



## 10<sup>th</sup> MEETING OF THE STANDING COMMITTEE

8- 10 July 2015, Kampala, Uganda

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### REVIEW OF POTENTIAL IMPACTS OF MARINE FISHERIES ON MIGRATORY SEABIRDS WITHIN THE AFROTROPICAL REGION

#### Background

At the First Session of the Meeting of the Parties to AEWA in November 1999, a project entitled “*Study of the potential impacts of marine fisheries on migratory seabirds*” was listed amongst the AEWA International Implementation Priorities 2000-2004 (Resolution 1.4). Following the acquisition of funding, the UNEP/AEWA Secretariat contracted the (then) Avian Demography Unit at the University of Cape Town, South Africa, to undertake the project (Cooper 2006).

During initial discussions on the scope and ambit of the project, it was agreed that it would be a desktop study, reviewing published and grey literature sources, and further that it would be restricted to the Afrotropical Region (Africa south of the Sahara). An initial draft was completed in 2009, by John Cooper and Samantha Peterson; this focused on the Atlantic Ocean.

After a review by the Technical Committee, a number of major issues were raised. In 2013 the UNEP/AEWA Secretariat managed to acquire extra funding and commissioned a revision of the report to BirdLife South Africa.

The current document represents a revised and updated version thereof, expanded to cover a broader range of fisheries in both Atlantic and Indian oceans. It was reviewed by the AEWA Technical Committee prior to and during its 12<sup>th</sup> Meeting in March 2015, where it was approved for submission to MOP6.

#### Action Requested from the Standing Committee

The Standing Committee is requested to decide on the submission of the report to the 6<sup>th</sup> Session of the Meeting of the Parties to AEWA.

**REVIEW OF POTENTIAL IMPACTS OF MARINE FISHERIES  
ON MIGRATORY SEABIRDS WITHIN THE AFROTROPICAL  
REGION**

**REPORT TO THE AFRICAN-EURASIAN WATERBIRD  
AGREEMENT**

January 2015

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## **Preparation of the report**

At the First Session of the Meeting of the Parties to AEWA in November 1999, one of the resolutions adopted (Resolution 1.4, International Implementation Priorities for AEWA 2000-2004) listed a project entitled “Study of the potential impacts of marine fisheries on migratory seabirds” (AEWA 1999, 2000). Following the acquisition of funding, the AEWA Secretariat contracted the (then) Avian Demography Unit at the University of Cape Town, South Africa, to undertake the project (Cooper 2006). During initial discussions on the scope and ambit of the project, it was agreed that it would be a desktop study, reviewing published and grey literature sources, and further that it would be restricted to the Afrotropical Region (Africa south of the Sahara). An initial draft was completed in 2009, by John Cooper and Samantha Peterson; this focussed on the Atlantic Ocean. This report represents a revised and updated version thereof, expanded to cover a broader range of fisheries in both Atlantic and Indian oceans.

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## Acronyms and Abbreviations

ACAP	Agreement on the Conservation of Albatrosses and Petrels
AEWA	African-Eurasian Waterbird Agreement
ATF	Albatross Task Force
BLI	BirdLife International
CCAMLR	Convention for the Conservation of Antarctic Marine Living Resources
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CMS	Catch Monitoring System
FAO	Food and Agriculture Organisation (of the United Nations)
IBA	Important Bird Area
ICCAT	International Commission for the Conservation of Atlantic Tunas
IOTC	Indian Ocean Tuna Commission
IUCN	International Union for the Conservation of Nature
IUU	Illegal, unregulated or unreported
NGO	Non-Governmental Organisation
NPOA	National Plan of Action
SEAFO	Southeast Atlantic Fisheries Organisation
SFC	Subregional Fishery Commission
SIOFA	South Indian Ocean Fisheries Agreement
SWIOFC	Southwest Indian Ocean Fisheries Commission
RFMO	Regional Fisheries Management Organisations

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## 1. Executive Summary

Fifty-four seabird species that are included on the African-Eurasian Waterbird Agreement (AEWA) Annex 2 list of birds are considered in this report, which deals with known and possible marine fisheries impacts on seabirds in the Afrotropical region (south of the Sahara). Three AEWA-listed species considered in this report are listed as globally Endangered, two as Vulnerable, and five are Near Threatened; a further 16 species are listed as Least Concern but have decreasing population trends.

The greatest concern arising from this review is the paucity of data on fisheries activities and of seabird interactions (direct and indirect) with fisheries.

### *Direct impacts*

Although longline and trawl fisheries are known to have direct, negative, widespread and significant impacts on procellariiform seabirds, there are few data to suggest that fisheries using these gear types have similar scales of impacts on AEWA-listed species in the Afrotropical region, with the exception of Cape Gannets *Morus capensis* and possible exception of Northern Gannets *M. bassannus*. Populations of some seabirds that scavenge around fishing vessels, particularly trawlers, may increase through provision of food in the form of fishery waste/discards, which can have unexpected impacts on the species in question and the ecosystem more generally. Artisanal fishing, particularly using gillnets, is believed to be widespread in the region, probably accounts for a significant proportion of total fish catches, and potentially impacts a very wide range of species. However there are virtually no gillnet catch or effort data available from the region, let alone data on seabird catch rates.

### *Indirect impacts*

Indirect impacts of fishing are probably pervasive, but are poorly quantified in the region. Appreciable, directed research effort is required to remedy this data gap. Indirect impacts include direct competition between fisheries and seabirds (e.g. overfishing) as well as indirect competition (displacement of seabirds) and loss of commensal species that leads to lower food availability, particularly for tropical seabird species foraging in association with tunas and tuna-like fish.

### *Cross-species synthesis*

The numbers of threats that species in various groups face varies. Gannets and boobies, cormorants, gulls, and terns all have species facing threats from three or more fisheries or ecosystem-type fisheries impacts, whereas other groups have species facing only one or two such threats. Changes in foraging behaviour arising from competition or changes to marine ecosystems and food webs are predicted to impact the most species across all taxonomic groupings.

### *Recommendations*

Cross-cutting recommendations are provided for three key issues affecting all countries in the region: collaboration, gillnet fishing and overfishing. Collaboration between AEWA Contracting Parties and Regional Fisheries Management Organisations (RFMOs) as well as between government departments within the same country are highlighted.

- i) National fisheries management processes (especially compliance, monitoring and surveillance) need to be strengthened, in parallel with strengthening the functioning of RFMOs (see ii below) with jurisdiction in coastal waters and over non-tuna species.
- ii) A detailed assessment by the AEWA Technical Committee of the operations of each relevant RFMO is needed, to assess synergies with AEWA priorities coupled with a prioritisation exercise that identifies risks to AEWA-listed species and needs for improved measures by the respective RFMOs or Agreements.
- iii) Following the model of the albatross agreement (ACAP), the AEWA Contracting Party governments should support and/or strengthen the functioning of the RFMOs and regional seas conventions, as set out in the AEWA Action Plan (paragraphs 4.3.7 and 4.3.8;

- UNEP/AEWA 2013), including reviews of Contracting Party submissions to RFMOs and their support for conservation measures proposed/adopted by RFMOs.
- iv) Better communication and collaboration between the governmental departments dealing with fisheries and the environment is needed.

This report also highlights the lack of knowledge of both the scope of gillnet fishing within the region and the impacts this type of fishing has on seabirds. Recommendations to address this include research into the effects of gillnetting, especially in countries for which gillnet catches are high, and educating gillnet fishes in high risk areas, such as near Important Bird Areas (IBAs).

A second major issue, overfishing, has the potential to affect many species listed by AEWA, either directly through a reduction in preferred prey or indirectly through changes in beneficial foraging associations with predatory fish. To address issues of overfishing the following recommendations are made:

- i) Stronger governmental controls are needed to ensure that foreign-owned vessels catch only what has been agreed to.
- ii) The improvement of agreements between African countries and distant water fishing nations to ensure the conditions benefit the African countries sufficiently.
- iii) National fish stock management processes, catch and effort and Catch Monitoring Systems are supported and improved to ensure domestic fisheries are well managed.
- iv) Collaborative efforts to reduce Illegal, Unreported and Unregulated (IUU) fishing must be increased.
- v) European and Asian countries which are parties to AEWA but which fish in the territorial waters of African nations (especially those which are parties to AEWA), should assist with strengthening compliance and monitoring.

Targeted interventions have been identified for each sub region. In West Africa, areas of focus should include (in no particular order):

- i. Establishing mandatory observer programmes for all foreign vessels fishing in African territorial waters, with transparency in data collection, submission and reporting.
- ii. Undertaking dietary studies of seabirds, especially Slender-Billed (*Larus genei*) and Audouin's (*L. audouinii*) gulls and Caspian (*Sterna caspia*) and Royal (*S. maxima*) terns, breeding in the region to determine the degree of overlap with fishery catches.
- iii. Banning of *net sonde*<sup>1</sup> or third-wire sensor cables where trawl vessels operate in areas of high seabird abundance.
- iv. Conducting surveys of seabirds attending fishing vessels (trawl, longline and purse-seine) especially in the upwelling region of Senegal to identify those species potentially at risk.
- v. Assessing the scope and severity of threats from fisheries to the Northern Gannet in Senegal and Mauritania.
- vi. Assessing disturbance and direct consumption of seabirds at breeding colonies.
- vii. Assessing the scale and nature of gillnet fishing, and its impacts on seabirds (direct mortality in particular).

Southern Africa:

- i. Spatially explicit quotas will be introduced to the South African sardine fishery in the coming years, to mitigate the effects of fishing on the seabirds such as the African Penguin. The impacts of this practice on seabirds should be thoroughly studied. The AEWA Technical Committee should remain aware of the results of this management change because the outcomes are likely to be applicable elsewhere.
- ii. An assessment should be made of the bycatch risk of seabirds from trawl, longline and gillnet fisheries in Angola.
- iii. The level of directed take of seabirds, especially Cape Gannets in Angola should be determined.

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<sup>1</sup> Also known as third wire or sensor cable, used to relay data to the ship's bridge

- iv. Angola and Namibia should be encouraged and supported to develop National Plans of Action for reducing the incidental catch of seabirds in all fisheries.

Eastern Africa:

- i. Many seabirds in eastern Africa forage in association with tunas. The risk to these birds of tuna stock depletion should be assessed.
- ii. The level of dependence of seabirds on tuna, and consequences from localised stock depletions/overfishing, should be quantified.
- iii. An assessment of disturbance and direct consumption of seabirds at breeding colonies.

## 2. Introduction

The Afrotropical region is one of high marine biodiversity, encompassing both highly productive but species-poor upwelling systems as well as warmer oligotrophic waters with high levels of diversity. Many seabirds in the region are intra-Africa or Palaearctic migrants and are listed under the African-Eurasian Waterbird Agreement (AEWA). Annex 2 of the Agreement currently lists 287 species of birds from 21 families occurring within the region to which the Agreement applies. Many of these species are wetland birds or waterbirds which are found primarily in fresh-water and estuarine habitats. Seabirds, which are found in inshore and offshore marine environments, make up 22% of the species on the list. However, a knowledge gap has been identified regarding the threats facing these species, especially those posed by fisheries. Threats to wide-ranging (pelagic) seabirds, the albatrosses and petrels (Families Diomedidae, Procellariidae and Hydrobatidae) have been well studied and are the remit of the Agreement on the Conservation of Albatrosses and Petrels (ACAP).

### 2.1. *Geographic and Taxonomic Scope*

This review covers the countries south of the Sahara, known as the Afrotropical region and includes both mainland and island nations. The term “seabird” as defined by Croxall et al. (2012) was used to identify species to be covered in this report. A seabird is a “species for which a large proportion of the total population rely on the marine environment for at least part of the year” (Croxall et al. 2012). Thus, birds that also forage in the inter-tidal zone, estuaries and lagoons in the marine environment, such as most waders and plovers and the larger wading birds such as storks and herons, are excluded from the review.

A total of 54 of AEWA’s listed species are seabirds according to this definition (Table 1), of which the majority, 36, are larids *sensu lato* (gulls and terns). Three of the 54 species are classified as Endangered, two as Vulnerable, five as Near Threatened and 44 as Least Concern (

Table 2). However, 16 of the Least Concern species also have decreasing global population trends, which is a cause for concern.

**Table 1:** The families of AEWA-listed species included in this review. Values in italics are subtotals.

<b>Family</b>	<b>Number of species</b>
Spheniscidae (Penguins)	1
Phaethontidae (Tropicbirds)	3
Sulidae (Gannets and boobies)	3
Phalacrocoracidae (Cormorants)	5
Fregatidae (Frigatebirds)	2
Haematopodidae (Oystercatchers)	2
Stercorariidae (Skuas)	2
Laridae (Gulls)	16
Sternidae (Terns and noddies)	20
<i>Terns</i>	<i>17</i>
<i>Noddies and Kittiwakes</i>	<i>3</i>
<b>Total number of species</b>	<b>54</b>

**Table 2:** The subset of AEWA-listed seabird species considered in this review, listed by IUCN threat status, population trend and taxonomic order. The number of countries per subregion in which they occur and in which they are vagrant (in parentheses) is also given. EN= Endangered, VU = Vulnerable, NT = Near Threatened, LC= Least Concern.

