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ECONOMIC, SOCIAL AND ENVIRONMENTAL IMPACT OF ILLEGAL, UNREPORTED AND UNREGULATED FISHING IN AFRICA

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LIST OF ACRONYMS

ALDFG	Abandoned, lost or otherwise discarded fishing gear
AfDB	African Development Bank
AIS	Automatic Identification System
APPECCAO	Adapting fishing policy to climate change in West Africa using scientific knowledge and indigenous knowledge
ASCLME	Agulhas and Somali Current Large Marine Ecosystems
ATS	Amphetamine-type stimulants
AU	African Union
AU-IBAR	African Union Inter-African Bureau for Animal Resources
BCLME	Benguela Current Large Marine Ecosystem
BMSY	Biomass maximum sustainable yield
CAFRS	Comprehensive African Fisheries Reform
CAMFA	Conference of African Ministers for Fisheries and Aquaculture
CBD	Convention on Biological Diversity
CCAMLR	Convention on the Conservation of Antarctic Marine Living Resources
CCLME	Canary Current Large Marine Ecosystem
CCRF	Code of Conduct for Responsible Fisheries
CECAF	Committee for the Eastern Central Atlantic Fishery
CEMAC	Central African Economic and Monetary Community
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CNSHB	National Centre for Fisheries Sciences Boussoura and Research Center scientists, Conakry
COFI	Committee on Fisheries (FAO)
COLTO	Coalition of Legal Toothfish Operators
COMESA	Common Market for Eastern and Southern Africa
COREP	Regional Fisheries Committee for the Gulf of Guinea
CPUE	Catch per Unit Effort
CSRP	Sub-Regional Fisheries Commission
CZM	Coastal Zone Management
DOALOS	Division for Ocean Affairs and the Law of the Sea
DSCC	Deep Sea Conservation Coalition
DWF	Distant Water Fisheries
DWFN	Distant Water Fishing Nations
EAF/A	Ecosystem approach to fisheries/aquaculture
ECCAS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
EEZ	Exclusive Economic Zone
EJF	Environmental Justice Foundation
ENSO	El Niño□Southern Oscillation
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FCWC	Fisheries Committee for the West Central Gulf of Guinea
FEZ	Free Economic Zone
FMC	Fisheries Monitoring Centre
FMM	FAO Multipartner Mechanism
FOC	Flag of convenience
FONC	Flag of non-compliance
GCLME	Guinea Current Large Marine Ecosystem
GDP	Gross domestic product
GEF	Global Environment Facility

GFCM	*General Fisheries Commission for the Mediterranean*
HSTF	*High Seas Task Force*
ICCAT	*International Commission for the Conservation of Atlantic Tunas*
ICES	*International Council for the Exploration of the Sea*
ICJ	*International Court of Justice*
ICRI	*International Coral Reef Initiative*
IEZ	*Inshore Exclusion Zone*
ILO	*International Labour Organization*
IMO	*International Maritime Organization*
INDP	*National Institute of Fisheries Development in (Cape Verde)*
INTERPOL	
IOC	*AFRICA IOC Sub-Commission for Africa and the Adjacent Island States*
IOC	*Indian Ocean Commission*
IOC	*Intergovernmental Oceanographic Commission*
IOI	*International Ocean Institute*
IOTC	*Indian Ocean Tuna Commission*
IPOA	*International Plan of Action*
ISS	*Institute of Security Studies, South Africa*
ITF	*International Transport Worker's Federation*
ITLOS	*International Tribunal for the Law of the Sea*
IUCN	*International Union for Conservation of Nature*
IUU	*Illegal, unreported and unregulated (fishing)*
IWC	*International Whaling Commission*
JICA	*Japan International Cooperation Agency LCBC Lake Chad Basin Commission*
LDC	*Least developed countries*
LDCF	*Least Developed Countries Fund (GEF)*
LIFDC	*Low-income food-deficit countries*
LME	*Large marine ecosystem*
MCS	*Monitoring, Control and Surveillance*
MDG	*Millennium Development Goal*
MMO	*Marine Management Organisation*
MPA	*Marine Protected Area*
MRAG	*Marine Resources Assessment Group*
MSC	*Marine Stewardship Council*
MSC	*Maritime Safety Committee*
MSY	*Maximum sustainable yield*
NEPAD	*New Partnership for Africa's Development*
NEST	*Nigeria Environmental Study/action Team*
NFFP	*NEPAD-FAO Fish Programme*
NGO	*Non-governmental organization*
NOAA	*National Oceanic and Atmospheric Administration*
NTZ	*No Take Zone*
OCR	*Ocean Conservation Research*
OECD	*Organisation for Economic Co-operation and Development*
OHI	*Ocean Health Index*
PAF	*International Partnership for African Fisheries Governance and Trade*
PSC	*Port State Control*
REC	*Regional Economic Commission*
RFB	*Regional fisheries body*
RFMO	*Regional fisheries management organization*
RFMOs	*Regional Fisheries Management Organisations*
SADC	*Southern African Development Community*

SFAA FAO FI	*Strategy for Fisheries and Aquaculture in Africa*
SIF	*Stop Illegal Fishing Working Group of NPCA/PAF*
SOLAS	*International Convention for the Safety of Life at Sea*
SOLAS	*Safety of Life at Sea Convention*
SPFIF	*Strategic Partnership for Sustainable Fisheries Investment Fund*
SRFC	*Sub-Regional Fisheries Commission*
SWIOFC	*South West Indian Ocean Fisheries Commission*
SWIOFP	*South West Indian Ocean Fisheries Project*
TEP Species	*Threatened, endangered and/or protected species.*
UN	*United Nations*
UNCLOS	*United Nations Convention on the Law of the Sea*
UNEP	*United Nations Environment Programme*
UNODC	*United Nations Office on Drugs and Crime*
UNTOC	*United Nations Convention against Transnational Organized Crime*
VMS Vessel	*Monitoring System*
WAEMU	*West African Economic and Monetary Union*
WWF	*World Wide Fund for Nature*

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Executive Summary

A key policy area of the policy framework and reform strategy for fisheries and aquaculture in Africa is the promotion of conservation and sustainable use of fisheries resources towards supporting blue economy development on the continent. Therefore one of the expected outcomes of this policy area is to ensure effective and sustainable regional Monitoring, Control and Surveillance (MCS) systems are operating in all regions in Africa. This work is therefore within this context.

This study addresses the following five key aspects related to IUU fishing in Africa, for wild captured marine resources:

- **Key characteristics:** A description of the living marine resources vulnerable to IUU fishing, and the characteristics of IUU fishing activity
- **Economic impacts:** An assessment, based on existing sources, of the scale of the economic impact of IUU fishing in the African EEZ.
- **Social and Environmental Impacts:** An assessment of the nature and scale of the social and environmental impacts on African coastal states and communities caused by IUU fishing.
- **Motivating and vulnerability factors:** Delineation of key factors motivating IUU fishing, as well as features and aspects that make Africa vulnerable to IUU fishing.
- **Measures for strengthening capacity as well as additional technical measures for eliminating and curbing IUU fishing**.
- **Recommendations and Plan of Action** to effectively deter, prevent and eliminate IUU fishing broadly consistent with the relevant provision of the policy framework and reform strategy for fisheries and aquaculture in Africa.

The presentation of review material and results is regionally disaggregated into the AU breakdown of African states of Northern, Eastern, Southern, Central and Western where appropriate. The main methodology has been a review of academic and grey literature, and a questionnaire based survey, backed by a limited amount of person to person interaction in Africa, as well as first-hand experience in the Southern and Central African region.

The characteristics of IUU fishing are diverse and include the involvement of both foreign and African actors. They include unauthorised fishing in closed areas/seasons, illegal fishing by foreign vessels (distance water fleets), fishing with forged and fraudulent licenses or vessel registrations, unreported and misreported catches, fishing threatened, endangered and protected (TEP) species, catching undersized fish, taking fish in excess of quota, using prohibited gear and methods, illegal transhipment, landing in unauthorised ports, fishing without an observer on board and failing to operate a vessel monitoring system.

Economic impacts of IUU fishing go beyond the year to year losses of fishing opportunity by coastal African states. They include lost port fees, port handling income, license fees, fuel sales, price depression due to oversupply into certain markets, negative impacts on product branding due to the entry of poor quality product into the market, market sanctions for product from known locales affected by IUU activity, increased harvest costs for legal operators, losses of taxation income for the state, confusion in scientific processes, downstream economic multiplier effects, and impacts on tourism due to habitat degradation.

There is a question mark over the usefulness of the existing FAO definition of IUU fishing for estimating the economic impact of IUU fishing. To illustrate, it seems likely that a substantial portion of nearshore artisanal and subsistence IUU fishing already enters into and produces multiplier effects on the local economy. As a result it would not be surprising to find that bottom up country specific economic studies divorced from catch reporting statistics estimate a larger economic benefit from fishing (here wild capture marine sources only are considered) than do estimates that work off the landed value of reported catches. There is indeed some evidence for this effect in the comparison between the Africa-wide ex-vessel value estimates reported by Pauly and Zeller (2015) of about $ 7.1 billion, and the values assigned as ex-vessel in de Graaf and Garibaldi (2014), about $ 9.8 billion. This difference is on its own sufficient to account for the general perception of IUU fishing at in the order of 20% (e.g. MRAG, 2005a), assuming that the value estimates just quoted are linked to underlying IUU tonnages in the same proportions. Recent work, in particular an article published in Nature Communications by Pauly and Zeller (2016), points to a much larger problem. The data and "catch reconstructions" supplementary to Pauly and Zeller's (2016) article suggest that the ex-vessel levels of IUU catches exist at a far larger overall scale than is suggested by most earlier studies and pronouncements. They estimate that the continent wide EEZ IUU catch is a staggering **4.7 million tons**. This amount excludes discards, and is about 80% of the reported tonnage of 5.9 million tons. Moreover, they also estimate that the unit price per kilogram of this IUU catch is far larger; 2.2 $/kg ex-vessel, compared to the weighted average price of 1.2 $/kg ex-vessel for reported catches. Their estimate of the **value of the IUU catch of $ 10 billion** (excluding discards) is therefore about 40% larger than their estimate of the value of the reported catch itself ($ 7.1 billion). Part of a possible answer to how and where such a large IUU catch could occur, in addition to the aforementioned domestic artisanal and subsistence catches, is the Chinese DWF. Estimates, also by Paul and Zeller, are that Chinese DWF catches are underreported by a factor of about 10, and that this component of foreign vessels fishing in the African EEZ catches 3.1 million tons, some 2.8 million tons of which is IUU. These estimates present a challenge at many levels in dealing with IUU fishing. The estimates suggest that of five African regions, West Africa is hardest hit by IUU fishing, followed by Northern Africa and then Central Africa.

This study estimates that if all IUU catch could enter the African value chain and stimulate economic activity, then this would add between $ 30 billion and $ 45 billion to the GDP of coastal states in Africa, which have an estimated combined GDP of about $ 2.77 trillion. This is an increase in the coastal African state GDP of between 1.1% and 1.7%. One's acceptance of this figure must be tempered by the earlier point about the definition of IUU and whether catch so defined is all available as a possible injection into African coastal economies. The problem is that a % of this amount is already flowing through the domestic economies, and another portion is caught by foreign vessels whose legal activity is often based on resources that African states do not have the capacity to exploit optimally - for Africa to take advantage of the IUU catch linked to this would require a massive capital and skills injection. On the other hand, as a recurrent theme in the literature review, there is clearly a portion of the foreign IUU catch which is taken in direct competition with domestic nearshore artisanal and subsistence catches, and this is an unambiguous opportunity lost by domestic fishers.

Attempts were made to verify and cross check Pauly and Zeller's (2015, 2016) figures against country by country estimates published elsewhere. The general result is that the Pauly and Zeller (2015) estimates, where corresponding values could be found, are larger than other values either published in the academic literature, or which are publically available via online searches. This has

prompted, as one recommendation emanating from this work, a call for the establishment of a common methodology or set of methodologies and technical guidelines for estimating IUU catches (the FAO is currently conducting a study of studies on methods with the intention of tabling technical guidelines at the next COFI meeting in 2016), and a recommendation that countries and RFMOs in Africa commit resources to verifying or replacing these with alternative estimates where they find grounds for tabling fresh estimates.

In general there is very little information available about the social impacts associated with IUU fishing. The main **impacts identified in this study were impacts on food security and nutrition, loss of existing jobs and potential employment opportunities, impacts on local livelihoods**, impacts on **safety and security**, impacts on **women and gender relations** as well as **human rights abuses** in board vessels. Although some of these social impacts linked to IUU fishing are relevant to all fishery sectors (e.g. layoff of crew), the main social impacts are experienced by local communities that are dependent on coastal resources for food and nutrition and livelihoods. For many medium to low income countries along the coast of Africa there are few alternatives to fishing (including post-harvest activities) and fishery related activities such as boat building and net making. Furthermore, fishing provides an important 'safety net' for the poor especially in times of hardship. Thus ensuring the sustainable use and conservation of these marine systems, and enabling safe and secure access to marine waters by coastal communities is of paramount importance. This is especially critical in countries on the eastern and western seaboard of the continent with a low development index and with a large percentage of their populations living in poverty.

The environmental impacts of IUU fishing are multifaceted, and can be classified into three areas: (a) stock status impacts and impacts on threatened, endangered and protected (TEP) species, (b) habitat degradation, and (c) impact on ecosystem services and biodiversity. Here it is argued that the costs of (a) are quantified by the cumulative value of IUU fishing since 1980. The only values available for this are those provided by the Sea Around Us project (Pauly and Zeller, 2015), which yield an amount (excluding discards, and using the price based on reported catches for IUU catches, to be conservative) of $ 326.3 billion, which breaks down for Central, Eastern, Northern, Southern and Western Africa into, respectively: $ 24.9 billion, $ 19.3 billion, $ 81.2 billion, $ 62.8 billion and $ 137.9 billion, The same qualifications attached to the earlier estimates of economic impact are applicable here and are not repeated.

IUU fishing "competes" with a range of other human impacts in the generation of the generic "environmental impacts" presenting an obstacle to the quantification of the relative role of IUU fishing. The negative environmental impacts of IUU fishing are often a magnification of the impacts of legal fishing, except that there are numerous facets of illegality associated with IUU fishing (gear, areas fished, retention of undersized individuals, targeting protected species) which have an added multiplication effect on the damage caused by IUU fishing. Some of the most significant and high profile marine habitats in Africa that are negatively impacted by IUU fishing are coral reefs. These are often accessible to the high human population density on the coast and are exploited by a range of destructive methods in the intertidal region, including beach seines, other drag net configurations, dynamite, poisons, and other destructive methods of harvesting. Thus the ecosystem service value of the coral habitat of Africa are being degraded and compromised, due to large degree to IUU fishing activity. Mangrove forests provide a valuable ecosystem service to the health of shrimp fisheries and also to some finfish species, acting as nursery grounds. Mangrove habitat degradation is mainly the

result of non-IUU fishing impact such as wood cutting and mariculture, but it is also partly the result of destructive harvesting approaches for crab and other shellfish. Other habitats that our review earmarked as under threat are seagrass habitats and seamounts, both partly due to destructive fishing. We also note the extremely high discard rates in industrial shrimp fisheries, in the order of 70% or larger on both sides of the African continent at low latitudes. There are presently unassessed impacts on the ecosystems within which these discard species function. Africa is home to a large number of threatened, endangered and protected species, many of them endemic. Some of these, such as turtles, are the target of direct exploitation (turtles and turtle eggs) a particularly destructive form of IUU fishing. Other impacts on these species occur via negative impacts on their habitats and ecosystem services.

Factors motivating IUU activities include seeking profits, rewards are high and the risks relatively low, debt relief, linkages and involvement with criminal networks, other forms of criminality, sourcing drugs or drug precursors in exchange for fish products, and poverty and limited alternative livelihoods.

The analysis of factors which make Africa particularly vulnerable to IUU fishing highlights the quality of governance as a significant factor. The dimensions of "Control of Corruption", "Government Effectiveness", "Rule of Law", "Voice and Accountability", and "Regulatory Quality" from the World Bank's governance index are all negatively related to the percentage of IUU fishing on a country by country basis (using Pauly and Zeller's estimates of IUU). A further factor in Africa is the legacy of civil wars, social turmoil and other crises which has created fertile ground for IUU fishing to prosper. For example, DWFs took advantage of the Ebola crisis in West Africa to escalate IUU fishing activity, when scarce resources to combat IUU fishing were being directed elsewhere.

Other vulnerability factors that emerge are, not surprisingly, weak and ineffective MCS, institutional corruption, the richness of resources and product value, existence of excess fishing capacity and perverse fishing subsidies for DWFs, inappropriate and low penalties for infractions in comparison to the value of the IUU catch, the availability of flags and ports of convenience, inadequate legal and justice systems, lack of political will to fight IUU, failure to patrol the EEZ or identify it, weak port inspections, absence of necessary diplomatic action to facilitate regional cooperation, inadequate data for MCS and inadequate regional sharing of such data, the absence of policies and legislation grounded in sustainability and precautionary principles, absence of the necessary platforms from which to launch MCS operations, and lack of transparency and data sharing around foreign fishing arrangements. Most of these factors lead logically to a range of recommendations for reforms.

As a preface to the plan of action we present various proposals to strengthen capacity as well as technical measures, for combatting IUU fishing. These include the following:

Forms of support required to strengthen capacity to enable African coastal countries to effectively curb IUU fishing

1. Strengthening MCS capacity and resourcing
    a. Strengthen capabilities, procedures and routines for MSC
    b. Extending the use of technology and innovation in support of MCS

2. Strengthening regional and international cooperation and coordination
    a. Strengthening the Role of RFMOs, RFBs and regional initiatives
    b. Enhance co-ordination across agencies leading fisheries management and development initiatives, strategies and plans
    c. Improving collection and sharing of data and information, the adoption of standards, and the promotion of transparency
    d. Improve international information sharing and co-ordination
    e. Improve national level responsibilities and coordination
    f. Promote Africa wide reconciliation of IUU catches
3. 3) Rolling out awareness raising, training and capacity building programmes
    a. Design and implement raising campaigns
    b. Develop and deliver training programmes and courses
4. Promoting greater civil society involvement in fighting IUU fishing
5. Developing the specialisation and professionalisation of activities and skills for combatting IUU fishing
6. Launching media and education campaigns to highlight the nature and negative impact of IUU fishing
7. Innovation around the acquisition of funding
8. AU member states to ensure coherence of their national fisheries policies on MCS with the relevant provisions of the policy framework and reform strategy for fisheries and aquaculture in Africa
9. A guide for the implementation of the policy framework and reform strategy for fisheries and aquaculture in Africa would assist member states in developing coherent policies for effective combating IUU

Technical measures for combatting IUU fishing

1. Promoting compliance with international instruments and agreements
    a. Strengthen UNCLOS in relation to IUU fishing
    b. Adoption of UNFSA
    c. Adoption of IPOA-IUU and development of an NPOA-IUU
2. Fast track adoption of Port State Measures
3. The development and adoption of a global registration of fishing vessels using a UVI (unique vessel identifier) system via IMO
4. Addressing the problem of “Irresponsible” Flags of Convenience (FoCs)
5. Establishing penalties for transgressions commensurate with the economic scale of the crime.
6. Publication of both positive (authorised) and negative (IUU) vessel lists
7. Imposing Market and Trade Sanctions
8. The promotion of traceability and eco-labelling schemes
9. Curbing or reducing perverse subsidies
10. Controls on fishing effort and fishing capacity commensurate with resource productivity
11. Development of Lacey Style Legislation to allow for compensation seeking for IUU fishing
12. Nations to implement ongoing and comprehensive assessments of IUU fishing in their EEZ

This document presents the following summary plan for action to tackle IUU fishing in Africa. For coherence, the plan of action and the measures proposed in this document are broadly consistent with the relevant provisions of the Policy Framework and Reform Strategy for fisheries and aquaculture in Africa.

1. Strengthen the MCS working group established under the African Fisheries Reform Mechanism to galvanise and facilitate co-ordination between regional bodies in the fight against IUU fishing.
2. Establish "IUU Regional Network" comprising RFMO, REC and LME bodies, with IUU regional working groups in each of these.
3. Convene a high level policy dialogue on IUU fishing with key actors (IMO, FAO, the International MCS Network, INTERPOL, IOC-UNESCO, UNEP, UNDOC etc.) to raise awareness at political level on the impacts and economic losses associated with IUU and the options to curb IUU fishing including the implementation of relevant international instruments;
4. Design, and implement targeted training and capacity development programmes (including on use of new and appropriate MCS technology) based on country specific needs assessments.
5. Enhance regional co-operation, and the adoption and implementation of regional and intra-regional minimum terms and conditions for fisheries access for FFAs.
6. Strengthen the capacity of regional institutions for combating IUU.
7. Fast-track the adoption of a Global UVI to vessels smaller than 100 GT, and explore the cost effectiveness of using regionalised vessel detection systems.
8. Include issues of IUU in the African position at WTO negotiations.
9. Develop a detailed IUU Strategy and Action Plan ("IUU SAAP") for Africa, and mobilize resources for its implementation.
10. Support member states for implementation of relevant provisions of Pan African fisheries policy framework and reform strategy as well as international instruments in combating IUU

1. Introduction

The non-compliance of fishing with formal regulations in the marine sector, known as IUU fishing, also referred to as ‘‘blue water crime’’ (e.g. Kuperan & Sutinen, 1998), and its negative ecological, economic and social impacts is a major developmental issue for Africa. To quote the High Seas Task Force (2006), one of many voices on the subject, “IUU fishing is detrimental to the wider marine ecosystem because it flouts rules designed to protect the marine environment which includes restrictions to harvest juveniles, closed spawning grounds and gear modification designed to minimise bycatch on non-target species. In so doing they reduce the availability of an invaluable protein source for some of the world’s most impoverished communities and enfeeble the livelihoods of millions of fishermen; incursions by trawlers into the inshore areas reserved for artisanal fishing can result in collision with local fishing boats, destruction of fishing gear and deaths of fishermen.”

International awareness of IUU fishing was sparked by the widespread piracy of toothfish that took place in the southern Ocean in the early 1990’s. Quantification of IUU is problematic due to its covert nature. Most methods for estimating the scale of IUU rely on measures of fishing effort (both legal and IUU based) which are derived independently of official statistics, and which are then scaled up by plausible estimates of daily or trip level landings (CPUE measures) (e.g. OLRAC, 2004a, 2004b). Other approaches are based on discrepancies between trade statistics and reported landings, or more rarely from data provided by informants.

Credible estimates (Agnew et al. 2009) indicate that at least 20 % of seafood worldwide is caught illegally (i.e. mostly ascribable to IUU fishing) representing estimated economic losses of between US$10 and $23 billion and an effective catch forfeit of between 11 and 25 million metric tons of fish per year. Another estimate of the economic scale of global pirate fishing is US$ 9 billion (Stop Illegal Fishing 2008). Based on what they term “catch reconstructions”, Pauly and Zeller (2015) report that although FAO fisheries statistics suggest an increase in global marine fisheries catches to 86 million tonnes in 1996, followed by a slight decline, actual catches may have peaked at 130 million tonnes, with a much stronger subsequent decline. The inferrence made in this document is that the 51 % shortfall in FAO statistics is due to IUU fishing, although this amount cannot necessarily be readily recouped for the economic benefits of fishing nations and coastal states.

MRAG (2005a) estimate the scale of IUU fishing catches in sub-Saharan Africa at 19 % of the reported catch. However, figures published recently by Pauly and Zeller (2015) suggest much larger levels of IUU fishing, far in excess of the MRAG (2005a) and the Agnew et al. (2009) estimates.

Yet, many of Africa’s poorest people depend on fish for food and as a source of livelihood. For many millions of coastal communities, fishing is either a main livelihood or part of a diverse and complex suite of livelihood activities that sustain and support millions of families. In addition, marine fisheries provides an estimated 6,39 million jobs (figures for people engaged in fishing on a full-time basis and those employed in processing on a full-time and part-time basis - de Graaf and Garibaldi (2014)). Most coastal nations in Africa, except for South Africa, Namibia and Equatorial Guinea as well as the northern countries that border on the Mediterranean Sea, have been categorised as Low Income Countries with a low human development index (Figure 2 1) (UNDP 2015). From a poverty perspective, several of these countries have a large percentage of their population categorised as MPI poor, and in several countries, approximately 25% of the population is categorised as destitute.

Over 60% of the coastal states in Africa also show that a large percentage of their population lives on less than US$ 2 per day (Figure 2 2) (Alkire and Robles 2015). The countries that are particularly precarious in terms of poverty indices are Somalia, Sierra Leone, Guinea, Guinea-Bissau, Liberia, Senegal, Mauritania, DRC, Nigeria in the Western African region, and Mozambique, Kenya and Madagascar in East Africa - all having over 25% of their population categorised as destitute. Thus from a poverty and vulnerability perspective several countries along the west and east African coast, and the island of Madagascar, are particularly at risk to the impacts of IUU fishing because of their very vulnerable status. However, given the lack of country level socio-economic data on the artisanal sector in most coastal African states, and the difficulty of clearly attributing poverty, food insecurity and loss of livelihoods to IUU fishing due to a range of other factors that threaten livelihoods and well-being, IUU fishing like climate change, needs to be seen as yet another major impact on already stressed and vulnerable communities.

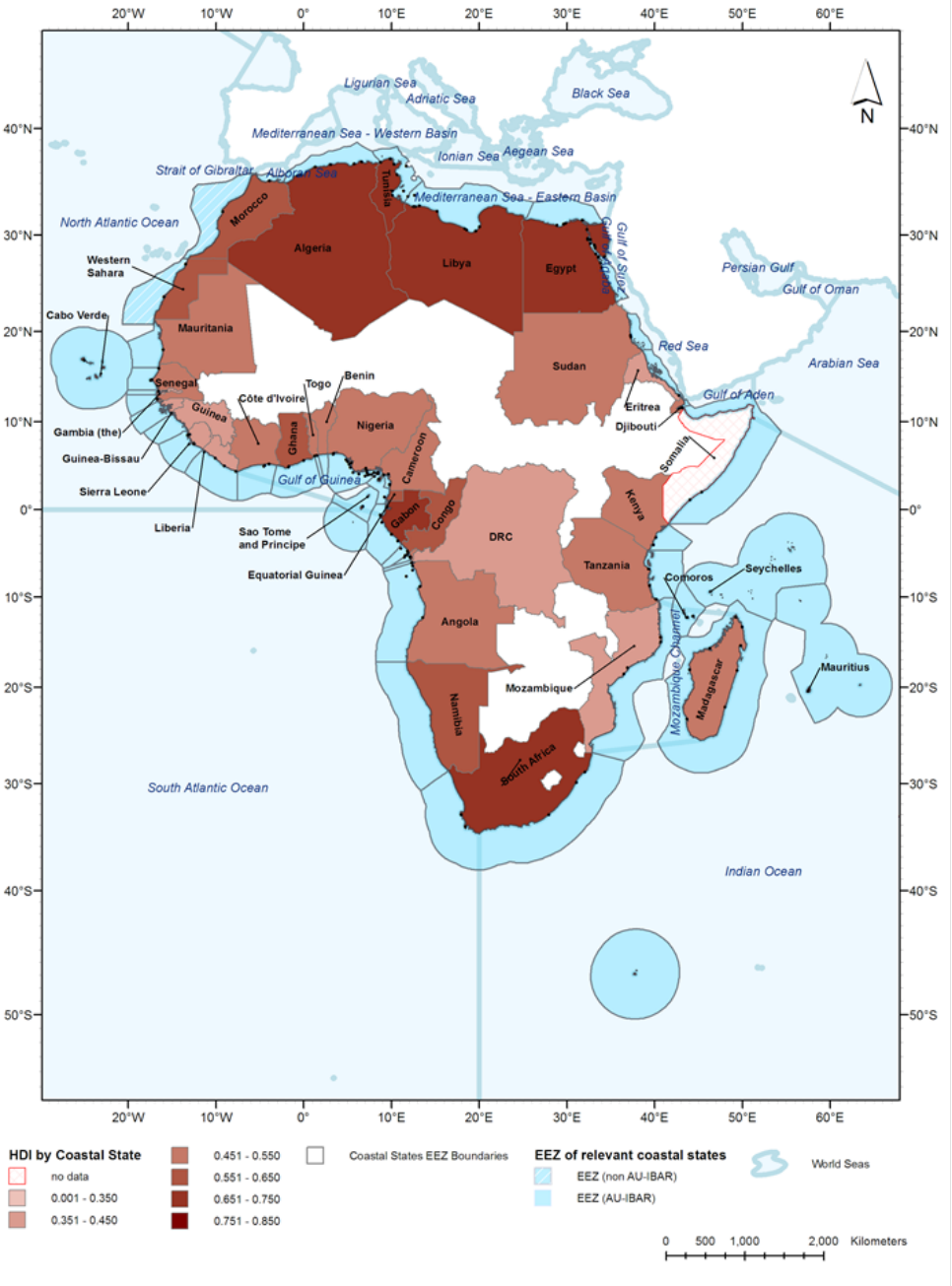


Figure 2 1. *Human development index of African coastal states colour coded.*

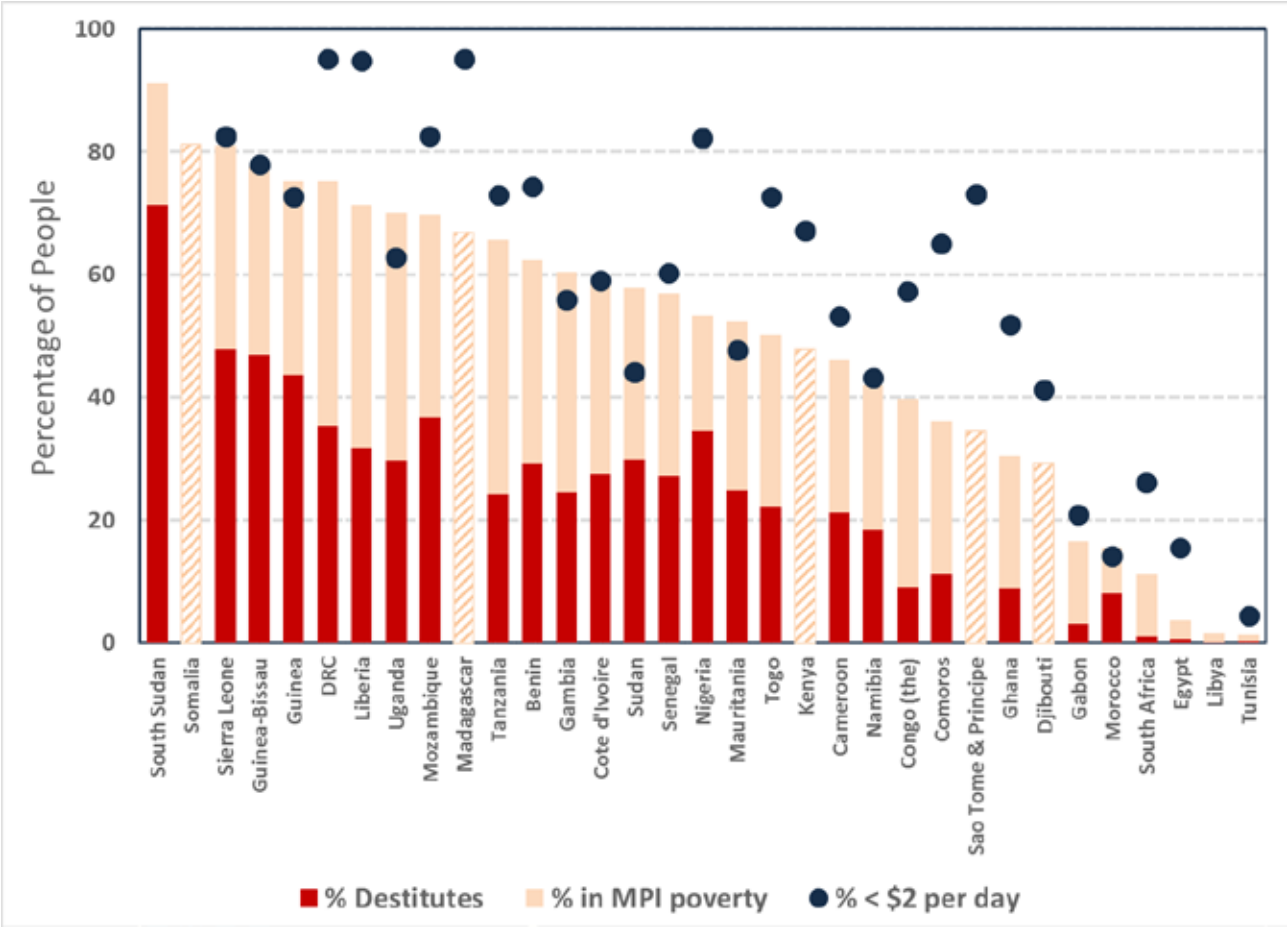


Figure 2 2. *Three different measures of poverty for selected African coastal states, based on data made available at the Oxford Poverty and Human Development Initiative website (http://www.dataforall.org/dashboard/ophi/index.php/mpi/country_briefings) (also (Alkire and Robles 2015). Patterned bars indicate that there were no data for "% Destitutes" but that data were available for "% in MPI poverty".*

Foreign vessels from Asia and developed countries in Europe often perpetrate illegal fishing in the waters of developing countries in Africa (Stiles et al. 2013). Greenpeace suggest that the bulk of IUU fishing can be traced to East Asian and Russian vessels (Africa Progress Panel 2014). The major challenge faced by African and other developing countries in the quest to combat IUU is the provision of adequate offshore surveillance (MRAG 2005b) and enforcement. Fraud, crime networks and the lack of government controls or traceability systems have all contributed to the ease with which illegal catches may be distributed around the globe (Stiles et al. 2013). The poverty context of many coastal communities in developing countries makes them vulnerable to illegal operators and syndicates who offer some financial relief to their plight.

In the face of these problems and challenges, it is important to record what an outstanding and valuable marine asset has been put at Africa's disposal. The Canary Current Large Marine Ecosystem is based on an Eastern Boundary Upwelling Systems, one of the most productive in the world, and is renowned for its high biological productivity. While only covering 2 to 3 percent of the global ocean surface area, it supports 8 percent of the global surface primary productivity. The CCLME supports important fish populations of small pelagic, demersal and tuna resources, which constitute reported non-IUU catches of 2 to 3 million tonnes, the highest fisheries production out of all African Large Marine Ecosystems. The Benguela Current LME is the most powerful coastal upwelling system in the world, whose high level of primary productivity drives an ecosystem which supports rich fisheries based on catches of rock lobster, cods, hakes and haddock, sardines and anchovies with a total

productivity of over a million tons per year. The Guinea Current Large Marine Ecosystem (GCLME) is one of the world's most productive marine areas which is very rich in fish resources and which is an important global region of marine biological diversity, supporting the livelihoods of approximately 40% of the 280 million people living along the shores of its constituent coastal states. During its monsoon season, the Somali Current Large Marine Ecosystem LME becomes one of the most intense coastal upwelling systems in the world, bringing rich nutrients to the surface waters, and supporting significant pelagic tuna resources and fisheries. The Agulhas Current LME is an area characterized by dynamic nutrient cycling and upwelling cells with coupled fisheries potential. The Red Sea LME is a highly productive Class I ecosystem. It contains complex reef system, together with mangroves, seagrass and macro-algal beds which form highly productive habitats for unique groups of species, with a very high degree of endemism, and hosting several species of marine mammals, turtles and seabirds. Although a Class III ecosystem the Mediterranean LME provides extremely stable fishing opportunities which provide an important boost to the economies of North Africa.

The FAO has led a number of far reaching initiatives aimed at combatting IUU fishing and/or improving fisheries management. After **UNCLOS**, the **UNFSA** (United Nations Fish Stocks Agreement) provided the legal framework for the creation of RFMOs (Regional Fisheries Management Organisations - today there are 19 RFMOS covering nearly the entire ocean). The **FAO Compliance Agreement (**FAO Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas Agreement), adopted in 1993 and entering into force in 2003, aims to provide an instrument for countries to take effective action, consistent with international law, to ensure compliance with applicable international conservation and management measures for living marine resources of the high seas. The 1995 **FAO Code of Conduct for Responsible Fisheries** is one of the most important soft law instruments. In 2001, the FAO, through its Committee on Fisheries (COFI), adopted the International Plan of Action to prevent, deter and eliminate IUU (**IPOA-IUU**). The IPOA-IUU represents a voluntary instrument, which lists a variety of context-specific measures that countries and regional fisheries bodies should adopt. The **FAO Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing** (the PSMA) was adopted by the FAO Conference in 2009. The main purpose of the Agreement is to prevent, deter and eliminate illegal, unreported and unregulated (IUU) fishing through the implementation of robust port State measures. **Voluntary Guidelines for Flag State Performance** were adopted by the FAO Technical Consultation in February 2013 and have been drawn up with a view to prevent, deter and eliminate IUU fishing through encouraging the implementation of flag State responsibilities. The **FAO Global Record of Fishing Vessels, Refrigerated Transport Vessels and Supply Vessels** is a further initiative developed in close collaboration with the International Maritime Organization (IMO) to combat IUU fishing. As a result the IMO Ship Identification Numbering Scheme now applies to both merchant ships and fishing vessels of 100 gross tonnage and above. Consequently, the preconditions have been met for using the IMO number as the global unique vessel identifier, recognized by COFI as a key component of the **Global Record**.

These UN/FAO initiatives provide the framework and legal provisions for coastal states, RFMOs, RFBs and other regional and international bodies to craft plans to combat IUU fishing. The task of adopting and implementing all of these international measures is highly technical, requires political will and funding, and will take time, particularly in developing countries and regions. In the meantime the scourge of IUU fishing continues. According to a number of independent studies Africa is the source of a disporportionate share of the global quantum of IUU fishing catches (e.g. Pauly & Zeller 2015).

This study's findings is consistent with numerous published studies and reports which estimate that IUU fishing in Africa comprises a substantial percentage of the total removals from the African EEZ. Thus for Africa we must assume a large IUU fishing impact, and act accordingly at all levels of fisheries management, monitoring, control and surveillance (MCS), international cooperation and law, technological and other means.

In response to mounting concerns regarding increasing levels of IUU fishing in Africa together with the attendant economic, ecological and social impacts,, from High level AU Ministerial Meetings in 2010 and 2014 and also in line with the implementation of the Policy framework and Reform Strategy for Fisheries and aquaculture in Africa, AU-IBAR commissioned OLRAC-SPS to undertake a review and an assessment of the economic, social and environmental impacts of IUU fishing in Africa. More specifically, the objectives of the study were to:

1. Analyse the different types of illegal fishing fleets: unlicensed foreign industrial vessels; by industrial and semi-industrial licensed vessels (local and foreign), by artisanal vessels;
2. Analyse the various illegal fishing practices (fishing in prohibited areas, using prohibited gears and methods, unauthorized transhipment or transfer, non-compliance with licensing conditions etc.);
3. Assess economic, social and environmental impacts of IUU fishing in African coastal countries;
4. Identify the key motivating factors (domestic and international) of the illegal fishing;
5. Analyse the internal and external area of vulnerability that enable illegal fishing activity to thrive (both at policy and governance levels);
6. Identify the specific forms of support to strengthen the capacity that would enable African coastal countries to effectively curb the IUU menace and thus deny the culprits the illegal benefits generated by their unscrupulous actions;
7. Develop action plans to effectively deter, prevent, eliminate IUU fishing in the specific region of your assignment;
8. Produce a comprehensive technical paper and advocacy paper on illegal fishing in the region of your assignment based on key findings and analysis.

1.1. Methodology and Scope of Study

Information on the nature of IUU fishing activities and the potential and actual environmental, social and economic impacts of IUU fishing in African coastal countries was gathered and reviewed during the 4 month duration of this study. Information for this study was collected from three main sources, namely:

1. A review of the literature,
2. A questionnaire survey aimed at fisheries managers, representatives of RFMOs, and other relevant government department officials as well as researchers and NGO s was prepared and circulated to 190 participants (see Appendix 1) - potential participants in the questionnaire were offered the following modes of completion: a) an online questionnaire format, b) a digital questionnaire format with responses by email, c) a Skype interview with an OLRAC SPS staff member d) return by hardcopy mail, and
3. A limited number of person to person interviews carried out connected to other travel by OLRAC SPS in Africa.

The literature review included a review of academic and grey literature (technical and other reports produced by fisheries management and development organisations working in Africa). We have

also corroborated information from regional and national seafood trade data and from academic researchers who have published such information to estimate the economic opportunity loss caused by IUU fishing, both on an annual basis and over a period of time corresponding to when African coastal states have exercised stewardship over the resources in each of their EEZs.

Although we received an 11% response rate for the questionnaire survey, the response from two of the regions (Northern and Central) was very low.

The scope of the study included the five UN-defined African regions, viz. Northern, Western, Central, Southern and Eastern, according to the UN definitions and usage of regionalisation for Africa, as is illustrated in Figure 2 3.

Figure 2 3. *A map of the regional affiliation of African maritime states used as the basis for the study.*

<u>This study focusses on marine wild capture fishing, and excludes inland freshwater fisheries and aquaculture.</u>

1.2. Definition of IUU

The Food and Agriculture Organisation's (FAO) International Plan of Action on IUU Fishing (IPOA-IUU), describes IUU fishing as follows (High Seas Task Force 2006):

"Illegal fishing refers to activities:

1. Conducted by national or foreign vessels in waters under the jurisdiction of a State, without the permission of that State, or in contravention of its laws and regulations;
2. Conducted by vessels flying the flag of States that are parties to a relevant regional fisheries management organisation but operate in contravention of the conservation and management measures adopted by that organization and by which the States are bound, or relevant provisions of the applicable international law; or
3. In violation of national laws or international obligations, including those undertaken by cooperating States to a relevant regional fisheries management organisation.

Unreported fishing refers to fishing activities:

1. Which have not been reported, or have been misreported, to the relevant national authority, in contravention of national laws and regulations; or
2. Undertaken in the area of competence of a relevant regional fisheries management organisation which have not been reported or have been misreported, in contravention of the reporting procedures of that organisation.

Unregulated fishing refers to fishing activities:

1. In the area of application of a relevant regional fisheries management organisation that are conducted by vessels without nationality, or by those flying the flag of a State not party to that organisation, or by a fishing entity, in a manner that is not consistent with or contravenes the conservation and management measures of that organisation; or
2. In areas or for fish stocks in relation to which there are no applicable conservation or management measures and where such fishing activities are conducted in a manner inconsistent with State responsibilities for the conservation of living marine resources under international law."

Table 2 1 highlights the relationship between different jurisdictions and the different components of IUU, the I, U and U.

Table 2 1. *Combating different types of IUU fishing activities demands different responses and widely different actors. Some responses rely on the national legal framework which may need improvement; others rely on international frameworks as is the case with regional fisheries management organisations.The following table highlights these differences by linking illegal, unreported and unregulated fishing to where it takes place and hence implicitly to the source of the action required, i.e. national, international or RFMO. Source: Schmidt, 2004.*

Illegal, Unreported and Unregulated fishing activities

Area	EEZs	High seas			
		With RFMOs			Without-RFMOs
Actors	Foreigners	Party	Co-operating States	Non-party	Any
Illegal					
Unreported					
Unregulated					

It suggests that IUU, the unregulated component of IUU is concerned with activity outside EEZs. It must be understood that IUU as defined and typically quantified does not provide a measure of the economic benefits that can be obtained by completely eliminating IUU fishing. The situation is complex. IUU fishing takes on a variety of forms dependent on who the perpetrators are, the nature of the resource and the fishery, and how product is taken to market. For example, IUU fishing in a large industrialised offshore context is very different to IUU fishing in small scale fisheries. While Figure 2 4 illustrates certain of the types of IUU, the following situations should be recognised:

- **Type DWF I:** Vessels from distant flag and origin countries operating in the high seas in violation of conservation measures managed by an RFMO. Typical fisheries targeted are large pelagic species such as tunas, other billfish or sharks. Another example is toothfish IUU fishing in the CCAMLR convention region. Transhipment of fish at sea is typical of such an operation. All product is taken to distant ports, mostly in frozen form. All aspects of this fishing operation are illegal. May involve the use of illegal gear and fishing in MPAs and other closed areas.

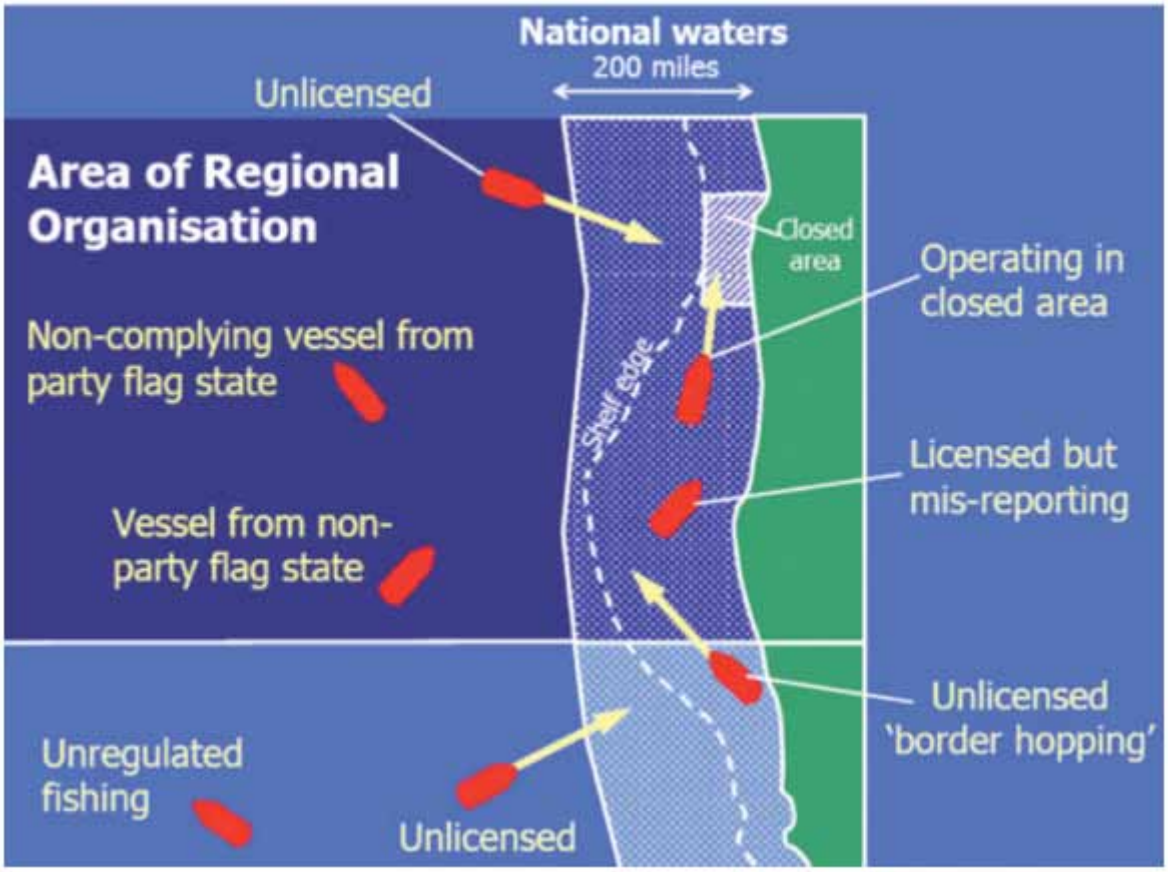


Figure 2 4. *Illustration of types of IUU fishing. Within an EEZ there may be unlicensed fishing (poaching), under- or non-reporting, or unauthorised fishing by area, seasonal, gear, quota or species. Outside EEZs there may be noncompliance with an RFMO, or there may be unregulated fishing outside the area of an RFMO. Note that many RFMOs also cover adjoining EEZ waters, but the primary jurisdiction in these cases remains that of the coastal state (https://brusselsbriefings.files.wordpress.com/2014/10/reader-bb38-iuu-fisheries-eng.pdf). Original source: (MRAG 2005a)*

- **Type DWF II**: A variant of the above is where the IUU vessels operate within an EEZ but close to the high seas boundary. Or make occasional incursions into the EEZ, to the extent that EEZ MCS is weak. The high seas component of this fishing operation may be legal, used as cover for illegal incursions into EEZs. Once again there is no landing of fish product locally, and this product is either transported to markets via an at sea transhipment process or by the fishing vessels themselves at the end of a fishing trip. May involve the use of illegal gear and fishing in MPAs and other closed areas.

- **Type LOCAL I**: IUU fishing under cover of a legal commercial industrial domestic fishery, wholly within an EEZ, or straddling more than one EEZ. This kind of IUU fishing takes place in a situation where fish product is landed and processed locally and is either sold domestically or exported from the coastal state post-processing. All aspects of this operation may appear to be legal, except that input or output controls exceed legally allocated amounts, and this fact is concealed in a variety of ways. Corruption and bribery of local MCS officials is a common feature of this kind of operation. A very well known example of this is the South Coast rock lobster operation in South Africa in the late 1990's where the legal operation was used as a cover for an illegal operation of equivalent size for the particular operator involved (Hout Bay Fishing). All product is processed in the same way as legal product and enters the normal commercial distribution channel. May involve the use of illegal gear and fishing in MPAs and other closed areas. This depends on whether the use of alternative illegal gear offers greater catching efficiencies and/or access to other fish sizes (typically juveniles).
- **African cross border activities:** Another example is border hopping, for example Kenyan shrimp trawlers fishing in Somali waters (as documented by MRAG, 2005b), or, also border hopping, Yemeni vessels fishing illegally in Somalia waters (Potgieter and Schofield 2010).
- **Type LOCAL II:** A wholly domestic illegal IUU fishing operation, coupled with a shadow illegal processing industry linked to black market operations. This kind of operation is typical of high value species such as abalone where artisanal method is used for wild capture, and where dried product retains a high end value. Generally the volume and mass of product is small enough to facilitate concealment at all stages of processing and distribution. This product can be moved in channels used by other dried product such as rhino horn, ivory, tiger tooth, lion bone etc. In this case the distribution network is sophisticated, and involves money laundering. One of the best known examples is the IUU fishing operation for abalone in South Africa, where illegal catches are perhaps 10 -20 times legal catches and the end value runs in the billions of ZAR, or 100s of millions of USD. Distribution in this case involves moving product into other countries in sub-Saharan Africa, from where it can be flown out mostly to SE Asia. Importation of this product may be in clear violation of international law or conservation agreements. In this case illegal harvesting often takes place at night, but may also take place be in daylight hours in full view of the public. Many of the species susceptible to this kind of operation are sedentary and are managed legally by means of a minimum legal size. In these cases IUU fishing will utilise sub-legal sized individuals of the species that are caught to boost catch rates.
- **Type LOCAL Mixed I/II:** Mixtures of Type LOCAL I and II exists where illegal product may find its way into legal distribution channels, and legal operations may provide product for illegal operations. An example of this situation is the South African West Coast rock lobster resource.

According to Stop Illegal Fishing (2008), the most common forms of IUU fishing in Africa are:

- Unauthorised fishing in closed areas/seasons.
- Illegal fishing by foreign vessels.
- Fishing with fake licenses or vessel registration.
- Non-reporting/misreporting of catches.
- Fishing protected species.
- Taking fish in excess of quota.
- Using prohibited gear and methods.
- Illegal transhipment.
- Landing in unauthorised ports.

- Fishing without an observer on board.
- Failing to operate a vessel monitoring system.

Illegal fishing by unauthorised vessels within an EEZ may be inaccessible to a national fishing industry that does not have the technical capability to access the affected stock, as in the case of a developing nation and a deep-water far offshore stock. Economic losses could in this case be viewed as lost income from license fees in terms of an SFPA (sustainable fishing partnership agreement), FAA (fishing access agreement) or FFA (foreign fishing arrangement). Illegal fishing in direct competition with a national fishery, either by means of foreign vessels or unregistered and unauthorised national vessels detracts from the national fishery, and represents an opportunity that could have been exploited by legal operators.

Fishing that is unreported within an EEZ may nevertheless represent economic activity and product that produces export earnings and a positive economic multiplier effect in a national economy (a typical multiplier used is 3), although it may not generate certain kinds of revenue for government such as taxation (although case dependent). Unregulated fishing in the high seas on a stock that is migratory and also occurs within an adjacent EEZ where this stock is a target species in a national fishery detracts from the economic benefit of the national fishery.

Discards, if unreported (as is typically the case), form part of the definition of IUU, but the nature, makeup and motivation for these discards has a bearing on what economic benefits could be realised by enforcing the landing of all discards. Discarding has an underlying economic logic which is variable and fishery specific. Fish are discarded for a reason and the reason is frequently but not always (e.g. with high grading) that they are unmarketable. The additional economic benefit that could be derived by landing what would normally be regarded as “trash fish” is moot.

Thus, although ideally a more nuanced analysis of the breakdown of IUU fishing in Africa, leading to a statement of the economic benefits that could be achieved by the complete eradication of IUU fishing, is most likely the desired outcome of a study such as this, such a statement is outside the scope of this work, and indeed of most quantitative IUU studies to date. In the main therefore the work reported here persists with the catchall concept of IUU in the quantification of IUU fishing and many of its associated impacts, ecological, economic and social. Some but only a limited attempt is made to disentangle discards to try to focus on that portion of IUU which is clearly a lost economic opportunity for African states. This does raise important issues about the utility of IUU as defined by FAO, but debating this here is out of scope for this study and document.

2. African Fisheries Overview

Relevant to a study into the impacts of IUU fishing on African marine wild capture fisheries are the following baseline issues:

a. The broad scale characteristics of African marine capture fisheries within their Large Marine Ecosystems (LMEs).
b. The reported and legal economic value of marine capture fisheries for African coastal states,
c. The reported and legal landed tonnage, and
d. Employment and communities reliant on African Marine Capture Fisheries

2.1 African marine capture fisheries within their Large Marine Ecosystems (LMEs)

Africa is surrounded by seven Large Marine Ecosystems (LMEs - see Figure 3 1 from Sherman et al. (2011)), and an important current, the South Equatorial Current to the east (SEC) viz.

- **West coast:** Benguela Current LME (BCLME), Guinea Current LME (GCLME), Canary Current LME (CCLME): 29, 28 and 27 of Figure 1 from Sherman et al (2011).
- **North African coast:** Mediterranean and Red Sea LMEs (MLME, RSLME): 26 and 33 of Figure 1 from Sherman et al. (2011) and
- **Eastern and Southern Africa:** Somali Coastal Current LME and Agulhas Current LME (SCLME and ACLME): 31 and 30 of Figure 1 from Sherman et al. (2011), and the South Equatorial Current (SEC).

Fisheries that operate in Africa are best described in relation to the LMEs listed above, where the locality of relevant large marine ecosystems is illustrated in Figure 3 1.

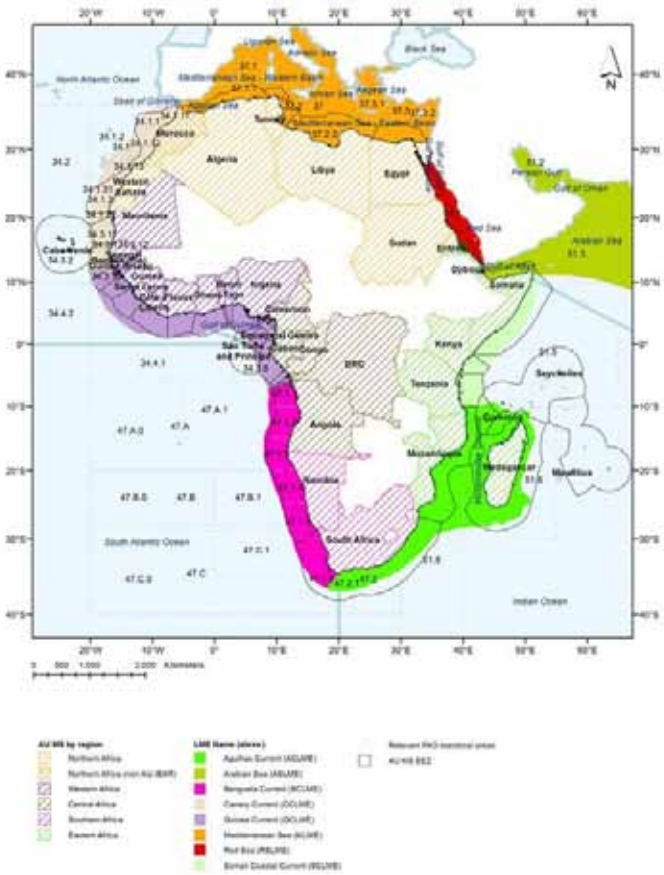


Figure 3 1. *Location of the Large Marine Ecosystems along the African coastline, after Sherman et al (2011)*

2.1.1 BCLME

2.1.1.1 Overview

The Benguela current flows along the coast of south-western Africa, and its influence stretches from the Cape of Good Hope (South Africa), past the coast of Namibia, to Luanda (Angola) in the north. It is a major eastern boundary coastal up-welling ecosystem and one of the most productive and bio-diverse ocean areas in the world.

2.1.1.2 Resources

In South Africa: Abalone, soles, hakes, horse mackerel, large pelagics (tuna and swordfish), a multispecies nearshore linefish fishery pursued in the inshore zone of habitat, oysters, Patagonian toothfish around the South African EEZ around PEMI (Prince Edward and Marion Islands), Prawns, Seaweeds, Sharks (small demersal fishery), Small pelagic fish (sardine, anchovy and round herring), South Coast rock lobster, Squid, Tuna Pole-Line, West Coast rock lobster and White mussels and small invertebrates. Small pelagic fish (mainly mullet), elephant fish and juveniles of several line fish species are targeted in estuaries and lagoons in South Africa

In Namibia: The main resources are hake, pilchards, horse mackerel, monk, lobster, crab, tuna, kingklip and other minor contributions. There is a small population of orange roughy off the Namibian coast and flatfish are also trawled to some extent. Crustacean resources include west coast rock lobster and red crab,

Commercial fisheries in Angola are based on the following species:

1. Horse Mackerels: Cape and Cunene horse mackerel (Trachurus capensis and T. trecae). These are the most abundant fish species in Angolan waters. In the past these species were primarily used for manufacturing of fishmeal, but the species are of high quality and acceptable for human consumption. Mackerels are consumed fresh but are also preserved (salted and dried).
2. Sardinellas (Sardinella aurita and Sardinella maderensis) are fished in parallel with horse mackerel. Between 1955 and 1973, sardinella catches fluctuated between 60,000 and 100,000 MT, but this can vary. In the past the sardinellas were used for fishmeal by the ex-Soviet fleet, but the Dutch industry intending to fish in Angola under an EU-Angola agreement freezes sardinella almost exclusively for human consumption.
3. Hake (Merluccius polli and, in the extreme south, M. capensis). The range of these species extends over South Africa and Namibia. Both stocks of cape hake were heavily depleted in the 1960s and ‘70s. This is a high value white fish with markets in Europe and the USA.
4. The large eye Dentex is another important demersal species.
5. Big tunas: Bluefin (Thunnus thynnus), albacore/yellowfin (T. albacares), bigeye (T. obsesus), and albacore (T. alalunga) are found further offshore, along the edge of the continental shelf. These are highly prized fish found in Angola at certain times of the year.
6. Smaller tunas are gaiado/skipjack (Katsuwonus pelamis), bonito (Sarda sarda), judeu/frigate tuna (Auxis thazard) and merima/little tuna (Euthynnus alleteratus) are found at a certain time of the year on the narrow coastal shelf between Lobito and Port Alexandre. These are taken by pole and line vessels and appear as a bycatch in purse seine catches. The small tunas are migratory and are most commonly caught in Angolan waters between October and January.

A wide range of demersal fish species is caught by artisanal and subsistence line fishers in Angola. Reconstructed total catches from the Angolan EEZ are shown in Figure 13 4 and Figure 13 5 (see

supporting figures at end of document), after Belhabib and Divovich (2015).

2.1.1.3 Fishing fleets

The BCLME sustains important artisanal and commercial fisheries and valuable offshore industries in South Africa, Namibia and Angola.

Because of the high levels of production associated with the system, the BCLME is characterised by resources that are exploited at an industrial rather than artisanal or subsistence levels. During the 1950s and 1960s there was a very rapid expansion of fishing activity in the region and very large hake, sardine, anchovy, horse mackerel, sardinella fisheries and rock lobster fisheries developed. These resources have almost all been over-fished and now catches are considerably less than they were at their peaks. Demersal fish resources have also been important for the industrial sector. Sparids, dentex, croakers, groupers and red Pandora are important industrial level demersal stocks in Angola, while hake is the principal demersal fishery resource in South Africa and Namibia. There is a small population of orange roughy off the Namibian coast and flatfish are also trawled to some extent. Crustacean resources include west coast rock lobster and red crab in South Africa and Namibia, and deep water prawns are trawled in Angola. A wide range of demersal fish species is caught by artisanal and subsistence line fishers in Angola and South Africa. Throughout the region a range of easily accessible molluscs and crustacean populations on rocky shores, sandy beaches and in estuaries provide resources for subsistence fishers. Small pelagic fish (mainly mullet), elephant fish and juveniles of several line fish species are targeted in estuaries and lagoons in South Africa.

Fisheries: The BCLME sustains important and valuable commercial fisheries in South Africa, Namibia and Angola. Inshore artisanal and subsistence fisheries are important features in South Africa and Angola but these groups are of minor importance in Namibia.

In terms of biomass the small pelagic fisheries of the BCLME have historically been the most important. Sardines and anchovy were the main target species of industrial purse seine vessels from South Africa and Namibia and sardinellas were fished in Angola. With the decline in sardine catches horse mackerel has become a species of considerable importance in the offshore purse seine fisheries. Demersal trawl fisheries target mainly hake along the South African and Namibian coasts but there are significant commercially important by-catch species like monkfish, adult horse mackerel, kingklip and snoek. Orange roughy are trawled at depths of 600 – 1000 m of the coast of Namibia. In Angola demersal species (breams, croakers, groupers, snappers, emperor) are caught by trawling and shrimp trawl fisheries are important.

The line fisheries of the BCLME waters exploit a large number of species. These include inshore reef fishes, offshore hake, migratory shoaling species like snoek, and offshore large pelagic species such as tuna and billfish, which form large, highly-migratory straddling stocks. Line fishing is undertaken mainly by artisanal and subsistence fishers in Angola and South Africa.

In Namibia, there is a very limited artisanal fisheries sector limited to line fishing from the shore, a small rock lobster ring net fishery and very minor beach seine netting. In Angola there are upwards of 50 000 artisanal fishers, using approximately 4 700 boats of various descriptions. Artisanal fisheries in Angola constitute a critical sector that underpins the livelihoods and provides food security for a significant proportion of the coastal population. The sector is essentially an open access fishery and

management is limited to limitation on the mesh size of gill nets used and a stipulation about the length of the boats that may be used. Fishers use a wide variety of gears (lift nets, small purse seine nets, gill nets, beach seine nets, hand lines and long lines) to target small and large pelagic species as well as a very wide range of demersal species. Lobsters are collected by diving and as a gillnet by-catch. In South Africa the artisanal and subsistence sectors are large and engage in a wide variety of fishing activities including fishing for rock lobsters (ring net) and abalone (diving), line fishing and the collection by hand of a wide variety of rocky shore, sandy beach and estuarine invertebrate organisms. Beach seines are common on the west coast, and gill nets targeting line fish species and small pelagic fish in estuaries and lagoons are important artisanal and subsistence fishing gears.

Namibia's commercial fishing sector therefore has many similarities with the South African commercial fishing sector. However, because of the arid and relatively deserted nature of the coastline in Namibia compared to South Africa, the small scale subsistence and artisanal sector is relatively underdeveloped in Namibia.

2.1.2 GCLME

2.1.2.1 Overview

The Guinea Current is fed by the North Equatorial Current of the Atlantic Ocean and flows south and eastward from Guinea Bissau in the north to Gabon in the south and influences the coasts of Guinea Bissau, Guinea, Sierra Leone, Liberia, Côte d'Ivoire, Ghana, Togo, Benin, Nigeria, Cameroon, Sao Tome and Principe, Equatorial Guinea, and Gabon. Its influence at times extends south of Gabon to the Democratic Republic of the Congo, the Republic of Congo and northern Angola. It includes a range of coastal habitats such as lagoons, bays, estuaries and mangrove swamps.

2.1.2.2 Resources

Rich in living marine resources, particularly small pelagic clupeids, but not as rich as the Canary Current LME to the north. Resources include locally important resident stocks supporting artisanal fisheries, as well as trans-boundary straddling and migratory stocks that have attracted large commercial offshore foreign fishing fleets. Exploited species include small pelagic fishes (sardinellas, round sardinella, bonga shad, anchovy, Madeira sardinella, mackerels anchovies, bonga shad) that migrate between countries, large migratory pelagic fishes (tuna, bonitos, swordfish and sailfish), crustaceans (Shrimps/Prawns and lobsters), sharks, rays and chimaeras (elephantfish), Cephalopods (Octopus and squid), a wide range of demersal fish (snappers, sparids, grunts, drums, ribbon fish, rock cods, kingfish) and benthic species like shrimps, soles and flounders. Oysters and clams are also collected at a subsistence level.

2.1.2.3 Fishing fleets and gears

All of the countries of the GCLME have industrial fisheries and artisanal and subsistence fisheries. Many of them have significant lagoon, estuarine, inland and freshwater fisheries as well though these are sometimes seasonal and confined to a subsistence level. Many of the GCLME countries have agreements with the European Union (EU) to allow EU vessels to fish for large pelagic fish like tuna, as well as other surplus fish resources within the EEZ of the relevant countries. In the industrial marine sector, small pelagics account for a large proportion of the landings (> 50 %). Small pelagic species are caught almost exclusively by purse seine fishing gear in the industrial sector. European Union countries fish under licence in the LME, targeting mainly pelagic tunas and billfishes with some allowances for mixed fishing. Cape Verde, Cote d'Ivoire, Gabon, Liberia, San Tome and Principe

and Senegal have tuna agreements with the EU while Guinea Bissau has a mixed agreement covering demersal species, shrimps and cephalopods. Large pelagic species are caught mainly by purse seine nets and by long line vessels but poling is sometimes carried out. Throughout the region there are industrial demersal trawlers targeting a wide range of species. These vessels use traditional bottom trawl gear consisting of a cone shaped net and trawl doors to keep the net open. Cod end mesh sizes vary greatly and the lack of control over mesh sizes is a source of concern to fisheries management programmes. Industrial and semi-industrial vessels also target pink shrimp using shrimp trawl gear of various designs. The artisanal marine sector in the GCLME uses a very wide range of fishing gear. Some of the gears are fished from motorised or un-motorised boats (mainly canoes) and some are fished form the shore. Generally large motorised sea-going canoes deploy various types of gillnets (drift, set) as well as purse seine nets to catch small pelagic fish as well large pelagic fish (tuna, sailfish and marlin) on occasion. Gill nets target a wide range of demersal fish species (Sparids, snappers, grunts, ribbon fish, kingfish and rock cods). The white shrimp resources off Nigeria and Cameroon are fished exclusively by artisanal fishery using small beam trawls operated from boats. The smaller canoes fish with hook and line, long lines and smaller gillnets, mainly targeting demersal fish species. The smallest canoes are used to deploy beach seine nets ranging between 200 m and 800 m in length and target small pelagic fish and shrimps.

