Review of Impacts of Illegal, Unreported and Unregulated Fishing on Developing Countries

FINAL REPORT

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Marine Resources Assessment Group Ltd
18 Queen Street
London, United Kingdom

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Cover photograph: Neil Ansell

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Abbreviations and Acronyms

BDM	Bêche-de-mer
BIOT	British Indian Ocean Territory
bn	Billion
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
DfID	Department for International Development
DWFN	Distant Water Fishing Nation
EEZ	Exclusive Economic Zone
EU	European Union
FAO	Food and Agricultural Organisation of the United Nations
FCMZ	(BIOT) Fisheries Conservation and Management Zone
FFA	Forum Fisheries Agency
FMC	Fisheries monitoring centre
FOC	Flag of Convenience
GDP	Gross Domestic Product
ICCAT	International Commission for the Conservation of Atlantic Tuna
IOTC	Indian Ocean Tuna Commission
IPOA	International Plan of Action
ITF	International Transport Workers Federation
IUU	Illegal, Unreported and Unregulated Fishing
m	Million
MCS	Monitoring, Control and Surveillance
MFMR	Ministry of Fisheries and Marine Resources (Namibia)
MOU	Memorandum of understanding
MRAG	Marine Resources Assessment Group
NAFO	North Atlantic Fisheries Organisation
NFA	National Fisheries Association (Papua New Guinea)
OECD	Organisation for Economic Co-operation and Development
OR	Open Register
PNG	Papua New-Guinea
RFMO	Regional Fisheries Management Organisation
SADC	Southern African Development Community
SEAFO	South East Atlantic Fisheries Organisation
SOCU	Surveillance Operations Co-ordinating Unit
SWIOFC	Southwest Indian Ocean Fisheries Commission
UNCLOS	United Nations Convention on the Law of the Sea
UNFSA	The UN Fish Stocks (Straddling Stocks and Highly Migratory Species) Agreement
VMS	Vessel monitoring system
WCPTC	Western and Central Pacific Tuna Commission

1. Introduction

This section describes the background to this study and considers various definitions of the types of fishing activity that come under the heading of illegal, unreported and unregulated (IUU) fishing[1].

1.1. Background to the study

IUU fishing is a global problem affecting both Exclusive Economic Zones (EEZs) and the high seas. A number of initiatives have been taken to quantify and combat it, notably the 2001 FAO International Plan of Action on IUU Fishing. In 2003 following a meeting of the Round Table on Sustainable Development at the OECD, a number of Ministers decided to form a High Seas Task Force with the objective of defining practical solutions to the problem. The UK is directly supporting the work of the High Seas Task Force. Part of this support covers work commissioned by the Department for International Development (DfID) to examine the *economic impacts of IUU fishing on developing countries*.

Although there are quite a lot of studies of IUU fishing in high seas waters, there is currently a dearth of information on the economic and other impacts of IUU fishing on developing countries. This study set out to address this, as far as possible, using empirical information available from the literature and by examining case studies of 10 developing countries around Africa and in Oceania that are currently suffering from differing levels of IUU fishing in their waters. The study was undertaken by MRAG Ltd between January and June 2005.

This project comprises two main tasks:

- an impact analysis of IUU fishing on developing countries (including economic, social, environmental, ecological, biological, health and nutritional impacts); and
- an empirical assessment of issues related to ecosystem and management.

These tasks necessarily overlap in their scope. A consideration of ecosystem and management issues is an integral part of a study of the impacts of IUU on developing countries. Nevertheless, this report is directed primarily at the first task. The second task will be addressed more directly by a separate report. This report has the following objectives:

1. To identify the key impacts of IUU fishing on developing countries using a range of potential sources and approaches to derive best available knowledge (empirical and anecdotal).
2. To derive a better understanding of the areas of vulnerability that enable IUU activity to thrive.

[1] While the term illegal, unreported and unregulated might suggest that to be classed as IUU, a fishing activity must be all three, the interpretation we have applied in this study is that a fishing activity can be classified as IUU if it constitutes action that is, under the definitions, either illegal, unreported or unregulated.

3. To identify specific forms of assistance to enable developing countries to better implement their responsibilities and resource management in respect of IUU and high seas fisheries.

An inception report was produced in February 2005 and was included in the literature presented to the High Seas Task Force at its meetings in Paris, 9 March 2004 and Rome, 11 March 2005. It is annexed to this report. A preliminary version of this report was also discussed at a DFID/NORAD funded workshop, held as part of the project process on the 16th and 17th June, 2005 in London. Comments generated from the discussion were incorporated into the final version. An additional report summarising the outputs of the workshop has been produced by DFID[2].