Common name	Species name	IUCN Red List status	Population trend	West Africa	Southern Africa	East Africa
Cape Cormorant	<i>Phalacrocorax capensis</i>	EN	Decreasing	1	3	1
Bank Cormorant	<i>Phalacrocorax neglectus</i>	EN	Decreasing		2	6
African Penguin	<i>Spheniscus demersus</i>	EN	Decreasing	(2)	3	1 (2)
Cape Gannet	<i>Morus capensis</i>	VU	Decreasing	7 (3)	3	2 (1)
Socotra Cormorant	<i>Phalacrocorax nigrogularis</i>	VU	Decreasing			7
White-eyed Gull	<i>Larus leucophtalmus</i>	NT	Stable			2
Audouin's Gull	<i>Larus audouinii</i>	NT	Stable	3		1
Crowned Cormorant	<i>Phalacrocorax coronatus</i>	NT	Stable		2	5
Damara Tern	<i>Sterna balaenarum</i>	NT	Stable	10 (1)	3	
African Oystercatcher	<i>Haematopus moquini</i>	NT	Increasing		2 (1)	(1)
Black Tern	<i>Chlidonias niger</i>	LC	Decreasing	17 (1)	3	1 (2)
Lesser Frigatebird	<i>Fregata ariel</i>	LC	Decreasing			6
Great Frigatebird	<i>Fregata minor</i>	LC	Decreasing			5 (1)
Eurasian Oystercatcher	<i>Haematopus ostralegus</i>	LC	Decreasing	10 (4)	2 (1)	5 (1)
Sooty Gull	<i>Larus hemprichi</i>	LC	Decreasing			7 (3)
Great Black-headed Gull	<i>Larus ichthyaetus</i>	LC	Decreasing			1 (1)
Common Black-headed Gull	<i>Larus ridibundus</i>	LC	Decreasing	9 (5)	(2)	7
Red-billed Tropicbird	<i>Phaethon aethereas</i>	LC	Decreasing	10 (5)	(2)	1 (1)
Black-legged Kittiwake	<i>Rissa tridactyla</i>	LC	Decreasing	4 (5)	(1)	(1)
Little Tern	<i>Sterna albifrons</i>	LC	Decreasing	16 (2)	1 (2)	4
Common Tern	<i>Sterna hirundo</i>	LC	Decreasing	18	3	4
Gull-billed Tern	<i>Sterna nilotica</i>	LC	Decreasing	14 (1)	(2)	9
Arctic Tern	<i>Sterna paradisaea</i>	LC	Decreasing	16 (2)	3	1 (1)
Saunders's Tern	<i>Sterna saundersi</i>	LC	Decreasing			9
Antarctic Tern	<i>Sterna vittata</i>	LC	Decreasing		1	6
Masked Booby	<i>Sula dactylatra</i>	LC	Decreasing	2		3
Brown Noddy	<i>Anous stolidus</i>	LC	Stable	6 (7)	1 (1)	4
Lesser Noddy	<i>Anous tenuirostris</i>	LC	Stable		(1)	1 (2)
Yellow-legged Gull	<i>Larus cachinnans</i>	LC	Stable			1
Grey-headed Gull	<i>Larus cirrocephalus</i>	LC	Stable	14 (4)	3	3 (2)
Mediterranean Gull	<i>Larus melanocephalus</i>	LC	Stable	1 (2)		1 (2)

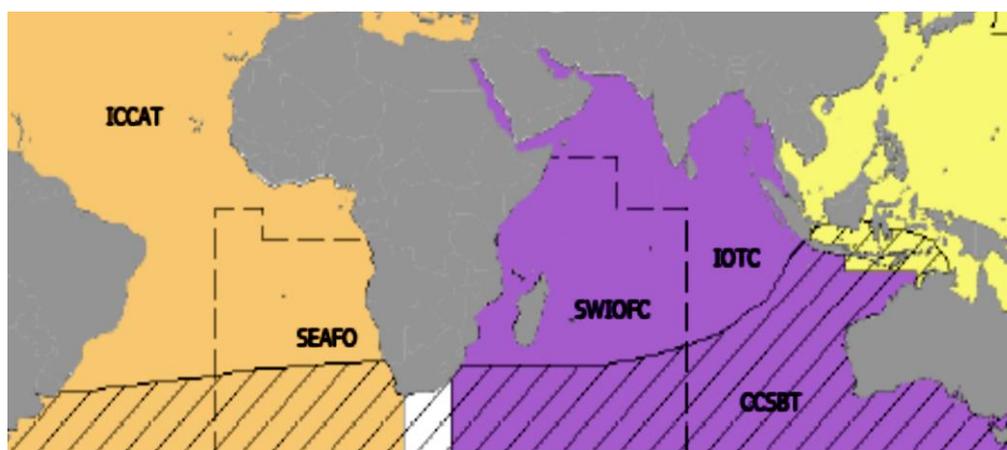
Common name	Species name	IUCN Red List status	Population trend	West Africa	Southern Africa	East Africa
White-tailed Tropicbird	<i>Phaethon lepturus</i>	LC	Stable	7 (3)	1 (1)	3
Red-tailed Tropicbird	<i>Phaethon rubricauda</i>	LC	Stable		1	6 (2)
Long-tailed Skua	<i>Stercorarius longicaudus</i>	LC	Stable	(6)	(3)	(1)
Great Skua	<i>Stercorarius skua</i>	LC	Stable	6 (5)		
Lesser-crested Tern	<i>Sterna bengalensis</i>	LC	Stable	4 (2)	1	4
Great Crested Tern	<i>Sterna bergii</i>	LC	Stable		2	10
Royal Tern	<i>Sterna maxima</i>	LC	Stable	17	2	
White-cheeked Tern	<i>Sterna repressa</i>	LC	Stable		(1)	9
Sandwich Tern	<i>Sterna sandvicensis</i>	LC	Stable	19	3	3 (1)
Sabine's Gull	<i>Xema sabini</i>	LC	Stable	10 (5)	2 (1)	4 (1)
Kelp Gull	<i>Larus dominicanus</i>	LC	Increasing	2 (1)	3	2 (3)
Lesser Black-backed Gull	<i>Larus fuscus</i>	LC	Increasing	18	2 (1)	6 (1)
Slender-billed Gull	<i>Larus genei</i>	LC	Increasing	5 (2)	(1)	(2)
Hartlaub's Gull	<i>Larus hartlaubii</i>	LC	Increasing		2	(1)
Little Gull	<i>Larus minutus</i>	LC	Increasing	2 (7)	(1)	(1)
Northern Gannet	<i>Morus bassanus</i>	LC	Increasing	6		(2)
Great Cormorant	<i>Phalacrocorax carbo</i>	LC	Increasing	12 (2)	3	4
Caspian Tern	<i>Sterna caspia</i>	LC	Increasing	16 (1)	3	4
Herring Gull	<i>Larus argentatus</i>	LC	Unknown			3
Heuglin's Gull	<i>Larus heuglini</i>	LC	Unknown	3 (1)	(1)	
Bridled Tern	<i>Sterna anaethetus</i>	LC	Unknown	10 (2)	1	4
Roseate Tern	<i>Sterna dougallii</i>	LC	Unknown	12 (1)	1	4 (1)
Sooty Tern	<i>Sterna fuscata</i>	LC	Unknown	15 (4)	3	4

### 3. Fisheries in the Afrotropical region

At their coarsest scale marine environments in the Afrotropics can be categorised broadly into temperate and tropical/subtropical seas. The temperate systems of northern West Africa, southern Africa and Somalia are productive, cold-water upwelling systems dominated by larids, sternids and procellariids. Demersal fishing (longlining and trawling) for whitefish and purse seining for small, shoaling, pelagic species (e.g. sardines) dominate in terms of biomass captured. Outside the upwelling systems are warmer, mostly oligotrophic waters characterised by lower productivity, but with a broader spread of seabird families. Fisheries tend to be small-scale or artisanal, with two exceptions: prawn trawling and tuna fisheries. Tuna purse seine and longline fleets operate across the entire region. Purse seiners in the region are restricted to fishing north of  $\sim 30^{\circ}\text{S}$  in the Indian Ocean and around the equator in the Atlantic Ocean, whereas longliners are active everywhere from the shelf edge into pelagic waters. Pelagic longline fishing is so ubiquitous that, to avoid repetition, it is not included in the descriptions of the types of fisheries in each region.

Illegal, unregulated or unreported (IUU) fishing is a significant concern, both globally and in the region (UN FAO 2001; Agnew et al. 2009). Indeed, estimated catches in West Africa exceed reported catches by around 40%, suggesting IUU fishing in this region at an enormous scale (Agnew et al. *op. cit.*)

#### 3.1. Regional Fisheries Management Organisations



**Figure 1.** Regional Fisheries Management Organisations with jurisdiction over high seas fisheries. ICCAT = International Commission for the Conservation of Atlantic Tunas, SEAFO = Southeast Atlantic Fisheries Organisation, SWIOFC = Southwest Indian Ocean Fisheries Commission, IOTC = Indian Ocean Tuna Commission, CCSBT = Commission for the Conservation of Southern Bluefin Tuna

Regional Fisheries Management Organisations (RFMOs) are multi-lateral agreements which manage fish stocks on the high seas and stocks that straddle international boundaries. Some RFMOs focus on a narrow group of species (e.g. the tuna RFMOs) while others agreements are broader and consider the impact of the fishery on the marine ecosystem. Under the United Nations Law of the Sea and linked agreements, RFMOs also have a duty to minimise bycatch, including seabirds, sharks and sea turtles. In this review we consider agreements that cover high seas fisheries and regional commissions that manage straddling stocks and shared resources within territorial waters of signatory states. While the operation of each RFMO differs, most have technical and scientific committees that assess data and make science-based management recommendations. Decisions are made by consensus or voting. Most RFMOs have mechanisms for making rules that are binding for all parties. In practice, enforcement of binding decisions is often difficult, particularly where those relate to on-deck activities. Methods commonly used to verify and track compliance include vessel tracking systems and fishery observer programmes.

Two RFMOs manage tuna and tuna-like species in the Afrotropical region – the International Commission for the Conservation of Atlantic Tunas (ICCAT) and the Indian Ocean Tuna Commission (IOTC) (Figure 1). Three RFMOs within the Afrotropical region have adopted strong seabird bycatch mitigation measures in line with advice on Best Practice from ACAP – namely ICCAT, IOTC and the Southeast Atlantic Fisheries Organisation (SEAFO). The two tuna commissions deal with seabird bycatch exclusively in pelagic longlining, whereas SEAFO does so for both demersal longlining (for Patagonian toothfish *Disostichus elegnioides*) and demersal trawling.

The Subregional Fishery Commission (SFC) is mandated to enhance collaborative efforts to manage fishing activities for non-tuna stocks in West Africa. However SFC has very little information available to the public and would require substantial strengthening to play a more active role in managing, *inter alia*, seabird bycatch. The Benguela Current Commission came into force in 2009 and manages ecosystem impacts of fisheries from shared fish resources within Angola, Namibia and South Africa. It has strong ecosystem management mandate but has not actively supported countries to regulate bycatch or other seabird impacts from relevant fisheries. To wit, neither Namibia nor Angola has a National Plan of Action (NPOA) for Seabirds. The South Indian Ocean Fisheries Agreement (SIOFA) and the South Western Indian Ocean Fishery Commission (SWIOFC) manage non-tuna fishing in the Indian Ocean. SIOFA deals with high seas fisheries for sedentary/non-migratory fish species, principally trawl fishing on seamounts. SWIOFC is a relatively new instrument (first meeting in 2005), arising from the SWIOF Project. It covers national waters and high seas, and includes all marine living resources in its remit, but its articles of agreement exclude tunas and explicitly require collaboration with IOTC and SEAFO. Nonetheless it appears that there is overlap between SWIOFC and SIOFA, where their respective areas of competence overlap. SWIOFC has to date not passed binding resolutions that deal with ecosystem impacts of fishing, but supports research and encourages cooperation within the region and with other bodies, including on the implementation of an ecosystem-based approach to fisheries management. Options for improving the effectiveness of fisheries management bodies are included in the recommendation section.

### 3.2. West Africa

Western Africa is here considered to stretch from Mauritania to the northern part of Angola. The region includes a large number of coastal countries, listed here from north to south: Mauritania, Senegal, The Gambia, Guinea-Bissau, Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Togo, Benin, Equatorial Guinea, Nigeria, Cameroon, Gabon, Congo, Democratic Republic of Congo (formerly Zaire) and Angola. In addition the offshore island countries of Cape Verde and Sao Tome and Principe fall within the subregion, equivalent to FAO Statistical Area 34.

Both commercial and artisanal marine fisheries operate in most West African coastal countries. Commercial fisheries operate mainly by longline, trawl and purse seine, with most nations licensing foreign fleets (primarily East Asian and European) to operate within their waters. Artisanal fisheries in the region are exceptionally diverse and difficult to characterise, with vessel size, numbers of crew, target species and gear types all highly variable, even within one day's fishing operation.

The countries in the northern part of the region are all net fish exporters (Table 3), owing in part to the productive upwelling system in the region. The commercial fleets of many of these countries are not well developed and have large numbers of foreign or joint venture vessels in operation (Table 3). Countries in the southern and equatorial part of this region are net fish importers and have large artisanal fisheries. Gillnets are the most commonly used gear in the artisanal fisheries, accounting for 22-73% of the total catch.

Most of the assessed fish stocks within the region are considered either fully exploited (43%) or overexploited (53%), with the major fish species in terms of landings, sardine *Sardina pilchardus* not fully exploited only from Senegal northwards (FAO 2012). This parlous state (53% overexploited) does not mean that negative impacts on seabird from fishing will remain as they are; as fish become scarcer,

effort to catch them is likely to increase, which may increase the rates of seabird interactions, further deterioration in fish stocks, etc. More alarming is the impact of overexploitation on low trophic level species such as sardines, with indirect impacts on seabirds through competition (e.g. Cury et al. 2011) and potentially more problematic, ecosystem-wide changes to trophic dynamics, with the potential for the permanent loss of commercially important species being a real possibility (e.g. Crawford 1998).