2.1.2.4 Landing information

Peak landings for the GCLME has been just over 900,000 tonnes, comprising industrial, artisanal and subsistence sources (where the last mentioned includes marine, estuarine, and lagoon environments), with Nigeria and Ghana accounting for about half of the reported landings. There is poor reporting of catch species composition which complicates fisheries analyses.

2.1.2.5 State of resources.

Reviews of the status of the LME's fisheries resources indicate that almost all the fish stocks are either overexploited or almost fully exploited (Ajayi 1994, Mensah and Quaatey 2002). These include small pelagic fish and shrimps in the western and central Gulf of Guinea and coastal demersal resources throughout the LME. There is also evidence of depletion of straddling and highly migratory fish stocks, with heavy exploitation of yellow-fin and big-eye tunas (Mensah and Quaatey 2002).

Various studies indicate artisanal fisheries in West Africa are facing challenges because of the almost entirely open access nature of the artisanal fisheries and the fact that the natural environment necessary to supporting the artisanal fisheries has been seriously degraded (Ajayi 1994).

The decline in inshore species is of particular relevance to artisanal and small scale fishers who, because of a lack of deep seagoing capacity, fish exclusively in the inshore area and rely heavily on fish stocks for food security. Throughout the region inshore areas are mainly reserved for artisanal fishers and there is often conflict between industrial fishers and artisanal fishers when industrial fleets come close inshore to target prawns and demersal fish stocks (Koranteng 2002, Koranteng and Pauly 2004). The use of small-sized mesh, especially in trawl, purse and beach seine nets is a widespread problem, especially in the central part of the region, and this probably contributes to over-exploitation. Small mesh netting results in the capture of many juvenile fish. However, these juveniles are seldom discarded (discards are mainly in the shrimp fishery). Other destructive fishing practices such as the use of explosives and chemicals are also common in the inshore areas (e.g., see Vakily (1993)) and have long lasting negative effects on inshore habitats. There are indications

that over-exploitation has altered the ecosystem as a whole, with impacts at all levels, including top predators. Species diversity and average size of the most important fish species have declined as a result of over-exploitation (Koranteng 2002, Cury et al. 2003).

2.1.3 CCLME

2.1.3.1 Overview

The CCLME is strongly influenced by the Canary Current which flows past Morocco, Mauritania, Senegal, Guinea-Bissau, the Canary Islands, Gambia, Cape Verde and Western Sahara, causing strong upwelling and high levels of primary and secondary production. There are three distinct upwelling zones – a northern zone centred off Mauritania, a southern zone that includes Senegal and Guinea and an oceanic zone that includes the Canary Islands and Cape Verde. Landings of both industrial and artisanal fisheries have declined in recent years and many of the stocks are considered collapsed or over-exploited.

2.1.3.2 Resources

There is a very large biomass and productivity of large and small pelagic fish. In general a very large range of fish and invertebrates are caught in the region including tuna, hake, demersal finfish, squid, octopus and shrimps. A large part of the fishery resources of the CCLME undertake trans-boundary migrations: the smaller pelagic fishes (sardines, sardinellas, mackerels and horse-mackerels) occur close to shore but migrate between EEZs. Some of the larger, near-shore coastal pelagic species (mullets, meagres, bluefish) make seasonal north-south migrations and the large pelagic species like the tunas (yellowfin, skipjack and bigeye) make long-distance movements both in and out of the CCLME and the EEZs of the various countries. Demersal species and crustaceans and molluscs tend to be localised, but where coastal distances are small, demersal fisheries can move between EEZs. There are extensive mangrove habitats along the coasts of the southern states. Many of the commercially important fish species depend on estuarine habitats for part of their life cycles (GEF CCLME Project). Exploited species include small pelagic fishes (sardines, bonga shad, mackerels, anchovies,), large migratory pelagic fishes (tuna, bonito swordfish, wahoo and sailfish), crustaceans (Shrimps/Prawns and lobsters), sharks, rays and chimaeras (elephantfish), Cephalopods (Octopus and squid), a wide range of demersal fish (hakes snappers, sparids, grunts, drums, ribbon fish, rock cods kingfish) and benthic species like soles and flounders. In the Cape Verde area moray eels and grouper are important demersal species.

2.1.3.3 Dependent community

Over a million people in the region are involved in some aspect of fisheries and there are over 100 000 artisanal fishers operating 20 000 canoe type boats and 1000 industrial vessels.

2.1.3.4 Fishing fleets

Principal fishing units for the marine industrial sector are purse seine vessels, long line vessels and demersal trawl vessels. Shrimp and cephalopod trawl vessels are also a feature of northwest African fisheries. The industrial marine sector targets four categories of fish - pelagic, demersal, cephalopods and crustaceans. Small pelagics including clupeoids like sardinella, round sardinella, bonga shad, anchovy and mackerels account for a large proportion of the landings (> 60%). These are caught with large purse seine nets in the coastal zone. Demersal fish are the most valuable resource and are heavily targeted by trawlers which mainly often process the catch at sea and export directly. Industrial shrimp trawlers, long liners and trawlers targeting cephalopods also make significant

catches. Land based fish factories in CCLME countries are largely not certified to process and export to EU countries.

Senegal and Caqpe Verde have tuna fishing agreeemnts with the EU which allow EU vessels to catch large pelagic fish species in local EEZ waters. Morocco has a “mixed” agreement with the EU which allows EU vessels to target a wide range of fish stocks Mauritania and Gambia have “dormant” mixed agreeements with the EU which currently do not allow the EU to fish in their waters.

The artisanal marine sector in the CCLME is very diverse and uses a very wide range of fishing gear in the marine and estuarine environment. Principal gears in the marine artisanal sector in terms of fish caught and impacts on fish stocks are artisanal purse seine nets, drift and bottom set gill nets, long lines, small shrimp/cephalopod trawls, and hand lines. Artisanal fishers mainly target species in the same sectors as the industrial fishers (small pelagic fish, demersal fish, cephalopods and crustaceans) but operate close to shore using predominantly planked canoes in the marine environment. The main ffishing gears are bottom set gill nets, hand and long lines for demersal fish and artisanal purse seine nets for small pelagic fish. Traps are used in the lobster fishery in Senegal. Demersal fish are the most important component of the artisanal fishery generally, but off Cape Verde, artisanal catches are made up largely of large pelagic species (tunas), goatfish, sea bass, and moray eels.

2.1.3.5 Landing information

Catches are large and very diverse – 1.6 million tonnes of small and medium pelagic fish, 80 000 tonnes of tuna 260 000 tonnes of demersal fish, 130 000 tonnes of other marine fish, 80 000 tonnes of cephalopods, and 17 000 tonnes of crustaceans. Peak landings for the CCLME have been over 2.3 million tonnes in the 1990s and current landings (2012 data FAO) indicate marine catches of about 2 million tonnes a year. Catches are made up of industrial, artisanal and subsistence catches in inland, marine, estuarine, and lagoon environments but more than 60% of the catch is made up of small and medium sized pelagic fish (clupeoid and mackerel species). Senegal and Mauritania account for the bulk of the reported landings. Multi-species fisheries are common in the region and multiple gears are used from both the shore and from motorised and un-motorised boats of widely varying sizes and sea worthiness. This and poor species reporting of catches complicates fisheries analyses.

2.1.3.6 State of resources

There has been a general decline in almost all of the fishery sectors of the CCLME (small pelagic fish, demersal fish, crustaceans – lobsters and shrimps, cephalopods, sharks and rays, and probably tuna). The decline in demersal fish populations is of particular concern because of their importance to artisanal fishing communities. The entire CCLME is threatened by over fishing at both industrial and artisanal levels. Subsistence estuarine and fresh water resources associated with the CCLME appear to be fully exploited.

2.1.4 MLME

2.1.4.1 Overview

The MLME is a semi-enclosed sea with a number of distinct bio-geographical units. The highest levels of productivity occur along the coasts, near major cities, and at river estuaries. Although overall, the Mediterranean Sea LME is considered to be a low productivity ecosystem, fisheries production is nevertheless of major economic importance. African countries impacted by the Mediterranean LME are northern Morocco, Algeria, Tunisia, Libya and Egypt.

2.1.4.2 Resources

Large pelagic fish species (tunas and billfish), small pelagic fish species (anchovies and mackerel and sardines), sharks and rays, flounders and soles, and a wide diversity of demersal fish species (breams, cods, gurnard, dentex, drums etc.) as well as crustaceans (lobsters, crabs and shrimps) and molluscs (mussels, oysters, octopus and squid). Small pelagic fish (herrings, sardines and anchovies) form the most important fisheries components but demersal fish and molluscs are also relevant.

2.1.4.3 Landings information

Fisheries production in the MLME is about 1.2 million tonnes a year (entire Mediterranean). Clupeoids (herrings, sardines and anchovies) form the most important species group with 38% of catch. Demersal coastal fishes account for 18% of the catch, and molluscs for 16%. Tunisia and Libya each catch about twice as much fish as Egypt.

2.1.4.4 Fishing fleets

A wide range of fishing gears is used in the MLME. Gill nets, purse seine nets and mid-water and demersal trawl gear capture the bulk of the fish production, but beach seines, hook and line and traps are also used. Shrimp trawlers capture about 40 000 tonnes of shrimps of varying species and about 60 000 tonnes of molluscs are also caught probably mostly by trawl gear (cephalopods) and some dredge gear. Most of the Libyan marine catch is sold fresh in large urban markets. The tuna industrial fishery in the Mediterranean accounts for less than four percent of the total catches landed. The tuna fleet is mainly composed of artisanal vessel (92.5 percent), Industrial marine sector: Principal fishing units for the marine industrial sector are the purse seine vessels, the vessels deploying gill nets and the demersal and mid-water trawl vessels. Shrimp trawl vessels are also a feature of the central Mediterranean area. The artisanal marine sector Most of the catch in Libya comes from the gill nets of the artisanal vessels targeting demersal fishes and artisanal seine nets targeting the small pelagic fishes. Principal gears in the marine artisanal sector in terms of fish caught and impacts on fish stocks are artisanal purse seine nets (lampara), drift and bottom set gill nets, and hand lines.

2.1.5 RSLME

2.1.5.1 Overview

The Red Sea LME impacts on the African countries of Egypt, Sudan, Djibouti, and Eritrea. The RSLME is a highly saline, warm system with a complex oceanography which is considered a highly productive system as a result of phytoplankton blooms in winter and the large extent of coral reef systems, mangroves and seagrass beds.

2.1.5.2 Resources

Catches from the waters of the Red Sea include about 35 fish species groups, dominated by small pelagic species (mackerel, sardine, anchovy) and demersal fish (lizard fish, snapper and emperors, bream, various kingfish species, barracudas, grouper and grey mullet). Invertebrates like cuttlefish, lobsters and trochus are caught and in recent years, landings of sea cucumber have become economically important. Large pelagic fish species targeted are yellowfin tuna and various sharks.

2.1.5.3 Fishing fleets

Fisheries resources of the Red Sea are exploited by subsistence fishers, artisanal fishers, and local and foreign industrial fishers. Many of the species fished in the Red Sea cross national boundaries and are essentially shared stocks.

The Red Sea industrial sector totals at least 7,500 fishermen and 1,600 industrial vessels. The semi-industrial fleet of purse-seiners and trawlers are mainly located in the north and use purse seine nets to catch small pelagic fish (sardine, mackerel species and sardinellas) and tuna, and trawl gear to catch a range of demersal fish species. Trawling for shrimp on a small commercial scale also takes place.

The artisanal sector comprises at least 29,500 fishermen and 9,000 vessels (mainly dhows and canoes). Artisanal fishermen use a range of gears, including long-lines, hand lines, gill nets, trawls, trammel nets, cast nets, tangle nets, traps and spears. Small pelagic fish species and demersal fish are the main targets. Some artisanal fishers migrate up and down the coast following migrating species like the mullets. Molluscs (Trochus spp.) and lobsters are captured by hand.

Subsistence fishers typically operate from the shore but a few use small wooden boats. Veranda nets, trammel nets, cast nets and hook and line are the main gears used to catch small pelagic fish species and demersal fish. The catch is consumed fresh locally, but a small proportion is salted or sun-dried.

2.1.5.4 State of resource

Assessment of the status of marine fish stocks in the Red Sea is complicated both by the lack of data, lack of comprehensive stock assessments of commercially important species and also by the shared nature of many of the stocks. However, it is very clear that marine fishing activities in the Red Sea and Gulf of Suez have increased significantly over the past two decades. This increase has occurred because the fisheries of the Red Sea and Gulf of Suez are essentially open access and unregulated. In addition, the price of fish has increased globally. Major increases in effort have occurred in the purse seine fisheries and demersal trawlers. Shark populations have also been very heavily targeted. All demersal and reef finfish stocks as well as the trochus and lobster fisheries in the Red Sea and Gulf of Suez are now considered fully or over-exploited. As a result of over-fishing, artisanal and subsistence hand line and net fisheries for reef fish species have been negatively impacted.

Over-exploitation, destruction of spawning, nursery and feeding grounds, and inadequate resource management and regulations are serious problem issues for the LMEs fish resources. Pollution (particularly because of the enclosed nature of the water body and the slow water turnover times) and habitat destruction are particular issues of concern. The absence of effective control, surveillance and enforcement of regulations has resulted in widespread poaching and habitat destruction by foreign and national vessels, especially in the Gulf of Aden and off the coasts of Yemen and Somalia. There is also apparently very limited applied fisheries research.

3.1.6 SCLME

3.1.6.1 Overview

The Somali maritime zone is one of the largest in the western Indian Ocean and includes one of the most important large marine ecosystems in the Indian Ocean. Somalia is the main area influenced by the SCLME but the Kenyan and northern Tanzanian coasts are also impacted to a small extent by the current system.

2.1.6.2 Resources

In Somali waters, the major marine resources in terms of biomass are the small pelagic species (sardinella species, anchovy, and various mackerel species) that occur mainly on the north east coast. The inshore waters support a rich and diverse demersal fish fauna mainly associated with reef systems. From a fisheries perspective the most important are the groupers, snappers, grunts, emperors, breams and lizard fishes. Sharks have long been a focus of Somali artisanal fishers because there is a ready market, profits are high especially for the fins, and more critically, shark meat and shark fins can be salt-dried so no freezer facilities are necessary. Often only the shark fins are harvested, since vessels are small, space and salting facilities limited. Lobsters occur along the east coast and prawns and mangrove crabs are present in the northwest areas of the country. Harvesting of sea cucumbers occurs in the northwest and possibly south of Mogadishu.

South of Somalia, Kenya and Tanzania have mainly tropical coral reef habitats in the inshore area, with a very high diversity of fish (demersal, small and large pelagic fish including sharks), crustaceans, molluscs (including squid and octopus) and echinoids, all of which are targeted to a greater or lesser extent by fishers using multiple gear types. Offshore tuna stock support industrial fisheries along the entire coast.

2.1.6.3 Fishing fleets

The industrial fisheries along the Somali coast developed much earlier than artisanal fisheries in response to the rich fish resources of the region. Fishing activities were always conducted by foreign vessels under license to the Somali Government before the 1991 civil war and subsequently under no authority at all. Industrial vessels typically use purse seine gear, demersal trawls, long lines and drift gill nets to target big and small pelagic fish and demersal fish.

Artisanal fishers use dugout canoes and dhow type craft as well as a range of fibreglass craft 6 – 9 m in length and powered by inboard and outboard engines. Because of the boats and gear they use, local fishers are confined to fishing in shallow coastal waters while foreign industrial fleets have historically exploited the offshore resources. Artisanal fishers use hand lines for catching demersal fish and long lines are used for shark, tuna and other big fish species like king mackerel. Gill nets with mesh sizes in the 150–200 mm range are the most important fishing gear and are used as drift or bottom-set nets, targeting mainly shark species but also large pelagic species (tunas, bonito and Spanish mackerel) and demersal reef fish. Beach seine nets are also used in places. Lobsters are caught using tangle nets, basket traps and by breath-hold and scuba diving. Prawns and large mangrove crabs are caught by hand by fishers in the northwest. Harvesting of turtles (mainly green turtles) take place in the northeast and provides a livelihood to a small group of people. The meat is highly sought after and the oil is used on boats. The type of gear used by artisanal fishers is often season and locality dependent, and fishing is limited in the windy months between June and the middle of September.

Along the Kenyan and Tanzanian coasts there are offshore industrial fisheries for tuna (purse seine) and a host of artisanal and subsistence fisheries operating in a range of habitats (sea grass beds, shallow rocky reefs, coastal bays, coral reef slopes, lagoons mangrove creeks, estuaries, mud flats and intertidal sandy and rocky shores). Many gear types are in use (gill nets, beach seine, hook and line, long line, surface drift nets, artisanal purse seine and encirclement type nets, mosquito nets, collection by hand, sticks and spear, traps, breath-hold diving, poison and dynamite). Many of these

latter fisheries are completely open access. Industrial vessels target inshore prawns and offshore crustaceans.

2.1.6.4 Dependent community

There are currently at least 50 fishing centres scattered along the Somali coastline, most of which are fairly small and geared exclusively toward artisanal inshore fishing activities. Numbers of fishers are difficult to verify, but appear to be in the region of 4500 active artisanal fishers and 5000 temporary fishers (Lovatelli 1996, Tello 2005). However there have also been estimates of as many as 30 000 people actively engaged in the fishing business (all aspects) in Somali coastal communities and another 60 000 may be engaged on a seasonal basis.

2.1.6.5 Somalia and UNCLOS

The UN Division for Ocean Affairs and the Law of the Sea, Office of Legal Affairs recognises Somalia's declaration of its Exclusive Economic Zone (EEZ) as of 3 July 2014.

2.1.6.6 State of resources

The civil war and its aftermath have been the biggest drivers of almost all aspects of life in Somalia, because they resulted in the destruction of most of the important institutional arrangements and infrastructure, causing major disruptions to the government and economy of the country. Consequently there is very limited availability of any quantitative fisheries data, no fisheries control, high levels of IUU fishing of the Somali fish resources, and widespread marine piracy. With no enforceable government fisheries policy in Somalia, all fisheries are open access which has generally negative impacts on the resource base. The sustainability and stock status of the various inshore and offshore fisheries in Somalia is thus largely a matter of guesswork. It is highly probable that there are significant negative ecological impacts on the inshore fisheries from an uncontrolled number of foreign vessels fishing illegally. Illegal trawling by foreign vessels targeting reef fish takes place close inshore, and reefs important to artisanal lobster and fin fish stocks are often badly damaged with consequent impacts on inshore ecosystems. Low value bycatch is discarded. Incidental capture of turtles and dolphins also occurs.

It is difficult to gauge the status of resources along the Kenyan and Tanzanian coasts because of the very large number of resources targeted. A number of artisanal and industrial fisheries are recorded as causing damage to the habitat in which they take place and there are few fishery management plans and catch controls.

2.1.7 SEC

2.1.7.1 Overview

The islands that lie east of Madagascar (i.e. excluding those in the Mozambique Channel) all lie in the path of the South Equatorial Current (SECLME) which provides the main input to both the Agulhas and Zanzibar currents. This wind-driven current is shallow and is considered not to change much in strength or direction, either seasonally or inter-annually. Madagascar, Comoros, Seychelles, and Mauritius are all influenced by the SEC.

2.1.7.2 Resources

The principal resources are the skipjack and yellowfin tuna stocks. Demersal fish stocks comprise kingfish, snappers, emperors, jobfish, mackerel, and groupers. There are minor lobster and sea

cucumber stocks in the Seychelles and throughout the region.

2.1.7.3 Fishing fleets

All of the countries influenced by the SEC have tuna fishing agreements with the EU since there is no local industrial level tuna fishing capacity. The tuna fishery is the major industrial fishery of the SEC and exploits the tuna resources in the South West Indian Ocean using principally purse seine and long line gear.

In the artisanal sector demersal fish are targeted using mainly hand-lines and large pelagic fish are caught by trolling from small boats. Lobsters are caught by breath-hold diving and sea cucumbers are collected by hand. In the sheltered lagoon of Mauritius, artisanal and subsistence fishers use a wide variety of gears including basket traps, hook-and-line, harpoons, encircling nets and gillnets. The Mascarene Plateau is an important semi-industrial demersal fishing site where fishers operating dories from a mother vessel use hand lines to target a range of demersal fish species at depths of 30-60 m. All the islands support subsistence fishers that operate in a very wide range of habitats and use multiple small scale methods (spear guns, harpoons, dynamite, poison, shore gathering by hand and using sticks, cast nets, beach seines, traps, basket and rock traps, and gill nets).

2.1.7.4 State of resources

The tuna resources of the SEC are probably maximally exploited. There is concern in most coastal areas regarding the status of demersal fish stocks and the Mascarene Plateau demersal fish stocks appear to be over-exploited. The minor resources targeted by subsistence fishers are generally not a source of concern. The island nations are major centres for tourism and tourism development is destroying coastal habitats which impacts on coastal fisheries resources targeted by subsistence and artisanal fishers.

2.1.8 ACLME

2.1.8.1 Overview

The Agulhas current is one of the largest western boundary currents in the world and is fed from a range of sources that originate from the westward flowing South Equatorial Current of the central Indian Ocean. Countries influenced by the ACLME are Madagascar, Mozambique and the east and south coasts of South Africa.

2.1.8.2 Resources

To the north of the LME tropical and sub-tropical habitats provide resources of large pelagic species (tuna, swordfish, sharks, Spanish mackerel) and small pelagic species (sardinella, sardines, mackerels), a very large range of demersal fish species, crustaceans (deep and shallow water lobsters, shrimps and crabs), sea cucumbers and a very wide range of mollusc species including squid and octopus. To the south in South Africa, the Agulhas bank provides a habitat for demersal species like hake, flat fish and kingklip as well as small pelagic species (sardines and mackerel).

2.1.8.3 Fishing fleets

There are offshore industrial fisheries for tuna (purse seine, long line), industrial trap fisheries for lobsters and crabs, industrial shrimp trawl fisheries, industrial bottom long line fisheries, industrial deep and inshore demersal trawl fisheries, industrial small pelagic fisheries (purse seine), industrial linefish fisheries, and industrial squid fisheries. There are also a host of artisanal and subsistence

fisheries operating in a range of tropical habitats (sea grass beds, shallow rocky reefs, coastal bays, coral reef slopes, lagoons mangrove creeks, estuaries, mud flats and intertidal sandy and rocky shores) as well as in the temperate habitats along the southern African coasts. Many gear types are in use in the small scale fisheries sector (gill nets, beach seine, hook and line, traps, long line, surface drift nets, artisanal purse seine and encirclement type nets, mosquito nets, cast nets, breath-hold diving, dynamite and collection by hand, sticks and spear,). Some of these latter fisheries are completely open access, particularly in Mozambique.

2.1.8.4 State of resources

Many of the industrial fishery resources of the region are either fully exploited or over exploited. There are management plans for most of the industrial fisheries in Mozambique and South Africa and Madagascar has a high level of community management for many of the inshore subsistence and artisanal fishery resources. There are concerns relating to the state of demersal fish stocks throughout the region and shark fisheries are generally considered over-exploited. Many of the minor resources targeted by subsistence fishers are considered over-exploited. IUU fishing is a problem for all the countries of the ACLME.

2.2 Economic value of African marine fisheries

Africa's fishing industry provides income to more than 12 million people. There are marine fisheries on all the Large Marine Ecosystems (LMEs) that surround the African coast and in all estuaries and lagoons.

de Graaf & Garibaldi (2014; see Table 3 1) estimated the value added by the fisheries and aquaculture sector in 2011 at more than US$ 24.0 billion, equivalent to 1.26 percent of the GDP for African countries combined.

Table 3 1. *A breakdown of the value of African fisheries taken from Garibaldi and de Graaf (2014). Landed value and post-harvest value addition is separated in this table.*

Fisheries and aquaculture contribution to GDP in the whole Africa by subsector

	Gross Value Added (US$ millions)	Contribution to GDP (%)
Total GDPs African countries	**1,909,514**	
Total Fisheries and Aquaculture	**24,030**	**1.26**
Total Inland Fisheries	**6,275**	**0.33**
Inland fishing	4,676	0.24
Post-harvest	1,590	0.08
Local licences	8	0.00
Total Marine Artisanal Fisheries	**8,130**	**0.43**
Marine artisanal fishing	5,246	0.27
Post-harvest	2,870	0.15
Local licences	13	0.00
Total Marine Industrial Fisheries	**6,849**	**0.36**
Marine industrial fishing	4,670	0.24
Post-harvest	1,878	0.10
Local licences	302	0.02
Total Aquaculture	**2,776**	**0.15**

A % breakdown of the 1.26 percentage value is as follows:

- Marine artisanal fisheries (0.43 percentage points),
- Marine industrial fisheries (0.36 percentage points),
- Inland fisheries (0.33 percentage points),
- Aquaculture (0.15 percentage points).

The World Bank (2012) estimated the contribution of fishing and post-harvest beneficiation globally. In Figure 3 2, official data on the contribution of the fisheries sector to GDP available for some countries are compared with the data produced by the present study and those from the World Bank study. The latter uses the term "extended GDP" and loosely defines this to include the "… downstream economic activities in the estimate of the global economic contribution of capture fisheries".

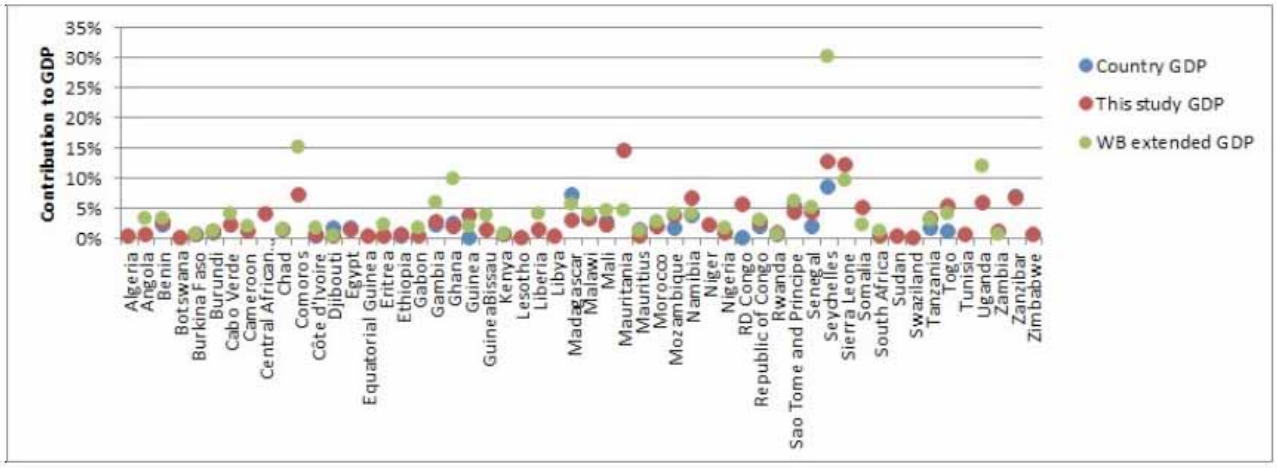


Figure 3 2. *Contribution of fisheries to GDP as reported nationally ("Country GDP"), as estimated by de Graaf and Garibaldi (2014) ("This study GDP") and as reported in a World Bank study ("WB extended GDP").*

For their reference year 2011, de Graaf and Garibaldi (2014) estimate that the harvest level (ex-vessel landed value) income generation amounts to $ 5.246 billion for marine artisanal fisheries and $ 4.67 billion for marine industrial fisheries, a total of $ 9.916 billion for marine wild capture in total. Including the post-harvest contributions, the total value generation is estimated at just under US$ 15 billion. Using contemporary estimates of GDP (source IMF) and the contribution (%) of fisheries to GDP from World Bank (2012) we obtain the estimates for coastal African states given in Table 14 1. The Africa wide totals of between $ 24.9 billion and $ 27.8 billion based on World Bank (2012) in Table 14 1 for the period 2013 to 2015 include economic multiplier effects (hence "extended GDP") using a multiplier of close to 3. The World Bank estimates of $ 24.9 billion to $ 27.8 billion are thus consistent with ex-vessel values of between $ 8.3 billion and $ 9.3 billion (i.e. $ 24.9/3 billion and $ 27.8/3 billion). Following this conversion the differences between the World Bank estimates and those of de Graaf and Garibaldi (2014) are between $ 1.6 billion and $ 0.6 billion, which is not inconsiderable in absolute terms, but depending on the context of the comparison could be viewed as representing broad agreement. The differences that exist are assumed to be due to

- The result of economic growth in the fishing industry between 2010 (The World Bank 2012) and 2011 (de Graaf and Garibaldi 2014).
- A degree of aquaculture and inland fish production by coastal African states in the de Graaf and Garibaldi (2014) estimates - although Figure 13 3 suggests that the inland fishery catch contribution to coastal African states' overall fisheries production in de Graaf and Garibaldi (2014) is small.

A further source for value estimation for African marine fisheries is a recent study by Pauly and Zeller (2015, 2016) and the supporting data which is made available globally through the Sea Around Us study at the University of British Columbia (see Pauly & Zeller, 2015). We summarise these results in Table 14 2. This provides an estimated total landed value for Africa (marine capture fisheries only) of $ 7.177 billion for 2010 (based on reported catches only), to be compared with the de Graaf and Garibaldi (2014) estimate of the value of landings of $ 9.916 billion in 2011 (their base year). The difference is substantial, with de Graaf and Garibaldi's (2014) estimates being about 40% larger than the Pauly and Zeller (2015) estimate, or by about $ 2.739 billion (note: the size and sign of the difference changes when the unreported catch values in Pauly and Zeller (2015) are included). Clearly the difference is related to the different methodologies employed. de Graaf and Garibaldi (2014) base their study on a questionnaire approach where in terms of catch tonnage and value the basic question types are as follows:

Table 3 2. *Format of data collected from the survey work underlying de Graaf and Garibaldi (2014).*

	Inland fisheries	Marine artisanal	Marine industrial
No. of fishing units by type of fishery	X	X	X
Total annual catches by type of fishery (tonnes)	X	X	X
Average fish price (ex-vessel or landing site price)	X	X	X
Gross Value Product by type of fishery (local currency)	X	X	X
Annual production cost[3] by type of fishery (local currency)	X	X	X
Value Added Ratio by type of fishery	X	X	X
Total value added (local currency)	X	X	X
No. of crew by type of fishery	X	X	X
Total male employment	X	X	X
Total female employment	X	X	X
Males/females %	X	X	X
Total crew number	X	X	X

These questionnaires were only administered to a sub sample of African countries, and then extrapolated to other countries using the FAO reported catches. To some degree then the economic value estimates in de Graaf and Garibaldi (2014) represent an independent estimate of value which can be used to assess the plausibility of the Pauly and Zeller (2015) estimates for unreported catches. The discrepancy of $ 2.8 billion between the two sources, as well as the World Bank to Pauly and Zeller difference, may therefore be related to the underreporting of artisanal catches that are estimated for West Africa by Belhabib et al and others (assumed to enter the domestic economy and show up in bottom up economic studies), and therefore this difference throws some light on the plausibility of the Pauly and Zeller (2015) estimates for unreported catches.

2.3 Landed tonnage

Two sources of information on the tonnage landed within the African EEZ are considered:

1. FAO marine capture statistics (FAO FishStatJ 2015)
2. The Sea Around Us (Pauly and Zeller 2015)

An analysis of FAO marine capture statistics (FAO FishStatJ 2015) yields the results shown in Table 14 3 (see supporting tables at the back of document), i.e. an estimated 5.072 million tonnes for Africa in 2010. The data from the Sea Around Us project yields the estimates for landed tonnage reported in Table 14 2 (see supporting tables), a landing in 2010 of 5.93 million tonnes. The reasons for the difference between these estimates were not fully resolved during this study, although it is in part to do with the absence of lagoon fishery catches in the FAO source. FAO (2011) also provides catch statistics for Africa by major FAO division according to the following spatial regions(Table 3 3):

Table 3 3. *FAO division reported tonnages for 2009 - note that these quantities include high seas catches and other non-African EEZ catches*

FAO Statistics Area	Reported Tonnage
51	4 141 000 tonnes
34	3 675 000 tonnes
47	1 194 000 tonnes
37 Mediterranean and Black Seas	1 479 000 tonnes
51 + 34 + 47 + 37	10 489 000 tonnes

The relevance of these estimates is that they include catches outside the African EEZ. Given African EEZ reported catches of 5 - 5.8 million tonnes, this shows that there is another roughly 5 million tonnes ascribable to fishing outside the African EEZs but within the relevant major FAO statistical divisions. Since one form of IUU fishing involves encroachment into EEZs, it is possible that some of the illegal fish caught within EEZs is being reported as high seas catches.

2.4 Employment and communities reliant on African Marine Capture Fisheries

Figures for total numbers of people employed in the fisheries sector worldwide and on the African continent in particular as well as the numbers of people reliant on fisheries for their livelihood and food security vary considerably across sources. However, recent research on “The Value of African Fisheries” by de Graaf and Garibaldi (2014) suggest that the fisheries and aquaculture sector employs about 12.3 million people. About 50% of this number is attributable to marine fisheries. Table 3 4 and Table 3 5 table immediately below summarizes total figures and shares by subsector and within subsectors. Half of the 12.3 million people employed in the fisheries sector are fishers, 4.9 million (42.4 percent) are processors and 0.9 million (7.5 percent) work in fish farming. More than half of the fishers (55 percent) are employed in inland fisheries whereas the largest share of processors (42 percent) is in marine artisanal fisheries followed by 30 percent in inland fisheries and 28 percent in industrial fisheries. Thus according to these estimates about 6.4 million people are employed in the marine industrial and artisanal sector. It is important to note is that women make up about one quarter of the workforce in the fisheries sector (all sectors), with 70.5 percent working in post-harvest activities of the marine industrial sector and 43.7% in the post-harvest activities of the marine artisanal fisheries sector.

These figures exclude the millions of additional people that are involved in part-time, seasonal and ad hoc work in the fisheries sector. These figures are difficult to estimate and in some sources are combined with estimates of total number of people reliant on fisheries for food and livelihoods. For example, the World Fish Centre’s 2014 Annual report, state that fish provides more than 1 billion poor people globally with most of their animal protein. Furthermore, looking at fisheries globally they estimate that “more than 250 million people depend directly on fisheries and aquaculture

for their livelihood, millions more are employed in fisheries and aquaculture value chains“ (World Fish, 2014). Given the poverty levels in Africa, we can assume that several 100 million of this global population dependent on fish for their main animal protein must live in Africa. In many, especially poor coastal communities, fisheries may be one of several livelihood activities and in times of hardship may provide a safety-net to poor marginalised families and individuals. However, what is clear from the literature is that small-scale fisheries play a major role in contributing to national economies, to urban and rural food supply, to employment and local livelihoods, and to trade. Thus given its importance, this fishery sector needs to be protected from the impacts and losses associated with IUU fishing.

Table 3 4. Employment estimates for African fisheries reported by de Graaf and Garibaldi (2014).

Table 44. Employment by subsector

	No. of employees (thousands)	Share subsector (%)	Share within subsector (%)
Total Employment	**12,269**		
Total Inland Fisheries	4,958	40.4	
Fishers	3,370		68.0
Processors	1,588		32.0
Total Marine Artisanal Fisheries	4,041	32.9	
Fishers	1,876		46.4
Processors	2,166		53.6
Total Marine Industrial Fisheries	2,350	19.2	
Fishers	901		38.4
Processors	1,448		61.6
Aquaculture workers	920	7.5	

Table 3 5. Employment estimates for African fisheries reported by de Graaf and Garibaldi (2014) by gender.

Table 45. Employment by gender

	Males (thousands)	Females (thousands)	Females (%)
Grand Total	**8,917**	**3,352**	**27.3**
Total Inland Fisheries	3,632	1,326	26.7
Fishers	3,143	227	6.7
Processors	489	1,099	69.2
Total Marine Artisanal Fisheries	4,041	961	23.8
Fishers	1,861	15	0.8
Processors	1,220	946	43.7
Total Marine Industrial Fisheries	1,328	1,021	43.5
Fishers	901	0	0
Processors	427	1,021	70.5
Aquaculture workers	876	44	4.8

3. Characteristics of IUU fishing in Africa

This section addresses the following topics:

- Types of illegal fishing fleets and vessels
- Nature of illegal fishing practices

3.1 Types of IUU fishing fleets and nature of IUU fishing

From a review of the available literature we identified a number of countries of origin for IUU fishing vessels and the different types of IUU fishing vessels. These were categorised into the following two major groups:

Origin of vessels.

1. Non-Africa vessels
2. Coastal state vessels
3. African non-coastal state vessels

Types of vessels and/or platform for fishing operations if not boat based

1. Trawlers
2. Purse seiners
3. Longliners
4. Small craft
5. Divers
6. Beach seine

We also came across information and commentary on the types of IUU fishing taking place, and an occasional comment on factors aiding and abetting the occurrence of IUU fishing, which we have grouped into two major sections:

Types of IUU fishing

Illegal

- Vessels authorised to fish in the EEZ border hopping into the EEZ
- Vessels authorised to fish in the adjacent EEZ border hopping
- Fishing in prohibited zones such as nearshore zones demarcated for artisanal fishermen/zonal violations/closed area violations/fishing in prohibited areas or seasons
- Illegal catches in artisanal fisheries
- Exceeding catch limitations on bycatch species
- Fishing of prohibited species
- Unauthorised trans-shipments
- Illegal life history stage, juvenile capture
- Dynamite and/or poison fishing
- Use of gill nets
- Incorrect description of exports
- Species misreporting

Unreported and unregulated

- Under- and/or misreporting catches in artisanal fisheries

- Exceeding catch limitations in general
- High grading
- Unlicensed fishing, non-compliance with license conditions in general
- Use of illegal gear & methods
- Use of illegal mesh size

3.1.1 Southern Africa

3.1.1.1 Origin of vessels

3.1.1.1.1 Foreign vessels

- ***Namibian EEZ:*** Prior to independence and before 1982 the offshore fisheries of Namibia were effectively open access and were targeted by DWFs from around the globe. Namibian independence in 1990 brought a sharp cessation to this activity. Within a year, illegal vessels dropped by 90 %, including 12 arrested vessels, of which 11 were Spanish – the most recurrent offenders in the country (Freeman 1992, Endangered Seas Campaign 1998). In 2004, six out of 16 inspected vessels were arrested (Stop Illegal Fishing 2008), e.g. Chinese vessels targeting mussels and limpets in IEZs (Pramod et al. 2006).
- ***South African EEZ:*** Some but a very limited number of foreign-flagged fishing vessels deployed by South African right-holders are permitted into certain fisheries (Stop Illegal Fishing 2008). This loophole may be stimulating some tuna IUU fishing by South African, Japanese and Taiwanese longliners (Stop Illegal Fishing 2008).
- ***PEMI toothfish IUU:*** Due to the challenging accessibility and remoteness of the Prince Edward Islands, South Africa, the Patagonian toothfish suffered large IUU fishing catches in the South African EEZ known as PEMI in the late 1990s. However, South Africa, together with other members of CCAMLR, have reduced the large-scale plunder of its Patagonian toothfish resources (Stop Illegal Fishing 2008). The 42 members (from 12 countries) of the COLTO initiative (Coalition of Legal Toothfish Operators) catch 90 % of global toothfish landings of which 60 % of are MSC certified. COLTO's presence in the Antarctic oceans has, together with the CCAMLR, reduced IUU toothfish catches within EEZs to ~ 0 % since 2005.
- ***South Africa and Namibia:*** MRAG & CapFish (2008) report that in recent years, only isolated incidents of IUU fishing by foreign-flagged longliners have occurred in South Africa and Namibia.

3.1.1.1.2 Domestic fishing vessels/divers

The best known and most important IUU activity in South Africa centres around IUU fishing for the lucrative abalone resource, which is accessed by divers along the south-west and south coasts. In some cases payment is in terms of drug precursors such as ATS takes place.

- There is widespread IUU fishing in the valuable inshore West Coast rock lobster resource using both legal and unlicensed fishing vessels.
- In the period 1987 to 1999 a well-publicised example of IUU fishing took place in the South African South coast rock lobster fishery. The investigation and prosecution of this operation followed special operations to inspect cold storage containers, coupled with the imposition of an effort control system which exposed the extent of underreporting. The director of the fishing company was convicted of 301 charges of bribery of fisheries inspectors (Sovacool and Siman-sovacool 2007), and then reached an out of court settlement in South Africa for ZAR 40 million (about $7 million at that time), but was subsequently arrested in the USA for smuggling. Following the prosecution of the company directors and owners and the cessation of IUU fishing in this sector, the CPUE recovered by 9 % per year over the next five years (Hauck and Kroese 2006).

In addition, a case for restitution under the US Lacey Act was launched. The case is significant in at least two respects, the first are the methods that were employed to estimate the scale of IUU fishing, the second are the methods employed to place a value on the impact of the IUU fishing (see OLRAC (2004a, 2004b)), and since this was the largest wildlife case ever tried by the US Department of Justice it is significant as a possible example for international legislation that is now being called for in certain quarters, i.e. for Lacey Act style legislation to add to other ongoing and envisioned measures to curb IUU fishing globally. Although IUU fishing for West Coast rock lobster has escalated alarmingly since that time, IUU fishing is not considered to be a problem in the highly industrial and capital intensive South Coast rock lobster fishery

- The extent of poaching for rock lobster and abalone in the Table Mountain National Park (South Africa) is significant (Brill and Raemaekers 2013).

3.1.1.2 Types of IUU fishing

- Types of IUU fishing in the West Coast rock lobster fishery include fishing at night from small craft, use of small craft (also known as bakkies) to pilfer from the nets of legal trap vessels(also known as chukkies which are vessels 10-15 metres in length with crew of 4 to 5 operating metal frame traps covered with fishing net mesh), at sea transactions and transhipments between the crew and illegal small craft operators, out and out illegal fishing from both licensed and unlicensed fishing vessels.
- In South Africa, illegal fishing is widespread in key and highly valuable inshore resources such as abalone and West Coast rock lobster, but not in the industrial trawl and purse seine fisheries.
- At the present time, in Namibia, the most important IUU fishing threats relate to unreported discards, and violations of coastal exclusion zones and piracy by licensed and unlicensed vessels (Stop Illegal Fishing 2008), including illegal border-crossings of pirate vessels from neighbouring EEZs or the high seas (Stop Illegal Fishing 2008).

3.1.1.3 Factors which aid and abet IUU fishing

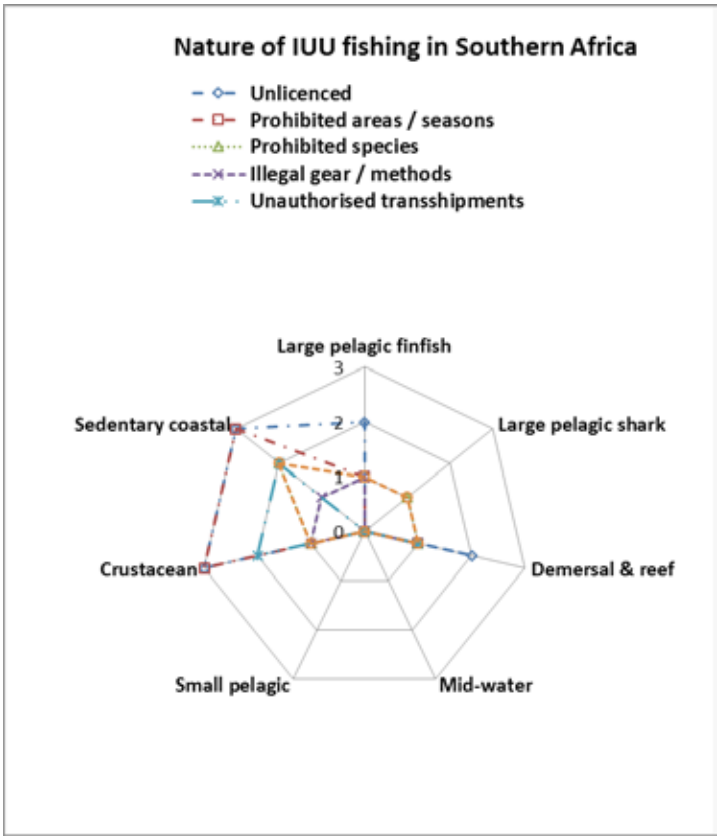
- Corrupt MCS officials, bribery, intimidations of MCS officials, community collusion, inefficient justice systems, poor investigative capacity.

3.1.2 Questionnaire results for Southern Africa about the nature of IUU fishing and types of vessels

a) Which IUU fishing issues are present in your region / country? Tick all that are applicable. b) Has IUU fishing increased or decreased in your country / region over the last 5 - 10 years?								
Part	**Fish Sector**	**Large pelagic finfish**	**Large pelagic shark**	**Demersal & reef**	**Mid-water**	**Small pelagic**	**Crustacean**	**Sedentary coastal**
a)	Unlicensed Foreign Vessels	2	2	2	1	1	1	1
	Industrial & semi-industrial licensed	2	3	2	1	1	2	1
	Artisanal fishers &/or vessels	2	1	1	1	1	4	4
b)	Increase/Decrease	-2	-1	-2			3	3

Vessels from which country / region are implicated most in IUU fishing in your region / country?								
Nature	Origin	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal
Foreign	Africa	1	1	2	1	1	3	3
	Asia	3	1					
FOC	Africa	1	1					

What is the nature of IUU fishing in your country / region? Tick all that are applicable.							
Nature	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal
Unlicenced	2		2			3	3
Prohibited areas / seasons	1		1			3	3
Prohibited species		1	1			1	2
Illegal gear / methods	1		1			1	1
Unauthorised trans-shipments			1			2	2
Non-compliance with license	1	1	1			1	2



3.1.3 Eastern Africa

3.1.3.1 Origin of vessels

3.1.3.1.1 Vessels of foreign non-African origin

- The Mauritian fishery sector comprises industrial, semi-industrial and artisanal fisheries; with tuna contributing the most industrial value (Stop Illegal Fishing 2008). Poaching from unlicensed foreign vessels and illegal transhipment of tuna catches at sea in order to conceal the tuna's origin are common IUU issues (Stop Illegal Fishing 2008) and compromises the economic and social benefits that a well-managed fishery sector could deliver (Stop Illegal Fishing 2008).
- Estimates by the High Seas Task Force (HSTF) are that there were (circa 2005 and 2006) "700 foreign-owned vessels fully engaged in unlicensed fishing in Somali waters" (High Seas Task Force 2006 p. 81). These foreign fishing vessels are reported to originate from Kenya, Pakistan, Saudi Arabia, Sri Lanka, Yemen Belize, France, Honduras, Japan, South Korea, Spain and Taiwan (Jennings 2001).
- In Somalia Foreign fishers conduct destructive fishing practices, putting local fish stock at risk, and chasing local fishermen away from productive fishing grounds using high-pressure or boiling water hoses and firearms (Jennings 2001, Mwangura 2005, Lehr and Lehmann 2006).
- Chinese tuna longliners are known to fish in the Somali EEZ without permission (Somalia Federal Ministry of Fisheries and Marine Resources 2015); four Korean trawlers are active along the coast of Somalia without licenses, and use ports in Oman, the U.A.E. and Kenya (Somalia Federal Ministry of Fisheries and Marine Resources 2015).
- Local groups in Somalia claim that Yemeni vessels are involved in illegal fishing on a continuous basis (Potgieter and Schofield 2010).
- There are gill-netters operating in Somali waters, mostly from Iran (see Federal Ministry of Fisheries and Marine Resources, 2015).
- Illegal trawlers owned by EU and Asian fishing companies, including those from Italy, France, Spain, Greece, Russia, Britain, Ukraine, Japan, South Korea, Taiwan, India, Yemen, Egypt and many others are present in Somali waters (Waldo 2009).
- According to UN reports, high-seas trawlers from countries such as South Korea, Japan and Spain have operated along the Somali coast, often illegally and without licenses, flying flags of convenience which further encourage IUU in the state (Tharoor 2009). Furthermore, some are fishing with forged documents, do not respect the minimum fishing distance (24 nautical miles), and do not report any data to authorities (Somalia Federal Ministry of Fisheries and Marine Resources 2015). These activities, especially those by trawlers, are assumed to be having a substantial negative impacts on the demersal ecosystem, and other fish and crustaceans, upon which artisanal fishers rely.
- In 2005, more than 800 IUUs fishing vessels were in Somali waters at one time.
- In Mauritius, Madagascar, Mozambique, and Tanzania, unreported fishing by Asian longline vessels is common (Stop Illegal Fishing 2008).
- Tuna is particularly problematic in East African Coastal & Island States, such as Kenya, Tanzania, Somalia and Seychelles, because IUU vessels from distant water fishing nations (DWFNs) are operating in their EEZ (MRAG 2005b), targeting tunas and billfishes.
- Stop Illegal Fishing (2008) reported that approximately 100 (mostly foreign) IUU vessels are (were circa 2008) operating in the Mozambican channel, contributing high levels of poaching, unregulated transhipment and misreporting of catch levels for tuna and shrimp.
- In Mozambique shrimp fisheries are being targeted by industrial DWF IUU fleets (MRAG 2005b). Illegal imports of boats, fraudulent licensing, unauthorised fishing, and violation of licence validity,

are the most common infractions in Mozambique according to Lopes & Pinto (2001). The majority of illegal boat owners are foreigners and nationals who partner with such foreigners (Lopes and Pinto 2001). Illegal marine fishing in Mozambique by foreigners is widely acknowledged but is not reflected in official catch statistics. The areas which are most affected at Cabo Delgado (Palma and Mocmboa da Praia), Inhambane (in the Bazaruto area) and Nampula (Angoche and Mussoril) - it is assumed that the focus of these operations are the highly-migratory tuna species (Lopes and Pinto 2001).

- Stop Illegal Fishing (2008) reported that there are documented incursions of non-licensed Asian and European tuna fleets into the Tanzanian EEZ. Other commentators also report the occurrence of IUU fishing in the Tanzanian EEZ, especially by DWFs (The World Bank 2008).
- IUU fishing by Asian longline class-type vessels is known to occur in Mauritius, Madagascar, Mozambique and Tanzania (MRAG and CapFish 2008).
- Infractions by non-licensed foreign vessels have decreased in recent years even though it is well known that there is little compliance with the ban on discards and on the use of illegal gear (Pramod et al. 2008).

3.1.3.1.2 Vessels of foreign African origin

- In a number of cases IUU fishing is characterised by border hopping, for example Kenyan shrimp trawlers fishing in Somali waters (MRAG 2005b).
- In Mozambique, unlicensed vessels (or vessels licensed in neighbouring States) and some licenced vessels have been found to be guilty of trawling in closed areas, particularly the nearshore zones demarcated for artisanal fishermen (MRAG 2005b).

3.1.3.1.3 Domestic IUU fishing vessels

- The Mozambique fishery sector consists primarily of an industrial and semi-industrial sector, with over 70 % of the active fleet targeting shrimp (Stop Illegal Fishing 2008). Approximately 85 % of all fisheries exports by value are derived from the industrial shallow-water shrimp fisheries (Lopes and Pinto 2001). Mozambique's artisanal fisheries are regarded as effectively "open-access" (Afonso 2006) with numerous offenses being perpetrated. As summarised by Lux Development (2005: p11) "artisanal fisheries are operated generally without management, landings data from this sector are incomplete, and there is not enough control in this sector." Mozambique has a history of high under-reporting of catches, mainly in the artisanal sector. Artisanal fishermen often fish during closed seasons and in protected areas (Stop Illegal Fishing 2008).
- In Tanzania, artisanal fishermen face restrictions of closed areas and gear, but not restrictions on time, catches, or capacity (Cunningham and Bodiguel 2006). Illegal gear use in IEZs and unlicensed border-crossings are persistent problems (Stop Illegal Fishing 2008).
- Madagascar not only faces problems in its difficult-to-patrol DWF areas, but food insecurity is a significant motivation for many artisanal fishers to turn to illegal fishing practices. The latter are increasing due to negative economic, social conditions, and environmental impacts (Stop Illegal Fishing 2008).

3.1.3.2 Industrial fishing vessels intruding in zones reserved for artisanal fishers

- Exploitation of fishing grounds reserved for small-scale fishers in Madagascar is common; e.g. > 66 % of the industrial shrimp trawler catches in 1998 were made within the two-mile zone which, by law, is reserved exclusively for small scale fishers (Drammeh 2000).

4.1.3.3 Types of IUU fishing

- As a rule, artisanal catches are poorly reported and unregulated, and minor offences are seldom recorded, or maintained or aggregated for use in MCS operations (MRAG and CapFish 2008). According to (MRAG 2005b, MRAG and CapFish 2008) the most frequent violations in artisanal fisheries are gear violations, fishing during closed seasons or within closed areas and size and species violations. In certain areas particularly destructive prohibited fishing methods are used. These include the use of dynamite (Wells 2009, Slade and Kalangahe 2015) and poison (Neuwinger 2004). In contrast to profit-seeking in the industrial sector, many artisanal offences are often driven by necessity and a lack of alternative livelihoods or food sources.
- Poaching and Illegal transhipment of tuna catches at sea are common in Mauritius.
- Gill-netters with non-specific mesh sizes target pelagic resources (e.g. tuna; billfish) and overturn high rates of bycatch, in particular marine mammals, turtles and sharks, some of which are protected under Somali law (Somalia Federal Ministry of Fisheries and Marine Resources 2015). The gill-netters, which are mostly Iranian in origin, are regularly observed in the EEZ of Somalia along the coast from Puntland to Jubbaland, and often close inshore (Somalia Federal Ministry of Fisheries and Marine Resources 2015).
- According to UN reports, high-seas trawlers from foreign countries are fishing with forged documents, are not respecting minimum fishing distance (24 nautical miles), and are not reporting any data to the authorities (Somalia Federal Ministry of Fisheries and Marine Resources 2015).
- In a number of cases IUU fishing is characterised by border hopping, for example Kenyan shrimp trawlers fishing in Somali waters (MRAG 2005b).
- In Tanzania, dynamite fishing and coral mining in marine fisheries not only degrades habitat, but are also problematic for small scale fisheries (Stop Illegal Fishing 2008).

3.1.3.4 Factors which aid and abet IUU fishing

- In Somalia, illegal trawling is thought to have fed the piracy problem, as in its infancy Somalia piracy, which seized trawlers without licenses, would often receive quick ransom payments as boat owners and companies backing those vessels wanted to evade attention for their violations of international maritime law (Tharoor 2009).
- Since the collapse of the Somali regime in 1991 (Waldo 2009), the legal ambiguity of EEZs and a lack of government regulation has led to high levels of illegal fishing (Somalia Federal Ministry of Fisheries and Marine Resources 2015).
- In 2007, piracy activities along the coast of Somalia drastically increased and permeated into the western Indian Ocean, forcing foreign fishing vessels far from the coast and outside waters under the jurisdiction of Somalia, and thereby resulted in a significant reduction in foreign fleets present in the area (Somalia Federal Ministry of Fisheries and Marine Resources 2015).
- However, since 2008, the implementation of several counter-piracy activities by foreign navy forces has reduced the number of pirate attacks in the Western Indian Ocean (Somalia Federal Ministry of Fisheries and Marine Resources 2015). Between 2013 and 2014, incident reports decreased from 30 incidents to only seven, both years with zero hijacked vessels (Somalia Federal Ministry of Fisheries and Marine Resources 2015). Due to these piracy reduction activities since 2012, fishing activities from foreign fleets resumed in the Somali basin, though associated with it are some unlicensed/non-compliant vessels within the Somali EEZ (Somalia Federal Ministry of Fisheries and Marine Resources 2015).

3.1.3.5 Factors which help in the fight against IUU fishing

- May 2014 saw Somalia become the 32nd Member of the Indian Ocean Tuna Commission (IOTC), with the goal of fully participating in the regional management of tuna and tuna-like species stocks in the Indian Ocean (Somalia Federal Ministry of Fisheries and Marine Resources 2015). A month later, Somalia proclaimed its EEZ under the terms of UNCLOS (Somalia Federal Ministry of Fisheries and Marine Resources 2015).
- In Somalia, artisanal communities are threatened by large-scale illegal and foreign fishing (Potgieter and Schofield 2010).

3.1.3.6 Other environmental impacts of IUU fishing

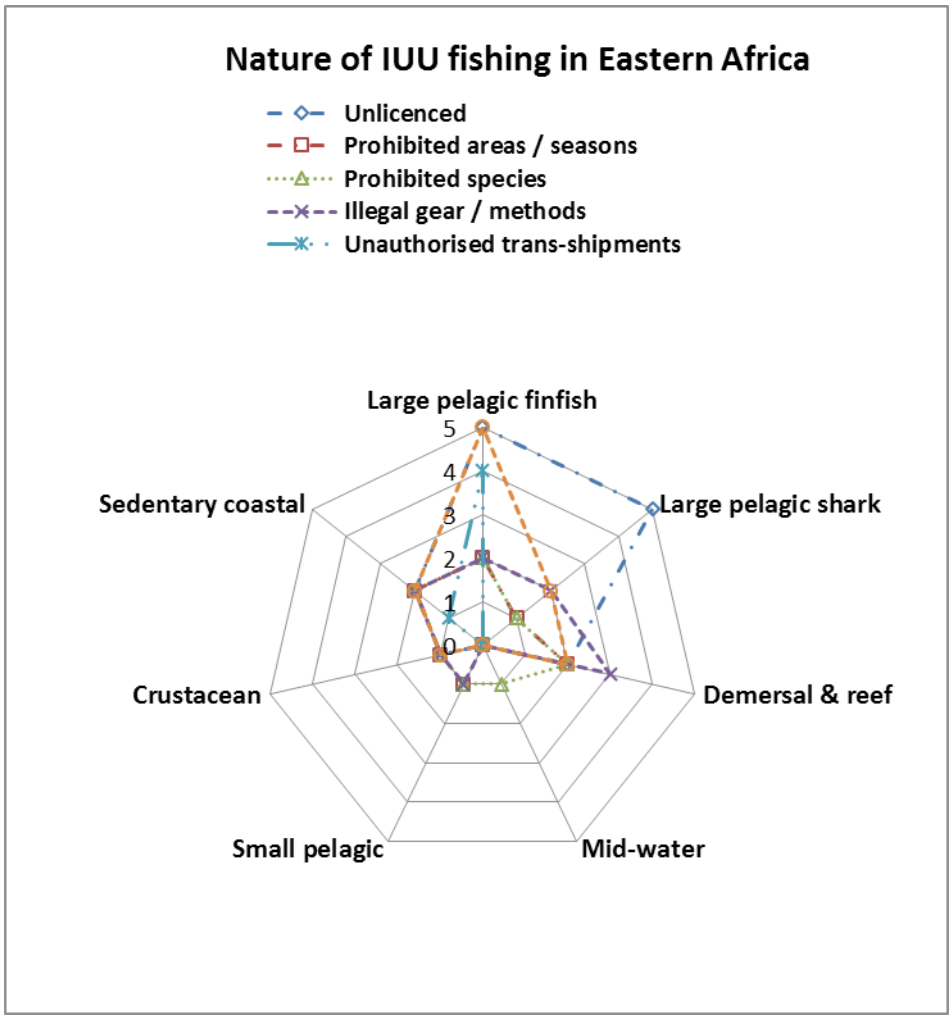
- In addition to illegal fishing, there have also been reports by local fishermen of foreign ships dumping toxic and nuclear waste (e.g. radioactive uranium; heavy metals such as cadmium and mercury; hospital waste) off Somalia's shores (UNEP 2005, Tharoor 2009).

3.1.4 Questionnaire results for Eastern Africa about the nature of IUU fishing and types of vessels

a) Which IUU fishing issues are present in your region / country? Tick all that are applicable. b) Has IUU fishing increased or decreased in your country / region over the last 5 - 10 years?								
Part	Fish Sector	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal
a)	Unlicensed Foreign Vessels	6	5	3	4	1	3	1
	Industrial & semi-industrial licensed	2	2	2	1	2	2	1
	Artisanal fishers &/or vessels	4	3	4	2	2	2	4
b)	Increase/Decrease	-2	-3	-1	1	0	-2	-3

Vessels from which country / region are implicated most in IUU fishing in your region / country?								
Nature	Origin	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal
Foreign	Africa	0	0	1	0	0	0	2
	Asia	9	5	3	0	1	3	0
	Europe	2	3	0	0	0	0	0
FOC	Africa	4	2	3	0	0	2	1
	Asia	11	5	3	0	1	0	0
	Europe	3	0	0	0	0	0	0
	North America	1	1	0	0	0	0	0
	Australia	0	0	0	1	0	0	0

What is the nature of IUU fishing in your country / region? Tick all that are applicable.							
Nature	**Large pelagic finfish**	**Large pelagic shark**	**Demersal & reef**	**Mid-water**	**Small pelagic**	**Crustacean**	**Sedentary coastal**
Unlicenced	5	5	2	0	0	1	2
Prohibited areas / seasons	2	1	2	0	1	1	2
Prohibited species	2	1	2	1	1	1	2
Illegal gear / methods	2	2	3	0	1	1	2
Unauthorised trans-shipments	4	0	0	0	0	0	1
Non-compliance with license	5	2	2	0	0	1	2



3.1.5 Northern Africa

3.1.5.1 Origin of vessels

3.1.5.1.1 Unknown

- IUU fishing cases have been consistently reported for the past five years, in Egypt (Öztürk 2015). IUU trawlers and purse seine vessels target shrimp from June to October (Öztürk 2015).

3.1.5.1.2 Vessels of foreign non-African origin

- Recent reports of foreign fishing fleets – one of Chinese origin – targeting bluefin tuna have been received (Jolly 2012).
- According to M. A. El Wahed (Egyptian General Authority for Fish Resources Development), the two main IUU problems facing Egyptian fisheries concern unlicensed and foreign fishing (GFCM 2015).
- According to A. Abukhder (Libyan General Authority for Marine Wealth), IUU fishing mainly relates to the activities of international vessels, i.e. trawlers targeting demersal and pelagic species in particular (GFCM 2015).

3.1.5.1.3 Vessels of foreign African origin

- Illegal fishing in Algerian waters is best exemplified by three Turkish trawlers detained for illegally fishing more than 200 tonnes of tuna in 2009 (Stop Illegal Fishing 2009).
- Tunisian and foreign vessels have been reported in recent years to have engaged in IUU fishing in the Gulf of Gabes, predominantly by small boats in summer targeting benthic species.

3.1.5.1.4 Domestic IUU fishing vessels

- Illegal fishing in Algerian waters is best exemplified by Algerian vessel detained for illegally fishing more than 200 tonnes of tuna in 2009 (Stop Illegal Fishing 2009).
- Algeria: Fish size regulations in Algeria have been legislated since 1994 (Cacaud, 2002; Belala 2004). Subsequently, high-value demersal species of sub-legal size, mainly surmulets (Mullus barbatus and M. surmuletus) and hake, (Merluccius merluccius) have been targeted by trawlers and are often sold illegally (Belhabib et al. 2015d).

3.1.5.2 Types of vessels

- Trawling represents the most commonly-used fishing method in Morocco (Öztürk 2015). Infractions commonly concern sparid fish; octopus; and shrimps and cuttlefish during their reproduction period and within the 3 nautical mile zone (Öztürk 2015).

3.1.5.3 Types of IUU fishing

- According to M. A. El Wahed (Egyptian General Authority for Fish Resources Development), the two main IUU problems facing Egyptian fisheries concern unlicensed and foreign fishing (GFCM 2015).
- Fish size regulations in Algeria have been legislated since 1994 (Cacaud 2002, Belala 2004). Subsequently, high-value demersal species of sub-legal size, mainly surmulets (Mullus barbatus and M. surmuletus) and hake, (Merluccius merluccius) have been targeted by trawlers and are often sold illegally (Belhabib et al. 2015d).
- Between 2000 and 2009, illegal bluefin tuna fishing in Algerian waters was reported (WWF 2006, Bregazzi 2007, WWF Mediterranean and WWF Italy 2008); with unreported catches of 2 728 tonnes (Belhabib et al. 2015d).

- In Algeria, IUU fishing infractions are concentrated during the reproductive period for many species between May August, and during the closed season for swordfish, i.e. between October and November (Öztürk 2015).
- Although artisanal catches in Libya are estimated to be negligible (Crawford et al. 2011), according to (Belhabib et al. 2015d) artisanal fisheries catches in Algeria are underestimated.
- IUU fishing by Libyan-flagged vessels has occurred since the 1990s, (Öztürk 2015).
- Large- and small-scale commercial catches are not reliably reported by official statistics (Khalfallah et al. 2015). By 2000, unreported catches increased strongly due to uncontrolled fishing associated with high discard levels (Crawford et al. 2011).

3.1.5.4 Factors which aid and abet IUU fishing

- There is no uniform legal framework for all riparian States at present, and the General Fisheries Commission for the Mediterranean (GFCM) remains the only organisation with the potential to manage and regulate IUU fishing in the entire Mediterranean Sea (Öztürk 2015).

3.1.5.5 Factors which help in the fight against IUU fishing

- At a recent GFCM meeting, the market dimension of IUU fishing was emphasised (GFCM 2015), focusing on efficient control systems through inspections, port State measures and satellite applications, and the illegal trafficking of fishery products (GFCM 2015).

