scale pelagic fishing is covered in Chapter 7 and some thoughts on the data quality aspects of this issue are given in Section 3.1.

## 7. Turtles, marine mammals and seabirds

Sections 2.1 to 2.9 contain information collected during the present study on the capture of protected and endangered species in small-scale pelagic fishing in the nine regions. In the regions where protected and endangered species in small-scale fisheries are an issue, the information can be summarized as follows:

- *Eastern Pacific Ocean.* Longlining targeting dolphinfish appears to catch a substantial number of turtles and, although this fishing does not target tuna, the concerned vessels often switch seasonally to target tuna. The capture of turtles by gillnets is a major issue, but most of these fisheries catch relatively small amounts of tuna and could hardly be considered targeted tuna fisheries.
- *Caribbean.* Concerning turtle bycatch, trolling (the most important small-scale technique in the region for capturing tuna) rarely catches turtles. Although gillnetting often catches turtles, it is a technique that does not produce much tuna. Small-scale longlining does catch turtles, but this technique is not widespread in the Caribbean, except in Grenada.
- *West Africa.* The capture of sea turtles is reported from a few countries of the region. As regards small-scale fishing, this appears to be mostly in fisheries in which tuna are a relatively minor component of the catch, rather than by the small-scale fisheries that catch substantial quantities of tuna.
- *Mediterranean.* The “hot bycatch issue” appears not to be related to the targeted tuna fisheries, but rather to the small-scale fisheries that catch small amounts of tuna and some turtles and mammals – primarily gillnetting.
- *Indian Ocean.* In terms of important bycatch issues in the tuna fisheries of the Indian Ocean, the catch of marine mammals and sea turtles is often mentioned, especially in the gillnet fisheries. In this regard, the gillnet fishery in Sri Lanka often receives attention for capturing large numbers of cetaceans. It should be pointed out, however, that pelagic gillnetting in Sri Lanka (and generally in most of the rest of the region) is of a scale larger than the “small-scale” of the present study.
- *East and Southeast Asia.* There is considerable concern over the capture of turtles by longline gear and turtle and mammals by gillnets. Virtually all longline gear is larger than small-scale and gillnetting is often large scale and/or is rarely focused on tuna.
- *Oceania.* Interactions between small-scale tuna fishing and mammals/seabirds/turtles are rare. One exception is in the Samoan alia longline fishery, which has captured sea turtles, albeit rarely. In a more general sense, when

small-scale tuna fishing craft transit between port and fishing grounds, turtles are occasionally sighted – and the boats could conceivably divert temporarily to hunt the them.

Some observations on the situation are:

- The identification of the levels of interactions between small-scale tuna fisheries and the sensitive species requires a much greater time for a literature search than was available to the present study.
- In the specialized turtle and marine mammal literature, when dealing with the capture by fishing gear of these animals, it is often not possible to determine whether the concerned fishery has relevance to tuna (i.e. whether significant quantities of tuna are captured), or if so, whether it is small-scale.

An example of the latter point occurs in a recent publication on global patterns of marine turtle bycatch (Wallace *et al.*, 2010):

Maximum bycatch per unit of effort values were 2.2 turtles per set for gillnets (Mediterranean Sea), 19.3 turtles per 1 000 hooks for longlines (Eastern Pacific Ocean), and 7.2 turtles per haul for trawls (Southwest Atlantic Ocean).

In the above example, there is likely to be a great difference in the turtle catch rates between inshore gillnets and large offshore pelagic gillnets and between inshore bottom set longlines and pelagic longlines. Kiszka (2006) reports that in the Western Indian Ocean the greatest potential threat to marine mammals is bycatch in fishing gears, especially gillnets and shark nets. Again, the scale and area of usage of the gear in question is unknown.

Quantitative catch data for turtles is not readily available for fisheries that can be confirmed as being small-scale pelagic fisheries. Only two cases were found during in the study (both in Appendix 1):

- In the Peru winter longline skiff fishery: the major non-tuna species caught are manta rays (26.3 percent of non-tuna catch), skipjack (18.4 percent), dorado (11.0 percent), thresher shark (8.8 percent), with reptiles contributing 0.1 percent to the non-tuna catch.
- In the Ecuador artisanal dorado and tuna longline fisheries: 196 turtle interactions during 41 observer trips on 136 different vessels sampled 185 sets using 20 570 hooks.

No quantitative catch data were found on the capture of marine mammals by what could be confirmed as small-scale pelagic fishing gear in this study. Hall and Williams (2000), however, cite studies to show that the mortality inflicted by: (i) the “artisanal fleet” of Ecuador to be at least 2 500 to 5 000 dolphins from four important ports; and (ii) for Peru “a variety of artisanal fisheries, some of which target tuna” to be “between 15 000 to 20 000 dolphins”. It is unknown whether the “artisanal” fisheries of those studies fall into the category of “small-scale” fisheries for the present study.

The information in Chapter 2 leads to the general conclusion that, of the gear categories used in small-scale pelagic fisheries, gillnets appear to have the most problems with capturing turtles and marine mammals. Handlines and troll lines

have the least and pelagic longlines are intermediate. Some additional comments should be made on this observation:

- The impression obtained in this study – that small-scale pelagic gillnets have more problems worldwide with turtles and mammals than small-scale pelagic longlines – is a qualitative assessment based on discussions with national and regional fisheries specialists, fisheries literature, and some data. This contention could be affected by the fact that more data exists on the small-scale longlines.
- The conclusion of Northridge (1991) is still valid: “For most of the gillnet fisheries of the world, information on catch rates is too poor to make any reasonable estimate of total catches of non-target species.”

Concerning seabirds, only two mentions of their capture by small-scale pelagic fishing gear were encountered:

- “Although no specific fishery interactions have been observed or reported for the troll fishery in New Zealand fishery waters, anecdotal reports and expert opinion consider that some albatross species are at risk of capture from this method” (Ministry of Fisheries, 2008).
- Birds were caught in small-scale fishing operations at one port in southeastern Brazil: surface longline for dolphinfish (0.15 birds/1 000 hooks and 1.08 turtles/1 000 hooks); slow trolling for bigeye tuna (0.41 birds/day); and handlining targeting yellowfin tuna (0.61 birds/day) (Bugoni *et al.* 2008).

Both of the above cases involve fisheries in subtropical or temperate areas. In the tropics (where the vast majority of small-scale tuna fishing occurs), the situation appears to be considerably different. Watling (2002) examined the available information on the tuna fisheries of the central and Western Pacific and concluded that seabird bycatch is extremely rare by comparison with the situation at higher latitudes.





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## 8. Discards

The discarding of catch in small-scale pelagic fisheries rarely occurs. Only a few incidents of this practice were encountered during the literature searches or in discussion with national and regional fisheries specialists. This was limited to disposing of worthless species (e.g. stingrays in Ecuador's longline fishery), illegal species (e.g. turtles at locations in the Caribbean where their capture is illegal), and recreational fishing in developed countries (e.g. the release or discard of fish in Australian sport fishing).

Kelleher (2005) indicates some discarding by the pelagic gillnet fisheries (which obviously catch tuna), but it is difficult to determine the amount of this fishing (if any) which is small-scale.

Discarding in small-scale pelagic fisheries appears to be so low that it should not be considered a major problem or a priority for receiving management attention.



## 9. Management of bycatch

### 9.1 GENERAL

In Section 1.4.1 the concept of bycatch as applied to small-scale fisheries was scrutinized. The idea was put forward that, although the concept can be relatively clear in large-scale fisheries of developed countries – where there is an objective of capturing certain high value fish – the bycatch concept becomes increasingly irrelevant in the progression to small-scale fisheries in developing countries, where almost everything in the catch has economic value and can become a target.

Similarly, the issue of bycatch management, as applied to small-scale fisheries that catch tuna, requires some additional consideration. In many large-scale fisheries, bycatch management equates to efforts to reduce or eliminate bycatch – because it is wasteful or harmful to the bycatch species. Most small-scale fisheries that catch tuna are true multispecies fisheries in which there are no discards and perhaps no threatened species in the catch. In these situations, the general thrust of reducing/eliminating bycatch may not be appropriate. What is required in many small-scale pelagic fisheries is attention to any components of the catch that are overexploited, threatened, or protected (herein called “sensitive species”).

Another issue dealing with bycatch management in small-scale fisheries is the practicality of management interventions. Is it realistic to carry out management intervention with limited government resources in developing countries where there could be a very large number of fishers and vessels, many of which are in isolated locations? In applying this question to small-scale pelagic fisheries, a number of views were obtained during the study:

- The opinion has been expressed that attempts to manage bycatch in these small-scale fisheries can be very difficult or impossible – for legal, moral, practical and other reasons. Some fisheries specialists refer to these as “semi-unmanageable”. They feel that any work on bycatch in these fisheries should focus on estimating the quantities of sensitive species, as management interventions can do little about these – with the idea that interventions to mitigate effects on these species should be focused on the large-scale fisheries that are more manageable.
- There is also the view that stresses awareness and education – that fisheries managers have a moral responsibility to educate fishers on the general and specific impacts of bycatch. It is contended that if small-scale fishers know the implications of taking some kinds of bycatch, then they may have a tendency to refrain from those that have negative effects.

- A third opinion is that fisheries managers in their quest to mitigate the effects of bycatch on certain species should consider the costs and benefits of various types and targets of management.

In examining the above attitudes to managing bycatch in small-scale pelagic fisheries, there could be some degree of reality and logic in each of the views. On the other hand, elements of the most appropriate approach to managing (or not managing) bycatch could be specific to a fishery. It would also depend on the time frame available for interventions and impacts. Enlightenment, for example, may work better for preventing turtle mortality in the Samoa longline fishery than in the gillnet fishery of the Côte d’Ivoire.

Another topic in bycatch management in small-scale pelagic fisheries that should be discussed is the source of concern over the bycatch. Although many fishers can understand the logic of reducing pressure on commercial species that are overexploited, even some fisheries managers in developing countries remain unconvinced of the need for giving partial or total protection to some species – and much of the management action to reduce bycatch of those species is catalyzed by forces outside the concerned country. The present study found this with turtles and mammals, and especially with sharks.

## **9.2 MITIGATION MEASURES – CONCEPTUAL ASPECTS**

Most of the interest in mitigating bycatch in tuna fisheries concerns large-scale fishing operations and is largely oriented to gear technology solutions. Mitigating bycatch in small-scale pelagic fisheries is associated with a very different set of objectives, mechanisms and challenges.

In Section 1.4.1, the idea is put forward that in many small-scale pelagic fisheries the goal of overall bycatch reduction can be both irrelevant and/or undesirable. It is suggested that a more appropriate objective is often the reduction of the capture of sensitive species.

Hall (1996) provides a good conceptual framework for bycatch reduction. He indicates that several possible lines of defense are available to reduce bycatch. Five of these are applicable to decreasing sensitive bycatch in small-scale pelagic fisheries:

- decreasing the total level of fishing effort;
- increasing the selectivity of the fishery by choices of gear, areas or seasons;
- modifying deployment conditions;
- increasing the fraction released alive from the gear; and
- increasing the fraction released alive from the deck.

The sociological context in which most of the small-scale pelagic fisheries operate is vastly different from that of the large-scale tuna fisheries and presents great challenges for bycatch reduction. Section 9.1 indicates that some fisheries specialists feel that many small-scale pelagic fisheries are “semi-unmanageable”.

Others have the attitude and approach embodied in a statement by Peckham *et al.* (2007):

Because small-scale fisheries are conducted primarily in developing nations where management and enforcement are limited, assessing and mitigating their bycatch presents an international conservation challenge. Command-and-control approaches such as fisheries closures are often impractical and inadvisable, particularly in developing nations. Because fishers' investment in the conservation process can increase their subsequent adoption of conservation strategies, solutions may depend on fishers' direct involvement and support in developing new social norms and economic alternatives.

### 9.3 MITIGATION MEASURES – SPECIFIC GROUPS OF SENSITIVE BYCATCH

#### 9.3.1 Turtles

FAO (2004) emphasizes that turtle bycatch mitigation has an important humanitarian aspect: the development, design and implementation of turtle conservation and management measures should take into account the socio-economic aspects of fishers and fishing communities. These communities may be dependent on marine fishery resources for their lives and livelihoods and a balance should be sought between the conservation and management of sea turtles on the one hand and sustainable livelihoods and poverty alleviation on the other.

FAO (2009a) reviews the technical measures to reduce bycatch of turtles in the two gear categories that are the most problematic with respect to small-scale pelagic fisheries.

##### *Gillnet fisheries:*

- lower-profile (narrower), stiffer nets;
- deeper setting for surface gillnet fisheries;
- longer tie-downs or avoid their use in demersal gillnets; and
- a maximum threshold for mesh size.

##### *Pelagic longline fisheries:*

- replacement of J and tuna hooks with wider circle hooks;<sup>3</sup>
- use of fish instead of squid for bait;
- setting gear deeper;
- use of dyed bait/camouflaged gear;
- reduced gear soak time, e.g. increasing number of sets per day;
- avoidance of fishing in certain sea surface temperatures; and
- use of intermittent flashing lightsticks in place of traditional continuous flashing lightsticks and not using luminous gear.

<sup>3</sup> A specialist on the interaction between longlines and turtles points out that the biggest impact of using circle hooks is to reduce mortality of turtles that are hooked, and not necessarily reduce the capture of turtles (M. McCoy, personal communication, May 2010).

## BOX 4

**A programme to reduce turtle bycatch in the Eastern Pacific Ocean**

A programme to mitigate the impact of tuna fishing on sea turtles resulted from an IATTC resolution. The work that eventuated was supported by the World Wide Fund for Nature (WWF), the United States Western Pacific Regional Fishery Management Council (WPRFMC), the United States National Oceanic and Atmospheric Administration (NOAA), the United States Department of State, the Overseas Fishery Cooperation Foundation of Japan, the Ocean Conservancy, the Defenders of Wildlife (Mexico), and several national conservation, industry, and fishworkers' organizations of the coastal countries of the Eastern Pacific Ocean.

The programme's aim is to seek ways to reduce this mortality by: (i) reducing the catches of sea turtles; and (ii) reducing the mortalities of sea turtles that are caught. The major way this is done is by promoting the use of: (i) "circle hooks" which tend to decrease the catches of sea turtles without affecting those of the target species; and (ii) "dehookers" which make it easier and less traumatizing to remove the hooks from the turtles. This programme brought together people sharing two simple goals: nobody wants sea turtles to become extinct, and nobody wants fishers to be put out of work.

Work began in Ecuador and expanded to other countries bordering the eastern Pacific. By June 2007, the programme was very active in Costa Rica, Ecuador, El Salvador, Guatemala, Panama and Peru and it was under development in Mexico and Nicaragua. In Colombia, the longline effort has been substantially reduced in recent years.

The bottom-up approach used by the programme to change – trying to convince fishers to fish sustainably and increase the selectivity of their fishing operations – is proving successful. The model shows real life evidence, coming from fishers' own fishing trips, of the benefits of the gear substitution and best practices for the turtles, and also the absence of negative impacts on the target catches. This approach seems to match fishers' own cultural and social learning process and the way they adopt innovations in gear and techniques.

*Source:* Largacha *et al.* (2005); Hall (2007).

The best documented case of a programme for reduction of turtle bycatch in small-scale pelagic fishing is that described for the artisanal longline fleets of the eastern Pacific (Box 4)

Gilman *et al.* (2009) investigate the mitigation of sea turtle bycatch in coastal passive net fisheries. They conclude that the following are gear-technology approaches that have been shown to significantly reduce sea turtle catch rates in individual gillnet fisheries:

- reducing net profile;
- increasing tie down length, or eliminating tie downs;
- placing shark-shaped silhouettes adjacent to the net; and
- illuminating portions of the net using green lightsticks.

Of these techniques, only net illumination was found not to cause a significant decrease in target species catch rates.

### 9.3.2 Marine mammals

In the fieldwork carried out during the present study, little information was encountered on techniques for reducing the incidental catch of marine mammals in small-scale pelagic fisheries. Similarly, the literature mentions few such techniques – and certainly much fewer than for sea turtles. Many studies indicate that the development of mitigating measures is constrained by lack of information – and often recommend observer programmes to obtain that information.

Young and Iudicello (2007) focus on strategies to mitigate cetacean bycatch. They state that there is an urgent need to better document the extent of this threat, assess cetacean populations, develop alternative fishing gear and practices and, at the same time, institute effective regional agreements that call for mitigation measures ranging from temporal and spatial closures to deterrents. Capacity building is crucial to providing local scientists with the skills necessary to undertake research to make progress on conservation efforts to reduce cetacean bycatch.

Reeve, Crespo and Gales (2005) cite examples to show that the lack of political will affects the development of measures to reduce cetacean bycatch in small-scale fisheries:

- Tens of thousands of coastal Ghanaians live from the sea and, therefore, gillnet closures over large areas do not seem feasible on socio-political grounds. Some public debate has been stirred by earlier work, but it has not created sufficient momentum to evoke a political response at the national level. This is partly because fisheries authorities remain unconvinced of the severity of the problem.
- With respect to the conservation of Burmeister's porpoise in Peru, despite heightened awareness and concern for conservation, authorities in Peru remain unconvinced that any action beyond merely outlawing commerce is needed to reduce the mortality of cetaceans in fisheries.

Technical measures for reducing cetacean bycatch in the various regions of the world include pingers, banning swordfish driftnets, establishing sanctuaries, increasing the size of sanctuaries, identifying/avoiding "hot spots", and simply making the capture of cetaceans by any fishing gear illegal. Not all of these are applicable or effective for small-scale pelagic fisheries.

### 9.3.3 Seabirds

As indicated in Chapter 7, the capture of seabirds is not common in many of the small-scale pelagic fisheries in the tropics. According to information in the appendixes, it is apparently more of a problem in some longline and troll fisheries in subtropical and temperate areas.

Streamer lines are the most commonly prescribed seabird bycatch mitigation measures for longline fisheries and one of the most effective. This technique has applicability to small-scale longlining for tuna – but bearing in mind that the

tropical longline fisheries generally do not have bird problems that small-scale longlining outside of the tropics is not common. BirdLife International (2009) describes their use:

Streamer lines were an innovation of Japanese tuna fishers to prevent bait loss to birds. They are inexpensive, simple and require no modification to fishing gear. A streamer line (also called a tori or bird scaring line) is a line with streamers that is towed from a high point near the stern as baited hooks are deployed. As the vessel moves forward, drag on the line creates an aerial segment (extent) from which streamers are suspended at regular intervals. With streamer lines, the aerial extent is critical when attempting to scare birds away from baited hooks. A towed object is used to create additional drag to maximize the aerial extent. The goal is to maintain the streamer line over the sinking baited hooks in such a way that the streamers prevent seabirds from attacking bait, becoming hooked and subsequently killed. Streamer lines are regarded as a primary mitigation measure. That is, when used alone they significantly reduce seabird bycatch. However, they work even more effectively when used in combination with other mitigation measures, including line weighting, night-setting, and disposing of offal away from the area where hooks are exposed to birds.



## 10. Improving information on small-scale pelagic fisheries: priority areas

There are some major gaps in information concerning bycatch of small-scale tuna fisheries. From the perspective of the present study, the priority areas for improvement are:

- The regional tuna fishery management organizations should collect and report information on a wider range of bycatch species. The current reporting results in an underestimate of non-tuna catches and only limited information is provided on some of the important species for small-scale pelagic fishing.
- The ICCAT and IOTC have a substantial amount of information on the catch of tuna and non-tuna species by small-scale fisheries. The IATTC and the Western and Central Pacific Fisheries Commission (WCPFC) should give this subject additional attention.
- According to the findings of the recent WWF study, the Pacific Ocean component of Indonesia alone is responsible for over half of the tuna caught by small-scale pelagic fishing in the world. Considering the large management implications of this, efforts should be made to confirm the validity of that study.
- Although a substantial amount of work on the bycatch of sensitive species through specialized studies has been undertaken, the value of that work for management purposes has been to some degree compromised by not knowing more about the concerned fisheries, especially whether they are tuna fisheries – and relevant to the work of the tuna RFMOs.



# 11. Conclusion

The aim of the study was to quantify catches of tuna and bycatch in small-scale pelagic fisheries. Additional goals were to identify on a global scale information gaps, major issues and management concerns associated with these fisheries and their bycatch.