**Table 3:** Fisheries production, trade and common gear types for countries considered in this report.

Country	Fisheries production (tonnes) <sup>1</sup>	Net fishery product trade <sup>2</sup>	Fishery trade as a percentage of agricultural trade (2011) <sup>2*</sup>	Fishery trade as a percentage of total merchandise trade (2011) <sup>2*</sup>	Gear type with largest catch (% of total) <sup>1</sup>	Gear type with second largest catch (% of total) <sup>1</sup>	Gear type with third largest catch (% of total) <sup>1</sup>	Proportion of total catch contributed by top three gear types
<b>West Africa</b>								
Mauritania	298 532	Exporter	92	11	Gillnets (26)	Purse seine (22)	Mid-water trawl (21)	69
Senegal	464 213	Exporter	38	12	Purse seine (39)	Other seine nets (15)	Bottom trawl (13)	67
Gambia	28 959	Exporter	18	6	Gillnets (73)	Bottom trawl (14)	Mid-water trawl (4)	91
Cape Verde	15 427	Exporter	98	82	Purse seine (18)	Tuna purse seine (17)	Gillnets (15)	51
Guinea-Bissau	62 072	Exporter	1	1	Gillnets (29)	Bottom trawl (19)	Purse seine (15)	62
Guinea	89 269	Exporter	5	1	Gillnets (64)	Bottom trawl (14)	Mid-water trawl (10)	89
Sierra Leone	73 415	Exporter	24	3	Gillnets (54)	Bottom trawl (13)	Mid-water trawl (13)	79
Liberia	24 908	Importer	2	1	Bottom trawl (19)	Purse seine (18)	Mid-water trawl (15)	52
Côte d'Ivoire	48 554	Importer	19	5	Gillnets (45)	Purse seine (19)	Other seine nets (14)	79
Ghana	259 055	Importer	14	2	Purse seine (32)	Other seine nets (23)	Mid-water trawl (14)	69
Togo	14 406	Importer	16	2	Purse seine (33)	Other seine nets (27)	Mid-water trawl (21)	81
Benin	7 860	Importer	3	1	Mid-water trawl (21)	Gillnets (17)	Hooks (14)	53
Nigeria	272 935	Importer	23	4	Gillnets (31)	Bottom trawl (16)	Mid-water trawl (14)	61
Cameroon	75 559	Importer	25	5	Gillnets (46)	Mid-water trawl (16)	Bottom trawl (9)	72
Equatorial Guinea	11 887	Importer	11	0	Gillnets (22)	Purse seine (20)	Mid-water trawl (10)	52
São Tomé e Príncipe	5 710	Importer	1	0	Gillnets (26)	Purse seine (18)	Tuna Longline (10)	54
Gabon	40 704	Importer	5	1	Gillnets (43)	Bottom trawl (17)	Mid-water trawl (13)	74
Congo	19 820	Importer	7	1	Gillnets (28)	Purse seine (19)	Mid-water trawl (15)	62
Democratic Republic of Congo	4 329	Importer	0	0	Gillnets (32)	Mid-water trawl (22)	Boat seine nets (22)	76
<b>Southern Africa</b>								
Angola	264 983	Importer	5	1	Mid-water trawl (43)	Gillnets (26)	Bottom trawl (12)	80
Namibia	481 105	Exporter	78	18	Mid-water trawl (60)	Bottom trawl (14)	Gillnets (10)	84
South Africa	654 094	Exporter	8	1	Purse seine (50)	Other seine nets (15)	Mid-water trawl (9)	75
Mozambique	21 656	Importer	6	1	Shrimp trawl (50)	Purse seine (15)	Gillnets (9)	74
<b>East Africa</b>								

Country	Fisheries production (tonnes) <sup>1</sup>	Net fishery product trade <sup>2</sup>	Fishery trade as a percentage of agricultural trade (2011) <sup>2*</sup>	Fishery trade as a percentage of total merchandise trade (2011) <sup>2*</sup>	Gear type with largest catch (% of total) <sup>1</sup>	Gear type with second largest catch (% of total) <sup>1</sup>	Gear type with third largest catch (% of total) <sup>1</sup>	Proportion of total catch contributed by top three gear types
Madagascar	131 124	Exporter	32	10	Gillnets (57)	Purse seine (10)	Hooks (9)	76
Mauritius	39 905	Exporter	46	13	Purse seine (37)	Tuna Longline (23)	Tuna Pole (15)	76
Réunion (to France)	2 801	No data	No data	No data	Purse seine (47)	Tuna Longline (29)	Tuna Pole (21)	97
Mayotte (to France)	4 367	Importer	0	0	Gillnets (46)	Purse seine (22)	Tuna Longline (12)	80
Comoros	5 258	No data	No data	No data	Purse seine (42)	Tuna Pole (15)	Mid-water trawl (8)	66
Tanzania	28 790	Exporter	9	2	Gillnets (30)	Hooks (18)	Other gear (14)	62
Seychelles	29 551	Exporter	99	63	Purse seine (51)	Tuna Longline (23)	Tuna Pole (22)	97
Kenya	2 839	Exporter	2	1	Hooks (28)	Traps (26)	Gillnets (20)	74
Somalia	32 121	Importer	1	1	Gillnets (80)	Purse seine (7)	Tuna Longline (7)	94

<sup>1</sup>Seas Around Us 2011

<sup>2</sup>FAO 2011

\* If the country is a net importer, the percentage given is of total imports. If the country is a net exporter, the percentage given is of total exports.

### 3.3. Southern Africa

Southern Africa is here defined as that part of Africa south of the Benguela Upwelling Region on the Atlantic coast and the South African/Mozambique border region on the Indian Ocean. It covers the coastal countries of (southern) Angola, (southern) Mozambique, Namibia and South Africa. Southern Madagascar could also be included in this, but in this report it has been placed in the East Africa group.

The Benguela upwelling system on the Atlantic and southern Indian ocean coasts of southern Africa supports several large commercial fisheries (Crawford et al. 1987), and both South Africa and Namibia are net exporters of fish products (Table 3). Most fishing takes place in Namibian and South African waters, with lesser amounts occurring in southern Angola (Petersen et al. 2007). Fisheries include a large purse-seine fishery for anchovy *Engraulis encrasicolus* and sardine *Sardinops sagax*, a large trawl fishery directed at two species of hake *Merluccius* spp. (demersal) and Maasbanker *Trachurus trachurus* (mid-water, mainly in Namibian waters), a demersal longline fishery also directed at hake and other species, and a relatively small pelagic longline fishery directed at tuna, swordfish and sharks (in both Namibian and South African waters). More detailed information on these fisheries may be found in Appendix 1, Crawford et al. (1987), Cooper & Ryan (2003) and Petersen et al. (2008).

In addition, there is a small, but high-value trap fishery for Cape Rock Lobster *Jasus lalandii* that takes place in both Namibia and South Africa and recreational or subsistence angling and exploitation of near-shore resources throughout the region. Little gillnetting takes place within the Benguela away from small-scale commercial and artisanal fishing within shallow bays and estuaries, for species such as mullet (*Liza spp*), although the extent of this activity in Angola is completely unknown but may be significant. Gillnetting is stated as being banned in Namibian waters by Currie et al. (2008). Very little artisanal fishing occurs on the low-populated Atlantic coasts of Namibia and South Africa, although a certain level does occur in southern Angolan waters (Roux et al. 2007).

On the Indian Ocean coast of South Africa similar fisheries to the Benguela system occur on the Agulhas Bank. North of this, marine fisheries are much smaller and more artisanal, but commercial operations include lobster traps, trawling for prawns and squid jigging.

Of significant concern to the conservation of seabirds in the region is the collapse of the Namibian sardine fishery (Ludynia et al. 2010) and the eastward shift in distribution of sardine and anchovy stocks in South Africa (Coetzee et al. 2008). The causes for the shift in distribution in South Africa remains unclear but could be due to a) intensely localised fishing pressure which has reduced the western population, b) a change in environmental conditions, c) fish spawned in the south exhibiting a high degree of natal homing and dominating the population because of disproportionately successful spawning in the southern part of the range, or a combination of the three (Coetzee et al. 2008). Regardless of the causes, the consequences for seabird conservation are dire, with the status of three seabird species which depend primarily on small pelagic fish stocks (African Penguin, Cape Cormorant and Cape Gannet) deteriorating most strongly in the western part of their distribution. Concerns of overfishing are the same as for West African fisheries, with competition and ecosystem changes both likely to cause significant, negative impacts on seabird species.

### 3.4. East Africa

Eastern Africa is here considered to include the coastal countries of Somalia, Kenya, Tanzania and northern Mozambique. Eritrea and Ethiopia are not included since their coastlines fall in the Red Sea, north of the Afrotropical Region. Additionally the island nations of Comoros, Madagascar, Mauritius, Reunion (France) and Seychelles fall within the region.

All these countries support large, but poorly quantified numbers of artisanal fishers targeting a wide variety of species. Small commercial fisheries operate using nets, trawls and handlines/rod-and-reels to catch a wide variety of fish and crustaceans (Appendix 1, FAO 2009 and Silva & Sousa 2009).

However, the largely oligotrophic tropical waters contrast with the western boundary upwelling systems of the eastern Atlantic; East Africa south of Somalia does not have productive upwelling systems and aside from pelagic tuna fishing, fisheries are mostly artisanal and restricted to the more productive, if relatively small geographical areas of estuaries, shallow shelf waters and fringing reefs. Few seabird species depend directly on inshore or coral reef communities for survival, so fisheries impacts in this region are minor. In Mozambique, in addition to tuna and artisanal fisheries, a sizeable prawn trawl fishery exists. Gillnet fishing in this region is common and can account for up between 30 and 80% of the total catch, especially in the north and around Madagascar (Table 3).

In Somalia, upwelling produces highly productive waters and artisanal fishers work close inshore to target reef fish, large pelagics species (e.g. tunas) and small pelagic shoaling species such as sardine *Sardinella* sp. and anchovy *Engraulis japonicus*). The IOTC declared a time-area closure for tuna catches in the area adjacent to the Somali coast, primarily in response to massive piracy problems. The impacts of both the closure and piracy have been noticeable; with considerably reduced effort (see annual reports on closures and piracy at the IOTC scientific committee meetings, available at [www.iotc.org](http://www.iotc.org)).

## 4. Impacts of fishing activities on seabirds

Fisheries, through both competition and mortality on fishing gear, pose one of the greatest threats to seabirds worldwide (Croxall et al. 2012). According to the unified classifications of threats to biodiversity and conservation actions (Salafsky et al. 2008), in general, the threats documented here fall under the category of Biological Resource Use, specifically Fishing and Harvesting of Aquatic Resources. Fisheries impacts on seabirds can be further classified as either direct or indirect.

Direct impacts are caused through accidental mortality (or ‘bycatch’) in fishing gear of a variety of fisheries. In some places, exploitation of nesting seabirds for use as food or as bait in hook/trap fisheries occurs but is poorly documented; it is not covered in any detail in this review. Direct impacts increase adult mortality, which for seabirds, being long-lived and slow to reproduce, can have more of an impact than if reproductive success were affected.

Indirect impacts are more complex to characterise. A main mechanism for indirect impacts is through reducing fish abundance causing competition for fish or fishing areas, which can increase distances which birds must travel to forage. Overfishing can also cause other ecosystem changes, which are hard to measure and can impact seabirds in variety of unexpected ways. Indirect fisheries impacts are expected to affect both adult mortality and reproductive success. Indirect effects of competition between fisheries and seabirds are probably pervasive across the region, and attempts to address this are in their infancy globally. Understanding at-sea distributions of many seabirds, or the spatio-temporal distribution of fishing effort by gear, both critical prerequisites for understanding fishery impacts on seabirds remain largely unknown in the region, with some notable exceptions.

Although direct impacts are typically more acute and (potentially) more easily quantifiable (because mortality can be ascribed to the fishery), for AEWA-listed seabirds within the Afrotropical region it is probably not the most problematic impact. An important caveat is the completely unknown risk from gillnetting, conducted on a massive scale in the region but almost entirely data-deficient.

The impacts of different fisheries on seabirds depend on both the nature of the fishery and the behaviour and foraging preferences of the seabirds. For example, albatrosses and petrels are frequently caught on longline hooks because they are marine scavengers and are attracted to discards from fishing vessels (Croxall et al. 2012). By comparison, few tern species follow fishing vessels because they prefer to capture live prey or cannot compete for discards with larger species, and they are therefore less susceptible to direct mortality in longline fishing.

### 4.1. Direct mortality

Direct mortality of seabirds occurs when birds become entangled, hooked or severely injured by coming into contact with fishing gear. Efforts to reduce mortality have been taken at the international level, by a number of RFMOs as well as the Food and Agriculture Organization of the United Nations (FAO). The FAO approach is via the International Plan of Action for Reducing Incidental Catch of Seabirds (FAO 1999), which in turn encourages countries to produce their own National Plans of Action (NPOA-Seabirds). The FAO has also produced Best Practice Technical Guidelines to assist countries to develop NPOAs.

At the national level an NPOA has the mandate to recommend the adoption of mitigation measures. However, within the Afrotropical Atlantic region, only South Africa has developed an NPOA-Seabirds, which was adopted in August 2008.

#### 4.1.1. Longline fisheries

Longline fishing is a technique whereby lines, often tens of kilometres long, are set from a moving vessel. Branch lines (of varying length) with baited hooks are attached to the main line. Longline fishing

is either demersal or pelagic. Demersal longlining targets bottom-dwelling (demersal) species. Lines are typically around 10 km long with short (~1 m) branchlines placed 1-2 m apart. Pelagic longlines are designed to work at the surface or in the water column. Pelagic longlines typically target large, high-value species such as tunas. The lines can extend upwards of 100 km each, with branchlines of 10-50 m in length and clipped individually to the mainline at distances of 10-100 m. Detailed descriptions of the varieties of longline fishing gear used for different target species may be found in Bjordal & Løkkeborg (1996), with a summarized account given in Brothers et al. (1999).

Seabirds are killed by longline fishing when they seize baited hooks during the setting operation. While attempting to 'steal' baits from the hooks, they become hooked and are then dragged under by the weight of the sinking line, resulting in the hooked individuals drowning. Additionally birds attracted to baited hooks and discards during line hauling may become hooked and injured or killed, often being brought aboard the fishing vessel while still alive (Brothers et al. 1999; Gilman et al. 2005).

Longline fisheries in the Afrotropical region are primarily a threat to scavenging procellariiform seabirds (Anderson et al. 2011), but both gannet species (Cape Gannet in southern Africa and Northern Gannet in West Africa) are known to be killed in demersal longlines (Watkins et al. 2008, Maree et al. 2014, Camphuysen *in litt*). Cape Gannets are also recorded as bycatch in pelagic longline fishing off South Africa (Albatross Task Force, unpublished data), which moots the possibility that the Northern Gannet is also susceptible.

Of significant concern, there are reports from Mauritania (Camphuysen *in litt*) of a cargo of seabirds that had been prepared, boxed and frozen for export in a shipment labelled fish. The scale of the seabird cargo and the species identity are unknown, but it seems likely that Northern Gannets were the main species involved and that a Chinese-flagged longline operation was responsible. BirdLife International is following up on this with Mauritanian authorities.

Elsewhere within the region, there are few reports of non-procellariiform seabird mortalities in either type of longline fishing. However, species caught by longliners elsewhere in their range may be vulnerable in the Afrotropical region as well. Audouin's (*L. audouinii*), Black-headed (*L. ridibundus*), Yellow-legged (*L. cachinnans*) and Mediterranean (*L. melanocephalus*) gulls, Sandwich (*S. sandvicensis*) and Black (*Chlidonias niger*) terns have all been reported killed in low numbers by longline fisheries in the Mediterranean, and their susceptibility to longlining off West Africa merits closer investigation (Cooper et al. 2003, Valeiras & Camiñas 2003). These fatalities seem likely to be isolated occurrences and such mortality is not expected to be a conservation problem for these or any other tern species within the Afrotropical Region.

#### *Mitigation measures*

There are several measures that can be used in both demersal and pelagic longline fisheries to reduce the incidental bycatch of seabirds (Brothers et al. 1999; Gilman et al. 2005). It has been demonstrated in areas that have reduced seabird bycatch, such as the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR) and in South Africa, that several measures need to be used simultaneously (Bull 2007).