3.1.6 Questionnaire results for Northern Africa about the nature of IUU fishing and types of vessels

a) Which IUU fishing issues are present in your region / country? Tick all that are applicable. b) Has IUU fishing increased or decreased in your country / region over the last 5 - 10 years?								
Part	Fish Sector	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal
a)	Unlicensed Foreign Vessels	0	0	1	0	0	1	0
	Industrial & semi-industrial licensed	1	0	1	0	1	1	1
	Artisanal fishers &/or vessels	0	0	0	0	0	0	1
b)	Increase/Decrease	1	0	1	0	1	1	1

Vessels from which country / region are implicated most in IUU fishing in your region / country?								
Nature	Origin	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal
Foreign	Africa	1	0	0	0	0	0	1
	Africa	1	0	0	0	0	0	0
	Europe	2	1	0	0	0	0	0

What is the nature of IUU fishing in your country / region? Tick all that are applicable.							
Nature	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal
Unlicenced	1	0	0	0	0	0	0
Prohibited areas / seasons	0	0	1	0	1	1	1
Prohibited species	0	0	1	0	1	1	0
Illegal gear / methods	0	0	1	0	0	1	1

3.1.7 Western Africa

3.1.7.1 Origin of vessels.

3.1.7.1.1 Unknown or all types of origin

- Senegal's EEZ represents one of the most industrially-exploited fishing areas in West Africa, and includes foreign fleets and fleets reflagged to Senegal (Belhabib et al., 2014). These fleets comprise trawlers, purse seiners, pole and line vessels and sardine/small pelagic vessels. The two main infractions recorded in this fishery are the presence of trawlers in the area which is exclusively reserved for artisanal fisheries - 6-7 miles from the coast (42.8 % of infractions), and tampering with fishing nets (22 %) (MRAG 2010).
- The marine resources of Guinea-Bissau are exploited by both national and foreign fleets, artisanal and industrial fleets, and IUU fishing is linked to all of these vessel types. IUU fishing activity includes gear and area violations, and unlicensed fishing (MRAG 2010).

3.1.7.1.2 Vessels of foreign non-African origin.

- A recent appraisal of the effects of Chinese Distant Water Fleets (DWFs) in West Africa by Greenpeace (2015) generated a non-exhaustive list of 183 documented IUU cases in six West African countries (Gambia, Guinea, Guinea-Bissau, Mauritania, Senegal and Sierra Leone) during the periods of from 2000 to 2006 and 2011 to 2013, of which 41 % were for fishing in prohibited areas, 38 % for fishing without a valid licence and 14 % for illegal mesh size use (Greenpeace 2015). Moreover, 31 % of these vessels have committed IUU more than twice during the period. New IUU cases documented as recently (2014) showed that the problems are chronic (Greenpeace 2015).
- During the last five years, 15 licensed shrimp and finfish bottom trawlers (largely Chinese and Korean) were convicted for operating within the IEZ.
- In Sierra Leone, several reports exist of foreign unlicensed vessels, being arrested for carrying out fishing operations close to shore (MRAG 2010).
- Illegal and unauthorised foreign fishermen in Nigeria have been reported in the last two decades, with some vessels flagged from Italy, Greece, Russia, Japan, Cameroon and Togo (MRAG and CapFish 2008). These vessels are larger than recommended for fishing in Nigerian waters, and make use of unapproved and sophisticated fishing gears (MRAG and CapFish 2008).
-

- In addition to heavy pressure from officially sanctioned foreign vessels, West Africa is vulnerable to unauthorised foreign vessels carrying out IUU fishing (Alder and Sumaila 2004), e.g. shrimp fisheries (e.g. in Guinea, Sierra Leone, and Liberia) (MRAG 2005b).
- Another infraction of concern to the eradication of IUU in the industrial sector is false nationalisation, whereby foreign vessels register as Mauritanian, thus qualifying for the reduced national licence fees for fishing, but do not complete the re-registration and reflagging process, e.g. 109 Chinese vessels (MRAG 2010).
- Greenpeace (2015) recently reported that at least 74 fishing vessels owned by four Chinese DWF companies have been exposed for fishing in illegal areas and falsifying their fishing vessels' gross tonnage (GT), i.e. 82 cases of IUU and GT fraud in Senegal, Guinea, Guinea-Bissau and Ghana.
- Almost 23 % of the 52 Chinese vessels observed in the waters of Guinea, by Greenpeace Africa, were involved in IUU fishing (Greenpeace 2015). Moreover, 74 out of 92 Chinese fishing vessels observed by the Greenpeace MY Esperanza crew in the area were found to have their Automatic Identification System (AIS) devices either switched off or not installed (Greenpeace 2015).

3.1.7.1.3 Vessels of foreign African origin

- In Mauritania illegal (unlicensed) fishing occurring in the artisanal sector stems mainly from Senegalese vessels crossing the border into Mauritania and fishing without authorisation under the Senegal-Mauritania agreement (MRAG 2010). The artisanal fleet comprises 4 022 Mauritanian and 1000 Senegalese pirogues that target small pelagic, demersal fish, octopus and crustaceans (MRAG 2010). The Mauritania–Senegal agreement for artisanal fishing provides for 300 Senegalese pirogues to fish small pelagics in Mauritanian waters (MRAG 2010). Therefore 700 Senegalese vessels are fishing illegally (MRAG 2010). The chief infractions by the artisanal fleet are: fictitious registration or lack of registration and not paying access fees; fishing without authorisation (unlicensed), including from the southern border; fishing in marine protected areas (MPAs) mainly the Parque Nacional de Banc d´Arguin (PNBA); and transhipment of catches at sea (MRAG 2010).
- In The Gambia, the artisanal fishery is dominated by foreign fishermen from Senegal and Ghana, and is an open access fishery and therefore largely unregulated (MRAG 2010).
- Unlicensed artisanal vessels in Guinea-Bissau target valuable pelagic and demersal fish species. Large numbers of highly efficient artisanal fishing boats coming from neighbouring countries, particularly Senegal, are having the greatest impact (MRAG 2010).
- In Guinea-Bissau fishermen trans-ship their most valuable catch to foreign trawlers in exchange for food, fuel and money (MRAG 2010).
- The artisanal fishery in Sierra Leone is affected by large numbers of unlicensed vessels illegally fishing in inshore waters originating from other countries in the sub-Region, particularly from Guinea (MRAG 2010). From previous accounts (see Djafal 2007) the Senegalese illegal artisanal fleet induce losses in the Sierra Leone artisanal fishery sector.
- In Guinea and Sierra Leone, unlicensed vessels (or vessels licensed in neighbouring States) and some licenced vessels have been found guilty of trawling in prohibited zones such as near shore zones demarcated for artisanal fishermen (MRAG 2005b).

3.1.7.1.4 Domestic IUU fishing vessels

- The industrial illegal fishing problems reported for Guinea-Bissau are mirrored in Guinea (MRAG 2005b), particularly w.r.t. the use of illegal gear in the IEZ (MRAG and CapFish 2008). In Ghana, the enforcement of its EEZ and its associated fisheries laws are weak (Atta-Mills et al. 2004b)

and Ghana-flagged vessels, including the commercial tuna fleet, have been implicated in IUU activities (Africa Progress Panel 2014).

- The artisanal fishery in Sierra Leone is affected by large numbers of unlicensed vessels illegally fishing in inshore waters originating from other countries in the sub-Region, particularly from Guinea (MRAG 2010). From previous accounts (see Djafal (2007)) the Senegalese illegal artisanal fleet induce losses in the Sierra Leone artisanal fishery sector.

3.1.7.2 Industrial fishing vessels intruding in zones reserved for artisanal fishers

- Senegal's EEZ represents one of the most industrially-exploited fishing areas in West Africa, and includes foreign fleets and fleets reflagged to Senegal (Belhabib et al. 2014a). These fleets comprise trawlers, purse seiners, pole and line vessels and sardine/small pelagic vessels. The two main infractions recorded in this fishery are the presence of trawlers in the area which is exclusively reserved for artisanal fisheries - 6-7 miles from the coast (42.8 % of infractions), and tampering with fishing nets (22 %) (MRAG 2010).
- In Guinea and Sierra Leone, unlicensed vessels (or vessels licensed in neighbouring States) and some licenced vessels have been found guilty of trawling in prohibited zones such as near shore zones demarcated for artisanal fishermen (MRAG 2005b).

3.1.7.3 Types of IUU fishing

- Catches within artisanal vessels are often poorly reported and unregulated, and if minor offences are detected these are seldom recorded, maintained or aggregated in a usable form (MRAG and CapFish 2008). Common violations in artisanal fisheries are gear violations, fishing during closed seasons or within closed areas and size and species violations (MRAG 2005b, MRAG and CapFish 2008). In addition, prohibited and destructive fishing methods such as dynamite (Wells 2009, Slade and Kalangahe 2015) and poison (Neuwinger 2004) fishing are especially problematic (MRAG and CapFish 2008). In contrast to the profit-seeking industrial sector, many artisanal offences are often driven by necessity and a lack of alternative livelihoods or food sources.
- In Guinea-Bissau, unlicensed shrimp trawlers catch a wide range of highly valuable species (MRAG 2010). Fishing vessels are known to tranship their catch to larger freezer vessels, which then transport the fish products to be sold in distant markets, therefore decreasing any direct or added value benefit from the landing of these fish in the relevant coastal state (MRAG 2010). In addition, illegal fishing and discarding at sea prevents Guinea-Bissau from realising the benefit from these additional catches.
- In Mauritania, the industrial cephalopod, shrimp and pelagic fisheries offences are mainly related to fishing in restricted areas, capture of juveniles, use of illegal gear and false catch declarations. Another infraction of concern to the eradication of IUU in the industrial sector is false nationalisation, whereby foreign vessels register as Mauritanian, thus qualifying for the reduced national licence fees for fishing, but do not complete the re-registration and reflagging process, e.g. 109 Chinese vessels (MRAG 2010).
- 74 out of 92 Chinese fishing vessels observed by the Greenpeace MY Esperanza crew in the area were found to have their Automatic Identification System (AIS) devices either switched off or not installed (Greenpeace 2015).
- In Gambia, illegal fishing activities affect predominantly the demersal fish stocks which are subject to overfishing (MRAG 2010). Illegal activity is relatively high in both licensed vessels and unlicensed vessels, e.g. use of illegal mesh size, double layered codends, fishing in closed areas and unauthorised transhipment (MRAG 2010). However, whilst violations are numerous, arrests

are low due to poor MCS (MRAG 2010).

- Senegal's EEZ represents one of the most industrially-exploited fishing areas in West Africa, and includes foreign fleets and fleets reflagged to Senegal (Belhabib et al. 2014a). These fleets comprise trawlers, purse seiners, pole and line vessels and sardine/small pelagic vessels. The two main infractions recorded in this fishery are the presence of trawlers in the area which is exclusively reserved for artisanal fisheries - 6-7 miles from the coast (42.8 % of infractions), and tampering with fishing nets (22 %) (MRAG 2010).
- In Guinea-Bissau IUU fishing activity includes gear and area violations, and unlicensed fishing (MRAG 2010).
- The most frequent offences committed in the Senegalese fishery are the use of monofilament nets which are prohibited in terms of the Fisheries Code (MRAG 2010).
- Unlicensed artisanal vessels in Guinea-Bissau target valuable pelagic and demersal fish species. Large numbers of highly efficient artisanal fishing boats coming from neighbouring countries, particularly Senegal, are having the greatest impact (MRAG 2010).
- In Guinea-Bissau fishermen trans-ship their most valuable catch to foreign trawlers in exchange for food, fuel and money (MRAG 2010).
- The Senegalese artisanal shrimp fishery is subject to a number of management measures including regulated mesh size and temporal fishery closures (i.e. biological rest period). In the Senegalese artisanal shrimp fishery a market for juvenile small fish and limited logistic capacity and manpower for monitoring, have resulted in the use of illegal nets (i.e. 8 mm mesh size instead of the legally authorised 12 mm mesh size)(CRODT 2008, MRAG 2010).
- The chief infractions In the Senegalese artisanal shrimp fishery are the use of non-compliant mesh sizes (37.9 %), landing of juveniles (22.4 %), and non-compliance with closed areas (17.2 %).
- In Sierra Leone, not all coastal areas are open to fishing, i.e. the IEZ such as the Yawri Bay breeding ground and nursery for both pelagic and demersal species are closed to fishing. However, legal vessels engage in illegal activities fish here, sometimes with gear violations.
- Confident that as a rule they have no reason to fear any checks by fisheries control agencies, some IUU vessels fish directly off the coast – in some cases at a distance of just one kilometre from the shore.
- Destructive small-mesh nets are used illegally in West Africa and other regions (MRAG 2010).

3.1.7.4 Factors which aid and abet IUU fishing

- In Western African states, from Guinea to Angola, shrimp and groundfish make up the most important marine resources (MRAG 2005b), increasing their vulnerability to IUU. This is further exacerbated by the increased potential for conflict with artisanal fisheries who fish inshore (MRAG 2005b). Whereas licensed vessels in some countries are known to provide artisanal fishers access to substantial shrimp discards, IUU vessels do not and the discarded shrimp are hence lost to the artisanal fishers (MRAG 2005b).
- Confident that as a rule they have no reason to fear any checks by fisheries control agencies, some IUU vessels fish directly off the coast – in some cases at a distance of just one kilometre from the shore.
- The Sub-Regional Fisheries Commission (SRFC), comprising seven member states in West Africa (Cape Verde, Gambia, Guinea, Guinea-Bissau, Mauritania, Senegal and Sierra Leone), has produced a detailed list of the various causes of IUU fishing.

- The Sub-Regional Fisheries Commission (SRFC) concludes that some IUU vessels off West Africa are in operation 365 days of the year, putting massive pressure on fish stocks. The refrigerated ships then make for ports in countries with lax controls, "ports of convenience", enabling them to land their catches unhindered. The practice of using a flag of convenience (FOC) also makes it easier to engage in IUU fishing activity. Instead of registering the ships in the shipping company's home state, IUU fishers operate their vessels under the flag of another state, such as Belize, Liberia or Panama, with less stringent regulations or ineffective control over the operations of its flagged vessels. Switching to a foreign register makes it possible for fishing vessels to circumvent restrictive employment legislation and minimum wage provisions in their home country, allowing shipping companies to pay lower wages and social insurance contributions than if the vessel were registered in Germany, for example. Furthermore, fisheries legislation in "flag-of-convenience" states is often extremely lax. These countries rarely, if ever, inspect their vessels for illegal catches. Monitoring of onboard working conditions is also inadequate, and conditions are correspondingly poor. The fishermen work for low wages on vessels whose standards of accommodation are spartan in the extreme, and which rarely comply with the current safety standards applicable to merchant shipping under the International Convention for the Safety of Life at Sea (SOLAS regulations). The SOLAS Convention contains exact details of equipment that must be available to ensure safety on board.
- In Gambia, whilst violations are numerous, arrests are low due to poor MCS (MRAG 2010).
- In Ghana, the enforcement of its EEZ and its associated fisheries laws are weak (Atta-Mills et al. 2004b, Africa Progress Panel 2014).
- In West Africa, harmful subsidies promoting overcapacity and a lack of alternative livelihoods worsen the IUU fishing situation (Österblom et al. 2010).
- MRAG (MRAG 2010) note that artisanal and coastal fishery infractions are dealt with separately to industrial infractions.
- Senegalese artisanal coastal pelagic fisheries are not subject to any land surveillance for mesh sizes or for the size of individual landings (MRAG 2010). Sea-based patrols operate exclusively for monitoring of the industrial fisheries industry, and therefore no infractions were officially recorded for the artisanal small pelagic fishery (MRAG 2010).
- In Gambia, almost no arrests or prosecutions have been made due to inadequate legislation and MCS in the artisanal fisheries sector.
- The high demand from fishmeal manufacturers in Dakar and traders from countries adjacent to the Gulf of Guinea (Guinea, Benin, Sierra Leone and other countries) has fuelled IUU fishing in the Senegalese artisanal shrimp fishery (MRAG 2010).

3.1.7.5 Factors which help in the fight against IUU fishing

- The marine resources of Guinea-Bissau are exploited by both national and foreign fleets, artisanal and industrial fleets. IUU fishing activity includes gear and area violations, and unlicensed fishing (MRAG 2010). It is interesting to note that a large proportion of the valuable fish exported to the European market originates from Guinea-Bissau waters rather than from Senegal, contrary to official reports (MRAG 2010).

3.1.7.6 Other environmental impacts of IUU fishing

- According to the World Ocean Report (WOR 2), IUU fishing is a catastrophe for the region's already severely overexploited fish stocks.

- The Sub-Regional Fisheries Commission (SRFC) concludes that some IUU vessels off West Africa are in operation 365 days of the year, putting massive pressure on fish stocks

3.1.7.7 Economic impacts

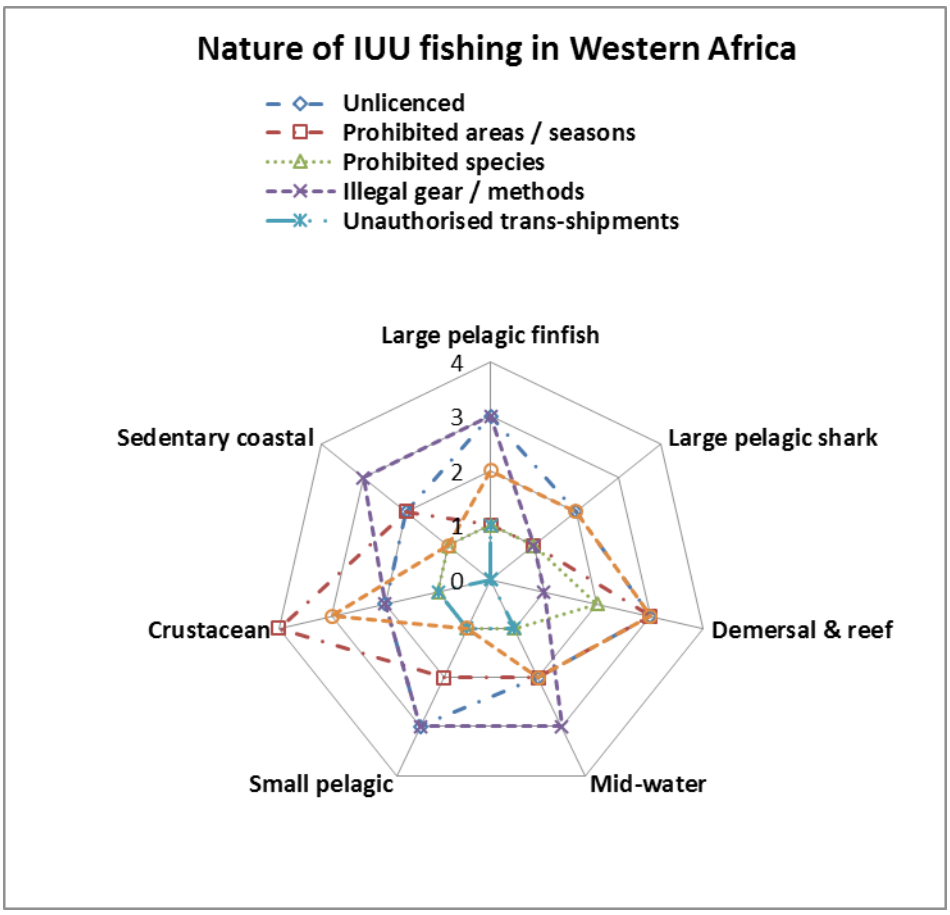
- The implications of illegal fishing by the artisanal fleet in Guinea-Bissau are that the catch with the highest value is generally landed in Senegal and exported to major markets at significantly higher prices and therefore the direct value added goes to Senegal rather than to Guinea-Bissau (MRAG 2010).

3.1.8 Questionnaire results for Western Africa about the nature of IUU fishing and types of vessels

a) Which IUU fishing issues are present in your region / country? Tick all that are applicable. b) Has IUU fishing increased or decreased in your country / region over the last 5 - 10 years?								
Part	Fish Sector	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal
a)	Unlicensed Foreign Vessels	3	2	3	3	3	4	2
	Industrial & semi-industrial licensed	2	1	3	2	2	3	1
	Artisanal fishers &/or vessels	1	1	2	1	3	1	1
b)	Increase/Decrease	-2	-1	0	2	2	2	2

Vessels from which country / region are implicated most in IUU fishing in your region / country?								
Nature	Origin	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal
Foreign	Africa	2	2	2	1	2	2	2
	Europe	2	1	0	0	1	0	0
FOC	Africa	1	0	0	0	0	0	0
	Asia	3	2	2	2	2	2	2
	Europe	2	1	0	0	0	0	0
	North America	0	0	0	2	2	0	0

What is the nature of IUU fishing in your country / region? Tick all that are applicable.							
Nature	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal
Unlicenced	3	2	3	2	3	2	2
Prohibited areas / seasons	1	1	3	2	2	4	2
Prohibited species	1	1	2	1	1	1	1
Illegal gear / methods	3	1	1	3	3	2	3
Unauthorised trans-shipments	1	0	0	1	1	1	0
Non-compliance with license	2	2	3	2	1	3	1



3.1.9 Central Africa

3.1.9.1 Origin of vessels

3.1.9.1.1 Unknown or not reported in source

- Illegal fishing is considered common yet only partly controlled in Gabon (Belhabib 2015a). Previous research reported on industrial trawlers fishing in and around Mayumba NP during the 2005 - 2006 season, and in the coastal waters around The Gamba, Loango south, and St Catherine (Parnell et al. 2007).

3.1.9.1.2 Vessels of foreign non-African origin

- IUU fishing by Asian longline class-type vessels are known to operate in Angola (MRAG and CapFish 2008).
- Examples of illegal fishing in Angola often involve Chinese vessels with African crew (ANGOP 2013), with a number of vessels arrested in very short time periods in the 2000s (ANGOP 2009, DN 2012, País 2014). The above-mentioned illegal fishing activities are not limited to Chinese trawlers and longliners flying FOCs (Flags of Convenience) (MRAG 2005a, Gianni and Simpson 2006); other fleets, from Korea, Spain, Namibia, Japan and Russia, are also involved in illegal fishing activities (Salopek 2004).
- The overwhelming evidence illustrates that China is the major contributor to illegal fishing activities in Angola (Salopek 2004). Along with Chinese illegal trawlers which can catch 320 t·boat-1·year-1 assuming 4 fishing trips and 80 t·boat-1·trip-1 (Salopek 2004). Korean mother-ships carry Senegalese pirogues onboard to fish in Angolan waters. This activity exploded in the 1990s and in 1998 when 100 Senegalese pirogues were confiscated (Sall et al. 2002).
- Estimates of IUU fisheries catches in Equatorial Guinea include 61 % of declared catches (MRAG 2005b). Illegal catches by industrial vessels were attributed exclusively to Soviet vessels between

1980 and 1985, and reflect the lack of monitoring during those years, and gradually these have been replaced by Chinese vessels, rampant in these waters. Belhabib, Hellebrandt, Allison, & Pauly (2015) estimate illegal catches for the period 1950 - 2010 at 13 000 tonnes for the period, with a maximum value of 1 200 tonnes in 2010.

- In Cameroon the industrial fishery is carried out by nationally flagged vessels, including reflagged Chinese vessels since the early 2000s (Pauly et al. 2014), which target demersal resources (Belhabib and Pauly 2015a). Illegal Chinese vessels caught an estimated 9 500 tonnes per year in 2009 (Pauly et al. 2014). Estimates of illegal catches have increased from low levels in the mid-1980s to 2 300 tonnes in 1989 to 9 500 tonnes per year in the late 2000s, mostly by Chinese and Russian vessels (Belhabib and Pauly 2015a).
- The Congo is characterised by declining fisheries resources, caused at least in part by overexploitation by foreign fleets (most notably from China), a lack of transparency, and high levels of corruption (Transparency International 2011). leading to licenses being awarded to about 70 foreign vessels despite the sustainable level being much lower (Maloueki 2005). According to WCS (2011), "Unregulated and unsustainable industrial fisheries are the most significant threat. Increasing numbers of domestic and foreign fishing boats venture into these coastal waters to fish illegally. Fish are caught at unsustainable levels" (WCS 2011). Industrial catches by Chinese fleets unauthorised to operate in Congo increased from low levels when the fishery began in 2001 to around 14 800 tonnes in 2010 (Belhabib and Pauly 2015b).
- In Gabon under-reporting by foreign vessels is presumed higher as vessels generally do not land their catch as they based in foreign ports (Kebe et al. 2007).
- Foreign vessels were identified as key IUU offenders in Angola (Pramod et al. 2008 p. 12), e.g. Chinese vessels (Salopek 2004, ANGOP 2013). Other fleets, from Korea, Spain, Namibia, Japan and Russia, are also known to be involved in illegal fishing activities (Salopek 2004).
- It appears that only foreign fishing fleets, i.e. most notably the Chinese fleet, operate within the small EEZ of the DRC (Pauly et al. 2014). Data limitations on IUU activities in DRC marine waters, make appraisal of IUU fishing problematic, but it is likely that there are foreign vessels fishing without licenses in the DRC's EEZ, whilst the artisanal fishery is unregulated not known to report any catches (Stop Illegal Fishing 2008).

3.1.9.1.3 Vessels of foreign African origin

- Korean motherships are known to carry Senegalese pirogues (i.e. small artisanal fishing canoes) on-board to fish Angolan waters. In 2004, over 25 days of aerial surveillance, 199 of these vessels were spotted, 29 committing serious infractions, and 13% of these were fishing without licenses (MRAG 2005b). Furthermore, 7 vessels were arrested for illegal fishing during a campaign of two weeks, in 2009 (ANGOP 2009), which translates into 170 vessels fishing illegally in 2009 (Belhabib and Divovich 2015).

3.1.9.1.4 Domestic or domestically flagged IUU fishing vessels

- In Equatorial Guinea, domestic industrial fisheries are considered completely non-existent by some (Beaudry et al. 1993), but a few domestic companies, i.e. owned by the state or firms based in Equatorial Guinea, are known to operate industrial vessels (BAID et al. 2015; OECD 2008). Data in this fishery is thought to be highly questionable as monitoring relies on statistics communicated directly by these vessels and/or on-board observers (FAO 2010). Equatorial Guinea is an irresponsible flag state, and the country emerged as an FOC (flag of convenience) state in the early 2000s (Österblom et al. 2010). Furthermore, a few vessels flagged to the country

appear to be on most common IUU lists, mostly from China (Gianni and Simpson 2006).

- Marine production in the DRC is predominantly derived from artisanal fishers using canoes and beach seines (Stop Illegal Fishing 2000). In the DRC, marine artisanal fisheries are not well monitored and reported upon in official statistics (Weijs et al. 2012).

3.1.9.2 Industrial fishing vessels intruding in zones reserved for artisanal fishers

- In Angola the encroachment of industrial vessels into the 4nm artisanal fishing zone is a major issue of concern both in terms of lost catch for the artisanal sector and damage to their nets and boats (Sowman and Cardoso 2010).

3.1.9.3 Types of IUU fishing

- In Angola, fishing in closed areas, illegal fishing methods, illegal mesh sizes and fishing without licenses, and encroachment by industrial vessels into artisanal areas and unlicensed foreign vessels are examples of IUU fishing (MRAG and CapFish 2008).

3.1.9.4 Factors which aid and abet IUU fishing (also: areas of vulnerability to IUU fishing)

- In Central African states, shrimp and groundfish make up the most important marine resources (MRAG 2005b), increasing their vulnerability to IUU. This is further exacerbated by the increased potential for conflict with artisanal fisheries who fish inshore (MRAG 2005b). Whereas licensed vessels in some countries are known to provide artisanal fishers access to substantial shrimp discards, IUU vessels do not and the shrimp are hence lost to the artisanal fishers (MRAG 2005b).
- Illegal fishing in Angola is increasing due to the almost complete absence of monitoring capacity (Lankester 2002, Agnonoticias 2013). The sea patrol units acquired recently (Angodenúncias 2014) lack the capacity of covering a large range of the Angolan EEZ, notably due to lack of fuel (Salopek 2004). This lack of capacity is easily illustrated by daily incursions of industrial fishing vessels into artisanal fishing areas (Ojukwu et al. 2013).
- Cameroon only declared an EEZ as late as 2000, although “illegal” fishing vessels already existed in 1989, with 9 vessels arrested (ENVIREP-CAM 2011).
- The Congo is characterised by a lack of transparency, and high levels of corruption (Transparency International 2011), leading to licenses being awarded to about 70 foreign vessels despite the sustainable level being much lower (Maloueki 2005). According to WCS (2011), “Unregulated and unsustainable industrial fisheries are the most significant threat. Increasing numbers of domestic and foreign fishing boats venture into these coastal waters to fish illegally. Fish are caught at unsustainable levels” (WCS 2011). Industrial catches by Chinese fleets unauthorised to operate in Congo increased from low levels when the fishery began in 2001 to around 14 800 tonnes in 2010 (Belhabib and Pauly 2015b).
- Like elsewhere in coastal SADC, small-scale fisheries in Gabon represent the main source of animal protein, but are threatened by increasing illegal fishing, a problem compounded by low MCS capacity (Barrett et al. 2014).
- Marine production in the DRC is predominantly derived from artisanal fishers using canoes and beach seines (MRAG and CapFish 2008). In the DRC, marine artisanal fisheries are not well monitored and reported upon in official statistics (Weijs et al. 2012).
- In Gabon under-reporting by foreign vessels is presumed higher as vessels generally do not land their catch as they based in foreign ports (Kebe et al. 2007).
- Data limitations on IUU activities in DRC marine waters, make appraisal of IUU fishing problematic.

- In Gabon, the artisanal sector is operated mainly by migrant fishers (Haakonsen 1992). These fisheries are the chief source of domestic fish landings, and can be characterized by weakness of production and the supremacy of migrant fishermen, and are problematic to monitor in terms of fisheries statistics (Bignouma 2011).
- Few countries have banned the beach seine net, yet Gabon is among them, however, enforcement of the ban has proven to be impossible without the collaboration and support of the local fishing communities (Drammeh 2000).
- The artisanal sector dominates the catches of Cameroon with over 71 % of total catches (Belhabib and Pauly 2015a). However, it lacks a licensing system for artisanal fisheries in spite of comprising 85 % of foreign artisanal fishers (Kamgaing 2009, ENVIREP-CAM 2011).
- In Angola, the fishing sector is a major source of employment, and contributes an estimated 126,000 jobs (MRAG and CapFish 2008). The industrial (and semi-industrial) sector are operated predominantly by the domestic reflagged fleet and the foreign fleet (du Preez 2009) with unknown catches. Although domestic fleets are expected to supply catch data to authorities (Agostinho et al. 2005), these catches are frequently under-reported (Belhabib and Divovich 2015). For example, catches in Cabinda, located in the Eastern Central Atlantic area, were almost completely unreported (Belhabib and Divovich 2015).

3.1.9.5 Other environmental impacts of IUU fishing

- The overwhelming evidence illustrates that China is the major contributor to illegal fishing activities in Angola (Salopek 2004). Often, these activities are related to other illegal activities, leading to loss of lives. Thus the quote (Salopek 2004): “at least two Angolan inspectors have vanished mysteriously while on observer duty aboard large industrial trawlers–suicides, assert the foreign skippers, pushed overboard, the fisheries police insist”. Also, politicians “are using the oceans as a bank account” (Salopek 2004).
- In Angola, like elsewhere in Africa, “illegal fishing is causing the depletion of marine resources”, [i.e.,] “foreign trawlers have hammered patches of coastline so hard that fish have become locally scarce—a blow to a nation where a million people rely on UN food aid” (Salopek 2004, Agnonoticias 2013).
- It is thought that the lack of security within Equatorial Guinea’s waters, has led to the emergence of piracy, which could be dissuading foreign investors.
- The industrial sector in the Gabon is predominantly operated by foreign vessels and joint ventures, inclusive of foreign reflagged vessels (mainly from China), which remain mainly under foreign beneficial ownership (Ekouala 2013).
- In Angola, the majority of fishers are involved in the artisanal sector, and this sector is important for ensuring food security. However the encroachment of industrial vessels into the 4nm artisanal fishing zone is a major issue of concern both in terms of lost catch for the artisanal sector and damage to their nets and boats (Sowman and Cardoso 2010).
- In Angola, dramatic increases in illegal catches made by industrial fleets have been observed culminating in a peak estimation of approximately 63 700 tonnes in 2010 (Belhabib and Divovich 2015). Illegal catches taken by Senegalese pirogues transported on-board Korean motherships have increased from 1 400 tonnes in 1990, to 12 500 tonnes in 1998 and have now remained relatively constant at around 13 500 tonnes per year during the late 2000s (Belhabib and Divovich 2015).
- In Gabon, in 2005, illegal catches were equivalent to 19 % of the total legal catch (MRAG 2005b). Illegal foreign catches have increased from less than 1 000 tonnes in 1986 to over 23 000 tonnes

in 2010 (Belhabib 2015a). Estimations of illegal catches in the past were 1 % of legal catches, but recent estimates indicate this figure has increased to around 50 % of legal catches (Belhabib 2015a). In 2010, Illegal fisheries have been estimated to have extracted over US$ 207 million from the waters of Gabon (Belhabib 2015a).

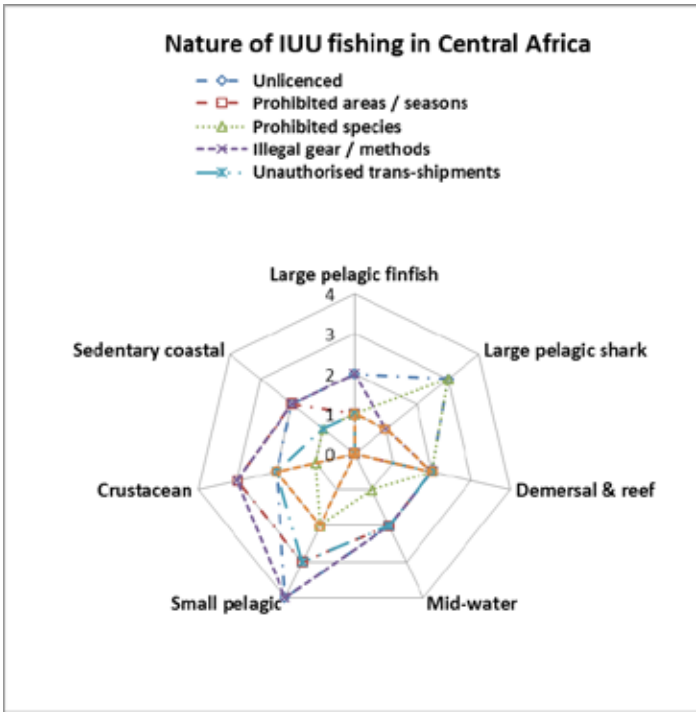
- MRAG (2005b) estimated for each landed tonne of fish, the equivalent of 1.23 tonnes were IUUs taken from the EEZ of the Democratic Republic of the Congo (DRC). Over 36 cases of IUU fishing were reported in 2005, of which five (13.9 %) were cases of illegal/unlicensed fishing (MRAG 2005b). Foreign legal catches have decreased; in contrast, illegal catches increased to 1 800 tonnes per year on average between 2008 and 2010, which appears to be compensating for the declining legal catch (Belhabib and Pauly 2015b).

3.1.10 Questionnaire results for Central Africa about the nature of IUU fishing and types of vessels

a) Which IUU fishing issues are present in your region / country? Tick all that are applicable. b) Has IUU fishing increased or decreased in your country / region over the last 5 - 10 years?								
Part	Fish Sector	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal
a)	Unlicensed Foreign Vessels	3	3	3	2	2	3	3
	Industrial & semi-industrial licensed	2	2	3	2	3	3	3
	Artisanal fishers &/or vessels	2	3	3	2	4	3	2
b)	Increase/Decrease	3	3	3	2	4	1	3

Vessels from which country / region are implicated most in IUU fishing in your region /								
Nature	Origin	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal
Foreign	Africa	1	0	2	0	0	2	2
	Asia	0	0	0	0	2	0	0
FOC	Africa	2	2	2	2	2	2	2
	Asia	1	1	1	1	1	1	1

What is the nature of IUU fishing in your country / region? Tick all that are							
Nature	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal
Unlicenced	2	3	2	2	4	2	2
Prohibited areas / seasons	1	0	2	2	3	3	2
Prohibited species	1	3	2	1	2	1	1
Illegal gear / methods	2	1	2	2	4	3	2
Unauthorised trans-shipments	1	0	2	2	3	2	1
Non-compliance with license	1	1	2	0	2	2	0



3.2 IUU Fishing and Organised Crime

Criminologists define organised fisheries crime as a systematic criminal activity "which is more likely to target the vulnerable and most valuable species, [and to] escalate… not only the seriousness of illegal activity but also its effect, through an increase in criminal activity generally, such as environmental offences, theft, fraud…" (Putt and Nelson 2008).

The UNODC defines IUU fishing as an environmental crime (UNODC, 2011). As with other environmental crimes, the resources targeted involved are typically high-value, low-volume species such as abalone. There are various mechanisms that IUU vessels employ to pursue IUU activities including switching off their transponders and tracking devices, incorrectly labelling their products, forging documents and certificates, laundering their catches through transhipment and selecting ports of convenience to offload their catches. However, increasing evidence from researchers, NGOs, INTERPOL and other international crime fighting agencies highlight the links between IUU fishing and criminal activities. These activities range from smuggling drugs and weapons, piracy, bribery and corruption, human trafficking, and prostitution. Bondaroff et al. (2015) argue that many types of IUU fishing constitute a form of transnational organised crime. They argue that in order to curb and eliminate IUU fishing it is necessary to treat IUU fishing as organised crime.

The ever-increasing global demand for high-value and low-volume seafood products (e.g., shark fin, bêche-de-mer (sea cucumbers), abalone, rock lobster) means that they may be traded for and with other illegal commodities, for example, drugs, arms, and human trafficking (Putt and Anderson 2007). In a recent review involving forced labour on fishing vessels, the United Nations referred to "cruel and inhumane treatment in the extreme" which in some cases results in abuse and reported deaths (UNODC 2011). Furthermore, forced or child labour in seafood processing has been reported for numerous countries including Nunoo et al. (2014) by the U.S. Department of Labor in 2010. Reports from EJF (2012) monitoring IUU activities off the coast of Sierra Leone provide chilling examples of children from Senegal (14 years of age) fishing from canoes deployed from a Korean-flagged mothership in the vicinity of Sherbro Island, working long hours and living in overcrowded

cramped accommodation on board the vessel for 3 months at a time.

Research undertaken by de Coning (2011) sought to ascertain whether there is transnational organized crime and other criminal activity in the fishing industry and, if so, what the vulnerabilities of the fishing industry are to transnational organized crime or other criminal activity. This research conducted over a period of six-months, comprised a desk top review of available literature, involved consultations with stakeholders as well as a two-day expert consultation held in Vienna, Austria. Of particular interest was to ascertain whether criminal activities take place in fishing industry have a negative impact on law-abiding fishers, the formal fishing industry, local fishing communities, and the general public. The study produced a number of very disturbing findings including 1) the severity of the abuse of fishers (including children) that had been trafficked for the purpose of forced labour on board fishing vessels leading in some cases to death; 2) several instances of reported deaths, as well as severe physical and sexual abuse, coercion and general disregard for the safety and working conditions of fishers; 3) human trafficking linked to marine living resource crimes where such a crime is defined as criminal conduct that may cause harm to the marine living environment due to disregard for environmental and conservation laws. A further finding of this study was that fishers/ crew are recruited by the organised crime networks because of their knowledge and skills of the sea but are seldom involved in the planning and oversight of these criminal activities. A further key finding of this study was that transnational organized criminal groups are engaged in marine living resource crimes in relation to high value, low volume species such as abalone. This research also found that criminal activity is also linked to illicit traffic in drugs, and that drugs are traded for high value marine living resources (de Coning 2011).

According to Bondaroff et al. (2015) IUU fishing can be considered as a subset of transnational organised environmental and natural resource crime. These IUU fishing operations are highly sophisticated and employ various mechanisms such as flagging and reflagging their vessels as they enter different EEZs, ensuring that ownership is difficult to track down, irregular vessel registration strategies, use of various vessel support services at sea and trans-shipment of illegal catch at sea and fraudulent catch documentation. Investigation and prosecution of IUU fishing related crimes in view of the strategies employed is very challenging and requires co-ordination and political will. The study found that although fishers are often recruited by organized criminal groups due to their skills and knowledge of the sea, they seldom seem to be regarded as the masterminds behind organized criminal activities involving the fishing industry or fishing vessels. It is therefore unfortunate that fishers, rather than more centrally placed persons in the criminal networks, are likely to be targeted when criminal activities involving fishing vessels or the fishing industry are investigated and prosecuted, particularly in light of the possibility that some of these fishers may be victims of human trafficking.

Various studies have highlighted a number of vulnerabilities of the fishing industry to transnational organized crime and other forms of criminal activity (de Coning 2011, UNODC 2011, EJF 2012, Phelps Bondaroff et al. 2015). The main vulnerabilities identified are as taken from the UNODC report:

1. The global reach of fishing vessels, easy access to surplus fishing vessels due to fishing quota restrictions, the legitimate presence of fishing vessels at sea, and the distribution network for fish and fish products create opportunity and legitimate cover for criminal activities.

2. There is a general lack of governance and rule of law in the fishing industry, in particular there is
   a. a lack of at-sea surveillance of vessel movements and trans-shipments. Compared to merchant vessels there is no comprehensive and transparent system of fishing vessel tracking or monitoring of their interaction with other vessels at sea;
   b. a lack of transparency of the identity of the beneficial ownership of fishing vessels and a lack of international records of fishing vessels' identity and history;
   c. a lack of ability or willingness of some flag States to enforce their criminal law jurisdiction; and
   d. a lack of international endorsement of existing international regulation of the safety of fishing vessels and working conditions of fishers at sea to bring these instruments into force and ensure compliance in port in the same manner as Port State Control (PSC) of merchant vessels.
3. Quota restrictions and declining fish stocks in many regions of the world have led to destitute fishers and fishing communities who are deprived of their livelihoods and of an important food source. The socio-economic conditions generated by overfishing may make fishers and fishing communities vulnerable to recruitment into criminal activities" (UNODC 2011).

Levels of organised criminal involvement in fishing sectors vary globally. The cases of illegal fishing for Patagonian toothfish and South African Abalone are perhaps two of the best examples of organised crime, the transnational nature of IUU fishing, and the numerous IUU methods employed, as well as the ecological consequences of IUU fishing (Phelps Bondaroff et al. 2015) Abalone poaching in South Africa has been linked to organised crime such as gangsterism, international crime syndicates and rogue national fleets, which aid international distribution and avoids traceability (MRAG and CapFish 2008, Goga 2014).

In Somalia, local companies jointly-owned by European and Arabian companies (e.g. UK and Italy based African and Middle East Trading Co. (AFMET), PALMERA and UAE-based SAMICO) are believed to have worked closely with Somali warlords who issued fake fishing licenses to foreign pirates fishing Somali marine resources and with whom they shared the illegal catches (Waldo 2009). Therefore, the highly lucrative, organised and transnational nature of IUU crimes makes eradication problematic.

3.2.1 Questionnaire results for IUU crime links

What kinds of other criminal activity do you associate with IUU fishing in your region / country? Tick all that are applicable.				
Activity Sector	**Foreign vessels**	**Local industrial**	**Artisanal fishers**	**Near-shore harvesters**
Human trafficking	4	1	0	1
Other illicit wildlife trade	5	2	3	2
Illicit wildlife products	4	1	0	2
Drug trade	6	3	5	4
Smuggling	7	4	9	7
Bribery / corruption	8	7	9	8
Abuse of labour / children / women	4	0	4	3

4 Economic, environmental and social impacts of IUU in African coastal countries

4.1 Economic Impacts of IUU in Africa

Economic impacts are mainly concerned with the losses to the economy from revenue generated from landed catches, taxes, licensing and landing fees, and job losses in the fishery and associated industries. Here we focus on the impact of lost harvesting opportunities. A first component of estimating this lost harvesting opportunity is to estimate the quantities of fish landed by IUU fishing.

4.1.1 Scale of IUU in Africa

Estimation of the quantities of fish landed by IUU fishing is confounded by the at times covert nature of IUU fishing, and the unreported nature of IUU fishing. A further factor that may interfere with attempts to quantify IUU fishing is the EU carding system.

Various approaches have been used to quantify IUU fishing, linked to numerous studies which have been undertaken to produce estimates of IUU fishing. The main method is based on estimating, by a variety of means, the total fishing effort relevant to a particular class of fishing vessels or methods of fishing, estimating the typical average catch per unit of fishing effort, multiplying the two to obtain a combined estimate of the IUU fishing catch, and then subtracting the reported catch from this estimate. This approach is often deployed via either a bottom-up approach, or a top down approach (MRAG Asia Pacific 2016). Other approaches aimed at estimating the scale of IUU fishing are

- to treat the IUU catch as an estimable parameter in stock assessment models,
- to use data on the confiscation of illegally caught fish product to estimate IUU quantities, or to estimate trends in IUU fishing amounts
- to use an expert panel as the basis for estimating the scale of IUU fishing
- to use trade data to detect a discrepancy between legal exports and imports declared by destination countries
- to use statistical methods to quantify a change in fishing behaviour between vessels with and without scientific observers on board, and form this to infer the scale of IUU fishing
- to use data supplied by informants.
- To extrapolate the % of IUU fishing from one fishery or specie or time period or spatial region to another

Combinations of all of these methods may be employed in ways that are specific to particular fisheries and the modus operandi of IUU fishing (see for example OLRAC, 2004a, 2004b).

Recent work by Pauly and Zeller (2015) aims to quantify the worldwide scale of IUU fishing. Data from the Sea Around Us project is an integration of a series of studies into IUU fishing, and this includes estimates for African countries. In some of the publications supporting the estimates that are provided, a range of uncertainty is provided, but not for all estimates. As a result it is not possible to comment generally on the reliability of the Pauly and Zeller (2015) estimates.

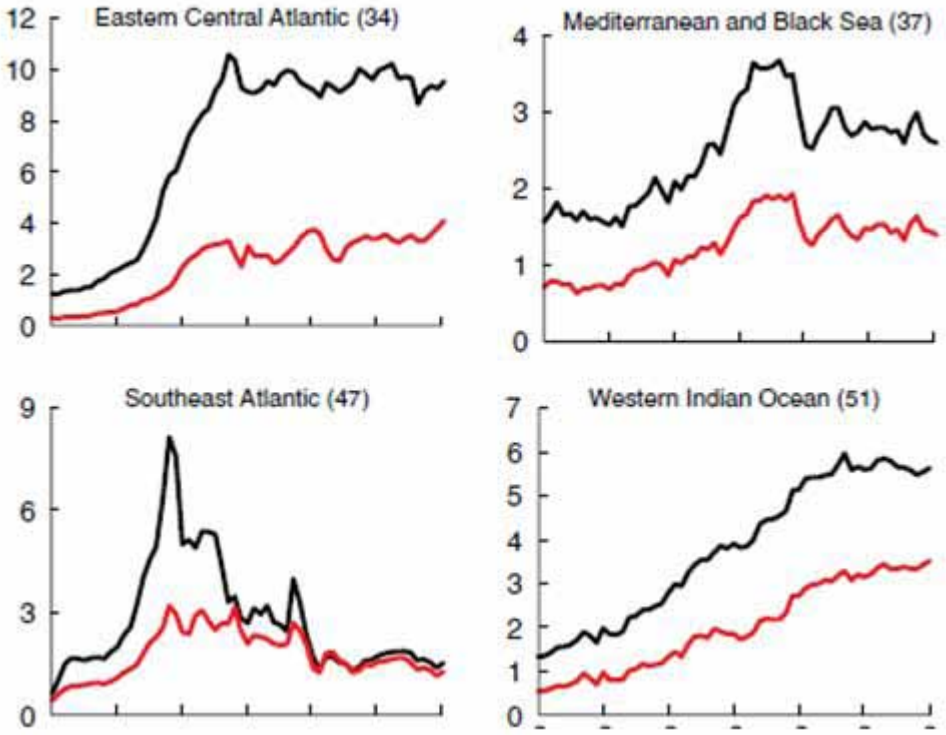


Figure 5 1. *Reported (red) and reconstructed catches reported in Pauly and Zeller (2016), by major FAO division.*

Figure 5 1 are results extracted from Pauly and Zeller (2015) for the four major FAO statistical divisions abutting Africa (34,37, 47 and 51) where red denotes reported catches, and black lines show the reconstructed catches which now include all non-reported forms of catch including discards, underreported catch and catch attributable to IUU fishing. Pauly and Zeller's (2015) global correction figure to convert reported catches to the total catch accounting for IUU fishing tonnages is roughly 1.50, implying a global average estimate of the amount of IUU fishing of 50% of reported amounts. This is considerably larger than other IUU amounts reported in the media and in various publications, both academic journals and other less formal publications. The latter put the figure at in the order of 20% (e.g. Agnew et al. 2009). For major FAO divisions relevant to Africa, i.e. FAO Major Divisions 34, 37, 47 and 51, the corrections based on the data made available by the Sea Around Us project (Zeller and Pauly 2015) are:

FAO Division 34: 150% (total catch = reported catch x 2.5, IUU catch/total catch = 1.5);

FAO Division 37: 80% (total catch = reported catch x 1.8, IUU catch/total catch =0.8);

FAO Division 47: 0% (total catch = reported catch x 1.0, IUU catch/total catch =0);

FAO Division 51: 60% (total catch = reported catch x 1.6, IUU catch/total catch =0.6).

Later on in this document we suggest that in some instances the estimates based on the data supplied by the Sea Around Us project may be too large. Nevertheless it does seem significant that in FAO division 34 (which covers AU regions Central Africa and Western Africa) the reconstructed catch percentages are three times the Pauly and Zeller (2015) global average of approximately 50%. This is broadly corroborated by the fact that FAO division 34 is where the available documentation, including some published work, indicates there is a particular problem with IUU fishing.

Table 14 4 and Table 14 5 (see supporting tables) provide country specific reported and unreported (IUU) estimates by African maritime country derived from the Sea Around Us data. In summary, from Table 14 4 and Table 14 5, if discards are excluded from the analysis, the figures for IUU catch are (see Table 5 1 below):

Table 5 1. *A regional summary of IUU catches estimated from the Sea Around Us data (Pauly and Zeller 2015).*

	Tonnage Unreported	% Breakdown out of Africa wide IUU estimate	IUU as % of IUU + Reported	IUU/ Reported
Central Africa	342090.885	7%	44.4	0.798
Eastern Africa	173354.1706	4%	31.6	0.462
Northern Africa	1425485.635	30%	47.4	0.901
Southern Africa	76941.88931	2%	7.1	0.076
Western Africa	2664174.316	57%	52.6	1.108
Grand Total	**4682046.896**	**100%**	**44.7**	**0.807**

The estimate of an IUU catch of 4.7 million tons is large in the African context, i.e. it is 80.7% of the reported catch. This amount includes IUU fishing catches by DWFs, industrial fishing by domestic and nearby African nations, artisanal fishing by domestic and nearby African nations, and subsistence fishing. It excludes provision for discards.

The DWF IUU catch is itself made up of catch due to DWFs from the EU, China and Other nations. Pauly et al. (2014) estimates that a substantial portion of the 4.7 million tons could be catches taken by China's DWF:

"We find that China, which over-reports its domestic catch, substantially under-reports the catch of its distant-water fleets. This catch, estimated at 4.6 million tonnes/year (95% central distribution, 3.4–6.1 million tonnes/year) from 2000 to 2011 (compared with an average of 368 000 tonnes/year reported by China to FAO), corresponds to an ex-vessel landed value of $ 8.93 billion per year (95% central distribution, 6.3 – 12.3 billion). Chinese distant-water fleets extract the largest catch in African waters (3.1 million tonnes/yr, 95% central distribution, 2.0–4.4 million tonnes)".

de Graaf and Garibaldi (2014) report on efforts to estimate the scale of fishing by DWFs, but experienced significant challenges accessing the relevant data. We assume, but it is not clear, that the quantities unearthed in their report are in some way already contained in the 5.1 to 5.9 million tons of catches that are reported to the FAO and therefore do not constitute IUU catches:

"The FAO Fisheries and Aquaculture Statistics and Information Branch (FIPS) attempted to estimate the value of fisheries agreements (FAs) between DWFNs and African States. Information on fisheries agreements between the European Union [EU] and African States is publicly available on the Internet. The total value of fisheries agreements with the European Union was calculated by adding up the amount it paid for access rights and the license fees paid by vessel owners. It was assumed that the catch quotas allocated in the fisheries agreements were fully fished, although there have been recent cases in which this has not occurred. Fisheries agreements between other countries and African States had to be extrapolated as very little information, if any, is publicly available on these agreements. … These catches by DWFNs in African waters are somewhat underestimated.... In

addition to the US$ 24 billion generated as value added by the fisheries and aquaculture sector, in 2011 African countries also received a total of more than US$ 0.4 billion for fisheries agreements with foreign nations fishing in their EEZs according to the official available data and those extrapolated which can be considered as a conservative estimate." - de Graaf and Garibaldi (2014)

de Graaf and Garibaldi (2014) note that historically "Catches by DWFNs represented more than half of total catch around Africa for 20 years between 1971 and 1991 (Figure 5 2). After the dissolution of the Soviet Union their share started to decrease abruptly. Since 2001 the DWFN's share has stabilized at about 25 percent of total catch." In Table 5 2 they report estimates of catches attributable to DWFs for 2011, breaking it down by EU and other nations. The total for other nations is 765 253 tons which is roughly consistent with the Chinese-only reported tonnage for their DWFs of 368 000 tonnes, but clearly very different to (Pauly et al. 2014) estimate of 3.1 million tons.

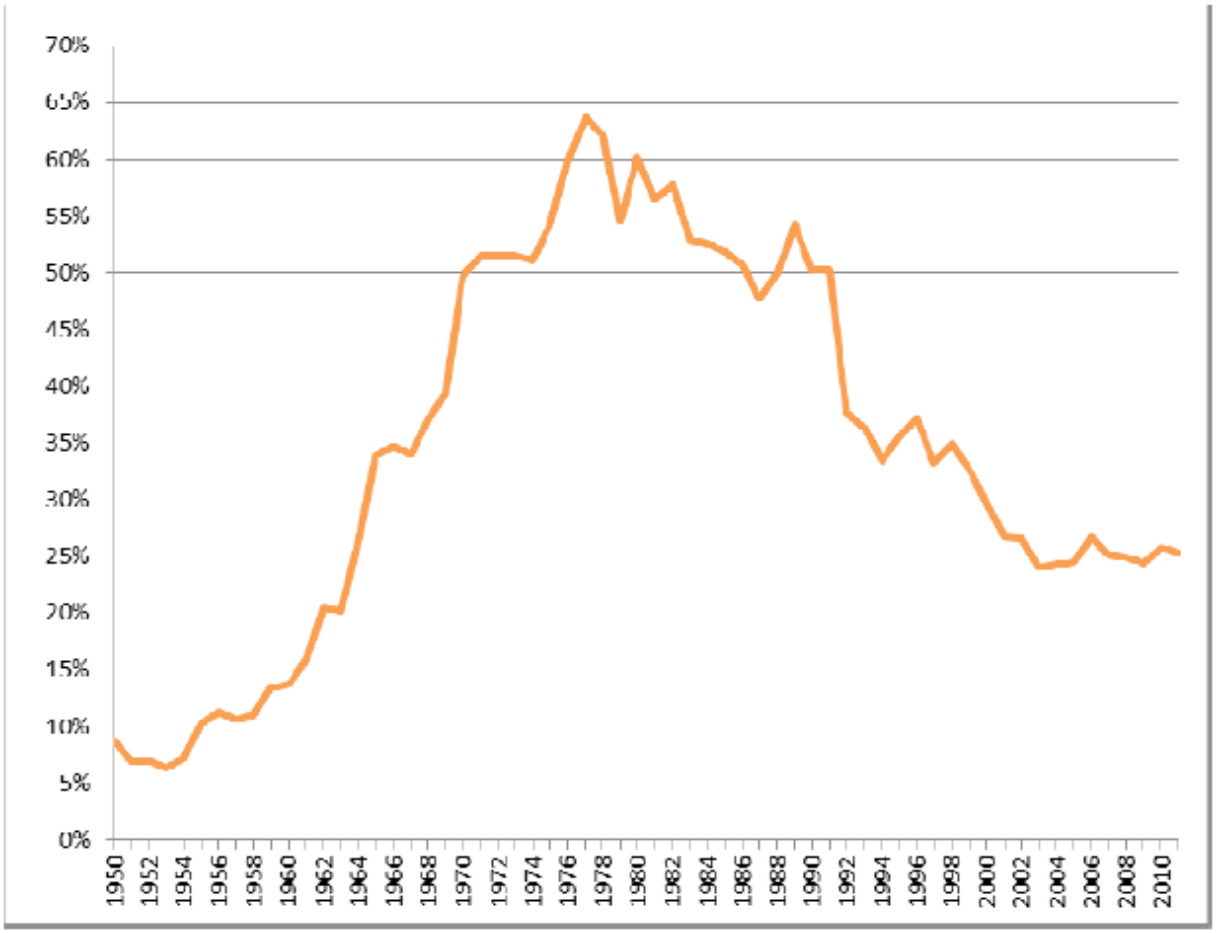


Figure 5 2. *Share of 1950-2011 DWFNs' catches on total catches around Africa. Source: de Graaf and Garibaldi (2014)*

Table 5 2. *Estimates of tonnages and income attributable to DWF's in the African EEZ for 2011 (from de Graaf and Garibaldi (2014)).*

Value of fisheries agreements (FA) between African States and the European Union in 2011

	Atlantic Ocean			Indian Ocean			Total		
	Catches by DWFNs (t)	Catches covered by FAs (t)	FAs value (Euro)	Catches by DWFNs (t)	Catches covered by FAs (t)	FAs value (Euro)	Catches by DWFNs (t)	Catches covered by FAs (t)	FAs value (Euro)
Tuna	57,449	31,500	3,598,000	177,439	98,800	11,723,000	234,888	130,300	15,321,000
Non-tuna	510,129	500,000	155,750,000	5,200	-	-	515,329	500,000	155,750,000
Total	**567,578**	**531,500**	**159,348,000**	**182,639**	**98,800**	**11,723,000**	**750,217**	**630,300**	**171,071,000**

Estimated value of fisheries agreements (FA) between African States and countries outside the European Union in 2011

	Atlantic Ocean			Indian Ocean			Total		
	Catches by DWFNs (t)	Catches covered by FAs (t)	FAs value (Euro)	Catches by DWFNs (t)	Catches covered by FAs (t)	FAs value (Euro)	Catches by DWFNs (t)	Catches covered by FAs (t)	FAs value (Euro)
Tuna	113,660	*62,000*	*7,070,000*	34,869	*19,500*	*2,315,000*	148,529	*81,500*	*9,385,000*
Non-tuna	651,593	*640,000*	*133,130,000*	10,865	...	...	662,458	*640,000*	*133,130,000*
Total	**765,253**	*702,000*	*140,200,000*	**45,734**	*19,500*	*2,315,000*	**810,987**	*721,500*	*142,515,000*

Estimated value of all fisheries agreements (FA) with African states in 2011

	Atlantic Ocean			Indian Ocean			Total			
	Catches by DWFNs (t)	Catches covered by FAs (t)	FAs value (Euro)	Catches by DWFNs (t)	Catches covered by FAs (t)	FAs value (Euro)	Catches by DWFNs (t)	Catches covered by FAs (t)	FAs value (Euro)	FAs value (US$)[1]
Tuna	171,109	*93,500*	*10,668,000*	212,308	*118,300*	*14,038,000*	383,417	*211,800*	*24,706,000*	*33,353,000*
Non-tuna	1,161,722	*1,140,000*	*288,880,000*	16,065	...	...	1,177,787	*1,140,000*	*288,880,000*	*389,988,000*
Total	**1,332,831**	*1,233,500*	*299,548,000*	**228,373**	*118,300*	*14,038,000*	**1,561,204**	*1,351,800*	*313,586,000*	*423,341,000*

Subtracting the approximately 368 000 tonnes/year reported by China to the FAO for its DWF from the best estimate of 3.1 million tons produced by Pauly and Zeller (Pauly and Zeller 2015) gives 2.73 million tons. This is 58% of the African IUU fishing tonnage amount of 4.7 million tons estimated by Pauly and Zeller (2015).

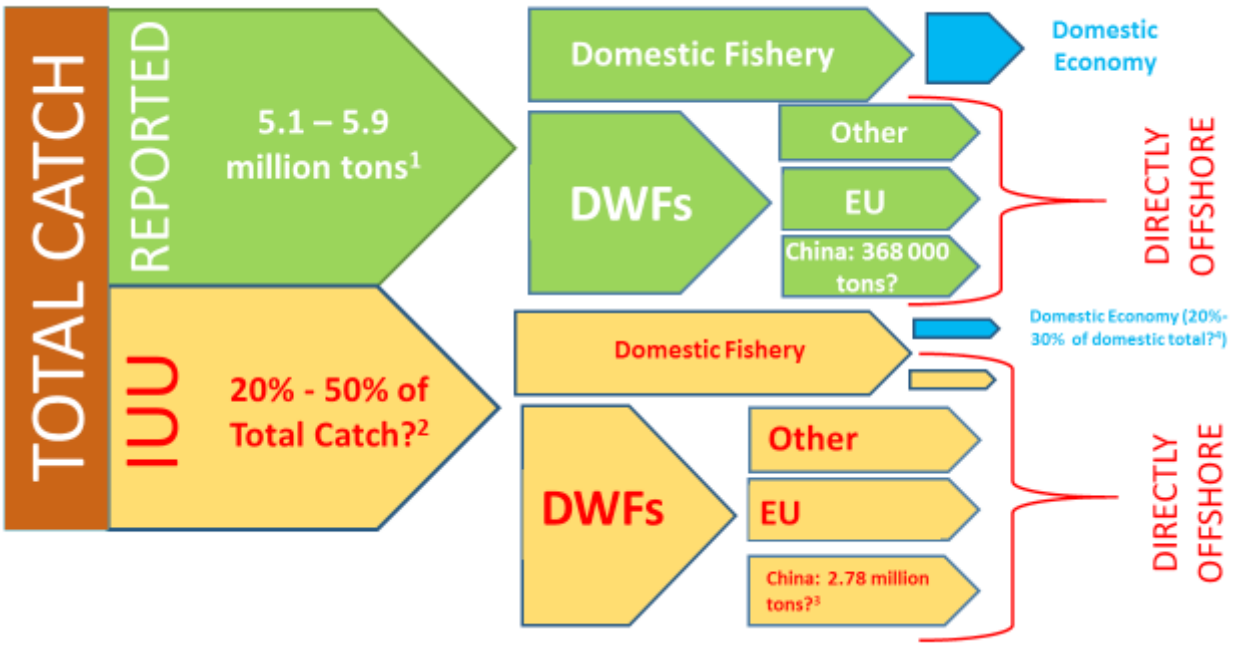


Figure 5 3. *A schematic of catch flows starting with the total catch, illustrating the factors that need to be considered when reconciling information that may be sourced in different ways. This document suggests that a detailed extension of such a mass balance exercise could be useful for providing further insight into the scale of IUU fishing in Africa.*

We assume that the bulk of the DWF IUU catch is due to industrial fishing. IUU fishing by artisanal methods also has to be considered, as is illustrated in Figure 5 3. We note that some indication of the scale of this component is provided by the discrepancy between the landed value estimates for the contribution of fishing to GDP reported in de Graaf and Garibaldi (2014) and The World Bank (2012) on the one hand, and value estimates reported in the Sea Around Us data (Pauly and Zeller 2015), the last mentioned based on the catches actually reported to the FAO. As discussed later on in this document it is reasonable to assume that a major proportion of the artisanal IUU catch is simply unreported, enters the domestic economy and shows up in bottom up economic studies, but does not reflect in the top down economic estimates produced on the basis of FAO reported catches.

The analysis and discussion so far has been piecemeal and as described thus far is at risk of exceeding the limits of its utility. It seems that what is really required, which is out of scope for this study, is a more comprehensive reconciliation exercise. As envisaged here such an exercise would be to set up a mass balance with country EEZ and high seas catches by fleet type/nation as sources, and to then include the various first order destinations as sinks in the balancing exercise, possible also including final (highest order) destination sinks as well, as suggested by the nature of all available and relevant data. This may potentially allow for many diverse kinds of information derived from different studies to be entered into a single interconnected model which would then show up important gaps and areas of agreement. Such an exercise may then provide a top down corroboration of the 4.7 million tons figure. It would be beneficial to run the model in dual mode as a value ($) based exercise, to facilitate the incorporation of results from economic studies. Species or species-group disaggregation of such an exercise may impose additional constraints on estimates of IUU and may add to the reliability of the final results. Of course given the global interconnectedness of the flows of fish catches/product, an Africa only approach would be compromised by unresolved boundary effects (i.e. inflows from and outflows to non-African sources and sinks), suggesting the need for a global model which is probably too ambitious as a first attempt at such an approach.

For this study we have taken a particular approach to providing estimates of the scale of IUU fishing. We note firstly that the estimates provided by the Sea Around Us study (Pauly and Zeller 2015) are the only comprehensive estimates available for all coastal African state. However, since the global estimate produced in Pauly and Zeller (2015) is a dramatic departure from estimates provided by other sources - globally about 50% of reported catches are IUU catch from Pauly and Zeller (2015) sources , other sources - a global figure of about 20% of reported catches, e.g. Agnew et al. (2009)), we treat these as a falsifiable null hypothesis. A null hypothesis is an estimate that is accepted (and therefore used for practical purposes) in the absence of evidence to the contrary.

Here, to test this null hypothesis we then compare these estimates to all available alternative estimates to formulate a view on whether Pauly and Zeller (2015) should be adjusted to a different value in light of these other estimates. Later on in this document we present a comparison between all alternative estimates that we could source within the scope of this study, and the corresponding value from Pauly and Zeller (2015).

Below we highlight some examples of the scale of IUU fishing by region to provide some further often qualitative insights into the scale of the IUU fishing problem.