The study made estimates of tuna and non-tuna catches in the small-scale fisheries of 181 country ocean areas. The total amount of tuna produced by these fisheries was about 681 000 tonnes per year in the mid-2000s. About 753 000 tonnes of non-tuna was produced by those same fisheries.

The major priorities for improving our understanding of bycatch in small-scale pelagic fisheries are improved coverage of bycatch by the tuna RFMOs that collect such information, increased involvement of the other tuna RFMOs in small-scale pelagic fisheries, verification of the high reported catches from small-scale pelagic fisheries in Indonesia, and greater technical details on the small-scale pelagic fisheries that take sensitive species.

Some of the major issues and management concerns related to small-scale pelagic fisheries and their bycatch are:

- The concept of bycatch has limited applicability to the many small-scale multispecies pelagic fisheries. Accordingly, it may be more appropriate to scrutinize components of the catch of these fisheries to determine if there are resource or other problems associated with the components – rather than assume that total bycatch reduction is an appropriate goal.
- Although some fisheries specialists contend that there are no small-scale fisheries that target tuna (i.e. only small-scale fisheries that take tuna as part of a catch), the study identified 15 small-scale fisheries that target tuna. These fisheries catch more than half of all tuna taken by small-scale fisheries.
- Discarding in small-scale pelagic fisheries appears to be so low that it should not be considered a major problem or a priority for receiving management attention.
- One of the most important issues in the bycatch of small-scale pelagic fishing is the capture of sensitive species, especially sea turtles and marine mammals. The targeted tuna fisheries are generally not problematic; the most difficulties appear to occur with small-scale gillnets, a gear that rarely targets tuna, but takes relatively large amounts of turtles and mammals.
- An important issue in dealing with bycatch management in small-scale fisheries is the practicality of management interventions. There is the view that management is impractical in situations where there are limited government resources and a very large number of fishers, vessels and ports.

Alternatively, there is also the view that stresses awareness and education – if small-scale fishers know the implications of taking some kinds of bycatch, then they may have a tendency to refrain from practices that have negative effects.

Much of the work of the present study consisted in estimating amounts of tuna and non-tuna species at the national level and identifying important issues. This approach seems to have been justified because of the rudimentary state of knowledge of many of the world's small-scale pelagic fisheries by outside agencies compared to that for large-scale fisheries.

The results of the present study suggest that the variety and complexity of issues related to small-scale tuna fisheries and associated bycatch are, in some respects, larger and more challenging than those of large-scale tuna fisheries.

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## Appendix 1 – Eastern Pacific

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Canada</b>	<ul style="list-style-type: none"> <li>Catches of tuna by small-scale fishing likely to be only by recreational fishers and be quite small, if any.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>DFO (2006) does not list any tuna under the important marine recreational species.</li> </ul>	<ul style="list-style-type: none"> <li>DFO (2006)</li> </ul>
<b>Chile</b>	<ul style="list-style-type: none"> <li>Amount of tuna caught by any small-scale fishing is not likely to be significant.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>Although there is an "artisanal" component in the swordfish fishery that is defined as fishing from boats less than 28 m in length.</li> </ul>	<ul style="list-style-type: none"> <li>Weidner and Serrano (1997)</li> <li>Descriptions by IATTC staff</li> </ul>
<b>Colombia</b>	<ul style="list-style-type: none"> <li>Little or no small-scale fishing activity where tuna is a significant portion of the catch.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>WPRFMC (2007) reports in former years that there was some longline effort targeting mahi-mahi (limited to a few shrimp boats during a shrimp closure period), but it has ceased.</li> </ul>	<ul style="list-style-type: none"> <li>Descriptions by IATTC staff</li> <li>WPRFMC (2007)</li> </ul>
<b>Costa Rica</b>	<ul style="list-style-type: none"> <li>In 2006, the "flota artisanal" of the Pacific coast artisanal fleet (all types of gear) caught 6 577 mt.</li> <li>23.4% was dorado, 14% was shark and 10.7% was "tuna".</li> </ul>	704	3 000	<ul style="list-style-type: none"> <li>Almost all of the vessels of the "flota artisanal" are outboard powered and about 87% are less than 10 m in length. They use a variety of gear but most of the tuna is caught on small longlines and handlines.</li> </ul>	<ul style="list-style-type: none"> <li>IATTC unpublished data</li> <li>Unpublished reports provided by IATTC staff</li> </ul>
<b>Ecuador</b>	<p><b>2008:</b> 22 345 mt of catch by small-scale longliners (<i>fibras</i>), including:</p> <ul style="list-style-type: none"> <li>10 732 mt of dorado;</li> <li>6 662 mt sharks/rays;</li> <li>1 447 mt of yellowfin;</li> <li>1 343 mt of blue marlin;</li> <li>850 mt of skipjack;</li> <li>142 mt of bigeye;</li> <li>(Note: 10.9% tuna).</li> </ul>	3 716	22 084	<p>Values on the left are average tuna catch and non-tuna catch for 2008 and 2009.</p> <p>Other information:</p> <ul style="list-style-type: none"> <li>There are two principal longline fisheries conducted by small vessels in Ecuador, one directed at tunas, billfishes and sharks (TBS) and the other directed at dorado. Most of the vessels have two sets of gear, one with larger hooks for the TBS fishery and the other with smaller hooks for the dorado fishery.</li> </ul>	<ul style="list-style-type: none"> <li>WPRFMC (2007)</li> <li>J. Martinez, SRP, pers. com., February 2010</li> <li>SRP (2009)</li> <li>M. Hall, IATTC, pers. com., February 2010</li> <li>Largacha et al. (2005)</li> </ul>

n.a. = not available

pers. com. = personal communication

mt = tonnes

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Ecuador, cont.	<p>2009: 29 256 mt of catch by small-scale longliners (<i>fibras</i>), including:</p> <ul style="list-style-type: none"> <li>• 11 804 mt of dorado;</li> <li>• 9 124 mt of sharks/rays;</li> <li>• 2 067 mt of yellowfin;</li> <li>• 1 768 mt of skipjack;</li> <li>• 1 360 of swordfish;</li> <li>• 1 240 of blue marlin</li> <li>• 1 158 of bigeye;</li> <li>• (Note: 17.1% tuna).</li> </ul>			<ul style="list-style-type: none"> <li>• <i>Fibras</i> are undecked outboard-powered vessels that use longline gear. About 3 420 <i>fibras</i> operate from 12 ports in the country. May to October is tuna/billfish/shark season for these vessels; the other months are the dorado season.</li> <li>• Catch data to the left are for both seasons combined.</li> <li>• SRP (2009) states that the catch in the artisanal dorado fishery is about 98.62% dorado, 0.06% Skip jack and 0.05% turtles.</li> <li>• Almost no discarding, except for the stingray (<i>Dasyatis violacea</i>), Gemphylloid fish and the manta rays (released alive).</li> <li>• In the “artisanal” dorado and tuna fisheries, Largacha <i>et al.</i> (2005) indicate 196 turtle interactions during 41 observer trips on 136 different platforms (<i>botes</i> or <i>fibras</i>) which sampled 185 sets using 20 570 hooks.</li> </ul>	
El Salvador	<ul style="list-style-type: none"> <li>• In 2002, there were about 257 outboard-powered “lanchas”.</li> <li>• For pelagic fishing, the principal target is shark, but some dorado and billfish are caught. Tuna is only a minor component of the catch.</li> </ul>	3	269	<ul style="list-style-type: none"> <li>• The fishery and catch composition is similar to that of Guatemala. For the purpose of this study, the tuna and non-tuna catches are assumed to be the same as that of Guatemala.</li> </ul>	<ul style="list-style-type: none"> <li>• IC Net (2002)</li> <li>• Descriptions by IATTC staff</li> </ul>
Guatemala	<ul style="list-style-type: none"> <li>• In 2006, about 630 small-scale longliners operated on the Pacific coast and caught 272 mt of fish.</li> <li>• The composition was 65% sharks, 29% dorado and 1% tuna.</li> </ul>	3	269		<ul style="list-style-type: none"> <li>• Jolon-Morales and Castaneda (2008)</li> </ul>
Honduras	<ul style="list-style-type: none"> <li>• Little, if any, tuna landed.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>• Honduras has a very short Pacific coast.</li> </ul>	
Mexico	The catch of tuna by artisanal fishing on the west coast of Mexico is largely limited to:			<ul style="list-style-type: none"> <li>• 300 outboard-powered vessels operate from an Oaxaca port, Puerto Ángel. Main catch is shark, yellowfin, skipjack, dorado, sailfish and marlin.</li> </ul>	<ul style="list-style-type: none"> <li>• Ortega (2007)</li> <li>• G. Compean, IATTC, pers. com., February 2010</li> </ul>



Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Mexico, cont.</b>	<ul style="list-style-type: none"> <li>Vessels operating mostly from Oaxaca, using mainly “cimbra” (longline) gear.</li> <li>Sport fishing near resort areas.</li> </ul>	<p>1 500</p> <p>1 500</p>	<p>No info.</p> <p>No info.</p>	<ul style="list-style-type: none"> <li>500 sport fishing vessels are registered on the Pacific coast of the country.</li> <li>Statistics are unavailable for the two types of small-scale fisheries that catch tuna; the tonnage listed to the left are educated guesses based on information from individuals familiar with fisheries in Mexico.</li> </ul>	<ul style="list-style-type: none"> <li>Descriptions by IATTC staff</li> <li>FAO Fishery Country Profile</li> </ul>
<b>Nicaragua</b>	<ul style="list-style-type: none"> <li>In 2007, the entire Pacific artisanal fleet caught 5 345 mt of fish.</li> <li>66% consisted of various snapper species. Dorado was 5.4% (289 mt), tuna was 2.9% (156 mt), and shark was 0.6 % (31 mt).</li> </ul>	156	At least 289	<ul style="list-style-type: none"> <li>Because the available data from all artisanal vessels is aggregated, it is not possible to precisely separate pelagic fishery catches (and the species composition) from that of demersal fishing.</li> <li>Most tuna appears to be caught by small longlines and handlines.</li> </ul>	<ul style="list-style-type: none"> <li>INPESCA Web site information</li> <li>Rivera (2001)</li> </ul>
<b>Panama</b>	<ul style="list-style-type: none"> <li>About 200 boats occasionally catch some black skipjack and seerfish; very little tuna taken.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>There are 5 925 “lanchas” (mostly below 12 m) that are outboard powered and licensed to fish for species that include tuna and use gear that includes longline. There are no landing statistics for these vessels.</li> </ul>	<ul style="list-style-type: none"> <li>L. Pacheco, pers. com., February 2010</li> <li>IATTC Panama Field Office staff</li> </ul>
<b>Peru</b>	<ul style="list-style-type: none"> <li>In Peru, for the period 2004–2009, 80 artisanal vessels that catch tuna, 2 tonnes or less.</li> <li>Of these 80 vessels, 68.5% use gill nets and 22.0% use handlines.</li> </ul>	29.7	(See comment to right)	<ul style="list-style-type: none"> <li>There are two principal longline fisheries conducted by small vessels in Peru that catch substantial amounts of tuna, one directed at tunas, billfishes and sharks (TBS) and the other directed at dorado. Most of the vessels have two sets of gear, one with larger hooks for the TBS fishery and the other with smaller hooks for the dorado fishery.</li> <li>These small vessels target dorado in the summer and tuna (when there is tuna) in the winter. If tuna is not abundant, the targets are a mixture of species that include billfishes, sharks, wahoo, oilfish, etc. In southern Peru they target sharks in the winter.</li> </ul>	<ul style="list-style-type: none"> <li>WPRFMC (2007)</li> <li>Unpublished data, El Instituto del Mar del Perú</li> <li>C. Estrella, IMARPE, pers. com., March 2010</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Peru, cont.				<ul style="list-style-type: none"> <li>The readily available data on artisanal tuna fishing is categorized by fish hold capacity. For the purpose of the present study, it is assumed that fishing using vessels with fish holds of less than 2 tonnes is "small-scale".</li> <li>The non-tuna catch is not readily available by vessel size or gear type, but rather by target tuna species.</li> <li>"Tuna" is considered to be yellowfin, bigeye, albacore and <i>Euthynnus</i>.</li> <li>For yellowfin, all artisanal gear types and vessel sizes caught 1 142 tonnes of non-tuna species while capturing 2 388 tonnes of tuna.</li> <li>The major non-tuna species caught are manta rays (26.3% of non-tuna catch), skipjack (18.4%), dorado (11.0%) and thresher shark (8.8%). Reptiles contributed 0.1% to the non-tuna catch.</li> </ul>	
United States	<ul style="list-style-type: none"> <li>Virtually all small-scale fishing for tuna on the United States west coast is by recreational fishers.</li> <li>95% of the tuna catch is albacore, but some bluefin, yellowfin and skipjack occurs (mainly in California).</li> </ul>	500 to 1 500	Usually less than 100	<ul style="list-style-type: none"> <li>Important bycatch species are sharks (mako, thresher blue), dorado, striped marlin, bonito and yellowtail.</li> </ul>	<ul style="list-style-type: none"> <li>C. Heberer, NMFS, pers. com., February–March 2009</li> </ul>

## Appendix 2 – Caribbean

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Antigua and Barbuda</b>	<ul style="list-style-type: none"> <li>Most large pelagics are caught by sport fishing vessels. There are about 35 of these vessels ranging from 6 m to 17.5 m; some tuna taken by gillnetting and trolling.</li> </ul>	Probably less than 10 mt	No info.		<ul style="list-style-type: none"> <li>Chakalall and Cochrane (2003)</li> <li>Mahon (2004)</li> <li>S. Singh-Renton, CRFM, pers. com. February 2010</li> </ul>
<b>Bahamas</b>	<ul style="list-style-type: none"> <li>The catch of large pelagic fish is dominated by foreign-based sport fishing.</li> </ul>	Probably less than 50 mt	No info., but tuna unlikely to be dominant component of the catch	<ul style="list-style-type: none"> <li>There is a bag limit for migratory fish caught by foreign sport fishing vessels – no more than 18 of these fish (e.g. tuna, wahoo, dolphinfish) can be aboard a vessel at any time.</li> </ul>	<ul style="list-style-type: none"> <li>S. Singh-Renton, CRFM, pers. com., February 2010</li> <li>FAO Fishery Country Profile</li> </ul>
<b>Barbados</b>	<p>Data reported to ICCAT shows that headline gear produced:</p> <ul style="list-style-type: none"> <li>In 2006, 36 mt of yellowfin, 3 mt of bigeye, and 2 mt of albacore, along with 51 mt of wahoo, sharks and other large pelagics.</li> <li>In 2007, 21 mt of yellowfin, 2 mt of bigeye and 2 mt of albacore, along with 50 mt of wahoo, sharks and other large pelagics.</li> <li>In 2008, 21 mt of yellowfin, 2 mt of bigeye and 1 mt of albacore, along with 47 mt of wahoo, sharks and other large pelagics.</li> </ul>	31 (See other estimates below)	49 (See other estimates below)	<p>Tuna catch and non-tuna catch is average of 2006 to 2008</p> <p>Other information:</p> <ul style="list-style-type: none"> <li>Amount of fish other than those large pelagics reported to ICCAT is not given in the ICCAT database.</li> <li>It is assumed that all headline catches reported to ICCAT are made by small-scale fisheries.</li> <li>The “headline” in the ICCAT statistics is actually trolling (mainly pulling by hand).</li> <li>In the ICCAT statistics for the gear category “headline”, the absence of skipjack and presence of yellowfin appears odd.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT database</li> <li>C. Parker, Barbados Fisheries Division, pers. com., February 2010</li> <li>S. Singh-Renton, CRFM, pers. com., February 2010</li> <li>R. Mahon, Univ. of the WI, pers. com., February 2010</li> </ul>