ACAP reviews and recommends international best practice mitigation measures and currently considers only three options for mitigating seabird bycatch: night setting (when fewer seabirds actively forage), deployment of 'bird scaring lines' to physically deter birds from hooks near the surface, and line weighting (to ensure that bait sinks rapidly below the reach of diving seabirds) (ACAP 2010). Fishers should also avoid discarding offal or non-target fish species during line-setting (known as "strategic offal discharge") to minimise seabird captures at this time; this is less of an overt risk to seabirds, because the line is being hauled so drowning is improbable. Being hooked during hauling should not be fatal, and if hooked birds are handled with care they should be released alive and survive. Fishers are encouraged to release birds brought aboard alive, first removing entangled or ingested hooks and lines if feasible. ACAP has developed hook removal guidelines (<http://acap.aq/resources/acap->

[conservation-guidelines](#)). These recommendations apply to pelagic and demersal longlines, although the technical specifications for measures differ with gear type. Fact sheets describing each measure for each type of longlining are available for download at <http://www.birdlife.org/worldwide/seabird-bycatch-mitigation-factsheets>

#### 4.1.2. Trawl fisheries

There are several types of trawl fishing, but in essence trawling involves towing a net along the seabed (benthic trawling) or at a particular depth (mid-water trawling), with the net attached to the vessel by means of steel cables. Trawlers vary greatly in size, but all tend to produce large volumes of waste (often in the tons), either as offal or as discarded fish bycatch.

The direct effects of trawling on seabirds have only been recognized as a serious conservation issue relatively recently (e.g. Croxall 2008). Recent studies in the southern hemisphere (e.g. Sullivan et al. 2006, Watkins et al. 2008) have confirmed that large numbers of mainly procellariiform birds can be killed or seriously injured by fishing gear from this industry. There are three ways that seabird fatalities can occur due to trawl fishing: net captures (diving birds swimming into the path of the open trawl net and being drowned), net entanglements (birds becoming entangled with the net) and cable strikes. Fatal interactions with cables are difficult to detect unless active seabird monitoring is taking place behind trawlers but occur relatively infrequently (Watkins et al. 2008). However, due to the scale of fishing effort of many trawl fisheries, these infrequent interactions can multiply up to very substantial total mortalities (Maree et al. 2014). Strikes against the *net sonde* (also known as third wire or sensor cable) were identified in the early 1990s (Bartle 1991), leading to the banning of the use of net sonde cables in several fisheries (e.g. CCAMLR 1998). Recent reports from South Africa indicate that side trawlers (vessels that bring the net up on the side of the vessel instead of the stern) may be a significant threat to Cape Gannets (*Morus capensis*) during certain conditions, as the net remains on the surface for longer periods of time (B. Rose pers. comm.).

#### Mitigation measures

There are primarily two options for reducing seabird bycatch from cable strikes, whereas the issue of net captures remains of lesser concern in the region, but also less tractable. For cable strikes, the use of paired bird scaring lines, set either side of the trawl cables, has been shown to be very effective in reducing the accidental deaths of seabirds (mainly procellariiforms, Sullivan et al. 2006, Bull 2007, 2009, Maree et al. 2014). This system is less effective for plunge-diving species such as Cape Gannets (Maree et al. 2014). Several studies have found that seabird mortality can be avoided almost completely if discarding does not occur when cables are in the water (Wienecke & Robertson 2002, Watkins et al. 2008; Abraham et al. 2009; Bull 2009; ACAP 2010; Favero et al. 2011). However, retention of offal for extended periods is not possible for many fisheries/vessels. Measures to reduce net captures include thorough cleaning of nets before they are deployed, and binding nets to ensure that the mouth of the net remains closed until the net has sunk well below the range of plunge-diving seabirds. Further work is required on entanglement risks to seabirds during gear retrieval.

#### 4.1.3. Gillnet fisheries

Gillnets are a static curtain of nets, designed to entangle fish. Nets are suspended vertically in the water column, and made of materials such as monofilament nylon that render them invisible, or nearly so, in water. This system of fishing includes the notorious high seas drift nets (“walls of death”), subject to an international moratorium (U.N. Resolution 46/215). Nets within national waters are usually set inshore and can be drifting, but are more commonly anchored. They are known to entangle (and then drown) seabirds, including AEWL listed species (e.g. Tasker et al. 2000, Montevecchi 2002).

Gillnet bycatch is a substantial threat to seabird populations worldwide, particularly in temperate and sub-polar regions. A recent literature review suggests that at least 400,000 birds die in gillnets each year, a figure similar to the total mortality estimates from all longline fisheries (Zydalis et al. 2013). However,

that same review found no published information on gillnet bycatch rates in Africa. The comments in this section refer therefore to general principles.

Seabirds most at risk from gillnets are those with the ability to make deep dives from the sea surface (“pursuit divers”), such as penguins, shearwaters, cormorants and alcid. In the region the only recorded seabird mortalities are from South Africa, for seabirds such as cormorants and the African Penguin. Low levels of fishing effort, including illegal nets (75 – 180 mm mesh) in South Africa, probably kill low numbers of seabirds that forage close to the shore and is not currently a significant threat to AEW-listed seabirds (S. Lamberth, *in litt.*). All cormorants are potentially at risk from gillnets (Žydelis et al. 2013). There is a strong likelihood that diving seabirds are captured in gillnets throughout the region, but there are effectively no data available and this must be considered a significant data gap and a high priority for action to fill the gaps.

#### *Mitigation measures*

This is a research field that is both active and still in relative infancy, and proven measures that are acceptable and affordable remain to be determined. Thus there is no Best Practice recommendation for mitigating seabird bycatch in gillnet fisheries, and developing incentives or support for this research is a key opportunity for AEW Contracting Parties.

Techniques and options for reducing seabird mortality in gillnet include time-area closures, visual and acoustic alerts and restrictions on effort (length of nets/number of connected net panels) or restrictions on fishing depth (Melvin et al. 1999; Žydelis et al. 2013). Visual methods include adding thicker twine to the net in its upper panels where diving seabirds are most encountered. However, this method also reduced catches of target species. Another option under investigation is use of lights emitting at a wavelength that is visible to seabirds and turtles, but which fish cannot see, but this will likely be of limited use for nocturnal foragers. Use of acoustic “pingers” has had mixed results with different species of alcid (but at least without reducing fish catches). A recent technique trialled is treating the net to increase its sound-reflecting ability, with some success in reducing seabird mortality but not affecting target catch (Trippel et al. 2003). Time of day that gillnets are set also has an influence on seabird mortality, with most occurring around sunrise in one study (Melvin et al. 1999).

Seasonal and/or geographical closures (sometimes known as Marine Protected Areas or MPAs) in areas of high density of foraging pursuit divers will reduce the mortality of seabirds. Restrictions of gillnets to depths deeper than those normally reached by seabirds also falls into this category of mitigation (FAO 2008). As for trawl fisheries the FAO has widened its mitigation advice to include gill-netting (FAO 2008).

#### *4.1.4. Lobster pots/traps*

A common method for catching crustaceans and benthic fish are traps, or “pots” set on the sea bottom. They have been known to result in the death of diving seabirds, such as cormorants, which presumably enter them in pursuit of lobster prey. Bank Cormorants *Phalacrocorax neglectus*, which feed on lobster (*Jasus lalandii*) in South Africa, have drowned in traps (Cooper 1981, Avery 1983, Crawford et al. 2008a, J. Cooper unpubl. data). It is unlikely that Bank Cormorants in Namibia are also at risk in this way, as their diets consist primarily of pelagic goby (*Sufflogobius bibarbatu*; J. Kemper pers. comm.). Socotra Cormorants *P. nigrogularis* are reported as regularly drowning in fishing traps set to a depth of at least 20 m (BirdLife International 2013). Crowned cormorants (*Phalacrocorax coronatus*) may also be at risk from drowning in traps, as they feed on benthic fish (Williams & Cooper 1983), but evidence is lacking. However, there are relatively few reports of seabird entanglements with these traps in the region, including from observed South African lobster fisheries (S. Lamberth pers. comm); hence the scale of this source of mortality is believed to be minor.

#### 4.1.5. Disturbance and directed mortality by fishermen

Both artisanal and recreational fishers can disturb breeding and roosting seabirds in the course of their activities, including deliberately exploiting them for food or use as bait, or killing them to prevent interactions with their fishing gear, such as seabirds 'stealing' bait from hooks. However, disturbance in colonies is not an effect of fishing on seabirds per se, and exploitation or disturbance of this nature is unlikely to be restricted to fishers. It is not considered in detail here.

Migrant Cape Gannets *Morus capensis*, especially juveniles, are reportedly killed off West Africa and Angola for food, mainly by artisanal fishers, who have been reported as deliberately setting floating surface lines with baited hooks (Petersen et al. 2007, Roux et al. 2007) but it is unknown if this is continuing. Directed mortality of seabirds during fishing is unlikely to be reported and is of unknown scale, and should be considered a priority data gap that should be filled.

### 4.2. Indirect effects

#### 4.2.1. Reduction in food availability

Fisheries can cause reductions in food through overfishing or competition for the same prey. While direct impacts of overfishing on seabirds can be difficult to prove, there is evidence of this in the region. The majority of fisheries in West Africa are either overexploited or fully exploited (FAO 2012). It has been suggested that declines in the *Sardinella* stocks may have affected terns, but good evidence for this relationship is lacking (Dunn & Mead 1981, Newbery 1999, Veen et al. 2003). The poor oversight and lack of controls or reporting for the large numbers of foreign-owned vessels operating in the region is cause for more concern of potential overfishing. Recently it has been estimated that China has underreported its catch taken in foreign waters by a factor of 12, with a large proportion (approx. 60%) taken in West Africa (Pauly et al. 2013). The European Union, Russia, Lithuania and Iceland also operate large fleets for small pelagic fish and take more than 500 000 tons of small pelagic fish of the coast of Mauritania per year, making the northwest African shelf one of the most intensively fished areas in the world (Zeeberg et al. 2006). As the fisheries in the Canary and Guinea currents are characterised as overexploited, it is likely that there has been some impact on seabirds (Moore 2007). Given the extensive and very poorly regulated nature of many coastal fisheries in the Afrotropics, this threat must be considered one of the highest priorities for further research.

In southern Africa the African penguin, Cape cormorant and Cape gannet forage on small pelagic fish, and reduced fish abundance has resulted in serious decreases, to the point where the African penguin and Cape cormorant have been listed as Endangered. (e.g. Crawford & Dyer 1995, Crawford 2003, 2007, Crawford et al. 2008b). In Namibia, overfishing of the sardine resource led to collapses in the national populations for those three seabird species (Kemper 2006).

Along the East African coast, reductions in seabird prey are likely to be caused by changes in foraging associations. Many terns, tropicbirds and noddies in the tropical and subtropical regions forage in association with large predatory fish such as tuna (Ramos 2000, Le Corre et al. 2012). The tunas drive small forage fish species to the surface, bringing them within the range of seabirds. If the abundance of tuna is reduced through overfishing, these and other seabird species will not be able to forage as successfully (Le Corre et al. 2012). The species in the Afrotropical region most likely to be affected by this are the three tropicbird species, the Masked Booby (*Sula dactylatra*), Greater (*Fregata minor*) and Lesser (*F. ariel*) frigatebirds, Brown (*Anous stolidus*) and Lesser (*A. tenuirostris*) noddies, and Bridled (*Sterna anaethetus*) and Sooty (*S. fuscata*) terns.

#### 4.2.2. Increase in food availability

Fisheries can also cause some seabirds' food supply to increase. Some fisheries could cause an increase in prey availability for seabirds if the fishery removes large fish that compete with seabirds for the same prey (Tasker et al. 2000, Montevecchi 2002, Furness 2003). Another source of increasing food availability, is discarding. Fishery discards represent a food source which may be greater than the

amount of food naturally available to seabirds (Furness et al. 2007). In 2010, the FAO estimated that globally no less than 7 million tons of fisheries discards were produced, although this is likely to be an appreciable underestimate because for many fisheries, accurate estimates of bycatch/discard volumes are not available (FAO 2010).

However, the long-held view that discards benefit scavenging seabirds has been challenged for the Cape Gannet, as fishery discards from the demersal trawl fishery are of lower energy value than are normal prey (small shoaling fish) leading to poor chick growth rates, high chick mortality and thus reduced breeding success (Pichegru et al. 2007; Grémillet et al. 2008). For other species elsewhere, discards can cause seabird populations, especially scavenging gull species. For example, the Northern Fulmar population expanded massively in response to widespread availability of discards in the North Sea (Votier et al. 2004). However, any gains from increased food availability may be offset by direct mortality (e.g. of Cape Gannets in the South African trawl fishery, Watkins et al. 2008).

Another concern is that changes in fishing practices in future could alter the availability of discards, resulting in unexpected consequences. Such changes could include reduced fishing effort, retention of species that are currently discarded, or conversion of bycatch into fishmeal (Voitier et al. 2004). Unexpected consequences could occur both for species that now rely on discards as an important food resource as well as the ecosystem as a whole. For example, in the Northwest Atlantic the population of scavenging gulls, such as the Herring Gull *Larus argentatus* increased rapidly due to the high availability of fishery discards (Stenhouse and Montevecchi 1999). However, this plentiful food source was no longer available when a moratorium was placed on the Canadian ground-fishery in the early 1990s. At this time, there was also an increase in Herring Gull predation on Leach's Storm Petrels *Oceanodroma leucorhoa*, which became especially severe with delayed spawning of capelin *Mallotus villosus*. Until the relationships between seabirds and trawl fisheries in Africa are well understood, we can only speculate on the potential effects of changed discard practices.

## 5. Cross-species synthesis

Most species considered in this review are affected in some way by fishing but there are a few that are thought not to be affected by fisheries, although this could be because no studies have been conducted. The Antarctic Tern (*Sterna vittata*) has a southerly distribution while breeding and interactions with fisheries are likely to be at a relatively low level. The Little (*Sterna albifrons*), Gull-billed (*S. nilotica*), White-cheeked (*S. repressa*), and Saunder's (*S. saundersi*) terns, and the Yellow-legged (*Larus cachinnans*), and Little (*L. minutus*) gulls are not thought to be impacted by fisheries because they are not as dependent on the marine environment as other tern and gull species.

The practice of discarding fishery waste products impacts the largest number of species under review (26) in various ways, although most of these impacts have been observed elsewhere in the world, and have not been confirmed in the Afrotropics. Gulls were the most common species to use discards, followed by terns and other larids, gannets, and skuas. Due to the prevalence of the impact of discarding, this category was removed from the following analysis but can be seen in Table 4.

However, reliance by seabirds on discards should not be ignored as this can have long-term impacts. Discards may not have the same energetic and nutritional value as natural prey, which can affect chick growth and condition, as it has with Cape Gannets (Pichegru et al. 2007; Grémillet et al. 2008). In this instance, discards can allow adult gannets to survive and maintain body condition when natural prey is lacking, but cannot be seen as an adequate, long-term replacement for the gannet's natural prey. Changes in fishing practices to reduce discards or a collapse in the target fishery can then cause populations of seabirds which have become reliant on discards to collapse or have other unforeseen consequences (e.g. scavenger gulls turned to preying upon storm-petrels in the North Atlantic after large-scale fishery closures; Stenhouse & Montevecchi 1999). Research should take place at seabird colonies in areas in which large-scale industrial fishing producing large amounts of discards occurs (e.g. West African upwelling zones) to determine what proportion discards make up in the diet of potentially affected seabirds.