4.1.1.1 Southern Africa

- **South Africa:** The tonnages of IUU fishing for abalone are presently in the order of 20 - 30 times the legal catch. In the West Coast rock lobster resource, about 25 % of the catch is assumed to comprise IUU fishing catches. However some new recent estimates place the figure at least 4 times higher, consequently new methods of estimating IUU fishing based on intelligence gathering techniques are under consideration.
- **South Africa:** Due to the challenging accessibility and remoteness of the Prince Edward Islands, South Africa, the Patagonian toothfish suffered a 32 000 tonne loss due to illegal fishing using highly-destructive gill-nets in the late 1990s despite the total allowable catch (TAC) set at 450 tonnes per year (Pramod et al. 2006, MRAG and CapFish 2008, Stop Illegal Fishing 2008). In 2006, the ports of Durban (South Africa), and Walvis Bay (Namibia) and others received this IUU catch (Sovacool and Siman-sovacool 2007). However, IUU in this region may be decreasing; South Africa, together with other members of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), have reduced the large-scale plunder of its Patagonian toothfish resources (Stop Illegal Fishing 2008). The 42 members across 12 countries belonging to the COLTO initiative (Coalition of Legal Toothfish Operators) are responsible for 90 % of the global toothfish TAC, 60 % of which is MSC certified. COLTO's presence in the Antarctic oceans has, together with the CCAMLR, reduced IUU toothfish catches within EEZs to ~ 0 % since 2005; and to only 6 % on the high seas in 2014 (COLTO 2015a). In the 2014/5 season, IUU toothfish catch was estimated at 1264-1500 tonnes (green weight); additionally one of the six remaining IUU vessels of the region was scuttled following a 110-day pursuit by Sea Shepherd vessels (COLTO 2015b).
- **South Africa:** In the period 1987 to 1999 IUU fishing carried out by Hout Bay Fishing (see e.g. OLRAC 2004a,b) was equivalent to 10 - 15% of the total catch, both legal and illegal.
- In **Namibia**, between 1971 and 1990, illegal catches increased from around 8 000 tonnes to 157 000 tonnes, and then rapidly decreased after independence to around 7,500 t in 2010 (Belhabib et al. 2015e). Following independence in 1990, the restructuring of Namibian fisheries resulted in a rapid decrease in IUU fishing to 7 500 tonnes and only 9 % of catches were estimated as unreported (Belhabib et al. 2015e).
- **Namibia:** In 2004, six out of 16 inspected vessels were arrested (Stop Illegal Fishing 2008), e.g. Chinese vessels targeting mussels and limpets in IEZs (Pramod et al. 2006).

5.1.1.2 Eastern Africa

- **Somalia:** Estimates by the High Seas Task Force (2006), are that "700 foreign-owned vessels fully engaged in unlicensed fishing in Somali waters".
- **Somalia:** In 2007, piracy activities along the coast of Somalia drastically increased and permeated into the western Indian Ocean, forcing foreign fishing vessels far from the coast and outside waters under the jurisdiction of Somalia. This resulted in a significant reduction in foreign fleets present in the area (Somalia Federal Ministry of Fisheries and Marine Resources 2015).
- **Madagascar:** In Madagascar > 66 % of the industrial shrimp trawler catches in 1998 were made within the two-mile zone which, by law, is reserved exclusively for small scale fishers (Drammeh 2000).

5.1.1.3 Northern Africa

- **Algeria:** Illegal fishing in Algerian waters is best exemplified by three Turkish trawlers and one Algerian vessel detained for illegally fishing more than 200 tonnes of tuna in 2009 (Stop Illegal Fishing 2009).

- **Algeria:** According to Belhabib et al. (2015d) artisanal fisheries catches in Algeria are underestimated (MPRH 2011), with about 80 % of total catches being unreported (MATE 2005).
- **Algeria:** Between 2000 and 2009, illegal bluefin tuna fishing in Algerian waters was reported (WWF Mediterranean & WWF Italy, 2008; WWF Mediterranean, 2006; Bregazzi 2007). Unreported catches were estimated to be 2 728 tonnes (Belhabib et al. 2015d)
- **Algeria:** Between 1950 and 2010, the illegal small fish catch in Algeria was estimated at about 118,043 tonnes with the trend in illegal small fish catches following governmental regulations and law enforcement incentives (Belhabib et al. 2015d) and shrimp catches were estimated at 271 000 tonnes, with the unreported component including 1 700 tons of transhipped catches between 1994 and 2010 (Belhabib et al. 2015d).
- **Algeria:** Large pelagic fish stocks are known to be heavily targeted by both illegal foreign fleets (WWF Mediterranean and WWF Italy 2008) and foreign fleets operating under fishing access agreements, and account for more than 80 % of the total estimated Algerian large pelagic catch (Belhabib et al. 2015d).

5.1.1.4 Western Africa

- **West Africa:** The World Ocean Report (WOR 2) reports that the situation off the coast of West Africa is particularly critical. Here, IUU fishing accounts for an estimated 40 per cent of fish caught – the highest level worldwide. This translates to IUU catches which are 66.7% the size of the legal reported catch.
- **West Africa:** The waters of West Africa are home to one of the world's greatest concentrations of finfish, crustaceans and molluscs as well as the highest reported IUU activity, with 33 % to 50 % - of the catch affected (Africa Progress Panel 2014).
- **West Africa:** In West Africa, combined losses for artisanal fishermen due to poaching are estimated at nearly 35 % of their total catch (MRAG 2010).
- **West Africa:** In West Africa illegal catches represent up to 37 % of the region's catch (EJF 2012).
- **West Africa:** Illegal catches and their corresponding discards were estimated at 2.6 million tonnes from 2000 to 2011 (Belhabib et al. 2014a).
- **West Africa:** Selected estimates of levels of illegal catch in the Western African region are (MRAG 2005a): Mauritania 9% inferred, Senegal 8% inferred, Gambia 12% inferred, Guinea-Bissau 41% Inferred, Guinea 102% direct estimate, Sierra Leone 35% direct estimate, Cape Verde 0% inferred
- **West Africa:** The Sub-Regional Fisheries Commission (SRFC) concludes that some IUU vessels off West Africa are in operation 365 days of the year, putting massive pressure on fish stocks.
- **West Africa:** Greenpeace (2015) recently identified that at least 74 fishing vessels owned by four Chinese DWF companies have been exposed for fishing in illegal areas and falsifying their fishing vessels' gross tonnage (GT), i.e. 82 cases of IUU and GT fraud in Senegal, Guinea, Guinea-Bissau and Ghana. Almost 23 % of the 52 Chinese vessels observed in the waters of Guinea, by Greenpeace Africa, were involved in IUU fishing (Greenpeace 2015). Moreover, 74 out of 92 Chinese fishing vessels observed by the Greenpeace MY Esperanza crew in the area were found to have their Automatic Identification System (AIS) devices either switched off or not installed (Greenpeace 2015).
- **West Africa, Artisanal vessels:** In West Africa, combined losses for artisanal fishermen due to poaching are estimated at nearly 35 % of their total catch (MRAG 2010).
- **Mauritania:** In the industrial cephalopod, shrimp and pelagic fisheries offences are mainly related to fishing in restricted areas, capture of juveniles, use of illegal gear and false catch declarations. Another infraction of concern to the eradication of IUU in the industrial sector is

false nationalisation, whereby foreign vessels register as Mauritanian, thus qualifying for the reduced national licence fees for fishing, but do not complete the re-registration and reflagging process , e.g. 109 Chinese vessels (MRAG 2010).

- **Mauritania:** The artisanal fleet comprises 4 022 Mauritanian and 1000 Senegalese pirogues that target small pelagic, demersal fish, octopus and crustaceans (MRAG 2010). The Mauritania–Senegal agreement for artisanal fishing provides for 300 Senegalese pirogues to fish small pelagics in Mauritanian waters (MRAG 2010). Therefore 700 Senegalese vessels are fishing illegally (MRAG 2010).
- **Mauritania:** Estimates of the extent of illegal (unlicensed) fishing in the Mauritanian artisanal fishery are 14 % (based on 700 illegal vessels and 4 322 legal vessels), with upper and lower limits at 5 % and 20 %, respectively, with illegal vessels assumed to be landing 100 % of their catch in Senegal (MRAG 2010).
- **Senegal:** The EEZ represents one of the most industrially-exploited in West Africa, and includes foreign fleets and fleets reflagged to Senegal (Belhabib et al. 2014a). These fleets comprise trawlers, purse seiners, pole and line vessels and sardine/small pelagic vessels. The two main infractions recorded in this fishery are the presence of trawlers in the exclusively reserved area for artisanal fisheries of 6-7 miles (42.8 % of infractions) and tampering with fishing nets (22 %) (MRAG 2010).
- **Senegal:** IUU catches in Senegal totalled 4.2 million tonnes between 2000 and 2011, and although IUU catches were shown to have remained relatively constant over time, illegal catches increased, in contrast to the legal Senegalese fleet (Belhabib et al. 2014a).
- **Senegal:** The Senegalese artisanal fleet represents the largest and most important in the area. It is estimate that 30 % of the catch is illegal (CRODT, 2008)(MRAG 2010).
- **Guinea-Bissau:** It is interesting to take note that a large proportion of the valuable fish exported to the European market originates from Guinea-Bissau waters rather than from Senegal as it has been officially reported (MRAG 2010).
- **Senegal:** A market for juvenile small fish and limited logistic capacity and manpower for monitoring, have resulted in the use of illegal nets (i.e. 8 mm mesh size instead of the legally authorised 12 mm mesh size) leading to an estimated 30 % of the catch (CRODT, 2008)(MRAG 2010). The chief infractions in this fishery are the aforementioned use of non-compliant mesh sizes (37.9 %) and landing of juveniles (22.4 %), and non-compliance with closed areas (17.2 %).
- **Sierra Leone:** In Sierra Leone, approximately one third of artisanal vessels regularly engage in illegal fishing, most notably by operating in closed areas (MRAG 2010).
- **Sierra Leone:** Between 2006 and 2010, over 30 % of the fleet were convicted for breaking the fishing ban within the channel area (MRAG 2010). The artisanal fishery in Sierra Leone is affected by large numbers of unlicensed vessels illegally fishing in inshore waters originating from other countries in the sub-Region, and particularly from Guinea (MRAG 2010). From previous accounts (see Djafal (2007)) the Senegalese illegal artisanal fleet induce losses in the Sierra Leone artisanal fishery sector.
- **Guinea-Bissau:** Illegal fishing is a consistent problem in Guinea-Bissau, Guinea and Sierra Leone. Past estimations suggest that illegal catches range from low/or undetermined in Cape Verde to very high in Guinea, i.e. 102 % of legal catch (MRAG 2005b). Guinea has showed persistently high levels of infractions (i.e. approximately 60 % of sightings in 1995-1996 and 2001 – MRAG, 2005)). The Environmental Justice Foundation (EJF) and Greenpeace investigated the extent and impact of IUU in Guinea, in 2006, observing 104 vessels, 53 of which were either engaged in, or linked to, IUU fishing activities (EJF 2007). In addition, Guinea-Bissau, and Sierra Leone showed increasing

occurrence of infractions from 1995-1996 to 2001, of 14 % and 28 % of sightings, respectively (MRAG and CapFish 2008). In contrast, the Gambia was observed to indicate a decrease in the occurrence of infractions from 19 % to 8 % of sightings over the same time period (MRAG 2005b).

Table 5 3. *Selected estimates of levels of illegal catch in the Western African region. Source: MRAG (2005).*

Country	IUU proportion to legal catch (%)	Estimate method
Mauritania	9	inferred
Senegal	8	inferred
Gambia	12	inferred
Guinea-Bissau	41	Inferred
Guinea	102	direct estimate
Sierra Leone	35	direct estimate
Cape Verde	0	inferred

4.1.1.5 Central Africa

- **Angola:** Foreign catches represented a third to a half of total removals from Angolan waters, most of which were never reported to Angola. Around 65% of industrial catches are species that are also caught by artisanal fisheries. This overlap illustrates the importance of tackling the issue of under-reporting and illegal fishing in Angolan waters (Belhabib & Divovich, 2015).
- **Angola:** (Belhabib & Divovich, 2015): Illegal catches by industrial fleets increased drastically from low levels in 1983 to a peak of around 63,700 t in 2010. Illegal catches taken by Senegalese pirogues transported to Angola onboard Korean mother-ships, increased from 1,400 t in 1990 when this activity began to 12,500 t in 1998 and then remained relatively constant at around 13,500 t·year-1 during the late 2000s (Figure 6a). China and South Korea (through Senegalese pirogues) contributed the most to illegal catches.
- **Angola:** (Belhabib & Divovich, 2015): Korean motherships are known to carry Senegalese pirogues (i.e. small artisanal fishing canoes) on-board to fish Angolan waters. In 2004, over 25 days of aerial surveillance, 199 of these vessels were spotted, 29 committing serious infractions, and 13% of these were fishing without licenses (MRAG 2005b). Furthermore, in 2009 7 vessels were arrested for illegal fishing during a campaign of two weeks (ANGOP 2009). This all translates into 170 vessels fishing illegally in 2009 (Belhabib and Divovich 2015).
- **Angola:** Dramatic increases in illegal catches made by industrial fleets have been observed. IUU fishing is estimated to have peaked in 2010 at 63 700 tonnes (Belhabib and Divovich 2015).
- **Cameroon:** Artisanal vessels: The artisanal sector dominates the catches of Cameroon with over 71 % of total catches (Belhabib and Pauly 2015a). However, it lacks a licensing system for artisanal fisheries in spite of comprising 85 % of foreign artisanal fishers (Kamgaing 2009, ENVIREP-CAM 2011).
- **Equatorial Guinea:** Estimates of IUU fisheries catches in Equatorial Guinea are 61 % of declared catches (MRAG 2005b, Belhabib et al. 2015a).
- **Cameroon:** The country only declared an EEZ in 2000, although “illegal” fishing vessels have been present since 1989. 9 vessels were arrested in 2011 (ENVIREP-CAM 2011). Since the early 2000s the industrial fishery has been involved nationally flagged vessels, including reflagged Chinese vessels (Pauly et al. 2014), targeting demersal resources (FAO 2010). Illegal Chinese vessels caught an estimated 9 500 tonnes per year in 2009 (Pauly et al. 2014). Estimates of illegal catches have increased from low levels in the mid-1980s to 2 300 tonnes in 1989 to 9 500 tonnes per year in the late 2000s. These are mostly due to Chinese and Russian vessels (Belhabib and Pauly 2015a).

- **Gabon:** Illegal catches are estimated at the equivalent of 50% of legal catches today, indicating an alarming increase in less than 25 years, which may partially explain the problem of over-exploitation in the waters of Gabon. Furthermore, of the around 80 taxa caught by the legal fisheries of Gabon, 40 taxa are also taken by illegal fisheries, indicating an overlap of 50% in taxa targeted or caught.
- **Gabon:** Small-scale fisheries in Gabon, the main source of animal protein, are threatened by increasing illegal fishing, combined with a low monitoring, control and surveillance capacity (Barrett et al. 2014). In 2005, illegal catches were equivalent to 19 % of the total legal catch (MRAG 2005b).Illegal foreign catches have increased from less than 1 000 tonnes in 1986 to over 23 000 tonnes in 2010 (Belhabib 2015a). Estimations of illegal catches in the past were suggested at 1 % of legal catches, but recent estimates indicate this figure has increased to around 50 % of legal catches (Belhabib 2015a).
- **Congo:** The Congo is characterised by declining fisheries resources , caused at least in part by overexploitation by foreign fleets (most notably from China), a lack of transparency, and high levels of corruption (Transparency International 2011) leading to licenses being awarded to about 70 foreign vessels despite the sustainable level being much lower (Maloueki 2005).
- **Congo:** Industrial catches by Chinese fleets unauthorised to operate in Congo increased from low levels when the fishery began in 2001 to around 14 800 tonnes in 2010 (Belhabib and Pauly 2015b).
- **DRC:** MRAG (2005b) estimated for each landed tonne of fish, the equivalent of 1.23 tonnes were IUUs taken from the EEZ of the Democratic Republic of the Congo (DRC)
- **DRC:** Over 36 cases of IUU fishing were reported in 2005, of which five (13.9 %) were cases of illegal/unlicensed fishing (MRAG 2005b). Foreign legal catches have decreased; in contrast, illegal catches increased to 1 800 tonnes per year on average between 2008 and 2010, which appears to be compensating for the declining legal catch (Belhabib and Pauly 2015b).
- **Equatorial Guinea:** For Equatorial Guinea, (Belhabib et al. 2015a) estimate illegal catches for the period 1950 - 2010 at 13 000 tonnes, with a maximum value of 1 200 tonnes in 2010.

4.1.2 Economic valuation of IUU fishing

Major economic impacts of IUU fishing include, but are not limited to the following:

a. **Lost license revenue income:** Losses from landing fees, licence fees and taxes payable by legal fishing operators (IUU catches transhipped or landed elsewhere). Such losses occur when vessels fishing on the high seas adjacent to the EEZ, or in adjacent EEZs make incursions into the coastal EEZ and fish with authorisation in circumstances where the normal terms of access are by mean of FFAs. The coastal EEZs are likely to be vulnerable to this kind of loss when there are numerous relatively narrow adjacent EEZs as is typical for countries between Gabon and Mauritania.
b. **Price depression due demand and supply effects.** This can occur in markets where IUU catch and legal catch are both be sold as if they were legal catches, through price elasticities in response to increased supply. A further negative impact of IUU fishing occurs when the product from this criminal activity competes on the same markets as legal product, the latter being perhaps product that is caught legally within the same EEZ by the local legal industry, or perhaps caught legally in other jurisdictions. This impact follows directly from price depression effects that occur when supply increases occur (see e.g. Lallemand et al. (2016)), as would be the case when far greater volumes are available for sale on a particular market than would be the case in the absence of IUU fishing. This source of damage was not evaluated by OLRAC (2004a, 2004b), but it should be considered in the event that, as is being recommended in certain quarters, Lacey Act

style legislation is enacted and enlisted in the fight against IUU fishing.

c. **Brand perception losses:** Further negative impacts occur when IUU fishing products are introduced into the same markets that legal product is being sold into. If these IUU fishing products are not subject to the same quality controls as the legal product then this can damage the perception of the brand and either compromise the price of the legal product or the access to certain markets for legal product.
d. **Market sanctions:** Costs and economic impacts of IUU fishing arise when the existence of IUU leads to sanctions on the importation of the legal product, as can occur in the case of the EU, via the EU's IUU Regulation. This has recently impacted the fisheries and exports into Europe by numerous developing countries, e.g. Papua New Guinea, Sri Lanka, Another related example is an eco-label or NGO rating which downgrades a particular resource, such as the recent downgrade of South African West Coast rock lobster from an orange listing to a red listing, which will limit or eliminate access to eco-label sensitive markets, particularly in circumstances where retailers have made a commitment to consumers to source sustainably caught fish products.
e. **Lost port fees, support services, fish handling and fuel sales, tourism income** (MRAG and CapFish 2008). Many IUU fishing vessels operate offshore and do not make use of the port services of the coastal state, although it should be said that this is also true of many DWF's. This represents a loss of income to the nation, caused by IUU fishing to the extent that it is a potential earning were the IUU fishing vessels and their fishing activity to be legalised.
f. **Increased harvesting costs and the costs of stock rehabilitation in the event that IUU is terminated and stocks need to be rebuilt to acceptable biological reference levels.** Methods for estimating this are outlined in OLRAC (2004a, 2004b).
g. **Losses of taxation income for the state.** This issue was investigation in OLRAC (2004a, 2004b).
h. **Direct loss of the value of the catches that could be taken by local fishermen if the IUU fishing was not taking place.** When the modality of IUU fishing is via the unauthorised encroachment of other flag state or origin state vessels into the economic marine zone of a sovereign coastal state, then there are lost economic opportunities for the coastal state and/or the fishermen and fishing industry of that coastal state. Most obviously there is a direct loss of the value of the catches that could be taken by local fishermen if the IUU fishing were not taking place. Some caution is however in order in interpreting this. In circumstances where the local fishing industry is not capacitated to engage in this fishery, then the loss is indirect, probably via lost opportunities to sell fishing access right to other legitimate operators from another country or region, or via the loss of value of that fishing access sale because of a reduction in the fishing conditions in the coastal state due to IUU fishing. OLRAC (2004a, 2004b) estimated the economic impact of IUU fishing on behalf of the US Department of Justice in the case (United States of America, Plaintiff-Appellant v. Arnold Maurice Bengis, Jeffrey Noll, and David Bengis Defendants-Appellees. No. 07-4895-cr United States Court of Appeals for the Second Circuit August Term, 2008 Argued: December 10, 2008), and concluded, as eventually agreed to by the restitution court acting in terms of the Lacey Act1, that one cannot assign both a cost to the lost catch and to the deterioration in the catching conditions, since these two costs are effectively different expressions of the same negative impact. One should either value one or the other, not both, and it was not admissible to sum the two. Nevertheless the lost catch is potentially substantial. This lost catch should be regarded as equivalent to the catch which would have to be forfeit by the legal fishing industry in order to get the fishery back to a condition that it would have been at had the IUU fishing not taken place. It is also equivalent to the additional catch costs that would be incurred in the event that the fishery is not rehabilitated and legal catches continue at former

levels. These considerations are seldom cited in relation to the general IUU literature, but they do become very important when economic impact estimates need to be impermeable in legal disputes, as in the OLRAC (2004a, 2004b) case.

i. **Impacts on the reliability of the scientific process.** Further impacts of IUU fishing arise in regard to the confusion they can create in the formulation of scientific advice for management. Exactly how this plays out depends on the exact modality of the IUU fishing. For example, in the example mentioned above, where other country flag/origin vessels encroach illegally into a coastal state's economic marine zone, then the main distortion that occurs is to the record of catches. In general, if this is not accounted for in the management process, then it can create an over-optimistic impression of the state of the resource, potentially inducing a state's fisheries management authority to manage the resource at a catch level that is too high. This is however not necessarily the case. In a number of cases in South Africa, when IUU fishing catches are introduced into the scientific calculations the results are sometimes somewhat counter-intuitive, and a possible outcome is an estimate that the resource is in fact more productive than is estimated when using only the small legal catch as the historic record of landings. Another "IUU fishing modality" is when a legal fishing operation engages in additional fishing and landings which are not authorised. Landings are then underreported, i.e. the illegal portion is omitted from the reports. This can be done in two ways, (1) where the effort associated with the illegal catch is reported but the catch is not (as is the case when it is impossible to hide this effort - e.g. a vessel was at sea for a known and unambiguous number of days), or (2) both the effort and the associated illegal catch are under-reported or not reported. Exactly how this confuses scientific deliberations will then depend on which of these two methods of illegal reporting are taking place.

j. **Multiplier effects in the impact of IUU fishing versus legal fishing on stocks and the environment:** A further impact occurs when the IUU fishing does not respect gear, minimum size and area restrictions. Perhaps the most common of these is the harvesting of undersized individuals or juveniles in general. This can mean that the impact of 1 ton of IUU catch in depressing the resource below its key target reference points is greater than 1 ton of legal catch. An example is the IUU fishing for West Coast rock lobster and abalone in South Africa. Both resources are being targeted by IUU operations which sell sub-legal size lobsters or abalone into a black market distribution network. The mathematical models used in the management process take account of these and in the process they estimate the impact ratio of 1 MT of legal versus IUU catch. IUU fishing thus has access to lobsters or abalone before they recruit to the legally exploitable stock, effectively depressing the recruitment rate to the legal exploitable biomass in the resource and fishery.

k. **Loss of income:** IUU fishing implies a loss of income and employment in industries, both in fishing itself or in industries related to or servicing fishing. There are multiplier effects of these costs through the economy, e.g. lost consumer demands by families of workers in the fishing industry and beyond.

l. **Losses due to discarding.** Discards clearly represent a component of the catch whose elimination might be beneficial to a range of fishers. For example, in West Africa there is utilization of shrimp discards from industrial vessels by artisanal vessels - in this case the relationship between discards and benefits is immediate and direct. However, as a rule, the extent of the losses due to discarding depends on the nature and species of the discards, and the survivorship of discarded individuals. In most circumstances, particularly for benthic finfish species, there is little if any survival amongst discarded fish. For crustacean species, or large pelagic species,

good survivorship following discarding is likely. Size is often an important driver of discards, particularly in response to minimum size regulations. Another significant factor is marketability and/or value, with smaller sizes being less marketable and thus more likely to be discarded. In these circumstances the benefits of curtailing discarding is equivocal, unless illegal operators are using small mesh gear, in which case the level of discards in the IUU fishing operation is much higher than in legal operations. In view of the disputable economic arguments around discarding, and the uncertainty around their estimation, these have been excluded from the economic valuations presented here.

Conservationist group Oceana estimates that the global economy loses between $10 billion and $23 billion annually from illegal fishing. A comprehensive assessment of the loss to Africa as a result of IUU fishing is outside the scope of this document. This section is limited to estimating the economic value of a single year's worth of IUU fishing. In the subsequent section on environmental impacts, we argue that the costs of the environmental impact is related to the value of the cumulative IUU catch since the time that Africa has been the steward of fisheries in its EEZ, i.e. roughly since about 1980. These cumulative catch estimates are contained in that section. The single year valuation is therefore related to the economic benefit that Africa could derive following the cessation of IUU fishing, for a single year, without allowing for stock rehabilitation.

Table 14 4 and Table 14 5 (see supporting tables) provide country specific economic value estimates derived from the Sea Around Us project data (Pauly and Zeller 2015), including valuations of IUU catches. The variants represented in these tables cover;

- Inclusion of discards, use of the "reported catch price" to value the unreported IUU catch
- Inclusion of discards, use of the "unreported catch price" to value the unreported IUU catch
- Excluding discards, use of the "reported catch price" to value the unreported IUU catch
- Excluding discards, use of the "unreported catch price" to value the unreported IUU catch

This places a value on African IUU fishing of, either including or excluding discards, reported and unreported (IUU) estimates by African maritime country derived from the Sea Around Us data. Taking these estimates at face value they suggest that the annual economic loss due to IUU fishing in Africa is between $ 10 billion and $ 13 billion depending on whether discards are excluded from or included in the analysis, and using Pauly and Zeller's (2015) IUU catch prices. These values are large and exceed the value of reported landings estimated by Pauly and Zeller (Pauly and Zeller 2015, Zeller and Pauly 2015) for Africa of some $ 7.177 billion by a considerable amount, either 50% or 90%, depending whether the value of discards are included or excluded from the IUU tonnage.

For this study we cross checked the data supplied by the Sea Around Us project with the estimates provided in the country specific documents for Africa, also provided by the Sea Around Us project, and referenced in the Pauly and Zeller (2016) article in Nature Communications. The results of these investigations are presented in Table 14 7.

Table 14 12 (see tables at the back of this document). There is some circularity in this investigation, but the predominance of RED cells in these tables suggests that the Pauly and Zeller (2015) estimates are generally larger than existing estimates published elsewhere.

We suggest that the data provided in the country specific documents are more reliable, based on the evidence of one or two large discrepancies. For example, whereas in Table 14 4 (see supporting tables) the Pauly and Zeller (2015) data suggest a 2010 unreported IUU tonnage for Morocco of close to 1.6 million tons, the relevant country specific document reveals that the tonnage of 1.6 million tons is in fact the total corrected catch for 2010 for Morocco, and the IUU component of this is in the order of 400 000 tons.

A notable feature of the pricing information made available from the Sea Around Us database is that typically the $/kg price for the IUU component of the total catch exceeds the price for the reported component of the total catch. So, for example, the $10 billion value for IUU catches excluding discards is associated with 4.7 million tons of fish, whereas the reported catch of 5.9 million tons is associated with a value estimate of $7.17 billion. The average prices comparing reported catches with unreported IUU catches (excluding discards) are:

- Reported: $7.17 billion/5.9 billion kg = 1.22 $/kg
- IUU excluding discards: $10 billion/4.7 billion kg =2.13 $/kg.

However, as shown in Table 14 4 and Table 14 5 (see supporting tables), even if one were to use the so-called “reported catch price”, the value of the IUU catch is still $ 5.58 billion. In the ensuing discussion and associated calculations we have generally used the value of $ 10 billion for the value of the IUU catch in Africa.

The valuation of IUU catches (2010 is the reference year used here) of $5.73 billion, albeit reduced by the exclusion of discards and the use of Pauly and Zellers (2015) “reported prices” is very high compared to other estimates (published or other). For example, MRAG (2005b) estimate the total annual value of all IUU to be US$0.9 billion in sub-Saharan Africa for 2003. Based on the same countries covered in the MRAG (2005b) report, the Sea Around Us study suggests a figure for 2010 for IUU fishing in sub-Saharan Africa which is 10 times larger. The country by country comparisons are as shown in Table 5 4.

This table shows that Pauly and Zeller’s ex-vessel IUU catch value is 10 times larger than the earlier MRAG (2005b) figure. These estimates are separated in time by seven years, since they use reference years of 2003 and 2010 respectively. We speculate that such a large difference cannot be attributed to growth of African fisheries over 7 years. Resolution of this matter needs more study and analysis before it would be possible to understand the factors driving such a large difference. Here, for economic value, we take the same approach as was taken with the estimates of the catches attributable to IUU fishing in a previous section, noting that the estimates provided by the Sea Around Us study (Pauly and Zeller 2015) are the only comprehensive estimates available for all coastal African state. We treat these as a falsifiable null hypothesis and test this null hypothesis using all available alternative estimates, to formulate a view on whether Pauly and Zeller (2015) should be adjusted to a different value in light of these other estimates. Comparisons are made available as a table which includes the specific alternative source reference, and as coloured tables (Table 14 7).

Table 5 4. *A comparison of the landed and IUU values estimated in MRAG (2005) and by Pauly and Zeller (2015, 2016), where for the latter the values are based on the data downloaded from the Sea Around Us project data.*

	Landed value ($ 000 000)		IUU value ($ 000 000)	
	MRAG (2005)	Pauly and Zeller (2015)	MRAG (2005)	Pauly and Zeller (2015)
Country	Reference Year: 2003	Reference Year: 2010	Reference Year: 2003	Reference Year: 2010
Angola	205	573	49	343
Benin	14	11	2	78
Cabo Verde	11	34	0	14
Cameroon	37	60	15	24
Comoros (the)	22	17	8	8
Congo (the)	26	85	15	80
Côte d'Ivoire	51	92	42	109
DRC	4	10	4	26
Equatorial Guinea	2	15	1	38
Eritrea	13	5	6	2
Gabon	55	89	11	116
Gambia (the)	24	110	3	77
Ghana	252	299	11	209
Guinea	103	159	105	1026
Guinea-Bissau	13	110	5	284
Kenya	15	19	4	14
Liberia	8	35	12	126
Madagascar	247	247	14	89
Mauritania	193	594	17	2408
Morocco	734	1329	59	3042
Mozambique	215	415	38	69
Nigeria	495	478	327	436
Tome and Princ	4	12	0.00	8
Senegal	423	543	32	688
Seychelles	137	112	8	2
Sierra Leone	81	150	29	87
Somalia	31	98	94	116
South Africa	626	499	0	97
Tanzania	91	110	17	40
Togo	20	27	10	91
Total	4152	6338	938	9747

Table 5 5. *A table with some of the important intermediate quantities used to calculate the contribution that the IUU catch could make to African economies, in absolute terms (World Bank values, PZ values) or as a proportion of the GDP (GDP Addition (%)). Note that the values in red have been assumed since the World Bank study did not provide estimates for these countries.*

Country	GDP $ Billions, 2015	GDP%/100	Extended Fisheries GDP, 2015($ Billions)	IUU value ratio	World Bank values ($ billions)	PZ values ($ billions)	GDP Addition (%)
Angola	102.0	0.030	3.060	0.599	1.833	1.03	0.01
DRC	39.1	0.010	0.391	2.576	1.007	0.08	0.00
Congo (the)	8.9	0.014	0.125	0.944	0.118	0.24	0.03
Gabon	13.8	0.008	0.110	1.301	0.144	0.35	0.03
Equatorial Guinea	10.0	0.020	0.200	2.547	0.509	0.12	0.01
Cameroon	28.5	0.009	0.257	0.396	0.102	0.07	0.00
Sao Tome and Principe	0.3	0.052	0.016	0.668	0.010	0.02	0.08
Sub-Total Central Africa	202.60	0.021	4.16	0.753	3.129	1.91	0.01
Madagascar	9.5	0.055	0.523	0.359	0.188	0.27	0.03
Mozambique	17.0	0.040	0.680	0.167	0.114	0.21	0.01
Eritrea	4.3	0.020	0.086	0.380	0.033	0.01	0.00
Djibouti	1.7	0.001	0.002	1.111	0.002	0.01	0.01
Somalia		0.020	0.000	1.174	0.000	0.35	
Kenya	63.1	0.005	0.316	0.741	0.234	0.04	0.00
Tanzania	46.2	0.027	1.247	0.365	0.456	0.12	0.00
Seychelles	1.4	0.300	0.420	0.014	0.006	0.00	0.00
Comoros (the)	0.6	0.150	0.090	0.486	0.044	0.02	0.04
Mauritius	11.6	0.010	0.116	0.216	0.025	0.02	0.00
Sub-Total Eastern Africa	155.400	0.022	3.479	0.330	1.150	1.05	0.01
Western Sahara							
Morocco	103.1	0.025	2.578	2.288	5.898	9.13	0.09
Algeria	175.1	0.010	1.751	1.596	2.794	0.88	0.01
Tunisia	44.3	0.010	0.443	0.008	0.003	0.00	0.00
Libya	29.7	0.010	0.297	0.614	0.182	0.22	0.01
Egypt	301.4	0.010	3.014	0.370	1.115	0.14	0.00
Sudan (the)	84.3	0.010	0.843	0.087	0.074	0.00	0.00
Sub-Total Northern Afric	737.900	0.012	8.926	1.798	16.051	10.37	0.01
South Africa	317.3	0.010	3.173	0.194	0.617	0.29	0.00
Namibia	12.9	0.030	0.387	0.312	0.121	0.19	0.02
Sub-Total Southern Afric	330.200	0.011	3.560	0.229	0.815	0.48	0.00
Gambia (the)	0.8	0.018	0.014	0.697	0.010	0.23	0.29
Senegal	14.0	0.023	0.322	1.268	0.408	2.06	0.15
Mauritania	4.7	0.045	0.212	4.056	0.858	7.22	1.54
Cabo Verde	1.6	0.013	0.021	0.395	0.008	0.04	0.03
Nigeria	493.0	0.014	6.902	0.913	6.299	1.31	0.00
Benin	7.7	0.018	0.139	6.994	0.969	0.23	0.03
Togo	4.2	0.040	0.168	3.379	0.568	0.27	0.07
Ghana	37.7	0.080	3.016	0.697	2.102	0.63	0.02
Côte d'Ivoire	31.3	0.008	0.250	1.179	0.295	0.33	0.01
Liberia	2.0	0.040	0.080	3.595	0.288	0.38	0.19
Sierra Leone	4.3	0.094	0.404	0.581	0.235	0.26	0.06
Guinea	6.7	0.018	0.121	6.459	0.779	3.08	0.46
Guinea-Bissau	1.0	0.037	0.037	2.585	0.096	0.85	0.85
Sub-Total Western Afric	609.0	0.019	11.7	2.132	24.910	16.90	0.03
Relevant Totals	2773.0	0.0	40.7		46.054	30.714	0.011

Table 14 12 - see supporting tables) intended to convey the overall impression of whether the Pauly and Zeller (2015) estimates are larger (red) or smaller (green) than other sources.

A calculation was carried out to determine how much fisheries could contribute to the GDP of African coastal states. Two different calculations were carried out and then compared. The first calculation uses country GDP levels as widely publicized in the literature for 2015, and applies the values for the "fisheries GDP" as a % of country GDP (The World Bank 2012) to calculate the "fisheries GDP" contributions. We then obtained the ratios of the value of the IUU catch (excluding provision for discards) divided by the value of the reported catches for 2010 from the data made available by the Sea Around Us project (Pauly and Zeller 2015). These ratios were applied to the "fisheries GDP" quantum's to calculate the total additional contribution to the GDP that could be achieved by the complete cessation of IUU fishing, assuming that this would all be a new addition to the economy. We refer to this amount as the "World Bank values". The second method was to simply multiply the value of the IUU catch reported by Pauly and Zeller (2015) by an ex-vessel value economic multiplier of 3.00 (based rather loosely on the average economic multiplier in Africa of 2.59 reported by Duck and Somalia, 2010), referred to as the "PZ values". This puts the two economic values of the possible benefit of IUU fishing on a similar footing, as the "extended GDP" contribution that is realized when the complete feed through effect of all economic activity takes place. The only difference that may remain is a degree of inland freshwater wild capture fishing GDP in the case of the "World Bank values". The following table (Table 5 5) shows the final results obtained using these two approaches:

The results suggest an absolute contribution of between $ 30.7 billion and $ 46.1 billion could be achieved, bearing in mind that the larger number is relevant to the World Bank document Hidden Harvest which includes a contribution from inland freshwater wild capture fisheries. The following figure (Figure 5 4) gives some indication of the degree of consistency between the two calculation approaches by country (i.e. each diamond symbol in this plot is a different African coastal state).

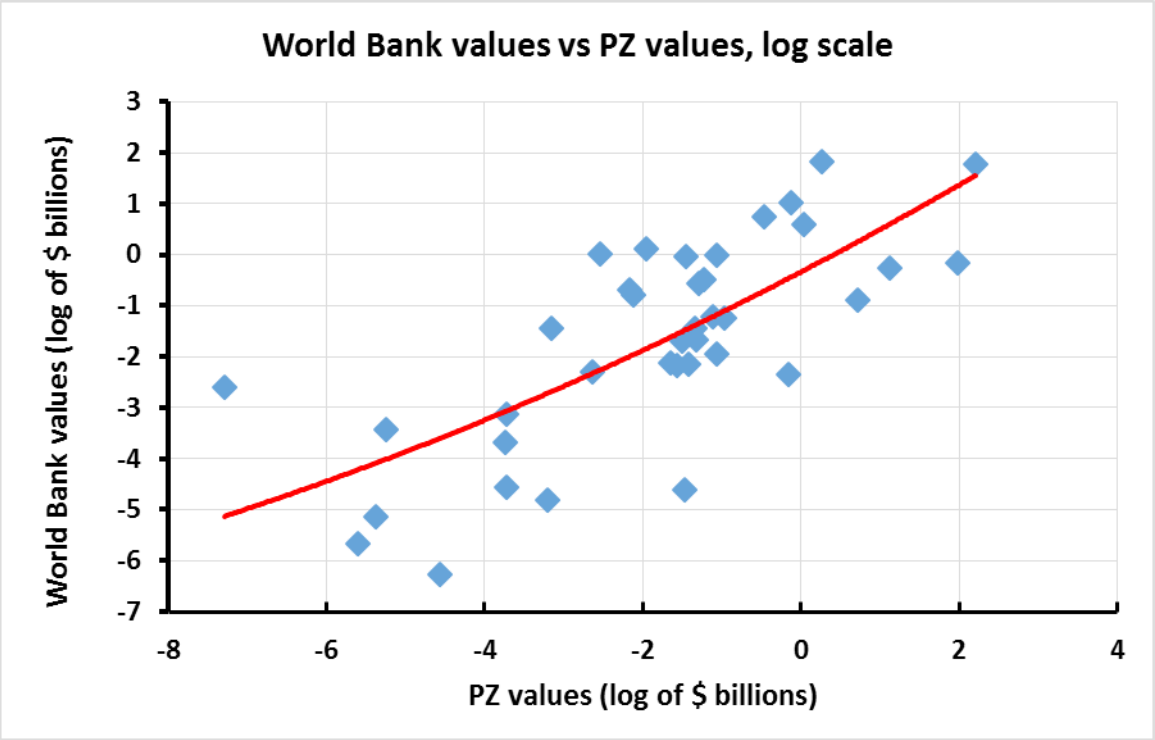


Figure 5 4. *A plot of the World Bank values versus the PZ values described in the text, on a log scale.*

The overall potential contribution of IUU fishing, were it to be possible to realize it all as a benefit for coastal African economies, is thus between 1.1% and 1.7% of the African coastal state GDP.
The following highlights a few examples of the scale of the economic impact of IUU fishing in Africa.

4.1.2.1 Southern Africa

- **outh Africa:** The value of IUU fishing for abalone alone is presently in the order of US$ 50 - 100 million annually, and tonnages are some 20 times the legal catch. In the West Coast rock lobster resource, IUU fishing accounts for about 25% of the total legal + IUU take from the resource according to estimates that are incorporated into stock assessment analyses and management scenarios. However some new recent estimates place the figure at least 4 times higher, consequently new methods of estimating IUU fishing based on intelligence gathering techniques are under consideration. South African IUU abalone is worth an estimated R 1.2 billion per year to the South East Asian markets.
- **South Africa:** In South Africa, for West Coast rock lobster, the annual value of IUU fishing is larger than $ US 10 million, or between ZAR 150 million and ZAR 200 million.
- **South Africa:** On a value basis IUU fishing in South Africa is estimated conservatively at about ZAR 1.5 billion per year, or in the order of US$ 100 million per annum circa March 2016.

4.1.2.2 Eastern Africa

- **Mozambique:** In Mozambique, unsustainable fishing is caused by the loss of national income (mainly from taxes); conflicts between foreign fleets and locals; an increase of CPUE; and a decrease in fish stocks (Lopes and Pinto 2001).
- **Tanzania:** In 2001 an estimated US$20 million was lost to IUU in Tanzania (Stop Illegal Fishing 2008).
- **Somalia:** IUU catches are estimated to remove more than US$450 million in fish value out of Somalia annually (Waldo 2009)
- **Somalia:** It is believed that each year the EU alone take IUU catches out of Somalia which is five times the value of its aid to Somalia (Waldo 2009).
- **Somalia:** Estimates of revenue losses from IUU fishing are about US$ 300 million a year (Stop Illegal Fishing 2008).
- **Kenya:** In East Africa, Kenya's coast has become quite vulnerable in recent years to illegal fishing, especially with regard to tuna fish. The government reports that the country loses at least $118 million annually due to illegal fishing and fish poaching
- **Somalia:** In addition to illegal fishing, there have also been reports by local fishermen of foreign ships dumping toxic and nuclear waste (e.g. radioactive uranium; heavy metals such as cadmium and mercury; hospital waste) off Somalia's shores (UNEP 2005, Tharoor 2009). According to the UN's 2005 report, it cost European companies US$ 2.50 per tonne to dump toxic waste off the Horn of Africa – a significant 100-fold decrease from the legal method of disposing within Europe (UNEP 2005).

4.1.2.3 Western Africa

- **West Africa sub-region:** IUU fish loss per boat per year was estimated to be up to US$ 3 million in the West Africa sub-region (MRAG and CapFish 2008), which could be losing up to US$ 1.3 billion annually (Copeland 2014).
- **Senegal:** More specifically, in the case of Senegal, the IUU loss of approximately US$ 300 million in 2012 is equivalent to about 2 % of the GDP (Belhabib et al. 2014b).

- **West Africa:** Kaczynski and Fluharty (2002) argue that EU access agreements do not economically or socially benefit West Africans. The fishery sector provides significant direct and indirect employment opportunities, specifically to more vulnerable groups such as women and young people , e.g. Senegal employs 125 354 people, comprising approximately 59 428 full-time artisanal fishers, 2 850 people in 76 processing plants, and 59 976 employees in craft workshops (MRAG 2010). In Sierra Leone, artisanal fisheries alone employ 30 000 full-time and 200 000 part-time fishers, and numbers are mirrored in Gambia where the sector contributes approximately 4 % of the GDP (MRAG 2010). In Côte d'Ivoire, where the sector represents only a relatively small percentage of the GDP, fisheries (i.e. both marine and inland) provide more than 400 000 people with livelihoods. In Mauritania, an estimated 704 undetected illegal artisanal vessels from Senegal can be found in Mauritanian waters, catching 13 000 tonnes of fish worth approximately US$ 14 million, resulting in a loss of US$ 1.4 million in license fees (MRAG 2010). Value-added losses are more significant, between US$ 8.5–12.1 million in fishing value-added, and a further US$ 9.3 million for processing value-added (MRAG 2010). These value-added losses accrue predominantly to Senegal, as a large proportion of the illegal catches are landed there, from where the majority of the illegal vessels (and crew) originate (MRAG 2010). It has been estimated that if the illegal vessels were removed, and the legal vessels were able to take the illegal vessels' catch, the outcome would be an additional 3 tons of catch per vessel, worth US$ 3 256 (MRAG 2010). This represents a potential 15 % reduction in revenue to the legal operators due to illegal fishing, which is significant. Intangible losses due to illegal fishing by unlicensed artisanal vessels result in decreased CPUE for legal operators, and less economically viable fishing operations. In addition, IUU has possible implications on market prices, with illegal operators able to undercut legal operators in asking price, due to lower costs as a result of not paying the licence fee (MRAG 2010).
- **Senegal:** In Senegal, government revenue is mostly lost through lost licence fees and associated port fees, but due to the small size of the artisanal fleet (and low vessel licence costs i.e. between US$ 30-50), and the level of illegal fishing in the industrial fleet, losses from this source are estimated to be low (i.e. less than US$ 0.2 million – MRAG, 2010). In contrast, estimated values of illegal fish from the artisanal fishery (US$ 39 million from the shrimp and pelagic fisheries combined, predominantly originating from the pelagic fishery) and to a much lesser extent the industrial fishery (at $ 1.2 million) are significant. Moreover, half of the value added (i.e. fishing and processing combined) is lost from the industrial fishery about US$ 153 000 (MRAG 2010). Intangible losses to illegal fishing in Senegal are mainly owing to the activities of the artisanal fishing fleet, which is using small mesh size nets. More recently, IUU catch in Senegal has been estimated to account for losses of US$ 300 million (Africa Progress Panel 2014) , which is significant considering past estimations in the region, for example US$ 110 million per year to IUU activities in Guinea, considered the worst in Africa at the time (MRAG 2006).
- **Guinea-Bissau:** In Guinea-Bissau loss of processing value added due to illegal fishing is negligible, due to no local processing of legal catches. Therefore, Guinea-Bissau would be able to retain more economic benefits from its fisheries not only if losses due to illegal fishing were reduced, but if more local processing were to take place (MRAG 2010). The inability of Sierra Leone to meet required international standards or tightly regulated markets has left the country unable to maximise the benefits from its resources. IUU has been estimated to result in considerable losses for the industrial fishery (US$ 2.2 million lost in value added) and gains for the artisanal fishery (US$ 15 million in value added) (MRAG 2010).

- **Nigeria:** Nigeria is estimated to sustain loses of about US$ 30 million annually to illegal fishers (MRAG and CapFish 2008). Crewmembers of trawlers are known to illegally off-load and sell considerable portions of their catch at sea, and some are even encouraged by the trawler owners to use the proceeds to illegally bunker Automotive Gas Oil (AGO) at sea (MRAG and CapFish 2008). Moreover, trawlers no longer possess free access to their fishing grounds as pirates, particularly in the Niger Delta, are known to frequently attacked trawlers at sea, with 88 such attacks between 2006 and 2008, making it a source for serious concern (MRAG and CapFish 2008).
- **Guinea-Bissau:** Destructive small-mesh nets are used illegally in West Africa and other regions (MRAG 2010) , and it has been suggested for example that by eliminating these nets in Guinea-Bissau, profits for other fishermen could increase between 50 and 100 % (MRAG 2010).

4.1.2.4 Central Africa

- **Gabon:** Economically, illegal fisheries are estimated to have extracted over $207 million US in 2010 from the waters of Gabon that could have been extracted by legal fisheries, assuming a price of $8.3/kg (RFI 2012). Thus, the net loss to the total Gabonese economy, if we could assume complete landings and processing within Gabon, using an economic multiplier of 2.95 (Dyck and Sumaila 2010), would be equivalent to $610 million US per year. The legal fisheries contribute $1.3 billion US to the Gabonese economy, i.e., around 9% of the Gabonese GDP in 2010, while small-scale fisheries alone contribute $800 million US of the total economy, i.e., 5% of the GDP, a clear indication of their importance to both the economy and food security.
- **Gabon:** In 2010, Illegal fisheries have been estimated to have extracted over $ 207 million from the waters of Gabon (Belhabib 2015a).

4.2 Environmental Impacts of IUU in Africa

Environmental Impacts of IUU fishing in Africa are multifaceted. IUU fishing is often associated with the use of illegal gear types such as gill nets which are indiscriminate with respect to species and size of fish. Therefore, when IUU fishing is taking place, effects on target stocks and bycatch species are a cause for concern. Of course, whatever damage may be occurring due to the use of legal fishing gear would be increased in the event of IUU fishing, even were the latter adhering to gear regulations. Effects on target stocks would include reducing the exploitable biomass or the spawning biomass below desirable levels, and below the levels that would be reached in the absence of IUU fishing. There could be impacts on TEP species such as sharks, seabirds and turtles through incidental mortality, increased potential for 'ghost' fishing (i.e. caused by discarded or lost fishing gear), and the use of indiscriminate methods and gears (i.e. non-specific hooks or mesh sizes, gillnets, small mesh trawl gear).

Although many of the above are easily categorised and quantified as species specific impacts, it is also necessary to view these impacts in the context of ecosystem impacts, where the interrelationships between species are recognised. In this context, overexploitation of a keystone species could have a ripple effect through the ecosystem. These impacts are not well understood, and mathematical models of these processes often produce counter-intuitive or contradictory results which thus have low reliability. Nevertheless there is a general view that top predators such as sharks are important for the functioning of the ecosystem, and similarly, but perhaps more directly, forage species such as small pelagics are often a major source of food of species at a higher trophic level. There is a clear view that the over-exploitation of small pelagics in such circumstances would have impacts that

go beyond their status as a single species, impacting on the status of piscivorous species such as seabirds, marine mammals and large predatory fish. There is thus an appreciation that "ecosystem services" can be compromised by overfishing. Exactly what happens to ecosystems when they are stressed too far is not clear at all. In some cases, it may be that an entire ecosystem or a sub-component of an ecosystem can move into an alternative stable state. An important response to these ecosystem level risks is the promotion of the Ecosystem Approach to Fisheries by the FAO. This is rapidly, but not without controversy, becoming the main reference framework for managing fisheries and implementing the principles of sustainable development. Many fisheries jurisdiction have only responded to the emergence of EAF partially or not at all, and some aspects such as the use of EBMs (Ecosystem Based Models) is still at a very early stage of development. It is not presently clear whether EBMs could ever form the basis for setting controls levels in fisheries.

Allied to the above is the additional appreciation that the environment is a very broad concept and thus that the environmental impacts of IUU fishing go far beyond the impacts on species, stocks and ecosystems, and include many aspects from the social and human dimensions. These are not dealt with in this section, but in a subsequent section headed "Social impacts of IUU in Africa".

For the purpose of this section the environmental impacts of IUU fishing are divided into three broad categories:

1. **Stock Status:** Impacts on the stock status for target species and for incidental non-TEP by-catch species. Impacts on TEP species, where TEP refers to Threatened, Endangered and Protected.
2. **Habitat:** Habitat damage.
3. **Ecosystem Services and Biodiversity:** Impacts on the ecosystem and ecosystem services, including impacts on TEP species.

4.2.1 Stock status impacts

The impact of IUU fishing on an isolated stock is understood in the same terms that other fishing impacts are understood, in terms of the impact on the exploitable stock or the spawning biomass. When stock assessment models are used to assess the scale of this impact, then it would be common practice to include a mathematical description of specific aspects of IUU fishing on a case by case basis. For example, if because of the use of illegal gear, or the violation of minimum size restrictions, the selectivity of the IUU component of the catch is represented as best possible, and as mentioned elsewhere in this document, this can make a unit of IUU catch or effort much more effective at depleting resource levels below its desirable reference point.

So the occurrence of IUU fishing means that the resource biomass may fall below common biological reference points such as BMSY, BMEY or B0.1. Whether this happens depends on how reliable the information about the scale of IUU fishing is, and how responsive management is to resource trends. In certain management contexts (e.g. abalone, South Africa), IUU fishing is fully incorporated into the management process, and management decisions are reactive to these levels of IUU fishing. In practice this means reducing allowable catches in order to achieve biological targets despite the existence of IUU fishing. In this context the impact of IUU fishing may not be on the stock status, but rather on the catch forfeit required from the legal catch to achieve biological targets despite the existence of IUU fishing. Biological targets are however only achievable if IUU fishing does not exceed sustainable levels. If IUU fishing exceeds sustainable catch levels for the stock then even setting the legal catch to zero will not lead to the achievement of biological targets. At this point the

impact of IUU fishing will go beyond reducing permitted legal catches, and extend to undesirable stock depletions.

In general, where management is weak and/or is not based on stock assessments, IUU fishing is likely to grow to a level that will cause biologically undesirable stock abundance depletions.

OLRAC (2004a, 2004b) proposed three different methods to estimate the economic impact of IUU fishing which are of use in expressing the deleterious impact of IUU fishing on stock status in financial terms:

1. **Stock rehabilitation and increased harvesting costs:** The value of the legal catch that must be foregone in order to rebuild the stock biomass to the level it would have achieved by a particular reference time point, had the IUU fishing catch not occurred, combined with the additional harvesting costs incurred by the legal fishery until such time that the resource biomass has been rehabilitated.
2. **Value of lost opportunities:** The value of the IUU fishing landings, viewed as the value of a lost opportunity.
3. **Taxation losses:** The lost tax revenue due to IUU fishing, assuming an infinite time horizon in which stock rehabilitation never occurs.

OLRAC (2004a, 2004b) proposes a methodology to estimate each of these economic costs. Methods 1 and 3 require the application of the same population models used for stock assessments, but extended to incorporate relevant economic features. There is a relationship between the costs obtained from Methods 1 and 2. For the examples addressed by OLRAC (2004a, 2004b)they are roughly equivalent but this is not a general result, and in practice each case will have to be analysed on its merits. Variables which affect the nature of the relationship between the costs obtained via Method 1 and Method 2 are:

1. The cost of variable fishing effort
2. The landed value of a unit of fishing product.
3. The catch history of the resource, both legal and IUU fishing
4. The surplus production relationship for the stock in question

The environmental cost of the over-depletion of stock biomass due to IUU fishing is perhaps only fairly related to the first component of Method 1, i.e. the underlined:

“The value of the legal catch that must be foregone in order to rebuild the stock biomass to the level it would have achieved by a particular reference time point, had the IUU fishing catch not occurred, combined with the additional harvesting costs incurred by the legal fishery until such time that the resource biomass has been rehabilitated”

However, it seems that the second component of the Method 1 cost “the additional harvesting costs incurred by the legal fishery until such time that the resource biomass has been rehabilitated” may be a useful stand-in proxy for the cost (in a very broad and general sense) to the ecosystem until such time that stock rehabilitation occurs. Thus both components of the Method 1 cost are potentially relevant to a valuation of the environmental impact and its financial equivalent.

It is therefore suggested

a. The financial costs derived from Method 1 are roughly equivalent to those given by Method 2
b. That the Method 1 costs and losses are a reasonable first off proxy for the financial equivalent of the environmental impact, and hence by (a) so are the Method 2 costs and losses.
c. That reckoning of losses and costs should only extend back to 1980, roughly the time of UNCLOS. The valuations quoted here have potential relevance to a debt owed by other nations to Africa, and such an interpretation only seems relevant since African coastal states had control of the resources within their EEZ.
d. That the above valuations of losses and costs should be adopted as the basis for any discussion of IUU fishing impacts until such time that they are replaced by alternative improved estimates, and that should a party find fault with these estimates then the burden of proof rests with the disagreeing party.

Under these terms the environmental impact of IUU fishing is equivalent in value terms to the value of the cumulative IUU fishing catch from 1980 to 2016.

For example, if the Africa wide level of IUU fishing is 33.3% of the legal catch, then the environmental impact of this catch is equivalent to the value of 33% of the legal catch. This means that over three years, IUU fishing has a value equivalent to the reported value of African marine catches for a single year.

What this means is that whereas in other sections of this document there has been a focus on the annual scale of IUU fishing and/or its value in relation to the legal catch, the environmental impact should be related to the value of the cumulative historical IUU catch which is a much larger figure than the annual IUU catch.

In order to estimate the value of the cumulative IUU catch that has occurred since 1980, we have made use of the Pauly and Zeller (2015) data, but we have used the “reported” price for this, and with these prices and the unreported catches (excluding discards), the estimated valuations areas given here in Table 5 6.

A large component of this is due to fishing in Namibian waters prior to independence in 1990, i.e. over the period 1980 - 1990. The main figures to take out of this table is the total cumulative value of IUU fishing in Africa for 1980 to 2016, which is, depending on whether discards are included or excluded, and using either the reported catch prices by year and country or the unreported catch prices by year and country:

Table 5 6. *Cumulative value of unreported catches from 1980 to 2016 based on the Sea Around Us data from Pauly and Zeller (2015), using country specific "reported" catches from Pauly and Zeller's data, assuming that the values for 2011 to 2016 are the same as those for 2010.*

Country By AU Region	With Discards			Without Discards		
	Tonnage UR (MT)	LV UR ($) Unrep PI	LV UR ($) Rep PI	Tonnage UR (MT)	LV UR ($) Unrep PI	LV UR ($) Rep PI
Central Africa	13696093 MT	$23,987,328,425	$33,243,519,737	10534723 MT	$17,620,523,549	$24,959,208,895
Angola	6170779 MT	$9,537,264,174	$17,960,195,931	3898948 MT	$5,665,467,748	$11,495,583,662
Cameroon	939111 MT	$1,300,968,866	$1,113,543,981	851262 MT	$1,204,872,272	$1,008,690,250
Congo, R. of	994407 MT	$2,460,132,758	$718,259,087	722032 MT	$1,393,630,002	$581,900,046
DRC	373733 MT	$685,630,021	$2,237,848,586	304396 MT	$613,331,943	$1,669,669,424
Equatorial Guinea	1654916 MT	$4,026,616,163	$3,675,024,981	1473650 MT	$3,641,372,749	$3,298,600,348
Gabon	3346191 MT	$5,517,450,072	$7,082,076,847	3113076 MT	$4,766,679,059	$6,536,863,162
Sao Tome & Principe	216957 MT	$459,266,370	$456,570,325	171360 MT	$335,169,776	$367,902,002
Eastern Africa	9594684 MT	$18,515,647,329	$24,566,257,864	7692368 MT	$14,216,983,391	$19,329,963,590
Comoros Isl.	108073 MT	$142,377,273	$196,600,414	108073 MT	$142,377,273	$196,600,414
Djibouti	36693 MT	$68,359,364	$83,167,096	32284 MT	$60,791,022	$73,612,752
Eritrea	91903 MT	$102,967,637	$116,519,444	39127 MT	$38,490,774	$57,724,047
Kenya	328419 MT	$503,946,254	$733,724,187	310209 MT	$477,127,395	$696,085,126
Madagascar	1501725 MT	$3,090,139,710	$4,107,135,886	961408 MT	$1,928,623,043	$2,727,110,261
Mauritius	102871 MT	$178,149,353	$302,225,823	102576 MT	$177,169,785	$301,500,034
Mozambique	4037830 MT	$9,658,398,674	$11,177,459,099	3059995 MT	$7,179,429,197	$8,187,489,507
Seychelles	29481 MT	$50,200,082	$63,080,254	25584 MT	$41,417,246	$54,745,442
Somalia	2203845 MT	$3,070,321,348	$5,671,188,139	1979458 MT	$2,623,452,379	$5,062,450,057
Tanzania	1153845 MT	$1,650,787,635	$2,115,157,522	1073653 MT	$1,548,105,278	$1,972,645,948
Northern Africa	82932400 MT	$198,159,312,634	$114,260,680,833	58200988 MT	$139,920,220,300	$81,228,127,421
Algeria	2420420 MT	$5,395,587,767	$8,102,071,707	1948186 MT	$4,115,715,524	$6,485,694,563
Egypt	1451720 MT	$2,238,557,690	$2,130,006,196	1042895 MT	$1,278,344,343	$1,550,542,543
Libya	915866 MT	$1,872,261,207	$3,022,532,502	374165 MT	$920,402,362	$1,321,470,730
Morocco	77469919 MT	$187,392,242,137	$98,990,036,044	54544898 MT	$133,020,034,351	$71,020,626,150
Sudan	25669 MT	$38,461,943	$38,219,902	17033 MT	$27,775,589	$27,370,636
Tunisia	648806 MT	$1,222,201,890	$1,977,814,481	273812 MT	$557,948,131	$822,422,799
Southern Africa	20306608 MT	$14,497,337,204	$70,533,127,239	16906834 MT	$9,423,582,710	$62,821,760,747
Namibia	18171507 MT	$10,877,412,598	$67,622,227,924	16414122 MT	$7,769,269,605	$61,747,790,177
South Africa	2135101 MT	$3,619,924,605	$2,910,899,316	492712 MT	$1,654,313,105	$1,073,970,571
Western Africa	128033649 MT	$275,243,564,109	$205,185,564,606	85980578 MT	$183,278,734,672	$137,948,827,934
Benin	1870119 MT	$2,446,023,601	$3,489,830,750	1854653 MT	$2,404,923,825	$3,457,946,556
CÃ´te d'Ivoire	2578396 MT	$3,052,555,360	$4,541,104,667	1904786 MT	$2,223,040,952	$3,158,145,025
Cape Verde	238458 MT	$538,909,375	$656,774,391	142919 MT	$306,348,697	$376,203,371
Gambia	4398332 MT	$9,435,024,350	$5,916,700,045	3043457 MT	$6,135,876,486	$4,142,366,108
Ghana	5359324 MT	$10,347,760,607	$10,717,118,552	1857811 MT	$3,345,679,784	$3,673,794,557
Guinea	19373723 MT	$46,901,680,974	$23,916,251,052	13000615 MT	$29,891,462,570	$16,032,715,815
Guinea-Bissau	8800878 MT	$20,114,033,874	$16,278,308,185	3939757 MT	$8,460,937,195	$7,748,094,742
Liberia	2678393 MT	$6,997,220,886	$5,389,982,660	1965511 MT	$5,054,200,156	$3,930,755,268
Mauritania	51640126 MT	$119,282,398,311	$79,913,484,045	33841390 MT	$83,046,316,630	$51,999,479,444
Nigeria	5661973 MT	$10,999,724,743	$11,131,084,837	5046590 MT	$9,818,701,785	$9,911,599,782
Senegal	18548422 MT	$34,843,531,632	$30,993,541,658	13734882 MT	$25,184,049,163	$23,206,602,808
Sierra Leone	5545642 MT	$8,096,147,015	$9,509,318,129	4379146 MT	$5,413,439,023	$7,724,234,251
Togo	1339862 MT	$2,188,553,381	$2,732,115,634	1269061 MT	$1,993,758,405	$2,586,890,207
Grand Total	254563434 MT	$530,403,189,700	$447,789,150,280	179815491 MT	$364,460,044,622	$326,287,888,587

Table 5 7. *Cumulative value of unreported catches from 1980 to 2016 based on the Sea Around Us data from Pauly and Zeller (2015), using country specific "reported" catches from Pauly and Zeller's data, assuming that the values for 2011 to 2016 are the same as those for 2010. Showing on the regional and Africa wide totals, either with or without discards, and using either the unreported catch price or the reported catch price.*

Country By AU Region	With discards		Without discards	
	Unreport catch price	Report catch price	Unreport catch price	Report catch price
Central Africa	$23,987,328,425	$33,243,519,737	$17,620,523,549	$24,959,208,895
Eastern Africa	$18,515,647,329	$24,566,257,864	$14,216,983,391	$19,329,963,590
Northern Africa	$198,159,312,634	$114,260,680,833	$139,920,220,300	$81,228,127,421
Southern Africa	$14,497,337,204	$70,533,127,239	$9,423,582,710	$62,821,760,747
Western Africa	$275,243,564,109	$205,185,564,606	$183,278,734,672	$137,948,827,934
Grand Total	$530,403,189,700	$447,789,150,280	$364,460,044,622	$326,287,888,587

For the period 1980 to 2016. These estimates were based on the data that can be downloaded from the Sea Around Us website. We carried out a crude cross check of these estimates against the country by country documents that report on the underlying analyses that led to these data and obtained estimates apparently less than these values, but further investigation of differences if they exist was beyond the scope of this document. The country specific references that were used for this were the following:

Algeria: (Belhabib et al. 2015d)
Angola: (Belhabib and Divovich 2015)
Benin: (Belhabib and Pauly 2015c)
Cabo Verde: (Santos et al. 2013)
Cameroon: (Belhabib and Pauly 2015a)
Comoros (the):(Doherty et al. 2015a)
Congo (the): (Belhabib and Pauly 2015b)
Côte d'Ivoire: (Belhabib and Pauly 2015d)
Djibouti: (Colléter et al. 2015)
DRC: (Belhabib and Pauly 2015b)
Egypt: (Mahmoud et al. 2015) (Tesfamichael and Mehanna 2012)
Equatorial Guinea: (Belhabib et al. 2015a)
Eritrea: (Tesfamichael and Mohamud 2012)
Gabon: (Belhabib 2015a)
Gambia (the): (Belhabib et al. 2013c, 2015c)
Ghana: (Nunoo et al. 2015)
Guinea: (Belhabib et al. 2013a, 2015a)
Guinea-Bissau: (Belhabib and Pauly 2015e)
Kenya: (Le Manach et al. 2015a)
Liberia: (Belhabib et al. 2015c)
Libya: (Crawford et al. 2011)
Madagascar: (Le Manach et al. 2011)
Mauritania: (The Pew Charitable Trusts and Sea Around Us 2014a)
Mauritius: (Boistol et al. 2011)
Morocco: (Belhabib et al. 2013b)
Mozambique: (Doherty et al. 2015b)
Namibia: (Belhabib et al. 2015c)
Nigeria: (Etima et al. 2015)
Sao Tome and Principe: (Belhabib 2015b)
Senegal: (FAO/CECAF 2006, Belhabib et al. 2014a, 2014b, 2015b, The Pew Charitable Trusts and Sea Around Us 2014b)
Seychelles: (Le Manach et al. 2015b)
Sierra Leone: (Khalfallah et al. 2015)
Somalia: (UNEP 2005, Bawumia and Sumaila 2010, Persson et al. 2015)
South Africa: (Baust et al. 2015)
Sudan (the): (Tesfamichael and Elawad 2012)
Tanzania: (Bultel et al. 2015)
Togo: (Belhabib et al. 2010)
Tunisia: (Halouani et al. 2015)
Western Sahara: None

4.2.2 Environmental Impact of IUU Fishing: habitats, ecosystem services and biodiversity

An assessment of the environmental impact of IUU fishing is complicated by the fact that many of the impacts that are due to legal fishing are also caused by IUU fishing. From this perspective the impact of IUU fishing is to magnify whatever impacts are due to legal fishing activities. However, IUU fishing is also often associated with some facet of illegality which acts as a multiplier on the scale of the impact due to IUU fishing. Examples are:

1. The use of small mesh nets, or other methods that increase the selectivity for juvenile or sub-standard size individuals, or the violation of minimum mesh sizes typical in fisheries for molluscs, crustaceans and bivalves, in which 1 ton of illegal catch has a much larger impact on the target stock than does 1 ton of legal catch.
2. The use of indiscriminate fishing gear such as gill nets, for which 1 ton of commercial product is associated with tens of tons of wasteful dead discards of a range of other species, some which may have value as a source of food for coastal communities, and yet other components of the catch which could comprise TEP species such as endangered seabirds, turtles, dolphins or sharks.
3. The use of fishing gear which causes damage to the habitat, for example the use of beach seines over coral reefs in the intertidal region where fishers walk over coral and overturn sections of the reef in the nets in order to sift out desirable product, obviously highly damaging to vulnerable reef areas. Dynamite fishing in coral reefs is another example.
4. IUU vessels ignore catch quotas and regulations for minimizing bycatch and are highly extractive, causing the populations of many commercially- and environmentally-important species to collapse. Illegal gear and methods such as gill nets, poison and dynamite fishing are indiscriminate and therefore have a high hit rate on non-target species, juveniles of target species, and threatened, endangered and protected species. Similarly, fishing in prohibited areas, MPAs and/or during closed seasons is detrimental. Where closed seasons are designed to limit fishing effort, their violation means that too much effort is being exerted on stocks, with destructive consequences.
5. IUU vessels flout rules designed to conserve marine ecosystems - such rules may include measures to reduce bycatch, protect spawning grounds, and prohibit the harvesting of protected species.
6. IUU fishing is generally associated with a disproportionate increase in discard amounts.