n.a. = not available  
pers. com. = personal communication  
mt = tonnes

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Barbados, cont.</b>	<p>The Barbados Fisheries Division indicates:</p> <ul style="list-style-type: none"> <li>• Small-scale tuna fishing is carried out by trolling from two types of vessels: open vessels near the coast (about 100 in Barbados) and larger partially-decked vessels (about 100) that are both close to the coast (July to October) and further offshore while in transit to flyingfish areas (November to June).</li> <li>• The trolling activity of these two types of vessels produces mainly dolphinfish and <i>Scomberomorus</i> (together about 85% of the catch), with the balance being mainly a mixture of wahoo, skipjack, <i>Sarda</i>, <i>Auxis</i> and billfish. Yellowfin and other large tunas are not very common.</li> <li>• No discarding of any species while at sea.</li> <li>• There are about 15 charter sport fishing vessels (plus some that sell catch), but the catch of tuna represents less than 1% of annual total.</li> </ul>	3	77	<ul style="list-style-type: none"> <li>• In Barbados the term “bonito” encompasses all the smaller tuna, including skipjack, <i>Sarda</i> and <i>Auxis</i>.</li> <li>• An 80 mt of annual “headline” catch (as given in the ICCAT statistics) is realistic as a total troll catch, but it is likely that the actual catches by trollers would include large pelagics not reported to ICCAT (e.g. <i>Scomberomorus</i>, dolphinfish).</li> <li>• The capture of turtles by trolling is rare. The capture of turtles is not legal.</li> <li>• Flyingfish and dolphinfish drive the pelagic fishing activities.</li> <li>• For charter sport fishing vessels, 100 kg per trip and 100 operational days annually for 15 vessels equates to 150 mt per year, of which less than 1.5 mt would be tuna.</li> </ul>	<ul style="list-style-type: none"> <li>• Commercial sport fishing vessel operators, pers. com., February 2010</li> </ul>
<b>Belize</b>	<ul style="list-style-type: none"> <li>• Because of the extensive reef system, there is little offshore fishing by small-scale vessels. There is some gillnetting but this targets <i>Scomberomorus</i>.</li> <li>• Significant sport fishing from resorts.</li> </ul>	Probably less than 10 mt	No info.		<ul style="list-style-type: none"> <li>• S. Singh-Renton, CRFM, pers. com., February 2010</li> <li>• Chakalall and Cochrane (2003)</li> <li>• Mahon (2004)</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Colombia</b>	<ul style="list-style-type: none"> <li>• ICCAT data show that “unclassified” gear has taken 46 to 50 mt annually of yellowfin in recent years.</li> <li>• It is likely that this yellowfin catch is from longliners that target shark – which are not small-scale.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>• Although the country has tuna resources, these are located predominantly on the Pacific coast.</li> </ul>	<ul style="list-style-type: none"> <li>• ICCAT database</li> </ul>
<b>Costa Rica</b>	<ul style="list-style-type: none"> <li>• Very little tuna fishing on the Caribbean coast; some commercial sport fishing.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>• FAO statistics show 10 mt of “tuna-like fishes” captured on the Caribbean coast of Costa Rica. An unknown portion are taken by small-scale fishing.</li> </ul>	<ul style="list-style-type: none"> <li>• FAO/FishStat</li> </ul>
<b>Cuba</b>	<ul style="list-style-type: none"> <li>• According to staff of the Centro de Investigaciones Pesqueras, there is no small-scale fishing for tuna in Cuba. Tuna are caught but the vessels used are greater than 14 m in length and have inboard engines of greater than 150 hp.</li> </ul>	n.a.	n.a.		<ul style="list-style-type: none"> <li>• R. Sanchez, CIP, pers. com., March 2010</li> </ul>
<b>Dominica</b>	<p>FAO statistics indicate that in the mid-2000s the average annual catch of pelagic fish was:</p> <ul style="list-style-type: none"> <li>• about 445 mt;</li> <li>• made up of 33% dolphinfish, 25% yellowfin, 13% blue marlin, 11% blackfin, 9% skipjack and 4% wahoo;</li> <li>• skipjack and yellowfin together averaged about 152 mt, or about 34% of the pelagic troll catch.</li> <li>• Fisheries Division staff indicate that about 400 boats participate in pelagic trolling on a seasonal basis. Dolphinfish is the most common component of the catch, with skipjack/yellowfin making up about one-third of the catch.</li> </ul>	152	293	<p>Tuna and non-tuna catches are the average of annual catches in the mid-2000s, as reported to FAO.</p> <p>Other notable information is:</p> <ul style="list-style-type: none"> <li>• There is no discarding of fish at sea.</li> <li>• Dolphinfish are seasonally captured between November and June.</li> <li>• There are reports of catching some scombrids (blackfin, small skipjack, <i>Auxis</i>) in beach seines.</li> <li>• The recent proliferation of FAD-associated fishing operations may have changed catch composition somewhat.</li> </ul>	<ul style="list-style-type: none"> <li>• FAO/FishStat</li> <li>• Derrick Theophile, Dominica Fisheries Division, pers. com., February 2010</li> <li>• S. Singh-Renton, CRFM, pers. com., February 2010</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Dominican Republic	<ul style="list-style-type: none"> <li>• FAO statistics show that in 2008, 386 tonnes of tuna were caught: 67% yellowfin, 20% bluefin, 13% skipjack.</li> <li>• FAO statistics show that in 2008, 1 006 tonnes of non-tuna pelagics were caught: 32% <i>Scomberomorus</i>, 26% blackfin, plus sailfish, cero and blue marlin.</li> <li>• An unknown portion of the above was taken by small-scale fishing. In view of the active FAD programmes at some ports, it is likely that a large percentage (at least 50%) comes from small-scale fishing.</li> </ul>	At least 200	At least 500	<ul style="list-style-type: none"> <li>• There is a significant amount of commercial sport fishing.</li> <li>• Trolling around FADs by small vessels produces most of the small-scale offshore catch.</li> </ul>	<ul style="list-style-type: none"> <li>• FAO/FishStat</li> <li>• Staff of the Sub-Secretariat of Fisheries in the Dominican Republic</li> </ul>
France (French Guiana, Guadeloupe, Martinique, St. Barthélemy, St. Martin)	<ul style="list-style-type: none"> <li>• In Martinique, small-scale fishing of large pelagic fish (blue marlin, yellowfin and blackfin tuna, dolphinfish and king mackerel), often using FADs, accounts for 3 700 tonnes.</li> <li>• In Guadeloupe, small-scale fishing for large pelagics is important, but no catch data are available. Trolling targets dolphinfish and wahoo, but yellowfin makes up about a quarter of catch around FADs.</li> </ul>	1 000	4 000	<ul style="list-style-type: none"> <li>• Trolling around FADs in Martinique produces about 29% blackfin tuna.</li> <li>• Trolling around FADs in Guadeloupe produces about 25% yellowfin.</li> <li>• 600 small vessels in the Martinique/Guadeloupe FAD fisheries.</li> <li>• Catch estimate to left should be considered crude.</li> <li>• In French Guiana, due to influence of the Amazon, likely to be very little tuna fishing.</li> </ul>	<ul style="list-style-type: none"> <li>• Taquet <i>et al.</i> (2000)</li> <li>• EC (2006a)</li> <li>• EC (2006b)</li> <li>• Diaz <i>et al.</i> (2002)</li> <li>• Doray <i>et al.</i> (2002)</li> <li>• S. Singh-Renton, CRFM, pers. com., February 2010</li> </ul>
Grenada	<ul style="list-style-type: none"> <li>• In the five-year period 2005–2009, an annual average of 1 349 tonnes of yellowfin and bigeye was caught by longline in Grenada (98% yellowfin).</li> <li>• Fisheries Department staff estimate that about 40% of this 1 349 tonnes, or about 540 tonnes, of yellowfin/bigeye comes from small-scale longlining.</li> </ul>	540	316	<ul style="list-style-type: none"> <li>• Three types of longliners operate from Grenada: (1) open pirogues are semi-decked, wooden, 5–7 m in length, powered by a single 15–40 hp outboard engine; (2) cabin pirogues, made from wood and/or fibreglass are 7–9 m in length, powered by two 40–75 hp outboard engines; and (3) vessels from wood and fibreglass, 9–15 m in length, and powered by a 130–300 hp inboard engine. For the purpose of the present study, type #1 and type #2 longliners are considered “small-scale”. In early 2010 there were about 270 type #1 and #2 longliners, mainly on the west coast.</li> </ul>	<ul style="list-style-type: none"> <li>• Grant <i>et al.</i> (2007)</li> <li>• Grenada Fisheries Dept., unpublished data</li> <li>• R. Baldeo, Grenada Fisheries Dept., pers. com., March 2010</li> <li>• FAO Fishery Country Profile</li> <li>• S. Singh-Renton, CRFM, pers. com., February 2010</li> <li>• ICCAT data</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Grenada, cont.</b>	<ul style="list-style-type: none"> <li>The non-tuna catch of small-scale longlining averaged 316 tonnes annually over the 2005–2009 period and consisted of sailfish/marlins (199 tonnes), blackfin (77 tonnes) and shark/other (40 tonnes).</li> </ul>	17	256, plus non-ICCAT species	<ul style="list-style-type: none"> <li>There is also a fleet of about 140 outboard-powered troll vessels, mainly on the east coast. These vessels catch wahoo, small tunas, dolphinfish, juvenile yellowfin and <i>Scorberomorus</i>. ICCAT data (which lists only species covered by ICCAT) shows that in the six-year period 2003–2008, the troll fleet caught an annual average of 273 tonnes, including 17 tonnes of tuna (mostly skipjack).</li> <li>There are reports of catching some scombrids (blackfin, small skipjack, <i>Auxis</i>) in beach seines.</li> </ul>	
<b>Guatemala</b>	<ul style="list-style-type: none"> <li>ICCAT database shows only purse seining activity.</li> <li>Little, if any, small-scale tuna fishing on Caribbean coast.</li> </ul>	n.a.	n.a.		<ul style="list-style-type: none"> <li>ICCAT database</li> </ul>
<b>Guyana</b>	<ul style="list-style-type: none"> <li>No directed tuna fishing, but pelagic gillnetting is undertaken.</li> <li>ICCAT database shows no tuna caught in gillnetting.</li> </ul>	n.a.	n.a.		<ul style="list-style-type: none"> <li>ICCAT database</li> <li>Descriptions by staff of FAO Subregional Office for the Caribbean</li> </ul>
<b>Haiti</b>	<ul style="list-style-type: none"> <li>Considerable trolling for large pelagics around FADs by small vessels that are powered by outboards or oars.</li> </ul>	At least 200	At least 500	<ul style="list-style-type: none"> <li>Tuna fishing activity is likely to bear some similarity to that of the Dominican Republic.</li> <li>For the purpose of this study, catches by small-scale fishing are assumed to be the same as for the Dominican Republic.</li> </ul>	<ul style="list-style-type: none"> <li>R. Lee, FAO, pers. com., March 2010</li> </ul>
<b>Honduras</b>	<ul style="list-style-type: none"> <li>ICCAT database does not show any small-scale fishing activity.</li> <li>Some sport fishing reported.</li> </ul>	Likely to be less than 10 mt per year	No info.		<ul style="list-style-type: none"> <li>ICCAT database, sport fishing Web sites</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Jamaica</b>	<ul style="list-style-type: none"> <li>• CRFM staff indicate that the small-scale tuna fishing in Jamaica is similar to that of Antigua – in which a substantial amount of large pelagics are caught by sport fishing vessels.</li> <li>• There are about 75 commercial sport fishing vessels.</li> <li>• A 1998 survey indicates that about 600 vessels are involved in fishing for large pelagics.</li> </ul>	600	No info.		<ul style="list-style-type: none"> <li>• Mahon (2004)</li> <li>• R. Mahon, UWI, pers. com., April 2010</li> <li>• S. Singh-Renton, CRFM, pers. com., February 2010</li> <li>• Grant et al. (1998)</li> </ul>
<b>Mexico</b>	<ul style="list-style-type: none"> <li>• According to the ICCAT database, all tuna taken on the Caribbean and Gulf of Mexico coasts of the country is by longlining.</li> <li>• For the purpose of this study, it will be assumed that no longlining is in the category of small-scale – and that all tuna catches by small-scale fishing activity are from sport fishing.</li> <li>• Some 3 500 sport fishing vessels are registered along Mexico's coast on the Gulf of Mexico and the Caribbean.</li> </ul>	Likely to be significant, but very difficult to estimate	No data, but likely to be much greater than tuna catch	<ul style="list-style-type: none"> <li>• The typical longliner is greater than 10 GT and carries from 6 to 18 crew.</li> <li>• Targets of sport fishing in the Gulf of Mexico and the Caribbean are mainly billfishes, dolphinfish and Atlantic tarpon.</li> </ul>	<ul style="list-style-type: none"> <li>• ICCAT database</li> <li>• S. Singh-Renton, CRFM, pers. com., February 2010</li> <li>• FAO Fishery Country Profile Solana-Sansores, R. and K. Ramírez-López (2006)</li> </ul>
<b>Nicaragua</b>	<ul style="list-style-type: none"> <li>• Little, if any.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>• Zero unloading of tuna recorded in 2000 for Caribbean coast.</li> </ul>	<ul style="list-style-type: none"> <li>• Rivera (2001)</li> </ul>
<b>Panama</b>	<ul style="list-style-type: none"> <li>• According to the FAO Fishery Country Profile, 95% of the fishing activity in the country occurs on the Pacific side. What little artisanal fishing occurring on the Caribbean side is predominantly focused on lobster, octopus, crab and shrimp.</li> </ul>	n.a.	n.a.		<ul style="list-style-type: none"> <li>• FAO Fishery Country Profile</li> </ul>



Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Saint Kitts and Nevis</b>	<ul style="list-style-type: none"> <li>Vessels used in pelagic fishing are 16 to 40 feet in length (equivalent to 4.8–12.2 m), powered by outboards ranging from 40 to 250 hp. Most pelagic fish are taken by trolling around FADs.</li> <li>In 2003, 44 tonnes of “tuna and mackerel” and 44 tonnes of dolphinfish were landed.</li> </ul>	44 (less the mackerel component, see column to left)	44 (plus the mackerel component)	<ul style="list-style-type: none"> <li>Catch were last reported to ICCAT in 2005.</li> </ul>	<ul style="list-style-type: none"> <li>Unpublished data of Statistics Division (St. Kitts) and Fisheries Unit (Nevis)</li> <li>FAO Fishery Country Profile</li> <li>ICCAT database</li> </ul>
<b>Saint Lucia</b>	<ul style="list-style-type: none"> <li>Tunas are caught by small-scale fishing using troll and longline gear from outboard-powered vessels from 5 to 9 m in length.</li> <li>According to ICCAT statistics, in 2008 the troll catch was 276 tonnes of tuna (61% skipjack, 38% yellowfin) and 432 tonnes of non-tuna (41% blackfin, 40% wahoo, 16% blue marlin).</li> <li>There are reports of catching some scombrids (blackfin, small skipjack, <i>Auxis</i>) in beach seines.</li> </ul>	276	432	<ul style="list-style-type: none"> <li>In the ICCAT statistics, it is not possible to identify the catches of tuna by sport fishing and small-scale longlining. According to CRFM sources, the country does not collect data on sport fishing.</li> <li>It is possible that the “troll” data in the columns to the left also contain the catches by other gears (i.e longline). This contention is reinforced by the fact that the FAO catch data for all pelagic species for 2008 are identical to that for the ICCAT “troll” gear.</li> <li>The FAO Profile indicates that offshore pelagic fishing takes pilot whales and dolphins. In the profile, one of the stated objectives of the management of the offshore pelagic fishery is the “maintenance of the traditional cetacean fishery”.</li> </ul>	<ul style="list-style-type: none"> <li>FAO Fishery Country Profile</li> <li>ICCAT database</li> <li>FAO/FishStat</li> <li>S. Singh-Renton, CRFM, pers. com., February 2010</li> </ul>
<b>Saint Vincent and the Grenadines</b>	<p>Data reported to ICCAT shows that troll gear produced:</p> <ul style="list-style-type: none"> <li>In 2006, 47 mt of yellowfin, 147 mt of skipjack, along with 60 mt of wahoo, sarda, sharks, billfish and other large pelagics.</li> <li>In 2007, 18 mt of yellowfin, 88 mt of skipjack, along with 37 mt of wahoo, sarda, sharks, billfish and other large pelagics.</li> <li>In 2008, 15 mt of yellowfin, 83 mt of skipjack, along with 58 mt of wahoo, sarda, sharks, billfish and other large pelagics.</li> </ul>	132 (see below)	52 (see below)	<ul style="list-style-type: none"> <li>Tuna catch and non-tuna catch are average of 2006 to 2008. Other information related to the ICCAT data: <ul style="list-style-type: none"> <li>Amount of discards, if any, is not given in the ICCAT database.</li> <li>Amount of fish other than those large pelagics reported to ICCAT is not given in the ICCAT database.</li> <li>It is assumed that all troll catches reported to ICCAT are made by small-scale fisheries.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>ICCAT database</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<p><b>Saint Vincent and the Grenadines, cont.</b></p>	<p>According to the St. Vincent Fisheries Division, there are about 500 active troll vessels (non-decked, outboard-powered and between 6 and 10 m in length). In recent years, approximate annual catches from those vessels by trolling have been 388 mt, made up of:</p> <ul style="list-style-type: none"> <li>• Dolphinfish, 35%, 136 mt</li> <li>• <i>Scomberomorus</i>, 35%, 136 mt</li> <li>• Skipjack, 20%, 77 mt</li> <li>• Other fish, 10%, 39 mt; this category includes small yellowfin, blackfin tuna, sharks and billfish.</li> </ul>	80	308	<p>Tuna catch and non-tuna catch are the average of recent years. Other notable information is:</p> <ul style="list-style-type: none"> <li>• Trolling for large pelagics occurs for about half of the year, with the vessels doing bottom fishing during the other months.</li> <li>• Trolling around FADs is not very significant because of reasonable success w/o FADs and because of poor longevity of FADs that have been tried.</li> <li>• Beach seining produces large amounts of fish and occasionally some large pelagic fish in August–September.</li> <li>• The “sarda” of the ICCAT reports is probably blackfin tuna (local name is bonito).</li> <li>• There are two commercial sport fishing operations.</li> <li>• Usually only rays are discarded at sea; sometimes sharks when catches are good.</li> <li>• Turtles are sometimes taken by fishing operations (there is an open season August–February), but not by pelagic trolling. They are taken by fishing near the coast.</li> </ul>	<ul style="list-style-type: none"> <li>• L. Streker, St. Vincent Fisheries Division, pers. com., February 2010</li> <li>• S. Singh-Renton, CRFM, pers. com., February 2010</li> </ul>
<p><b>Suriname</b></p>	<ul style="list-style-type: none"> <li>• Fishing conditions similar to Guyana and French Guiana. Due to influence of large river systems, there is likely to be very little tuna fishing.</li> </ul>	n.a.	n.a.		<ul style="list-style-type: none"> <li>• Descriptions by staff of FAO Subregional Office for the Caribbean</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Netherlands (Aruba, Bonaire, Curaçao, Saba, Sint Eustatius, Sint Maarten)	<ul style="list-style-type: none"> <li>An estimate in 2003 indicated the annual small-scale troll catch of tuna in the former Netherlands Antilles to be about 60 tonnes.</li> <li>A sampling of species obtained in pelagic fishing showed: wahoo (13.1%), flyingfish (11.7%), tuna (11.1%), rainbow runner (6.3%) and dolphinfish (3.6%).</li> </ul>	60	540	<ul style="list-style-type: none"> <li>An FAO report states: "There is no clear distinction between target species and bycatch. Fish with the highest market value include wahoo, dorado, etc. Less desired fish species are shark, marlin and tuna.</li> <li>A description of fisheries on St. Maarten indicates only 30 fishers; there is no mention of fishing for large pelagics.</li> </ul>	<ul style="list-style-type: none"> <li>Dilrosun (2002)</li> <li>Die (2003)</li> <li>Gillett (2005)</li> </ul>
Trinidad and Tobago	<ul style="list-style-type: none"> <li>ICCAT data shows 2.5 tonnes of pelagic fish (including .05 tonnes of tuna) caught by rod-and-reel gear in 2008.</li> </ul>	Probably less than 25 mt annually	No info.	<ul style="list-style-type: none"> <li>Large number of open outboard-powered boats.</li> <li>Pelagic fishing targets wahoo, <i>Scorberomorus</i> and sharks, but tuna are not often caught.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>Gillett (2005)</li> </ul>
United Kingdom – Bermuda	<ul style="list-style-type: none"> <li>Sport fishing is quite important.</li> <li>During the five-year period 2004–2008, an annual average of 160 tonnes of fish was landed, presumably by pelagic sport fishing. Of this 160 tonnes, 45 tonnes were tuna (almost all yellowfin). The non-tuna catch (115 tonnes) was 86% wahoo and 5% Atlantic black skipjack.</li> </ul>	45	115		<ul style="list-style-type: none"> <li>FAO/FishStat</li> </ul>
United Kingdom – Virgin Islands	<ul style="list-style-type: none"> <li>Recreational sport fishing is significant, but little, if any, small-scale tuna fishing – most artisanal fishing is carried out on the shelf.</li> </ul>	Probably less than 5 mt annually	No info.		<ul style="list-style-type: none"> <li>S. Singh-Renton, CRFM, pers. com., February 2010</li> </ul>
Other United Kingdom possessions in the tropical Western Atlantic (Anguilla, Cayman Islands, Montserrat, Turks and Caicos Islands)	<ul style="list-style-type: none"> <li>Likely to be quite small and mostly limited to the by-catch of other types of small-scale fishing activities and sport fishing.</li> </ul>	Probably less than 5 mt annually	No info.		<ul style="list-style-type: none"> <li>Descriptions by staff of FAO Subregional Office for the Caribbean.</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<p><b>United States (Western Tropical Atlantic)</b></p>	<ul style="list-style-type: none"> <li>According to ICCAT data, in the three-year period 2006–2008, the average annual catch of species covered by ICCAT from:               <ul style="list-style-type: none"> <li>- handlining was 35 tonnes, of which tuna was 60%;</li> <li>- rod-and-reel was 121 tonnes, of which tuna was 11%;</li> <li>- gillnet was less than 1 tonne.</li> </ul> </li> </ul>	<p>21</p> <p>13</p>	<p>14</p> <p>108</p>		<ul style="list-style-type: none"> <li>ICCAT data</li> </ul>
<p><b>Venezuela (Bolivarian Republic of)</b></p>	<ul style="list-style-type: none"> <li>According to ICCAT data, during the three-year period 2006–2008, an annual average of 370 tonnes of fish was landed by artisanal gillnet vessels. About 2.5% of the gillnet catch was tuna. Blue marlin and Atlantic sailfish made up most of the non-tuna catch.</li> </ul>	<p>2</p>	<p>72</p>	<ul style="list-style-type: none"> <li>There are two types of artisanal gillnet vessels: (1) about 35 small gillnet vessels (7–10 m) take daily trips; and (2) about 70–75 vessels of 9–14 m take 5–20 day trips, use handlines and pelagic longlines with 400–600 hooks.</li> <li>Although it is not known how much of the gillnet catches reported to ICCAT are from type #1 longliners (assumed to be small-scale), for the purpose of the present study, 20% of the gillnet catches reported to ICCAT are taken to be from small-scale vessels.</li> <li>Although there is longlining from small-scale vessels, tuna is not reported among the top 10 species captured.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>Gillett (2005)</li> <li>Wildermann <i>et al.</i> (2009)</li> </ul>