1.2. Definitions of IUU fishing

The FAO IPOA to prevent, deter and eliminate illegal, unreported and unregulated fishing elaborated the definition of IUU fishing provided in Box 1:

Box 1. Definitions of IUU Fishing (FAO IPOA)

A. **Illegal** fishing refers to activities:

A.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;

A.2 conducted by vessels flying the flag of States that are parties to a relevant regional fisheries management organization 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

A.3 in violation of national laws or international obligations, including those undertaken by cooperating States to a relevant regional fisheries management organization.

B. **Unreported** fishing refers to fishing activities:

B.1 which have not been reported, or have been misreported, to the relevant national authority, in contravention of national laws and regulations; or

B.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.

C. **Unregulated** fishing refers to fishing activities:

C.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 organization, or by a fishing entity, in a manner that is not consistent with or contravenes the conservation and management measures of that organization; or

C.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.

Note: Notwithstanding paragraph C, certain unregulated fishing may take place in a manner which is not in violation of applicable international law, and may not require the application of measures envisaged under the International Plan of Action (IPOA).

These formal definitions are correct from a legal point of view, but do not necessarily help us to understand the widely differing types of activities that might be considered

[2] DFID/NORAD, 2005. International Workshop on Impacts of Illegal Unreported and Unregulated Fishing on Developing Countries, 16th to 17th June 2005, DFID, London. Workshop Proceedings. 16 pp.

to be IUU. In order to do this is it helpful to identify exactly what types of IUU fishing exist and why they may, or may not, be important for this particular study.

Figure 1 elaborates several common types of IUU fishing and these are discussed further in the following paragraphs.

a) Illegal/poaching activity is the easiest to define. It is usually expressed as fishing without a licence in an EEZ. This can apply to national vessels, to vessels licensed to fish in an adjacent area that have crossed the boundary to fish in an area where they are not licensed; and to vessels fishing on the high seas that cross the boundary for the same purpose. There are four principal types of effect that poaching may have on fisheries and coastal states:

   1. increased fishing mortality, and because the catches are not reported it is very difficult to determine the extent of damage this causes to target stocks;
   2. conflict with non-IUU fishermen, in particular artisanal fishermen;
   3. forfeit of potential revenue from licensing legitimate fishing activity; and
   4. reduction in fishing opportunities for non-IUU fishermen.

   This type of activity conforms to most peoples' usage of the term illegal fishing and carries the implication that fish are "stolen". Illegal fishing within EEZs must be seen essentially as a failure of national, not international, MCS systems to deter illegal fishing through detection, apprehension and the imposition of sanctions through the process of law. Regardless of which flag state is transgressing, it is ultimately the responsibility of the coastal state to enforce the law within its EEZ. This type of activity is usually also the hardest to detect, precisely because the vessels are unlicensed.

b) There are other types of illegal fishing which may be undertaken by otherwise legally licensed vessels. Licensed vessels may still fish illegally by contravening the terms and conditions of their licence, for example using illegal gear, catching fish over the allocated quota, fishing in closed areas and/or seasons, exceeding bycatch limits, non- or partial reporting of data, or - or submission of erroneous data. Enforcement of the terms and conditions of licensing is also the responsibility of the coastal state, but illegal activities in this category are usually seen as being different from the unlicensed poaching. These activities arise as a failure of the control component of MCS, rather than a failure of surveillance. Licensed vessels are not generally regarded as pirates or poachers in the way that unlicensed operators are. Nevertheless, activities such as fishing in prohibited areas and seasons, with illegal gears, or not reporting the full extent of catches can be just as damaging for fish stocks, and the environment as fishing without a licence.

c) Mis-reporting, or failing to report, catch and other data may constitute both illegal and unreported fishing. The FAO definition suggests that unreported fishing may not necessarily be illegal, although it is evident that it should also be considered illegal where reporting obligations form part of national laws and regulations or licence conditions. From the perspective of effects, the distinction is of little importance, because unreported fishing can be just as damaging to fish stocks and the environment whether or not it is illegal. However, there is a distinction to be made between unreported data from fishing within EEZs and that from fishing outside EEZs. We presume that non-reporting or mis-reporting is usually illegal with EEZs. Outside EEZs, failure to report catches may be considered illegal where the catches are taken from an area regulated by an RFMO and there are reporting requirements in place.