Apart from the impacts on fish stocks themselves, IUU fishing causes collateral damage to habitats and TEP species:

1. The discarding of offal, spent bait and dead catch may change species behaviour and community assemblages, and may induce localised hypoxia or anoxia on the seabed (Gilman et al. 2014).
2. Vulnerable Marine Ecosystems (e.g. seamounts, hydrothermal vents, cold water coral reefs and sponge fields) should be restricted to non-demersal fishing to avoid environmental stress (Gilman et al. 2014).
3. IUU fishing impacts disproportionately on threatened, endangered and protected species (TEP species), and causes seabed degradation from the use of destructive fishing gear and methods.
4. Negative impacts on TEP species such as sharks, seabirds and turtles is often greater as a result of incidental mortality from 'ghost' fishing (i.e. caused by discarded or lost fishing gear such as nets), or as a result of the use of indiscriminate methods and gears (i.e. non-specific hooks or mesh sizes). The latter are all hallmarks of IUU fishing.

And fishing in general is altering the natural balance of interaction in ecosystems with unknown consequences. Although damage to ecosystem services is a probable outcome of uncontrolled IUU

fishing activity, legal fishing activity may also be implicated given the uncertainties surround the role of fishing within natural ecosystems. The following diagram of a food web illustrates the nature of interactions in a marine ecosystem:

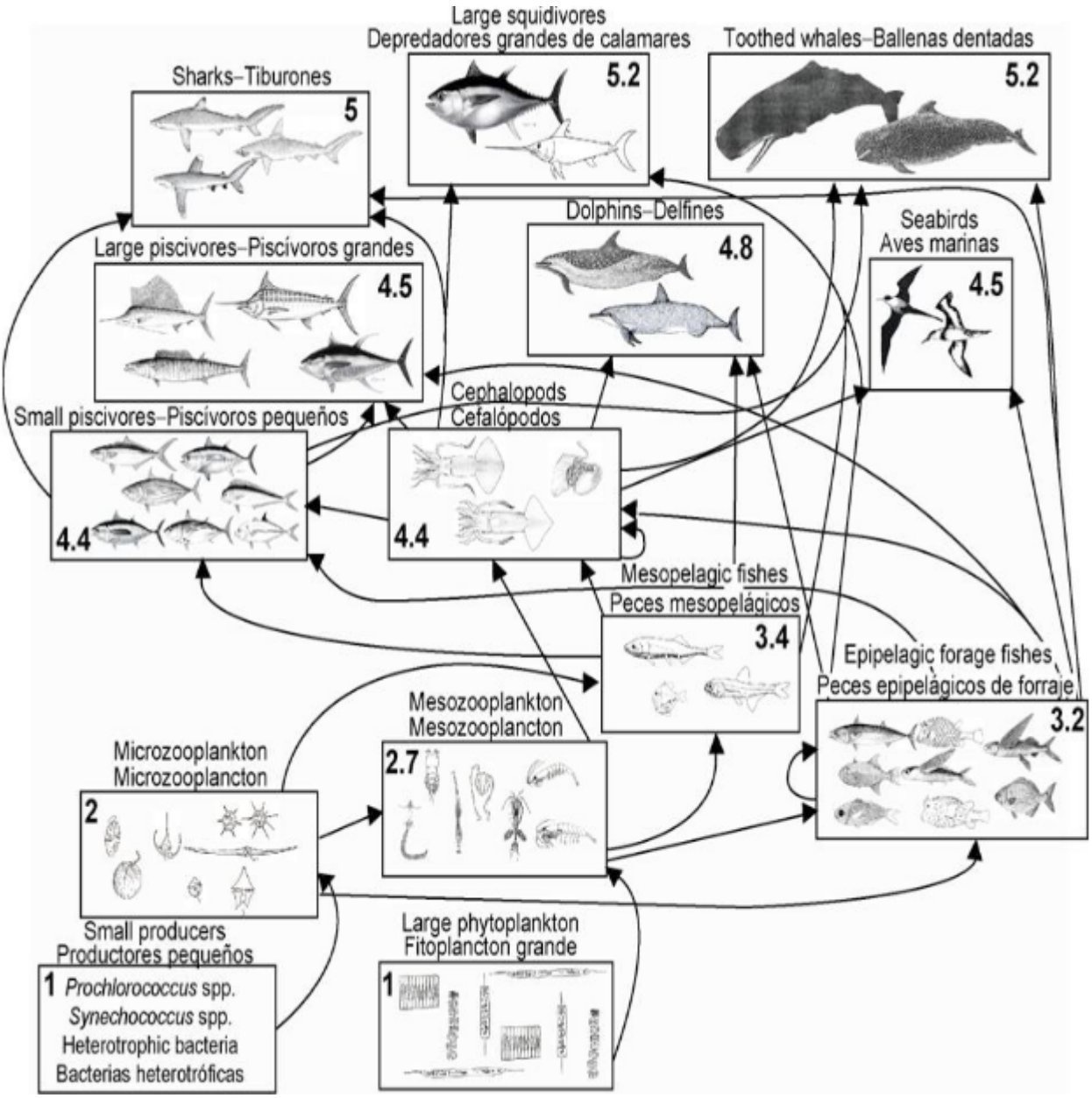


Figure 5 5. *Ecopath model of the eastern Pacific pelagic ecosystem. (source: Olson & Watters 2003. IATTC Bulletin.22(3)).*

This diagram is relevant to the Eastern Pacific. The point is that there are many complex linkages in a typical food web for a given ecosystem. Scientists do not know exactly how unnatural impacts on the components of the food web will alter the functioning of this system. For example, the disproportionate removal of tertiary predators such as sharks or tunas would cause a predatory release of their prey populations, with unknown consequences. Or, alternatively, removal of prey populations from the trophic web in a disproportionate manner could stress predatory stocks, with unknown consequences, one of which may be an alternative stable state, involving a completely different balance between components of the ecosystem, which may or may not be desirable.

There are some perverse market effects associated with IUU fishing. As fish stocks are depleted by overfishing, their relative market value increases. This is a positive feedback loop which incentivises IUU fishers to fish in excess of the regulated TAC or TAE. This accelerates stock depletion rates and

sets up subsequence steps in the fishing process involving the exploitation of less desirable life history stages of target species such as sub-adults or juveniles, and then switching to species of lesser value within the same general locality. This process is known as fishing down the food web (Pauly 2007). This is not atypical for legal operations, but is aggravated when IUU fishing is taking place.

IUU vessels, particularly older vessels, are often not well-maintained and do not meet safety requirements and regulations (Phelps Bondaroff et al. 2015). As a result, abandoned, lost or otherwise discarded fishing gear (ALDFG), oil and other equipment may be spilled and abandoned at sea, with consequent damaging impacts on marine wildlife. ALDFG comprises mainly gillnets and pots (Macfadyen et al. 2009) which 'ghost fishes' for non-target species (including protected turtles, seabirds, sharks and marine mammals) on a continuous basis. ALDFG becomes incorporated into the benthic environment and food web (Macfadyen et al. 2009). At present, little data is available on ALDFG in Africa (Macfadyen et al. 2009) but reports from fishers highlight the damage caused by this aspect of both legal and IUU fishing discarded gear (Media prop 2015). NGOs such as Greenpeace and Sea Shepherd have strong public backing and funding to patrol the oceans to remediate the damage caused by ALDFG and salvaging oil spills.

Apart from extracting biomass that could otherwise be fished by artisanal and subsistence communities, the habitat degradation by IUU vessels can hamper the return of the spawning stock to its breeding grounds and nurseries. This feedback loop is pronounced in coastal fishing villages where incursions by trawlers into the EEZ and the IEZ (Inshore Exclusion Zone) destroys coral reef beds where, in the case of Western and Central Africa, many pirogues have fished historically. Poverty-ridden fishing communities who earn poorly from legal fishing practices are likely to disregard the environmental impacts resulting from IUU fishing practices if there are prospects for higher profits (Phelps Bondaroff et al. 2015).

The role of other anthropogenic effects: A further complication faced by this assessment is that there are many other anthropogenic impacts that "compete" with IUU fishing. With the accelerated development of the blue economy, there are multiple overlapping "uses" of the marine environment, including oil and gas exploration and extraction, and a range of mining operations. Thus while it is possible to list and characterise the impacts due to IUU fishing, it is often not possible to tease out the relative role of IUU fishing compared to all the other impacts. For example, mangrove swamp ecosystem services include their role as nursery grounds for shrimps and finfish. Impacts on mangrove swamps include certain types of IUU fishing in the swamps themselves, but their ecosystem service utility is also compromised by wood cutting and aquaculture, to name but two other anthropogenic impacts. Drainage of land sourced effluent into the marine environment also has a major impact on the ecosystem health of nearshore habitats for marine resources. All of these considerations have forced the presentation in this section to be pitched at a descriptive qualitative level rather than a quantitative level.

4.2.3 Regional Perspectives on the Environmental Impacts of IUU fishing

4.2.3.1 Southern Africa

In South Africa the following resources are managed by means of, inter alia, minimum legal sizes:

- West Coast rock lobster
- Abalone
- Mussels

- Other bivalves and molluscs
- Numerous line fish species

IUU fishing is rife in the South African abalone and West Coast rock lobster fisheries and involves the violation of minimum size regulations. The impact of this kind of IUU on the legal fishery is severe because it effectively cuts off recruitment before it reaches the legal exploitable stock. The ecosystem level impact of the overexploitation of abalone by IUU fishing is thought minor because abalone feed on drifting kelp, so their removal is not a major problem for the functioning the sub-tidal and inter-tidal ecosystem. IUU fishing of West Coast rock lobster is thought by some scientists to be having a negative impact on populations of bank cormorants who rely on rock lobster as prey. West Coast rock lobster fishing also has an impact on whales who are occasionally entangled in trap lines. This is potentially exacerbated by IUU fishing to the extent that this increases the amount of fishing effort beyond legal limits.

At the present time, in South Africa, the African penguin population is declining to dangerous levels. Although there is no suggestion that this is due to IUU fishing of their prey, small pelagic species, the issue is the subject of a great deal of scientific study and academic controversy.

In South Africa, fishing within no-take MPAs is prohibited. There is evidence that IUU fishing is being carried out in these areas (MRAG and CapFish 2008; Raemaekers et al. 2013). In the SADC region, while no country allows marine mammals and turtles to be caught (Amador 2006), specific regulations in each SADC country are largely overlooked.

Two vessels from South Africa are reported to have engaged in Patagonian toothfish IUU fishing in the 2011/12 period, operating in violation of CCAMLR's measures to reduce seabird bycatch (U.S. Department of Commerce 2013). Records from CCAMLR indicate that two vessels flagged to South Africa may have violated CCAMLR Conservation Measures in 2011 or 2012 because of:

1. The occasional incidents of the disposal at sea of inorganic waste (violation of Conservation Measure 26-01).
2. Hooks observed in the offal discarded, as well as the disposal of fishing gear at sea.
3. Failure to comply with all of the requirements of Conservation Measure 25-02 to minimize the incidental mortality of seabirds in longline gear.
4. Vessel did not comply with the required ratio of one research haul to three commercial hauls while operating in SSRU 58.4.1G, nor did it meet the minimum separation distance for research hauls while operating in SSRU 48.6D and 48.6G.

South Africa explained that it immediately informed the vessels that their licenses would be revoked or suspended if further infringements were noted. The South African authorities also designed a compliance adherence reporting form that includes all the CCAMLR Conservation Measures addressing waste disposal, seabird mitigation measures, and general fishing operations. By mandate, this form is to be completed and submitted weekly by the National Scientific Observer to the Department to ensure that the vessels fully adhere to CCAMLR Conservation Measures. South Africa is not being identified because it took appropriate measures to prevent future IUU."

Amongst a wide variety of violations, IUU fishing includes the mis or unreporting of catches (e.g. Patagonian toothfish is often landed as Chilean seabass) and as a result, the level of stock abundance

estimated via quantitative scientific studies is uncertain or biased. Port inspectors often lack the technical background to differentiate between species and generally accept the record of catch and species reported by the vessel crew.

Since the IUU catch is low compared to the total reported catch in the South African Development Community (SADC) (Pauly and Zeller 2015), the associated environmental impacts in the large pelagic sector are considered to be low to medium (MRAG and CapFish 2008). Higher impacts have been identified for the coastal shrimp and demersal reef fisheries, driven in large part by very high discard ratios in the shrimping operations (as high as 1:8) (MRAG and CapFish 2008). Only a small proportion of this bycatch is landed by the industrial fishing fleet, with a portion of the catch discarded and another portion transhipped to semi-industrial and artisanal vessels (MRAG and CapFish 2008).

Seabird bycatch by longlining is a common problem which is exacerbated when longlining is carried out on an IUU basis. Global estimates are that between 2001 and 2003 alone, 26 668 petrels and albatrosses suffered incidental mortality from legal toothfish longlining operations alone (Tin et al. 2009). This, coupled with the fact that illegal toothfish has been recorded at double the legal reported TAC, implies that longliners pose a significant threat to seabirds. Fortunately measures to curb IUU fishing for toothfish by CCAMLR have been highly successful, and so we expect a significant decline in seabird mortalities from this source. The affected seabird species, particularly albatrosses, are k-selected, i.e. they have long reproductive cycles and low recruitment rates making them very vulnerable to extraordinary sources of mortality. The chick-rearing stage which is vital to the recruitment of the population, faces the greatest incidental mortality risk.

In trawling operations in South Africa there is the potential for the incidental mortality of seabirds through interactions with the trawl warps. These seabirds include petrels, albatrosses, shearwaters and other species which breed on islands in the southern Ocean. This risk is being mitigated by the use of bird scaring devices, known as TORI and RORI lines. Fishing permits stipulate the use of these devices but violations are thought to occur, increasing the impact on seabird populations. As such the failure to use TORI or RORI lines constitutes a kind of IUU fishing. Note however that trawling may also boost populations of seabirds by making food available to them - they feed on the nets as they are hauled in and on offal from the fish processing operation discarded into the sea. The direct impact of trawling and longlining on marine mammal populations is small. There is however potential for ecosystem level competition between marine mammals and fishing operations. Seals for example feed on both hake and small pelagics, which are the subject of commercial fishing operations. There is however no consensus on whether fishing impacts on these species via this route is significant.

The South African hake fishery is the main trawling operation in the country and is presently an MSC certified fishery. As a result, there are numerous provisions in place to ensure that habitat destruction is minimised. This is being done by (a) the ring fencing of trawling operations within the historical trawl footprint, and (b) experiments to estimate the impact of trawling on and the recovery rate of the benthic habitat.

In Namibia the following resources are managed by means of, inter alia, minimum legal sizes:

- West Coast rock lobster
- A range of bivalves and molluscs
- Line fish species

Abalone do not occur in Namibia. The incidence of IUU fishing for West Coast rock lobster is limited by comparison with South Africa. The state of Namibian fisheries prior to independence in 1990 was severely depleted. The lack of legislation governing TACs of commercially important species drove populations down. Since democracy, fisheries management took hold and stocks regained to pre-industrial levels. Namibia is being hailed as a major success story in the fight against IUU fishing.

4.2.3.2 Eastern Africa

Coasts and marine areas in Tanzania are threatened by IUU, including piracy, oil spills and destructive fishing methods like dynamite fishing. The country is lacking in technical and infrastructural capacity to control IUU and their impacts on the environment (ASCLME Project and SWIOFP 2012). Piracy along the Somali coast is thought to have initially stemmed from the illegal dumping of toxic waste (e.g. radioactive uranium; heavy metals such as cadmium and mercury; hospital waste) by foreign vessels (UNEP 2005, Tharoor 2009) in the Somalian EEZ. Local fishermen who were outcompeted by foreign industrial fleets rebelled against the poorly-functioning government to reclaim their fishing territory and protect their fishing resources (Boto et al. 2012). These activities, especially those by trawlers, are thought to have had a substantially negative impact on the demersal ecosystem and on stocks of fish and crustaceans, upon which artisanal fishers rely.

In the Agulhas and Somalia Current Large Marine Ecosystems (ASCLME) foreign UU fishing vessels, including trawlers, encroach into the Inshore Exclusion Zone and cause damage to lobster and fin fish stocks upon which artisanal fishers are reliant (ASCLME Project 2011). Turtles and dolphins are frequent incidental victims during these IUU operations.

Gill-netters with non-specific mesh sizes target large pelagic resources (e.g. tuna; billfish) and overturn high rates of bycatch, including protected species of marine mammals, turtles and sharks (Somalia Federal Ministry of Fisheries and Marine Resources 2015). The gill-netters, which are mostly Iranian in origin, are regularly observed in the EEZ of Somalia along the coast from Puntland to Jubbaland, often close inshore (Somalia Federal Ministry of Fisheries and Marine Resources 2015).

Impacts of coastal shrimp and demersal reef fisheries on ecosystems are a major source of concern (MRAG and CapFish 2008). In the case of shrimp fisheries one of the main problems is the very high rates of bycatch and the transfer of this bycatch to semi-industrial or artisanal vessels. This is extremely detrimental to these bycatch species. Exceeding the by-catch limit is not an offence in Mozambique and Tanzania (Amador 2006). Artisanal fishermen often fish during closed seasons and in protected areas (Stop Illegal Fishing 2008). Some artisanal fishers of Mozambique (and elsewhere in Senegal; Nigeria) exchange shrimp catches for bycatch from other vessels, which is then processed or sold for immediate consumption (The World Bank 2012). In Mozambique, abandoning fishing gear is not illegal (Amador 2006). Tanzanian legislation prohibits water pollution and fishing within MPAs without a licence (Amador 2006). Whereas licensed vessels in some countries are known to provide artisanal fishers access to substantial shrimp discards, IUU vessels do not and the discarded shrimp are lost to the artisanal fishers (MRAG 2005b).

In Tanzania, the resurgence of dynamite fishing, which was previously prevalent in the 1990s, is destroying coral reefs along the coast (Anderson 2012). Dynamite fishing and coral mining in marine fisheries not only degrades valuable breeding and nursery habitat, but is also problematic for small scale fisheries (Stop Illegal Fishing 2008).

In Kenya, by-catch comprises 70 % of the marine catch (Winter 2009). Along the Kenyan coast, sensitive marine habitats include coral reefs and sea-grass beds, and transitional marine wetland habitats comprise mangroves and salt marshes. The coral reefs in particular are the subject of destructive fishing practices (Winter 2009). In Diani, the most overfished region in Kenya, the Orange striped triggerfish (Balistsapus undulates) and the Tripletail wrasse (Cheilinus trilobatus) have been overexploited, leading to a disproportionate 500% increase in their prey, sea urchin (Echinometra mathaei) (Winter 2009). The high number of sea urchins feeding on the reef has reduced coral cover drastically, and turf algae has taken its place (Winter 2009). Compounding these problems is the use of beach seine nets in the intertidal zone above coral reefs. Beach seine nets have small mesh sizes and are highly indiscriminate; the use of these nets involves walking on and turning over the fragile coral reef system, clearly extremely destructive (Winter 2009). Dynamite fishing, common in Tanzania, has also been reported in Kenya (Winter 2009).

Artisanal and industrial fisheries cause damage to the habitat where few fishery management plans and catch controls are in place. As a result, the full extent and status of coastal marine resources in Kenya and Tanzania is unknown. Kenya is home to five of the seven species of sea turtles (Winter 2009); three of which nest and two which forage on the delicate sea-grass beds (Table 5 8). Poaching and more indirectly, beach development has stifled reproduction of nesting turtles (Winter 2009). The use of gillnets, and illegal off-takes kill 6000 turtles a year in Kenya alone. Habitat destruction from destructive fishing methods, together with poaching and other activities have caused sea turtle populations to decline by between 25-75% (Winter 2009). Nesting and foraging grounds are only formally protected within MPAs, and even within these areas, enforcement remains a hurdle (Winter 2009). From 1991-2005, 1584 turtle mortalities were reported due to poaching and fishing (trawling and 'ghost fishing' from ALDFG). The extinction risk of many animals has been increased as a result of IUU fishing. Turtles are often sold on the black market as exotic pets, décor items and medicinal purposes. In East Africa, as in Southern Africa, IUU fishing is linked in some cases to drug-related crimes. For example, as a result of their high value, turtle nesting grounds on beaches are often raided for eggs which are then exchanged for drugs and money (Phelps Bondaroff et al. 2015).

Table 5 8: *Five of the seven turtle species are present in Kenyan waters. Data from Winter (2009).*

Habitat use	Species	Common name	IUCN Red List Status
Beach nesting	Chelonia mydas	Green	Endangered
	Eretmochelys imbricata	Hawksbill	Critically endangered
	Lepidochelys olivacea	Olive ridley	Endangered
Sea-grass forager	Caretta caretta	Loggerhead	Endangered
	Dermochelys coriacea	Leatherback	Critically endangered

4.2.3.3 Central Africa

In Gabon, in 2005, illegal catches were equivalent to 19 % of the total legal catch (MRAG 2005b). Illegal foreign catches have increased from less than 1 000 tonnes in 1986 to over 23 000 tonnes in 2010 (Belhabib 2015a). Estimates of illegal catches in the past were 1 % of legal catches, but recent estimates indicate this figure has increased to about 50 % of legal catches (Belhabib 2015a). It is

estimated that in 2010 illegal fisheries caught more than US$ 207 million worth of fish products from the waters of Gabon (Belhabib 2015a). The industrial sector in the Gabon is predominantly operated by foreign vessels and joint ventures, inclusive of foreign reflagged vessels (mainly from China), which remain mainly under foreign beneficial ownership (Ekouala 2013).

Species diversity and average size of the most important fish species have declined as a result of over-exploitation in the BCLME region (Koranteng 2002, Cury et al. 2003)

In Angola, industrial IUU fishing catches rose dramatically to approximately 63 700 tonnes in 2010 (Belhabib and Divovich 2015).

In Angola, water pollution from oil spills, ALDFG , dumping ballast water and fishing within MPAs without a licence are all illegal (Amador 2006). The majority of fishers are involved in the artisanal sector which is vital from a food security standpoint. The practice in Angola of Senegalese pirogues fishing in Angola and then trans-shipping their IUU catches to Korean motherships has risen from 1400 tonnes in 1990, to 12500 tonnes in 1998, stabilising at approximately 13500 tonnes per year during the late 2000s (Belhabib and Divovich 2015). As is unfortunately the case elsewhere in Africa, “illegal fishing is causing the depletion of marine resources”, i.e. “foreign trawlers have hammered patches of coastline so hard that fish have become locally scarce—a blow to a nation where a million people rely on UN food aid” (Salopek 2004, Agnonoticias 2013).

The overwhelming evidence indicates that China is the major contributor to illegal fishing activities in Angola (Salopek 2004). Often, these activities are related to other illegal activities, leading to loss of lives. Thus the quote (Salopek 2004): “at least two Angolan inspectors have vanished mysteriously while on observer duty aboard large industrial trawlers–suicides, assert the foreign skippers, pushed overboard, the fisheries police insist”. Also, politicians “are using the oceans as a bank account” (Salopek 2004)..

Cameroonian shrimp trawlers have a staggering bycatch ratio of 8:1, and a discard ratio of 1:4 (ENVIREP-CAM 2011). MRAG (2005b) estimated that in the EEZ of the DRC, for each tonne of fish landed legally, the equivalent of 1.23 tonnes was taken by IUU fishing. Furthermore it appears that decrease in foreign legal catches has resulted in a, possibly compensatory, increase in IUU catch to a level of 1 800 tonnes per year, over the period 2008 to 2010 (Belhabib and Pauly 2015a).

4.2.3.4 Western Africa

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) species covers fish, corals, molluscs, marine turtles, manta rays, sharks, marine mammals and seabirds. CITES species such as the Great White Shark (Carcharodon carcharias), Whale Shark (Rhincodon typus) and species of Hammerhead Shark (Sphyrna lewini) occur in the West African region (INTERPOL 2014).

Benin is home to 250 species of fish, including commercially-important tuna, ten crustacean species and four cephalopod species (INTERPOL 2014).

Tuna and sharks are the main fisheries of the Cape Verde Islands, and Sierra Leone is rich in biodiversity including several valuable species of shrimp, cephalopods, lobster, small pelagics (bonga), large pelagics (tuna) and demersals (croakers, snappers, groupers) (INTERPOL 2014).

The prospects of managing tuna fisheries on a sustainable basis are enhanced by their high numbers, straddling stocks and strong RFMO mandates. However, because they function in ecosystems as tertiary consumers, depletions in tuna stocks could alter the balance of the food web as a result of the "predatory release" of their prey stocks: crustaceans, small pelagic fishes and cephalopods. This would most likely have knock-on effects in the ecosystem resulting in long term community rearrangement. Similarly, fishing for apex predators such as sharks is more likely to cause high-magnitude imbalances in ecosystems, especially for highly-productive coastal ecosystems that coexist with fisheries (Worm et al. 2013). Senegal, Sierra Leone and Cameroon governments plan to delimit marine protected areas in an effort to conserve biodiversity hotspots (INTERPOL 2014).

Due to poor MCS capacity and transboundary territories, discards from foreign fleets are a challenging issue in West Africa. Based on reconstructed estimates, discards exceeded 1000 tonnes in 2010 alone (Belhabib and Pauly 2015c). The Sub-Regional Fisheries Commission (SRFC) concludes that some IUU vessels off West Africa are in operation 365 days of the year, putting massive pressure on fish stocks (Kelleher 2002). This IUU fishing is a catastrophe for the region's already severely overexploited fish stocks, according to the World Ocean Report (WOR 2).

The use of small-sized mesh, especially in trawl, purse and beach seine nets is a widespread problem, especially in the central part of the region, and this probably contributes to over-exploitation. Small mesh netting results in the capture of many juvenile fish. However, these juveniles are seldom discarded (discards are mainly in the shrimp fishery). Other destructive fishing practices such as the use of explosives and chemicals are also common in the inshore areas (e.g., see Vakily (1993)) and have long lasting negative effects on inshore habitats. There are indications that over-exploitation has altered the ecosystem as a whole, with impacts at all levels, including top predators.

In West Africa illegal catches and their corresponding discards were estimated at 2.6 million tonnes from 2000 to 2011 (Belhabib and Divovich 2015). In Mauritania, fishing in marine protected areas (MPAs) mainly the Parque Nacional de Banc d´Arguin (PNBA). Illegal fishing by artisanal vessels in the Parque Nacional de Banc d´Arguin (PNBA) restricted area in Mauritania causes environmental impacts such as stock depletion including those of the protected spawning stock of many species (MRAG 2010). Consequently, this may affect the resilience of stocks and their potential growth rates due to the removal of mature spawning fish. Fishing in this protected area will have negative impacts on biodiversity and the marine ecosystem as a whole. In Ghana, artisanal fishers use small mesh sizes, and trawlers operate close inshore which destroys coastal habitats (Atta-Mills et al. 2004a). In Nigeria, the use of undersized meshes results in the netting of juveniles, and consequently depletion of the resource (MRAG and CapFish 2008). In Guinea, overexploitation of giant African threadfin, ray species and snappers lead to major decrease in fish size (Belhabib et al. 2013a).

The GCLME's mangrove swamps are nursery grounds for many tropical fish and shrimp (Nematopalaemon hastatus) species that are commercially important for the live reef fish restaurant and aquarium industries (Flewwelling et al. 2002, Governments of the 16 GCLME Countries 2006), as well as flagship species such as otters, sitatungas, crocodiles and the endangered West African manatee Trichechus senegalensis. These mangrove beaches are also home to whales, dolphins and four of the seven turtle species (Green, Leatherback. Hawksbill, Olive Ridley). Mangroves around central and eastern Africa contribute to the highly productive southern gulf of Guinea from Guinea Bissau to Angola (Governments of the 16 GCLME Countries 2006). Despite their economic and

environmental importance, mangroves are threatened by deforestation, charcoal production (usually for smoking fish (ENVIREP-CAM 2011)) and eutrophication from agricultural effluent The loss of mangroves also gives rise to alien species encroachment from hardy grasses (Paspalum vaginatum) and water Hyacinth (Eichhornia crassipes). Crab fisheries set up in pristine Mangroves are not often well-maintained, and are abandoned with no post-closure habitat rehabilitation.

Artisanal fishers export illegal Periwinkle catches from the mangroves of Bakassi and Douala to Nigeria (ENVIREP-CAM 2011). Mangroves are sensitive habitats that remain unprotected in parts of Cameroon such as the Tiko-Douala, Ntem estuary and Bakassi peninsula (ENVIREP-CAM 2011).

4.2.3.5 Northern

Several species in the Mediterranean Sea are negatively affected by IUU fishing. In Morocco, sparid fish, shrimps, octopus and cuttlefish have been reported in IUU catches (GFCM and FAO 2013).

Industrial IUU fishing and associated ghost fishing and bycatch in the Mediterranean Sea and specifically in Tunisia, is said to deteriorate fish stocks and biodiversity (GFCM and FAO 2013). Dogfish, stingray and dolphins are often entangled in ghost nets. Sea grass beds are damaged by deep-water trawling and this exerts pressure on the benthic community, including endemic sponges (Axinella cannabina), elasmobranchs, white sharks and sting rays. Clam dredging disturbs the silt and causes turbidity for macro- and meiobenthos (GFCM and FAO 2013). The most common bycatch species are listed in Table 5 9.

Table 5 9: *Bycatch species reported in the Mediterranean. Data from (GFCM & FAO, 2013).*

Species	Common name	IUCN Red List Status	Threat from IUU
Phalacrocorax aristotelis desmarestii	Mediterranean shag	Least concern	Driftnets; long lines
Larus audouinii	Audouin's gull		
Caretta caretta	Loggerhead turtle	Endangered	Bottom trawling; set nets; swordfish surface longlines
Chelonia mydas	Green turtle		
Stenella coeruleoalba	Striped dolphin	Least concern	Driftnets
Delphinus delphis	Common dolphin		
Physeter catodon	Sperm whale	Vulnerable	
Balaenoptera physalus	Fin whale	Endangered	

4.2.4 LME Perspective on Environmental Impacts

The LME perspective is significant for an assessment of the environmental impact of IUU fishing for two reasons,

1. Because many environmental impacts do not respect national or regional boundaries, and are more likely be measureable at an ecosystem level, and
2. Because the Transboundary Diagnostic Analyses carried out for LMEs is followed by a Strategic Action Plan, making it a logical "home" for certain of the actions that may assist with combatting, inter alia, IUU fishing. However, a weakness in the LME approach for this study is that the TDAs do not focus on IUU fishing, a possible area for improvement in the LME approach by GEF.

GEF, the LME funding body, recommends the use of LMEs as the geographic focus for ecosystem-based assessments and management strategies. The procedure that GEF has recommended is that on the basis of the TDA, countries prepare a Strategic Action Plan (SAP). In the SAP, the countries

propose to remedy the transboundary issues identified in the TDA and outline national and regional commitments to policy, legal and institutional reform. Countries follow Project goals and milestones leading towards an adaptive, ultimately self-financing, management regime for LMEs located within Regional Sea areas around the globe. The TDA and SAP processes for LMEs are consistent with the 2002 Johannesburg targets and Plan of Implementation (POI) of the World Summit on Sustainable Development (WSSD).

In the early 2000s, in 14 Projects globally, 111 countries involved in the preparations of Transboundary Diagnostic Analyses had started the scientific characterization of LMEs, to identify the causes of trends in biomasses and yields and the significant instances of coastal pollution, damaged habitats and depleted fish stocks. In 13 out of 29 LME case studies, climate forcing was the principal driver of change in biomass and yield; in 14 LMEs it was overfishing; and in one LME, eutrophication. (see http://www.unep.org/regionalseas/publications/brochures/pdfs/LMEs_brochure.pdf).

All of the LMES are home to a range of endemic species and TEP species. It seem beyond the scope of this document to highlight specific issues related to all these TEP species, which are impacted by both IUU and legal fishing to various degrees. At this stage it seems appropriate (a) to bring to the reader's attention the availability of this information in considerable detail in the various LME TDAs, and (b) where seems useful, to illustrate with examples of environmental impacts that are due wholly or partly to IUU fishing.

4.2.4.1 GCLME

The following four Major Perceived Problems and Issues were identified in the GCLME:

1. Decline in GCLME fish stocks and unsustainable harvesting of living resources;
2. Loss of ecosystem integrity (changes in community composition, vulnerable species and biodiversity, introduction of alien species) and yields in a highly variable environment including effects of global climate change;
3. Deterioration in water quality (chronic and catastrophic) from land and sea-based activities, eutrophication and harmful algal blooms;
4. Habitat destruction and alteration including inter-alia modification of seabed and coastal zone.

Mangrove swamps occur throughout the coastal region of the GCLME, particularly in the Niger Delta of Nigeria which is Africa's largest and the world's third largest mangrove forests. These areas serve as spawning and breeding grounds for many transboundary fish species and shrimps. Mangrove forests in the GCLME region are being impacted and threatened by over-cutting (for fuel wood and construction timber) and other human activities. Some of these activities include, in some cases, IUU fishing in mangrove swamps (destructive shellfish harvesting techniques), and aquaculture.

TEP examples for the GCLME: The GCLME contains a diversity of molluscs and crustaceans and small mammals such as sitatungas, otters, and large mammals such as manatees. Four of the seven remaining species of marine turtles in the world occur in the Gulf of Guinea. Despite international initiatives to protect them, marine turtles are still secretly hunted for food throughout the Gulf of Guinea, and their eggs are collected by humans and destroyed by dogs and pigs. In some shrimp fisheries in the sub-region (e.g. in Nigeria and Cameroon), introduction of the turtle excluder device (TED) is being considered. This device allows turtles to escape from shrimp nets when caught. Marine mammals that inhabit the waters of the Gulf of Guinea are mainly cetaceans (whales and dolphins)

and sirenians (manatees). Whales, especially toothed, fin and humpback whales migrate to the waters of the Gulf of Guinea from Antarctica at the end of summer. In Congo, the most important aquatic mammals are lamantins.

4.2.4.2 CCLME

Note that the TDA for the CCLME provides a very comprehensive summary of the status of the commercial exploited stocks in the region which are too extensive to be communicated in this document. We simply set out s few of the high level issues and some examples relevant to TEP species.

As in the GCLME, the loss of mangrove habitat is a major issue in the CCLME. Causal factors identified in the CCLME TDA include non-sustainable logging, increased salinity due to major dams, sedimentation, mariculture and inadequate shellfish harvesting methods (we presume this would be categorised as IUU fishing). Ecosystem impacts include the loss of fish breeding areas, the loss of biodiversity and disturbance to the food web.

In the CCLME the degradation of seabed habitats by destructive trawling fishing methods is recognised as one of the causes of declining fisheries. But the degradation of seabed habitats and seamounts is also ascribed to inadequate coastal management causing sedimentation, pollution, oil and gas exploration and exploitation and coastal erosion. Impacts on ecosystems include the regression of seagrass beds, the loss of breeding areas, loss of biodiversity and disturbance to the food web. Socio-economic consequences include reduction of fishery resources, loss of revenues from fisheries, food insecurity, human migration and increased poverty.

The TDA for the CCLME records the following marine species included on the IUCN Red List as either Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) as well as a range of sharks and finfish species not show here, many of which would be at risk from IUU fishing:

AVES						
ANSERIFORMES	ANATIDAE	*Marmaronetta angustirostris*	Marbled duck, marbled teal; sarcelle marbrée	VU	2012	decreasing
CHARADRIIFORMES	SCOLOPACIDAE	*Numenius tenuirostris*	Slender-billed curlew; courlis à bec grèle	CR	2012	decreasing
FALCONIFORMES	FALCONIDAE	*Falco cherrug*	Saker, saker falcon; faucon sacre	EN	2012	decreasing
GRUIFORMES	GRUIDAE	*Balearica pavonina*	Black crowned-crane; grue couronnée	VU	2012	decreasing
PROCELLARIIFORMES	PROCELLARIIDAE	*Puffinus mauretanicus*	Balearic shearwater; puffin des Baléares	CR	2012	decreasing
		Puffinus yelkouan	Yelkouan shearwater; puffin de Méditerranée	VU	2012	decreasing
REPTILIA						
TESTUDINES	CHELONIIDAE	*Chelonia mydas*	Green turtle; tortue verte	EN	2004	decreasing
		Lepidochelys olivacea	Olive ridley; tortue de Ridley, tortue olivâtre	VU	2008	decreasing
	DERMOCHELYIDAE	*Dermochelys coriacea*	Leatherback turtle; tortue luth	CR	2000	decreasing
MAMMALIA						
CARNIVORA	PHOCIDAE	*Monachus monachus*	Mediterranean monk seal; phoque-moine méditerranéen	CR	2013	decreasing
CETARTIODACTYLA	BALAENOPTERIDAE	*Balaenoptera borealis*	Sei whale; rorqual de Rudolphi, rorqual boréal, rorqual sei	EN	2008	unknown
		Balaenoptera musculus	Blue whale; baleine bleue	EN	2008	en hausse
		Balaenoptera physalus	Common rorqual; rorqual commun	EN	2013	unknown
	DELPHINIDAE	*Sousa teuszii*	Atlantic hump-backed dolphin; dauphin à bosse de l'Atlantique	VU	2012	decreasing
	HIPPOPOTAMIDAE	*Hippopotamus amphibius*	Hippopotamus; hippopotame	VU	2008	decreasing
	PHYSETERIDAE	*Physeter macrocephalus*	Sperm whale; cachalot	VU	2008	unknown
SIRENIA	TRICHECHIDAE	*Trichechus senegalensis*	African manatee; lamantin d'Afrique, lamantin du Senegal	VU	2008	unknown

5.2.4.3 BCLME

We simply note that the level of IUU fishing in South African and Namibian sector of the BCLME is judged to be at fairly moderate levels, and indeed the BCLME TDA does not identify IUU fishing or destructive fishing methods as a problem. Nor does it appear to view the poaching of West Coast rock lobster and abalone as within its purview, reflecting perhaps the focus on environmental issues related to anthropogenic factors that are not IUU fishing related. As a result we consider that this topic is adequately covered in our preceding regional section.

5.2.4.4 ASCLME

The ASCLME identifies the destruction of coral reefs as a major environmental impact and identifies overfishing and destructive fishing activities such as the use of dynamite as an important causal factor, amongst a range of other factors - sedimentation, pollution, tourism developments, coral mining and bleaching due to climate change. In addition, in some countries infestations of crown-of-thorns starfish are increasing and diseases are an emerging issue. Fisheries interventions included bans on destructive gears or fishing methods such as seine nets, small mesh size nets (for example, in Kenya nets less than 2.5 inch mesh size) and dynamite, but enforcement of these regulations is weak in the region.

Marine resource theft at sea, IUU, dynamite fishing, piracy, drowning of mariners and oil spills are some of the threats and challenges to Tanzanian coastal and marine areas. Most of the responsible institutions lack capacity to deal with these challenges. They are generally constrained by a lack of appropriate equipment and/or trained personnel or plans to deal with those existing challenges.

The dominant coastal habitat types in the ASCLME are mangrove forests, seagrass beds, and coral reefs, interspersed with estuarine and lagoon systems, sandy beaches, and rocky shores.

Coral reefs occur along much of the 500 km Kenyan coastline. The coast is densely populated in parts with extensive artisanal fisheries. The coral reefs are threatened by fishing gear and poor fishing methods, although all destructive methods of fishing are illegal. These methods include beach seines and other drag-nets. Small-scale commercial octopus collecting by means of spearguns and the gathering of ornamental shells also causes habitat destruction by walking on fragile coral reefs.

A similar situation pertains in Tanzania with the addition of dynamite fishing in coral reefs. There are also fishing related impacts on seagrass habitats in the region. These habitat impacts are described in considerable detail in the ASCLME TDA, with country breakdowns too numerous to document here. In Mozambique the mangrove related shrimp fishery have in the past been estimated to contribute 40% to the country's GNP, with an annual average catch of 8,600t valued at about US$80 million. Mangrove cover has reduced at a rate of 18.2km2/year due a wide range of human activities, which threatens the sustainability of the shrimp fishery.

Marine mammal mortality through fisheries interactions in the region are thought to be generally low and lower than elsewhere in the world. While this is relevant mainly to offshore regions, there is greater concern for coastal species and fisheries. Three coastal marine mammal species are likely particularly affected by human activities, including fisheries, and are consequently highly vulnerable:

- Dugong dugon (classified as Vulnerable by IUCN)
- Sousa chinensis (classified as Near Threatened by IUCN)

- Tursiops aduncus

Over the last few decades the ASCLME has seen a large increase in fishing diversity and effort, invariably resulting in higher turtle mortalities and bycatch. The South West Indian Ocean is home to five species of sea turtle of which the green turtle and hawksbill are the most widely distributed and abundant and have been the most severely impacted by direct exploitation, an obvious form of IUU fishing.

4.3 Social Impacts of IUU fishing in Africa

Understanding social impacts requires an evaluation of all impacts on humans and on all the ways in which people and communities interact with their socio-cultural, economic and biophysical surroundings. It also considers both the direct, indirect and cumulative costs of impacts. A broad view of 'social impacts' includes related fields such as health, culture, heritage, aesthetics, or gender (Vanclay 2003:3). In the context of IUU fishing a convenient way of conceptualising social impacts is as changes brought about by IUU fishing, to one or more of the following social dimensions:

- **People's way of life -** that is, how they live, work, play and interact with one another on a day-to-day basis;
- **Their food security and livelihoods -** the availability and quality of the food they eat, their ability to pursue their livelihoods
- **Their culture and cultural heritage -** that is, their shared beliefs, customs, customary practices, kinship ties, values, and language or dialect;
- **Their community structure and organisation -** its cohesion, stability, character, organisational integrity;
- **Gender relations -** how men and women interact, the roles they play in the home and community, the division of labour, access to and distribution of resources and power dynamics that exist between them;
- **Their political and governance systems -** the extent to which people are able to participate in decisions; the level of interaction with and support from government, the quality of local and customary governance systems; and the resources provided for governance interactions;
- **Their environmental quality -** the quality of the environment including the air, water, soils, that people use and the level of hazard or risk they are exposed to;
- **Their health and wellbeing -** includes physical, mental, social and spiritual wellbeing, their access to basic services such as water and sanitation, their control over resources, satisfaction with their quality of life, and ;
- **Their safety and security -** that includes personal safety and living free from threats and dangers that may harm them or expose them to risk;
- **Their human rights -** any infringement on human rights which may include a violation of their civil liberties;
- **Their property rights -** particularly whether people are economically affected, or experience personal disadvantage
- **Their fears and aspirations -** their perceptions about their safety, their fears about the future of their community, and their aspirations for their future and the future of their children (adapted and developed from Vanclay 2003:4).

The above list identifies the range of social dimensions that may be affected by IUU fishing and highlights the complexity of issues that need to be considered when assessing impacts of IUU fishing. The review of the literature reveals a dearth of information on social dimensions and social impacts of

IUU fishing in Africa. Most of the research on impacts of IUU fishing focuses on exploring the nature and scale of IUU, estimating the quantum of fish removed illegally or not reported and estimating the potential direct economic impacts (based on tonnage and value of unreported/illegally harvested fish), and to a lesser extent on the environmental impacts. Social impacts are given scant attention and in most cases are only identified and not discussed or assessed in any detail.

A review of the literature identifies the following six main social impacts (Table 5 10) associated with IUU fishing in Africa:

- Impacts on food security and nutrition are generally recognised as a major social impact particularly where coastal communities are reliant on fish for food and as a major source of protein. IUU activities degrade habitats, undermine ecosystem services, impact on fish populations, affecting fish availability and resulting in negative impacts on community and household food security and nutrition.
- Loss of existing jobs and potential employment opportunities are mentioned in most research and government reports. Employment losses occur because IUU fishing impacts fish stocks, degrades habitats, reduces catches and such operations compete unfairly in the market affecting the economic viability of legal enterprises and resulting in layoff of crews in both domestic commercial and artisanal vessels and in the post-harvest sector.
- IUU fishing impacts local livelihoods and the livelihood options available to many coastal dwellers especially. This includes those involved in harvesting of fish as well as those in post-harvest activities (processing and trading) as well as livelihoods linked to fishery-related downstream economic activities such as boatbuilding, repairing nets, operating services at landing sites.
- Safety and security mainly associated with damage to boats and injury to fishers (and even death) due to clashes between artisanal and commercial vessels is compromised and threatened. The intrusion of commercial vessels into the IEZ or the designated artisanal zone in a country may be from legal domestic or foreign commercial vessels operating illegally in this zone, or from illegal foreign vessels operating within the EEZ. Direct conflict between IUU and other fishery users occurs frequently and is mentioned in several reports and papers. Conflicts between IUU industrial and artisanal or semi-artisanal fishers are particularly prevalent in shrimp fisheries around Africa (Guinea; Sierra Leone; Liberia; Mozambique; Somalia) as well as in the inshore fisheries of Mauritania and Senegal (MRAG 2010).
- A few reports mention the impact on women and gender relations (WorldFish Center 2011, de Graaf and Garibaldi 2014) highlighting in particular how IUU fishing impacts on the critical role played by women in securing food for the family and how reduced availability of fish has second order impacts in the post-harvest sector which is dominated by women .
- Human rights abuses on IUU vessels have been increasingly documented by NGOs engaged in efforts to curb IUU fishing as well as researchers examining the linkages between IUU fishing and organised transnational organised crime. Human rights abuses include no safety equipment on board the vessel, poor and insufficient food, poor accommodation and poor hygiene standards. Furthermore, there are increasing reports of forced child labour and shocking working conditions not compliant with ILO standards (EJF 2012). Human trafficking and prostitution are also linked to IUU fishing activities (UNODC 2011, EJF 2012, Phelps Bondaroff et al. 2015) with far-reaching social, physical and psychological impacts.

While some of these social impacts linked to IUU fishing are relevant to all fishery sectors (e.g. layoff of crew), the main social impacts are experienced by local communities that are dependent on coastal resources for food and nutrition, livelihoods and as a source of income. For many medium to low income countries there are no alternatives to fishing and it provides a 'safety net' for the poor especially in times of hardship (Béné and Heck 2005, MRAG 2005b, WorldFish Center 2011) and thus ensuring the health of these marine systems as well as safe and secure access to these resources, are of paramount importance to these vulnerable coastal communities.

Table 5 10. *Social Impacts of IUU Fishing identified in the literature*

Social Dimension	SOCIAL IMPACTS
Food security and nutrition	Detrimental impacts on fish stocks, habitats as well as safety issues, reduces the availability and increases prices of a critical source of food and nutrition especially to local fishing communities reliant on marine resources.
Employment	Decline in fish stocks and fish habitats due to IUU fishing (less fish for domestic fishers both commercial and artisanal) as well as the direct and indirect economic losses in all fishery sectors leads to layoff of crews and in some cases closure of related fishing enterprises (processing plants, shops, women traders) with resultant job losses.
Local livelihoods	IUU fishing through overexploitation of certain species and safety issues may lead to impacts on fishing livelihoods and consequent reduction in household incomes and therefore exacerbates poverty. Reduced fish may lead to conflicts in communities and emergence of local powerful individuals/groups that "capture" the resources from the broader community
Women and gender relations	Reduced quantity of fish being landed affect women in several ways including their ability to secure nutritious food for the family, obtain income for other household necessities, their ability to work and earn a living.
Health and Safety	Conflicts at sea especially where commercial vessels (legal and Illegal) encroach into the artisanal zone leading to damage to vessels, injury and even death. Injuries and death of fishers have devastating consequences on poor fishing households
Human Rights Abuses	These include no safety equipment on board, poor working and living conditions including poor accommodation, food and hygiene conditions. Forced child labour, human trafficking and prostitution are also linked to IUU fishing.

Sources: (MRAG 2005b, EJF 2005a, 2005b, Stop Illegal Fishing 2008, Grobler 2008, Agnew et al. 2010, Groeneveld 2010, Nwabeze et al. 2011, The World Bank 2012, Paterson et al. 2013, INTERPOL 2014, Mofolo and Boto 2014, Belhabib and Divovich 2015, Phelps Bondaroff et al. 2015, Sjöstedt and Sundström 2015, Greenpeace 2015, Mirabel Bausinger et al. 2016).

Responses from the questionnaire survey administered during this study reveals that fisheries managers and others fishery stakeholders identified similar social impacts as those identified from the literature review although these have been grouped slightly differently (Table 5 11).

The only additional socio-economic impact identified through this survey was "Decreased national development" due to IUU fishing and was highlighted as a matter of grave concern especially in the large pelagic finfish sector and in the crustacean sector. Although difficult to quantify in general terms and at a country level due to lack of data and the complexity of ascertaining the percentage contribution of IUU fishing to low economic growth rates and weak investment in social development as opposed to other factors, estimates of losses to the coastal countries in Africa through IUU fishing based on Paul and Zeller's (2015) figures suggest a value of approximately 4.7 million tons per annum for all maritime countries (Figure 5 1, excluding discards). Estimates of the additional contribution that revenue lost to IUU fishing could make to GDP (between 1.1 -1.7% see table 5.5) are significant, highlighting the potential lost socio-economic development opportunities (assuming they were realised). Allocation of these resources on much needed infrastructural development, social services

Table 5 11. *Socio-economic impacts associated with IUU fishing based on the questionnaire responses as totals for Africa as a whole - marine wild capture fisheries only, and coastal marine states.*

Socio-Economic Impacts - Africa	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	small pelagic	Crustacean	sedentary coastal	Total
Habitat degradation	8	7	12	3	6	13	13	62
Uneconomical domestic fisheries	8	7	9	6	10	10	9	59
Poor local food security	7	6	9	6	9	10	11	58
Local livelihoods	7	6	10	7	11	11	11	63
Downstream economic costs	10	9	10	8	10	9	8	64
Fishing crew layoffs	7	5	4	3	4	7	6	36
Decreased national development	10	7	8	5	6	9	8	53
Negative fish price effects	8	5	8	3	6	10	6	46
Social decline	8	6	6	4	7	9	9	49

and welfare could contribute to alleviating the social stressors experienced in maritime countries, especially those countries with a low HDI, and those with a significant percentage of the population categorised as MPI poor and destitute (see Figure 2 2).

Many of these coastal communities are already poor, marginalised and vulnerable to a range of threats (including climate change) and are largely helpless in the face of rampant IUU fishing. The review of the literature identifies that the coastal communities of nations such as Mauritania, Guinea-Bissau, Guinea, Senegal, Liberia, Sierra Leone, Angola, and in east African countries of Somalia, Kenya, Tanzania, Mozambique and Madagascar are highly dependent on fisheries resources for food and livelihoods and gain their main source of protein from fish and fish products (MRAG 2005b, Commonwealth Foundation 2008, Stop Illegal Fishing 2008, Belhabib and Divovich 2015). The poverty profile in most of these fishery dependent countries shows that over 50% of the population is categorised as MPI poor (Figure 2 2) while in Sudan, Sierra Leone, Guinea-Bissau, Guinea the DRC, Liberia, Mozambique, Nigeria, and Benin 30% and more of the population is categorised as destitute (there is no data available for % destitute in Somalia, Madagascar and Kenya) (Alkire and Robles 2015).

The poverty conditions in poor coastal communities are exacerbated by the negative effects of IUU fishing. These dire circumstances often force local artisanal fishers to use destructive fishing gears and techniques (nets with small mesh sizes in many countries, dynamite fishing), disregard rules and local customary laws (for example fish in protected areas and take undersized fish) and engage in illegal and illicit activities linked to the IUU fishing operations. Often poor fishers end up indebted to boat owners, buyers or crime bosses and are driven to overfishing, participating in the illegal chain of activities (e.g. abalone poaching in South Africa) and other illegal activities (dealing in drugs, arms and other contraband) to pay back their debts (Martini 2013, de Greeff, 2013; Raemaekers and

Sowman 2015). Women in particular are vulnerable to impacts of IUU fishing as their role is largely in the post-harvest sector (buying, cleaning, processing, financing and trading) and if fish catches are significantly reduced in local areas, fish harvesters may seek alternative livelihoods, or migrate to other areas or even other countries with significant impacts on women who are largely responsible for household food security, and providing for other basic needs.

To exacerbate matters, in some countries many of these poor and food insecure fishers/fishing communities can see the IUU vessels from the shore and/or from their boats but note that fisheries authorities and enforcement officials fail to take action to sanction transgressors (MRAG and CapFish 2008, Glaser et al. 2015). This leads to anger and frustration amongst communities and promotes illegal activities and environmentally damaging practices (e.g. use of illegal gears, dynamite fishing, and fishing in prohibited areas) (EJF 2005b, Stop Illegal Fishing 2008, Agnew et al. 2010). This situation may also erode customary marine governance systems that incorporate conservation practices and undermine government conservation and sustainability programmes and efforts.

Countries vulnerable to IUU fishing tend to be those with poorer governance structures and systems and weak MCS systems (Figure 6 1). This was already highlighted in a study by MRAG in 2005 that found a "striking relationship between the level of governance of a country and its vulnerability to IUU" (MRAG 2005b). IUU fishing further undermines the rule of law, fuels corruption, leads to other criminal activities and can even lead to political instability (McNulty 2013, Sander et al. 2014, Phelps Bondaroff et al. 2015). Furthermore, it detracts from government mandates to manage resources sustainably and equitably. Due to nature of corruption in IUU, the financial gains made through IUU fishing seldom find their way back into the domestic economy, and the fishery sector in particular, and instead the earnings are used to enable organised criminals to continue illegal and illicit activities (Gilman et al. 2014, Phelps Bondaroff et al. 2015).

The growing literature that looks at the links between IUU fishing and organised crime is highlighting a range of additional human rights abuses and social impacts (Standing 2008, EJF 2012, Öztürk 2015, Phelps Bondaroff et al. 2015, Mirabel Bausinger et al. 2016). These concern smuggling goods, forced labour, child labour, inhumane working and sleeping conditions on board IUU vessels, allegations of murders at sea, prostitutions, and human trafficking. These activities occur largely due to the distance and isolation of IUU vessels, the strong competition within the industry, and the extent of poverty in many African countries resulting in a steady supply of vulnerable workers (Phelps Bondaroff et al. 2015). There is very little documented information on the scale and exact nature of these human rights abuses and social impacts associated with organised crime at sea, and further work to better ascertain these linkages and impacts is urgently required.

This following sections present a brief overview of particular social impacts that were identified and/or investigated in the five regions under consideration. However, it needs to be noted that there is very limited literature on social impacts across all regions and few reports go beyond identifying the impacts. There is no assessment and evaluation of social impacts at a regional or country level regarding how IUU fishing impact on the various social dimensions usually considered in a social impact assessment.

4.3.1 Northern Africa

Öztürk (2015) recognizes that there are multiple social, economic and legal dimensions to the impacts that IUU has within the Mediterranean region. In his discussion of social, economic and environmental impacts however social considerations are not evaluated beyond the superficial listing of the social impact of 'loss of human lives and injuries in general' Öztürk (2015 p. 81).

The FAO (2013) workshop on IUU Fishing in the Mediterranean Sea in Tunisia set out actions to enable the GFCM to address IUU fishing and contribute to the sustainable development of fisheries and aquaculture. This workshop identified that it is instrumental to any such action that a better knowledge of IUU fishing activities is grasped to "minimize the risk of undermining the reliability of information obtained through collected data and that of hampering the effectiveness of any prospective management plan for selected Mediterranean fisheries" (FAO 2013:1). However, the main targets of the workshop reflect economic and catch considerations of the FAO and broader international IUU literature in the way social impacts are not listed, nor are they discussed as an important knowledge area for this decision-making.

4.3.2 Western Africa

The SIF (2008) combine their analysis of illegal fishing in Southern and Western Africa waters with a number of detailed qualitative case studies. These cases provide a rich description of the socio-economic impacts of IUU on individual fishermen and women. In Guinea, if the fishermen do not catch fish, the women have no means of making a living, and cannot afford to feed or educate their children (EJF 2005a). Declines in catch are evaluated in economic as well as livelihood and cultural terms. The threat to health and well-being of impacts associated with IUU fishing is exemplified by the use of anecdotal stories. Although the SIF (2008) report provides a standard evaluation of different aspects of the fishery - types of fishery, health of the fishery, economic data and management issues at comparative country levels, it does not provide a standard evaluation of social impacts of IUU at a country level.

In 2010 while conducting investigations into alleged IUU fishing in the EEZ of Sierra Leone, the EJF and Greenpeace International came across fishing vessels used as 'mother ships' containing sleeping quarters for about 200 Senegalese fishers (Phelps Bondaroff et al. 2015). The sleeping conditions on the board the vessel unacceptable comprising cardboard mattresses layered on top of one another. Crews on board fishing vessels involved in illegal fishing and associated crimes are more at risk of human trafficking because operators readily take advantage of an endless supply of workers desperate for income. Since many countries in the region lack effective monitoring methods, there are no incentives for operators to meet international human rights standards on ships (Phelps Bondaroff et al. 2015).

EJF (2012) has reported on various human rights abuses in their work off the coast of West Africa. Of concern was the case they reported on where a Korean-flagged vessel had deployed canoes in the IEZ off Sierra Leone, near Sherbro Island. Interviews conducted with several of the crew identified three crew members as young as 14 years old. These boys were from Senegal and were on board this mothership for 3 months at a time and were required to fish every day. According the report (EJF 2012) the accommodation on board the vessel was unsatisfactory, as people were living in very cramped and unhygienic conditions.

INTERPOL (2014) acknowledges that IUU can undermine the sustainability of marine living resources, and threaten the economic, social and political stability of coastal communities, especially in West Africa where small-scale or artisanal fishermen depend on sustainable near-shore fisheries for their source of income and survival. They link political, social and economic stability to organized criminal activities (INTERPOL 2014). This highlights the importance of curbing and eliminating IUU in the Western Africa region if sustainable fisheries are to be attained. However INTERPOL's (2014) evaluation of IUU does not elaborate on the nature of the social aspects of the fishery that they are investigating nor does their evaluation present an understanding of the dynamics of social impacts that result from IUU.

Research undertaken by MRAG in 2010 in several coastal countries provides information on various economic impacts associated with IUU fishing and briefly touch on some of the associated social impacts although these are not discussed in any detail.

Kelleher (2002) reports that in some West African states there is conflict between industrial and artisanal fishermen, especially where fishing grounds are narrow and close to shore. Conflict between artisanal and IUU vessels is observed to be common in Sierra Leone. Drammeh (2000) also reports that in the West African sub-region industrial fishing vessels (legal and illegal) often encroach on small scale fishing grounds with both licensed and pirate fishing vessels using fishing gear and equipment, methods and techniques which are prohibited. Conflicts may be direct (vessels running others down) or indirect (removing all available fish or shrimp), the former often leading to accidents, death and injury amongst artisanal and other local inshore fishers which in itself will have economic and social consequences (lower catches through injury, loss of earnings) for fishers and their families.

Social impacts are identified in the MRAG report (Agnew et al. 2010). Illegal fishing in Guinea Bissau gives rise to an extensive range of social problems; it has been reported that violent acts directly related to illegal fishing are not uncommon. Examples are clashes between Guinea Bissau nationals and the crew of Senegalese fishing vessels who regularly camp on the various islands of the Bijagos archipelago. Clashes are also known to occur between small-scale fishermen and large industrial vessels, as a result of industrial vessels damaging artisanal fishing gear and trawling within artisanal fishing areas. Several reports from various West African countries have highlighted the presence of large industrial vessels fishing during the night (when there is no surveillance capacity) within restricted areas MRAG (Agnew et al. 2010). This type of fishing is indeed highly destructive and known to directly affect the livelihood of a large number of people from the various coastal communities. The economic model does not take directly into account the biodiversity loss and inherent economic impact of these illegal actions. This would require an in-depth study focussed solely on this issue.

4.3.3 Southern Africa

IUU fishing in Southern Africa is widespread in the abalone fishery as well as the West Coast Rock Lobster (WCRL) industry. The closure of the abalone fishery in 2008 was an emergency measure by government due to concerns regarding impacts of poaching on the sustainability of the resource, as well as socio-economic impacts (MRAG and CapFish 2008, de Greef and Raemaekers 2014). It has been estimated that the illegal production of abalone in South Africa is in the order of 2400 tons or 63% of total production, which comprises about 2/3 of total exports, while the legal quota is 96 tons and farmed abalone 1440 tons (Britz et al. 2015). In addition to the estimated economic loss of R1.1

billion to the economy, research over the years has provided an understanding of how the illegal fishery works and some of the social impacts associated with it (de Greef and Raemaekers 2014). A major concern is that abalone poaching has resulted in organised crime syndicates (mainly Chinese) infiltrating local fishing communities, enticing locals, in particular the youth, to participate in their operations disrupting community life and families in significant ways. Access to quick money and the lifestyle offered by these criminals has led to increased use of drugs in these communities, school drop outs and a host of other social impacts (Stop Illegal Fishing 2008, Britz et al. 2015).

The research conducted in the abalone illegal trade in South Africa provides an integrated and prioritized consideration of the social impacts:

"The associated social costs of the illegal abalone trade through the apparent involvement of so many members of coastal communities, from young to old, have severe long-term implications for these communities. It is alarming to hear the anecdotal accounts of children dropping out of school and adults leaving the formal job sector to poach. Such a situation will not only result in further marginalisation of these vulnerable individuals from earning a living within the legal economy but will also preclude any future opportunities to benefit from the use of this endemic marine species" (Stop Illegal Fishing 2008).

According to Belhabib et al. (2015e), Namibia performs very well in terms of fisheries reporting, monitoring and stock rebuilding strategies. This is confirmed by Sjöstedt and Sundström (2015), although neither Belhabib et al. (2015e) nor Sjöstedt and Sundström (2015) provide a robust social characterization as a basis for their evaluation. Overall, the case of Namibian fisheries provides a good example of how to escape neo-colonial pressure on fishery resources, and rebuilding fisheries after major collapses (Belhabib et al. 2015e). Beyond the catch and economic considerations, Paterson et al. (Paterson et al. 2013) identified that the fact that "fisheries management is not socially driven" means, "the ecological, economic, and social realities around Namibia's fisheries management are not sustainable". This is illustrated by the lack of transparency in terms of employment potential as the numbers claimed by industry to be employed onboard vessels (Ministry of Fisheries 2009) are exaggerated by around 30% for political reasons (Grobler 2008). This is further reflected in no specific social measures being identified in the 'Namibian National Plan of Action to prevent, deter and eliminate IUU fishing' (Republic of Namibia 2007).

4.3.4 Eastern Africa

In SADC shrimp fisheries, social impacts are high as there are direct conflicts between the industrial and artisanal (beach seine and other) fisheries when fishing in the inshore areas. These include impacts on food security of coastal communities and loss of fishing gear through entanglements, constraining their ability to fish (MRAG and CapFish 2008). In demersal and small pelagic fisheries indirect economic losses through misreporting or underreporting by fishers are considered to be the main issue. Social impacts in these fisheries are relatively low as there is little direct competition for resources between IUU fishers and local communities.

Potgieter and Schofield (2010) recognise that around the Somali coast there is a fundamental need to restore law and order ashore in order to deliver security offshore. In their evaluation of 'poverty, poaching and pirates', the social impacts of IUU in the region are well elaborated with a discussion of food security corruption, drugs and human trafficking. Allias (2009) observes that after arms and

drugs, trafficking in human beings is the best source of income for organised crime. However, it seems that people are starting to replace drugs as the second largest source of income, as 'bodies can be replaced' (Allias 2009: 69).

4.4 Social impact assessments on IUU fishing required

A dearth of literature exists on the social impacts associated with IUU fishing especially with regard to impacts on coastal communities and households with respect to livelihoods, food security and gender issues. Most attention is given to estimating the potential economic value of unreported catches, and the associated economic losses as well as the impacts of IUU fishing on fish populations, marine ecosystems and threatened and endangered species. Social considerations are presented as an add-on to the research agenda, with information provided at a very descriptive level with limited analysis on the nature, extent and severity of social impacts and how these differ across regions and countries and contexts.

5 Key motivating factors and vulnerabilities to IUU fishing

5.1 Key motivating factors

Kuperan and Sutinen (1998) outline a theoretical framework for understanding the factors that are influential in individuals' decision to violate fisheries regulations. They point out that the standard model suggests that an individual commits a crime if the expected utility from committing the crime (A) exceeds the utility from engaging in legitimate activity (B), but caution that this model does not explain the evidence very well and it leads to policy prescriptions that are impractical. Elaborating on the latter, they point out that the two ways of achieving A < B, viz. to increase the probability of apprehension and/or increase the penalties, are not cost effective and/or not palatable to the law courts. They then go on to discuss why, in their context, between 50% and 90% of fishers comply with regulations. Their overall summary of the factors that drive compliance are:

1. Potential illegal gain
2. Severity and certainty of sanctions
3. Individuals' moral development and their standards of personal morality
4. Individuals perceptions of how just and moral the rules that are being enforced are
5. Social environmental influences.