## Appendix 3 – Non-Caribbean areas of the Western Atlantic

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Argentina	<ul style="list-style-type: none"> <li>Because of the Argentine continental shelf, there is probably little, if any, tuna fishing from small vessels</li> </ul>	n.a.	n.a.		
Brazil	<p>According to ICCAT data, handline and sport fishing produced:</p> <ul style="list-style-type: none"> <li>In 2008, 26 tonnes of tuna and 29 tonnes of non-tuna species (93% other species of tunas).</li> <li>In 2007, 34 tonnes of tuna and 77 tonnes of non-tuna species (75% other species of tunas).</li> <li>In 2006, 34 tonnes of tuna and 22 tonnes of non-tuna species (37% other species of tuna, 28% sharks).</li> </ul> <p>According to F. Hazin:</p> <ul style="list-style-type: none"> <li>The small-scale artisanal fisheries (using vessels that are fully or partially undecked, with outboard engines or sails) for tuna and tuna-like species is mainly located in the north and northeast regions of the Brazilian coast.</li> <li>Species of the genus <i>Thunnus</i>, mainly the yellowfin tuna, <i>Thunnus albacares</i>, are caught by handline and small longlines. The total yearly catch of the species of this genus, considering only those fisheries using vessels that are fully or partially undecked, is about 500 tonnes, about one fourth of which is composed by the blackfin tuna caught mainly in the State of Rio Grande do Norte (around 5° south latitude).</li> </ul>	400	1 500	<p>These catches are the averages of 2006–2008:</p> <ul style="list-style-type: none"> <li>A previous study, Gillett (2005), estimated that “artisanal fisheries” catch about 2 000 mt of the principal market species of tuna. It is unknown how much “small-scale fishing” (as defined in the present study) is included in this “artisanal fishing” category.</li> <li>According to ICCAT documentation, in 2008 all Brazilian baitboats were greater than 20 m.</li> <li>According to ICCAT documentation, in 2008 62 longline vessels out of a fleet of 95 vessels were under 20 m. It is not apparent from that data how many, if any, longliners were small-scale.</li> <li>In the ICCAT database, only the categories of handline and sport fishing appear to be wholly in the category of small-scale.</li> </ul> <p>Bugoni <i>et al.</i> (2008) study the fishing activities of the Itaipava fleet in southeastern Brazil:</p> <ul style="list-style-type: none"> <li>The fleet is composed of 497 vessels and deploys hooks from 18°S to 35°S.</li> <li>Seven fisheries were defined, including some that could be small-scale (type of vessels not described): fast trolling for tuna and tuna-like species, slow trolling for bigeye tuna, handlining, surface longline for dolphinfish.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>Gillett (2005)</li> <li>Bugoni <i>et al.</i> (2008)</li> <li>F. Hazin, Universidade Federal Rural de Pernambuco, pers. com., April 2010</li> </ul>

n.a. = not available

pers. com. = personal communication

mt = tonnes

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Brazil, cont.	<ul style="list-style-type: none"> <li>Dolphinfish (yearly production of about 5 000 tonnes) and bonitos (yearly production of about 1 500 tonnes), are also important components of the catch, although, as for the mackerels, a significant portion of these figures come from more sophisticated artisanal vessels which are decked and have inboard engines.</li> </ul>			<ul style="list-style-type: none"> <li>Capture rates were higher for the surface longline for dolphinfish (0.15 birds/1 000 hooks) and 1.08 turtles/1 000 hooks); slow trolling for bigeye tuna (0.41 birds/day); and handlining targeting yellowfin tuna (0.61 birds/day). Total catch of tunas and bycatch not given.</li> </ul>	
Canada	<p>According to ICCAT data, harpoon, rod and reel, tended line and trap net gear produced:</p> <ul style="list-style-type: none"> <li>In 2008, 570 tonnes of tuna and 259 tonnes of non-tuna (99% swordfish).</li> <li>In 2007, 442 tonnes of tuna and 272 tonnes of non-tuna (98% swordfish).</li> <li>In 2006, 727 tonnes of tuna and 204 tonnes of non-tuna (99% swordfish).</li> </ul>	580	245	<p>These catches are the averages of 2006–2008.</p> <ul style="list-style-type: none"> <li>The standard bluefin tuna boat is an east coast lobster boat: “partially undecked”, highly powered, 45 feet in length (equivalent to 13.7 m), and uses rod-and-reel gear.</li> <li>Among the various gear types reported to ICCAT, catches include that made by harpoon, rod-and-reel, tended line and trap net. For the purpose of the present study, all these gear types are considered small-scale.</li> </ul>	<ul style="list-style-type: none"> <li>D. Aldous, pers. com., March 2010</li> <li>ICCAT database</li> </ul>
St. Pierre and Miquelon	<ul style="list-style-type: none"> <li>Only catches by longline gear reported to ICCAT in recent years.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>The last tuna caught by small-scale fishing gear was by sport fishing (1 tonne) more than decade ago.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT database</li> </ul>
United Kingdom – Bermuda	<ul style="list-style-type: none"> <li>Sport fishing is quite important.</li> <li>During the five-year period 2004–2008, an annual average of 160 tonnes of fish was landed, presumably by pelagic sport fishing. Of this, 45 tonnes were tuna (almost all yellowfin). The non-tuna catch (115 tonnes) was 86% wahoo and 5% Atlantic black skipjack.</li> </ul>	45	115		<ul style="list-style-type: none"> <li>FAO/FishStat</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Uruguay	<ul style="list-style-type: none"> <li>No information on any small-scale tuna fishing.</li> <li>It is assumed that little, if any, occurs.</li> </ul>			<p>Because the Uruguayan longline fleet operates 100–200 miles (equivalent to 160.9–321.8 km) from the coast, it is assumed that no longliner is small-scale.</p>	<ul style="list-style-type: none"> <li>Mora and Domingo (2006)</li> </ul>
United States (Northwest Atlantic)	<p>According to ICCAT data, harpoon, handline, rod and reel, troll and trap net gear produced:</p> <ul style="list-style-type: none"> <li>In 2008, 1 645 tonnes of tuna and 3 583 tonnes of non-tuna (62% <i>Scomberomorus</i>, 17% black skipjack).</li> <li>In 2007, 4 074 tonnes of tuna and 14 773 tonnes of non-tuna (87% <i>Scomberomorus</i>).</li> <li>In 2006, 5 927 tonnes of tuna and 2 623 tonnes of non-tuna (56% <i>Scomberomorus</i>, 9% blackfin).</li> </ul>	3 882	6 993	<p>These catches are the averages of 2006–2008.</p> <ul style="list-style-type: none"> <li>Among the various gear types reported to ICCAT, catches include those made by harpoon, handline, rod and reel, troll and trap net. For the purpose of the present study, all these gear types are considered small-scale.</li> </ul>	
United States (Gulf of Mexico)	<p>According to ICCAT data, handline, rod and reel, troll and trap net gear produced:</p> <ul style="list-style-type: none"> <li>In 2008, 394 tonnes of tuna and 1 535 tonnes of non-tuna (37% <i>Scomberomorus</i>, 31% black skipjack).</li> <li>In 2007, 278 tonnes of tuna and 1 536 tonnes of non-tuna (52% <i>Scomberomorus</i>, 29% black skipjack).</li> <li>In 2006, 341 tonnes of tuna and 1 718 tonnes of non-tuna (69% <i>Scomberomorus</i>, 25% black skipjack).</li> </ul>	538	1 594	<p>These catches are the averages of 2006–2008.</p> <ul style="list-style-type: none"> <li>Among the various gear types reported to ICCAT, catches include those made by handline, rod and reel, troll and trap net. For the purpose of the present study, all these gear types are considered small-scale.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT database</li> </ul>





## Appendix 4 – West Africa

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Angola</b>	<ul style="list-style-type: none"> <li>Pelagic fishing by artisanal vessels does not catch tuna but is limited to Scomber, Euthynnus and Sarda. Catches by handline and driftnets is limited to these same species.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>Vessels under 14 m are considered artisanal.</li> </ul>	<ul style="list-style-type: none"> <li>Nsilulu (2007)</li> <li>Kebe <i>et al.</i> (2006)</li> </ul>
<b>Benin</b>	<ul style="list-style-type: none"> <li>No tuna catches by any kind of fishing reported to ICCAT in the past 10 years.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>Most artisanal fishing is within 5 miles (equivalent to 8 km) of the coast but the continental shelf extends out to about 12 miles (19.3 km).</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT database</li> <li>FAO Fishery Country Profile</li> </ul>
<b>Cameroon</b>	<ul style="list-style-type: none"> <li>No tuna fishing has been reported to ICCAT.</li> </ul>			<ul style="list-style-type: none"> <li>Most small-scale marine fishing takes place within 3 miles (equivalent to 4.8 km) of estuaries, where catching tuna is unlikely. Shrimp and sardinella fisheries predominate.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT database</li> </ul>
<b>Cape Verde</b>	<p>According to ICCAT data, artisanal handline produced:</p> <ul style="list-style-type: none"> <li>In 2008, 1 140 tonnes of tuna and 401 tonnes of non-tuna species (100% wahoo).</li> <li>In 2007, 1 240 tonnes of tuna and 401 tonnes of non-tuna species (100% wahoo).</li> <li>In 2006, 1 846 tonnes of tuna and 503 tonnes of non-tuna species (100% wahoo).</li> </ul>	1 409	435	<p>These catches are the averages of 2006–2008.</p> <ul style="list-style-type: none"> <li>Handlines are used to catch tuna by artisanal fishing, while pole and line is used by semi-industrial and industrial fishing.</li> <li>Sport fishing is not very developed, but it is gradually increasing.</li> <li>In 2005, the artisanal fleet available to fish for tuna consisted of 270 non-motorized and 766 motorized canoes. These canoes carry a total of three crew.</li> <li>There are targeted shark fisheries and a small amount of sport fishing (both of which apparently catch some tuna).</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT database</li> <li>Kebe <i>et al.</i> (2006)</li> <li>Marques da Silva Monteiro (2008), (2009)</li> <li>R. Lee, FAO, pers. com., March 2010</li> <li>P. Pallares, ICCAT, pers. com., February 2010</li> </ul>

n.a. = not available  
pers. com. = personal communication  
mt = tonnes

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Congo	<ul style="list-style-type: none"> <li>No tuna fishing reported to ICCAT in recent years.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>Although there are significant artisanal marine fisheries using large canoes (many fishers originate from Ghana and Togo), sardinella and demersal species are targeted.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT database</li> <li>FAO Fishery Country Profile</li> </ul>
Côte d'Ivoire	<p>According to ICCAT data, gillnetting produced:</p> <ul style="list-style-type: none"> <li>In 2008, 9 624 tonnes of tuna and 6 537 tonnes of non-tuna species (52% non-principal market species of tuna, 26% <i>Euthynnus</i>).</li> <li>In 2007, 2 033 tonnes of tuna and 836 tonnes of non-tuna species (48% <i>Euthynnus</i>, 18% blue marlin).</li> <li>In 2006, 2 048 tonnes of tuna and 825 tonnes of non-tuna species (36% <i>Euthynnus</i>, 22% blue marlin, 21% frigate tuna).</li> </ul>	4 568	2 733	<p>These catches are the averages of 2006–2008.</p> <ul style="list-style-type: none"> <li>There is an artisanal fishery off the Ivorian continental shelf that exploits tunas and other large pelagics.</li> <li>This is a driftnet canoe fishery that started in 1984. Since 1988, this artisanal fishery has been regularly monitored.</li> <li>The principal groups of fish landed are billfish (sailfish and marlins), swordfish, sharks and small tunas.</li> <li>The capture of sea turtles (<i>Chelonia mydas</i>, <i>Dermochelys coriacea</i>) and some dolphins are reported.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>Ngoran and Kothias (2005)</li> <li>Konan and Rene (2009)</li> </ul>
Democratic Republic of the Congo	<ul style="list-style-type: none"> <li>No tuna fishing reported to ICCAT in recent years.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>The coastline is very short, about 40 km (160 km if the river mouth of Congo is included). This leads to a very small exclusive economic zone (EEZ) compared with the other African coastal countries. Furthermore, much of the small EEZ is reserved for oil production.</li> <li>What little marine artisanal fishing that occurs targets nearshore species.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT database</li> <li>FAO Fishery Country Profile</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Equatorial Guinea</b>	<ul style="list-style-type: none"> <li>No tuna fishing reported in the country to ICCAT in recent years.</li> <li>For the purpose of the present study, due to the scarcity of information, the annual landings of tuna and non-tuna will be assumed to be twice that of the Ada (2008) review.</li> </ul>	100	100	<ul style="list-style-type: none"> <li>Small-scale fishers typically fish from canoes within four nautical miles of the coast and target sardinella and <i>Ethmalosa</i> spp.</li> <li>No system in the country for collecting information on fishing activities.</li> <li>Some tuna caught by trolling from small canoes.</li> <li>A review (Ada 2008) gives the landings by pelagic fishing in the “maritime zone of Annobon” for the first six months of 2006 as 51 tonnes of tuna and 51 tonnes of non-tuna (increasing order: sharks, barracuda, seerfish and sailfish).</li> </ul>	<ul style="list-style-type: none"> <li>Kebe <i>et al.</i> (2006)</li> <li>ICCAT database</li> <li>Ada (2008)</li> </ul>
<b>Gabon</b>	<ul style="list-style-type: none"> <li>According to ICCAT data, no catches of tuna by gear that is likely to be small-scale have been reported since 2003.</li> <li>For the purpose of the present study, it is assumed that annual catches of tuna and non-tuna are 1 000 tonnes, about half of which is tuna.</li> </ul>	500	500	<ul style="list-style-type: none"> <li>The capture of tuna and related species forms not more than 10% of the entire catch of the marine artisanal fisheries.</li> <li>In 2006, the fish catch of marine artisanal fisheries was 22 086 tonnes (36 tonnes of marine turtles were also reportedly captured).</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT database</li> <li>Kebe <i>et al.</i> (2006)</li> <li>FAO Fishery Country Profile</li> </ul>
<b>Gambia</b>	<ul style="list-style-type: none"> <li>Data reported to FAO shows that an annual average of about a half tonne of yellowfin was taken in the period 2004–2008.</li> </ul>	0.5	n.a.	<ul style="list-style-type: none"> <li>Gambia is a small country stretching along the banks of the Gambia River, and has only a short marine coastline. The marine fisheries resources are greatly influenced by the freshwater flow from the river, and hence large tuna catches would not be expected nearshore.</li> <li>Most reported tuna catches are likely to be from sport fishing.</li> </ul>	<ul style="list-style-type: none"> <li>FAO/FishStat</li> <li><a href="http://www.accessgambia.com">www.accessgambia.com</a></li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Ghana</b>	<ul style="list-style-type: none"> <li>Annual reports by Ghana to ICCAT make no mention of any small-scale fishing activity.</li> <li>For the purpose of the present study, it is assumed that annual catches of tuna and non-tuna are 200 tonnes, about half of which is tuna.</li> </ul>	100	100	<ul style="list-style-type: none"> <li>Fonteneau and Marcille (1993) report a very active artisanal tuna fishery: “multiple fishing gears: ringnets, gillnets, trawlers, beach seines, etc. It is stated that “the artisanal fleets of Ghana are probably among the most ancient to have exploited Atlantic intertropical tuna”.</li> <li>Obeng (2003) indicates that both troll and handline gear are used by artisanal fisheries to catch yellowfin, but the total catches of these gears is small.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT database</li> <li>Fonteneau and Marcille (1993)</li> <li>Government of Ghana (2009)</li> <li>Obeng (2003)</li> <li>A. Fonteneau, pers. com., February 2010</li> </ul>
<b>Guinea</b>	<ul style="list-style-type: none"> <li>Camara (2007) states: “In Guinea, the tuna fishery is exclusively industrial and foreign. While there is no specialized artisanal fleet, some tuna species and small tunas (all species mixed) are regularly landed by artisanal fishers.”</li> <li>For the purpose of the present study, it is assumed that the annual capture of tuna by small-scale fishing is about 100 tonnes, with the understanding that the amount of non-tuna species captured is likely to be much larger.</li> </ul>	100	n.a.	<ul style="list-style-type: none"> <li>A fairly recent development is the establishment of a longline fishery for shark.</li> <li>The shark fishery and perhaps the gillnet fisheries (e.g. bonga shad fishing) are likely to take at least some tuna.</li> <li>None of the shark catches are reported to ICCAT.</li> <li>From the readily available information, it appears to be a situation that for small-scale fishing, tuna is a minor bycatch in fisheries for other types of fish – and no targeting of tuna occurs.</li> </ul>	<ul style="list-style-type: none"> <li>Camara (2007)</li> <li>Kebe <i>et al.</i> (2006)</li> <li>FAO Fishery Country Profile</li> </ul>
<b>Guinea-Bissau</b>	<ul style="list-style-type: none"> <li>No data reported to ICCAT in the last decade</li> </ul>	n.a.	n.a.	<p>According to the FAO Fishery Profile:</p> <ul style="list-style-type: none"> <li>In the artisanal sector (fishing using vessels up to 60 hp), there are 107 fishing vessels in the archipelago, 29 of which are motorized.</li> <li>Tuna is not specifically mentioned in the information on catches nor as a development prospect.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>FAO Fishery Country Profile</li> </ul>
<b>Liberia</b>	<ul style="list-style-type: none"> <li>There is an active marine artisanal fishery by both indigenous Kru fishers and Fanti fishers of Ghanaian descent, but tuna are apparently not targeted.</li> <li>Catch of tuna by small-scale fishing assumed to be zero.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>ICCAT data show about 270 tonnes annually of billfish taken by gillnet fishing during past decade, but no tuna reported.</li> <li>In the FAO Fishery Profile, no tuna species is cited as a major resource.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>FAO Fishery Country Profile</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Mauritania</b>	<ul style="list-style-type: none"> <li>• ICCAT data does not show any tuna catches from this country.</li> <li>• There is an active marine artisanal fishery (10 000 fishers; 3 000 canoes) but tuna are apparently not targeted.</li> </ul>	n.a.	n.a.		<ul style="list-style-type: none"> <li>• ICCAT data</li> <li>• FAO Fishery Country Profile</li> </ul>
<b>Morocco</b>	<p>According to ICCAT data, handlining produced:</p> <ul style="list-style-type: none"> <li>• In 2008, 150 tonnes of tuna and 307 tonnes of non-tuna species (92% <i>Sarda</i>);</li> <li>• In 2007, 179 tonnes of tuna and 187 tonnes of non-tuna species (95% <i>Sarda</i>);</li> <li>• In 2006, 556 tonnes of tuna and 250 tonnes of non-tuna species (96% <i>Sarda</i>).</li> </ul>	295	248	<p>These catches are the averages of 2006–2008.</p> <ul style="list-style-type: none"> <li>• Tuna are caught in Morocco by several gears, including handlines, driftnets and traps.</li> <li>• For the purpose of the present study, only the handlines are considered small-scale. This is because the driftnets are used from vessels 14–16 m in length and (as explained in the introduction to this study) traps are not considered small-scale due to the physical size of many traps.</li> <li>• According to El Ktiri and Idrissi (2009), the vessels involved in handlining tuna are less than 7 m in length. The catches by handline gear from the Mediterranean coast are not included in the two columns to the left.</li> <li>• It should be noted that the ICCAT data in the column to the immediate left does not include sharks. Shark capture data are aggregated by all gears and both coasts – so it is not possible to identify the amount of shark capture by small-scale gear (i.e. handline) in the ICCAT data.</li> </ul>	<ul style="list-style-type: none"> <li>• ICCAT data</li> <li>• El Ktiri and Idrissi (2009)</li> <li>• A. Fonteneau, pers. com., February 2010</li> </ul>
<b>Namibia</b>	<ul style="list-style-type: none"> <li>• No small-scale tuna fishing.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>• There is very little artisanal fishing in Namibia. The tuna are fairly well offshore as a result of the cold current near the coast and, although there are a few locally-based tuna longliners, they are not in the small-scale category.</li> </ul>	<ul style="list-style-type: none"> <li>• M. Batty, pers. com., April 2010</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Nigeria	<ul style="list-style-type: none"> <li>No tuna catches reported to ICCAT since 1996.</li> <li>Apparently, little tuna is captured by small-scale fishing activity.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>Although there is substantial gillnetting targeting sharks, this fishing usually takes place in relatively shallow water (25 to 100 m depth) so tuna unlikely to be often taken.</li> <li>Data reported by Nigeria to FAO shows an annual average of about 250 tonnes of "tuna-like fishes, not elsewhere included" for the years 2004–2008.</li> <li>According to the FAO Fishery Profile, the artisanal canoe fleet exploits coastal waters up to five nautical miles from shore, targeting small pelagics (<i>Sardinella</i> spp. and <i>Ethmalosa</i> spp.).</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>Solarin <i>et al.</i> (2009)</li> <li>FAO Fishery Country Profile</li> </ul>
Saint Helena (United Kingdom)	<p>According to ICCAT data, fishing by rod and reel produced:</p> <ul style="list-style-type: none"> <li>In 2008, 173 tonnes of tuna.</li> <li>In 2007, 117 tonnes of tuna.</li> <li>In 2006, 88 tonnes of tuna.</li> </ul>	126	n.a.	<p>These catches are the averages of 2006–2008.</p> <ul style="list-style-type: none"> <li>No non-tuna is reported for those years.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> </ul>
Sao Tome and Principe	<ul style="list-style-type: none"> <li>Data reported to ICCAT for recent years does not appear to be complete (e.g. only trolling for swordfish in 2008).</li> <li>Estimate of catches in column to right based on Anibal (2008) and assumes that only troll and handline gear is in the category of small-scale.</li> <li>In 2005, troll gear produced 1 tonne of tuna and 468 tonnes of other species (43% sailfish, 29% swordfish).</li> <li>In 2005, handline gear produced 12 tonnes of tuna and 285 tonnes of other species (50% sharks, 37% sailfish).</li> </ul>	13	753	<ul style="list-style-type: none"> <li>According to Kebe <i>et al.</i> (2006), it is likely that the catches of tunas and related species by artisanal fishers make up about 10% of all catches by artisanal fishing (total of about 3 000 tonnes).</li> <li>There are about 1 900 small fishing boats between 5 and 14 m in length. Among these vessels about 50 are dedicated to the capture of tunas and related species.</li> <li>Tunas are captured by troll, handline and purse seine gear – but the latter gear does not appear to be in the category of small-scale as some of the nets are up to 1 200 m in length.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>Anibal (2008)</li> <li>Kebe <i>et al.</i> (2006)</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Senegal	<ul style="list-style-type: none"> <li>Tuna are captured by a variety of gear types but it is assumed that only trolling, handlining and sport fishing fall into the category of small-scale.</li> <li>There is pelagic sport fishing from vessels based in Dakar and Mbour, but neither the ICCAT data nor Sow <i>et al.</i> (2009) show any tuna captured by sport fishing gear 2006–2008.</li> <li>As there are discrepancies between ICCAT data and Sow <i>et al.</i> (2009), the latter is used in the estimates for the present study.</li> <li>In 2007, “artisanal fishing” produced 237 tonnes of tuna and 11 372 of non-tuna species (37% <i>Scorber</i>, 30% <i>Euthynnus</i>, 16% sharks).</li> <li>In 2006, “artisanal fishing” produced 154 tonnes of tuna and 11 041 tonnes of non-tuna (35% <i>Euthynnus</i>, 31% <i>Scorber</i>, 12% sharks).</li> </ul>	196	11 206	<p>These catches are the averages of 2006–2007:</p> <ul style="list-style-type: none"> <li>There are several sources of information on the catches of artisanal pelagic fisheries, including a fleet inventory every six months, morning and afternoon, on catch sampling, etc.</li> <li>Sow <i>et al.</i> (2009) indicate that artisanal vessels use handline, troll line and purse seine gear to catch tunas and related species.</li> <li>ICCAT data show no catches by purse seine gear, but have a category of gillnet which is not mentioned by Sow <i>et al.</i> (2009).</li> <li>In 2006, ICCAT data show catches of tuna only by baitboats (industrial category), whereas Sow <i>et al.</i> (2009) show catches of skipjack, yellowfin and bigeye by “artisanal fisheries”.</li> <li>Using the readily available data, it is not possible to extract any catches from fishing that is not small-scale (i.e. purse seining) from the aggregated artisanal category of Sow <i>et al.</i> (2009). The estimate in the two columns to the left is therefore likely to be an overestimate.</li> <li>According to Fonteneau and Marcille (1993), the Senegalese artisanal tuna fishery has been catching tuna for several centuries and is “currently very active and well-covered by fishing statistics”.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>Kebe <i>et al.</i> (2006)</li> <li>Sow <i>et al.</i> (2009)</li> <li>Fonteneau and Marcille (1993)</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Sierra Leone	<ul style="list-style-type: none"> <li>After 2000, the ICCAT database does not show any data on very small-scale tuna catches from this country.</li> <li>Catches of tuna by small-scale fishing activity are assumed to be zero.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>The FAO Fishery Profile shows about 8 000 artisanal fishing craft in the country, but no tuna species is cited as a major resource.</li> <li>Although there is considerable artisanal fishing activity: about 8 000 canoes fishing in the 3- to 5-mile (equivalent to 4.8-8 km) Inshore Exclusive Zone, the catch is <i>Ethmalosa</i> spp., <i>Ilisha</i> spp., <i>Sardinella</i> spp., <i>Pseudotolithus</i> spp., threadfins, barracuda and catfish.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>FAO Fishery Country Profile</li> </ul>
South Africa	<p>According to ICCAT data, fishing with rod and reel produced:</p> <ul style="list-style-type: none"> <li>In 2008, 211 tonnes of tuna and 1 tonne of non-tuna species (100% non-major species of tuna).</li> <li>In 2007, 2 391 tonnes of tuna and no non-tuna species.</li> <li>In 2006, 890 tonnes of tuna and 1 tonne of non-tuna species (100% non-major species of tuna).</li> </ul>	1 164	1	<p>These catches are the averages of 2006–2007:</p> <ul style="list-style-type: none"> <li>Rod-and-reel fishing increased in 2007, with 62 vessels reporting yellowfin catches in 2007, as opposed to 35 vessels in 2006.</li> <li>These vessels target yellowfin by fishing in close proximity to hake longliners and trawlers, which act as FADs.</li> <li>There is a recreational fishery, including informal charter and sport fisheries, operating in the vicinity of Cape Town which targets albacore and yellowfin using rod and reel and spearguns from small fishing vessels (5–10 m). Catch data for this fishery is not available, but is considered to be relatively small in comparison with the commercial rod and reel fishery.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>Clarke and Smith (2009)</li> </ul>
Togo	<p>According to the ICCAT database, although catches of billfish and sharks were made, no tuna were caught by any gear.</p>	n.a.	n.a.	<ul style="list-style-type: none"> <li>ICCAT shows only fishing by gillnets in the past decade.</li> <li>According to the FAO Fishery Profile, three types of gillnets are used in Togo, with the shark gillnets being the gear most likely to capture large pelagic.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>FAO Fishery Country Profile</li> </ul>