Where no such requirements exist, or where an area is not regulated by an RFMO, the only legal obligation that exists is a general requirement to report catches to the flag State of the vessel concerned. Nevertheless, we classify all mis- or non- reporting of data as equally damaging to the ability of a coastal state authority to manage its fisheries. As discussed above, fishery data may be unreported because the fishing is unlicensed (i.e. poaching), but it may also arise from licensed fishing, either by nationals or foreign vessels fishing under access agreements in a state's waters.

d) Unregulated fishing is well described by the FAO definition. It includes fishing on the high seas by 'free riders', i.e. those who fail to sign up to regional management arrangements and refuse to comply with the conservation and management measures established by those arrangements. It also includes fishing on the high seas where there are no regional management arrangements in place. However, even in this case, States are under basic obligations both in customary international law and under the LOSC to utilize fish stocks in a sustainable manner. An example is the Madagascar ridge fishery for orange roughy. This is not regulated by any local or regional authority, but that does not mean that the fishery can be pursued without regard to sustainability. From the perspective of effects, such fisheries must in our view be considered to be unregulated.

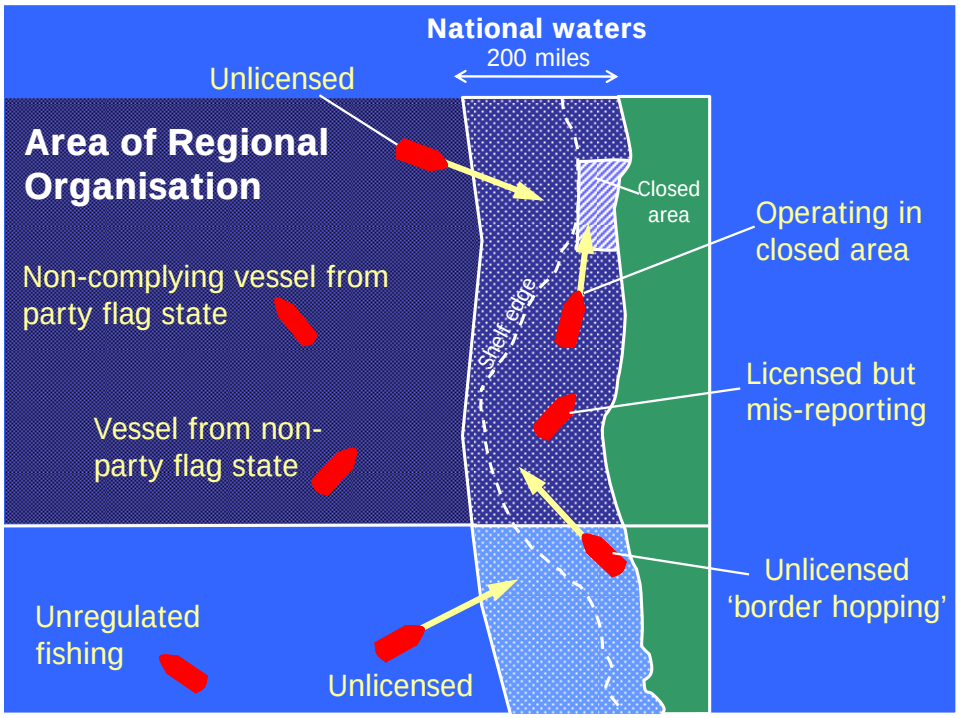

Figure 1 Illustration of types of IUU fishing. Within an EEZ there may be unlicensed fishing (poaching), under- or non-reporting, or unauthorised fishing by area, seasonal, gear, quota or species. Outside EEZs there may be non-compliance with an RFMO, or there may be unregulated fishing outside the area 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.

The FAO envisages other subtle types of IUU fishing in high seas fisheries covered by an RFMO. For instance, non-compliance by a party to the RFMO is illegal under its national law, whereas non-compliance by a non-party to the RFMO is unregulated. In both these cases there may also be non-reporting. Despite the subtlety of definition, all these activities have the same effect – they undermine attempts to assess and conserve the stocks and the environment. From the point of view of non-IUU fishermen, they reduce opportunities to fish.

In summary, this study is primarily focussed on the effects of IUU on developing countries. This means both

- the direct effects of poaching, underreporting and other illegal activities with EEZ waters (categories (a), (b) and (c) above); and

- the indirect effects of IUU activities in high seas waters on the fishing opportunities available for developing countries or adverse ecosystem effects. We here talk about IUU because, as shown above, outside the EEZ such fishing may be illegal, or unregulated, or unreported.