They then analyse data using a model in which the probability of an individual violating a regulation decreases with

1. Increasing probability of detection and sanction (or the greater the enforcement inputs)
2. Increasing penalties if sanctioned
3. Increases in B/A
4. Increasing moral development of the individual
5. Increasing perception by the individual that the legislation is legitimate
6. Increasing perception by the community individual that the legislation is legitimate,

And conclude that

"Our analysis of Malaysian fishermen's compliance demonstrates that the extension of the basic deterrence model to include moral obligation and social influence variables results in a richer and superior model of compliance behavior. The analysis provides empirical support for the argument that in addition to tangible gains and losses, moral development, legitimacy, and the behavior of others are important determinants of compliance. These variables are important both for the study of compliance behavior and for the design and implementation of regulatory policy".

With respect to the last mentioned, "regulatory policy", they conclude that "If large enough, relative to illegal gains, the certainty and severity of sanctions should be an effective enforcement instrument" and that "enforcement is an essential element of compliance policy". But they also suggest that

"authorities should determine what policies and practices are judged fair by segments of the population subject to regulations. This may mean, for example, that civil penalties and other sanctions should be comparable in value with the larger of the harm done or gains realized. This may indicate that fishermen subject to surveillance and monitoring be treated with dignity and respect. This may also require that the boundaries of the closed zone appear to be reasonable and appropriate to fishermen."

Further to the above, the quality of governance in the coastal state is undoubtedly a key component of vulnerability to IUU fishing, as is illustrated in the comparison between the IUU as a percentage of the reported catch (on a tonnage or value basis) and the various components of the World Bank Governance index - see Figure 6 1, where a strong reduction in IUU in relation to more robust forms of governance is clear, as has been identified by various researchers and fisheries development and/ or management bodies using different data inputs to those used here (as is also noted in Agnew et al. (2009), Stop Illegal Fishing (2008) and the FAO).

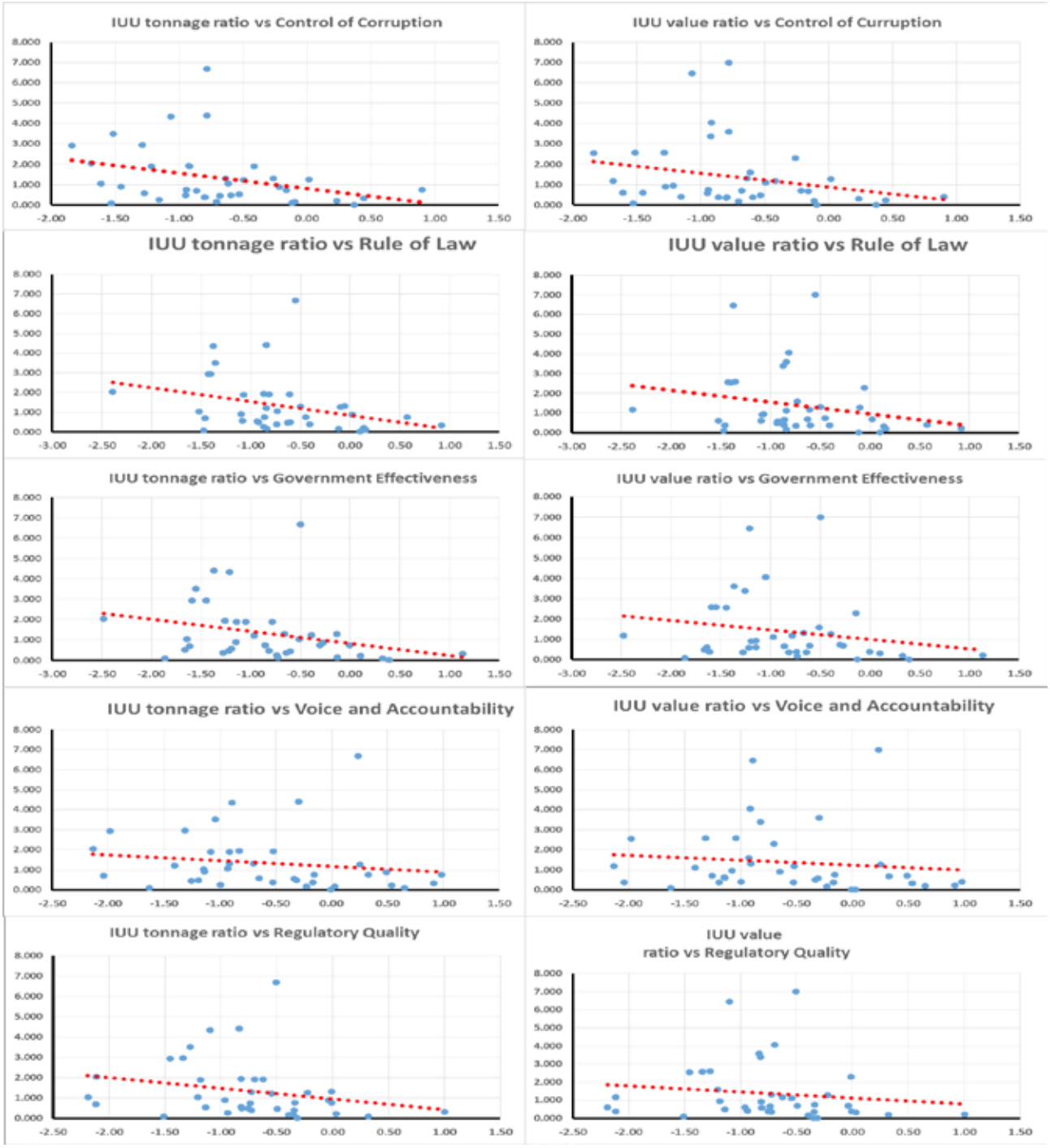


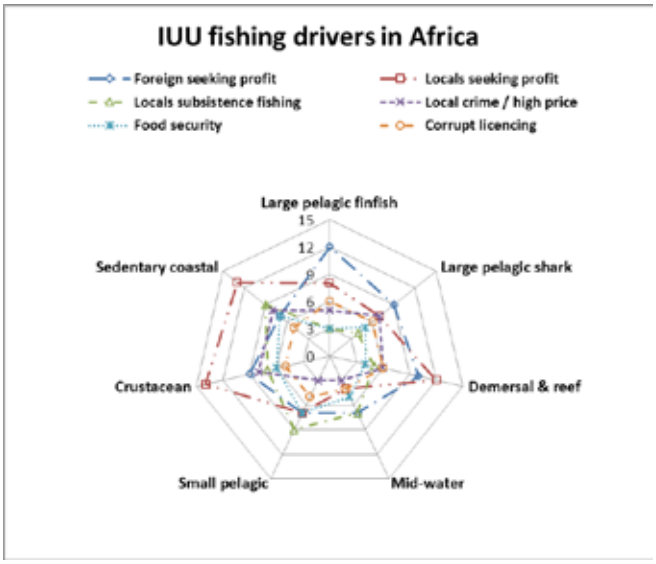
Figure 6 1. *Plot of the ratio of unreported IUU tonnage to the reported catch tonnage from Pauly and Zeller's (2015) data versus the various components of the WGI world governance index on the left, and on the right the same plots but the y-axis value is now the ratio of unreported IUU value to the reported catch value from Pauly and Zeller's (2015) data. World Bank Governance index for 2014, source: http://data.worldbank.org/data-catalog/worldwide-governance-indicators. For IUU we used the 2010 estimate provided at the Sea Around Us website (see Pauly and Zeller, 2015). The stippled red line in each case is the best fitted linear relationship.*

The following is a further list of the motivating factors and key vulnerabilities of IUU fishing in Africa as emerged from the literature review:

- Foreign vessels seeking profit/high volumes
- Local vessels seeking profit
- Subsistence food requirements
- Poverty and livelihood needs
- Meeting the requirement of criminal networks
- Various mechanisms within these networks actively promote IUU. This includes money laundering, and payment for high value products such as abalone with drugs or drug precursors.
- Moreover, Equatorial Guinea has be linked with acting as a staging post for drug operations where cargos are received from the high seas (Wood 2004).
- In Algeria the subsidies programs offered have increased fisher's debts and encouraged the use of illegal fishing methods (Cacaud 2002, Chalabi et al. 2015).

5.1.1.1 Questionnaire results for Africa as a whole

In your view, which are the most important drivers of IUU in your country/region? Tick all that are applicable.							
IUU Drivers	**Large pelagic**	**Large pelagic**	**Demersal & reef**	**Mid-water**	**Small pelagic**	**Crustacean**	**Sedentary coastal**
Foreign seeking profit	12	9	10	7	7	9	7
Locals seeking profit	8	7	12	4	7	14	13
Locals subsistence fishing	3	4	5	7	9	7	9
Local crime / high price	5	7	6	3	3	8	8
Food security	3	5	4	5	7	6	7
Corrupt licencing	6	6	6	4	5	5	5



5.1.2 Vulnerabilities

5.1.2.1 Resource characteristics

- Richness of resources coupled with inadequate MCS capacity,
- High value of product value

5.1.2.2 Fleet characteristics and subsidies

- The existence of too much fishing capacity meaning that there are too many boats fishing for too few fish making legal fishing increasingly difficult (Stiles et al. 2013).
- Perverse incentives and subsidies: Perverse subsidies to the fisheries sector (such as for vessel construction and fuel tax waivers) reduce the real costs of fishing and enable fishing to continue beyond the point at which it would otherwise be unprofitable. The countries that provide the most subsidies are Japan (USD 5.1 billion), India (USD 4.5 billion), the EU (USD 3.2 billion) and China (USD 2.7 billion); seven countries provide two-thirds of all subsidies. By subsidising excessive fishing fleets, the likelihood of irreversible overfishing is greater, there are negative environmental impacts (e.g. bottom trawling-induced habitat destruction) and negative socio-economic impacts, particularly for impoverished communities relying on artisanal fish stocks as a primary source of protein and livelihood. Whilst efforts towards eliminating such subsidies such as, the Friends of the Fish trade measures, are underway, there has been no significant reduction to date (Telesetsky 2013). However, these trade measures incentivise cooperation as associated parties would likely benefit positively from dispute settlements and natural resource conservation with the World Trade Organisation (WTO), and those opposed to the measures may lose valuable market access. The WTO process represents the best opportunity to tackle harmful fisheries subsidies on a global level.

5.1.2.3 Legal frameworks, justice systems, penalties

- A lack of information or knowledge and/or a functional legal framework to control IUU activity,
- National law inadequately integrated with or responsive to regional and international agreements.
- Unsurprisingly, impunity related to IUU fishing is rampant. Companies involved in illegal fishing are either not punished or receive sanctions that are too weak to have a deterrent effect. Studies suggest that penalties would have to be increased 24-fold to have a real deterrent effect on illegal fishing activities (Love 2010). In many countries fines are based on what the company/ fishers are able to pay. As in the majority of cases the actual owner is hidden behind a beneficial one, fishermen who themselves often work in very poor conditions and receive very low salaries, are the ones arrested and who pay the fines. Overcapacity is also seen as one of the drivers of IUU fishing. There are too many fishing fleets for the number of fish available, and as a result competition and local depletions of fish stocks are driving fishermen to protected areas (Stiles et al. 2013).
- Fines for fishing crimes are minor compared to the value of the IUU catch (High Seas Task Force 2006). For example, 1.0 to 2.5 % of the value of the IUU catch is paid by the European community (Stiles et al. 2013). Some researchers have found that an increase in the chance of being caught has a greater chance of acting as a deterrent than a similar increase in fines (Akpalu 2011).

5.1.2.4 Availability of possible evasive tactics

Ports of non-compliance or ports of convenience facilitate IUU fishing, and the pro-active application of port controls under the aegis of the PSMA, for example, requires the application of substantial resources (Stop Illegal Fishing 2008). Las Palmas de Gran Canaria, located in Spain's Canary Islands, is

possibly the most important point of entry for West African catches en route to Europe, laundering and facilitating the movement of IUU catches into the European market (Stop Illegal Fishing 2008). The port's status as a Free Economic Zone (FEZ) enables favourable customs regulations and institutionally weaker control over the transhipment of goods (Stop Illegal Fishing 2008), posing a threat to African fisheries (Stop Illegal Fishing 2009).

Flags of convenience are used to conceal stolen fish and reduce liability for the owners if the illegal vessel is captured. Flags of convenience have been described as the scourge of today's maritime world" (Stop Illegal Fishing 2008). These flags are used to conceal stolen fish and reduce liability for the owners if the illegal vessel is captured. Vessels registered under flags of convenience do not necessarily have owners or crew from that country, nor are they required to visit the country issuing the flag (Smith 2009). They represent one of the simplest and commonest ways for illegal fishing operations to skirt management and conservation measures, and therefore avoid penalties for IUU infractions (Stop Illegal Fishing 2008). They are easy, quick and cheap to acquire, often obtainable over the internet for a few hundred dollars, and allow IUU fishing vessels to flag-hop, i.e. re-flag and change names several times, even within a season, to confuse management and surveillance authorities (FAO Fisheries Department 2002, Griggs and Lugten 2007, Smith 2009, Flothmann et al. 2010). Also, illegal vessels are known to register in international tax havens, through front companies or joint ventures (Griggs and Lugten 2007, Smith 2009, Flothmann et al. 2010).

5.1.2.5 Weak and ineffective MCS

- MCS capacity and failure to identify and patrol EEZ: MCS capacity issues include limited knowledge of the scale of IUU activities in the region; limited regional assets and capacity; extent of areas requiring surveillance and significant dispersal of fleets; and limited or non-existent coordinated systems for regional MCS (MRAG and CapFish 2008). These factors directly stimulate IUU in the SADC.
- Weak port inspections and a lack of coordination and information exchange.
- Inadequate and uncoordinated MCS information exchange at a regional level.
- Low probability of capture.

5.1.2.6 Governance

- Weak governance,
- Corruption within institutions: Corruption within institutions can work its way down through an agency or corporation (Sumaila and Jacquet 2008). Illegal fishing operations are known to forge or alter paper catch documents and bribe inspectors, customs and border patrols to sign false catch documents or allowed illegal catches to enter their state without the proper documentation (Roheim 2008, Sumaila and Jacquet 2008) as legal products (Hauck and Kroese 2006).
- Lack of political will
- Weak legal frameworks

5.1.2.7 Diplomatic facilitation

- The appropriate diplomatic environment does exist in the SADC for efficient and harmonised data sharing to take place (MRAG and CapFish 2008).

6.1.2.8 Terrain aspects

- The logic of divide and rule.
- Although RFMOs aid in IUU combat by improving MCS, long-standing fleet members (e.g. Indian Ocean Tuna Commission (IOTC)) still experience high IUU levels (MRAG and CapFish 2008).
- Limited formal or diplomatic mechanisms or frameworks in place for regional cooperation and coordination.

5.1.2.9 Data collection, management, harmonisation and exchange

- Weak port inspections and a lack of coordination and information exchange weaken the power to eradicate IUU (MRAG and CapFish 2008).
- Data captured at sea and land are not currently processed and stored in a harmonised way, either nationally or regionally (MRAG and CapFish 2008).
- Current data standards, data holding capabilities and data confidentiality policies remain uncoordinated for MCS information exchange, and are focused on domestic requirements at the expense of regional exchange and coordination, representing a significant barrier to prevention of IUU in the SADC region (MRAG and CapFish 2008).

6.1.2.10 Questionnaire results for Africa as a whole

What factors make your country / region vulnerable to IUU? Tick all that are applicable.							
Vulnerability Areas	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal
Poor MCS	17	13	14	10	12	13	13
Poor penalties and deterrance	9	8	11	5	6	8	9
Corrupt enforcement/licencing	7	7	7	7	8	11	12
Poor anti-IUU strategy	4	3	4	2	3	3	4
Poor EEZ legislation	10	10	8	8	9	7	8
Local livelihoods at risk	5	5	7	7	10	8	10
Poor understanding of IUU	9	8	6	5	8	8	6
Lack of political will	7	6	7	5	7	9	9
Poor coordination	8	6	6	4	5	6	8

The following are some regionally specific issues related to vulnerabilities to IUU (motivating factors were not regionalised).

5.2 Southern Africa

5.2.1 Vulnerabilities

5.2.1.1 Resource characteristics

- High value inshore resources such as rock lobster and abalone are a major incentive for IUU fishing by domestic operators.

5.2.1.2 Fleet characteristics and subsidies

- Overcapacity in the line fishery leads to overexploitation but technically this is not IUU fishing.

5.2.1.3 Legal frameworks, justice systems, investigations, penalties

- During 2003-2004, South African IUU abalone came under fire by the anti-poaching unit,

MARINES, resulting in the infiltration of poaching syndicates and conviction and/or fines for poachers and leaders (Sjöstedt and Sundström 2015). In addition, an enforcement strategy based on information gathering and increased costs to poachers, called Operation Trident, was launched (Steinberg 2005, Moolla 2010). These efforts improved compliance and increased convictions (Japp 2004).

- According to Raemaekers et al. (2011 : p441), ‘‘a lack of government funding and policy continuity resulted in the highly-effective environmental courts being closed in 2005, and termination of the MARINEs programme in 2006.’’ Hence IUU drastically increased from 2005 - 2009, which ‘‘has been directly linked to the institutional collapse at Marine Coastal Management’’ (Moolla, 2010: 36).

5.2.1.4 Availability of possible evasive tactics

- Namibia has achieved effective port state control as a result of a high MCS capacity and stipulations for fishing vessels to fly a Namibian flag.

5.2.1.5 MCS and related topics

- The Namibian MCS includes systematic sea patrols to ensure regulatory compliance by licensed vessels through regular at-sea inspection and air patrols. This system assisted in decreasing the occurrence of IUU (Stop Illegal Fishing 2008) by detecting and deterring unlicensed fishing vessels and monitoring the movement and operation of licensed fleets (Stop Illegal Fishing 2008).
- We note that in Namibian and Southern Africa unreported fishing offences are often committed by nationals and/or vessels flying their own flags (MRAG and CapFish 2008). Incursions by foreign flagged vessels are thought to be rare, but there are exceptions.
- In South Africa natural resource agency staff were reduced by two-thirds over ten years, thereby preventing effective monitoring (Hauck and Kroese 2006).
- In 2002, 42 % of Namibian MCS expenditure came from fishing revenue (Bergh and Davies 2004); and was built strongly on the financial, human and material support from the Namibian government.
- South Africa has four dedicated patrol vessels and fishery control officers to monitor fisheries and inspect vessels’ catches at harbours, and a fixed wing air patrol operating out of Cape Town (Stop Illegal Fishing 2008).

5.2.1.6 Diplomatic facilitation

- Regional MCS cooperation (especially between Namibia and South Africa) is good and likely to improve with the initiation of the Benguela Commission (MRAG and CapFish 2008).

5.2.1.7 Terrain aspects

- Far flung EEZ waters around Prince Edward and Marion Island vulnerable to IUU fishing (toothfish) because of difficulty of policing waters.

5.3 Eastern Africa

5.3.1 Vulnerabilities

5.3.1.1 Legal frameworks, justice systems, penalties

- International laws and the new Federal Somali Fisheries Law Article 15 adopted in December 2014, specifying Fishing and Entry procedures in Somali waters, provide legal mechanisms to control fishing activities in the EEZ of Somalia (Somalia Federal Ministry of Fisheries and Marine Resources 2015).
- In Mozambique, prosecution of legal infractions are often delayed, and unpaid fines have accumulated (Kelleher 2002, Amador 2006).
- In Tanzania legal processes have not performed adequately and many offenders merely pay small fines instead of being prosecuted in a court, and offenses are not subjected to gradation (Amador 2006, Shauri 2006, Pramod et al. 2008).

5.3.1.2 MCS and related topics

- Low MCS capability, corruption and weak regulatory structures brought on by the recent protracted civil war has catalysed the increase of IUU in Somalia (MRAG 2005b).
- Madagascar possesses strong MCS in industrial fisheries, and this has led to high levels of compliance in the past.
- In Madagascar the essentially open access artisanal fisheries are inherently difficult to monitor and are characterised by excessive fishing pressure, which poses a challenge to fisheries management (Stop Illegal Fishing 2008). Hence, weak or negligible enforcement (Le Manach et al. 2011, 2012) encourage foreign fishing fleets (often Chinese or Korean) to exploit Madagascan marine resources (Petrossian et al. 2015).
- Certain fishing vessels take advantage of Somali low MCS capacity (Waldo 2009) and are operating in contravention of the international and Somali Fisheries laws.
- In Somalia IUU remains a problem due to the low MCS capacity, lack of a Fisheries Monitoring Center (FMC), VMS or AIS, and almost no patrols from Somali Coast Guards and Navy due to the lack of vessels and equipment. A United Nations report in 2006 stated that the absence of the country's once serviceable coastguard has led to Somali waters becoming the site of an international "free for all," with fishing fleets from around the world illegally plundering Somali stocks and ousting the country's own rudimentarily-equipped fishermen (Tharoor 2009). Furthermore, these types of fishing vessels are not calling at Somali ports, and therefore cannot be inspected by Somali port inspectors (Somalia Federal Ministry of Fisheries and Marine Resources 2015).
- In Mozambique, MCS measures were implemented late and with limited resources (Afonso 2006).
- Tanzanian MCS measures were implemented slowly and have relied heavily upon donor funding (Lokina 2006). While measures such as on-board observers and a requirement of vessels to be in contact with authorities three times a day exist (Lokina 2006), Tanzania's MCS is regarded to be weak (Sjöstedt and Sundström 2015).

5.3.1.3 Governance

- Corruption and weak regulatory structures brought on by the recent protracted civil war has catalysed the increase of IUU in Somalia (MRAG 2005b).
- Corruption has long thwarted efforts to eradicate IUU activities and poorly-paid law enforcement officials are persuaded to accept bribes, e.g. observers in Kenya would accept shrimp as a bribe;

leading to the termination of the national shrimp observer programme, and patrolling officials would sell their fuel to poachers in Tanzania (Stop Illegal Fishing 2008).

- In Mozambique, corruption remains a serious challenge, which is epitomised by the fishing ministry and the current president's economic interests in fishing companies (Kelleher 2002, Lux Development 2005, Mosse 2005, Pramod et al. 2008, Stop Illegal Fishing 2008).

5.3.1.4 Diplomatic facilitation

No relevant comment.

5.3.1.5 Terrain aspects

Very long coastlines and very large EEZs, challenging to MCS.

5.4 Northern Africa

5.4.1 Vulnerabilities

5.4.1.1 Legal frameworks, justice systems, penalties

- Egypt, Libya and Morocco have legal measures and well-informed teams in place to combat IUU fishing, e.g. six month license suspension (for the first offence);revoking the license (upon the second offence).
- Legal measures to reduce IUU fishing in Libya are stipulated in applicable laws and executive regulations.
- In Morocco, legal measures regulate fisheries; statistics are maintained on boats and fines and a monitoring system for the fishing fleet and a central observation system for fishermen exists (Öztürk 2015).
- Legal measures in Tunisia comprise a 1994 law concerning IUU fishing; in addition coastguards receive training on IUU (Öztürk 2015).

5.4.1.2 Availability of possible evasive tactics (FoCs, PoCs, PSMA not adopted)

- At a GFCM meeting in 2015, O. Chahi (Ministry of Fisheries and Marine Resources of Algeria) suggested that the key problems facing the Algerian fishery sector were the management and the control of their ports, a responsibility which is divided among different national institutions. This problematic issue is compounded by inadequately trained national inspectors (GFCM 2015).

5.4.1.3 MCS and related topics

- MCS in Libya is enforced by the effective coastguard and surveillance over the coasts (Öztürk 2015). In addition, information on IUU fishing is provided by fishermen and commercial ships to the central operation centre of marine ports and MCS for the tuna fishing fleet is available for Libyan vessels equipped with VMS system (Öztürk 2015).
- Legal measures to reduce IUU fishing in Libya are stipulated in applicable laws and executive regulations. Despite this, IUU is still thriving in Libya, due to the limitations of coastguard facilities, the low awareness on sustainable fishing and a shortage of human MCS resources (GFCM 2015).
- In Libya many conflicts have taken place since 2011 and there is practically no control of the fishing activities, which increased substantially (Crawford et al. 2011), especially in the form of illegal foreign fishing.
- In Morocco, legal measures regulate fisheries; statistics are maintained on boats and fines and a monitoring system for the fishing fleet and a central observation system for fishermen exists (Öztürk 2015).

- In Algeria, the National Frontier Service has controlled all types of fishing activities within both the territorial sea and protected areas (Öztürk 2015).
- Monitoring and enforcement systems in Algeria rely on officially designated land-based observers, which are mostly unqualified for coastal fisheries monitoring and a few at-sea observers on a few licensed foreign vessels operating under fishing agreements (Belhabib et al. 2015d).
- In Tunisia there is a boat observation system for bluefin tuna and landing control at fishing ports (Öztürk 2015).
- The problem of IUU fishing in Tunisia has proven undeterred by the relevant legal and MCS measures, in relation to deep sea habitats and protected areas (GFCM 2015).

5.4.1.4 Terrain aspects

- • The narrow Algerian continental shelf and the subsidies programs offered have increased fisher's debts and encouraged the use of illegal fishing methods (Cacaud 2002, Chalabi et al. 2015).

5.4.1.5 Data collection, management, harmonisation and exchange

- In Algeria, the National Frontier Service maintains a database of national infringements since 2008. The database includes a comprehensive list of infractions. The most common infractions are concerned with fishing in protected areas; fishing of undersized specimens; fishing during closed seasons; and using prohibited gears (GFCM 2015).

5.5 Western Africa

5.5.1 Vulnerabilities

5.5.1.1 Legal frameworks, justice systems, penalties, management measure rooted in sustainability concepts

- The presence of enabling legislation for the governance of IUU in the region strongly influences the potential of the region to fight and eradicate IUU. Therefore, the lack of such legislation undermines attempts in this endeavour (Greenpeace 2015).
- The recurring IUU fishing problem of Chinese DWF companies as highlighted in the recent appraisal by (Greenpeace 2015) has been attributed to the failure of existing regulatory frameworks (Greenpeace 2015).
- A lack of policy and regulations grounded in sustainability and precautionary principles, and inadequate management objectives and strategies allows such DWF companies to over-expand, and generates a problematic situation for the responsible authorities to manage.
- In the Mauritanian fisheries legislation (Code des Pêches) the concept of IUU fishing is not formally covered (MRAG 2010). However, the relevant international agreements and conventions have been adopted, and the major illegal fishing types are covered by Mauritanian legislation, with the legal basis for MCS activities provided in the Fisheries Code (Code des Pêches, loi No 2000-025) and its Decree No 2002-073 of 1 October 2002 (MRAG 2010)
- In Senegal, the Decret N° 98-498 sets the majority of the terms for the Law Enforcement Code of marine fishing in both the artisanal and industrial fishery.
- Senegalese artisanal fisheries are subject to relatively few controls, and this has led to relatively high levels of illegal fishing, in particular the use of undersized mesh (MRAG 2010).
- In Gambia the legal provision for the licensing of local and foreign industrial fishing vessels is set out in Part V of the Fisheries Act 1991 (MRAG 2010).

- In Sierra Leone, national fisheries legislation provides for penalties for all different infractions yet levels of detection of infractions remains low, since implementation of applicable laws requires a great deal of surveillance effort which is not readily available in the country (MRAG 2010).
- In Nigeria and Ghana a review of numerous national fisheries laws, acts and regulations is required to enable enforcement to be an effective restraint to IUU fishing (MRAG and CapFish 2008).

5.5.1.2 Availability of possible evasive tactics

- In Mauritania there are a large number of flag-of-convenience vessels in the region (Gianni and Simpson 2006), and therefore risks of incursion of unauthorised vessels into Mauritanian waters exists (MRAG 2010).
- Guinea is known to possess rampant IUU fishing which has led to its identification by the EU as a non-cooperating State is indicative of the challenges facing Western African coastal States and regional bodies (Greenpeace 2015).

5.5.1.3 MCS and related topics

- The lack of sufficient and rigorous MCS operations allows IUU to continue unabated.
- Many West African coastal states lack the means and capacity to manage and control DWFs (Greenpeace 2015).
- Corrupt fishers will seek to take advantage of these weaker systems and the waters of coastal states where limited control exists become sanctuaries for IUU fishing. Limited MCS capacity compounds the problem.
- Compliance with VMS rules across the region is inadequate and catalyses IUU fishing (EJF 2012). A relevant example is Guinea which does not currently have a functioning VMS, and its lack of MCS combined with a recent crackdown on illegal fishing in Sierra Leone, is believed to have led many vessels to relocate there (EJF 2012)
- Crew on board an illegal fishing vessel which were interviewed by EJF in June 2012 described Guinea as “the easiest place in the region to fish illegally” (EJF 2012).
- Levels of illegal fishing, i.e. ranging from 1.5 % to 10 % of vessels, are relatively low, and this is perhaps due to MCS presence in Mauritanian waters which deters unlicensed ‘pirate’ vessels (MRAG 2010).
- MCS in Mauritania faces several challenges, including: a weak economy to provide for the scope of the issues and the high costs of fisheries MCS.
- In Senegal, Fisheries Protection and Surveillance Directorate (Direction de la Protection et de la Surveillance des Pêches, DPSP) is responsible for MCS in the country, which has primarily been focused on the industrial fishing fleet with activities deemed relatively successful, according to the DPSP, and the number of arrests for infractions having fallen considerably from 64 in 1997 to 18 in 2007 (MRAG 2010).
- Observers were no longer admitted onboard Senegalese flagged vessels after 1996 (Pramod et al. 2006), which is thought to have encouraged reflagging practices, and the ‘Senegalization’ of fishing access agreements, under which observers were mandatory, to joint venture reflagging (Niasse and Seck 2011). The lack of observers produces unreliable catch data, which is compounded by the fact that these vessels often land their catches in countries others than the ones in which they fish (Pramod et al. 2006).
- Evidence of illegal practices by vessels fishing in Senegalese waters (UNEP 2005) supports the notion that catch inspection schemes alone are not very effective. Even with observers onboard,

the Senegalese authorities struggled to control of legal foreign fleets, including those from EU countries (Kaczynski and Fluharty 2002, Witbooi 2008).

- MCS in Gambia is the joint responsibility of the Gambia Navy and the Fisheries Department. The artisanal fishery sector is currently not covered in the MCS program and legislation does not comprehensively address issues relating to artisanal fisheries, therefore IUU is a concern in this sector.
- Anecdotal reports suggest that due to the overall fuel scarcity and frequent shortages in Guinea-Bissau, when national fisheries MCS operations buy fuel to operate its fleet, it serves as a prior warning to the whole fishing community (MRAG 2010).
- In Sierra Leone owing to the scarcity of resources, the Navy combines fisheries with security patrols; however the limited autonomy of the surveillance vessels compromises the surveillance range, rendering them ineffective to provide sufficient coverage of the EEZ (MRAG 2010). Ineffective surveillance places fishery resources at risk to illegal foreign fleets, which are reliant on this incapacity, and therefore the EEZ's outer reaches remain virtually open to illegal fishing and piracy (MRAG 2010).
- According to (MRAG and CapFish 2008), the chief determinant of IUU fishing in Nigeria's territorial waters is the inability of the relevant agencies to monitor the activity due to lack of necessary platforms such as patrol boats, aircrafts and vessel monitoring systems (VMS). In Nigeria and Ghana, neither country has measures in place which are vigorous enough to efficiently fight IUU activities in their EEZ (MRAG and CapFish 2008).

5.5.1.4 Diplomatic facilitation, regional cooperation

- The process of verifying catch is compromised by a lack of communication and coordination between the EU and coastal States in West Africa (EJF 2012).
- increasing cooperation in MCS under the auspices of the Sub-Regional Fisheries Commission (Guinea Bissau, Guinea, Sierra Leone, Gambia, Mauritania, Cape Verde and Senegal) has occurred, and the Commission has issued a joint ministerial declaration on IUU fishing which is thought to be promising (Nouakchott Declaration - Kelleher, 2002)) but nonetheless its effectiveness is yet to materialise.

5.5.1.5 Terrain aspects

- Some vessels take advantage of neighbouring fishing grounds on the border of Guinea and Guinea Bissau to evade detection or inspection by border-crossing (MRAG 2005b).

5.6 Central Africa

5.6.1 Vulnerabilities

5.6.1.1 Fleet characteristics and subsidies

- In Cameroon, fishing effort has increased radically (Djama and NNa Abo'o 1999).

5.6.1.2 Legal frameworks, justice systems, penalties

- Management of Cameroon fisheries is a recent initiative, as the first fishery policy document for Cameroon was formulated in 2011 (ENVIREP-CAM 2011).
- In Angola the possibility of judicial appeal has incentivised contestations in court, prolonging judicial procedures (Amador 2006). Enforcement officers are not granted policing powers (BCLME, 2005) and are underfinanced (Sjöstedt and Sundström 2013).

5.6.1.3 MCS and related topics

- In Cameroon, control of the landing operations and reporting by industrial fleets is lacking (Belhabib and Pauly 2015a), despite a part of the (unreported) industrial catches landing in the only military port of the country (Belhabib and Pauly 2015a).
- Angola has poor MCS capacity and poor infrastructure to improve (Lankester 2002, Pramod et al. 2008, Agnonoticias 2013). The sea patrol units have recently been acquired (Angodenúncias 2014) however; these lack the capacity to cover the large ranges of the Angolan EEZ (Salopek 2004), resulting in daily incursions by industrial fishing vessels into artisanal fishing areas (Ojukwu et al. 2013).
- In Angola, no observer scheme exists and no formal catch inspection scheme is reported (Pramod et al. 2008 pp. 11–12).

5.6.1.4 Governance

- In Angola, there are countervailing internal issues such as evidence of widespread malpractice due to violating boats often co-owned or operated by government officials (Sjöstedt and Sundström 2013). Vested interests of politicians and civil servants have led to the presumption that enforcement is deliberately kept low, and diligent inspectors are often marginalised (Cederrand 2004).
- An evaluation of the UN Code of Conduct for Responsible Fishing rates Angola at the lower end with regards to compliance to the code (Pitcher et al. 2008). According to Pramod (2011 p. 12) recent assessments state that, "Angola has very low offshore sea patrol capacity due to absence of a designated patrol vessel for this purpose" and dockside inspections are limited due to limited joint MCS activities among navy, police, and port authorities (Sjöstedt and Sundström 2013).
- All of the SADC states with the exception of DRC and Angola have operational VMS systems (MRAG and CapFish 2008).
- In Equatorial Guinea patrolling at sea by barreras (i.e. maritime checkpoint inspection vessels) has increased due to intrusions and recent attacks originating in the Niger Delta (Campos-Serrano 2013). Unfortunately, these patrols are of a relatively low efficiency and illegal fishing is thought to probably have increased (Belhabib et al. 2015a).

5.6.1.5 Data collection, management, harmonisation and exchange

- Cameroon currently does not possess a data collection system for fisheries (Belhabib and Pauly 2015a) "Existing statistics in the artisanal sector are just vague estimations and extrapolations and the actual volume of fish production in this sector is unknown" and "bycatch […] is not taken into account in the national statistics, due to lack of log books on vessels" (ENVIREP-CAM 2011). Low monitoring performance in Cameroon is exemplified by unchanged artisanal catches (i.e. inclusive of marine, continental and aquaculture) from 1999 to 2010 (Nnana 2010). The lack of knowledge of the fishery sector has given rise to severe over-exploitation documented from the mid-1980s.
- Limited information originating from Equatorial Guinea due to the censorship of publications (see Wood 2004), has caused difficulties with accessing fisheries information (Belhabib et al. 2015a). Statistical monitoring of the artisanal fishery sector remains basic to non-existent (Kebe et al. 2007), and industrial fisheries statistical monitoring relies on on-board observers (FAO 2010).

6. Forms of support required to strengthen capacity to enable African coastal countries to effectively curb IUU fishing

In this document we distinguish between activities designed to strengthen capacity for curbing IU fishing, and technical measures that can contribute to curbing and eliminating IUU fishing. Thus, to illustrate, training strengthens capacity for curbing IUU fishing, but trade sanctions are measures which contribute to curbing IUU fishing. This section focusses on activities which strengthen capacity. It is followed by another section which lists the various "IUU curbing" measures that can be taken. There is a connection between these two sections, they refer to each other.

Various forms of support and measures and interventions are required to tackle IUU fishing. This sections focusses on key measures and activities to strengthen capacity to help African countries to more effectively curb IUU fishing.

6.1 Strengthening MCS capacity and resourcing

6.1.1 Strengthen capabilities, procedures and routines for MSC

Most reports and articles reviewed, as well as the responses from the questionnaires, highlight the lack of capacity and resources to monitor and control IUU activities as a major issue that needs to be addressed. Development of a strong national capability in MCS and the development of robust procedures and MCS routines are urgently required to tackle IUU. Furthermore, improving regional and sub-regional co-operation to tackle IUU activities should be encouraged. Sub-regional patrols have been undertaken in all the CSRP countries (Mauritania, Senegal, Gambia, Cape Verde, Guinea-Bissau, Guinea and Sierra Leone) and have yielded some positive results (MRAG 2010). Use of scientific observer programs, or replacement of these programs by electronic monitoring and electronic reporting (EM/ER) technology with appropriate mechanisms for cost recovery could enhance these efforts.

Until the high level of corruption amongst government departmental personnel is addressed, MCS and legal enforcement will prove inconsequential. Experimentation with new technology should be encouraged as it is key to the success of future MCS operations (see below), and financial support for such efforts needs to come from those nations reaping the greatest benefits from current fisheries agreements in distant water relationships.

Stricter patrolling and enforcement of regulations governing the artisanal fishing zones to stop or reduce the intrusion of industrial vessels into these zones is needed. Gaining support from government to implement the legislation and abide by their international commitments requires awareness of these various international instruments and systems of accountability to ensure that enforcement offices are held to account when transgressions are overlooked. Promoting accountability requires greater involvement of fishers (in both the industrial and artisanal sectors) in fisheries management and decision-making through establishment of co-management structures and arrangements. Furthermore, government-community collaboration would also assist in regulating illegal activities (e.g. use of prohibited gear, fishing in closed areas) within the IEZs by the artisanal sector. Development of co-management arrangements with industry players as well as local fishing communities ensures that fishers are involved in various aspects of fisheries management and encourages a greater sense of custodianship over resources and demands that governments be more accountable to their citizenry.

6.1.2 Extending the use of technology and innovation in support of MCS

The frontier of innovation in the technology and software for enhancing the effectiveness of MCS is a moving target. African states need to evaluate the current state of technological development and see what offerings may strengthen MCS capacity. The following is a list of some developments that have taken place in the last 5 to 10 years.

Electronic monitoring and reporting (EM/ER): Electronic reporting is used to record fishing activity data (e.g. catches, landings, sales) and to report them to fisheries authorities while still at sea, or alternatively once in port. In the EU ER is compulsory for vessels above 12 m. It replaces paper logbooks and is therefore often referred to as an electronic logbook or "e-logbook". It also replaces sales notes. The EM of EM/ER refers to the use of camera equipment on board vessels which are high definition stills of the fishing process. These images can be integrated into the ER report in such a way as to facilitate auditing and cross checking the data in the ER reports using photographs of the actual fishing operation.

Vessel Monitoring System (VMS): By current definition, a VMS programme monitors fishing vessels that have VMS units installed. These operate by pulsing vessel identification and position information via satellite to a central receiving unit. In this context, a limitation of VMS is that vessels without installed VMS units or vessels with faulty VMS units are not being monitored. In many cases, illegal fishing may be conducted by these vessels.

Automatic Identification System (AIS): The Automatic Identification System (AIS) is an autonomous and continuous vessel identification and monitoring system used for maritime safety and security which allows vessels to electronically exchange with other nearby ships and authorities ashore the vessel identification data, position, course and speed.

Satellite Remote Sensing: Imaging satellites can detect vessels either optically or by synthetic aperture radar (SAR). Satellite imagery can potentially detect all fishing vessels, i.e. those with shipboard VMS units, those without VMS units, those with faulty VMS units, and vessels that have gone "black" by disabling their VMS equipment. It is important to note the distinction between detecting vessels and identifying them. Most current satellite imaging technology does not allow the identification of vessels. Also, the combined use of a VMS and satellite imaging could be more effective than a VMS alone. The VMS could identify participating vessels, and managers could focus their interest on vessels detected, but unidentified, by the satellite imagery.

Radar and Sonar: Other remote surveillance methods could also be useful in combination with VMS programme. The coverage and effective range of these systems tend to be localized, but radar (land or sea-based) and sea-based sonar systems have been used for the remote detection of vessels. As with satellite imaging, these tools may detect vessels, but may not identify them.

Vessel Detection System (VDS): The EU is also encouraging a wider use of a Vessel Detection Systems (VDS), a satellite-based technology (satellite imaging of sea areas) which may help to locate and identify fishing vessels at sea. According to EU legislation (Regulation 1224/2009), fisheries control authorities shall have a technical capacity to use VDS. The basic function of VDS is to allow the identification of vessels and the detection of their positions at sea. The Vessel Detection System relies on polar-orbiting satellites carrying Synthetic Aperture Radar (SAR) instruments which can

detect vessels at sea under most conditions – day and night and through cloud.

Catapult and Windward: New satellite tracking capabilities from enterprises like Catapult and Windward linked with predictive analytics capabilities automate vessel tracking in real time (Srour 2015)(Srour 2015)(Srour 2015)(Srour 2015)(Srour 2015)(Srour 2015)(Srour 2015)(Srour 2015)(Srour 2015)(Srour 2015)(Srour 2015)(Srour 2015)(Srour 2015)(Srour 2015). The Catapult capability extends to detecting and flagging vessels which switch off their AIS/VMS, enter a restricted zone, slow their velocities to fishing speeds or meet with other vessels for potential transhipments or conflicts. The regional application of these technologies should be considered in the African context since they offer a way of optimising the application of MCS platforms (ships, aircraft) for IUU deterrence, and are thus ultimately a cost saving measure for MCS.

Combined monitoring: The modern technologies for fisheries control do not replace traditional control and surveillance methods, such as inspections onboard vessels or on shore. However, used correctly, the new technologies help to better target actions and therefore cut costs and increase effectiveness. By crosschecking data collected via the different systems, fisheries authorities can apply risk based control strategies and detect illegal activities that could otherwise go unnoticed. Wise, proper and effective use of modern technologies significantly reduces the total costs for fisheries monitoring and surveillance.

6.2 Strengthening regional and international cooperation and coordination

Given the global syndication and coordination of IUU fishing, the complexity of the measures that are needed to fight IUU fishing, and the associated costs, efforts to curb and eliminate IUU fishing need to be co-ordinated across multiple jurisdictions. A number of different regional bodies can be harnessed for this. These include RFMOs, RECs and LME related bodies. The areas of regional level collaboration that could contribute to strengthening capacity include, but are not limited to, the following:

1. Strengthening the role of RFMOs, RFBs and regional initiatives
2. Extension and regionalisation of the use of the available range of international legal and voluntary instruments.
3. The creation of a diplomatic environment around coordinated MCS programmes to assist under-resourced nations to make progress against IUU fishing.
4. Facilitation of regional workshops on a range of topics related to IUU fishing
5. Regionally initiated and coordinated training on a wide range of topics related to IUU fishing
6. Regional data sharing, data collection and database management for data related to IUU fishing
7. Regional research and investigation into the scale of IUU fishing
8. Regional pooling of specialised skills in a range of field related to IUU fishing e.g. investigative, prosecutorial and legal expertise, fisheries science and economic studies, social impact studies
9. Building capacity amongst fisheries enforcement agencies within countries
10. Regional intelligence sharing, data sharing and pooling of resources.
11. Enhancing and improving communication between national agencies and customs and port authorities and between these and relevant regional and global bodies.

The following sections provide additional clarification on some of the areas of regional action listed above.

6.2.1 Strengthening the Role of RFMOs, RFBs and regional initiatives

Given lack of capacity at national level in many developing world regions, the involvement of RFBs, RFMOs and RECs offers the potential to galvanize efforts against IUU fishing. This area therefore needs to be developed and coordinated with any action plan drawn up by flag states and coastal states. One example which illustrates this is the operational VMS data sharing protocol between South Africa and Mozambique. Another is the establishment of institutions like the Benguela Current Commission which can be used to coordinate anti-IUU initiatives at a regional level.

Strengthening RFBs and RFMOs is therefore critical to strengthening capacity to combat IUU fishing. There are many challenges facing RFMOs, not least of which are the budgets available for carrying out their functions including anti-IUU activities, as illustrated in the following table.

TOTAL ANNUAL BUDGET OF MAIN RFMOs											
RFMO	ICCAT (2006) (a)	WCPFC (2012) (b)	NAFO (2012) (c)	IOTC (2001) (d)	SPRFMO (2013-2014) (e)	CCSBT (2012) (f)	IATTC/CIAT (2013)(g)	SEAFO (2012)(h)	CCAMLR 2013(i)	IPHC 2012 (j)	NEAFC (2008) (k)
Total (US)	2,954,886.67	6,403,884	1,875,000	1,085,525	706,913.13	1,960,848	6,335,009	323,412.78	4,651,430	4,900,000	1,533,197

A further obstacle is the several parties to these various International instruments and agreements have not enacted national legislation to give effect to these measures. Research indicates that although RFMOs have contributed to curbing IUU activities by improving MCS in some areas, long-standing fleet members such as the Indian Ocean Tuna Commission (IOTC) are still experiencing high levels of IUU (MRAG and CapFish 2008). In order to facilitate improved regional co-operation and collaboration on issues such exchange of data, logbook reporting schemes and information management systems, political support and improved relations across countries is required (MRAG and CapFish 2008).

In order to improve accountability and performance in RFMOs it is recommended that they be encouraged to adopt best practices and applicable codes of conduct - see for example (Lodge et al. 2007). It is also recommended that each RFMOs is regularly (e.g. biannually) evaluated against a standard set of metrics in order to identify areas of improvement and to stimulate progress and improvements at RFMO level. It is recommended that such evaluations be carried out by independent parties. Such evaluations have been carried out in the past, as reported for example in http://www.globaloceancommission.org/wp-content/uploads/POP-9_Reform-of-Fisheries-Management_FINAL-1.pdf, which reports the following RFMO shortcomings:

1. Many RFMO conventions need updating to incorporate the provisions of the UNFSA and other internationally agreed standards and modern principles of fisheries management
2. A failure of RFMOs to require, and States to provide, timely and accurate catch and by-catch data
3. Lack of sufficient mechanisms to enforce compliance by RFMO members with the rules and recommendations of the RFMOs
4. A lack of transparency in decision-making
5. Failure to establish management measures consistent with scientific information and advice
6. Decision-making structures which allow one or more states to block or 'opt out' of compliance with agreed regulations.

It is envisaged that transparent and independent performance reviews will contribute towards improvement in the governance of RFMOs, will address some of the issues mentioned above, and aid in the fight against IUU fishing.

Initiation and establishment of IUU working groups at RFMO level. Their first brief will be to carry out a review of available estimates of IUU fishing levels and either accept the best available estimates or present alternative estimates where these estimates are refuted.

A number of RFMOs can serve as models for how to go about developing anti-IUU initiatives. These include ICCAT and CCAMLR. CCAMLR has achieved considerable success in combating IUU fishing of toothfish. Since not all RFMOs have jurisdiction within EEZs, relevant regional organisations concerned with EEZ fishing activity need to be enlisted into this activity, modelling their approaches on those RFMOs which have successfully implemented such actions. RFMOS which are relevant to Africa and which have jurisdiction over stocks in African EEZs need to be involved in the development of a coordinated plan of action, including SRFC, FCWC, CECAF, COREP, COMHAFAT-ATLAFCO, ICCAT, GFCM, IOT, NAMMO, SEAFO, SWIOFC, PERSGA, SIOFA. With regard to trade measures, involvement by RECs is appropriate. Relevant RECs for such an African wide initiative include AMU/UMA, CEN-SAD, COMESA, EAC, CEEAC-ECCAS, CEDEAC - ECOWAS, IGAD and SADC.

6.2.2 Enhance co-ordination across agencies leading fisheries management and development initiatives, strategies and plans

In addition, various Africa-wide partnerships, initiatives and plans have been developed over the past 10 years that concern strengthening and reforming fisheries management in Africa. Tackling IUU fishing is an important theme addressed by these initiatives and in these strategies and plans. Regional bodies and ministries responsible for fisheries management and IUU in particular should familiarise themselves with these initiatives, strategies and plans and should develop action plans to enable implementation of the strategies and plans as appropriate. These should be seen as part of the recommendations for regional collaboration to strengthen the capacity to curb IUU fishing. A brief outline of these initiatives, strategies and plans are provided in the box below.

The Partnership for African Fisheries (PAF): This is part of the New Partnership for Africa's Development (NEPAD), a technical body of the African Union. PAF works to improve the sustainability of Africa's fisheries and improve the returns provided by this sector. PAF is committed to a vision in which fish contribute significantly to African prosperity and growth. The Partnership for African Fisheries is the parent organization of both Stop Illegal Fishing and Fish-i Africa. Stop Illegal Fishing is committed to ending the devastating impacts of IUU across African fisheries. It works to recover fish stocks, promote sustainable seafood, increase stakeholder engagement, improve fisheries management, and influence policy by tackling the root causes of illegal fishing in Africa. The Fish-i Africa program supports the sustainable use of fisheries resources and, by combating IUU fishing, seeks to support one of the key economic growth prospects for developing coastal states in the region.

The 2050 Africa Integrated Maritime Strategy (2050 AIMS): There are various AU initiatives to address IUU at the continental level. In January 2014 the 22nd summit of the AU in Addis Ababa adopted the **2050 Africa Integrated Maritime Strategy (2050 AIMS)** accompanied by a plan of action. IUU fishing is tackled in the section on fisheries and aquaculture and sets out clear goals and strategies for African states to reduce IUU. This is part of a continental maritime strategy, and reinforces the call for cooperation across member states, RECs and RFMOs.

AU-IBAR Strategic Plan: The African Union-InterAfrican Bureau for Animal Resources (AU-IBAR) has included fisheries issues in its Strategic Plan 2010-2014. It supports RFMOs and member states to sustainably manage marine and inland capture fisheries based on international best practices. The Strategic Partnership for Sustainable Fisheries Investment Fund Project aims to promote sustainable use of fisheries resources and the management of marine ecosystems that support them with the overall aim of poverty eradication and enhancement of sustainable income growth of the fishing communities of Sub-Saharan Africa (AU-IBAR 2004-2012).

The Policy Framework and Reform Strategy for Fisheries and Aquaculture, endorsed by the Summit of African Heads of States and Governments (HSG) in 2014 through an Executive Council Decision, provides a blue print for positive reform to promote the sustainable use and development of Africa's fisheries resources. There is a strong emphasis on promoting coherence of fisheries policies and initiatives. Member states are encouraged to develop action plans to enable implementation of the policy framework and reform strategy. Fisheries management agencies and development partners are encouraged to align their interventions.

RFMO and REC Initiatives: There are also in existence a number of initiatives at RFMO and REC level which are already acting according to the recommendations made in this section.

6.2.3 Improving collection and sharing of data and information, the adoption of standards, and the promotion of transparency

Improving the collection and sharing of data and information requires regional coordination and cooperation in the following ways:

- Linking national data collection systems to the "Pan-African Strategy on improvement of fisheries and aquaculture data collection, analysis and dissemination". This will require the adoption of data standards.
- Sharing data and information on fisheries agreements between African states and DWFs. This includes sharing information about fishing operations by foreign fleets authorised by coastal states.
- Transparency and full disclosure of all Foreign Fisheries Agreements (FFAs).
- Working groups on fisheries statistics should be constituted at the continental and/or RFB levels to share knowledge for the management of shared stocks. This will require the adoption of data standards, as well as other standards such as the Kobe process as the basis for information sharing on stock and fishery issues
- Data harmonization, development of regional databases relevant to combatting transnational IUU fishing activities. Sharing information about criminal activities via regional bodies
- Collection of data "upstream" and "downstream" of IUU fishing operations to better define the nature and scope of IUU fishing and to improve knowledge of the economic and social forces which drive IUU fishing.
- Regional expertise in stock assessment and fisheries management advice

6.2.4 Improve international information sharing and co-ordination

The nature of IUU fishing is such that it takes place over multiple jurisdictions and includes a variety of techniques to hide illegal activities, from the use of FOC, reflagging as vessels enter different EEZ's, transhipment of goods at sea, vessel and owner name changes and so on. This requires co-ordination and intelligence sharing amongst the many law enforcement actors in these different jurisdictions as well as organisations such as INTERPOL, IMO, international NGOs such as EJF and Greenpeace and the relevant RFMOs and country Ministries.

6.2.5 Improve national level responsibilities and coordination

- Within nation states, the need for improved coordination and cooperation at all levels of government and for transparency.
- To encourage the development of codes of conduct and corporate social responsibility initiatives.
- Cooperation at all levels of government and transparent data sharing is necessary for research into the scale of IUU as well as defining maximum sustainable yields for commercially-important species. Governments need to archive this data and make it available for neighbouring countries, RFBs and RFMOs to ensure transparency and build long-standing partnerships.
- Legislation and enforcement is ultimately the responsibility of the state. The onus is hence on flag states to ensure that operators and companies have sufficient standards in place and adhere to legal requirements. Governments should refrain from subsidising fishing fleets to prevent overfishing and encourage corporate social responsibility initiatives. Some portion of the national budget should be invested in the fishing industry and MCS in particular.
- Nations that are involved in exports to the EU need to meet the requirement of the EU IUU Regulation which includes a catch documentation scheme.

6.2.6 Promote Africa wide reconciliation of IUU catches

The analysis of the scale and value of IUU fishing as presented in this document has reached the limits of its utility. However, in their present form the estimates of the scale of IUU fishing in the African EEZ are startling and there is the potential for far reaching international legal, diplomatic and political repercussions. The authors are aware that some disagreements with the estimates based on the Sea Around Us project have been voiced at national level (Senegal for example). This does not invalidate these estimates. It underscores the high profile and serious implications that such estimates enjoy. African coastal states need to take ownership of the process of producing such estimates, given the implications they have at an African coastal state level. We recommend three actions in this regard which fall within the ambit of capacity strengthening:

1. Urgent national or regional level reviews of the state and scale of IUU fishing in Africa. This exercise should take the estimates provided in this document and critically re-assess them with the benefit of enriched local knowledge. Where the final estimates differ substantively from those produced here, new estimates documenting the methods and assumptions made should be publicised.
2. Further work on the reconciliation of estimates of the scale of IUU fishing needs to be carried out which integrates the national level estimates. This would be a comprehensive reconciliation exercise which tries to reach agreement between diverse sources of information relevant to IUU fishing. Such an exercise would involve setting up a mass balance with country EEZ and high seas catches by fleet type/nation as sources, and to then include the destinations as sinks in the balancing exercise, possible also including final destination sinks as well, as suggested by the nature of all available and relevant data. This may potentially allow for many diverse kinds of information derived from different studies to be entered into a single interconnected model which would then show up important gaps and areas of agreement. Such an exercise may then provide a top down corroboration of Pauly and Zeller's (2015) estimate of IUU fishing in the African EEZ of 4.7 million tons. It would be beneficial to run a value ($) based model in parallel to one based on tonnage, to facilitate the incorporation of results from economic studies. Species-group disaggregation of such an exercise may impose additional constraints on estimates of IUU and may add to the reliability of the final results. Of course given the global interconnectedness of the flows of fish catches/product, an Africa only approach would be compromised by unresolved boundary effects (i.e. inflows from and outflows to non-African sources and sinks), suggesting the need for a global model which is probably too ambitious as a first attempt at such an approach.
3. Further work is required to explore the nuances of the potential economic benefits that would flow from the cessation of IUU fishing. The FAO definition of IUU fishing does not sit well with the aims of such an economic assessment, for reasons that have already been explained in previous sections of this document. This matter requires attention since it feeds into the prioritisation of areas requiring attention.

6.3 Rolling out awareness raising, training and capacity building programmes

6.3.1 General approach and suggested topics

Prior to embarking on an awareness raising campaign or a training and capacity building programmes, it is necessary to clarify the target audience and their information and in the case of training, their skills requirements. With respect to training and capacity development, training requirements analyses need to be carried out with trainee populations prior to designing the programme and/or courses and selecting or developing the training materials. Consultation with RFMO representatives, fisheries managers and other ocean governance stakeholders is necessary to identify the nature of

training that would be most suitable for different target audiences. Course evaluations should be carried out routinely to enable refinement and improvement of quality and relevance of training offerings.

Training and capacity development is a long term process. While short courses and workshops are useful and can contribute to knowledge transfer and skills development, the development and roll-out of a training programme that incorporates on-site training as well as follow-up online training courses and mentorship programmes is likely to yield much more satisfactory results. In order to reach the requisite number of trainees, a cost effective approach would be to design and implement "train the trainer" courses at regional or continental level, and for trainers to then deliver targeted training in their regions or countries. It is preferable that a team of trainers that includes African educators, is involved in the design and delivery of such programmes and that their involvement extends beyond a "once-off" training intervention. Where appropriate and possible, the use of on-line courses and webinars to reduce the costs of travel and repeating courses should be explored.

Ideally there needs to be coordination of training and capacity building at the regional (RFMO or RFB) to ensure regional information needs are incorporated into programmes. Where appropriate, sharing of costs for training and capacity building at a regional level or continentally should be encouraged. The proposal is that training programmes and courses are offered at the regional level, and that local in-country trainers present the training at the national level.

Proposals on general training themes and topics

Training topics on relevant international and voluntary instruments, technical guidelines, codes of conduct, and domestic law relevant to IUU

- Sovereignty aspects of MCS
- Overview of international instruments including UNCLOS, UNFSA, CCRFs, IPOA-IUU and NPOA
- Dedicated training on Port State Measures Agreement (PSMA).
- Voluntary Guidelines and in particular on FoCs.
- Legal, institutional and regulatory frameworks, domestic legislative reform, fisheries policy development

Training in RFMOs and RFBs

- Training about the legal status of and membership obligations in RFMOs, as well as the code of conduct and responsibilities / mandates of RFMOs, RFBs
- Training in regard to the potential role of RFMOs and RFBs in fisheries management with focus on collaborative efforts to combat IUU fishing.
- Training in case studies of international and regional cooperation around fisheries management and MCS

Training on Monitoring, control and surveillance: Principles, procedures, tools and technologies

- Approaches to MCS
- Proven cost effective MCS Tools
- Emerging MCS technologies and methodologies
- Observer training courses.
- FCO training courses.
- Fishing vessel boarding, inspection procedures, fisheries enforcement.
- Vessel register and observer schemes.
- Regional cooperation and collaboration for MCS.
- Mechanism for sustainable financing of MCS.
- Fish species identification training

Fisheries science and management

- Fisheries science and fisheries management approaches for sustainable utilization
- Methods of data collection and analysis
- Data grooming for use in stock assessments

Understanding the human dimensions of IUU fishing

- Understanding the human dimensions of IUU fishing
- Methods of impact assessment for social, gender and health impact studies
- Collection and analysis of human dimensions data
- Involvement of fishers in data collection and analysis

Specialised training topics

Specialised training in data gathering, management and analysis

- Training for statistical staff in national and regional institutions in the collection, management and analysis of data needed to estimate the contribution of the fisheries to GDP and employment

Specialised training on WTO negotiations training, focussing on subsidies

- Training and trade-related technical assistance by FAO focussing on fisheries issues in relation to WTO agreements, specifically with regard to fishing vessel subsidies for DWFs, and the impact of DWFs with respect to IUU fishing in the African EEZ.
- Subsidies, international trade in fishery products and the WTO Subsidy Agreement.

Specialised Training on investigation and prosecutions

- Overview of relevant international instruments that can be harnessed to assist with these tasks
- Prosecution procedures, evidence gathering procedures
- Facilitation of harmonization of penalties for IUU offences between jurisdictions, and significantly increasing them

Other special topics training

- Training re IUU vessel lists - negative vessel lists.
- Training re authorised vessel lists - positive vessel lists.
- Training re FFAs, and terms of access
- Training in the EU carding system, and reform requirements.
- Fish product traceability training

6.3.2 Awareness raising campaigns

General public awareness raising and education regarding the nature, scale and impacts of IUU fishing can enhance understanding of the severity of the these activities and garner support for campaigns and actions to curb IUU fishing as well as place pressure on government to act more decisively..

Promotional and educational campaigns with market actors including intermediate buyers, processors, distributors and consumers can also raise awareness and change attitudes and behavior. Such activities will help raise awareness of the problems and improve the knowledge of the social, economic and environmental consequences of IUU activities.

6.4 Promoting greater civil society involvement in fisheries management and enforcement

Fishers and other civil society actors such as NGOs can play a major role in assisting with monitoring, surveillance and data collection required to address IUU fishing. Fishers, unlike government officials, are actively engaged in all stages of the fish value chain and can provide reports on what they observe from the shore, at sea and at landing sites. They can also provide information on local illegal activities as well as possible reasons for transgressions that may require alternative management approaches. NGOs can also play an important role in working collaboratively with fishing communities to implement projects and programmes to curb IUU fishing. The role of NGOs in projects and programmes that involve local fishing communities in surveillance and monitoring

such as the EJF surveillance programme in Sierra Leone in the Sherbro River area, have made a major contribution to curbing IUU activities in the region. Local fishers are required to report IUU fishing vessels and EJF vessels then travel to these locations and take photographs and GPS readings. This information is then analysed in their Sierra Leone and London offices and offending vessels are identified. This information is then communicated to relevant authorities, partner organisations and the European Commission, if relevant. This community-NGO partnership programme has led to identification of several illegal operations, the imposition of fines, increased controls on importation of fish from West Africa to Las Palmas, and the blacklisting of certain vessels by the EU (Boto and Mofolo 2014).

A further recent example of citizen action is the BlackFish initiative which is an information sharing hub about the activities and locations of known IUU fishing vessels.

The blacklisted Chinese vessel, Fu Yuan 076, used illegal driftnet gear in the Indian Ocean on 25-01-16. After observing this offense, the Sea Shepherd vessel Steve Irwin followed the vessel into the South China seas where the vessel destroyed the driftnets on 13-03-16. This is likely an attempt to jettison evidence of illegal gear; however, Steve Irwin's account of all offenses has been communicated to the Chinese government, IOTC, Interpol and CCSBT. Steve Irwin will remain in pursuit until the vessel goes into port to ensure it faces legal action. http://maritime-executive.com/article/fishing-vessel-enters-south-china-sea-sea-shepherd-pursues

6.5 Developing the specialisation and professionalisation of activities and skills for combatting IUU fishing

As mentioned earlier in this document, a significant portion of IUU fishing is carried out by deliberate and highly organised criminal syndicates. The investigative, prosecutorial, legislative and justice aspects of combatting IUU fishing therefore require persons and organisations that possess significant skills in all these aspects. It is likely that when such cases are investigated and prosecuted through normal legal and justice channels, the scale of legal arguments that can be mounted in defence will be considerable and will require an appropriate level of response.

It is therefore necessary for specialisation and a high level of skills to exist at the following levels:

- Investigators
- Prosecutors
- Judges and magistrates
- Specialist courts
- Penalties/sentences.

Developing nations in particular do not necessarily have the resources to develop and maintain such capability. Regional or even international level expertise and possibly legal institutions may be required. An International Environment Court as proposed by the International Environment Court Coalition would of course be an appropriate response, although the legal feasibility and practicality and effectiveness of such an approach still require considerable investigation (see for example Pederson, O.W. 2012. "An International Environmental Court and International Legalism". Journal of Environmental Law, Volume 24, Issue 3, pp. 547-558.)

INTERPOL and UNODC input should be ongoing and more specialisation into IUU would be valuable for these organisations.

6.6 Launching media and education campaigns to highlight the nature and negative impact of IUU fishing

Overall there is a need for the priorities and perceptions of IUU fishing issues to change for all, including business, enforcement institutions, and international and development partners. An example of a recent initiative which furthers this general aim is the recent "African Journalists for Sustainable Fisheries" workshop held in Accra, Ghana (March 2016) with the theme "Harnessing the Power of Media to Raise Awareness on Africa's Fisheries". The workshop was an initiative of AU IBAR. The workshop gathered over 140 journalists across 40 African countries, and the journalists were trained on accurate reporting to build increased awareness while producing a conducive environment for helping to secure a sustainable future for fisheries resources in Africa. Significantly, at the workshop it was noted that "regional institutions are mandated by member states to promote sustainable management at regional level" and "regional fisheries bodies and the regional fisheries economic communities would provide, inter alia, the opportunity to develop regional frameworks for combating IUU, intra-regional trade, establishing regional standards and certification schemes".

6.7 Questionnaire response regarding support requirements

Arrange the following support structures necessary to reduce & ultimately eliminate IUU fishing in your country / region, in order of most important (1) to least important (7).					
Average rank shown by region. No comment by North and Central Africa					
Southern Africa		**Eastern Africa**		**Western Africa**	
Financial	4.3	**Financial**	1.0	**Financial**	3.0
Infrastructural	6.5	**Infrastructural**	1.7	**Infrastructural**	3.0
Legal	4.0	**Legal**	2.4	**Legal**	5.0
NPOA-IUU	5.3	**NPOA-IUU**	6.0	**NPOA-IUU**	
Political	5.0	**Political**	2.7	**Political**	6.0
Regional	6.0	**Regional**	4.0	**Regional**	4.0
Scientific	5.0	**Scientific**	2.7	**Scientific**	2.0
Technical	3.0	**Technical**	3.0	**Technical**	2.0

7. Technical measures for combatting IUU fishing

This section outlines the measures that are available for combatting IUU fishing by providing a short description and some recommendations regarding each topic. These measures are not to be confused with "Actions" which are the final section of this document.

7.1 Promoting compliance with international instruments and agreements

There are a number of international instruments and agreements that deal with enhancing fisheries management and include provisions that if applied, could significantly contribute to addressing the impacts and losses associated with IUU fishing. The FAO in particular has led a number of far reaching initiatives aimed at combatting IUU fishing and/or improving fisheries management (See box below). These UN/FAO initiatives provide the framework and legal provisions for coastal states, RFMOs, RFBs and other regional and international bodies to craft plans to combat IUU fishing. The task of adopting and implementing all of these international measures is highly technical, requires political will and funding, and will take time, particularly in developing countries and regions. There is an onus on coastal states to ratify relevant international conventions and agreements and implement them nationally. In many cases this will require the revision of national legislation. It is necessary to provide technical support to countries to achieve this.