## Appendix 5 – Northeast Atlantic

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Faroe Islands (Associate Member)	<ul style="list-style-type: none"> <li>According to ICCAT data, no tuna fishing in recent years.</li> </ul>	n.a.	n.a.		<ul style="list-style-type: none"> <li>ICCAT data</li> </ul>
France	<p>According to ICCAT data, trolling and handlining:</p> <ul style="list-style-type: none"> <li>In 2008, produced 70 tonnes of tuna.</li> <li>In 2007, produced 90 tonnes of tuna.</li> <li>In 2006, produced 4 tonnes of tuna.</li> </ul>	55	n.a.	<p>These catches are the averages of 2006–2008:</p> <ul style="list-style-type: none"> <li>Tuna is captured by a variety of techniques on France's Atlantic coast, but for the purpose of the present study, only handlining and trolling are considered small-scale. However, there is considerable uncertainty in this assumption.</li> <li>Some of ICCAT catch data (especially sharks) are Atlantic/Mediterranean combined, so the Atlantic non-tuna catch cannot be readily identified.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> </ul>
Denmark	<ul style="list-style-type: none"> <li>According to ICCAT data, no tuna fishing in recent years.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>In past decades, there was a sport fishery for bluefin off Denmark, but it no longer exists.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>Collins (2009)</li> </ul>
Iceland	<ul style="list-style-type: none"> <li>According to ICCAT data, no tuna fishing in recent years.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>Iceland did not conduct any bluefin tuna fishery in 2006 or 2007.</li> <li>In 2008, there was some catch of bluefin by vessels from Iceland, but these were made in the Mediterranean.</li> </ul>	<ul style="list-style-type: none"> <li>Government of Iceland (2008)</li> <li>Government of Iceland (2009)</li> </ul>

n.a. = not available  
pers. com. = personal communication  
mt = tonnes

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Ireland</b>	<p>According to ICCAT data, trolling:</p> <ul style="list-style-type: none"> <li>• In 2008, produced 3 tonnes of albacore (no other species reported).</li> <li>• In 2007, produced 10 tonnes of albacore (no other species reported);</li> <li>• In 2006, produced 17 tonnes of albacore and 0.1 tonnes of non-tuna (all swordfish).</li> </ul>	10	n.a.	<p>These catches are the averages of 2006–2008:</p> <ul style="list-style-type: none"> <li>• According to ICCAT data, catches of tuna are made by several gear types.</li> <li>• For the purpose of this study, only trolling is considered small-scale. However, there is considerable uncertainty in this assumption.</li> </ul>	<ul style="list-style-type: none"> <li>• ICCAT data</li> </ul>
<b>Netherlands</b>	<ul style="list-style-type: none"> <li>• No tuna fishing has been reported to ICCAT</li> </ul>	n.a.	n.a.		<ul style="list-style-type: none"> <li>• ICCAT data</li> </ul>
<b>Norway</b>	<ul style="list-style-type: none"> <li>• No tuna fishing in recent years.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>• The only tuna species normally caught in Norway waters was bluefin tuna.</li> <li>• There was a drastic decline and disappearance of bluefin tuna in Norway waters since the early 1960s, and no catch in recent years by any technique.</li> <li>• Norway adopted on 3 May 2007 a prohibition for Norwegian vessels to fish and land bluefin tuna in Norway's territorial waters, in the Norwegian economic zone and in international waters.</li> </ul>	<ul style="list-style-type: none"> <li>• Anon (2009c)</li> <li>• Nøttestad <i>et al.</i> (2008)</li> <li>• ICCAT (2009)</li> </ul>
<b>Portugal</b>	<ul style="list-style-type: none"> <li>• According to ICCAT data, handlining in 2008 produced 212 tonnes of tuna (no non-tuna reported); this catch was made in the Azores.</li> <li>• There was no handlining reported in 2007 or 2006.</li> </ul>	212	n.a.	<p>These catches are just for 2008:</p> <ul style="list-style-type: none"> <li>• It should be noted that, according to ICCAT data, there are 184 baitboats of less than 20 m – and some of those could be small-scale.</li> <li>• According to ICCAT data, catches of tuna are made by several gear types.</li> <li>• For the purpose of this study, only handlining is considered small-scale – but there is considerable uncertainty in this assumption.</li> <li>• It is assumed that handlining in 2007 and 2006 was placed in a different gear category (e.g. other surface gears).</li> </ul>	<ul style="list-style-type: none"> <li>• ICCAT data</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Spain	<p>According to ICCAT data, handlining:</p> <ul style="list-style-type: none"> <li>• In 2008, produced 6 tonnes of tuna (no non-tuna reported).</li> <li>• In 2007, produced 10 tonnes of tuna (no non-tuna reported).</li> <li>• In 2006, produced 4 tonnes of tuna (no non-tuna reported).</li> </ul>	7	n.a.	<p>These catches are the averages of 2006–2008:</p> <ul style="list-style-type: none"> <li>• In 2004, there were 95 baitboats less than 10 GRT in size based in the Canary Islands (Delgado de Molina <i>et al.</i>, 2006). Another study from the previous year showed 340 vessels less than 5 GRT size based in the Canary Islands. Some of these baitboats could be small-scale.</li> <li>• According to ICCAT data, catches of tuna are made by several gear types.</li> <li>• For the purpose of this study, only handlining is considered small-scale – but there is considerable uncertainty in this assumption.</li> </ul>	<ul style="list-style-type: none"> <li>• ICCAT data</li> <li>• Delgado de Molina <i>et al.</i> (2006)</li> <li>• Pallarés <i>et al.</i> (2005)</li> </ul>
United Kingdom	<p>According to ICCAT data, handlining:</p> <ul style="list-style-type: none"> <li>• In 2008, produced 50 tonnes of tuna and 3 tonnes of non-tuna (all sharks).</li> <li>• In 2007, produced 21 tonnes of tuna and 3 tonnes of non-tuna (all sharks).</li> <li>• In 2006, produced 7 tonnes of tuna and 3 tonnes of non-tuna (all sharks).</li> </ul>	26	3	<p>These catches are the averages for 2006–2008:</p> <ul style="list-style-type: none"> <li>• According to ICCAT data, catches of tuna are made by several gear types.</li> <li>• For the purpose of this study, only handlining is considered small-scale – but there is considerable uncertainty in this assumption.</li> </ul>	<ul style="list-style-type: none"> <li>• ICCAT data</li> </ul>



## Appendix 6 – Mediterranean

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Albania</b>	Little or no tuna caught by small-scale fishing.	n.a.	n.a.	<ul style="list-style-type: none"> <li>• ICCAT data shows only catches of swordfish and <i>Sarda</i>, with no data after 1999.</li> <li>• FAO data shows no tuna catch.</li> </ul>	<ul style="list-style-type: none"> <li>• ICCAT data</li> <li>• FAO/FishStat</li> </ul>
<b>Algeria</b>	<p>According to ICCAT data, handlining produced:</p> <ul style="list-style-type: none"> <li>• In 2007, 20 tonnes of tuna and 7 tonnes of non-tuna (91% <i>Sarda</i>).</li> <li>• In 2006, 21 tonnes of tuna and 87 tonnes of non-tuna (83% swordfish).</li> <li>• In 2005, 27 tonnes of tuna and 244 tonnes of non-tuna (72% swordfish).</li> <li>• The ICCAT data appear to show either great variability or inconsistency of reporting.</li> </ul>	23	113	<p>These catches are the averages for 2006–2008:</p> <ul style="list-style-type: none"> <li>• Algeria's fleet ranges in size from 6 to 24 m, and is made up of 93 seiners and 295 artisanal longliners (Government of Algeria, 2008).</li> <li>• Another source gives a fleet of 106 "artisanal longliners" (Di Natale <i>et al.</i>, 2009).</li> <li>• It is not possible using ICCAT data to identify catches (if any) made by small-scale longliners – consequently only handlining is considered small-scale in the present study.</li> <li>• The small boats often catch just one bluefin per day by handlining.</li> <li>• No handlining is reported in the 2008 ICCAT data (2008 appears incomplete for other gear types as well).</li> </ul>	<ul style="list-style-type: none"> <li>• ICCAT data</li> <li>• Di Natale <i>et al.</i> (2009)</li> <li>• Government of Algeria (2008)</li> <li>• A. Srour, FAO, pers. com., March 2010</li> </ul>
<b>Croatia</b>	<p>According to ICCAT data, handlining produced:</p> <ul style="list-style-type: none"> <li>• In 2008, 8 tonnes of tuna and no non-tuna species.</li> <li>• In 2007, 2 tonnes of tuna and no non-tuna species.</li> </ul>	5	n.a.	<p>These catches are the averages of 2007–2008:</p> <ul style="list-style-type: none"> <li>• Most bluefin caught with purse seine gear.</li> </ul>	<ul style="list-style-type: none"> <li>• ICCAT data</li> </ul>

n.a. = not available  
pers. com. = personal communication  
mt = tonnes

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Cyprus</b>	<p>According to ICCAT data, in 2008:</p> <ul style="list-style-type: none"> <li>• Sport fishing/handline produced 3 tonnes of tuna and no non-tuna.</li> <li>• No catch by sport fishing/handline was reported in 2006/2007, but there was some made by "unclassified" gear.</li> </ul>	3	n.a.		<ul style="list-style-type: none"> <li>• ICCAT data</li> </ul>
<b>Egypt</b>	<ul style="list-style-type: none"> <li>• Little or no tuna caught by small-scale fishing.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>• No tuna catches reported to ICCAT in recent years</li> </ul>	<ul style="list-style-type: none"> <li>• ICCAT data</li> </ul>
<b>France</b>	<p>According to ICCAT data:</p> <ul style="list-style-type: none"> <li>• In 2008, only fishing by purse seining and unclassified gear reported.</li> <li>• In 2007, sport fishing produced 2 tonnes of tuna and 0.1 tonne of spearfish.</li> <li>• In 2006, only fishing by purse seining and unclassified gear reported.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>• Gaudin and De Young (2007) report that offshore boat-based sport fishing catches bluefin tuna, swordfish and dolphinfish.</li> <li>• The ICCAT data appears to show either great variability or inconsistency of reporting.</li> </ul>	<ul style="list-style-type: none"> <li>• ICCAT data</li> <li>• Di Natale <i>et al.</i> (2009)</li> <li>• Gaudin and De Young (2007)</li> </ul>
<b>Greece</b>	<p>According to ICCAT data, handlining produced:</p> <ul style="list-style-type: none"> <li>• In 2008, 93 tonnes of tuna and no non-tuna species.</li> <li>• In 2007, 75 tonnes of tuna and no non-tuna species.</li> <li>• In 2006, 25 tonnes of tuna and no non-tuna species.</li> </ul>	64	n.a.	<ul style="list-style-type: none"> <li>• Di Natale <i>et al.</i> (2009) state that gillnets and handlines are used by small vessels to catch tunas, but the ICCAT data show no gillnetting.</li> </ul>	<ul style="list-style-type: none"> <li>• ICCAT data</li> <li>• Di Natale <i>et al.</i> (2009)</li> </ul>
<b>Israel</b>	<ul style="list-style-type: none"> <li>• Little or no tuna caught by small-scale fishing.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>• No tuna catches reported to ICCAT in recent years.</li> </ul>	<ul style="list-style-type: none"> <li>• ICCAT data</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Italy	<p>According to ICCAT data:</p> <ul style="list-style-type: none"> <li>In 2008, harpoon gear caught 5 tonnes of albacore and 24 tonnes of other species (94% swordfish).</li> <li>In 2008, sport fishing caught 17 tonnes of tuna and no non-tuna species.</li> <li>In 2007, no harpoon or sport fishing reported.</li> <li>In 2006, sport fishing caught 277 tonnes of tuna and no non-tuna species.</li> </ul>	100	8	<p>Di Natale <i>et al.</i> (2005) report off Sicily:</p> <ul style="list-style-type: none"> <li>In this area there are traditionally several types of fishing activities targeting bluefin tuna. The most documented is the historical harpoon fishery targeting this species, but also swordfish (<i>Xiphias gladius</i>), Mediterranean spearfish (<i>Tetrapturus belone</i>) and sometimes even the sunfish (<i>Mola mola</i>).</li> <li>The commercial headline fishery for bluefin tuna is a traditional activity in the Straits of Messina. It is now carried out by a fleet of very small wooden vessels (5–8 m in length), variable in number from year to year, usually with two fishers on board.</li> </ul> <p>The ICCAT data appears to show either great variability or inconsistency of reporting.</p>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>Di Natale <i>et al.</i> (2009)</li> <li>Di Natale <i>et al.</i> (2006)</li> <li>Di Natale <i>et al.</i> (2005)</li> </ul>
Lebanon	<ul style="list-style-type: none"> <li>Little or no tuna caught by small-scale fishing.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>No tuna catches reported to ICCAT in recent years</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> </ul>
Libyan Arab Jamahiriya	<ul style="list-style-type: none"> <li>Little or no tuna caught by small-scale fishing.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>ICCAT data shows only catches of tuna made by longline, trap, purse seine and "unclassified" gear.</li> </ul>	<ul style="list-style-type: none"> <li>Di Natale <i>et al.</i> (2009)</li> <li>A. Srouf, FAO, pers. com., March 2010</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Malta</b>	<ul style="list-style-type: none"> <li>It is not possible to extract the small-scale longline data categories.</li> <li>Component from the ICCAT purse seine and for the purpose of the present study, the estimates of Camilleri (personal communication) are used for the seine/FAD fishery. All longlining is taken to be larger than the present study's "small-scale" category.</li> <li>No data could be found on sport fishing, so any such catches not included in estimate.</li> </ul>	1	350	<ul style="list-style-type: none"> <li>A small-scale seine fishery using mainly open boats 6–18 m in length catches about 300 to 400 mt of all fish species annually around FADs using seine gear. The catch is mainly dolphinfish, with 10% other species including juvenile bluefin tuna.</li> <li>Gaudin and De Young (2007) report that for sport fishing the main species are albacore, Atlantic bonito, Atlantic little tuna, bluefin tuna and spearfish.</li> <li>Some of the longline vessels are undecked and therefore in the category of small-scale for the purpose of the present study.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>M. Camilleri, GFCM, pers. com., March 2010</li> <li>Gaudin and De Young (2007)</li> </ul>
<b>Morocco</b>	<p>According to ICCAT data, handlining produced:</p> <ul style="list-style-type: none"> <li>In 2008, 3 tonnes of tuna and 49 tonnes of non-tuna (76% <i>Sarda</i>).</li> <li>In 2007, 23 tonnes of tuna and 43 tonnes of non-tuna (59% <i>Sarda</i>, 33% <i>Eurhynchus</i>).</li> <li>In 2006, 187 tonnes of tuna and 27 tonnes of non-tuna (67% <i>Sarda</i>, 33% <i>Auxis</i>).</li> </ul>	71	40	<p>These catches are the averages of 2006–2008:</p> <ul style="list-style-type: none"> <li>There is handlining for tuna in the Mediterranean near the Straits of Gibraltar using boats measuring less than 7 m in length.</li> <li>The small boats often catch just one bluefin per day by handlining.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>El Ktiri and Idrissi (2009)</li> <li>Di Natale et al. (2009)</li> <li>A. Srour, FAO, pers. com., March 2010</li> </ul>
<b>Serbia and Montenegro*</b>	Little or no tuna caught by small-scale fishing.	n.a.	n.a.	<ul style="list-style-type: none"> <li>ICCAT data show only catches of tuna by purse seine gear, with no data after 2001.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> </ul>

\* For the period covered, disaggregated data not available for the two countries.



Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Spain</b>	<p>According to ICCAT data, sport fishing produced:</p> <ul style="list-style-type: none"> <li>In 2008, 15 tonnes of tuna (all bluefin) and no non-tuna species.</li> <li>In 2007, 20 tonnes of tuna (all bluefin) and no non-tuna species.</li> <li>In 2006, 8 tonnes of tuna (all bluefin) and no non-tuna species.</li> </ul>	12	n.a.	<ul style="list-style-type: none"> <li>Baez <i>et al.</i> (2009) report on artisanal longlining in Spain's Alboran Sea; however, the size of the vessels used (an average length of 12.25 m, a mean gross tonnage of 11.65) places them in a category larger than the "small-scale" of the present study.</li> <li>Some handling of tuna reported in the Gibraltar area, but it does not appear in the ICCAT data.</li> <li>Gaudin and De Young (2007) report that for sport fishing the main species are bluefin tuna, the Atlantic little tuna, the Atlantic bonito and skipjack. Less common: frigate tuna and albacore tuna.</li> </ul>	<ul style="list-style-type: none"> <li>A. Srour, FAO, pers. com. March 2010</li> <li>Baez <i>et al.</i> (2009)</li> <li>Gaudin and De Young (2007)</li> </ul>
<b>Syrian Arab Republic</b>	<ul style="list-style-type: none"> <li>Little or no tuna caught by small-scale fishing.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>In 2006, no data were submitted to ICCAT. In 2007 and 2008, no catches by gear types that appear to be small-scale were reported to ICCAT.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> </ul>
<b>Tunisia</b>	<p>According to ICCAT data, sport fishing (handlining) produced:</p> <ul style="list-style-type: none"> <li>In 2008, no tuna catch.</li> <li>In 2007, 4 tonnes of tuna (all bluefin) and no non-tuna species.</li> <li>In 2006, 3 tonnes of tuna (all bluefin) and no non-tuna species.</li> </ul>	2	n.a.	<ul style="list-style-type: none"> <li>Another source (Government of Tunisia, 2009) states that the entire catch of bluefin tuna was carried out by 42 purse seiners, of which 23 were over 24 m in length, and one longline vessel.</li> <li>Hattour (2007) states that in Tunisia small tunas can be taken as bycatch with nets, lights and by pelagic trawl. The traps, which constituted the major gear for catching bluefin tuna and small tunas, have been relegated to last place, and have been abandoned since 2003.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>Government of Tunisia (2009)</li> </ul>
<b>Turkey</b>	<ul style="list-style-type: none"> <li>The tuna catch by gillnets, trammel nets, trolling and sport fishing cannot be estimated with the readily available data; however, for the purpose of the present study it is assumed to be 10 tonnes.</li> </ul>	10	n.a.	<ul style="list-style-type: none"> <li>ICCAT data show that all tuna in recent years was caught by purse seine gear.</li> <li>Di Natale <i>et al.</i> (2009) indicates that some tuna was also caught by gillnets, trammel nets and trolling.</li> <li>Gaudin and De Young (2007) indicate that sport fishing catches bluefin and albacore tuna.</li> </ul>	<ul style="list-style-type: none"> <li>ICCAT data</li> <li>Di Natale <i>et al.</i> (2009)</li> <li>Gaudin and De Young (2007)</li> <li>Ministry of Agriculture and Rural Affairs (2009)</li> </ul>



## Appendix 7 – Indian Ocean

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Australia (Indian Ocean portion)</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Handlining produced an annual average of 1.7 tonnes of tuna and 13.3 tonnes of non-tuna species (44% <i>Scorberomorus commerson</i>).</li> <li>Trolling produced an annual average of 1.4 tonnes of tuna and 310.7 tonnes of non-tuna species (95% <i>Scorberomorus commerson</i>).</li> </ul>	3	324	<ul style="list-style-type: none"> <li>Longtail tuna are taken using the minor line method, usually in northern waters off Western Australia and the Northern Territory.</li> </ul>	<ul style="list-style-type: none"> <li>IOTC data</li> <li>DEH (2004)</li> </ul>
<b>Bahrain</b>	<ul style="list-style-type: none"> <li>No tuna catch reported for the three-year period 2006–2008.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>Non-tuna catches reported by several gear types.</li> </ul>	<ul style="list-style-type: none"> <li>IOTC data</li> </ul>
<b>Bangladesh</b>	<ul style="list-style-type: none"> <li>Tuna catch reported only by gillnet gear.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>Most offshore gillnetting uses vessels 12 m and 14 m in length, equipped with 15–23 hp inboard engines and 8 crew.</li> <li>For the purpose of the present study, it is assumed that the gillnetting is larger than small-scale.</li> </ul>	<ul style="list-style-type: none"> <li>IOTC data</li> <li>Mohiuddin <i>et al.</i> (1980)</li> </ul>
<b>Comoros</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Handlining produced an annual average of 2 246 tonnes of tuna and 5 102 tonnes of non-tuna (species breakdown not given);</li> <li>Trolling produced an annual average of 8 719 tonnes of tuna and 724 tonnes of non-tuna (45% <i>Scorberomorus commerson</i>, 33% <i>Euthynnus affinis</i>).</li> </ul>	10 965	5 827	<ul style="list-style-type: none"> <li>Much of the trolling is done from a fleet of about 1 500 fibreglass skiffs 6.3 to 7.1 m in length.</li> <li>FADs are often used.</li> </ul>	<ul style="list-style-type: none"> <li>IOTC data</li> <li>FAO Fishery Country Profile</li> <li>Badrane (2009)</li> <li>Poonian <i>et al.</i> (2008)</li> <li>Herrera, IOTC, pers. com., April 2010</li> </ul>

n.a. = not available  
pers. com. = personal communication  
mt = tonnes

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Comoros, cont.				<ul style="list-style-type: none"> <li>Troll lines targeting pelagic fish are the most common fishing gear used on two of the islands visited in a survey (97% of fishers on Grande Comore and 91% of fishers on Mohéli). Fifty-four percent of Grand Comorian fishers and 28% of Mohélian fishers reported that they had caught turtles, whether accidentally or deliberately. It was not always clear during interviews as to whether turtles caught were actually bycatch or whether the fishers had caught them intentionally (Poonian <i>et al.</i>, 2008)</li> <li>Work on fisheries statistics in the early 1990s by a French project gives credibility to the large catches in the columns to the left.</li> </ul>	
Djibouti	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Gillnetting produced an annual average of 11 tonnes of tuna and 84 tonnes of non-tuna (83% <i>Scorpaenopsis commersoni</i>).</li> <li>It is assumed that half of the above was captured by small-scale fishing.</li> </ul>	5	42	<ul style="list-style-type: none"> <li>Tuna catch reported by only gillnet gear.</li> <li>In the country there are a total of about 90 artisanal fishing boats, of which 75 are small, open boats (6 to 8 m) powered by outboard engines. Some 15 of the boats are longer (10– 4 m) and equipped with inboard engines.</li> <li>For the purpose of the present study, it is assumed that half of the gillnetting is small-scale.</li> </ul>	<ul style="list-style-type: none"> <li>IOTC data</li> <li>Morgan (2006a)</li> </ul>
East Timor	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Gillnetting produced an annual average of 1.7 tonnes of tuna and 1.3 tonnes of non-tuna (85% <i>Thunnus tonggol</i>).</li> <li>Handlining produced an annual average of 0.4 tonnes of tuna and no non-tuna.</li> <li>Trolling produced an annual average of 2.6 tonnes of tuna and no non-tuna.</li> </ul>	5	1		<ul style="list-style-type: none"> <li>IOTC data</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Egypt</b>	According to IOTC data, for the three-year period 2006–2008, gillnetting is reported but no tuna catch.	n.a.	n.a.		<ul style="list-style-type: none"> <li>IOTC data</li> </ul>
<b>Eritrea</b>	According to IOTC data, for the three-year period 2006–2008, gillnetting is reported but no tuna catch.	n.a.	n.a.		<ul style="list-style-type: none"> <li>IOTC data</li> </ul>
<b>France – Réunion Island</b>	According to IOTC data, for the three-year period 2006–2008: <ul style="list-style-type: none"> <li>Handlines and troll lines produced an annual average of 221 tonnes of tuna and 40 tonnes of non-tuna (28% blue marlin, 24% striped marlin).</li> </ul>	221	40	<ul style="list-style-type: none"> <li>Includes both artisanal and sport fishing.</li> </ul>	<ul style="list-style-type: none"> <li>IOTC data</li> </ul>
<b>France – Overseas territories</b>	According to IOTC data, for the three-year period 2006–2008: <ul style="list-style-type: none"> <li>Handlining produced an annual average of 109 tonnes of tuna and 13 tonnes of non-tuna (72% sailfish).</li> <li>Trolling produced an annual average of 677 tonnes of tuna and 11 tonnes of non-tuna (63% of various sharks).</li> </ul>	786	24		<ul style="list-style-type: none"> <li>IOTC data</li> </ul>
<b>India</b>	According to IOTC data, for the three-year period 2006–2008: <ul style="list-style-type: none"> <li>Gillnetting produced an annual average of 6 444 tonnes of tuna and 69 613 tonnes of non-tuna (32% <i>Scomberomorus commerson</i>, 22% <i>Euthynnus affinis</i>). Half of this is considered small-scale (i.e. 3 222 tonnes and 34 806 tonnes);</li> </ul>	18 098	53 238	<ul style="list-style-type: none"> <li>In the mainland of India, tuna fishing is carried out by small-scale mechanized and traditional vessels operating in waters up to about 80 m deep all along the coastline. The fishery does not target tunas, and boats use multispecies gear such as gillnets, purse seines, hooks and lines, and troll lines (Somvanshi et al., 1998).</li> </ul>	<ul style="list-style-type: none"> <li>Somvanshi et al. (1998)</li> <li>IOTC data</li> <li>M. Herrera, IOTC, pers. com., April 2010</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
India, cont.	<ul style="list-style-type: none"> <li>Handline produced an annual average of 1 380 tonnes of tuna and 13 126 tonnes of non-tuna (28% <i>Scomberomorus commerson</i>, 19% frigate tuna, 13% <i>Euthynnus affinis</i>).</li> <li>Trolling produced an annual average of 4 402 tonnes of tuna and 5 306 tonnes of non-tuna (62% <i>Euthynnus affinis</i>).</li> <li>Fishing by baitboat produced an annual average of 9 094 tonnes of tuna and no non-tuna.</li> </ul>	15 008	18 885	<ul style="list-style-type: none"> <li>Tuna catches are reported by IOTC from the following gear: baitboat, gillnet, handline, lift nets, ring nets and troll.</li> <li>Baitboats in India are those that operate in the Lakshadweep islands. The vessels used are small and outboard powered.</li> <li>For the purpose of the present study, it is assumed that half of the gillnet catches and all of the catches by handline, baitboat and troll are from small-scale fishing activity.</li> </ul>	
Indonesia (Indian Ocean portion)	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Handlining produced an annual average of 555 tonnes of tuna and 14 200 tonnes of non-tuna (41% <i>Scomberomorus commerson</i>, 33% <i>Scomberomorus guttatus</i>).</li> <li>Trolling produced an annual average of 14 453 tonnes of tuna and 4 685 tonnes of non-tuna (53% <i>Euthynnus affinis</i>, 17% <i>Scomberomorus commerson</i>).</li> </ul>	15 008	18 885	<ul style="list-style-type: none"> <li>A WWF study in 2007 estimated the tuna catch in Indonesia. In Fishery Management Areas #8 and #9 (i.e. the Indian Ocean portion of Indonesia), tuna catches by handline and troll line were given as 72 125 tonnes and 139 726 (total 211 851 tonnes). "Tuna" in that study consisted of the principal market species (as in the present study) plus "tongkol," a local term for small species of tuna. This small-scale catch (211 851 tonnes) is about ten times greater than that given by the IOTC data. According to IOTC staff, the source of the discrepancy could be how the catches are allocated to gear types.</li> <li>For consistency across the Indian Ocean, the IOTC data are used in this study. It should be noted, however, that there is a considerable difference between the IOTC data and the WWF estimate.</li> </ul>	<ul style="list-style-type: none"> <li>IOTC data</li> <li>Ingles <i>et al.</i> (2008)</li> <li>M. Herrera, IOTC, pers. com., April 2010</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Iran, Islamic Republic of</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Gillnetting produced an annual average of 64 771 tonnes of tuna and 76 753 tonnes of non-tuna (35% longtail tuna, 21% <i>Euthynnus affinis</i>). 40% of this is considered to be small-scale.</li> <li>Trolling produced an annual average of 300 tonnes of tuna and 694 tonnes of non-tuna (67% <i>Scomberomorus commerson</i>).</li> </ul>	26 208	31 355	<ul style="list-style-type: none"> <li>The fishing vessels operating in the Persian Gulf area consist of 66 steel trawlers, 2 835 wooden vessels and 6 793 outboard-powered small boats.</li> <li>No information is available for identifying the number of gillnet vessels (or the catches by those vessels) that are small-scale.</li> <li>For the purpose of the present study, it is assumed that 40% of the gillnet catches and all of the catches by trolling are from small-scale fishing activity.</li> <li>Gillett (2005) estimated that tuna catches from 1 GRT gillnet vessel fleet was about 4 700 mt per year in the period 1997–2001.</li> </ul>	<ul style="list-style-type: none"> <li>IOTC data</li> <li>Morgan (2006b)</li> <li>Gillett and Herrera (2009)</li> <li>Gillett (2005)</li> <li>M. Herrera, IOTC, pers. com., April 2010</li> </ul>
<b>Jordan</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Gillnetting produced an annual average of 30 tonnes of tuna and 34 tonnes of non-tuna (76% <i>Euthynnus affinis</i>).</li> <li>Trolling produced an annual average of 5 tonnes of tuna and 8 tonnes of non-tuna (81% <i>Euthynnus affinis</i>).</li> </ul>	35	42	<ul style="list-style-type: none"> <li>The local fishing fleet consists entirely of small outboard motorboats, approximately 5 m in length.</li> <li>For the purpose of the present study, it is assumed that all catches reported to IOTC are from small-scale fishing activity.</li> </ul>	<ul style="list-style-type: none"> <li>IOTC data</li> <li>Morgan (2006c)</li> </ul>
<b>Kenya</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Gillnetting produced an annual average of 67 tonnes of tuna and 1 355 tonnes of non-tuna (77% blue marlin).</li> <li>Handlining produced an annual average of 14 tonnes of tuna and 191 tonnes of non-tuna (64% blue marlin).</li> <li>Trolling produced an annual average of 113 tonnes of tuna and 153 tonnes of non-tuna (44% sailfish, 15% sharks).</li> </ul>	194	1 699	<ul style="list-style-type: none"> <li>Of the fishing craft along the coast, 135 are motorized, 991 use paddles, while 1 179 use sails for propulsion.</li> <li>Catches reported to IOTC are by gillnetting, handlining and trolling. For the purpose of the present study, all these gear types are considered small-scale.</li> <li>Kenya enjoys a reputation as one of the world's great big game sports fishing destinations. Kenya's marine waters contain most of the major target game species.</li> </ul>	<ul style="list-style-type: none"> <li>IOTC data</li> <li>FAO Fishery Country Profile</li> <li>Kariuki (2006)</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Kuwait</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Only gillnetting was reported (which is not likely to be small-scale) – and the gillnetting did not result in the capture of any tuna.</li> </ul>	n.a.	n.a.		<ul style="list-style-type: none"> <li>IOTC data</li> </ul>
<b>Madagascar</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Trolling produced an annual average of 9 788 tonnes of tuna and 12 000 tonnes of non-tuna (55% <i>Scomberomorus commerson</i>).</li> </ul>	9 788	12 000		<ul style="list-style-type: none"> <li>IOTC data</li> </ul>
<b>Malaysia</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Only gillnetting/trolling reported but it did not result in the capture of any tuna.</li> </ul>	n.a.	n.a.		<ul style="list-style-type: none"> <li>IOTC data</li> </ul>
<b>Maldives</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Handlining produced an annual average of 5 838 tonnes of tuna and 3 754 tonnes of non-tuna (species breakdown not given). 50% of the handline catch is considered to be small-scale (i.e. 2 919 tonnes and 1 877 tonnes).</li> <li>Trolling produced an annual average of 1 793 tonnes of tuna and 3 280 tonnes of non-tuna (species breakdown not given).</li> <li>“Fish netting” produced an annual average of 92 tonnes of tuna and 654 tonnes of non-tuna (species breakdown not given).</li> </ul> <p>Ministry of Fisheries unpublished data shows that in 2008, sailing baitboats caught 5 553 tonnes of tuna and 371 tonnes of non-tuna.</p>	10 357	6 182	<ul style="list-style-type: none"> <li>Data reported in IOTC show fishing by baitboat, “fish net”, handlining, coastal longlining, trolling and “unclassified”.</li> <li>Some of the handline tuna fishing takes place from vessels over 20 m in length.</li> <li>Unpublished data from the Ministry of Fisheries disaggregates the baitboat category so that the catches from sailing baitboats can be identified.</li> <li>For the purpose of the present study, it is assumed that 50% of the handline catches, all of the catches by trolling and “fish net”, and all of the catches by sailing baitboats are from small-scale fishing activity.</li> </ul>	<ul style="list-style-type: none"> <li>IOTC data</li> <li>M. Shiham Adam, Marine Research Centre, pers. com., March 2010</li> <li>Adam (2006)</li> <li>Adam and Jauharee (2009)</li> <li>Ministry of Fisheries unpublished data</li> <li>M. Herrera, IOTC, pers. com., April 2010</li> </ul>



Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Mauritius</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Fishing by handline and troll line produced an annual average of 797 tonnes of tuna and 284 tonnes of non-tuna (96% sailfish).</li> </ul>	797	284	<ul style="list-style-type: none"> <li>There is an artisanal FAD fishery and an offshore sport fishery.</li> <li>The sport fishery takes about the same amount of fish as the FAD fishery, which is done by droplining with live bait. The most common species caught around FADs is albacore, which are never taken in trolling.</li> <li>Other than the relatively few sharks taken, these fisheries are 'clean', with no turtle, marine mammal or seabirds caught.</li> </ul>	<ul style="list-style-type: none"> <li>IOTC data</li> <li>Jehangeer (2006)</li> <li>D. Ardill, pers. com., April 2010</li> </ul>
<b>Oman</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Handline fishing produced an annual average of 6 188 tonnes of tuna and 5 799 tonnes of non-tuna (58% longtail tuna, 22% <i>Scomberomorus commerson</i>).</li> <li>Trolling produced an annual average of 1 045 tonnes of tuna and no tonnes of non-tuna.</li> </ul>	7 233	5 799	<ul style="list-style-type: none"> <li>Both traditional and industrial fisheries catch large pelagics, with almost 50 000 tonnes caught in 2004, of which traditional fishery contributed almost 90 %. To catch large pelagics, both gillnets and lines are used. The traditional fisheries use handlines, while industrial fisheries use longlines.</li> <li>There are almost 2 000 small-scale fishing vessels: glass-reinforced plastic (fibreglass) vessels (8–10 m in length overall); and <i>shashas</i>, a locally designed boat made of palm fronds.</li> <li>For the purpose of the present study, it is assumed that handlining and trolling is small-scale; gillnetting is not considered to be small-scale.</li> </ul>	<ul style="list-style-type: none"> <li>IOTC data</li> <li>FAO Fishery Country Profile</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Pakistan</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Gillnetting produced an annual average of 6 858 tonnes of tuna and 29 919 tonnes of non-tuna (31% sharks, 26% <i>Scomberomorus commerson</i>, 20% longtail tuna).</li> <li>It is assumed that 10% of the gillnet catches are made by small-scale fishing activity: 686 tonnes of tuna and 2 991 tonnes of other species.</li> </ul>	686	2 991	<ul style="list-style-type: none"> <li>Khan (2006) indicates 34 917 tonnes of fish are captured in the “artisanal tuna fishery”. Tuna are caught by artisanal vessels while targeting mackerels and sharks which receive better prices in the domestic market. There is a sport fishery that catches billfish and tuna.</li> <li>The vessels participating in pelagic gillnetting are just above “small-scale” as used in the present study – they are generally fully decked and inboard powered.</li> <li>For the purpose of the present study, it is assumed that 10% of the catches by pelagic gillnetting are made by small-scale fishing activity.</li> </ul>	<ul style="list-style-type: none"> <li>Khan (2006)</li> <li>P. Fanning, FAO, pers. com., March 2010</li> </ul>
<b>Qatar</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Gillnetting produced an annual average of 1 tonne of tuna and 2 416 tonnes of non-tuna (88% <i>Scomberomorus commerson</i>).</li> </ul>	1	2 416	<ul style="list-style-type: none"> <li>The gillnets are of small size and used from open skiffs.</li> </ul>	<ul style="list-style-type: none"> <li>IOTC data</li> <li>M. Herrera, IOTC, pers. com., April 2010</li> </ul>
<b>Saudi Arabia</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>No tuna catches reported.</li> </ul>	n.a.	n.a.		<ul style="list-style-type: none"> <li>IOTC data</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Seychelles	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Handlining produced an annual average of 5 tonnes of tuna and 118 tonnes of non-tuna (75% <i>Euthynnus affinis</i>).</li> </ul>	5	118	<ul style="list-style-type: none"> <li>The semi-pelagic handline fishery is the most important artisanal fishery in terms of weight landed. Most catches in this fishery are taken by inboard-powered vessels ('whalers') that largely operate on the Mahe Plateau, although catches of semi-pelagic species by smaller outboard-powered vessels are variable and may also be significant. The principal species are <i>Carangoides</i> spp., <i>Caranx</i> spp., <i>Sphyraena</i> spp., <i>Euthynnus affinis</i> and larger tuna species. Around 90 vessels have operated annually in this fishery over the last decade.</li> <li>There are 91 whaler-type vessels, which are traditional clinker-constructed vessels, 9 to 12 m in length overall, with inboard engines. These are now mostly partially decked. There are also about 280 fibreglass vessels, 5 m in length and powered by 25–40 hp outboard engines.</li> </ul>	<ul style="list-style-type: none"> <li>IOTC data</li> <li>Robinson <i>et al.</i> (2006)</li> <li>FAO Fishery Country Profile</li> </ul>
South Africa	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Sport fishing produced an annual average of 6 tonnes of tuna and 86 tonnes of non-tuna (87% sharks).</li> </ul>	6	86		<ul style="list-style-type: none"> <li>IOTC data</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Sri Lanka	<p>The IOTC data do not show any longline catch,* so the catch data used here comes from two other sources.</p> <ul style="list-style-type: none"> <li>According to Dissanayake (2005), the smallest vessels that use gillnets are known as UN2A. These vessels are 8.8–9.8 m in length and have an inboard engine of about 40 hp. These vessels are larger than the category “small-scale” of the present survey. Some 300 to 400 vessels that are 5.5–7.2 m in length with outboard motors participate in tuna fishing.</li> <li>According to L. Joseph (personal communication), about 200–300 undecked fibreglass outboard-powered vessels operate in the northwest and east seasonally conducting longline fishing for yellowfin and bigeye. Each of these boats carry about 125–150 hooks and the fleet produces about 35 000 tonnes of fish (about 9 000 tonnes skipjack, 6 000 tonnes yellowfin and 20 000 tonnes smaller tuna).</li> </ul>	15 000	20 000	<p>With respect to bycatch, Sri Lanka tuna fisheries have some degree of notoriety for capturing cetaceans.</p> <ul style="list-style-type: none"> <li>Young and Iudicello (2007) cite information indicating that large numbers of at least 14 species of cetaceans have been killed in directed hunts and by entanglement in fishing gear in Sri Lanka, with spinner dolphins caught most frequently. Scientists estimate that, from 1984 through 1986, some 350 000 gillnets accounted for between 8 042 and 11 821 bycatch mortalities around the Sri Lankan coast.</li> <li>Northridge (1991) indicates that estimates of catches of cetaceans by all drift gillnet vessel (both large and small-scale) range from 13 000 to 45 000 per year (late 1980s data).</li> </ul> <p>It should be pointed out, however, that the tuna fishery which seems to capture most cetaceans and attract most attention, pelagic gillnetting, is of a larger scale than the “small-scale” of the present study.</p>	<ul style="list-style-type: none"> <li>IOTC data</li> <li>Dissanayake (2005)</li> <li>L. Joseph, pers. com., March 2010</li> <li>Young and Iudicello (2007)</li> </ul>

\* Upon clarification with IOTC, the gear type “hand” sometimes includes small-scale longlining, whereas “longline” mainly refers to industrial longlining.

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Thailand (Indian Ocean portion)</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Only gillnetting was reported (which is not likely to be small-scale) – and the gillnetting did not result in the capture of any tuna.</li> </ul>	n.a.	n.a.		<ul style="list-style-type: none"> <li>IOTC data</li> </ul>
<b>United Arab Emirates</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>No tuna catches reported.</li> </ul>	n.a.	n.a.		<ul style="list-style-type: none"> <li>IOTC data</li> </ul>
<b>United Kingdom – Indian Ocean territories</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Sport fishing produced an annual average of 14 tonnes of tuna and 11 tonnes of non-tuna (no species breakdown).</li> </ul>	14	11		<ul style="list-style-type: none"> <li>IOTC data</li> <li>M. Herrera, IOTC, pers. com., April 2010</li> </ul>
<b>United Republic of Tanzania</b>	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Handlining produced an annual average of 848 tonnes of tuna and 4 404 tonnes of non-tuna (45% sharks, 20% <i>Scomberomorus commerson</i>).</li> <li>Trolling produced an annual average of 275 tonnes of tuna and 443 tonnes of non-tuna (39% sharks, 35% <i>Scomberomorus commerson</i>).</li> <li>Gillnetting produced an annual average of 390 tonnes of tuna and 3 778 tonnes on non-tuna (33% shark, 29% <i>Scomberomorus commerson</i>).</li> </ul>	1 513	8 626	<ul style="list-style-type: none"> <li>The IOTC data show catches of tuna by gillnetting, handlining and trolling.</li> <li>Gillnets are small-scale.</li> <li>For the purpose of the present study, it is assumed that handlining, gillnetting and trolling is small-scale; gillnetting is not considered to be small-scale.</li> </ul>	<ul style="list-style-type: none"> <li>IOTC data</li> <li>M. Herrera, IOTC, pers. com., April 2010</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Yemen	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Handlining produced an annual average of 17 882 tonnes of tuna and 24 747 tonnes of non-tuna (50% sharks, 29% longtail tuna).</li> <li>It is assumed that all of this is by small-scale fishing.</li> </ul>	17 882	24 747	<ul style="list-style-type: none"> <li>Two types of vessels are used for handlining tuna: (1) <i>Houris</i>: fibreglass boats ranging from 7–9 m long, with outboard engines 40–75 hp. (2) <i>Sambuqs</i>: wooden boats ranging from 15–25 m long, powered by inboard diesel engines 40–150 hp. These vessels are engaged in multi-day fishing with trips ranging from one to three weeks targeting mainly sharks.</li> <li>The majority of craft currently operated are <i>houris</i>. Between 100 to 150 <i>sambuqs</i> operate in the Gulf of Aden and about 600 operate in the Red Sea on a seasonal basis.</li> <li>In 2004, it was estimated that a total of 10 682 vessels participated in tuna fishing.</li> <li>IOTC staff believe that about 90% of the country's tuna catch is by the small fibreglass boats (i.e. small-scale in the present study).</li> <li>It is likely that the gillnetting catches significant amounts of turtles.</li> </ul>	<ul style="list-style-type: none"> <li>IOTC data</li> <li>Herrera and Lepere (2005)</li> <li>M. Herrera, IOTC, pers. com., April 2010</li> <li>G. Van Santen, pers. com., April 2010</li> </ul>
Other Indian Ocean areas	<p>According to IOTC data, for the three-year period 2006–2008:</p> <ul style="list-style-type: none"> <li>Only gillnetting was reported (which is not likely to be small-scale).</li> </ul>	n.a.	n.a.		<ul style="list-style-type: none"> <li>IOTC data</li> </ul>

## Appendix 8 – East and Southeast Asia

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
<b>Cambodia</b>	<ul style="list-style-type: none"> <li>There are no fisheries which target tuna or have tuna as a significant bycatch.</li> </ul>	n.a.	n.a.		<ul style="list-style-type: none"> <li>Gillett (2004)</li> </ul>
<b>China</b>	<ul style="list-style-type: none"> <li>Tuna species distribution maps show that the principal market species of tuna are not often found close to the coast of mainland China. Significant catches of tunas by small vessels would therefore not be expected.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>According to INFOYU, there are no fishing vessels specialized in tuna fishing along the coast.</li> </ul>	<ul style="list-style-type: none"> <li>Gillett (2005)</li> <li>Collette and Nauen (1983)</li> <li>Staff of INFOYU</li> </ul>
<b>Democratic People's Republic of North Korea</b>	<ul style="list-style-type: none"> <li>Assumed to be none for the principal market species of tuna.</li> </ul>	n.a.	n.a.		
<b>Indonesia (FAO Area 71 portion)</b>	<p>Ingles <i>et al.</i> (2008) comprehensively reviewed tuna fisheries in Indonesia. The report of that study in conjunction with Ingles shows:</p> <ul style="list-style-type: none"> <li>Total Indonesia annual tuna catch (all areas/scales/gear) is over twice the official estimate.</li> <li>Small-scale tuna catches in the Area 71 part of Indonesia are: <ul style="list-style-type: none"> <li>trolling – 306 500 tonnes; handlining – 226 500 tonnes; small-scale pole and line – 61 000 tonnes;</li> <li>various gill/trammel nets – 31 000 tonnes;</li> <li>total all small-scale gears – 625 000 tonnes.</li> </ul> </li> </ul>	375 000	500 000	<ul style="list-style-type: none"> <li>Gillett (2005) made an estimate of annual tuna catches by handlining and trolling (but not small-scale pole and line) in the Area 71 part of Indonesia of 67 000 mt, but the author indicated that the estimate should be considered "educated guesswork".</li> <li>Pet-Soede <i>et al.</i> (2002) examine the pole-and-line catch and show that 99.62% of the biomass was targeted species (tuna), the remaining 0.38% of the catch consisting of 23 species, including 6 pelagic fish, 11 reef fish, 3 molluscs, 2 cephalopods, 3 echinoderms and 1 crustacean. <i>Coryphaena hippurus</i> comprised 40% of the pole and line bycatch. A mean of 0.013 kg of fish being produced with every kg of fish landed. All of the pelagic species caught by the pole-and-line fishery were utilized by the fishers or sold.</li> </ul>	<ul style="list-style-type: none"> <li>Pet-Soede <i>et al.</i> (2002)</li> <li>Ingles <i>et al.</i> (2008)</li> <li>J. Ingles, WWF, March 2010</li> <li>J. Pet, pers. com., March 2010</li> <li>P. Mous, pers. com., March 2010</li> </ul>

n.a. = not available

pers. com. = personal communication

mt = tonnes

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Indonesia (FAO Area 71 portion), cont.	<ul style="list-style-type: none"> <li>The above estimates include the principal market species (as in the present study) plus "tongkol", a local term for small species of tuna. Tongkol makes up about 40%. Total of the principal market species is therefore about 375 000 tonnes.</li> <li>With respect to the catch composition of the main tuna gear, pole and line produces about 99% tuna (principal market species), handlining about 50% tuna and trolling about 60%. Netting produces variable but much smaller quantities of tuna, perhaps 30%. This information could be used to make an educated guess at the non-tuna catch of small-scale pelagic fishing.</li> </ul>			<ul style="list-style-type: none"> <li>Ingles et al. (2008) describe two important types of craft used for small-scale tuna fishing: (1) small pole-and-line vessels between 5 and 15 GT called "funae" that use outboard motors; and (2) handline vessels from less than 1 GT to 5 GT that use outboard motors.</li> <li>In the Ingles et al. (2008) study, an important tuna fishery bycatch issue (which is applicable to small-scale fisheries) is the catch of juvenile tuna. For example: "Troll lines catch substantial amounts of juvenile tunas up to 10–50% in Padang, West Sumatra and 10–20% in Sorong, West Papua".</li> </ul>	
Japan	<ul style="list-style-type: none"> <li>The small-scale troll fishery described in the column to the right produces about 2 000 to 4 000 tonnes per year, about 25% of which is bluefin and skipjack.</li> <li>The non-tuna species in the catch include <i>Euthynnus</i> and <i>Scomberomoros</i>.</li> <li>There are reports of a substantial amount of sport fishing for tuna in Japan, but information on this topic is not readily available.</li> </ul>	750	2 250	<ul style="list-style-type: none"> <li>Non-industrial gear for tuna fishing includes troll, trap, pole and line and small-scale longline. For the purpose of the present study, only troll is considered small-scale.</li> <li>Total troll catches of tuna in Japan range from 8 000 to 20 000 tonnes annually in recent years, but much of this is by fishing that is not "small-scale" as defined for the present study.</li> <li>There is a fishery that qualifies as "small-scale". Partially decked boats troll juvenile bluefin, skipjack and bullet tunas and operate very close to the coast. The boats are less than 10 m in length, are partly undecked and normally operated by one man. This fishery is important in the sense that they provide most of the seed juvenile bluefin for tuna farming companies in Japan.</li> </ul>	<ul style="list-style-type: none"> <li>Z. Suzuki, WCPFC, pers. com., April 2010</li> <li>J. Ianelli, NMFS, pers. com., April 2010</li> <li>P. Miyake, pers. com., April 2010</li> <li>Y. Takeuchi, NRIFSF, pers. com., April 2010</li> <li>Anon (2009a)</li> <li>Anon (2009b)</li> </ul>



Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Malaysia	<ul style="list-style-type: none"> <li>Assumed to be none for the principal market species of tuna.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>Some skipjack reported from the portion of the South China Sea to the northwest of Borneo, but apparently none taken by non-industrial gear in Malaysia.</li> </ul>	<ul style="list-style-type: none"> <li>Gillett (2005)</li> </ul>
Philippines	<p>In the five-year period 2003–2007, the small handline vessels caught an annual average of 108 839 tonnes of tuna.</p> <p>Data from 2006–2008 show the catch composition of the handline fishery:</p> <ul style="list-style-type: none"> <li>yellowfin (<i>Thunnus albacares</i>) – 80 to 83%;</li> <li>bigeye (<i>Thunnus obesus</i>) – 2 to 3%;</li> <li>albacore (<i>Thunnus alalunga</i>) – 1 to 3%;</li> <li>other species – 12 to 17%;</li> <li>the other species include marlins (<i>Makaira mazara</i> and <i>Makaira indica</i>), swordfish (<i>Xiphias gladius</i>) and sailfish (<i>Istiophorus platypterus</i>).</li> </ul>	108 839	18 458	<ul style="list-style-type: none"> <li>Vera and Hipolito (2006) state the primary producer of the high-priced Class A or <i>sashimi</i>-grade tuna destined for the international market is the humble handliner. The tuna boom in General Santos has attracted poor fishers from different provinces in southern and central Philippines who come there to seek their fortune in tuna handlining. There is an estimated 3 000–4 000 boats engaged in tuna fishing, which corresponds to about 30 000–40 000 handline fishers. The simple handline vessel with outriggers and a small engine is mostly 18–36 feet in length (equivalent to 5.4–10.9 m). Its small engine, with 1.5 horsepower.</li> </ul>	<ul style="list-style-type: none"> <li>Barut and Garvilles (2009)</li> <li>Vera and Hipolito (2006)</li> </ul>
Republic of Korea	<ul style="list-style-type: none"> <li>Assumed to be none for the principal market species of tuna.</li> </ul>	n.a.	n.a.		
Russian Federation	<ul style="list-style-type: none"> <li>Assumed to be none for the principal market species of tuna.</li> </ul>	n.a.	n.a.		
Singapore	<ul style="list-style-type: none"> <li>Assumed to be none for the principal market species of tuna.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>As the principal market species of tuna are uncommon near Singapore, it is not likely significant quantities of principal market species of tuna are taken by non-industrial fisheries.</li> </ul>	<ul style="list-style-type: none"> <li>Collette and Nauen (1983)</li> </ul>
Taiwan Province of China	<ul style="list-style-type: none"> <li>Information on very small-scale tuna fishing not readily available. Assumed to be zero.</li> </ul>	n.a.	n.a.		<ul style="list-style-type: none"> <li>M. McCoy, GPA, pers. com., April 2010</li> </ul>
Thailand (FAO Area 71 portion)	<ul style="list-style-type: none"> <li>Assumed to be none for the principal market species of tuna.</li> </ul>	n.a.	n.a.	<ul style="list-style-type: none"> <li>FAO statistics show no catch of tuna on the Pacific side</li> </ul>	<ul style="list-style-type: none"> <li>FAO/FishStat data</li> </ul>

Country area	Small-scale tuna fisheries and catches	Annual tuna catch (Tonnes)	Annual non-tuna catch (Tonnes)	Other information	Source of information
Viet Nam	<ul style="list-style-type: none"> <li>• Lewis (2005) makes estimates of the annual tuna catch by gear:               <ul style="list-style-type: none"> <li>- purse seine (650 vessels at 100 tonnes/vessel) 6 500 tonnes;</li> <li>- small longline (1 500 vessels at 10 tonnes/vessel) 15 000 tonnes;</li> <li>- large longline (40 vessels at 100 tonnes/vessel) 4 000;</li> <li>- gillnet (1 400 vessels at 50 tonnes/vessel) 7 000 tonnes;</li> <li>- other coastal provinces with fewer data, various gears – 10 000 tonnes;</li> <li>- total ~ 42 500 mt.</li> </ul> </li> <li>• Lewis (personal communication) indicates that there are no statistics available but it can be crudely estimated that about 10% of Viet Nam's tuna catch is made by undecked vessels.</li> </ul>	4 250	n.a.	<ul style="list-style-type: none"> <li>• According to Roberts (2002), Vietnamese fishers in the central provinces have traditionally caught tuna with weirs, rake nets, drag nets and especially by fishing lines. It should be noted that most of this "tuna" is <i>Auxis</i>, <i>Euthynnus</i>, and other small tunas, with the only principal market species being skipjack tuna, but this is a very small proportion (0.59%) of the "tuna" catch.</li> <li>• There is no information available on the non-tuna catches of small-scale pelagic fisheries, but presumably the amount is substantial, especially for gillnetting.</li> </ul>	<ul style="list-style-type: none"> <li>• Roberts (2002)</li> <li>• Lewis (2005)</li> <li>• A. Lewis, pers. com., April 2010</li> </ul>