1.3. Historical perspective

Fish stocks have always been vulnerable to too much fishing, but wide-scale overexploitation really started with the development of the distant water fishing fleets of the Soviet Union in the 1950s, followed by the development of similar fleets by Japan, other Far Eastern states, European states and the USA in the 1970s. Until the creation of Exclusive Economic Zones (EEZs) in the 1970s, the enshrining of this (previously customary law) concept in UNCLOS (1982) and the formalisation of the obligation to cooperate for the purposes of conservation in UNFSA (1995) such fishing was merely unregulated[3]. Since the inclusion of many important high seas areas and species in RFMOs from the late 1950s onwards[4], and the introduction of EEZs by most states between the late 1970s and mid 1990s, fishing activity in contravention of management measures has become classified as IUU.

A major review of IUU fishing was first conducted by the Global Fisheries Enforcement Workshop (October 25-27, 1994, Washington DC). This identified several key areas where IUU was a problem. In Namibia IUU fishing was conducted mainly by Spanish vessels fishing for hake; Senegal identified considerable IUU fishing by pirate foreign vessels inside its EEZ, as indeed did many of the member countries of the “sub-regional commission for fisheries” (Mauritania, Senegal, Cape Verde, Gambia, Guinea Bissau and Guinea); in the South Pacific, the Forum Fisheries Agency identified considerable under reporting by DWFNs (Japan, Korea

[3] Cooperative arrangements to manage shared stocks started with the 1911 Fur Seal agreement. This model began to exemplify what was meant by international cooperation and gradually transmuted itself a customary law obligation to cooperate for the purposes of conservation. The classic statement of cooperation through RFMOs was reflected in the 1955 Rome Technical Conference on High Seas Fishing but was not enshrined in treaty law until UNFSA (1995) (pers. comm., Michael Lodge of the High Seas Task Force).

[4] Although most of these early RFMOs were agreed for the purposes of allocation rather than conservation.

and Taiwanese vessels)[5] in the EEZs of Pacific island states; and considerable quantities of tuna were being taken by unregulated fishing vessels in the Atlantic ocean, primarily those flagged to non-parties to ICCAT,.

Since then there have been a number of initiatives on IUU fishing, in particular the negotiation of the FAO IPOA on IUU fishing (June 2001), several conferences including the OECD workshop on IUU fishing (April 2004, Paris[6]), and the initiation of a Ministerial Task Force to tackle the problem (December 2003). However, even this workshop did not attempt a quantification of the scale of the worldwide IUU problem.

As part of its research for the implementation of the IPOA[7], the FAO has recently asked its member states to comment on the types of IUU fishing that they perceive in their waters. The responses were limited, and are only marginally useful to this study - our more detailed approach applied to the case studies has provided more useful data – but they reinforce our results.

Of 22 African countries responding in FAO Table 12 (Figure 2), only one reported poaching as a significant contribution to IUU, although to a certain extent licence violations can also be seen as poaching. By far the most important aspect for African countries was fishing with Illegal gear. Although this latter does come within the wider definition of IUU fishing, it is not an issue which is central to our consideration in this paper.

The picture for Africa is in contrast to the responses from Latin America and the Caribbean, the Near East and the South West Pacific where poaching was seen as more generally a major problem by the respondent FAO Members. This is especially true of the South West Pacific when combined with licence violations.

Regional differences are also evident in FAO Table 13 (Figure 2). Tuna is of major concern to the South West Pacific island states and shrimp, demersal and inshore fish are important to African and Near East states.

These patterns appear repeatedly throughout this report: Africa has problems with shrimp/demersals and tuna, the Southwest Pacific with tuna and invertebrates and Latin America with crustaceans (essentially a Caribbean problem).

One of the difficulties in undertaking a review of the impacts of IUU fishing in developing countries is that quantitative estimates of the scale IUU fishing are very difficult to obtain. A further complication is that the IUU problem is a moving target. A number of the IUU problem areas identified in 2000 have now been solved, or part solved, while others have appeared. For instance, there is now little or no IUU fishing in Namibian waters, thanks to a very high profile MCS and observer system coupled with a foreign fleet licensing scheme (Berg & Davis, 2004[8]). Unregulated fishing for tuna in the Atlantic has declined considerably (from about 2000 t in 1999 to 500 t in

[5] Bray, K. 2000. A global review of Illegal, Unreported and Unregulated (IUU) fishing. FAO/Government of Australia workshop on IUU fishing, Sydney, 2000, Document AUS:IUU/2000/6, Appendix 2.
[6] OECD 2004. Fish Piracy Combating Illegal, Unreported and Unregulated Fishing.
[7] FAO, 2004 op cit

[8] Berg, E. P and Davies, S. 2004. Against All Odds: Taking Control of the Namibian Fisheries. In: Namibia's Fisheries: Ecological, Economic and Social Aspects (U.R. Sumaila, D. Boyre, M. D. Skogen, S. I. Steinshamm. Eds.). Eburon.