- **The 1995 UN Fish Stocks Agreement:** The UN Fish Stocks Agreement entered into force on 11 December 2001, and is the most comprehensive of the binding international instruments in defining the role of RFMOs and elaborating measures that could be taken in relation to IUU fishing activities - today there are 19 RFMOS covering nearly the entire ocean.
- **FAO CA:** The FAO Compliance Agreement (FAO Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas Agreement), adopted in 1993 and entered into force in 2003, aims to provide an instrument for countries to take effective action, consistent with international law, to ensure compliance with applicable international conservation and management measures for living marine resources of the high seas.
- **FAO CCRF:** The 1995 FAO Code of Conduct for Responsible Fisheries is one of the most important soft law instruments, coupled with the international plans of action, elaborated under its provisions, on seabirds, sharks, fishing capacity and illegal, unreported and unregulated (IUU) fishing
- **FAO Technical Guidelines on the Ecosystem Approach to Fisheries (2003)** is a voluntary instrument that provides guidance taking a more holistic and integrated approach to fisheries management that addresses multiple needs and desires of society, without jeopardising options for future generations to benefit from marine ecosystems.
- **FAO International Guidelines for the Management of Deep-sea Fisheries in the High Seas (2008)** is a voluntary instrument
- **FAO International Guidelines on Bycatch Management and Reduction of Discards (2010)** is voluntary instrument
- **IPOA-IUU:** In 2001, the FAO, through its Committee on Fisheries (COFI), adopted the International Plan of Action to prevent, deter and eliminate IUU (IPOA-IUU). The IPOA-IUU represents a voluntary instrument, which lists a variety of context-specific measures that countries and regional fisheries bodies should adopt.
- **PSMA:** The FAO Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (the PSMA) was adopted by the FAO Conference in 2009. The main purpose of the Agreement is to prevent, deter and eliminate illegal, unreported and unregulated (IUU) fishing through the implementation of robust port State measures.
- **FOCs:** Voluntary Guidelines for Flag State Performance were adopted by the FAO Technical Consultation in February 2013 and have been drawn up with a view to prevent, deter and eliminate IUU fishing through encouraging the implementation of flag State responsibilities.

- **The Global Record:** The FAO Global Record of Fishing Vessels, Refrigerated Transport Vessels and Supply Vessels is a further initiative developed in close collaboration with the International Maritime Organization (IMO) to combat IUU fishing. As a result the IMO Ship Identification Numbering Scheme now applies to both merchant ships and fishing vessels of 100 gross tonnage and above. Consequently, the preconditions have been met for using the IMO number as the global unique vessel identifier, recognized by COFI as a key component of the Global Record.
- **FAO Voluntary Guidelines for Securing Sustainable Small-scale Fisheries** is a voluntary instrument that provides guidance on protecting, supporting and developing the small-scale fisheries sector with a view to strengthenig the contribution of the sector to food secuirty and poverty eradication
- **SADC Protocol on Fisheries** is a voluntary instrument that places obligations on member states to take all necessary measures to prevent deter and eliminate IUU fishing.
- **Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa and the Guide for it's implementation.** This document promotes the conservation and sustainable uses of fishries uses. The Guide has critiria and indicators for alignment of national and regional policies on MCS with the Policy framework and and Refor strategy for fishereis in Africa

7.1.1 Strengthen UNCLOS in relation to IUU fishing

Many of the Articles contained in the UNCLOS provide the impetus for specific measures relating to IUU fishing taken by RFMOs, including information and data requirements, establishment of registers, requirements for high seas fishing, landings, port inspection and trans-shipment, inspection and enforcement and cooperation with non-members.

An important deterrent against IUU fishing in the UN Fish Stocks Agreement relates to non-members of RFMOs. If they do not agree to apply the conservation and management measures, they are not discharged from the obligation to cooperate in the conservation of the relevant fish stocks. If they do not cooperate, members are authorised to take measures to deter activities of vessels which undermine the effectiveness of the RFMO's conservation and management measures. This has taken the form in some RFMOs of trade information/catch documentation schemes, trade sanctions and measures inter alia prohibiting trans-shipment and landings of fish caught from IUU activities, and seeking to discourage investment in such activities. Some RFMOs have established subsidiary bodies such as compliance committees to develop procedures to collect information on IUU fishing and recommend deterrent measures.

International ocean and fisheries agencies as well as regional bodies and commissions have an important role to play in exerting pressure on states to comply with the provisions in these instruments. In a recent report published by the Global Ocean Commission, emphasis is placed on the importance of strengethening UNCLOS through a new binding agreement amongst nations on the conservation and sustainable use of marine biological diversity beyond natonal jursidictions. The United Nations General Assembly has established a preparatory committee to offer recommendatons on key elements of the text (GOC 2016). To enhance compliance with these instruments GOC (2016) suggest the requirement for all State Parties to meet on an annual basis to report on progess with implementation and thereby promote greater accountability.

7.1.2 Ratification and adoption of UNFSA

The UNFSA has only been ratified by about 80 Nations including the European Union although important IUU fishing nations like China have not ratified this agreement (See Page 7, GOC Nov 2013).

7.1.3 Adoption of IPOA-IUU and development of an NPOA-IUU

The IPOA-IUU calls for a national level response to the IPOA-IUU known as an NPOA-IUU, which is a national plan of action in the fight against IUU fishing. Very few countries in Africa have responded pro-actively to this initiative. In general it is accepted that it is necessary in the fight against IUU to have an explicit plan for combatting IUU at a national level, preferably as an NPOA-IUU. It is likely however that countries require some assistance in the development and implementation of NPOA-IUU. This is clearly an area where RFMOs and RFBs can provide assistance. Appendices 2 and 3 provide additional summary information of the requirements stipulated in terms of IPOA-IUU.

All countries should be encouraged to adopt the IPOA IUU and formulate a NPOA IUU. RFMOs should adopt the IPOA IUU and require member countries to comply. Progress should be reported regularly (e.g. biannually) at a relevant regional or international meeting so there is some degree of accountability and reporting.

7.1.4 Implementation of the Policy framework and Reform Strategy for fisheries and Aquaculture in Africa

The Policy Framework and Reform Strategy for fisheries and aquaculture in Africa was endorsed by the African Heads of States and Governments in 2014 as a blue print for the sustainable development of fisheries and aquaculture sector on the continent. A key policy pillars in this policy document is to promote conservation and sustainable and sustainable uses of fisheries resources. The policy document has a strategic action for ensuring effective and sustainable regional Monitoring, Control and Surveillance (MCS) systems are operating in all regions. The Guide to facilitate the implementation of the pan African policy document was developed.

7.2 Fast track the adoption of and adherence to Port State Measures

The FAO Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (the Agreement) was adopted by the FAO Conference in 2009. The main purpose of the Agreement is to prevent, deter and eliminate illegal, unreported and unregulated (IUU) fishing through the implementation of robust port State measures such as inspection of licenses, catch certificates, and fishing gear. The Agreement envisages that parties, in their capacities as port States, will apply the Agreement in an effective manner to foreign vessels when seeking entry to ports or while they are in port. The application of the measures set out in the Agreement will, inter alia, contribute to harmonized port State measures, enhanced regional and international cooperation and reduce the flow of IUU-caught fish into national and international markets. The Agreement will only come into force after ratification by 25 nations and to date 19 nations have ratified the agreement, although there are only a few from Africa. The Agreement is binding and stipulates minimum port States measures. However, countries are free to adopt more stringent measures than those outlined in the Agreement (FAO 2009).

In order to accelerate implementation of PSMA, FAO has initiated a series of regional workshops which aim to, inter alia:

- promote the strengthening and harmonization of port State measures at regional level
- highlight the importance of developing concerted actions between port States and flag States in implementing port State measures effectively
- encourage the reinforcement of the implementation of existing Regional Plans of Action to combat IUU fishing and the development of new ones

- facilitate exchange of national experiences in combating IUU fishing, including through participation in group problem solving exercises and other participatory activities dealing with real world situations
- highlight the role of regional fisheries management organizations and arrangements (RFMOs) in the implementation of the Agreement
- draw up related national and regional action plans and recommendations in general, legal and policy, institutional and capacity development and operations terms
- identify opportunities for regional cooperation to implement port State measures

The relevant FAO workshop covering the Atlantic Coast of Africa was held in Praia, Cabo Verde (20-24 July 2015). Sixteen countries from the Atlantic coast of Africa participated as well as national and international CSOs and a number of intergovernmental organizations.

Uptake in Africa is progressing, but at a slow rate. It seems clear that regional actions in this regard could provide impetus to roll out the PSMA scheme more broadly, as is clearly recognised and promoted by the FAO in its regional workshops (see points above). These efforts should be strongly endorsed and supported by African RFMOs, RFBs and possibly even RECs.

It is noted that the FAO maintains a list of supporting document on PSMAs at *http://www.fao.org/fishery/psm/agreement/en.*

Raising awareness and building capacity on provisions contained within the PSMA and how these provisions could be harnessed to deter IUU fishing activities should be a central focus of any training and awareness raising initiatives concerned with IUU fishing.

7.3 The development and adoption of a global registration of fishing vessels using a UVI (unique vessel identifier) system via IMO

A major challenge in any action against IUU vessels is the ease with which vessels are able to change their identity. A uniform global vessel identification system is required in order to assist investigations and prosecutions. The extension of the International Maritime Organisation's (IMO) requirement for numbers and tracking devices for all fishing vessels as is presently the case for merchant ships is the best route to achieving this goal in the short term.

The assignment of globally unique, permanent identification numbers to fishing vessels would greatly improve the ability to quickly and accurately identify vessels, trace their history, and link them to specific fishing activities. The International Maritime Organization (IMO) requires all passenger ships of 100 GT or more and cargo vessels of 300 GT or more to get a unique and permanent number from the independent company, IHS-Fairplay. Until recently fishing vessels were exempt from this, although under current IMO regulations a number can be issued upon application. The Food and Agriculture Organization (FAO) identified the implementation of UVIs for fishing vessels as an essential prerequisite to establish a successful Global Record of Fishing Vessels, Refrigerated Transport Vessels, and Supply Vessels. In 2013, the IMO Maritime Safety Committee approved a paper submitted by several IMO member States, together with FAO and WWF, proposing amendments to IMO Resolution A.600(15) extending the IMO Ship Identification Numbering Scheme to fishing vessels on a non-mandatory basis. On 4 December 2013, the IMO Assembly adopted a new resolution, A.1078 (28), revoking resolution A.600 (15) on the IMO Numbering Scheme. In effect the IMO numbering scheme

now applies to both merchant ships and fishing vessels of 100 gross tons or more. The preconditions have therefore been met for using the IMO number as the global UVI, now recognized by COFI as a key component of the FAO Global Record of Fishing Vessels, Refrigerated Transport Vessels and Supply Vessels. FAO and IMO are working together through the Joint FAO/IMO Ad Hoc Working Group on Illegal, Unreported and Unregulated Fishing and Related Matters (FAO 2014).

7.4 Addressing the problem of "Irresponsible" Flags of Convenience (FoCs)

For this study the main issue of concern relating to FoCs is the protection offered by FOCs to IUU fishing vessels, it is also significant for labour organisations such as the ITF campaigning for fair and safe working conditions. The following countries have been declared FoCs by the ITF's fair practices committee (a joint committee of ITF seafarers' and dockers' unions), which runs the ITF campaign against FOCs:

Antigua and Barbuda, Bahamas, Barbados, Belize, Bermuda (UK), Bolivia, Burma, Cambodia, Cayman Islands, Comoros, Cyprus, Equatorial Guinea, Faroe Islands (FAS), French International Ship Register (FIS), German International Ship Register (GIS), Georgia, Gibraltar (UK), Honduras, Jamaica, Lebanon, Liberia, Malta, Marshall Islands (USA), Mauritius, Moldova, Mongolia, Netherlands, Antilles, North Korea, Panama, Sao Tome and Príncipe, St Vincent, Sri Lanka, Tonga, Vanuatu.

Amongst other measures, and as part of its campaign against FOCs, the ITF is requesting the elimination of the FOC system and the establishment of a regulatory framework for the shipping industry. In the short term however the elimination of the FOC system will be problematic and other solutions are required while efforts to eliminate FOCs continue. A number of RFMOs have already initiated joint action on FOCs. This includes the identification of FOCs, the labelling of vessels flying an FOC as an IUU vessel, maintaining, updating and publicising lists of IUU vessels, the imposition of trade restrictions on product traded by IUU fishing vessels, the exchange of these lists amongst RFMOs, and the denial of access to ports by IUU vessels.

Voluntary Guidelines for Flag State Performance were adopted by the FAO Technical Consultation in February 2013 and have been drawn up with a view to prevent, deter and eliminate IUU fishing through encouraging the implementation of flag state responsibilities. The agreed Guidelines are wide-ranging and address the purpose and principles, the scope of application, performance assessment criteria, cooperation between flag States and coastal States, a procedure for carrying out an assessment, encouraging compliance and deterring non-compliance by flag States, cooperation with and assistance to developing States with a view to capacity development, as well as the role of FAO. They are expected to provide a valuable tool for strengthening compliance by flag States with their international duties and obligations regarding the flagging and control of fishing vessels. Such actions are ideally suited to RFMOs/RFBs and RECs.

7.5 Establishment of penalties for transgressions commensurate with the economic scale of the crime.

Unsurprisingly, impunity related to IUU fishing is rampant. Companies involved in illegal fishing are either not punished or receive sanctions that are too weak to have a deterrent effect. Studies suggest that penalties would have to be increased by 24 times to have a real deterrent effect on illegal fishing activities (Love 2010). In addition, in many countries, fines are established based on the company/ fishers ability to pay. As in the majority of cases the actual owner is hidden behind a beneficial

one, fishermen who themselves often work in very poor conditions and receive very low salaries, are the ones arrested and who pay the fines. Furthermore, there need to be stringent penalties for falsifying licences and catch documents. Confiscating the vessel and the catch could also prove effective. Here we propose that the FAO should consider setting technical guidelines regarding how these penalties are determined and implemented, to be tailed for regions by RFMOs and other relevant regional bodies. An encouraging response to this problem is the practice in Indonesia of the explosive destruction of IUU fishing vessels at sea. For example, see
http://en.tempo.co/read/news/2016/03/14/055753352/Minister-Susi-Drowns-MV-Viking

"The Viking, black-listed by Greenpeace and issued with a Purple Notice from INTERPOL, was sunk by Fisheries Minister Susi of Indonesia on 14 March 2016. The Viking represented the final dismemberment of the Bandit 6, a term coined by Sea Shepherd for the six IUU toothfish vessels in the southern oceans."

7.6 Publication of both positive (authorised) and negative (IUU) vessel lists

7.6.1 IUU and unauthorised vessels

A recommendation of this study is the broadening of the existing initiatives by RFMOs to develop, maintain, update, share and publicise lists of IUU vessels through channels such as "http://www.iuu-vessels.org/iuu". Trygg Mat Tracking regularly and timeously updates a consolidated list of IUU vessels. Table 14 6 (see supporting tables) is a list of IUU vessels made available by the IOTC as at 18-03-2016 as an example.

7.6.2 Authorised vessels

RFMOs and other bodies should develop, maintain, update, share and publicise lists of authorised fishing vessels such as is described below:

Authorised tuna vessels: "A comprehensive global list of tuna vessels is now available online. Near real-time information on vessels authorized to fish for tuna is now available to the public thanks to collaboration among tuna regional fishery management organizations. In the fight against illegal, unregulated and unreported (IUU) fishing, access to information on authorized fishing vessels and cargo vessels is essential. This week FAO announced that the tuna Regional Fishery Management Organizations, with support of the Common Oceans Tuna Project have released the online version of the Consolidated List of Authorized Vessels (CLAV) that is now updated daily. End users can access the CLAV at http://tuna-org.org/GlobalTVR.htm (please go to the bottom of the page to enter the CLAV browser). Users can search the CLAV registry based on multiple criteria while having access to historical data as well. The CLAV was created through the collaboration of the five tuna regional fisheries management organizations (t-RFMOs) by merging their lists of authorized vessels. The five t-RFMOs are: the Inter-American Tropical Tuna Commission (IATTC), the International Commission for the Conservation of Atlantic Tuna (ICCAT), the Indian Ocean Tuna Commission (IOTC), the Western and Central Pacific Fisheries Commission (WCPFC) and the Commission for the Conservation of Southern Bluefin Tuna (CCSBT). Vessel information includes physical characteristics and vessel histories, and a unique vessel identifier is assigned to each vessel. At the time of this report, the CLAV database authorised tuna fishing vessels listed 18444 vessels, dominated by the United States of America, longliners, and large vessels over 24 m." This initiative needs to be expanded to include other RFMOs and countries of origin for DWF fleets such as Asia (Russia and China). African coastal states which are party to FFAs should also make public the information about DWF vessels fishing in African EEZ in terms of those FFAs.

Database on EU Distant Water Fleet (*see http://www.whofishesfar.org/***):** The EU lends its flag to a large fleet of vessels that operate in distant waters, meeting our ever-growing demand for seafood by netting catch as far afield as Greenland the distant Pacific Island States, and in all world's oceans. All EU fishing vessels operating in third-country waters or on the high seas need an authorization under the EU's Fishing Authorisation Regulation (FAR). However, until now it was unknown how many boats operated in these waters, their names, and where and when they were authorised to fish. WhoFishesFAR discloses this information for the first time ever, making it available to the general public. From 2010 to 2014 at least 15,264 fishing vessels operated under EU flags in external waters using a FAR authorization and are included in this database. The data has been provided by the European Commission and also includes additional information from 2006 to 2020, amounting to 16,336 unique vessels – including 978 licences that were given to third (or non-EU) countries to operate in EU waters. The data includes all official agreements, but not private agreements, as the EU Commission itself admits that the EU has no data on these agreements. This website aims to demonstrate the need for institutional transparency and accountability of the activities of the EU fleet activities in waters outside EU. Transparent, accountable and sustainable activities of the EU fleet should be guaranteed no matter where they operate.

Recommendation: It is recommended that all flag states are encouraged to follow suit to publicise lists of authorized vessels. In particular coastal states should publish lists of authorized vessels. It is recorded that our literature review showed that most African fisheries access agreements with China are not publically available. RFMOs should advocate that flag states publicise list of vessels that are allowed to fish under their flags.

7.7 Imposing Market and Trade Sanctions

The IUU Regulations is an EU legislative instrument to address IUU fishing through trade sanctions. The EU colour coded carding system blocks access to EU markets for fish and fish products from countries where IUU is not being adequately controlled, and has proven to be highly effective. Such initiatives need to be more broadly applied by importing nations such as the USA where it is acknowledged that there is a large IUU content in imports. Other countries also need to follow suit.

Typical shortcomings identified under the EU IUU Regulation are illustrated in the following example: "The main shortcoming identified by Commission in the suggested plan of action were related to several failures to implement international law obligations, linked in particular to the adoption of an adequate legal framework, lack of adequate and efficient monitoring, lack of observer scheme, lack of a deterrent sanctioning system, and to improper implementation of the catch certification scheme. Other identified shortcomings relate, more generally to the compliance with international obligations including Regional Fisheries Management Organisations (RFMOs) recommendations and resolutions. A lack of compliance with recommendations and resolutions from relevant bodies such as the International Plan of Action against Illegal, Unreported and Unregulated fishing of the United Nations (IPOA-IUU) was also identified. However, the lack of compliance with non-binding recommendations and resolutions was considered only as supporting evidence and not as a basis for the identification."

Examples of action and progress with the EU IUU Regulations are as follows (see also Figure 8 1):

1. *http://focustaiwan.tw/news/aipl/201603170025.aspx:* "To prevent looming trade sanctions by the EU following a yellow card, Taiwan are in the process of ratifying a bill to increase penalties

against reported long distance IUU vessels. The estimated output of the 1300-1600 fleet of Taiwanese long distance vessels (6.5 - 8 % of Taiwan's fishing fleet) is NT$ 50 billion (US$ 1.5 billion). If the IUU issues are not addressed, EU sanctions could cost the nation NT$ 1 billion (US$ 30.8 million)".

2. *http://ec.europa.eu/newsroom/mare/itemdetail.cfm?item_id=28071&subweb=343&lang=en: "(18/12/2015)* Commissioner Karmenu Vella, responsible for Environment, Maritime Affairs and Fisheries, today met with Sherry Ayittey, Minister of Fisheries and Aquaculture Development of Ghana. The Commissioner thanked Ghana, and the Minister personally, for the strong commitment shown in tackling illegal, unreported and unregulated fishing. The progress made, in close cooperation with the EU, resulted in the lifting of the EU's "yellow card" on 1 October this year. This was not only a huge political success for Ghana, the Commissioner said, but also a clear example for other countries in Africa and around the world that positive change was possible with the right political commitment. He also expressed the Commission's wish to build on this success and pursue close cooperation with Ghana, not just on illegal fishing, but also on broader ocean governance issues."
3. *https://www.undercurrentnews.com/2016/04/22/ejf-90-of-sierra-leones-iuu-vessels-able-to-sell-to-eu/* (EJF_ 90% of Sierra Leone's IUU vessels able to sell to EU _ Undercurrent News. pdf): "April 22, 2016, 4:29 pm Undercurrent News NGO the Environmental Justice Foundation (EJF) has urged the government of Sierra Leone to protect its fisheries resources, after the EU warned the country over its failure to combat illegal "pirate" fishing. The EU commission warned Sierra Leone with a "yellow card" after considering the country's level of development and engagement against illegal, unreported and unregulated (IUU) fishing to be inadequate. This formal notice should encourage the country to take immediate actions, or it will risk being banned from exporting fish to the EU as Sri Lanka was, until April 21, when the commission lifted that ban. EJF has been documenting illegal fishing in Sierra Leone's waters for seven years, it said. Between Jan. 1 2010 and July 31 2012, EJF's community surveillance project in southern Sierra Leone received 252 reports of pirate fishing by industrial vessels in inshore areas. 90% of these vessels were accredited to export their catches to Europe, it said. 'For a country so dependent on fish, it is critical that Sierra Leone recognizes the importance of combatting IUU fishing,' said EJF executive director Steve Trent. "

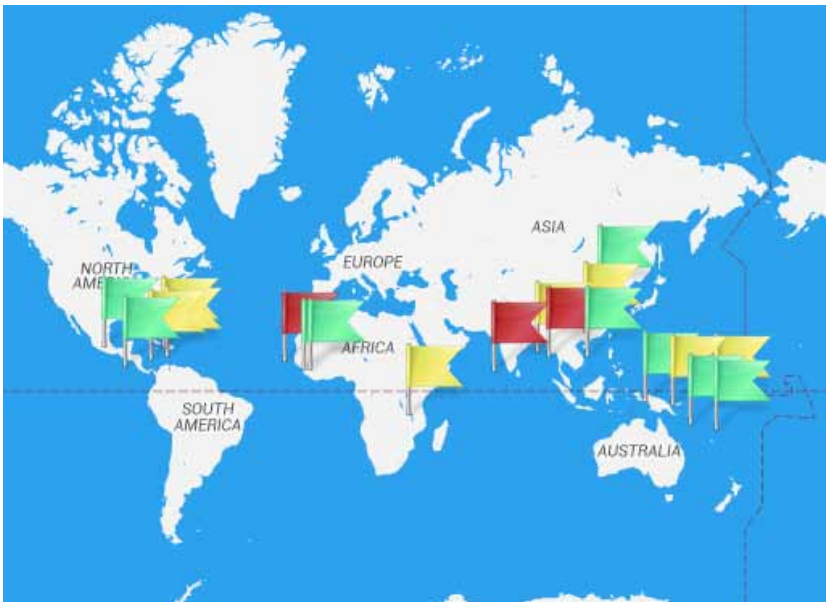


Figure 8 1. *Map of IUU listing and delisting of red and yellow carded countries since implementation of the EU's IUU system in 2012 - last updated October 2015. Source: http://www.iuuwatch.eu/iuu-fishing/red-yellow-carding/map-of-iuu-fishing/.*

7.8 The promotions of Traceability and Eco-labelling schemes

Traceability in the food chain is increasingly becoming a requirement in several fish importing countries in the developed world. Certification initiatives ranging from certification of products and processes to eco-labelling are increasingly being used as a means of monitoring and deterring IUU products.

Eco-labelling has the potential to dramatically improve many aspects of fisheries management and should be supported by fisheries management authorities. We note the following excerpt from Lallemand et al. (2016) regarding the MSC certification of the South African hake fishery:

> *"MSC certification has had a considerable impact on the management of the South African hake resource with respect to governance, the promotion of sustainable fisheries management practice, and the application of ecosystem-based management approaches. In their discussions, as part of the management process, hake industry representatives, scientists, fisheries managers and NGOs frequently refer to the MSC principles and objectives. These references range from discussions about resource harvesting strategies, the mitigation of detrimental environmental impacts, and observations about the competence of governance. This new paradigm has resulted in considerable improvements in the management process which were absent in the decades preceding certification. Underlying this all is the acknowledgment that MSC certification brings substantial benefit to the hake trawling industry, to processors and traders, and consequently for employment as well. "*

Traceability and chain of custody certification is a feature of a number of eco-labelling bodies such as the MSC. However this is something that can be implemented on a stand-alone basis without necessarily going for full and complete certification. It is worth noting that the MSC offers special certification routes for data poor fisheries. It is also highly relevant that, as pointed out in Lallemand et al (2016), there is the potential for significant value enhancement to be derived for a fishery which is certified, and there is also the potential for access to valuable markets that cannot be accessed by product from uncertified fisheries. We quote again from Lallemand et al (2016) in the context of assessing the impact of the loss of MSC certification, where status quo is the current situation with MSC certification in place:

> *"The analysis showed that the fishery's Net Present Value (NPV) of combining these scenarios over a 5-year period corresponds to a 37.6% reduction vis-à-vis the status quo. This study showed that retaining MSC-certification is critical for the fishery to maintain its market position."*

Trade documentation schemes: These exist for tuna, swordfish and toothfish and require that documentation is provided when trading in these fish and fish products. These schemes are considered most effective when coordinated by RFMOs.

7.9 Curbing or reducing perverse subsidies

Perverse subsidies are a major driver of IUU fishing and need to be curtailed and if possible eliminated:
"Subsidies that reduce the cost of fisheries operations and those that enhance revenues make fishing enterprises more profitable than they would otherwise be. This results directly or indirectly in the build-up of excessive fishing capacity, leading to the overexploitation of fishery resources." (Sumaila et al. 2013)

Global fisheries subsidies were estimated at about USD 35 billion in 2009 dollars. Capacity-enhancing subsidies constituted the highest categories provided at over USD 20 billion. Subsidies contributed by developed countries are far greater (65% of the total) than that contributed by developing countries (35% of the total); Asia is by far the greatest subsidizing region (43 % of total), followed by Europe (25 % of total) and North America (16 % of total). Japan provides the highest amount of subsidies among developed countries (19.7% of total), followed by China, and here considered a developed country (19.6% of total).

The WTO is undoubtedly the most effective forum for achieving progress in regard to fishing subsidies. The WTO has been active in the effort to discipline fisheries subsidies as economic theory has clearly demonstrated that subsidies distort the market. Fisheries that receive subsidies get an undue advantage in the market place over those who do not. This is an important concern because generally large fishing companies capture most of the subsidies to the disadvantage of small-scale fishers, and by extension, fishers in developing countries are also disadvantaged since their governments do not have the means to compete with those of developed countries.

The WTO's ASCM (Agreement on Subsidy and Countervailing Measures) has been expanded to include a clear definition of the nature of fishing subsidies and prohibitions on fishing subsidies (Sumaila et al. 2013).

7.10 Controls on fishing effort and fishing capacity commensurate with resource productivity

Controls on fishing effort and fishing capacity are recommended, levels should be commensurate with sustainable catch levels. In jurisdiction where output controls are the exclusive form management, input controls have the potential to curb IUU fishing which is going under the radar of catch compliance systems. The FAO Code of Conduct for Responsible Fisheries contains the following clauses which refer to controlling fishing capacity and fishing effort:

> *"6.3 States should prevent overfishing and excess fishing capacity and should implement management measures to ensure that fishing effort is commensurate with the productive capacity of the fishery resources and their sustainable utilization. States should take measures to rehabilitate populations as far as possible and when appropriate.*

7.1.8 States should take measures to prevent or eliminate excess fishing capacity and should ensure that levels of fishing effort are commensurate with the sustainable use of fishery resources as a means of ensuring the effectiveness of conservation and management measures.

7.4.3 Studies should be promoted which provide an understanding of the costs, benefits and effects of alternative management options designed to rationalize fishing, in particular, options relating to excess fishing capacity and excessive levels of fishing effort.

7.4.4 States should ensure that timely, complete and reliable statistics on catch and fishing effort are collected and maintained in accordance with applicable international standards and practices and in sufficient detail to allow sound statistical analysis. Such data should be updated regularly and verified through an appropriate system. States should compile and disseminate such data in a manner consistent with any applicable confidentiality requirements".

Here we recommend instead a rationally based system of effort controls, coupled with, where appropriate, capacity limitations. FFAs should assess the implied fishing effort and landings and ensure that these fall within sustainable limits.

7.11 Development of Lacey Style Legislation to allow for compensation for IUU fishing

The Lacey Act is a law in the USA which makes it possible for the United States government to seek restitution for victims of environmental crimes, the last mentioned certainly include IUU fishing. IUU fishing of rock lobsters and other species in South African waters are the basis for the biggest wildlife case prosecuted under the Lacey Act in US history (OLRAC 2004a, 2004b).

On 28 March 2013, the Sub-Regional Fisheries Commission (SRFC) sought the assistance of the International Tribunal for the Law of the Sea (ITLOS) regarding serious IUU fishing by foreign states within the waters of its members, based on the following four questions (Haughton 2015).

1. What are the obligations of the flag State in cases where illegal, unreported and unregulated (IUU) fishing activities are conducted within the Exclusive Economic Zone of third party States?
2. To what extent shall the flag State be held liable for IUU fishing activities conducted by vessels sailing under its flag?
3. Where a fishing licence is issued to a vessel within the framework of an international agreement with the flag State or with an international agency, shall the State or international agency be held liable for the violation of the fisheries legislation of the coastal State by the vessel in question? and
4. What are the rights and obligations of the coastal State in ensuring the sustainable management of shared stocks and stocks of common interest, especially the small pelagic species and tuna?

An important question that arises is whether and under what circumstances a state could be held liable for IUU fishing by vessels flying its flag.

ITLOS found that failure of the flag state to comply with its international legal obligations concerning IUU fishing could indeed lead to liability and the payment of damages to the coastal State for the harm caused. It should however be noted that the flag state could only be liable for its vessels engaging in IUU fishing if the flag state fails to discharge its due diligence responsibility to take the measures necessary to fulfil its international obligations and is therefore in breach of its legal duty. So if the flag State can demonstrate that it has complied with its international obligations and made every effort to prevent its vessels from engaging in IUU fishing, it would not be liable, even if its vessels were found to be engaged in actual IUU fishing.

Based on the ITLOS ruling it may be possible to consider litigation for IUU fishing by vessels flagged by known FOC states. It does seem however that the legal framework to facilitate such action needs further development. Such legal reform could involve the development of Lacey Act style national legislation by coastal states but such an innovation would be greatly assisted by clarifications and enabling legislation enacted at an international level. Further analysis of the present legal situation would also be of some assistance in advancing this matter. It would be necessary to more clearly define the victims of the crime of IUU fishing, and the perpetrators who may be liable for restitution under defined legal situations. The effective use of such a tool has the potential to create a more direct counter incentive to IUU fishing than the rather diffuse positive rewards that accrue from successful anti-IUU fishing actions.

(NOAA Fisheries 2013) "The Lacey Act also provides the United States with the authority to impose significant sanctions against individuals and companies engaged in trafficking illegally taken fish and wildlife."

7.12 Nations to implement ongoing and comprehensive assessments of IUU fishing in their EEZ

This study encountered a variety of different methods for estimating the scale of IUU fishing. Also diverse and creating some confusion are the different methods and units that are employed to report on the scale of IUU fishing, Given the indications about the scale of IUU fishing in Africa revealed by the reviews and interviews carried out here, the following requirements are urgent:

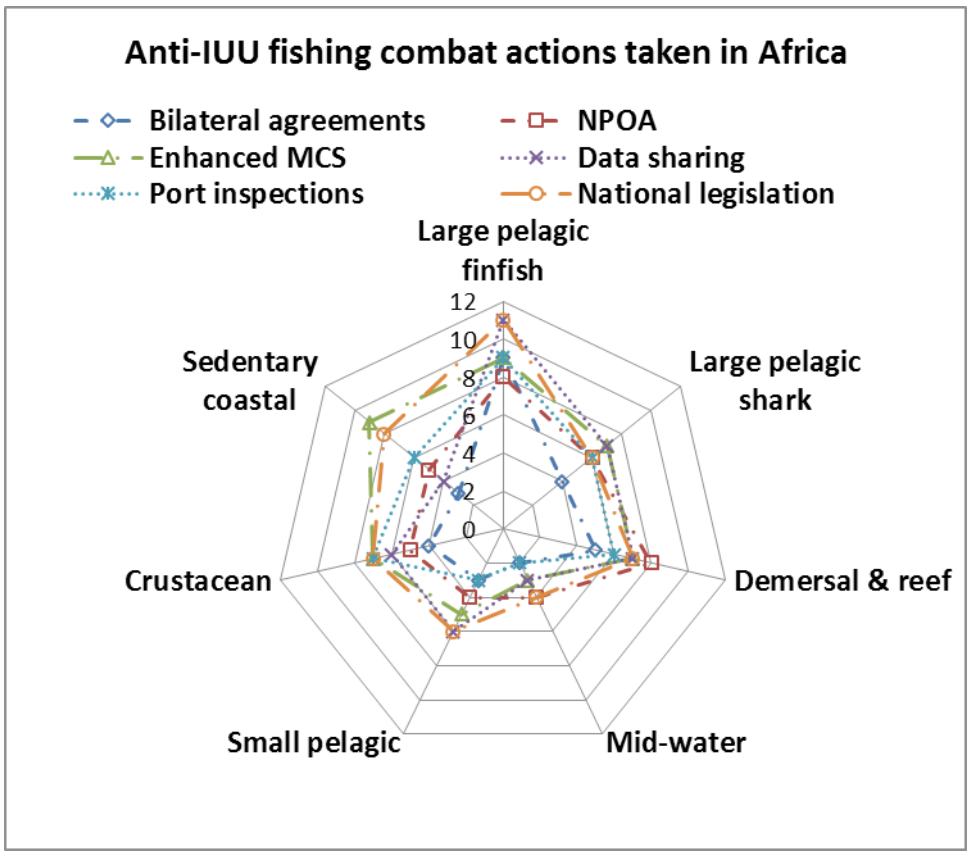
1. In depth national level studies into IUU fishing to become a regular activity by national governments. Results to be reported regularly.
2. That FAO to investigate methods for estimating levels of IUU and provide guidance and where possible specifications for methods that will be deemed to be adequate, in, to mention one example, restitution claims in terms of Lacey Act style legislation (as is elsewhere in this document recommended needs consideration for implementation).
3. The FAO to provide guidance on the regularisation of methods to report upon the scale and impact of IUU fishing.

7.13 Main actions taken by African coastal states to curb IUU fishing

Respondents to the questionnaire survey focused on 6 main actions for fighting IUU fishing.

What actions have your country / region taken to combat IUU fishing? Tick all that are applicable.

AU Region	Anti-IUU fishing combat actions	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal
Africa Total	Bilateral agreements	9	4	5	2	3	4	3
	NPOA	8	6	8	4	4	5	5
	Enhanced MCS	9	7	7	3	5	7	9
	Data sharing	11	7	7	3	6	6	4
	Port inspections	9	6	6	2	3	7	6
	National legislation	11	6	7	4	6	7	8
Central Africa	Bilateral agreements	0	0	0	0	1	0	0
	NPOA	1	1	1	0	1	0	0
	Enhanced MCS	1	1	1	0	1	0	2
	Data sharing	1	1	1	0	2	1	0
	Port inspections	1	1	2	1	2	2	1
	National legislation	1	1	2	1	2	2	1
Eastern Africa	Bilateral agreements	4	3	2	0	0	0	0
	NPOA	2	2	2	1	0	0	0
	Enhanced MCS	2	3	2	0	1	1	2
	Data sharing	5	3	3	0	1	0	0
	Port inspections	3	3	1	0	0	1	1
	National legislation	5	3	3	0	1	1	3
Northern Africa	Bilateral agreements	1	0	0	0	0	0	0
	NPOA	0	0	0	0	0	0	0
	Enhanced MCS	1	0	0	0	0	0	0
	Data sharing	1	0	0	0	0	0	0
	Port inspections	1	0	0	0	0	0	0
	National legislation	1	0	0	0	0	0	0
outhern Africa	Bilateral agreements	1	0	1	0	0	2	1
	NPOA	2	1	2	0	0	2	2
	Enhanced MCS	2	1	1	0	0	3	2
	Data sharing	1	1	1	0	0	3	2
	Port inspections	2	1	2	0	0	2	2


Anti-IUU fishing combat actions taken in Africa
Bilateral agreements
NPOA
Enhanced MCS
Data sharing
Port inspections
National legislation
Large pelagic finfish
Large pelagic shark
Demersal & reef
Mid-water
Small pelagic
Crustacean
Sedentary coastal
12
10
8
6
4
2
0

8. Recommendations

Recommendations are listed separately for (a) coastal and flag states, (b) importing countries, (c) RFMOs/RFBs and (d) the UN FAO.

8.1 Coastal and flag states

8.1.1 Adoption, implementation and adherence to regional and international instruments relevant to curbing IUU

- UNCLOS
- The UNFSA (United Nations Fish Stocks Agreement)
- FAO CA: The FAO Compliance Agreement
- FAO CCRF: The 1995 FAO Code of Conduct for Responsible Fisheries
- IPOA IUU - and develop a national plan of action (NPOA IUU).
- IPOA Capacity - Implement effort controls and limitations on fishing capacity
- FAO Technical Guidelines on the Ecosystem Approach to Fisheries (2003)
- FAO International Guidelines for the Management of Deep-sea Fisheries in the High Seas (2008)
- FAO International Guidelines on Bycatch Management and Reduction of Discards (2010)
- PSMA: The FAO Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (the PSMA)
- FOCs: Voluntary Guidelines for Flag State Performance.
- The Global Record: The FAO Global Record of Fishing Vessels, Refrigerated Transport Vessels and Supply Vessels.
- FAO Voluntary Guidelines for Securing Sustainable Small-scale Fisheries
- SADC Protocol on Fisheries
- Policy Framework and Reform Strategy for fisheries and aquaculture in Africa
- A Guide for the Implementation of the Policy Framework and Reform Strategy for fisheries and aquaculture in Africa

8.1.2 Active Participation in Regional Fisheries Management Organisations, RFBs and RECs

- Ratification of relevant regional fisheries agreements: Any state which has a real interest in a fishery must join or cooperate with the relevant organisation and such participation is a pre-condition to access to the relevant resources.
- Participation in regional fisheries agreements and organisations: Participating in relevant regional fisheries agreements, and complying with and implementing the measures adopted by regional organisations.
- Membership of relevant RFMOs or participation as a cooperating non-member: Along with ratification of relevant treaties, membership of relevant RFMOs or participation in such organisations as a cooperating non-member is the most basic method by which a flag state can implement its obligations to cooperate. In most cases a flag State which is a party to a regional agreement will be a member of the organisation established by that agreement.
- Compliance with RFMO measures: Membership of, or formal cooperation with, RFMOs is not in itself sufficient. A flag state must also implement the measures agreed within RFMOs, including for example transposition and enforcement of quotas, fulfilling catch, effort and other data reporting requirements; participation in RFMO-mandated observer programmes, inspection schemes or other monitoring, control and surveillance measures; or participation in catch documentation schemes either as a member or as a non-member.
- Collaborate fully and actively with efforts to expand the role of RFMOs and RFBs, for example in negotiations around FFAs, or in the development of action plans around international instruments adopted to curb IUU fishing.

- Harmonisation of penalties and data collection and data storing protocols

8.1.3 Transparency and data and information sharing

- Publicise lists of authorised fishing vessels including those authorised in terms of FFAs.
- Publicise lists of IUU fishing vessels.
- Ensure transparency regarding FFAs
- Ensure accurate reporting to FAO of all known catches by flagged vessels, catches in the EEZ, and catches by vessels fishing under FFAs.
- Curb harmful fishing subsidies in terms of and as directed by agreeements reached at the WTO.
- Promote collaboration and transparency between relevant national agencies, fisheries management, fisheries science, MCS, export/import, naval organisations and port management.
- Encourage nations to subscribe to FITI (Fishing Industry Transparency Initiative).

8.1.4 Legal and judicial

- Implement national legal reforms to enable and facilitate the adoption and implementation of and adherence to international instruments relevant to curbing IUU fishing
- Creation of specialised investigative and judicial units for the prosecution of IUU fishing crimes.
- Establish penalties for IUU crimes which are commensurate with the value of the IUU catch and which are adequate to deter IUU fishing.
- Work to harmonise penalties for fish crimes in the relevant region and amongst RFB member countries.
- Root out corruption in national organisations involved in MCS and fisheries management.

8.1.5 Research

- Evaluate the estimates of IUU fishing in this document and enrich these with additional local knowledge.
- Conduct regular national investigations into levels of IUU fishing for stocks under state or RFMO management.
- Establish sustainability based controls for fish stocks under sole domestic management

8.1.6 Media, NGOs and eco-labelling

- Encourage and support exposure of the media to all aspects related to IUU fishing under state or organisational control.
- Assist and colloborate with NGOs, citizen action groups (e.g. BlackWatch) and community organisations involved in action against IUU fishing.
- Support initiatives for eco-certification within fisheries under state or organisational jurisdiction, and work to capacitate and improve fisheries governance to meet the standards of eco-certification, where relevant.

8.2 Importing countries

- Establish transparent IUU related standards for approving the importation of fishing products. The EU IUU regulation is an example of an approach which has produced positive results.
- Adopt all international instruments relevant to curbing IUU fishing.

8.3 RFMOs/RFBs

- Adopt and implement all international instruments relevant to curbing IUU fishing developed by the FAO.
- Participate in regular performance reviews carried out by an independent body. Publicise the results of performance reviews.
- Draw up a code of conduct committing to best practice, according to widely publicised and accepted guidelines.
- Exploit opportunities to use regionalisation to adopt all relevant international instruments mentioned in the previous section to curb IUU fishing, particularly in circumstances where member states have insufficient capacity and resources for such initiatives.
- Carry out performance reviews of member countries in relation to their participation in RFMOs, maintain records of outcomes by members, and make adherence to CMs and other RFMO rules publically available.
- Explore and exploit oppportunities to collaborate with other RFMOs and bodies around efforts to combat IUU fishing.

8.4 UN/FAO

- Review all international instruments developed since UNCLOS with an eye for loopholes that are exploited by IUU fishing. Explore creative modifications to close these gaps
- Develop strategies and guidelines to sanction Ports of Convenience.
- Develop standards for estimating and reporting levels of IUU, and maintain databases relevant to this activity. Promote the refinement and development of this activity.
- Explore the feasibility of the creation of an International Environmental Court, publicise findings.
- Continue to enhance INTERPOL's specialisation in IUU fishing crimes. Continue to promote and deepen collaboration between different organisations involved in investigating international crimes linked to IUU fishing crimes.
- Explore and promote the further expansion of the implementation of the global record of fishing vessels.
- Explore the feasibility of creating a global vessel tracking centre for fishing vessels, or support same.
- Related to the above, continue to explore cost effective technology to enhance the effectiveness of national level MCS, and advise globally on a regular basis. e.g. low cost cumulative tracking technologies for fishing vessels.
- Contribute to the development of objective standards to form the basis for market related measures targetting IUU fishing, or states which are not meeting minimum requirements in the fight against IUU fishing.
- Establish the legal principles of restitution for IUU fishing by the victims of IUU fishing crimes, if possible. Advise on any legal innnovations required to create a legal route for victims to seek restitution, if possible.
- FAO to publicize the recommended methodology for estimating IUU fishing catches as developed in the first half of 2016.

9. Action Plan

9.1.1 Strengthen the MCS Working Group of the African Fisheries Reform Mechanism

- Establish "IUU Regional Network" comprising RFMO, REC and LME bodies, with IUU regional working groups in each of these
- Draw on all existing Africa-wide national and regional initiatives, policies, strategies and plans (e.g. the 2050 Africa Integrated Maritime Strategy and the Policy Framework and Reform strategy for Fisheries and Aquaculture (2014)) in regard to IUU fishing.

9.1.2 Awareness raising of the impacts and economic losses of IUU fishing

- Convene High level Policy Dialogue on IUU fishing with key political actors and representatives from key agencies (IMO, FAO, INTERPOL, IOC-UNESCO, UNEP etc.) to raise awareness at political level about the impacts and economic losses associated with IUU, and the need for actions to curb IUU fishing.
- Raise awareness at political level about the suite of international instruments and other measures for curbing IUU fishing to empower governments to act - in particular focus on the urgency to ratify PSMA in order to bring this agreement into force.
- Raise awareness amongst the general public about the impacts and losses of IUU fishing through social media, etc. to encourage greater citizen involvement and action

9.1.3 Training and capacity development for more effective MCS

- Commission the design, development and implementation of targeted training and capacity development programmes and courses based on country specific needs assessments. This needs to be done in consultation with relevant governance actors and agencies (e.g. RFMOs, LME bodies, enforcement agencies, fisheries Ministries, port authorities, customs agencies)

9.1.4 Strengthen MCS capacity and resourcing

- Strengthen capabilities, procedures and routines for MSC through carefully designed and delivered training programmes and courses,
- Employ new and appropriate technologies to support and strengthen MCS efforts. (This requires a review of the current state of technological development and evaluation of what technologies would strengthen MCS capacity in the particular region).
- Enhance regional co-operation of agencies charged with IUU enforcement through improving communication channels, sharing of data and intelligence,

9.1.5 Fast-track technical measures to Curb IUU fishing

- Extend the Global UVI to vessels smaller than 100 GT, and enforce compliance in general
- Explore the cost effectiveness of using regionalised vessel detection systems.

9.1.6 Strengthen the role and capacity of RFMOs

- Through training and skills development in targeted areas as mentioned in previous sections
- Annual review of RFMO performance in relation to code of conduct

9.1.7 Strengthen African representation at WTO negotiations to include the "MCS Working Group and AU Member States"

- The "MCS Working Group" and AU member states shall be capacitated to attend WTO negotiations

to ensure that the perverse fishing subsidies disbursed for the benefit of DWFFs in DWF nations are considered and addressed. The "MCS Working Group" should gather input form the "IUU regional network" in order to be properly informed for such meetings.

9.1.8 Commission detailed socio-economic impact studies in selected countries

- Commission economic impact studies using the common methodology being developed by the FAO to assess the costs of IUU fishing for comparative purposes.
- Commission social impact assessments in countries particularly vulnerable to and impacted by IUU fishing.
- Use this information to enhance awareness of the impacts and to gain political support for measures to curb IUU fishing.
- Develop a Guide for methodology assessment of socio-economic and environmental impacts of IUU

9.1.9 Develop a detailed IUU Strategy and Action Plan ("IUU SAAP") for Africa

- Use this document as a baseline for developing an IUU Strategy and Action Plan with clear goals, objectives, targets, timeframes and funding requirements. This will include additional function for the IUU working groups of regional bodies.
- Use the findings of this document to leverage funding from the European Union and other developed world agencies to support the development of such an S&AP.
- Critical to the process of developing this IUU S&AP is the involvement of key IUU stakeholders including representatives from RFMOs, LME bodies, fisheries Ministries, Port authority agencies, customs agencies and Justice Ministries to ensure understanding of issues, gain agreement of the strategies and action plans and the timeframes.

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11. Annexes

11.1. Figures

Figure 13 1. *An indication of the area of responsibility for the main RFMOs (Regional Fisheries Management Organisations) around Africa.*

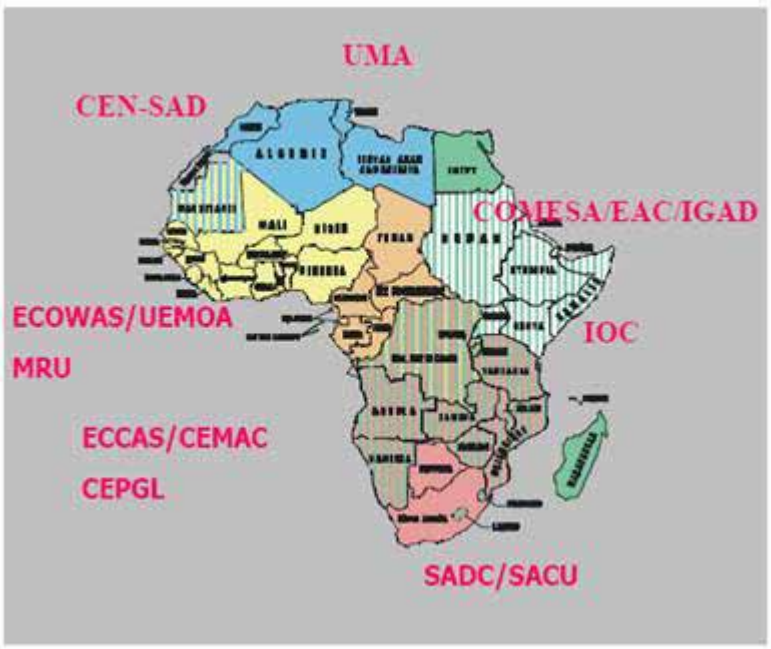

Figure 13 2. *An indication of the membership of RECs (Regional Economic Communities) in Africa.*

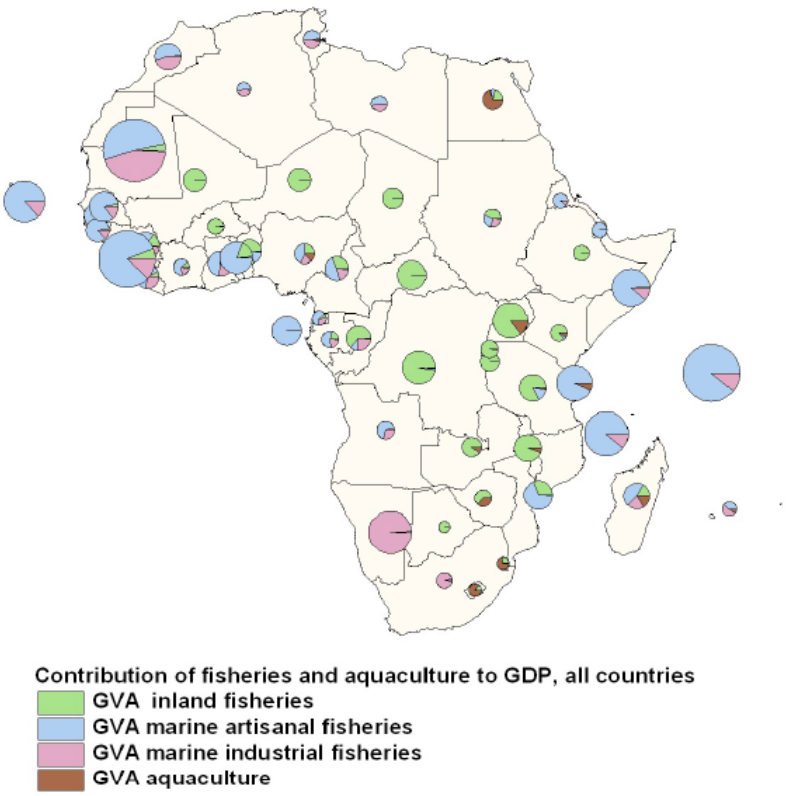

Figure 13 3. *Contribution to GDP by subsector (size of pie indicates total contribution to GDP). Source: de Graaf and Garibaldi (2014).*

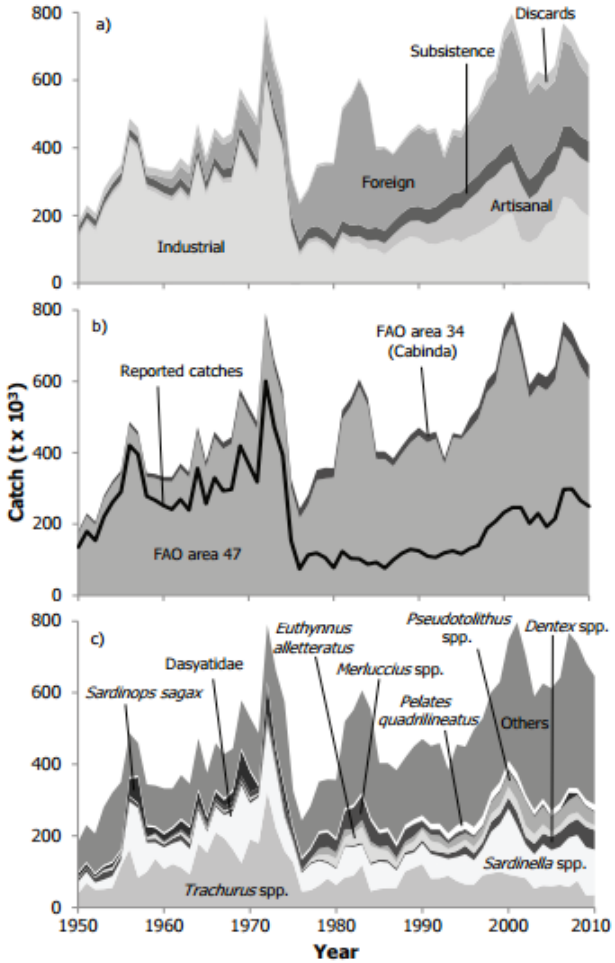

Figure 13 4. *Reconstructed total catches from the Angolan EEZ by (a) sector including domestic and foreign catches, (b) area including domestic catches and (c) taxon including domestic and foreign catches, 1950 - 2010. Source: Belhabib and Divovich (2015).*

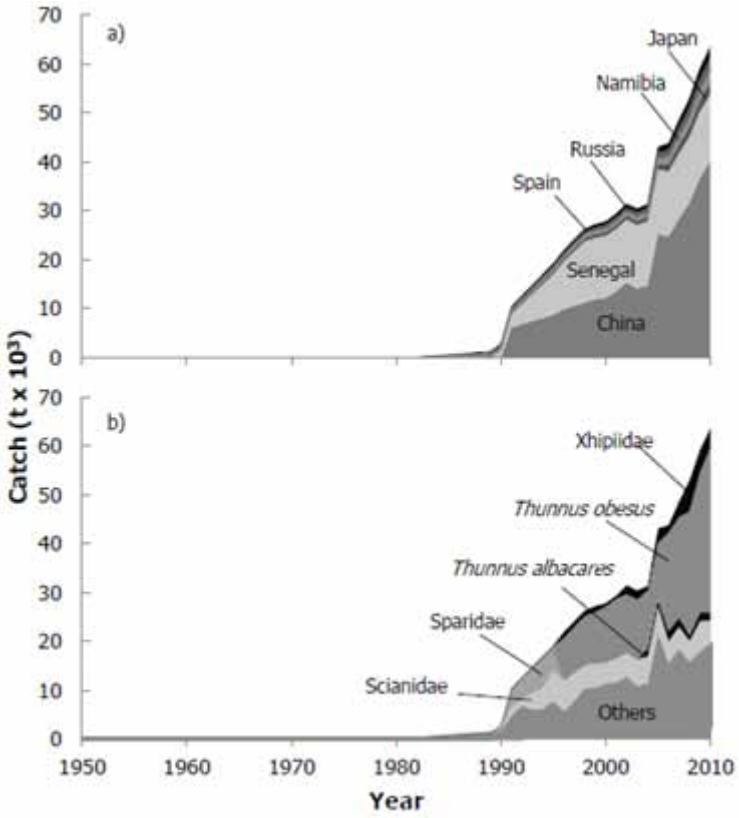

Figure 13 5. *Reconstructed illegal catches from Angola by (a) country and (b) taxon, 1950 - 2010. Source:*

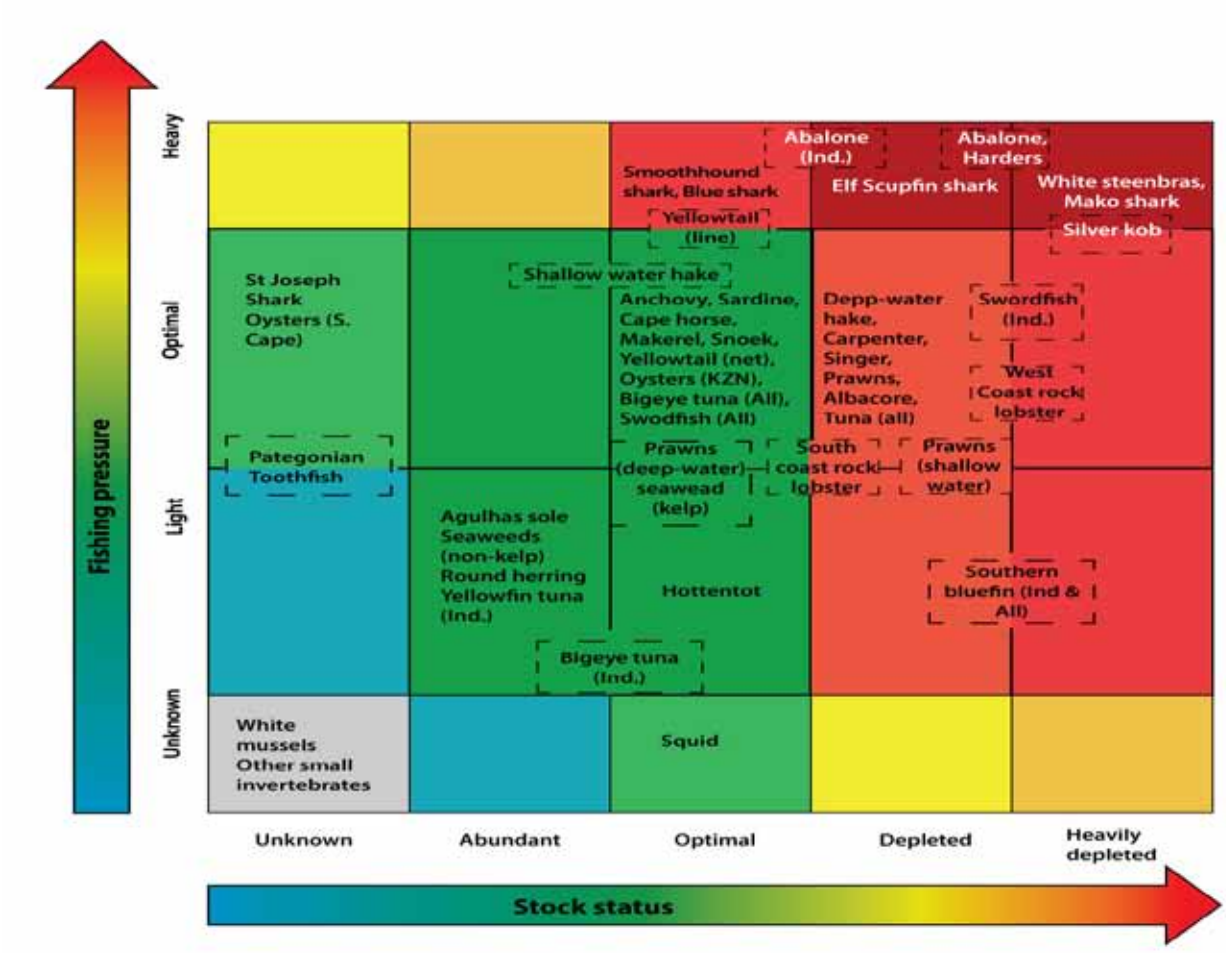

Figure 13 6. ***DAFF (2014) summary of stock status.***

11.2. Tables

Table 14 1. *Estimates of the contribution of fisheries to GDP for coastal African states, which is assumed to comprise predominantly but not exclusively marine capture fisheries. These estimates are based on contemporary estimates of GDP and the % contribution to GDP from fisheries published in World Bank (2012).*

		2013	2014	2015	Fisheries	2013	2014	2015
Country	AU Region	GDP US$ Billions	GDP US$ Billions	GDP US$ Billions	GDP%/100	Fisheries GDP	Fisheries GDP	Fisheries GDP
Madagascar	Eastern Africa	10.6	10.7	9.5	0.055	0.583	0.5885	0.5225
Mozambique	Eastern Africa	15.6	16.7	17	0.04	0.624	0.668	0.68
South Africa	Southern Africa	366.2	350.1	317.3	0.01	3.662	3.501	3.173
Namibia	Southern Africa	12.9	13.6	12.9	0.03	0.387	0.408	0.387
Angola	Central Africa	124.2	129.3	102	0.03	3.726	3.879	3.06
Gambia (the)	Western Africa	0.9	0.8	0.8	0.018	0.0162	0.0144	0.0144
Senegal	Western Africa	15	15.7	14	0.023	0.345	0.3611	0.322
Mauritania	Western Africa	5.2	5.1	4.7	0.045	0.234	0.2295	0.2115
Cabo Verde	Western Africa	1.8	1.9	1.6	0.013	0.0234	0.0247	0.0208
Western Saha	Northern Africa							
Morocco	Northern Africa	107.2	110	103.1	0.025	2.68	2.75	2.5775
DRC	Central Africa	32.7	35.9	39.1				
Congo (the)	Central Africa	13.5	13.6	8.9	0.014	0.189	0.1904	0.1246
Gabon	Central Africa	17.6	18.2	13.8	0.008	0.1408	0.1456	0.1104
Equatorial Gu	Central Africa	17.1	15.5	10				
Cameroon	Central Africa	29.6	31.8	28.5	0.009	0.2664	0.2862	0.2565
Sao Tome and	Central Africa	0.3	0.3	0.3	0.052	0.0156	0.0156	0.0156
Nigeria	Western Africa	521.8	574	493	0.014	7.3052	8.036	6.902
Benin	Western Africa	8.3	8.7	7.7	0.018	0.1494	0.1566	0.1386
Togo	Western Africa	4.4	4.6	4.2	0.04	0.176	0.184	0.168
Ghana	Western Africa	47.8	38.6	37.7	0.08	3.824	3.088	3.016
Côte d'Ivoire	Western Africa	31.1	33.7	31.3	0.008	0.2488	0.2696	0.2504
Liberia	Western Africa	2	2	2	0.04	0.08	0.08	0.08
Sierra Leone	Western Africa	4.9	4.8	4.3	0.094	0.4606	0.4512	0.4042
Guinea	Western Africa	6.2	6.7	6.7	0.018	0.1116	0.1206	0.1206
Guinea-Bissau	Western Africa	1	1.1	1	0.037	0.037	0.0407	0.037
Algeria	Northern Africa	209.7	213.5	175.1				
Tunisia	Northern Africa	47	48.6	44.3				
Libya	Northern Africa	65.5	41.1	29.7				
Egypt	Northern Africa	271.4	286.4	301.4				
Sudan (the)	Northern Africa	66.6	74.8	84.3	0	0	0	0
Eritrea	Eastern Africa	3.4	3.9	4.3	0.02	0.068	0.078	0.086
Djibouti	Eastern Africa	1.5	1.6	1.7	0.001	0.0015	0.0016	0.0017
Somalia	Eastern Africa				0.02			
Kenya	Eastern Africa	54.9	60.9	63.1	0.005	0.2745	0.3045	0.3155
Tanzania	Eastern Africa	44.4	48.1	46.2	0.027	1.1988	1.2987	1.2474
Seychelles	Eastern Africa	1.4	1.4	1.4	0.3	0.42	0.42	0.42
Comoros (the	Eastern Africa	0.7	0.7	0.6	0.15	0.105	0.105	0.09
Mauritius	Eastern Africa	11.9	12.6	11.6	0.01	0.119	0.126	0.116
Total	**Africa**	**2176.3**	**2237**	**2035.1**		**27.5**	**27.8**	**24.9**
						1.26%	**1.24%**	**1.22%**

Table 14 2. *African marine capture value and tonnages as estimated from the data provided as part of the "Sea Around Us" project, for 2010 - Pauly and Zeller (2015).*

Country By AU Region	Landed Value Reported	%	Tonnage Reported	%
Central Africa	$844,494,401.13	11.77 %	428437.0 MT	7.22 %
Angola	$573,193,921.81		253188.4 MT	
Cameroon	$60,486,300.50		63990.3 MT	
Congo, R. of	$84,577,533.60		36412.9 MT	
DRC	$10,136,364.89		6261.9 MT	
Equatorial Guinea	$15,071,186.87		9113.4 MT	
Gabon	$88,941,301.27		52909.2 MT	
Sao Tome & Principe	$12,087,792.20		6560.8 MT	
Eastern Africa	$647,691,742.06	9.02 %	375465.0 MT	6.33 %
Comoros Isl.	$16,612,405.10		14971.2 MT	
Djibouti	$3,103,533.97		1831.4 MT	
Eritrea	$4,586,453.04		4397.3 MT	
Kenya	$19,146,002.85		10170.9 MT	
Madagascar	$247,408,394.08		120897.8 MT	
Mauritius	$36,441,672.21		15892.0 MT	
Mozambique	$414,610,956.91		130233.9 MT	
Seychelles	$111,537,211.76		73978.2 MT	
Somalia	$98,394,019.45		41639.5 MT	
Tanzania	$110,462,049.61		91686.7 MT	
Northern Africa	$1,922,920,572.11	26.79 %	1582179.8 MT	26.67 %
Algeria	$183,585,861.93		113197.6 MT	
Egypt	$126,738,720.76		93124.1 MT	
Libya	$121,055,194.02		50125.3 MT	
Morocco	$1,329,494,040.50		1246206.0 MT	
Sudan	$2,595,545.20		1722.3 MT	
Tunisia	$159,451,209.70		77804.4 MT	
Southern Africa	$705,814,623.05	9.83 %	1010153.9 MT	17.03 %
Namibia	$206,776,764.98		371337.7 MT	
South Africa	$499,037,858.07		638816.2 MT	
Western Africa	$2,641,966,866.58	36.81 %	2404906.8 MT	40.55 %
Benin	$11,083,973.80		9498.0 MT	
Côte d'Ivoire	$92,065,409.33		59029.8 MT	
Cape Verde	$34,386,406.22		15037.4 MT	
Gambia	$109,934,950.56		123293.1 MT	
Ghana	$299,283,413.69		238709.9 MT	
Guinea	$158,828,855.24		156896.5 MT	
Guinea-Bissau	$109,709,974.27		64367.7 MT	
Liberia	$35,122,328.48		17544.9 MT	
Mauritania	$593,687,602.27		777296.6 MT	
Nigeria	$477,918,386.45		324023.4 MT	
Senegal	$542,585,615.63		400536.7 MT	
Sierra Leone	$150,288,271.88		196554.2 MT	
Togo	$27,071,678.76		22118.5 MT	
Grand Total Africa	$7,177,499,161.83	100.00 %	5931376.4 MT	100.00 %