Cape Gannets are the only species for which there is reliable evidence of direct mortality in the trawl and longline fisheries in the region. Other species, mainly gulls have been recorded as being killed in longline fisheries in other regions, mainly the Mediterranean but not in the Afrotropical region, which indicates a general lack of data for the region. The other species known to be affected by direct fishery related mortalities are the cormorants, which are killed in gillnets or traps. Many of the species considered in this report are not likely to experience directed mortality from fishing due to their foraging habits (e.g. they do not scavenge behind fishing vessels and only take live prey) or movement patterns (e.g. foraging areas do not overlap with fishing areas).

The Cape and Northern gannets are affected by more fisheries than any other species under consideration (five and four, respectively). The Great Cormorant, Mediterranean Gull and Common Tern are each subjected to three negative impacts from fisheries.

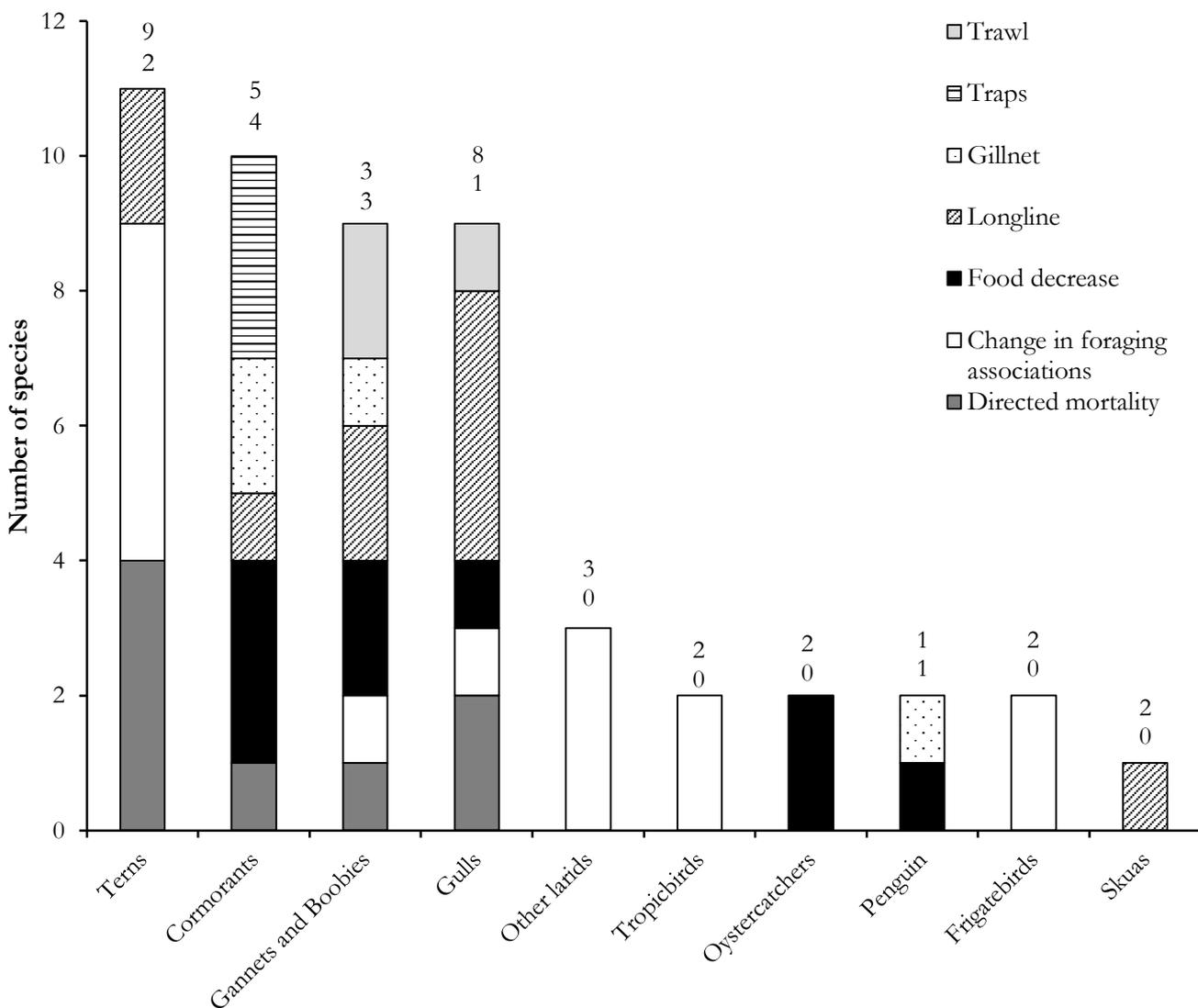
**Table 4:** The main impacts of fishing on AEWA listed species. EN= Endangered, VU = Vulnerable, NT = Near Threatened, LC= Least Concern. A question mark next to an impact signifies that the impact has affected the species elsewhere but has not been recorded in the region.

Common name	Scientific name	IUCN Red List status	Direct		Indirect
			Interactions with gear	Interactions with fishers	Ecosystem effects
Cape Cormorant	<i>Phalacrocorax capensis</i>	EN			Food decrease
Bank Cormorant	<i>Phalacrocorax neglectus</i>	EN	Traps		Food decrease
African Penguin	<i>Spheniscus demersus</i>	EN	Gillnet		Food decrease
Cape Gannet	<i>Morus capensis</i>	VU	Longline, Trawl	Directed mortality	Discards, Food decrease
Socotra Cormorant	<i>Phalacrocorax nigrogularis</i>	VU	Traps		Food decrease?
African Oystercatcher	<i>Haematopus moquini</i>	NT			Food decrease?
White-eyed Gull	<i>Larus leucophthalmus</i>	NT			Discards
Audouin's Gull	<i>Larus audouinii</i>	NT	Longline?		Discards
Crowned Cormorant	<i>Phalacrocorax coronatus</i>	NT	Gillnet?, Traps?		
Damara Tern	<i>Sterna balaenarum</i>	NT		Directed mortality?	
Brown Noddy	<i>Anous stolidus</i>	LC			Discards?, Change in foraging associations?
Lesser Noddy	<i>Anous tenuirostris</i>	LC			Change in foraging associations
Black Tern	<i>Chlidonias niger</i>	LC	Longline?		
Lesser Frigatebird	<i>Fregata ariel</i>	LC			Change in foraging associations
Great Frigatebird	<i>Fregata minor</i>	LC			Change in foraging associations
Eurasian Oystercatcher	<i>Haematopus ostralegus</i>	LC			Food decrease?
Herring Gull	<i>Larus argentatus</i>	LC			Discards?, Change in foraging associations?
Yellow-legged Gull	<i>Larus cachinnans</i>	LC	Longline?		Discards
Grey-headed Gull	<i>Larus cirrocephalus</i>	LC			Discards
Kelp Gull	<i>Larus dominicanus</i>	LC	Trawl		Discards

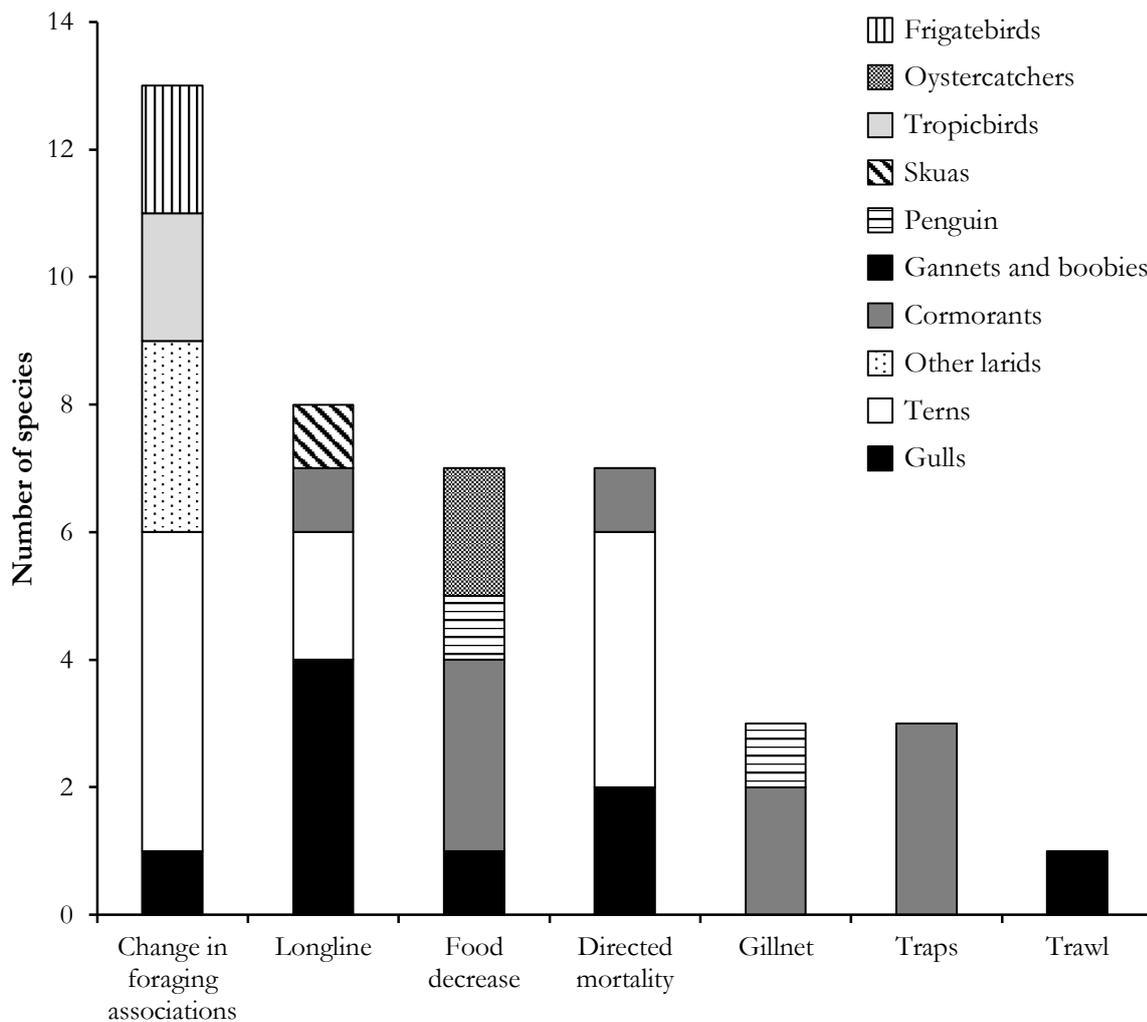
Common name	Scientific name	IUCN Red List status	Direct		Indirect
			Interactions with gear	Interactions with fishers	Ecosystem effects
Lesser Black-backed Gull	<i>Larus fuscus</i>	LC			Discards
Slender-billed Gull	<i>Larus genei</i>	LC			Discards
Hartlaub's Gull (King Gull)	<i>Larus hartlaubii</i>	LC			Discards
Sooty Gull	<i>Larus hemprichi</i>	LC			Discards
Heuglin's Gull	<i>Larus heuglini</i>	LC			Discards
Great Black-headed Gull	<i>Larus ichthyaetus</i>	LC		Directed mortality	Discards
Mediterranean Gull	<i>Larus melanocephalus</i>	LC	Longline?	Directed mortality?	Discards
Little Gull	<i>Larus minutus</i>	LC			Food decrease
Common Black-headed Gull	<i>Larus ridibundus</i>	LC	Longline?		Discards
Northern Gannet	<i>Morus bassanus</i>	LC	Longline?, Trawl		Discards, Food decrease
Red-billed Tropicbird	<i>Phaethon aetheras</i>	LC			Change in foraging associations
White-tailed Tropicbird	<i>Phaethon lepturus</i>	LC			
Red-tailed Tropicbird	<i>Phaethon rubricauda</i>	LC			Change in foraging associations
Great Cormorant	<i>Phalacrocorax carbo</i>	LC	Longline?, Gillnet	Directed mortality	
Black-legged Kittiwake	<i>Rissa tridactyla</i>	LC			Discards?, Change in foraging associations?
Long-tailed Jaeger	<i>Stercorarius longicaudus</i>	LC			Discards
Great Skua	<i>Stercorarius skua</i>	LC	Longline?		Discards?
Little Tern	<i>Sterna albifrons</i>	LC			
Bridled Tern	<i>Sterna anaethetus</i>	LC			Change in foraging associations
Lesser-crested Tern	<i>Sterna bengalensis</i>	LC			Discards?
Great Crested Tern	<i>Sterna bergii</i>	LC			Discards?, Change in foraging associations

Common name	Scientific name	IUCN Red List status	Direct		Indirect
			Interactions with gear	Interactions with fishers	Ecosystem effects
Caspian Tern	<i>Sterna caspia</i>	LC			Discards?
Roseate Tern	<i>Sterna dougallii</i>	LC		Directed mortality	Change in foraging associations
Sooty Tern	<i>Sterna fuscata</i>	LC			Change in foraging associations
Common Tern	<i>Sterna hirundo</i>	LC		Directed mortality	Discards, Change in foraging associations
Royal Tern	<i>Sterna maxima</i>	LC			Discards?
Gull-billed Tern	<i>Sterna nilotica</i>	LC			
Arctic Tern	<i>Sterna paradisaea</i>	LC		Directed mortality	Discards?
White-cheeked Tern	<i>Sterna repressa</i>	LC			
Sandwich Tern	<i>Sterna sandvicensis</i>	LC	Longline?		
Saunders's Tern	<i>Sterna saundersi</i>	LC			
Antarctic Tern	<i>Sterna vittata</i>	LC			
Masked Booby	<i>Sula dactylatra</i>	LC	Gillnet?		Change in foraging associations?
Sabine's Gull	<i>Xema sabini</i>	LC			Discards

Four groups, the terns, cormorants, sulids and gulls, have more than nine instances of species being affected by fisheries (Figure 2). For the terns and gulls, this can be explained by the large number of species included in the review that are affected by only one or two fisheries. As there are only three sulid and five cormorant species listed, this suggested that these two groups are most at risk from fishery threats within the region. The terns are mostly affected by a decrease in food availability due to changing foraging associations (through the decrease in marine predators forcing prey to the surface; see Section 4.2.1) and directed mortality (either persecuted by fishermen for stealing fish or caught for food or sale; Figure 2). The cormorants are affected to a large extent by a decrease in food availability, bycatch in gillnets and fish traps. The sulids and gulls are affected by a similar suite of fisheries; changes in foraging associations, decreases in food availability and, longline and trawl bycatch (Figure 2).