## Appendix 9 – Oceania

Area	Small-scale tuna fisheries and catches	Tuna catch (Tonnes)	Non-tuna catch (Tonnes)	Other information	Source of information
<b>American Samoa</b>	<ul style="list-style-type: none"> <li>Tuna troll fishery – 17 tonnes of tuna, 1 tonne of other fish; about 17 vessels participating.</li> <li>Small boat (alia) fishery – about 15 tonnes of tuna, 1 tonne of other (mainly dolphinfish, wahoo and shark). Only one alia operated as longliner in 2008.</li> </ul>	32	2	<ul style="list-style-type: none"> <li>Data for year 2008.</li> <li>Text of the report states that recreational and subsistence catches are included.</li> <li>Little, if any, discarding.</li> <li>Alia catches estimated from independent Samoa alia fleet.</li> </ul>	<ul style="list-style-type: none"> <li>NMFS (2009)</li> <li>Hamilton (2007)</li> </ul>
<b>Australia</b>	<ul style="list-style-type: none"> <li>In the 2004/05 season, minor lining produced 52.4 tonnes of tuna and 6.8 tonnes of non-tuna species.</li> <li>In the 2005/06 season, minor lining produced 4.6 tonnes of tuna and 4.9 tonnes of non-tuna species.</li> <li>In those years, the main non-tuna species were sharks, striped marlin and “other”.</li> <li>Commercial trolling, rod and reel and headline gear produced 143.5 tonnes in 2007.</li> <li>In the 12 months prior to May 2000, recreational fishing in New South Wales and Queensland resulted in the capture of 107 tonnes of “tuna/bonitos”, about half of which were released/discarded.</li> <li>About 32% of this “tuna/bonito” category are species other than principal market species of tuna. For the purpose of the present survey, 68% of the category “tuna/bonitos” is considered tuna.</li> </ul>	68	6	<p>Catches are the average for the years cited.</p> <ul style="list-style-type: none"> <li>“Minor lining” is defined to be hand lining, poling, rod and reel and trolling operations.</li> <li>It is assumed that the catches in the category of “minor lining” are small-scale.</li> <li>From 1999/2000 to 2005/06, two blue marlin were the only reported interactions with no-take or with non-fish species in the minor line sector.</li> </ul>	<ul style="list-style-type: none"> <li>AFMA (2008)</li> <li>Evans (2007)</li> <li>BRS (2003)</li> </ul>
		73	34		

n.a. = not available

pers. com. = personal communication

mt = tonnes

Area	Small-scale tuna fisheries and catches	Tuna catch (Tonnes)	Non-tuna catch (Tonnes)	Other information	Source of information
Cook Islands	<ul style="list-style-type: none"> <li>According to the Ministry of Marine Resources (MMR), the catch from the Cook Islands FAD fishery by subsistence and semi-commercial fishers in recent years has averaged between 20 and 50 tonnes of fish being caught annually. In 2007, the amount is estimated to be 49.3 tonnes.</li> <li>For the purpose of the present study, it is assumed that the tuna catch by small-scale fishing in the entire Cook Islands is twice that of the FAD fishery.</li> </ul> <p>Sampling by SPC/MMR over several years shows:</p> <ul style="list-style-type: none"> <li>Rarotonga trolling (open water, inshore FAD, offshore FAD) produced 21.3 tonnes of tuna and 4.0 tonnes of non-tuna species (50% wahoo, 29% dolphinfish, 6% marlin, 6% shark).</li> <li>Aitutaki trolling (open water, inshore FAD, offshore FAD) produced 6.9 tonnes of tuna and 2.9 tonnes of non-tuna species (63% wahoo, 27% dolphinfish, 6% barracuda).</li> <li>Drop-stoning for tuna produced a tonne or less of total catch in Rarotonga and Aitutaki, with the non-tuna species mostly dolphinfish and rainbow runner.</li> </ul>	99	25	<ul style="list-style-type: none"> <li>Data was obtained by the SPC/MMR sampling programme in the Cook Islands.</li> <li>Tuna catches by small-scale fishing have decreased in recent years due to competition in the market with longliner bycatch.</li> <li>Research on trolling catch composition and fishing areas indicates some degree of seasonal targeting of wahoo.</li> </ul>	<ul style="list-style-type: none"> <li>SPC (unpublished data)</li> <li>MMR (2008)</li> <li>Chapman <i>et al.</i> (2005)</li> </ul>

Area	Small-scale tuna fisheries and catches	Tuna catch (Tonnes)	Non-tuna catch (Tonnes)	Other information	Source of information
<b>Fiji</b>	<ul style="list-style-type: none"> <li>Gillett (2005) estimated a tuna catch of 1 000 tonnes per year.</li> <li>For the purpose of the present study, it is assumed that the species composition of the total catch and of the non-tuna catch is similar to that of the troll fishery of Rarotonga, Cook Islands. That is: 80% tuna, 20% non-tuna; and for the non-tuna, 50% wahoo, 29% dolphinfish, 6% marlin, 6% shark.</li> </ul>	1 000	250	<ul style="list-style-type: none"> <li>Almost all small-scale tuna fishing is by trolling.</li> <li>Some commercial and private sport fishing.</li> <li>FADs deployed mainly around the main city of Suva.</li> </ul>	<ul style="list-style-type: none"> <li>Gillett (2005)</li> </ul>
<b>French Polynesia</b>	<ul style="list-style-type: none"> <li>“Poti maraa” fishery (troll, harpoon, vertical longline) – 926 tonnes of tuna, 300 tonnes of dolphinfish, 148 tonnes of billfish, 88 tonnes of wahoo, 103 tonnes of other; 280 vessels in fleet.</li> <li>Bonitier fishery (pole and line, troll headline) – 528 tonnes of tuna, 19 tonnes of dolphinfish, 23 tonnes of billfish, 29 tonnes of wahoo, 67 tonnes of “other”; 50 vessels in fleet.</li> </ul>	1 454	777	<ul style="list-style-type: none"> <li>Data for year 2007.</li> <li>The “small-scale nearshore tuna fishery” is made up of two components: “poti maraa” vessels (6–8 m) and “bonitier” vessels (10–12 m).</li> </ul>	<ul style="list-style-type: none"> <li>Service de la Pêche (2008)</li> </ul>
<b>Guam</b>	<ul style="list-style-type: none"> <li>Tuna troll fishery – 145 tonnes of tuna, 5 tonnes of billfish, 51 tonnes dolphinfish, 1 tonne pomfret, 45 tonnes of wahoo, 3 tonnes of other fish; about 385 vessels participating.</li> </ul>	145	105	<ul style="list-style-type: none"> <li>Data for year 2008.</li> <li>Text of the report states that recreational and subsistence catches are included.</li> </ul>	<ul style="list-style-type: none"> <li>NMFS (2009)</li> </ul>
<b>Hawaii (United States)</b>	<ul style="list-style-type: none"> <li>Tuna troll fishery – 650 tonnes of tuna, 195 tonnes of billfish, 247 tonnes of dolphinfish, 222 tonnes of wahoo and 1 tonne of other; about 1 512 vessels participating.</li> <li>Tuna headline fishery – 368 tonnes of tuna, 8 tonnes of billfish, 17 tonnes of dolphinfish, 18 tonnes of pomfrets and 5 tonnes of wahoo. About 470 vessels participating in only the tuna headline fishery.</li> </ul>	1 018	713	<ul style="list-style-type: none"> <li>Data for year 2008.</li> <li>Text of NMFS (2009) states that recreational and subsistence catches are included in these catch data.</li> <li>Little, if any, discarding in troll fishery; small amount of sharks discarded in headline fishery.</li> <li>The Hawaii tuna headline fishery has three components: “ika-shibi” fishing at night, “palu ahi” fishing during the day and jigging on FADs.</li> </ul>	<ul style="list-style-type: none"> <li>NMFS (2009)</li> <li>Itano and Holland (2000)</li> <li>D. Itano, University of Hawaii, pers. com., February 2010</li> <li>P. Dalzell, WRFM/C, pers. com., February 2010</li> </ul>

Area	Small-scale tuna fisheries and catches	Tuna catch (Tonnes)	Non-tuna catch (Tonnes)	Other information	Source of information
Kiribati	<ul style="list-style-type: none"> <li>Data supplied by the Kiribati government was used by SPC to estimate that the “artisanal” tuna catch in Kiribati in 2007 was 8 223 tonnes of skipjack and 4 347 tonnes of yellowfin (12 570 tonnes total).</li> <li>An informal survey done by a fisheries specialist based on Tarawa indicated that troll catches are about 88% tuna and 12% non-tuna species.</li> <li>That survey showed that the non-tuna species are mainly wahoo, dolphinfish, shark and sailfish.</li> </ul>	12 570	1 714	<ul style="list-style-type: none"> <li>The “artisanal” catch of the SPC estimate is mostly trolling from open skiffs but some drop-stoning for tuna from canoes is carried out.</li> <li>Marlin is occasionally caught by drop-stoning.</li> </ul>	<ul style="list-style-type: none"> <li>Lawson (2009)</li> <li>M. Savins, pers. com., April 2010</li> <li>H. Genthe, pers. com., April 2010</li> </ul>
Marshall Islands	<ul style="list-style-type: none"> <li>It is estimated that 950 tonnes of fish are taken annually by small-scale commercial fishers. Government fishery officials believe that tuna make up between 5 and 10% of these landings.</li> </ul>	71	57	<ul style="list-style-type: none"> <li>No information on non-tuna catch.</li> <li>Using troll catch information from Nauru, about 57 tonnes of non-tuna catch could be expected.</li> </ul>	<ul style="list-style-type: none"> <li>Gillett (2005)</li> <li>Gillett (2010a)</li> </ul>
Micronesia (Federated States of)	<ul style="list-style-type: none"> <li>Each year, small-scale commercial trolling for tuna produces about 57 tonnes of tuna that is sold locally.</li> <li>Subsistence catches of tuna, mainly in the outer islands, are taken by handline and trolling with outboard-powered motorboats or by canoe. Subsistence fishing yields about 1 900 tonnes per annum.</li> </ul>	1 957	196	<ul style="list-style-type: none"> <li>Handline/troll catches sampled by one survey in the outer islands consisted of 60% yellowfin, 25% skipjack, 9% kawakawa, 5% bigeye and 1% frigate tuna.</li> <li>For the purpose of the present study, it is assumed that this catch composition is applicable to all small-scale tuna fishing in Micronesia (Federated States of).</li> </ul>	<ul style="list-style-type: none"> <li>Gillett et al. (2001)</li> <li>Gillett (1987)</li> </ul>

Area	Small-scale tuna fisheries and catches	Tuna catch (Tonnes)	Non-tuna catch (Tonnes)	Other information	Source of information
Nauru	<ul style="list-style-type: none"> <li>The total small-scale fish production of Nauru was estimated to be 650 tonnes in 2007. For the purpose of the present study, it is assumed that small-scale pelagic fishing produces about 150 tonnes of tuna per year.</li> </ul> <p>Sampling by SPC and Nauru government shows:</p> <ul style="list-style-type: none"> <li>Mid-water handlining produced 55% tuna and 45% non-tuna species. For the non-tuna: 66% rainbow runner, 11% flyingfish, 8% wahoo.</li> <li>Trolling produced 96% tuna and 4% non-tuna species. For the non-tuna: 60% wahoo, 16% rainbow runner, 9% flyingfish, 3% barracuda.</li> </ul>	150	18	<ul style="list-style-type: none"> <li>Data obtained by SPC/Nauru sampling programme in Nauru.</li> </ul>	<ul style="list-style-type: none"> <li>SPC (unpublished data)</li> <li>Gillett (2010a)</li> </ul>
New Caledonia	<ul style="list-style-type: none"> <li>About ten vessels participate occasionally in trolling.</li> <li>A small amount of recreational fishing occurs.</li> <li>Total tuna catch likely to be around 20 tonnes per year.</li> </ul>	20	10	<ul style="list-style-type: none"> <li>No information is available on the composition of the non-tuna catch.</li> <li>Amount of non-tuna catch based on a similar style of fishing in French Polynesia (bonitier vessels).</li> </ul>	<ul style="list-style-type: none"> <li>Chapman (2004)</li> </ul>
New Zealand	<ul style="list-style-type: none"> <li>Albacore troll catch averaged about 3 000 tonnes annually in the present decade.</li> <li>A recreational fishery for Pacific bluefin tuna has recently developed, and preliminary estimates of catches are in excess of 10 tonnes per year.</li> <li>The historic survey results suggest annual recreational catches of albacore have around 245 to 260 tonnes annually.</li> <li>Gillett (2005) estimated that catches of tuna by small-scale fishing is assumed to be 10% of the troll catch.</li> </ul>	350	35	<ul style="list-style-type: none"> <li>There is no readily available information on the non-tuna catch by small-scale tuna fishing besides the statement by Murray and Griggs (2002) that trolling does not appear to have an appreciable bycatch.</li> <li>The non-tuna catch is semi-arbitrarily estimated to be 10% of the tuna catch.</li> <li>Ministry of Fisheries (2008) states: "Although no specific fishery interactions have been observed or reported for the troll fishery in New Zealand fishery waters, anecdotal reports and expert opinion consider that some albatross species are at risk of capture from this method."</li> </ul>	<ul style="list-style-type: none"> <li>Ministry of Fisheries (2009)</li> <li>Gillett (2005)</li> <li>Ministry of Fisheries (2008)</li> <li>Murray and Griggs (2002)</li> </ul>

Area	Small-scale tuna fisheries and catches	Tuna catch (Tonnes)	Non-tuna catch (Tonnes)	Other information	Source of information
Niue	<ul style="list-style-type: none"> <li>The Niue Department of Agriculture, Forestry and Fisheries uses the figure of 120 tonnes as the production from all small-scale fisheries in Niue.</li> <li>For the purpose of the present study, it is assumed that small-scale pelagic fishing produces 100 tonnes of fish per year.</li> <li>Sampling by SPC over several years shows that trolling produces 31% tuna and 67% non-tuna species.</li> <li>For the non-tuna species: 72% wahoo, 22% dolphinfish.</li> </ul>	31	67	<ul style="list-style-type: none"> <li>Data obtained by SPC sampling programme in Niue.</li> <li>Research on trolling catch composition and fishing areas indicates some degree of seasonally targeting wahoo.</li> </ul>	<ul style="list-style-type: none"> <li>SPC (unpublished data)</li> <li>Chapman <i>et al.</i> (2005)</li> </ul>
Northern Mariana Islands	<ul style="list-style-type: none"> <li>Tuna troll fishery – 80 tonnes of tuna, 1 tonne of billfish, 5 tonnes of dolphinfish, 1 tonne of wahoo, 3 tonnes of other; about 47 vessels participating.</li> </ul>	80	10	<ul style="list-style-type: none"> <li>Data for year 2008.</li> <li>Text of the report states that recreational and subsistence catches are included.</li> </ul>	<ul style="list-style-type: none"> <li>NMFS (2009)</li> </ul>
Palau	<ul style="list-style-type: none"> <li>A household income and expenditure survey was conducted in Palau from May through November 2006. From that survey and a knowledge of Palau fisheries, it can be estimated that the small-scale commercial and subsistence catches were about 60 tonnes for that year.</li> </ul>	60	50	<ul style="list-style-type: none"> <li>Estimate of non-tuna troll catch is semi-arbitrary.</li> </ul>	<ul style="list-style-type: none"> <li>Alonz (2007)</li> </ul>



Area	Small-scale tuna fisheries and catches	Tuna catch (Tonnes)	Non-tuna catch (Tonnes)	Other information	Source of information
Papua New Guinea	<ul style="list-style-type: none"> <li>There are around 15 operational tuna "pump boats" between Lae and Madang which operate six months per year. This fleet catches about 1 500 tonnes of tuna per year. The bycatch is mainly dolphinfish and sharks, perhaps 100 tonnes per season.</li> <li>There are about 1 000 "banana boats" (outboard-powered open fibreglass skiffs) that occasionally troll for tuna. The annual tuna catch has been estimated to be about 400 to 700 kg of tuna per banana boat per year, or about 550 tonnes of tuna per year for the fleet.</li> </ul>	2 050	1 475	<ul style="list-style-type: none"> <li>Little information is available on the non-tuna catch for trolling, but it is likely to be two to three times the tuna catch.</li> </ul>	<ul style="list-style-type: none"> <li>H. Walton, PNG/NFA, pers. com., March 2010</li> <li>NFA coastal fisheries staff, pers. com., March 2010</li> </ul>
Pitcairn Islands	<ul style="list-style-type: none"> <li>Long boats and skiffs are occasionally used for trolling tuna and other coastal pelagics.</li> <li>An educated guess of the tuna and non-tuna catch would be 1 tonne and 3 tonnes, respectively.</li> </ul>	1	3		<ul style="list-style-type: none"> <li>Adams and Langley (2005)</li> <li>Gillett (2010a)</li> </ul>
Samoa	<ul style="list-style-type: none"> <li>Alia longline fishery – 665 tonnes of tuna, 28 tonnes of other (mainly dolphinfish, wahoo and shark); 37 vessels in fleet.</li> <li>Alia troll fishery – 113 tonnes of tuna, 3 tonnes of other; 15 vessels in fleet.</li> </ul>	778	31	<ul style="list-style-type: none"> <li>Data for year 2007 for alia troll, 2006 for alia longline.</li> <li>Only the alia (undecked catamarans, about 9–11 m in length) are considered small-scale tuna vessels.</li> <li>No information on any discards. The national tuna management plan states: "There shall be no discarding of bycatch species".</li> </ul>	<ul style="list-style-type: none"> <li>Fisheries Division (2008)</li> <li>Fisheries Division (2009)</li> <li>Hamilton (2007)</li> </ul>
Solomon Islands	<ul style="list-style-type: none"> <li>All small-scale landings of tuna (commercial and subsistence) are estimated to be about 10% of the entire coastal fisheries catch.</li> <li>The entire small-scale fisheries catch was estimated to be 18 259 in 2007.</li> </ul>	1 826	n.a.		<ul style="list-style-type: none"> <li>Gillett (2005)</li> <li>Gillett (2010b)</li> </ul>

Area	Small-scale tuna fisheries and catches	Tuna catch (Tonnes)	Non-tuna catch (Tonnes)	Other information	Source of information
<b>Tokelau</b>	<ul style="list-style-type: none"> <li>Many part-time subsistence fishers.</li> <li>A large variety of traditional techniques are used, including catching yellowfin by noose from an unpowered canoe.</li> <li>It can be inferred from a study in the late 1980s that the present annual catch of tuna is about 50 tonnes.</li> </ul>	50	50		<ul style="list-style-type: none"> <li>Gillett and Toloa (1987)</li> </ul>
<b>Tonga</b>	<ul style="list-style-type: none"> <li>Coastal trolling for tuna and other pelagic species is a well-established practice in some fishing communities throughout Tonga, notably on 'Eua, 'Atata, 'Euaiki, 'Uiha and Ofolaga, but no catch data are available.</li> <li>There are about 10 commercial sport fishing vessels.</li> <li>For the purpose of this document, in consideration of the above information, it will be assumed that about 50 tonnes of tuna is taken each year by small-scale fishing.</li> </ul>	50	13	<ul style="list-style-type: none"> <li>For the purpose of the present study, it is assumed that the species composition of the catch is similar to that of the troll fishery of Rarotonga, Cook Islands; that is: 80% tuna, 20% non-tuna.</li> </ul>	<ul style="list-style-type: none"> <li>Gillett (2010c)</li> </ul>
<b>Tuvalu</b>	<ul style="list-style-type: none"> <li>A 2004/2005 household income and expenditure survey estimated that subsistence and commercial catches of tuna are 625 tonnes per year.</li> </ul>	625	n.a.	<ul style="list-style-type: none"> <li>All tuna catches in Tuvalu are from small-scale fishing.</li> <li>Government of Tuvalu (2009) indicates that the artisanal fleet landed a total catch of 25.7 tonnes in 2008.</li> </ul>	<ul style="list-style-type: none"> <li>CSD (2006)</li> <li>Government of Tuvalu (2009)</li> </ul>
<b>Vanuatu</b>	<ul style="list-style-type: none"> <li>A few sport fishing and bottom-fishing vessels occasionally catch tuna.</li> <li>A household income and expenditure survey was conducted in Vanuatu in 2006. It estimated the catch of "tuna/bonito" to be 7.5 tonnes per year.</li> </ul>	7	n.a.		<ul style="list-style-type: none"> <li>NSO (2007)</li> </ul>
<b>Wallis and Futuna Islands</b>	<ul style="list-style-type: none"> <li>Only sporadic trolling in the ocean.</li> <li>Tuna catch likely to be less than 5 tonnes per year.</li> </ul>	5	5	<ul style="list-style-type: none"> <li>Estimate of non-tuna troll catch is semi-arbitrary.</li> </ul>	



Why study bycatch from small-scale tuna fisheries? Bycatch from purse seining and longlining has been the subject of a considerable amount of research. Small-scale tuna fishing and the associated bycatch have received relatively little attention, and no work has been carried out to obtain a global overview. In addition, several recent studies link small-scale fisheries to bycatch of threatened species. This document summarizes on a national level catch information of small-scale tuna fisheries and those small-scale fisheries that catch tuna. It also aims to identify on a regional basis data gaps, major issues and management concerns associated with these fisheries and their bycatch.