Table 14 3. *Catch estimates for marine capture fisheries for African coastal countries for catches within the EEZ. Method: Based on FAO Global Marine Capture 2008 - 2013 using FishStat data.*

Country By AU Region	2010	2011	2012	2013	Average	% Africa
Angola	270000.0 MT	263000.0 MT	267000.0 MT	265000.0 MT	266250.0 MT	
Cameroon	40721.0 MT	45826.0 MT	61658.0 MT	78455.0 MT	56665.0 MT	
Congo, R. of	34686.0 MT	39843.0 MT	43184.0 MT	37127.0 MT	38710.0 MT	
DRC	4491.0 MT	4250.0 MT	4000.0 MT	3818.0 MT	4139.8 MT	
Equatorial Guinea	6376.0 MT	6115.0 MT	9758.0 MT	7600.0 MT	7462.3 MT	
Gabon	22292.0 MT	25822.0 MT	23000.0 MT	23000.0 MT	23528.5 MT	
Sao Tome and Principe	4827.0 MT	5100.0 MT	5400.0 MT	5750.0 MT	5269.3 MT	
Central Africa	383393.0 MT	389956.0 MT	414000.0 MT	420750.0 MT	402024.8 MT	7.80 %
Comoros Isl.	63517.0 MT	38218.0 MT	12343.0 MT	10400.0 MT	31119.5 MT	
Djibouti	1590.0 MT	1667.0 MT	2167.0 MT	1702.0 MT	1781.5 MT	
Eritrea	3286.0 MT	2639.0 MT	4152.0 MT	4000.0 MT	3519.3 MT	
Kenya	8629.0 MT	7346.0 MT	8887.0 MT	9160.0 MT	8505.5 MT	
Madagascar	94138.0 MT	96238.0 MT	91075.0 MT	81434.0 MT	90721.3 MT	
Mauritius	7226.0 MT	7266.0 MT	6604.0 MT	7309.0 MT	7101.3 MT	
Mozambique	117719.0 MT	120132.0 MT	145611.0 MT	137241.0 MT	130175.8 MT	
Seychelles	87108.0 MT	75483.0 MT	68702.0 MT	74128.0 MT	76355.3 MT	
Somalia	29800.0 MT	29800.0 MT	29800.0 MT	29800.0 MT	29800.0 MT	
Tanzania	54366.0 MT	55103.0 MT	60409.0 MT	67422.0 MT	59325.0 MT	
Eastern Africa	467379.0 MT	433892.0 MT	429750.0 MT	422596.0 MT	438404.3 MT	8.50 %
Algeria	93607.0 MT	101762.0 MT	105543.0 MT	100058.0 MT	100242.5 MT	
Egypt	121363.0 MT	122304.0 MT	114199.0 MT	106662.0 MT	116132.0 MT	
Libya	50006.0 MT	30004.0 MT	35004.0 MT	36004.0 MT	37754.5 MT	
Morocco	1136426.1 MT	955685.4 MT	1153645.4 MT	1243937.7 MT	1122423.6 MT	
Sudan	5358.0 MT	5008.0 MT	5008.0 MT	5008.0 MT	5095.5 MT	
Tunisia	96667.8 MT	101976.0 MT	108709.0 MT	109898.7 MT	104312.9 MT	
Northern Africa	1503427.9 MT	1316739.4 MT	1522108.4 MT	1601568.4 MT	1485961.0 MT	28.82 %
Namibia	379128.0 MT	411125.0 MT	465883.0 MT	482938.0 MT	434768.5 MT	
South Africa	639189.0 MT	543433.0 MT	718095.0 MT	424193.0 MT	581227.5 MT	
Southern Africa	1018317.0 MT	954558.0 MT	1183978.0 MT	907131.0 MT	1015996.0 MT	19.71 %
Benin	9441.0 MT	7743.0 MT	12158.0 MT	16256.0 MT	11399.5 MT	
Cape Verde	19713.0 MT	22130.0 MT	20189.0 MT	23646.0 MT	21419.5 MT	
Côte d'Ivoire	67508.0 MT	65305.0 MT	71976.0 MT	71110.0 MT	68974.8 MT	
Gambia	41970.0 MT	36700.0 MT	31091.0 MT	39155.0 MT	37229.0 MT	
Ghana	280259.0 MT	275558.0 MT	284939.0 MT	207912.0 MT	262167.0 MT	
Guinea	97504.0 MT	104500.0 MT	112233.0 MT	105000.0 MT	104809.3 MT	
Guinea-Bissau	6434.0 MT	6399.0 MT	6400.0 MT	6400.0 MT	6408.3 MT	
Liberia	7300.0 MT	7300.0 MT	7300.0 MT	7300.0 MT	7300.0 MT	
Mauritania	261238.0 MT	357011.0 MT	422709.0 MT	277624.0 MT	329645.5 MT	
Nigeria	323599.0 MT	334205.0 MT	356745.0 MT	381856.0 MT	349101.3 MT	
Senegal	375604.0 MT	393726.0 MT	427713.0 MT	438149.0 MT	408798.0 MT	
Sierra Leone	186000.0 MT	190400.0 MT	190000.0 MT	186000.0 MT	188100.0 MT	
Togo	22535.0 MT	19122.0 MT	14320.0 MT	15015.0 MT	17748.0 MT	
Western Africa	1699105.0 MT	1820099.0 MT	1957773.0 MT	1775423.0 MT	1813100.0 MT	35.17 %
Total Africa	5071621.9 MT	4915244.4 MT	5507609.4 MT	5127468.4 MT	5155486.0 MT	100.00 %

Table 14 4. *Use of the data from Pauly and Zeller (2016) to provide country by country estimates of IUU fishing. Values and landings figures are circa 2016. Amounts include discards.*

Country By AU Region	Landed Value Reported	Landed Value Unreported with unreported price	Landed Value Unreported with reported price	LV IUU Ratio	LV IUU %	Tonnage Reported	Tonnes Unreported	Tonnage IUU Ratio	Tonnage IUU %
Central Africa	$844,494,401	$797,072,207	$886,212,711	0.94	48.6 %	428437 MT	430069 MT	1.004	50.1 %
Angola	$573,193,922	$450,612,265	$512,829,666	0.786	44.0 %	253188 MT	226525 MT	0.895	47.2 %
Cameroon	$60,486,300	$26,173,180	$15,212,475	0.433	30.2 %	63990 MT	16094 MT	0.252	20.1 %
Congo, R. of	$84,577,534	$105,810,127	$159,837,769	1.251	55.6 %	36413 MT	68815 MT	1.890	65.4 %
DRC	$10,136,365	$32,910,959	$29,872,277	3.247	76.5 %	6262 MT	18454 MT	2.947	74.7 %
Equatorial Guinea	$15,071,187	$41,635,937	$44,197,452	2.763	73.4 %	9113 MT	26726 MT	2.933	74.6 %
Gabon	$88,941,301	$131,544,685	$115,333,558	1.479	59.7 %	52909 MT	68609 MT	1.297	56.5 %
Sao Tome & Principe	$12,087,792	$8,385,054	$8,929,515	0.694	41.0 %	6561 MT	4847 MT	0.739	42.5 %
Eastern Africa	$1,062,302,699	$392,223,680	$444,229,417	0.369	27.0 %	505699 MT	212929 MT	0.421	29.6 %
Comoros Isl.	$16,612,405	$8,078,090	$8,905,741	0.486	32.7 %	14971 MT	8026 MT	0.536	34.9 %
Djibouti	$3,103,534	$3,933,614	$3,781,446	1.267	55.9 %	1831 MT	2231 MT	1.218	54.9 %
Eritrea	$4,586,453	$3,561,182	$3,210,574	0.776	43.7 %	4397 MT	3078 MT	0.700	41.2 %
Kenya	$19,146,003	$14,191,214	$14,379,586	0.741	42.6 %	10171 MT	7639 MT	0.751	42.9 %
Madagascar	$247,408,394	$98,144,711	$93,820,131	0.397	28.4 %	120898 MT	45846 MT	0.379	27.5 %
Mauritius	$36,441,672	$7,890,646	$11,841,128	0.217	17.8 %	15892 MT	5164 MT	0.325	24.5 %
Mozambique	$414,610,957	$69,362,781	$63,845,823	0.167	14.3 %	130234 MT	20055 MT	0.154	13.3 %
Seychelles	$111,537,717	$1,897,777	$1,573,777	0.017	1.7 %	73978 MT	1043 MT	0.014	1.4 %
Somalia	$98,394,019	$140,630,192	$200,925,888	1.429	58.8 %	41640 MT	85030 MT	2.042	67.1 %
Tanzania	$110,462,050	$44,538,475	$41,945,878	0.403	28.7 %	91687 MT	34816 MT	0.380	27.5 %
Northern Africa	$1,922,920,572	$4,435,079,956	$2,132,420,513	2.306	69.8 %	1582180 MT	1853435 MT	1.171	53.9 %
Algeria	$183,585,862	$383,810,392	$192,540,971	2.091	67.6 %	113198 MT	118719 MT	1.049	51.2 %
Egypt	$176,738,771	$73,212,865	$59,775,707	0.578	36.6 %	93124 MT	44584 MT	0.479	32.4 %
Libya	$121,055,194	$121,000,733	$126,020,104	1.000	50.0 %	50125 MT	52181 MT	1.041	51.0 %
Morocco	$1,329,494,040	$3,834,451,360	$1,729,111,332	2.884	74.3 %	1246206 MT	1625701 MT	1.305	56.6 %
Sudan	$7,595,545	$776,935	$776,935	0.087	8.0 %	1772 MT	151 MT	0.087	8.0 %
Tunisia	$159,451,210	$22,377,670	$24,795,969	0.140	12.3 %	77804 MT	12099 MT	0.156	13.5 %
Southern Africa	$705,814,623	$331,512,130	$105,255,760	0.470	32.0 %	1010154 MT	139189 MT	0.138	12.1 %
Namibia	$206,776,765	$135,680,014	$44,322,991	0.656	39.6 %	371338 MT	79597 MT	0.214	17.7 %
South Africa	$499,037,858	$195,832,116	$60,932,769	0.392	28.2 %	638816 MT	59592 MT	0.093	8.5 %
Western Africa	$2,641,966,867	$7,989,924,426	$4,026,153,338	3.024	75.2 %	2404907 MT	3741324 MT	1.556	60.9 %
Benin	$11,083,974	$80,563,367	$74,042,434	7.268	87.9 %	9498 MT	63448 MT	6.680	87.0 %
Côte d'Ivoire	$92,065,409	$175,665,245	$175,741,532	1.908	65.6 %	59030 MT	112681 MT	1.909	65.6 %
Cape Verde	$34,386,406	$31,091,194	$25,900,778	0.904	47.5 %	15037 MT	11377 MT	0.753	43.0 %
Gambia	$109,934,951	$89,245,400	$49,656,019	0.812	44.8 %	123293 MT	55690 MT	0.452	31.1 %
Ghana	$299,283,414	$504,112,275	$263,191,787	1.684	62.7 %	238710 MT	209923 MT	0.879	46.8 %
Guinea	$158,828,855	$1,590,470,366	$689,859,133	10.014	90.9 %	156897 MT	681466 MT	4.343	81.3 %
Guinea-Bissau	$109,709,974	$522,922,892	$384,753,169	4.766	82.7 %	64368 MT	225738 MT	3.507	77.8 %
Liberia	$35,177,378	$177,961,979	$154,813,780	5.067	83.5 %	17545 MT	77335 MT	4.408	81.5 %
Mauritania	$593,687,602	$3,332,833,823	$1,128,665,558	5.614	84.9 %	177297 MT	1477726 MT	1.901	65.5 %
Nigeria	$477,918,386	$470,666,336	$272,368,691	0.985	49.6 %	324023 MT	184663 MT	0.570	36.3 %
Senegal	$547,585,616	$810,947,179	$687,197,940	1.495	59.9 %	400537 MT	503595 MT	1.257	55.7 %
Sierra Leone	$150,288,272	$103,191,269	$72,593,211	0.687	40.7 %	196554 MT	94941 MT	0.483	32.6 %
Togo	$27,071,679	$100,258,201	$52,374,356	3.703	78.7 %	22119 MT	42792 MT	1.935	65.9 %
Grand Total Africa	$7,177,499,162	$13,945,812,399	$7,594,271,739	1.943	66.0 %	5931376 MT	6376946 MT	1.075	51.8 %

Table 14 5. *Use of the data from Pauly and Zeller (2016) to provide country by country estimates of IUU fishing. Values and landings figures are circa 2010. Amounts exclude discards*

Country By AU Region	Landed Value Reported	Landed Value Unreported without Discards using "Unreported price"	Landed Value Unreported without Discards using "Reported price"	LV IUU Ratio	LV IUU %	Tonnage Reported	Tonnes Unreported - Discards	Tonnage Ratio	Tonnage IUU %
Central Africa	$844,494,401	$635,484,337	$696,742,828	0.75	42.9 %	428437 MT	342091 MT	0.798	44.4 %
Angola	$573,193,922	$343,367,242	$385,202,811	0.599	37.5 %	253188 MT	170150 MT	0.672	40.2 %
Cameroon	$60,486,300	$23,974,431	$13,831,163	0.396	28.4 %	63990 MT	14632 MT	0.229	18.6 %
Congo, R. of	$84,577,534	$79,843,853	$123,143,973	0.944	48.6 %	36413 MT	53017 MT	1.456	59.3 %
DRC	$10,136,365	$26,116,093	$22,106,761	2.576	72.0 %	6262 MT	13657 MT	2.181	68.6 %
Equatorial Guinea	$15,071,187	$38,391,340	$40,769,917	2.547	71.8 %	9113 MT	24653 MT	2.705	73.0 %
Gabon	$88,941,301	$115,712,414	$102,880,323	1.301	56.5 %	52909 MT	61201 MT	1.157	53.6 %
Sao Tome & Principe	$12,087,792	$8,078,965	$8,807,880	0.668	40.1 %	6561 MT	4781 MT	0.729	42.2 %
Eastern Africa	$647,691,742	$281,666,664	$340,602,890	0.435	30.3 %	375465 MT	173354 MT	0.462	31.6 %
Comoros Isl.	$16,612,405	$8,078,090	$8,905,741	0.486	32.7 %	14971 MT	8026 MT	0.536	34.9 %
Djibouti	$3,103,534	$3,447,460	$3,437,412	1.111	52.6 %	1831 MT	2028 MT	1.108	52.6 %
Eritrea	$4,586,453	$1,744,766	$1,967,010	0.380	27.6 %	4397 MT	1886 MT	0.429	30.0 %
Kenya	$19,146,003	$14,191,214	$14,379,586	0.741	42.6 %	10171 MT	7639 MT	0.751	42.9 %
Madagascar	$247,408,394	$88,913,460	$84,812,226	0.359	26.4 %	120898 MT	41444 MT	0.343	25.5 %
Mauritius	$36,441,672	$7,887,872	$11,839,279	0.216	17.8 %	15892 MT	5163 MT	0.325	24.5 %
Mozambique	$414,610,957			0.000	0.0 %	130234 MT		0.000	0.0 %
Seychelles	$111,537,212	$1,540,245	$1,311,848	0.014	1.4 %	73978 MT	870 MT	0.012	1.2 %
Somalia	$98,394,019	$115,519,873	$175,221,398	1.174	54.0 %	41640 MT	74152 MT	1.781	64.0 %
Tanzania	$110,467,050	$40,343,684	$38,778,391	0.365	26.8 %	91687 MT	32146 MT	0.351	26.0 %
Northern Africa	$1,922,920,572	$3,458,072,063	$1,624,531,151	1.798	64.3 %	1582180 MT	1425486 MT	0.901	47.4 %
Algeria	$183,585,862	$292,916,363	$153,639,383	1.596	61.5 %	113198 MT	94733 MT	0.837	45.6 %
Egypt	$126,738,721	$46,905,260	$46,124,966	0.370	27.0 %	93124 MT	33348 MT	0.358	26.4 %
Libya	$121,055,194	$74,327,119	$67,319,681	0.614	38.0 %	50125 MT	27875 MT	0.556	35.7 %
Morocco	$1,329,494,040	$3,042,464,025	$1,355,798,849	2.288	69.6 %	1246206 MT	1268686 MT	1.018	50.4 %
Sudan	$7,595,545	$726,935	$726,935	0.087	8.0 %	1772 MT	151 MT	0.087	8.0 %
Tunisia	$159,451,210	$1,737,360	$1,471,338	0.008	0.8 %	77804 MT	694 MT	0.009	0.9 %
Southern Africa	$705,814,623	$161,560,670	$61,444,284	0.229	18.6 %	1010154 MT	76942 MT	0.076	7.1 %
Namibia	$206,776,765	$64,507,163	$32,878,116	0.312	23.8 %	371338 MT	59044 MT	0.159	13.7 %
South Africa	$499,037,858	$97,053,506	$28,566,169	0.194	16.3 %	638816 MT	17898 MT	0.028	2.7 %
Western Africa	$2,641,966,867	$5,631,844,619	$2,859,827,542	2.132	68.1 %	2404907 MT	2664174 MT	1.108	52.6 %
Benin	$11,083,974	$77,525,419	$73,084,965	6.994	87.5 %	9498 MT	62628 MT	6.594	86.8 %
Côte d'Ivoire	$92,065,409	$108,534,887	$97,109,897	1.179	54.1 %	59030 MT	62264 MT	1.055	51.3 %
Cape Verde	$34,386,406	$13,569,842	$12,780,636	0.395	28.3 %	15037 MT	5589 MT	0.372	27.1 %
Gambia	$109,934,951	$76,609,531	$41,441,109	0.697	41.1 %	123293 MT	46477 MT	0.377	27.4 %
Ghana	$299,283,414	$208,587,760	$108,103,935	0.697	41.1 %	238710 MT	86224 MT	0.361	26.5 %
Guinea	$158,828,855	$1,025,890,630	$474,006,075	6.459	86.6 %	156897 MT	468239 MT	2.984	74.9 %
Guinea-Bissau	$109,709,974	$283,608,406	$231,260,053	2.585	72.1 %	64368 MT	135682 MT	2.108	67.8 %
Liberia	$35,122,328	$126,259,436	$109,774,160	3.595	78.2 %	17545 MT	54836 MT	3.125	75.8 %
Mauritania	$593,687,602	$2,408,075,739	$789,367,739	4.056	80.2 %	777797 MT	1033488 MT	1.330	57.1 %
Nigeria	$477,918,386	$436,190,934	$747,378,039	0.913	47.7 %	324023 MT	164796 MT	0.507	33.6 %
Senegal	$542,585,616	$688,172,361	$564,510,554	1.268	55.9 %	400537 MT	416722 MT	1.040	51.0 %
Sierra Leone	$150,288,272	$87,383,581	$67,032,009	0.581	36.8 %	196554 MT	87668 MT	0.446	30.8 %
Togo	$27,071,679	$91,486,092	$49,033,372	3.379	77.2 %	22119 MT	40062 MT	1.811	64.4 %
Grand Total Africa	$7,177,499,162	$10,168,628,353	$5,583,148,695	1.417	58.6 %	5931376 MT	4682047 MT	0.789	44.1 %

Table 14 6: *Sixty-eight IUU vessels were listed by the IOTC as of 18-03-2016. Source: http://iuu-vessels.org/iuu, maintained by Trygg Mat Tracking.*

IUU Vessel	IMO #	IRCS	IUU Vessel	IMO #	IRCS	IUU Vessel	IMO #	IRCS
Aneka 228			Hoom Xiang 105			Sri Fu Fa 168		
Balena			Hoom Xiang 11			Sri Fu Fa 18		
Blue Ocean Marine	7826271	V3AF3	Kim Seng Deng 3			Sri Fu Fa 188		
Chi Tong			KM. Aneka 228			Sri Fu Fa 189		
Feng Jung Chin 1			Kuang Hsing 127			Sri Fu Fa 286		
Fu Hsiang Fa 18			Kuang Hsing 196			Sri Fu Fa 67		
Fu Hsiang Fa No. 01			Kunlun	7322897	J8B5336	Sri Fu Fa 888		
Fu Hsiang Fa No. 02			Lingsar 08			Tian Lung No. 12		
Fu Hsiang Fa No. 06			Mann Yih Hsing			TS Elegance	8919403	V3PB8
Fu Hsiang Fa No. 08			Ocean Explorer	7826245		TS Emerald	8919415	V3PG8
Fu Hsiang Fa No. 09			Ocean Liberty	7806702		TS Excellence	8919427	TGSY3
Fu Hsiang Fa No. 11			Ocean Lion	7826233	3CM2155	TS Prosperity	9223227	9GHE
Fu Hsiang Fa No. 13			Ocean Star Marine	7817440	V3AG3	Wan Feng		
Fu Hsiang Fa No. 17			Parsian Shila	9404285	9BKI	Yi Hong 106		
Fu Hsiang Fa No. 20			Rawad 1	8655409	A4DD9	Yi Hong 116		
Fu Hsiang Fa No. 21		OTSO24 or OTSO89	Samudera Perkasa 11			Yi Hong 16		
Fu Hsiang Fa No. 23			Samudera Perkasa 12			Yi Hong 3		
Fu Hsiang Fa No. 26			Shuen Siang			Yi Hong 6		
Fu Hsiang Fa No. 30			Sin Shun Fa 6			Yongding	9042001	3CAE
Full Rich		HMEK3	Sin Shun Fa 67			Yu Fong 168		BJ4786
Gunsur Melyan 21			Sin Shun Fa 8			Yu Fu 11		
Hoom Xiang 101			Sin Shun Fa 9			Yu Mann Won		
Hoom Xiang 103			Songhua	9319856	3CAF			

Table 14 7. *Colour coding red and green denotes a source of information which is alternative to the estimate provide by Pauly and Zeller (2015), The Sea Around Us (SAU) data. Red indicates that the value for the reported quantum from the alternative source is less than the SAU data, green indicates that it is larger than the SAU data. Brown indicates that the alternative source is cumulative for a number of years, and cannot be compared. Black on white numbers are species or sector specific and therefore also strictly not comparable. A blue background means that the corresponding Pauly and Zeller (2015) amount was not available to this study. This table is for Central Africa.*

Country	LV Reported	LV Unreported	LV IUU Ratio	LV IUU %	Tonnage R	Tonnes IUU	Tonnage IUU Ratio	Tonnage IUU %	Source	Note
Central Africa	$333,000,000.00	$96,557,669.63			334154.00 MT	101125.19 MT	0.303	23.23 %	MRAG 2005b	Based On 2003 FAO Catch data
					18679885.3 MT	12436174.9 MT	0.666	39.97 %		Cumulative Total Domestic
Questionnaire Min								50.0 %		
Questionnaire Max								70.0 %		
Angola	$205,000,000.00	$49,027,261.46			202033.00 MT	48317.68 MT	0.239	19.30%	MRAG 2005b	Based On 2003 FAO Catch data
						63700.0 MT [1]			Belhabib & Derovich 2015	1 Industrial [2010]
					13338049.00 MT [2]	6390951.00 MT [2]	0.479[2]	33.0 %		2[Cumulative Total Domestic
								50.0 %		
Cameroon	$37,000,000.00	$15,039,381.15			62801.0 MT	25526.71 MT	0.406	28.90%	MRAG 2005b	Based On 2003 FAO Catch data
						9500.0 MT/year [1]			Belhabib & Pauly 2015a	1[Late 2000s
					2638432.00 MT [2]	1308168.00 MT [2]	0.496[2]	33.15 %[2]		2[Cumulative Total Domestic
Congo, R. of	$26,000,000.00	$15,204,437.40			22683.0 MT	13264.70 MT	0.585	36.90%	MRAG 2005b	Based On 2003 FAO Catch data
					975089.0 MT	1833271.0 MT	1.880	65.28 %	Belhabib & Pauly 2015b	Cumulative Total Domestic
DRC	$4,000,000.00	$4,908,685.97			4010.0 MT	4921.0 MT	1.227	55.10%	MRAG 2005b	Based On 2003 FAO Catch data
					133628.00 MT	404962.00 MT	3.031	75.19 %	Belhabib et al. 2015c	Cumulative Total Domestic
Equatorial Guinea	$2,000,000.00	$1,215,434.08			2650.0 MT	1610.5 MT	0.608	37.80%	MRAG 2005b	Based On 2003 FAO Catch data
					158134.0 MT	483066.0 MT	3.055	75.34 %	Belhabib et al. 2015a	Cumulative Total Domestic
Gabon	$55,000,000.00	$10,632,458.23			35972.00 MT	6954.01 MT	0.193	16.20%	MRAG 2005b	Based On 2003 FAO Catch data
	$1,300,000,000.00	$207,000,000.00			1048950.0 MT	1593180.0 MT	1.519	60.30%	Belhabib 2015c	Cumulative Total Domestic
Sao Tome & Principe	$4,000,000.00	$530,011.33			4005.0 MT	530.7 MT	0.133	11.70%	MRAG 2005b	Based On 2003 FAO Catch data
					387603.3 MT	422576.9 MT	1.090	52.16	Belhabib 2015b	Cumulative Total Domestic

Table 14 8. *Colour coding red and green denotes a source of information which is alternative to the estimate provide by Pauly and Zeller (2015), The Sea Around Us (SAU) data. Red indicates that the value for the reported quantum from the alternative source is less than the SAU data, green indicates that it is larger than the SAU data. Brown indicates that the alternative source is cumulative for a number of years, and cannot be compared. Black on white numbers are species or sector specific and therefore also strictly not comparable. A blue background means that the corresponding Pauly and Zeller (2015) amount was not available to this study. This table is for Eastern Africa*

Country	LV Reported	LV Unreported	LV IUU Ratio	LV IUU %	Tonnage R	Tonnes IUU	Tonnage IUU Ratio	Tonnage IUU %	Source	Note
Eastern Africa	$789,000,000.00	$187,594,913.07			382055.75 MT	132360.91 MT	0.509	21.80%	MRAG 2005b	Based On 2003 FAO Catch data
					9285385.00 MT	12861484.00 MT	1.385	58.07%		
Questionnaire Min		$ 300000000				132000.0 MT		0.05%		
Questionnaire Max								98.00%		
Comoros Isl.	$22,000,000.00	$8,386,740.33			11053.00 MT	4213.57 MT	0.381	27.60%	MRAG 2005b	Based On 2003 FAO Catch data
					379319.00 MT	136673.00 MT	0.360	26.49%	Doherty et al. 2015a	Cumulative Total Domestic
Djibouti	$400 000.00[3]				350.0 MT [1]				FAO_De Young_2006	1[Artisanal [2002]
					25773.0 MT	9792.0 MT	0.380	27.53%	Gelbêter et al. 2015	Cumulative Total Domestic
Eritrea	$13,000,000.00	$6,230,769.23			6689.00 MT	3205.97 MT	0.479	32.40%	MRAG 2005b	Based On 2003 FAO Catch data
					324748.0 MT	379217.0 MT	1.168	53.87%	Teclemichael & Mehamud 2012	Cumulative Total
	$42 000 000.00[3] $1 201 000.00[2]								World Bank -IBI 2012	1[Extended fisheries GDP 2[GDP [2007]
	$12 200 000.00				9306.0 MT				FAO_De Young_2006	Industrial + Artisanal [Demersal, Shrimp& Pelagic, 2006]
Kenya	$15,000,000.00	$3,750,000.00			7095.00 MT	1773.75 MT	0.250	20.00%	MRAG 2005b	Based On 2003 FAO Catch data
					350284.0 MT	616351.0 MT	1.760	63.76%	Le Manach et al. 2015a	Cumulative Total Domestic
	$6 300 000.00[3] $4 100 000.00[2]				5811.00 MT [2]				FAO_De Young_2006	1[Total [2003] 2[Demersal, Pelagic, Crustacean & Molluscs
Madagascar	$247,000,000.00	$13,823,653.64			100670.00 MT	5634.12 MT	0.056	5.30%	MRAG 2005b	Based On 2003 FAO Catch data
					2395686.00 MT	2297426.0 MT	0.959	48.95%	Le Manach et al. 2011	Cumulative Total Domestic
	$59 000 000.00[3] $2 390 000.00[2]								FAO_De Young_2006	Profit Margins 1[Industrial [2002] 2[Artisanal [2002]
Mauritius	$18,000,000.00				10968.00 MT		0.000	0.00%	MRAG 2005b	Based On 2003 FAO Catch data
					478303.0 MT	204089.0 MT	0.427	29.91%	Boistel et al. 2011	Cumulative Total
	$29,358,098.00				10044.0 MT				FAO_De Young_2006	Total [2002]
Mozambique	$215,000,000.00	$37,941,176.47			76926.00 MT	13575.18 MT	0.176	15.00%	MRAG 2005b	Based On 2003 FAO Catch data
					1788639.0 MT	6405904.0 MT	3.581	78.17%	Doherty et al. 2015b	Cumulative Total Domestic
	$159 936 000.00[3] $50 000 000.00[2]				19584.00 MT [1] 80000.00 MT [2]				FAO_De Young_2006	1[Semi-Industrial & Industrial [2003] 2[Artisanal [2003]
Seychelles	$137,000,000.00	$7,514,767.93			86020.00 MT	4718.40 MT	0.055	5.20%	MRAG 2005b	Based On 2003 FAO Catch data
					223180.0 MT	65761.0 MT	0.295	22.76%	Le Manach et al. 2015b	Cumulative Total Domestic
	$5,800,000.00				3450.0 MT				FAO_De Young_2006	Artisanal [Trap, semi-pelagic & demersal handline]
Somalia	$31,000,000.00	$93,000,000.00			29800.00 MT	89400.00 MT	3.000	75.00%	MRAG 2005b	Based On 2003 FAO Catch data
					922886.00 MT	904614.00 MT	0.980	49.50%	Persson et al. 2015	Cumulative Total Domestic
	$450,000,000.00								FAO 2011	2005
Tanzania	$91,000,000.00	$16,947,805.46			52834.8 MT	9839.9 MT	0.186	15.70%	MRAG 2005b	Based On 2003 FAO Catch data
					2396567.0 MT	1841657.0 MT	0.768	43.45%	Bollet et al. 2015	Cumulative Total Domestic

Table 14 9. *Colour coding red and green denotes a source of information which is alternative to the estimate provide by Pauly and Zeller (2015), The Sea Around Us (SAU) data. Red indicates that the value for the reported quantum from the alternative source is less than the SAU data, green indicates that it is larger than the SAU data. Brown indicates that the alternative source is cumulative for a number of years, and cannot be compared. Black on white numbers are species or sector specific and therefore also strictly not comparable. A blue background means that the corresponding Pauly and Zeller (2015) amount was not available to this study. This table is for Northern Africa.*

Country	LV Reported	LV Unreported	LV IUU Ratio	LV IUU %	Tonnage R	Tonnes IUU	Tonnage IUU Ratio	Tonnage IUU %	Source	Note
Northern Africa	$734,000,000.00	$59,513,513.51			928123.60 MT	75253.26 MT	0.081	7.50%	MRAG 2005b	Based On 2003 FAO Catch data
					39974977.00 MT	27259938.00 MT	0.669	37.60%		Cumulative Total Domestic
Questionnaire Min								10.00%		
Questionnaire Max								55.00%		
Algeria								80%[1] 20 - 40%[2]		1] Artisanal 2] Shark
						118043.00 MT [1] 1700.00 MT [2] 2728.00 MT [3]				1] Total small fish 2] Shrimp [1994-2010] 3] Bluefin Tuna [2000 - 2002]
					3897877.0 MT	3421906.0 MT	0.878	46.75%		Cumulative Total Domestic
Egypt					3363928.00 MT	1987138.00 MT	0.591	37.13%		Cumulative Total Domestic
							0.7[1]	10%[1] 10 - 30 %[2]		1] Artisanal 2] Subsistance 3] Industrial [2010]
Libya								5.3%[1] 16.7%[2]		1] Industrial 2] Artisanal
					974612.0 MT	1276656.0 MT	1.310	56.71%		Cumulative Total Domestic
Morocco	$734,000,000.00	$59,513,513.51			928123.60 MT	75253.26 MT	0.081	7.50%	MRAG 2005b	Based On 2003 FAO Catch data
					28323942.0 MT	20121257.0 MT	0.710	41.53%		Cumulative Total Domestic
					18000.00 MT			50.00%		Mediterranean [2006]
					630.00 MT [1] 20000.00 MT [2]					1] Bluefin Tuna 2] Cephalopod
Sudan					91873.0 MT	36657.0 MT	0.399	32.35%		Cumulative Total Domestic
Tunisia					3322745.0 MT	416324.0 MT	0.125	11.1%		Cumulative Total Domestic
								42%[1] 17%[2] 15%[3]		1] Artisanal 2] Trawl 3] Small pelagic

Table 14 10. *Colour coding red and green denotes a source of information which is alternative to the estimate provide by Pauly and Zeller (2015), The Sea Around Us (SAU) data. Red indicates that the value for the reported quantum from the alternative source is less than the SAU data, green indicates that it is larger than the SAU data. Brown indicates that the alternative source is cumulative for a number of years, and cannot be compared. Black on white numbers are species or sector specific and therefore also strictly not comparable. A blue background means that the corresponding Pauly and Zeller (2015) amount was not available to this study. This table is for Southern Africa.*

Country	LV Reported	LV Unreported	LV IUU Ratio	LV IUU %	Tonnage R	Tonnes IUU	Tonnage IUU Ratio	Tonnage IUU %	Source	Note
South Africa	$1,158,000,000.00				1475084.0 MT				MRAG 2005b	Based On 2003 FAO Catch data
					65116148.00 MT	5287018.72 MT	0.083	7.65%		Cumulative Total Domestic
Questionnaire Min						500.0 MT		10.0 %		
Questionnaire Max						8000.0 MT				
Namibia	$532,000,000.00				635707.0 MT				MRAG 2005b	Based On 2003 FAO Catch data
					11175069.0 MT	953337.7 MT	0.085	7.86%	http://www.seaaroundus.org/	Cumulative Total Domestic
South Africa	$626,000,000.00				839377.00 MT				MRAG 2005b	Based On 2003 FAO Catch data
					53941079.0 MT	4333681.0 MT	0.080	7.44%	Bunet et al. 2015	Cumulative Total Domestic
		$82 700 000.00[1] $68 900 000.00[2] $45 000 000.00[3] $20 000 000.00[4]				>1000.00 MT [1] 30000.00 MT [2] 60.00 MT [3] 40.00 MT [4]		15%[1]	1] This Report ? 2] SF 2008 3] Okuz 2004 b	1] Abalone 2] Toothfish 3] SCRS [1987 - 2003] & WCSS [1998 - 2008]

Table 14 11. *Colour coding red and green denotes a source of information which is alternative to the estimate provide by Pauly and Zeller (2015), The Sea Around Us (SAU) data. Red indicates that the value for the reported quantum from the alternative source is less than the SAU data, green indicates that it is larger than the SAU data. Brown indicates that the alternative source is cumulative for a number of years, and cannot be compared. Black on white numbers are species or sector specific and therefore also strictly not comparable. A blue background means that the corresponding Pauly and Zeller (2015) amount was not available to this study. This table is for Western Africa*

Country By AU Region	LV Reported	LV Unreported	LV IUU Ratio	LV IUU %	Tonnage R	Tonnage IUU	Tonnage IUU Ratio	Tonnage IUU %	Source	Note
Western Africa	$1,688,000,000.00	$594,178,908.69			1569668.0 MT	476330.1 MT	0.381	23.96%	MRAG 2005b	Based On 2003 FAO Catch data
					46895608.76 MT	62756832.21 MT	2.204	61.05%		Cumulative Total Domestic
Questionnaire Min								10.0 %		
Questionnaire Max								37.0 %		
Benin	$14,000,000.00	$1,695,067.26			11648.0 MT	1410.3 MT	0.121	10.80%	MRAG 2005b	Based On 2003 FAO Catch data
					1780840.0 MT	2155560.0 MT	1.245	55.46%	Belhabib and Pauly 2015c	Cumulative Total Domestic
Côte d'Ivoire	$51,000,000.00	$42,065,693.43			46903.00 MT	38686.42 MT	0.825	45.20%	MRAG 2005b	Based On 2003 FAO Catch data
					2638383.0 MT	4384117.0 MT	1.662	62.43%	Belhabib and Pauly 2015d	Cumulative Total
Cape Verde	$11,000,000.00				8136.00 MT				MRAG 2005b	Based On 2003 FAO Catch data
					408280.0 MT	306279.0 MT	0.759	43.16%	Santos et al. 2013	Cumulative Total Domestic
Gambia	$24,000,000.00	$2,905,829.60			34366.00 MT	4160.91 MT	0.121	10.80%	MRAG 2005b	Based On 2003 FAO Catch data
	$15 000 000.00[1]	$1 700 000.00[1]			30000.00 MT [1]		0.120	10%[1]	Agnew et al. 2010	1]Artisanal
					865663.6 MT	1262960.9 MT	1.459	59.33%	http://www.seaaroundus.org	Cumulative Total Domestic
Ghana	$252,000,000.00	$10,773,722.63			315784.00 MT	13500.67 MT	0.043	4.10%	MRAG 2005b	Based On 2003 FAO Catch data
					11288900.0 MT	8871800.0 MT	0.786	44.01%	Ramos et al. 2015	Cumulative Total
Guinea	$103,000,000.00	$105,080,808.08			115925.0 MT	118266.9 MT	1.020	50.50%	MRAG 2005b	Based On 2003 FAO Catch data
	$56 000 000.00[1] $4 300 000.00[2]	$83 700 000.00[1]			48500.00 MT [1]			60%[1]	Agnew et al. 2010	1]Artisanal 2]Fisheries GDP contribution
					2015233.0 MT	6290754.0 MT	3.122	75.74%	Belhabib et al. 2013a	Cumulative Total Domestic
							0.640		EK. 2005a	
Guinea-Bissau	$13,000,000.00	$5,335,684.06			6003.0 MT	2463.9 MT	0.410	29.10%	MRAG 2005b	Based On 2003 FAO Catch data
					157142.0 MT	1437258.0 MT	9.146	90.14%	Belhabib & Pauly 2015e	Cumulative Total Domestic
	$21 000 000.00[1] $29 000 000.00[2] $12 700 000.00[3]	$23 700 000.00[1] $14 800 000.00[2]			17883.00 MT [1] 1500.00 MT [2]			53.5%[1] 33.8%[2]	Agnew et al. 2010	1]Artisanal 2]Industrial 3]Fisheries GDP contribution
Liberia	$8,000,000.00	$11,704,433.50			6864.00 MT	10042.40 MT	1.463	59.40%	MRAG 2005b	Based On 2003 FAO Catch data
					334221.3 MT	503019.2 MT	1.505	60.08%	http://www.seaaroundus.org	Cumulative Total Domestic
Mauritania	$193,000,000.00	$17,010,881.39			187650.0 MT	16539.8 MT	0.088	8.10%	MRAG 2005b	Based On 2003 FAO Catch data
					3854796.0 MT	7725075.0 MT	2.004	66.71%	Belhabib et al. 2012 - Mauritania	Cumulative Total Domestic
Nigeria	$495,000,000.00	$327,259,136.21			300194.0 MT	198467.1 MT	0.661	39.80%	MRAG 2005b	Based On 2003 FAO Catch data
					8650199.0 MT	5279601.0 MT	0.610	37.90%	Etim et al. 2015	Cumulative Total Domestic
	$233 570 000.00 - $581 640 000.00	$30,000,000.00							Fabaye 2008	
Senegal	$423,000,000.00	$32,328,310.01			430784.00 MT	32923.21 MT	0.076	7.10%	MRAG 2005b	Based On 2003 FAO Catch data
					11249533.82 MT	17776797.81 MT	1.580	61.24%	http://www.seaaroundus.org	Cumulative Total Domestic
		$194 000 000.00 - $300 000 000.00						29.00%	Belhabib et al. 2014a, 2014b	
	$91 000 000.00[1] $23 000 000.00[2] $1 800 000.00[3]	$39 300 000.00[1] $1 200 000.00[2]			433867.00 MT [1] 17000.00 MT[2]			8% 30%[1] 5%[2]	Agnew et al. 2010	1]Artisanal [small-pelagic & shrimp] 2] Industrial [Demersal] 3]Fisheries GDP contribution
Sierra Leone	$81,000,000.00	$28,607,577.81			82926.0 MT	29287.8 MT	0.353	26.10%	MRAG 2005b	Based On 2003 FAO Catch data
					3153211.1 MT	4979616.3 MT	1.579	61.23%	http://www.seaaroundus.org	Cumulative Total Domestic
	$18 000 000.00[1] $11 000 000.00[2] $6 200 000.00[3]	$7 900 000.00[1] $7 000 000.00[2]			34851.00 MT [1] 1300.00 MT [2]			30 - 35%	Agnew et al. 2010	1]Artisanal 2]Industrial 3]Fisheries GDP contribution
Togo	$20,000,000.00	$9,411,764.71			22485.0 MT	10581.2 MT	0.471	32.00%	MRAG 2005b	Based On 2003 FAO Catch data
					559206.0 MT	1784494.0 MT	3.191	76.14%		Cumulative Total Domestic

Table 14 12. *Colour coding red and green denotes a source of information which is alternative to the estimate provide by Pauly and Zeller (2015), The Sea Around Us (SAU) data. Red indicates that the value for the reported quantum from the alternative source is less than the SAU data, green indicates that it is larger than the SAU data. Brown indicates that the alternative source is cumulative for a number of years, and cannot be compared. Black on white numbers are species or sector specific and therefore also strictly not comparable. A blue background means that the corresponding Pauly and Zeller (2015) amount was not available to this study. This table is for Africa as a whole*

Region	LV Reported	LV Unreported	LV IUU Ratio	LV IUU %	Tonnage R	Tonnes IUU	Tonnage IUU Ratio	Tonnage IUU %	Source	Note
Mediterranean		€ 825,000,000.00			1436743.00 MT	28600.00 MT		30 - 40% 40 - 50%[1]	WWF 2014 FAO 2014 Agnew et al. 2009	Tuna & swordfish 2007
Sub-Saharan Africa	$4,702,000,000.00	$937,845,004.90			4689085.35 MT	785069.49 MT	0.338	19.31%	MRAG 2005b	Based On 2003 FAO Catch data
Africa		$1 100 000 000.00 $2 600 000 000.00			179952004.03 MT	120601447.82 MT	0.670	40.13%	EJF 2009	
Global		$10 000 000 000.00 $23 500 000 000.00 $9,500,000,000.00 $25,000,000,000.00			77800000.00 MT	11000000.00 MT 26000000.00 MT		18.00% 20 - 40%	Agnew et al. 2009 MRAG 2005b Pauly et al. 2002 FAO 2014 WWF 2014	2000 - 2003 Based On 2003 FAO Catch data 2010 Tuna

Table 14 13. *Socio-economic impacts associated with IUU based on questionnaire responses (broken down by region).*

Socio-Economic Impacts - Africa	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal	Total
Habitat degradation	8	7	12	3	6	13	13	62
Uneconomical domestic fisheries	8	7	9	6	10	10	9	59
Poor local food security	7	6	9	6	9	10	11	58
Local livelihoods	7	6	10	7	11	11	11	63
Downstream economic costs	10	9	10	8	10	9	8	64
Fishing crew layoffs	7	5	4	3	4	7	6	36
Decreased national development	10	7	8	5	6	9	8	53
Negative fish price effects	8	5	8	3	6	10	6	46
Social decline	8	6	6	4	7	9	9	49

Socio-Economic Impacts - Northern Africa	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal	Total
Habitat degradation	0	0	1	0	1	1	1	4
Uneconomical domestic fisheries	0	0	1	0	1	1	1	4
Poor local food security	0	0	0	0	0	1	1	2
Local livelihoods	0	0	1	0	0	1	1	3
Downstream economic costs	1	0	1	0	1	1	1	5
Fishing crew layoffs	1	0	0	0	0	0	0	1
Decreased national development	1	0	1	0	0	1	1	4
Negative fish price effects	1	0	1	0	0	1	0	3
Social decline	0	0	0	0	1	1	1	3

Socio-Economic Impacts - Southern Africa	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal	Total
Habitat degradation	1	1	2	0	0	3	4	11
Uneconomical domestic fisheries	1	1	1	1	1	4	4	13
Poor local food security	2	1	2	1	1	4	4	15
Local livelihoods	2	1	2	1	1	4	4	15
Downstream economic costs	2	1	2	1	1	3	3	13
Fishing crew layoffs	0	1	0	0	0	3	3	7
Decreased national development	1	0	0	0	0	3	3	7
Negative fish price effects	2	0	1	0	0	3	2	8
Social decline	1	0	1	0	0	3	3	8

Socio-Economic Impacts - Western Africa	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal	Total
Habitat degradation	3	2	2	2	2	4	2	17
Uneconomical domestic fisheries	3	2	2	2	3	2	2	16
Poor local food security	2	1	2	2	3	2	2	14
Local livelihoods	2	1	2	2	3	3	2	15
Downstream economic costs	3	2	2	2	2	2	2	15
Fishing crew layoffs	3	2	2	1	2	2	2	14
Decreased national development	4	2	2	2	2	2	2	16
Negative fish price effects	3	2	2	2	2	2	2	15
Social decline	3	2	2	2	2	2	2	15

Socio-Economic Impacts - Eastern Africa	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal	Total
Habitat degradation	3	3	5	0	1	2	3	17
Uneconomical domestic fisheries	2	2	3	1	2	1	1	12
Poor local food security	2	2	3	1	2	1	3	14
Local livelihoods	2	2	3	1	3	1	2	14
Downstream economic costs	3	4	3	2	2	1	1	16
Fishing crew layoffs	1	1	0	1	0	0	0	3
Decreased national development	2	2	2	1	1	0	1	9
Negative fish price effects	1	1	1	0	1	1	0	5
Social decline	3	2	1	0	1	0	1	8

Socio-Economic Impacts - Central Africa	Large pelagic finfish	Large pelagic shark	Demersal & reef	Mid-water	Small pelagic	Crustacean	Sedentary coastal	Total
Habitat degradation	1	1	2	1	2	3	3	13
Uneconomical domestic fisheries	2	2	2	2	3	2	1	14
Poor local food security	1	2	2	2	3	2	1	13
Local livelihoods	1	2	2	3	4	2	2	16
Downstream economic costs	1	2	2	3	4	2	1	15
Fishing crew layoffs	2	1	2	1	2	2	1	11
Decreased national development	2	3	3	2	3	3	1	17
Negative fish price effects	1	2	3	1	3	3	2	15
Social decline	1	2	2	2	3	3	2	15

Table 14 14. *Relevant AU-IBAR member states' affiliation to Regional Fishery Bodies (RFBs) and Regional Fishery Management Organisations (RFMOs)*

		Agreement on the Conservation of Albatrosses and Petrels	Committee on Inland Fisheries and Aquaculture of Africa (CIFAA)	Ministerial Conference on Fisheries Cooperation among African States	Regional Fisheries Commitee for the Gulf of Guinea	Commission Sous-régionale des pêches	Fishery Committee of the West Central Gulf of Guinea	International Whaling Commission
		Global and Trans-ocean	Inland waters	Atlantic Ocean	Atlantic Ocean	Atlantic Ocean	Global and Trans-ocean	Global and Trans-ocean
Region/ Country	**# of countries**	**ACAP**	**CIFAA**	**COMHAFAT-ATLAFCO**	**COREP**	**CSRP**	**FCWC**	**IWC**
Northern Africa	**6**		**2**	**1**				**1**
Algeria								
Egypt			✓					
Libya								
Morocco (Western Sahara)				✓				✓
Sudan			✓					
Tunisia								
Central Africa	**7**		**4**	**4**	**5**			**3**
Angola				✓				
Cameroon			✓		✓			✓
Congo			✓		✓			✓
Equatorial Guinea				✓				
Gabon			✓	✓	✓			✓
Sao Tome and Principe					✓			
DRC			✓	✓	✓			
Western Africa	**13**		**9**	**9**		**7**	**6**	**9**
Benin			✓	✓			✓	✓
Cabo Verde				✓		✓		
Côte d'Ivoire			✓	✓			✓	✓
Gambia			✓			✓		✓
Ghana			✓	✓			✓	✓
Guinea			✓	✓		✓		✓
Guinea-Bissau				✓		✓		✓
Liberia							✓	
Mauritania						✓		✓
Nigeria			✓	✓			✓	
Senegal			✓	✓		✓		✓
Sierra Leone			✓	✓		✓		
Togo			✓				✓	✓
Southern Africa	**2**	**1**						**1**
Namibia								
South Africa		✓						✓
Eastern Africa	**10**		**7**					**3**
Comoros								
Djibouti								
Eritrea			✓					✓
Kenya			✓					✓
Madagascar			✓					
Mauritius			✓					
Mozambique			✓					
Seychelles								
Somalia			✓					
Tanzania			✓					✓
Totals	**38**	**1**	**22**	**14**	**5**	**7**	**6**	**17**

		Lake Tanganyika Authority	Lake Victoria Fisheries Organization	Regional Organization for the conservation of the Environment of the	Subregional Fisheries Commission	Southwest Indian Ocean Fisheries Commission	Western Central Atlantic Fishery Commission	Western Indian Ocean Tuna Organization	
		Inland waters	Inland waters	Mediterranean, Black Sea, Red Sea	Atlantic Ocean	Indian Ocean	Atlantic Ocean	Indian Ocean	
Region/ Country	**# of countries**	**LTA**	**LVFO**	**PERSGA**	**SRFC**	**SWIOFC**	**WECAFC**	**WIOTO**	**Total # of RFBs member-ships**
Northern Africa	**6**			**2**					**6**
Algeria									*0*
Egypt				✓					*2*
Libya									*0*
Morocco (Western Sahara)									*2*
Sudan				✓					*2*
Tunisia									*0*
Central Africa	**7**	**1**							**17**
Angola									*1*
Cameroon									*3*
Congo									*3*
Equatorial Guinea									*1*
Gabon									*4*
Sao Tome and Principe									*1*
DRC		✓							*4*
Western Africa	**13**				**7**		**1**		**48**
Benin									*4*
Cabo Verde					✓				*3*
Côte d'Ivoire									*4*
Gambia					✓				*4*
Ghana									*4*
Guinea					✓		1		*6*
Guinea-Bissau					✓				*4*
Liberia									*1*
Mauritania					✓				*3*
Nigeria									*3*
Senegal					✓				*5*
Sierra Leone					✓				*4*
Togo									*3*
Southern Africa	**2**					**1**			**3**
Namibia									*0*
South Africa						✓			*3*
Eastern Africa	**10**	**1**	**2**	**2**		**8**		**5**	**28**
Comoros						✓			*1*
Djibouti				✓					*1*
Eritrea									*2*
Kenya			✓			✓		✓	*5*
Madagascar						✓			*2*
Mauritius						✓		✓	*3*
Mozambique						✓		✓	*3*
Seychelles						✓		✓	*2*
Somalia				✓		✓			*3*
Tanzania		✓	✓			✓		✓	*6*
Totals	**38**	**2**	**2**	**4**	**7**	**9**	**1**	**5**	**102**

Table 14 15. *Relevant AU-IBAR member states' affiliation to Regional Economic Communities (RECs)*

	African Economic Community	African Union	Economic and Monetary Community of Central Africa	Community of Sahel-Saharan States	Common Market for Eastern and Southern Africa	East African Community	Economic Community of Central African States	Economic Community of West African States	Greater Arab Free Trade Area	Intergovernmental Authority on Development	Indian Ocean Commission	Southern African Customs Union	Southern African Development Community	West African Economic and Monetary Union	Arab Maghreb Union	West African Monetary Zone
	Global and Trans-ocean	Global and Trans-ocean	Atlantic Ocean	Global and Trans-ocean	Global and Trans-ocean	Indian Ocean	Atlantic Ocean	Atlantic Ocean	Atlantic Ocean, Mediterranean Sea, Indian Ocean	Indian Ocean	Indian Ocean	Atlantic Ocean, Indian Ocean	Atlantic Ocean, Indian Ocean	Atlantic Ocean	Atlantic Ocean, Mediterranean Sea	Atlantic Ocean
	AEC	**AU**	**CEMAC**	**CEN-SAD**	**COMESA**	**EAC**	**ECCAS**	**ECOWAS**	**GAFTA**	**IGAD**	**IOC**	**SACU**	**SADC**	**UEMOA**	**UMA**	**WAMZ**
Northern Africa	6	6		5	3				5	1					4	
Algeria	✓	✓							✓						✓	
Egypt	✓	✓		✓	✓				✓							
Libya	✓	✓		✓	✓				✓						✓	
Morocco	✓	✓		✓											✓	
Sudan	✓	✓		✓	✓				✓	✓						
Tunisia	✓	✓		✓					✓						✓	
Central Africa	7	7	4	1	1		6						2			
Angola	✓	✓					✓						✓			
Cameroon	✓	✓	✓				✓									
Congo	✓	✓	✓				✓									
Equatorial Guinea	✓	✓	✓				✓									
Gabon	✓	✓	✓				✓									
Sao Tome and Principe	✓	✓		✓			✓									
DRC	✓	✓			✓								✓			
Western Africa	12	13	1	12			1	10						6	1	6
Benin	✓	✓		✓				✓						✓		
Cabo Verde		✓														
Côte d'Ivoire	✓	✓		✓										✓		
Gambia	✓	✓		✓				✓								✓
Ghana	✓	✓		✓				✓								✓
Guinea	✓	✓	✓	✓			✓	✓						✓		✓
Guinea-Bissau	✓	✓		✓				✓						✓		
Liberia	✓	✓		✓				✓								✓
Mauritania	✓	✓		✓											✓	
Nigeria	✓	✓		✓				✓								✓
Senegal	✓	✓		✓				✓						✓		
Sierra Leone	✓	✓		✓				✓								✓
Togo	✓	✓		✓				✓						✓		
Southern Africa	2	2										2	2			
Namibia	✓	✓										✓	✓			
South Africa	✓	✓										✓	✓			
Eastern Africa	10	10		5	7	2				4	4		5			
Comoros	✓	✓		✓	✓						✓					
Djibouti	✓	✓		✓	✓					✓						
Eritrea	✓	✓		✓	✓					✓						
Kenya	✓	✓		✓	✓	✓				✓						
Madagascar	✓	✓			✓						✓		✓			
Mauritius	✓	✓			✓						✓		✓			
Mozambique	✓	✓											✓			
Seychelles	✓	✓			✓						✓		✓			
Somalia	✓	✓		✓						✓						
Tanzania	✓	✓				✓							✓			

12. Appendix 1: Questionnaire used in this study to elicit responses about IUU fishing in Africa.

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09 March 2016

Please kindly note that you may remain anonymous, and all questions are optional.

AFRICAN UNION
INTERAFRICAN BUREAU FOR ANIMAL RESOURCES

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26 January 2016

TO WHOM IT MAY CONCERN

OLRAC SPS CONSULTANCY FIRM

TO ASSESS AND DEVELOP A COMPREHENSIVE DOCUMENT ON THE ECONOMIC, SOCIAL AND ENVIRONMENTAL/ECOLOGICAL IMPACTS OF ILLEGAL, UNREPORTED AND UNREGULATED (IUU) FISHING IN AFRICA

The Consulting Firm, OLRAC SPS, has been contracted by the African Union-InterAfrican Bureau for Animal Resources (AU-IBAR) to assess and develop a comprehensive document on the economic, social and environmental/ecological impacts of IUU fishing in Africa. The geographical scope of this study is in the five regions of the African continent (Western, Central, Eastern, Southern and Northern regions).

This exercise is in line with key concerns raised by the Joint Ministerial Conference of Agriculture, Rural Development, Fisheries and Aquaculture in May 2014, Addis Ababa, Ethiopia, on the ***'overexploitation of the fisheries resources including Illegal, Unreported and Unregulated Fishing leading to plundering of the resources'*** in the Maritime Exclusive Economic Zones (EEZ) of Africa. These concerns were against the background of poor knowledge on the current factual information on the dimensions and ramifications of IUU fishing on the continent's socio-economic development, food security and livelihoods.

This activity supports the implementation of the policy framework and Reform Strategy for Fisheries and Aquaculture in Africa in awareness enhancing and capacity strengthening for advocacy by African Union member states on updated and comprehensive information on economic, social and cultural impacts of IUU that have tended to undermine the effective contributions of fisheries to overall societal benefits on the continent.

AU-IBAR is therefore kindly requesting all assistance be accorded to the consultancy firm, OLRAC SPS, to ensure a successful accomplishment of this consultancy. The period of implementation of this activity is 90 days.

Professor Ahmed El-Sawalhy
Director, AU-IBAR/Head of Mission

Dr. Mike Bergh
OLRAC SPS – Email: mike@olsps.com

FAO Definition of IUU Fishing:

Illegal fishing refers to activities:

1. conducted by national or foreign vessels in waters under the jurisdiction of a State, without the permission of that State, or in contravention of its laws and regulations;
2. conducted by vessels flying the flag of States that are parties to a relevant regional fisheries management organisation but operate in contravention of the conservation and management measures adopted by that organisation and by which the States are bound, or relevant provisions of the applicable international law; or
3. in violation of national laws or international obligations, including those undertaken by cooperating States to a relevant regional fisheries management organization.

Unreported fishing refers to fishing activities:

1. which have not been reported, or have been misreported, to the relevant national authority, in contravention of national laws and regulations; or
2. undertaken in the area of competence of a relevant regional fisheries management organization which have not been reported or have been misreported, in contravention of the reporting procedures of that organization.

Unregulated fishing refers to fishing activities:

1. in the area of application of a relevant regional fisheries management organization that are conducted by vessels without nationality, or by those flying the flag of a State not party to that organisation, or by a fishing entity, in a manner that is not consistent with or contravenes the conservation and management measures of that organisation; or
2. in areas or for fish stocks in relation to which there are no applicable conservation or management measures and where such fishing activities are conducted in a manner inconsistent with State responsibilities for the conservation of living marine resources under international law.

1. Please provide your name, position & affiliation.

2. Which country or region do your answers below relate to?

3. How long have you been involved with fisheries or fishing industry? > 10 years, 2 - 10 years, < 2 years

4.1. Which IUU fishing issues are present in your region/country? Tick all that are applicable (Y/N).

Questions 4.1 was disaggregated by (a) vessel type, and (b) species groups, as follows: two levels:

a)

- Unlicensed Foreign Vessels
- Industrial & semi-industrial licensed Vessels,
- Artisanal Fishers &/or vessels

b)

- Large pelagic finfish resources (highly migratory) (e.g. tunas, billfishes)
- Large pelagic shark resources (highly migratory)
- Demersal & reef fish resources (both deep-water & on the shelf) (e.g. snappers, groupers, emperor, rabbit fish, hake, alfonsinos, wreckfish, ballfish, orange roughy, armourhead, deepwater rockcod etc.)
- Mid-water resources (e.g. horse mackerel)
- Small pelagic resource (e.g. sardinella, pilchard, anchovy, red-eye)
- Crustacean resources (e.g. prawns, rock lobster, deepwater crabs, other crabs)
- Sedentary coastal resources (e.g. abalone, mussels, octopus, sea cucumber molluscs in general)

4.2. Estimate scale of IUU catch (% of legal or reported catch, or tonnage per year)

Questions 4.2 was disaggregated by (b) species groups only.

5. Has IUU fishing increased or decreased in your country/region over the last 5-10 years?
This was disaggregated by b) species group, and also by the following:
- Increased (I) or Decreased (D) and by what %
- Possible reason(s)

6. Vessels from which country/region are implicated most in IUU fishing in your region / country?
This was disaggregated by b) species group, and also by the following
- Countries/regions of origin
- Flag of convenience country

7. What is the nature of IUU fishing in your country/region? Tick all that are applicable.
This was disaggregated by b) species group, and also by the following
- Vessels fishing without a license
- Fishing in prohibited areas or seasons
- Fishing prohibited species
- Use of illegal gear & methods
- Unauthorised trans-shipments
- Non-compliance with other license conditions
- Other (specify)

8. In your view, which are the most important drivers of IUU in your country/region? Tick all that are applicable.
This was disaggregated by b) species group, and also by the following
- Foreign vessels looking for profits/fishing large volumes
- Local vessels looking for profits, because catch rates are sub-economical
- Locals looking for food on a subsistence level
- Local criminal distribution networks, high price
- Inadequate food security in the country/region
- Licenses issued to known IUU fishing vessels
- Other (specify)

9. What factors make your country/region vulnerable to IUU? Tick all that are applicable.
This was disaggregated by b) species group, and also by the following
- Inadequate resources for effective MCS/enforcement
- Inadequate penalties & deterrence for offenders
- Corrupt enforcement officials, corrupt license allocations
- Lack of anti-IUU strategy/action plan
- Inadequate legislation over the EEZ
- Livelihoods problems in coastal communities
- Lack of understanding of IUU
- Lack of political will
- Lack of coordination across foreign affairs, fisheries, justice etc.
- Other (specify)

10. What are the economic & social impacts associated with IUU fishing in your country/region? Tick all that are applicable.

This was disaggregated by b) species group, and also by the following

- Habitat degradation
- Uneconomical domestic fisheries
- Deprivation of coastal communities food security
- Deprivation of coastal communities livelihoods
- Downstream economic costs on livelihoods in fish trade & processing
- Fishing vessel crew layoffs
- Lost opportunities for national development
- Negative fish price effects
- Social decline
- Other (specify)

11. What actions have your country/region taken to combat IUU fishing? Tick all that are applicable. This was disaggregated by b) species group, and also by the following

- Bilateral agreements
- NPOA on IUU fishing
- Enhanced MCS, specify
- Data sharing with other countries & regions
- Port inspections
- National legislation
- Other (specify)

12.1. Arrange the following support structures necessary to reduce & ultimately eliminate IUU fishing in your country/region, in order of most important (1) to least important (7). 1 2 3 4 5 6 7

- Financial
- Infrastructural
- Legal
- Political
- Regional
- Scientific
- Technical

12.2. Suggest agencies/organisations you believe could assist with these efforts.

- Financial
- Infrastructural
- Legal
- Political
- Regional
- Scientific
- Technical

13. What actions are required in your country/region to combat IUU fishing? (open ended response requested).

14. What kinds of other criminal activity do you associate with IUU fishing in your region/country? Tick all that are applicable.

Dimension 1:

- Human trafficking
- Other illicit wildlife trade
- Illicit wildlife products: Ivory/rhino horn etc.
- Drug trade
- Smuggling in general
- Bribery & corruption
- Abuse of labour, children or women
- Other (specify)

Dimension 2:

- Foreign Vessels
- Local Industrial Vessels
- Artisanal Fishing Craft
- Nearshore Resource Harvesting

15. What contribution do governments, RFBs (Regional Fisheries Boards), RFMOs (Regional Fisheries Management Organisations) & NGOs (Non-Governmental Organisations) make towards IUU eradication? (Dimension 1: choose one of: Little or none, Small, Neutral/Not applicable, Medium, Vital)

- Government
- RFBs
- RFMOs
- NGOs
- Other (specify)

16. Which key focus areas you would like governments, RFBs, RFMOs &/or NGOs to address specifically? (open ended question).

17. Do you have data, documents or information that can assist this study? Tick all that are applicable (Y/N).

- Documents
- Data
- References
- Contact
- Persons
- Can you supply these to this study via email

Thank you for your participation in this questionnaire.

- Number of persons approached: 196 unique persons; 220 unique emails (i.e. 24 emails were secondary points of contact)
- Number of responses received: 22 usable responses
- Response rate: 22/196 = 11%

13. Appendix 2: The 1995 UN Fish Stocks Agreement

The UN Fish Stocks Agreement entered into force on 11 December 2001, and is the most comprehensive of the binding international instruments in defining the role of RFMOs and elaborating measures that could be taken in relation to IUU fishing activities. The vital role of RFMOs in implementing the UN Fish Stocks Agreement was recognized by all States Parties at the 2002 Informal Meeting of the States Parties. Although the UN Fish Stocks Agreement applies primarily to the highly migratory and straddling fish stocks on the high seas, its broad acceptance and application is evidenced by the reinforcement of other international instruments, implementation at the regional level, and to some extent by State practice within areas of national jurisdiction.

The UN Fish Stocks Agreement complements and strengthens a number of provisions of the 1982 UN Convention by seeking to ensure a harmonious development of coherent conservation and management measures for exclusive economic zones (EEZs) and the high seas. It is recognized that the effective implementation of this instrument depends on political will and a high degree of cooperation between coastal states and high seas fishing nations and fishing entities on a range of technical issues. Part III, relating to mechanisms for international cooperation, sets out the central role of appropriate RFMOs as a mechanism through which States Party to the Agreement should act to meet their obligations and exercise their rights under the Agreement.

In particular, Article 8 of Part III is pivotal, and relates to cooperation for conservation and management. It provides, inter alia, that where a competent RFMO exists, states should either become members, or they should agree to apply the conservation and management measures established by such organizations. This complements other Articles, including those providing the following:

- only those states which are members of a RFMO, or which agree to apply the relevant RFMOs conservation and management measures, shall have access to the fishery resources to which these measures apply;
- the establishment and functions of RFMOs;
- the nature and extent of participatory rights for new members;
- transparency required in the activities of RFMOs;
- the strengthening of existing organizations and arrangements;
- monitoring, control and surveillance (MCS) by flag States providing for international, regional and sub-regional cooperation in enforcement, including:
  - » duties of the flag State;
  - » compliance and enforcement by the flag State;
  - » international cooperation in enforcement;
  - » sub-regional and regional cooperation in enforcement;
  - » basic procedures for boarding and inspection;
  - » port State measures.

Many of these Articles provide the impetus for specific measures relating to IUU fishing taken by RFMOs, including information and data requirements, establishment of registers, requirements for high seas fishing, landings, port inspection and trans-shipment, inspection and enforcement and cooperation with non-members.

An important deterrent against IUU fishing in the UN Fish Stocks Agreement relates to non-members of RFMOs. If they do not agree to apply the conservation and management measures, they are not discharged from the obligation to cooperate in the conservation of the relevant fish stocks. If they do not cooperate, members are authorised to take measures to deter activities of vessels which undermine the effectiveness of the RFMO's conservation and management measures. This has taken the form in some RFMOs of trade information/catch documentation schemes, trade sanctions and measures inter alia prohibiting trans-shipment and landings of fish caught from IUU activities, and seeking to discourage investment in such activities. Some RFMOs have established subsidiary bodies such as compliance committees to develop procedures to collect information on IUU fishing and recommend deterrent measures.

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