**Figure 2:** The number of AEWA listed species affected by fisheries. The numbers above the columns indicate the number of species in the group which are impacted by fisheries (top) and the number affected by more than one type of fishery (bottom). Note that some of these impacts have been documented to occur outside the Afrotropical region but can be reasonably assumed to affect species within the region as well. The group “other larids” refers to the Black-legged kittiwake *Rissa tridactyla*, Brown *Anous stolidus* and Lesser *A. tenuirostris* noddies



**Figure 3:** Fishery impacts on the groups of birds under review. Note that some of these impacts have been documented to occur outside the Afrotropical region but can be reasonably assumed to affect species within the region as well. The group “other larids” refers to the Black-legged kittiwake *Rissa tridactyla* and the Brown *Anous stolidus* and Lesser *A. tenuirostris* noddies.

A large group of species, mostly larids (gulls, terns and noddies) are vulnerable to decreases in food availability due to changes in foraging associations induced by overfishing of tuna, which force seabird prey fish to the surface when foraging (Figure 3). Although bycatch in trawl and longline fisheries is a threat for some species, particularly gannets and gulls, there is no compelling evidence to suggest that the risk for AEW-listed species is in any way similar to the scale experienced by procellariiform seabirds. However, trawl and demersal longline bycatch rates, particularly in West Africa, merit closer investigation. The absence of observers and near-complete lack of publicly available data on fishing operations, catch and effort statistics or bycatch data from virtually all non-tuna, Atlantic fisheries north of Namibia is a major concern. Should appreciable seabird bycatch rates be found, it is likely that solutions already developed (to address procellariiform bycatch) could be used in these fisheries (see sections 4.1.1 and 4.1.2).

Decreases in food availability from competition are expected to affect a very wide range of species groups, including the African Penguin, gannet, cormorant, gull and tern species. Of these groups, small pelagic fish feature in the diets of six of them. Directed mortality also affects several species (mostly terns but also gulls and gannets) considered in this review.

## 6. Recommendations

### 6.1. Summary of cross-cutting regional issues

There are three issues which are common to many countries in the region and recommendations are provided for each of these. Collaboration between AEWA states and RFMOs should be strengthened. Two issues, the unknown impact of gillnetting and the potential for overfishing, both have the potential to affect almost all the seabirds in the region. They are also most likely to impact species most significantly and represent glaring information gaps. Prioritisations are given for all recommendations; however, this reflects the urgency with which actions should be initiated rather than importance.

#### *Collaboration*

Collaborative efforts between AEWA and national governments and non-governmental organisations should be explored, especially where pilot studies, demonstration projects or initial data-gathering exercises are considered appropriate. However, with some exceptions, the majority of the marine fisheries in the Afrotropical area are already (at least notionally) subject to management from a diversity of RFMOs and two regional seas conventions (Nairobi Convention and Abidjan Convention). Better collaboration between AEWA and these organisations is needed to understand and address negative impacts of fishing on seabirds.

#### Recommendations:

- (i) National fisheries management processes (especially compliance, monitoring and surveillance) need to be strengthened, in parallel with strengthening the functioning of RFMOs (see ii below) with jurisdiction in coastal waters and over non-tuna species. This could be achieved through the development of bycatch or Ecosystem Approach to Fisheries management working groups, comprised of representatives from the relevant countries and RFMOs. RFMOs maintain databases of registered vessels, but there is little uniformity in registration across RFMOs. The development of a consolidated list should be called for by Contracting Party governments that are members of RFMOs in the region.

*Suggested organisation/body responsible:* National governments of Contracting Parties

*Priority:* High

- (ii) A detailed assessment by the AEWA Technical Committee of the operations of each relevant RFMO is needed, to assess synergies with AEWA priorities coupled with a prioritisation exercise that identifies risks to AEWA-listed species and needs for improved measures by the respective RFMOs or Agreements

*Suggested organisation/body responsible:* AEWA Technical Committee with cooperation from RFMOs

*Priority:* High

- (iii) Following the model of ACAP, the AEWA Contracting Party governments should support and/or strengthen the functioning of the RFMOs and regional seas conventions identified in (ii), as set out in the AEWA Action Plan (paragraphs 4.3.7 and 4.3.8; UNEP/AEWA 2013). This could be achieved through appointing national focal points, establishing memoranda of understanding, and active representation and participation in meetings of these bodies by AEWA representatives. The provision of briefs from the AEWA Secretariat to Contracting Parties attending RFMO meetings (similar to the approach used by ACAP) could also serve to strengthen RFMO functioning. The AEWA Secretariat should engage with the ACAP Secretariat for assistance in approaching RFMOs, as ACAP may be able to provide advice on the approaches that have worked in the past.

*Suggested organisation/body responsible:* National governments of Contracting Parties and AEWA Secretariat

*Priority:* Medium

- (iv) In most countries in the region, communication and collaboration between the governmental departments dealing with fisheries and the environment is poor or lacking. Better communication will help to ensure that ecosystem considerations are explicitly included in fisheries management. Collaboration could be achieved by the formation of joint working groups, memoranda of understanding and creating opportunities for regular formal and informal communication between staff in the two departments.

*Suggested organisation/body responsible:* National governments of Contracting Parties

*Priority:* Medium

### *Gillnet fishing*

The nature, scale and impacts of gillnet fisheries on seabirds, particularly seabird bycatch, is a largely unknown. Efforts should be made to understand the gillnet fisheries in the region including measures to reduce or avoid seabird bycatch. The impact of gillnet fisheries on seabirds will likely be hard to quantify as gillnets are set primarily by artisanal fishers. The nature of artisanal fishing means that effects on seabirds are expected to be both localised and hard to control. Preliminary assessments of actual impacts anywhere in the region would be a significant step.

### Recommendations:

- (i) Research should be undertaken, with the assistance of artisanal fishermen, to understand the effects of gillnetting on seabirds, particularly countries in which gillnet catches make up a substantial proportion of fisheries production (e.g. Gambia, Guinea, Sierra Leone, Côte d'Ivoire, Cameroon, Gabon, Madagascar, Mayotte and Somalia; Table 3)

*Suggested organisation/body responsible:* Universities, research institutions, and NGOs (local and international) with the support of the national fishery management bodies

*Priority:* High

Should research show that gillnet fishing does have a substantial impact, the following recommendations should be followed:

Mitigation measures should be put in place, including educating local fishermen about their responsibilities, legal obligations and impacts, and providing incentives for changed behaviour would be required. However, this would also need enormous and ongoing efforts. This approach may not be feasible everywhere along the coast, so targeted interventions may be required, such as in communities operating in or near marine Important Bird Areas that have been identified by BirdLife International (BLI 2010, Lascelles et al. 2012)

*Suggested organisation/body responsible:* NGOs working in the relevant countries with the support of national governments.

### *Overfishing*

The potential for overfishing to cause population reductions and/or ecosystem regime changes that create unpredictable consequences for top predators such as seabirds represents another data gap. While overfishing by local vessels can occur, overfishing by foreign owned fleets in African territorial waters, including through IUU but also through poor management and controls of legitimate fisheries, may be more of a problem. Historically many African countries have not been able to afford their own commercial fishing fleets and have entered into agreements with other countries in Europe and Asia. There is growing evidence that the current types of agreements in place are against the long-term interests of the coastal African states and the sustainability of their fish resources (Kaczynski & Fluharty 2002).

### Recommendations:

- (i) Stronger governmental controls are needed to ensure that foreign-owned vessels catch only what has been agreed to. Pauly et al. (2013) recommend that governments should ensure that all current and future fishing agreements with distant-water fishing nations are made public, as this will encourage more robust competition and ensure more favourable terms for African countries. AEW Contracting Parties should also enlist the support of the Food and

Agriculture Organisation of the United Nations (FAO) to better record and monitor the catches from joint-venture or foreign-vessel fishing operations in their territorial waters.

*Suggested organisation/body responsible:* Governments of Contracting Parties with the support of the FAO

*Priority:* High

- (ii) Multimillion dollar fishing agreements between African countries and distant-water fishing nations are often negotiated with conditions that do not benefit African countries. AEWAs Contracting Parties with large numbers of foreign vessels fishing in their territorial waters would also benefit from strengthening RFMOs, which can increase the bargaining power of African countries over the interests of distant-water fishing nations (Kalaidjian 2010). Measures could include authorising RFMOs (e.g. SFC for West Africa) to represent countries within the region in negotiating fishery agreements with distant-water fishing fleets, especially managing transboundary species and developing codes of conduct (Kaczynski & Fluharty 2002).

*Suggested organisation/body responsible:* Governments of Contracting Parties with the support of RFMOs

*Priority:* High

- (iii) National fish stock management processes, catch and effort and Catch Monitoring Systems must be supported and improved to ensure domestic fisheries are well managed.

*Suggested organisation/body responsible:* National governments of Contracting Parties

*Priority:* Medium

- (iv) IUU fishing can contribute to overfishing and collaborative efforts will be needed to decrease it. Potential measures should focus removing the support structures for IUU, such as transshipments and access to markets. Additional measures could include the implementation of Port States Measures, implementing observer programmes, making data publically available, and ensuring that all vessels are fitted with Vessel Monitoring Systems (VMS). Other potential measures are listed in Gianni and Simpson (2005).

*Suggested organisation/body responsible:* National governments of Contracting Parties supported by AEWAs Secretariat

*Priority:* Medium

- (v) European and Asian countries which are parties to AEWAs but which fish in the territorial waters of African nations (especially those which are parties to AEWAs), should assist with strengthening compliance and monitoring.

*Suggested organisation/body responsible:* Governments of all AEWAs Contracting Parties

*Priority:* Medium

**Box 1. Lessons in implementing national and regional programmes to address seabird-fishery interaction: BirdLife International's Albatross Task Force**

Although the nature and scale of the seabird bycatch issue in longlining had been known for more than 20 years (Brothers 1991), there was no coordinated work to test and implement solutions. The Albatross Task Force (ATF) teams were established by BirdLife International to address the persistent problem of seabird bycatch in longline fishing. The ATF works nationally, mainly at sea, onboard commercial fishing vessels during fishing trips to collect data and conduct experiments to understand the realities and impacts of the fishing industry on seabirds. It involves three stages; first is mainly the collection of seabird abundance and interaction data during fishing operations. Second is to work with fisherman and partnerships within the fishing industry to find and implement solutions that reduce seabird bycatch.

This includes conducting experimental research during production fishing to prove that measures being advocated are effective, safe, simple to implement, affordable and do not adversely affect catch rates. It also involves negotiating agreements for fishery-wide rules (or permit conditions). The third phase is to support independent observer programmes and monitor compliance, maintain a watching brief on fisheries activities and to provide ongoing training for fishers in the whys and hows of seabird bycatch mitigation.

This approach is driven by some key underlying principles, which underpin a highly successful programme that, in South Africa, has led to reductions in seabird bycatch rates in target fisheries of 80-95%. Engaging with a fishing industry with the specific intention of implementing measures to reduce the impact on vulnerable species requires a multi-level approach. The experience of the ATF in dealing with fisheries in 'grassroots' projects provides lessons of what has been successful. The following factors have proven beneficial when collaborating with industry at a national or local scale.

- Early initiation of a collaborative approach
- Inclusion of comparative target catch analysis
- Locally employed staff
- Mindfulness of local socio-geographic factors
- Consistency and continuity of project awareness
- Step-wise approach to investigation and dissemination
- Medium- to long-term commitments (8 years in some countries)

Although the specifics of the possible impacts of gillnet or overfishing will be different from direct impacts of bycatch that the ATF has addressed, these general principles should be given serious consideration should AEWA opt to initiate projects to reduce fisheries risks to seabirds.

## 6.2. Subregion-specific recommendations

More specific recommendations for the three sub regions are given below. Due to the lack of information, many of these recommendations involve developing research programmes to determine which fisheries are affecting seabirds in the region. Priorities have been assigned to these recommendations based on the scale and severity of the problem being addressed as well as the degree of difficulty in implementing the recommendation.

### 6.2.1. West Africa

- (i) Observer programmes to collect catch, effort and bycatch data are needed. It should be mandatory, as a fishing permit condition and funded through licencing arrangements, that foreign-flagged vessels may only operate in territorial waters if a trained observer is onboard. Such a system is in place for pelagic longline operations in South Africa (West & Smith 2013). Evidence from elsewhere (e.g. IOTC 2013) suggests that establishing such arrangements will require significant monetary and institutional support from external bodies such as RFMOs. There is a need to accommodate legitimate concerns about commercially sensitive information. However, significant aspects of data and reports from such observer programmes must be made publicly available. A lack of transparency will undermine the credibility and the utility of observer programmes.

*Suggested organisation/body responsible:* Fishery management authorities within the government of Contracting Parties.

*Priority:* High

- (ii) Studies of the diets of breeding gulls and terns in western African coastal countries are needed, to ascertain the degree of overlap with fishery catches, by way of direct

observations of foraging birds, sampling prey items fed to non-fledged young and by collecting regurgitated pellets at roosts and at breeding sites. For terns direct observations can be made of birds carrying prey as they land in their colonies. Species to study include Slender-billed and Audouin's gulls and Caspian and Royal terns.

*Suggested organisation/body responsible:* Universities, research institutions, and NGOs (local and international)

*Priority:* High

- (iii) Where trawl vessels operate in areas of high seabird abundance, *net sonde* or third-wire sensor cables should be banned, and additional risk should be investigated as a priority.  
*Suggested organisation/body responsible:* Fishery management authorities within the government of Contracting Parties, in collaboration with NGOs  
*Priority:* High
- (iv) Surveys of the seabirds attending longline, trawl and purse-seine vessels and gillnet operations, with observations of species occurrence, relative abundance, interactions, scavenging and mortalities. Studies using tracking devices and stable isotope ratios could supplement direct observations and assist in assessing the degree of reliance of individuals or populations on particular fishery discards. Species most likely to be present are gulls and terns, both resident and Palearctic species. Some work in this area is already underway through the Senegal NGO 'FIBA' (<http://www.lafiba.org>).  
*Suggested organisation/body responsible:* Fisheries observers and NGOs  
*Priority:* Medium
- (v) Understanding the nature and extent of potential threats (bycatch, directed take, competition, etc.) on Northern Gannets in Senegal and Mauritania.  
*Suggested organisation/body responsible:* Universities, research institutions, and NGOs (local and international)  
*Priority:* Medium
- (vi) Although disturbance and direct consumption of seabirds is not a threat that accrues to seabirds from fisheries *per se*, it is a concern for AEW-listed seabird species in West Africa. Encouragingly, similar problems were addressed in both Ghana and Senegal by way of educational programmes in the 1980s and 1990s (Newbery 1999).  
*Suggested organisation/body responsible:* Local universities, research institutions, and NGOs (local and international)  
*Priority:* Medium

### 6.2.2. Southern Africa

- (i) Efforts to introduce spatially explicit quotas are underway for the South African small pelagic fishery. This objective seeks to avert localised overexploitation of sardine and anchovy resources, especially around breeding colonies of seabirds such as African Penguins. The Technical Committee should remain aware of the results of this management change because the outcomes are likely to be applicable to addressing overfishing concerns elsewhere in the Afrotropical region.  
*Suggested organisation/body responsible:* South African Department of Agriculture Forestry and Fisheries, university researchers.  
*Priority:* High
- (ii) An assessment of the scale and bycatch risks from trawl, longline and gillnet fisheries in Angola should be conducted. This is an important information gap for the region.  
*Suggested organisation/body responsible:* Angolan Ministry of Fisheries with universities, research

institutions, and NGOs (local and international). Collaboration with the Benguela Current Commission is recommended.

*Priority:* High

- (iii) Level of directed, artisanal take of Cape Gannets (and other seabirds) in southern Angolan waters. Initially a scoping study could include interviews and analyses of landings conducted in fishing villages and local fish markets in larger centres, coupled with an analysis of ring recoveries. If feasible, at-sea observations of artisanal fishers should be made.

*Suggested organisation/body responsible:* Angolan Ministry of fisheries, research institutions, Benguela Current Commission and NGOs.

*Priority:* High

- (iv) Angola and Namibia have significant longline fisheries as well as several species of albatross visiting their waters. Both these countries should develop a National Plan of Action for reducing the incidental catch of seabirds in their fisheries. This is an FAO-led initiative and the plans should contain recommendations for the adoption of appropriate mitigation measures.

*Suggested organisation/body responsible:* Namibian and Angolan fishery management and environmental affairs bodies with support from FAO, the Benguela Current Commission and NGOs.

*Priority:* High

### 6.2.3. East Africa

- (i) An assessment of the potential risks from tuna stock depletion on AEWA-listed species that forage in association with tunas. This could include models of colony trends for key species eastern Africa coupled to environmental and fisheries catch data (freely available online, including for the latter from IOTC), conducted over several years to ascertain trends and the impacts of tuna catches on food availability for seabirds. This too would have impacts much wider than the species, colony or region of study.

*Suggested organisation/body responsible:* Co-ordinated approach through AEWA and East African governments and universities, research institutions, and NGOs.

*Priority:* High

- (ii) Tracking overlaps interactions between breeding seabirds and tuna fisheries, using small loggers for species that are known to be (at least partially) dependent on foraging associations with tunas. The miniaturisation of tracking devices makes spatial studies of even quite small seabirds now possible.

*Suggested organisation/body responsible:* Universities, research institutions, and NGOs (local and international).

*Priority:* High

- (iii) Disturbance and directed take are a concern for some seabirds in Madagascar. Studies should be done to quantify the scale of the problem. If necessary education programmes should be implemented.

*Suggested organisation/body responsible:* Madagascan fishery management and environmental affairs bodies with local universities, research institutions, and NGOs.

*Priority:* Medium

## 7. References

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## 8. Appendix

**Appendix 1:** A characterisation of artisanal and commercial/industrial fisheries within the Afrotropical region, describing the numbers of vessels, catch and gear used. Data are taken from FAO Fishery and Aquaculture country profiles (FAO 2014). Dataset age is given in parenthesis below each country

Country (date of report)	Artisanal	Industrial
<b>West Africa</b>		
Mauritania (2006)	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> Approx. 250 wooden Senegalese boats operate along with many other small Mauritanian boats of wood, aluminum or fibreglass.</li> <li>- <b>Gear:</b> encircling nets, gillnets, traps, longlines, and traps.</li> <li>- <b>Catch:</b> Coastal fish are targeted</li> </ul>	<ul style="list-style-type: none"> <li>- Accounts for 90% of catch</li> <li>- 72 economically valuable species targeted</li> <li><b>Catch and Vessels:</b> Cephalopods (octopus, squid, cuttlefish) - 125 national vessels and 55 vessels fishing under the Fisheries Agreement with the EU</li> <li>Shellfish (green lobster, pink lobster, the tiger shrimp, prawn, shrimp slope, crab and sea urchin) - 23 shrimp trawl vessels, 37 European shrimp vessels</li> <li>Demersal fish (hake, bream, sole, captain) - 31 national fishing vessels, 34 foreign vessels fishing</li> <li>Pelagic (Sardinella, sardines, horse mackerel, mackerel, pelagic squid) - 60-70 foreign-owned vessels</li> <li>Tuna and tuna-like species (swordfish, yellowfin, skipjack)</li> <li>Oysters and clams.</li> </ul>
Senegal (2008)	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> Approx. 13,903 fishing units (mostly canoes)</li> <li>- <b>Catch:</b> Small coastal tunas (Ravil, Bonito, skipjack mackerel) targeted</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> Small refrigerated sardine vessels (sardine, horse mackerel, mackerel and bonga)</li> <li>143 coastal and demersal trawlers (115 Senegalese-owned)</li> <li>Tuna- Senegalese Pole-line, and foreign-owned purse seine vessels (Albacore, Bigeye, skipjack)</li> <li><b>Catch:</b> Crustaceans, molluscs and fish (pandora (<i>Pagellus bellottii</i>), white grouper (<i>Epinephelus aeneus</i>), snapper (<i>Pagrus caeruleostictus</i>), red mullet (<i>Pseudupeneus prayensis</i>) and Lesser African threadfin (<i>Galeoides decadactylus</i>), hake (<i>Merluccius polli</i> and <i>Merluccius senegalensis</i>) and deep water shrimp (<i>Parapenaeus longirostris</i>)</li> </ul>

Country (date of report)	Artisanal	Industrial
Gambia (2007)	<ul style="list-style-type: none"> <li>- Artisanal fishing accounts for 93% of the country's catch</li> <li>- Fishers are of different nationalities including Senegalese, Ghanaians, Guineans and Malians</li> <li>- <b>Gear and Catch:</b></li> <li>- Surrounding gillnet- small pelagic fish (clupeids, especially Bonga/shad <i>Ethmalosa fimbriata</i>)</li> <li>- Bottom gillnet- demersal fish</li> <li>- Catches of <i>Sardinella aurita</i> (round sardinella) and <i>Sardinella maderensis</i> (flat sardinella) are becoming increasingly important</li> </ul>	<ul style="list-style-type: none"> <li>- Private Gambian entrepreneurs in partnership with private investors from countries such as Greece, Spain, Italy, China, South Korea and Holland</li> <li>- <b>Vessels:</b> 15 shrimp trawlers, 17 fish/cephalopod trawlers</li> <li>- <b>Catch:</b> demersal species with preference for cephalopods, shrimps and other high value species (barracuda, groupers, snappers etc)</li> </ul>
Cabo Verde (2008)	<ul style="list-style-type: none"> <li>- Accounts for 60% of total catch</li> <li>- <b>Vessels:</b> &gt;1000 small craft, 74% of which are motorised</li> <li>- <b>Gear:</b> handlines, beach seines and gillnets</li> <li>- <b>Catch:</b> large oceanic pelagic fish (sharks and tunas, particularly yellowfin and bigeye), small coastal pelagic species (sardine, mackerel) and demersal fish (grouper, bream, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Catch:</b> Large pelagic species (<i>Thunnus albacares</i>, <i>T. obesus</i>, <i>Katsuwonus pelamis</i>, <i>Acanthocybium solandri</i>), the small tuna (<i>Auxis thazard</i> and <i>Euthynnus alletteratus</i>), coastal pelagic species (black mackerel (<i>Decapterus macarellus</i>) and mackerel (<i>Selar crumenophthalmus</i>) represent more than 90% of total catch.</li> </ul>
Guinea-Bissau (2001)	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> Approx. 100 fishing vessels (27% motorised)</li> </ul>	<ul style="list-style-type: none"> <li>- Limited to two joint venture vessels with China</li> </ul>
Guinea (2005)	<ul style="list-style-type: none"> <li>- <b>Gear:</b> encircling gillnets to catch croaker and coastal pelagic species</li> </ul>	<ul style="list-style-type: none"> <li>- Dominated by foreign-owned vessels</li> <li>- <b>Gear:</b> Offshore demersal fishery using longlines and gillnets</li> <li>- <b>Catch:</b> Lutjanidae and Sparidae</li> </ul>
Sierra Leone (2008)	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> Approx. 8000 vessels (8% motorised), wooden canoes of varying length</li> <li>- <b>Gear:</b> ringnets, bottom gillnets, surface gillnets, beach seines, castnets, longlines and handlines</li> </ul>	<ul style="list-style-type: none"> <li>- Dominated by foreign-owned vessels</li> <li>- <b>Gear and Catch:</b> shrimp and finfish demersal trawlers</li> </ul>

Country (date of report)	Artisanal	Industrial
Liberia (2007)	<p>- Accounts for 60% of catch</p> <p>- <b>Vessels:</b> Kru canoes some with outboard motors using hooks, longlines and gillnets, Fanti canoes with larger engines using ring and purse nets, gillnets and Popohs (dugout canoes) using beach seines</p> <p>- <b>Catch:</b> <i>Caranx</i>, <i>Sphyraena</i>, <i>Cybium</i>, <i>Trichiurus</i>, <i>Sardinella</i>, <i>Ethmalosa</i>, <i>Chloroscombrus</i>, <i>Ilisha africana</i>, <i>Pseudotolithus</i>, <i>Dentex</i>, <i>Cyanoglossus</i>, <i>Galeoides decadactylus</i> and <i>Pentanemus quinquarius</i> (Polynemidae), <i>Drepane africana</i> (Drepanidae), <i>Arius</i> spp. (Ariidae), <i>Cynoglossus</i> spp. (Cynoglossidae), <i>Ilisha africana</i>, <i>Ethmalosa fimbriata</i> (Clupeidae) and <i>Parapenaeus atlantica</i> and <i>Lutjanus</i> spp</p>	<p>- <b>Vessels:</b> 28 trawlers (incl. Chinese vessels), 20 shrimp vessels</p> <p><b>Catch:</b> Shrimp (<i>Penaeus duorarum notialis</i> and <i>Parapenaepsis atlantica</i>) and pelagic and demersal resources, including <i>Pomadasy jubelini</i>, <i>Pseudotolithus senegalensis</i>, <i>P. typus</i> and <i>Lutjanus</i> spp.</p>
Côte d'Ivoire (2008)	<p>- Accounts for 59% of fish production</p> <p><b>Gear and Catch:</b> Purse seine- sardine (<i>Sardinella aurita</i>) and herring (<i>Sardinella maderensis</i>)</p> <p>Long driftnets- bonito (<i>Sarda sarda</i>), skipjack (<i>Euthynnus alletteratus</i>), sailfish (<i>Istiophorus albicans</i>), marlin (<i>Makaira nigricans</i> and <i>Tetrapturus albidus</i>), swordfish (<i>Xiphias gladius</i>) and sharks (<i>Carcharhinus falciformis</i>, <i>Sphyrna zygaena</i>, <i>Sphyrna lewini</i>, <i>Isurus</i> spp.)</p> <p>Gillnets for demersal species</p>	<p>- Accounts for 39% of fish production</p> <p>- <b>Vessels:</b> 20 trawl vessels, 17 small pelagic purse seine vessels, 20 European tuna seine and pole and line vessels (mainly Spanish and French)</p> <p>- <b>Catch:</b> <i>Sardinella aurita</i> (Round sardinella) dominates small pelagic fishery, Yellowfin tuna (<i>Thunnus albacares</i>) and Bigeye tuna (<i>T. obesus</i>) dominate tuna catches. Also targeted- <i>Brachydeuterus auritus</i> (bigeye grunt), <i>Pagellus bellottii</i> (Red pandora), <i>Ilisha africana</i> (West African ilisha), <i>Pseudotolithus senegalensis</i> (Cassava croaker), <i>Trigla</i> sp. (gurnard), <i>Sardinella maderensis</i> (Maderian sardinella), <i>Chloroscombrus chrysurus</i> (Atlantic bumper)</p>
Ghana (2004)	<p>- Accounts for 60-70% of catch</p> <p>- <b>Vessels and Gear:</b> Approx. 9 981 canoes using purse seines, beach seiners, set nets, draft gill nets and hook and line</p> <p>- <b>Catch:</b> 300 different species of commercially important fish, 17 species of cephalopods, 25 species of crustaceans and 3 turtle species. Small pelagics (round sardinella, flat sardinella, anchovy and chub mackerel) are most important</p>	<p>- <b>Vessels:</b> large, steel-hulled foreign-built trawlers, shrimpers, tuna pole and line vessels and purse seiners</p>

Country (date of report)	Artisanal	Industrial
Togo (2007)	<p>- Vessels and gear: Approx. 400 dugout canoes (both motorised and non-motorised) using a variety of gears (lines, longlines, bottom and surface gillnet, floating shark net, purse seine, beach seine and trawl)</p> <p>- <b>Catch:</b> <i>Engraulis encrasicolus</i>, <i>Dentex</i> spp., <i>Lutjanus</i> spp., <i>Epinephelus</i> spp., <i>Pseudotolithus</i> spp., <i>Brachydeuterus auritus</i>, <i>Sphyrna</i> spp., <i>Makaira</i> spp., <i>Caranx</i> spp., <i>Thunnus</i> spp., <i>Sardinella maderensis</i>, <i>Dactylopterus volitans</i></p>	<p>- <b>Vessels:</b> Foreign-owned demersal trawlers</p>
Benin (2008)	<p>- Accounts for 93% of catch</p> <p>- <b>Catch:</b> Clupeidae (<i>Sardinella maderensis</i> <i>Ilisha africana</i>, <i>Sardinella aurita</i>); Engraulidae (<i>Engraulis encrasicolus</i>), Carangidae (<i>Chloroscombrus snapper</i>, <i>Selene dorsalis</i> <i>Decapterus rhonchus</i>, <i>Decapterus punctatus</i>, <i>Caranx hippos</i>, <i>Caranx crysos</i>, <i>Caranx senegallus</i> etc.), Scombridae (<i>Scomberomorus tritor</i>, <i>Sphyaena</i> sp., Trichiuridae (<i>Trichiurus lepturus</i>), as well as sharks, flying fish.</p>	<p>- Sector underdeveloped with many Nigerian, Togo and Greek vessels</p> <p>- <b>Vessels:</b> Approx. 12 vessels (shrimp trawl and mid-water trawl)</p> <p>- <b>Catch:</b> Sciaenidae (<i>Pseudotolithus</i> sp.), Ariidae, Cynoglossidae, Polynemidae (<i>Galeoides decadactylus</i>, <i>Polydactylus quadrifilis</i>, <i>Pentanemus quinquarius</i>, etc.)</p>
Nigeria (2007)	<p>- <b>Vessels:</b> planked and dugout canoes (most motorised)</p> <p>- <b>Catch:</b> Pelagics- largely <i>Ethmalosa</i> (bonga) and <i>Sardinella</i> species</p> <p>Demersals- dominated by Croakers, Soles, Threadfins, Catfishes and Sharks</p> <p>Shellfish- dominated by the Penaeid shrimps, crabs and certain bivalves</p>	<p>- <b>Vessels:</b> Approx. 20 Bottom and mid-water trawlers and shrimp trawlers</p> <p><b>Catch:</b> Croakers (<i>Pseudotolithus</i> spp.), Sole (<i>Cynoglossus</i> spp.), Groupers (<i>Epinephelus</i> spp.) Snappers (<i>Lutjanus</i> spp.), Bigeyes (<i>Brachydeuterus</i> spp.), Threadfins (<i>Polydactylus</i> spp.), Barracudas (<i>Sphyaena</i> spp.), Jacks (<i>Caranx</i> spp.), Horse mackerels (<i>Trachurus</i> spp.), and Cutlass fishes (<i>Trichiurus</i> spp.), Penaeid shrimps</p>
Cameroon (2007)	<p>- <b>Vessels:</b> 7 335 canoes</p> <p>-<b>Gear and Catch:</b> Gillnet- demersal species majority of the family Sciaenidae, Aridae and Polynemidae</p> <p>Surrounding gillnet- bonga (<i>Ethmalosa fimbriata</i>)</p> <p>Purse seine- Bonga and incidentally <i>Sardinella maderensis</i> and hunchback (<i>Pseudotolithus elongatus</i>)</p> <p>Surface gillnet- Pelagic: bonga and <i>Ilisha africana</i>)</p> <p>Net fishing: shrimp (<i>Nematopalaemon hastatus</i>)</p>	<p>- <b>Vessels:</b> 10 trawlers, 45 Shrimp trawlers</p> <p><b>Catch:</b> <i>Arius beudeloti</i>, <i>Caranx Hippos</i>, <i>Caranx lugubris</i>, <i>Selene dorsalis</i>, <i>Chloroscombrus chrysurus</i>, <i>Cynoglossus monodi</i>, <i>Cynoglossus senegalensis</i>, <i>Drepane africana</i>, <i>Lutjanus goreensis</i>, <i>Lutjanus agennes</i>, <i>Lutjanus endecacanthus</i>, <i>Lutjanus dentatus</i>, <i>Galeodes decadactylus</i>, <i>Pentanemus quinquarius</i>, <i>Pseudotolithus elongatus</i>, <i>Pseudotolithus typus</i>; <i>Pseudotolithus senegalensis</i>, <i>Pagrus ariga</i>, <i>Penaeus</i> sp., <i>Carcharinus</i>, <i>Portinus validus</i></p>

Country (date of report)	Artisanal	Industrial
Equatorial Guinea (2003)	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> Shrimpers had 28 boats in 1990, with total landings of 4842 tons.</li> <li>- <b>Gear:</b> gillnets, cast nets, hooks</li> <li>- Catch small pelagic sardine spp and <i>Ethmalosa</i> spp</li> </ul>	<ul style="list-style-type: none"> <li>- No national industrial fleet, EU vessels operate in EEZ under the management of ICCAT</li> </ul>
São Tomé e Príncipe (2008)	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> Small wooden and fibreglass boats</li> <li><b>Gear and Catch:</b> Purse seine (small tuna - Little tunny <i>Euthynnus alletteratus</i>, skipjack <i>Katsuwonus pelamis</i>, yellowfin <i>Thunnus albacare</i>), handline (bigeye <i>Thunnus obesus</i>)</li> <li>Also target Sciaenidae, <i>Pagellus</i> spp, Polynemidae, <i>Acanthocybium</i>, <i>Istiophorus albica</i>, Exocoetidae, <i>Decapterus</i> spp, <i>Caranx hippos</i>, <i>Caranx</i> spp, Elasmobranchii, <i>Elagatis bipinnulata</i></li> </ul>	<ul style="list-style-type: none"> <li>- No national fleet, vessels from EU and Japan undertake industrial fishing</li> </ul>
Gabon (2007)	<ul style="list-style-type: none"> <li>- Occurs mainly in lagoons and estuaries</li> <li>- <b>Vessels:</b> Approx. 1000 motorized canoes and 500 non-motorized canoes</li> <li>- <b>Gear:</b> purse seine (bonga), longlines (red carp groupers, barracudas, big captainfish, sharks, catfish, bream, rays) and beach seine (small coastal pelagics)</li> </ul>	<ul style="list-style-type: none"> <li>- Industry types: Large pelagic fishery in association with European Union and Japan</li> <li>Coastal fishing composed of local and foreign fleets (South Korea, China and EU)</li> <li>- <b>Vessels:</b> 25 Trawlers, 14 Shrimp, 3 longliners, 2 Crabbers, 16 Shrimp vessels</li> <li><b>Catch:</b> Shrimp dominates catches. Fish, cephalopods and crabs also targeted</li> </ul>
Congo (2006)	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> Approx. 254 Popo canoes (from Benin and Ghana) which are mostly mechanised and ~1000 Vili canoes (local) of which 15% are motorised</li> <li>- <b>Gear:</b> Drift nets, beach seines and cast nets</li> <li>- <b>Catch:</b> bars (<i>Pseudotolithus</i> spp.), Sole (<i>Cynoglossus</i> spp.) Pink sea bream (<i>Dentex</i> spp.), black sea bream (<i>Pomadourus</i> spp.), small captains (<i>Galeoides decadactylus</i>), barbs (<i>Pentanemus quinquarius</i>), groupers (<i>Epinephelus</i> spp.), red captains (<i>Lutjanus</i> spp.), bigeye grunt (<i>Brachydeuterus auritus</i>), catfish (<i>Arius</i> spp.), Sardinella (<i>Sardinella</i> spp.), bonga (<i>Ethmalosa fimbriata</i>), horse mackerel (<i>Trachurus treacae</i>), barracudas (<i>Sphyrna</i> spp.), sharks (<i>Carcharhinus</i> spp.), rays (<i>Raja miraletus</i>) and shrimp (<i>Penaeus notialis</i> and <i>Parapenaeopsis atlantica</i>)</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> 22 trawlers, 3 sardine vessels, 4 shrimp</li> <li>- Catch: 33% pelagic species, 60% demersal and 7% shrimp.</li> </ul>

Country (date of report)	Artisanal	Industrial
Democratic Republic of Congo (2009)	<ul style="list-style-type: none"> <li>- Accounts for large proportion of the small amounts of marine fish catches</li> <li>- <b>Vessels and Gear:</b> canoes and beach seines</li> </ul>	<ul style="list-style-type: none"> <li>- No industrial fishery</li> </ul>
<b>Southern Africa</b>		
Angola (2007)	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> Approx. 3000-4500 boats (majority not motorised)</li> <li>- <b>Catch:</b> demersal species such as groupers, Snappers, sea breams, croakers and spiny lobster</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> Approx. 200 industrial vessels, many joint venture or foreign-owned vessels, mainly from China, Korea, and Spain</li> <li>40 demersal vessels (24 Angolan, 16 foreign), 110 purse seiners, 29 shrimp trawlers, 16 tuna vessels (all foreign-owned)</li> <li>- <b>Catch:</b> horse mackerel, sardinella, tunas, shrimps, deep sea red crab, lobsters and other demersal fishes</li> </ul>
Namibia (2007)	<ul style="list-style-type: none"> <li>- Artisanal fisheries do not exist</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Vessels and Catch:</b> Hake- 121 demersal trawlers (also monkfish, sole, snoek and kingklip), 28 demersal longliners</li> <li>Horse mackerel- 15 mid-water trawlers</li> <li>Sardine and anchovy- 36 purse seiners</li> <li>Orange roughy and alfonsino - 5 deep water trawlers</li> <li>Tuna vessels - 73 longline and pole and line</li> <li>Rock lobster - 34 vessels</li> <li>Deep-sea red crab - 2</li> <li>Linefish (kob, snoek and steenbras)- 16</li> </ul>

Country (date of report)	Artisanal	Industrial
South Africa (2007)	<ul style="list-style-type: none"> <li>- Small scale and subsistence fishing uncommon</li> <li>- <b>Catch and Gear:</b> ring nets and traps - West coast rock lobster beach seine and gillnets- linefish, reef fish, rays and sharks</li> </ul>	<ul style="list-style-type: none"> <li>- 250 species commercially targeted (5% comprise 90% of landed catch)</li> <li>- <b>Vessels and Catch:</b> Hake (<i>Merluccius paradoxus</i> and <i>M. capensis</i>)- Demersal hake trawl (70 vessels), demersal longline (64 vessels) and handline (hake), inshore trawl (31 vessels, also sole <i>Austroglossus pectoralis</i>)</li> <li>Small pelagic purse seine (100 vessels)- sardine (<i>Sardinops ocellatus</i>), anchovy (<i>Engraulis capensis</i>) and round herring (<i>Etrumeus whiteheadi</i>)</li> <li>Horse mackerel (<i>Trachurus capensis</i>)- midwater trawl (6 vessels)</li> <li>Tuna (longfin and yellowfin)- bait and pole (200 vessels), pelagic longline (31 vessels)</li> <li>Patagonian toothfish- demersal longline</li> <li>Shrimp pink prawn (<i>Haliporoides triarthrus</i>), langoustine (<i>Metanephrops andamanicus</i>), <i>Nephropsis stewarti</i>, red crab (<i>Chaceon macphersoni</i>), Natal deepwater rock lobster (<i>Palinurus delagoae</i>)- trawl</li> <li>Rock lobster <i>Jasus lalandi</i> and <i>Palinurus gilchristi</i>- traps, ring nets</li> <li>Squid chokka squid (<i>Loligo vulgaris reynaudi</i>)- jig (138 vessels)</li> <li>Line fish (over 250 species of finfish)- hand line (over 400 vessels)</li> </ul>
Mozambique (2007)	<ul style="list-style-type: none"> <li>- Accounts for 80% of catch</li> <li>- <b>Vessels:</b> non-motorised boats (~15 000)</li> <li>- <b>Gear:</b> Beach seine, gillnets and longlines</li> <li>- <b>Catch:</b> Crustacean (prawns, deepwater shrimp, crayfish, lobsters and crabs), Marine finfish (demersal and pelagic species mainly grouper, snapper, emperor and sea bream, migratory tuna species (yellowfin, big eye and albacore, swordfish and shark), Cephalopods and Molluscs (squid, octopus, sea cucumbers, bivalves)</li> </ul>	<ul style="list-style-type: none"> <li>- 70% of TAC goes to joint ventures between Mozambique and companies from Japan and Spain</li> <li>- <b>Catch:</b> lobster, crabs, gamba (deep water shrimp), fish, shallow water shrimp, crayfish and squid.</li> </ul>
<b>East Africa</b>		
Madagascar (2005)	<ul style="list-style-type: none"> <li>- Accounts for 53% of marine catch</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> Dominated by EU vessels, 43 purse seine, 50 surface longline, some shrimp trawlers</li> <li><b>Catch:</b> Tuna, billfish and sharks, shrimp</li> </ul>

Country (date of report)	Artisanal	Industrial
Mauritius (2006)	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> ~2000 boats (2004)</li> <li>- <b>Gear:</b> basket traps, hook-and-line, harpoons, large nets and gillnets</li> <li>- <b>Catch:</b> <i>Lethrinus mahsena</i> dominates, lethrinids, scarids, sigannids, mullets and tunas</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> Tuna and tuna-like species- 3 local longline vessels, European purse seiners</li> <li>- <b>Catch:</b> dominated by Albacore tuna</li> </ul>
Réunion (to France) (2008)	No data	No data
Mayotte (to France)	No data	No data
Comoros (2003)	<ul style="list-style-type: none"> <li>- <b>Gear:</b> hand lines and trolling from motorized fibreglass vessels</li> <li>- Tunas</li> </ul>	- No national fleet but 40 seiners and 25 longliners from the EU have licences
United Republic of Tanzania (2007)	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> Canoes and small boats (~7200)</li> <li>- <b>Gear:</b> Gillnets</li> <li>- <b>Catch:</b> Fin fish and shrimp</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Catch:</b> Inshore- shellfish (shrimps and lobsters), cephalopods and crabs</li> <li>Offshore- tuna, tuna-like species, marlin, sword fish and sharks caught by foreign purse seine and longline vessels</li> </ul>
Seychelles (2007)	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> small, motorized boats</li> <li>- <b>Gear and Catch:</b> Handline fishery important (73% of landings) with 280 fibreglass vessels, 91 whaler-type vessels and 16 schooners. Targets snappers <i>Lutjanus</i> spp., green jobfish <i>Aprion virescens</i>, groupers <i>Epinephelus</i> spp., capitaines Lethrinids spp. and semi-demersal trevally <i>Carangoides</i> spp.</li> <li>Encircling nets: mackerel (<i>Rastrelliger</i> spp.)</li> <li>Small-seine fishery: small pelagics, in particular horse mackerel (<i>Decapterus</i> spp.) 3 vessels</li> <li>Longline: sharks</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> semi-industrial fishery, consisting of small, locally-owned long-liners targeting pelagic species (mainly yellowfin and big-eye tuna and swordfish) 7 vessels</li> <li>Industrial fisheries: foreign-owned purse seiners (French and Spanish) - skipjack and yellowfin, and longliners (Taiwanese and Japanese) - tuna (yellowfin and big-eye)</li> </ul>
Kenya (2007)	<ul style="list-style-type: none"> <li>- General: Restricted to inshore due to a lack of resources to venture further offshore</li> <li>- <b>Vessels:</b> unmotorised boats</li> <li>- <b>Catch:</b> Demersal species (rabbit fish, scavengers, parrot fish, pouter and black skin), pelagic species (mainly cavalla jacks, mullets, mackerels, barracudas, king fish, bonitos/tunas and sail</li> </ul>	<ul style="list-style-type: none"> <li>- <b>Vessels:</b> 5 shrimp trawlers, deep sea fish resources exploited by distant waters fishing nations- 33 purse seine, 30 longline</li> <li>- <b>Catch:</b> foreign vessels largely unknown</li> </ul>

Country (date of report)	Artisanal	Industrial
	fish), crustaceans (lobsters, prawns and crabs), migratory species (tuna and tuna-like species)	
Somalia	No data	No data