2002) following trade-related and sanctions and a black list introduced by ICCAT[9][10]. A similar story has unfolded in the Antarctic, with a reduction in IUU catches of toothfish from 33,000 t in 1997 to 2600 t in 2004[11]. However, IUU fishing continues to be widespread (Figure 1), and a threat to the fish stocks and fisheries economies of many developing states. Thus many of the problems identified by earlier reviews of IUU fishing have either been reduced (through management action) or displaced.

Against this background, we have used a variety of approaches to provide an updated evaluation of IUU fishing activity and hence impacts with a developing country focus. A review of all available sources of information on IUU fishing is presented in Annex A.

Table 12
Main forms of reported IUU fishing

Region (number of responses)	**Illegal Gear 51.8%**	**Taboos 30.4%**	**Illegal Species 30.4%**	**Poaching 17.9%**	**License 17.9%**
Africa (22)	14	8	9	1	4
Asia (6)	4	1	0	1	1
Europe (1)	1	1	1	0	0
Latin America & Caribbean (11)	3	1	3	3	1
Near East (6)	5	4	2	2	0
North America (1)	1	1	1	0	0
Southwest Pacific (9)	1	1	1	3	4
total count (56)	29	17	17	10	10

Legend to table headers: The fraction below each column header represents the fraction of countries that reported the issue; **Illegal Gear** includes prohibited gears (such as out-lawed destructive fishing methods) and gear not in line with size restrictions (*e.g.* nets with mesh sizes below legally defined minima); **Taboos** refers to fishing in seasonally or spatially closed areas; **Illegal Species** relates to the taking of either protected or undersized species, including bycatch; **Poaching** refers to foreign nationals entering waters of another coastal State and harvesting resources without a valid authorization; **License** relates to license violations in general, by either fishing without a permit (nationals), or fishing beyond the provisions provided for in the license.

Table 13
Main fisheries within which IUU fishing is reported

Region (number of responses)	**Inshore & Juveniles 23.5%**	**Tuna & Billfish 23.5%**	**Lobster & Molluscs 17.6%**	**Demersal Prawn & Fish 14.7%**	**Smaller Pelagics 8.8%**
Africa (22)	4	2	1	4	1
Asia (6)	1	0	0	1	0
Europe (1)	1	0	0	0	0
Latin America & Caribbean (11)	1	1	3	0	1
Near East (6)	0	1	0	0	0
North America (1)	0	0	0	0	0
Southwest Pacific (9)	1	4	2	0	1
total count (56)	8	8	6	5	3

Legend to table headers: The fraction below each column header represents the relative importance of the issue within the pool of issues reported (cumulative percentage value). The listed fisheries account for 88.1% of all reported fisheries; **Inshore & Juveniles** indicates violations of closed or reserved inshore areas, and/or the illegal harvesting of under-sized individuals; **Tuna & Billfish** indicates fisheries targeting big pelagics of mainly those two groups; **Lobster & Molluscs** refers to fisheries of sedentary, mainly shallow water species, of generally high value; **Demersal Prawn & Fish** refers to mainly bottom trawl fisheries targeting shrimp and demersal fish; **Smaller Pelagics** refer to purse seine and pelagic trawl operations, targeting smaller pelagic fish, not part of the tuna & billfish, shark and marine mammal groups.

Figure 2 FAO Tables 12 and 13 reproduced from the Regional Statistical Analysis of Responses by FAO Members to the 2003 Questionnaire on Action Taken by FAO Members to Implement the International Plan of Action to Prevent, Deter, and Eliminate Illegal, Unreported and Unregulated Fishing (TC IUU-CAP/2004)

[9] Restrepo, 2004. Estimation of unreported catches by ICCAT. OECD workshop on IUU fishing paper AGR/FI/IUU(2004)20

[10] There are indications, however, that substantial quantities of tuna from the Atlantic may be "laundered" through the Indian Ocean.

[11] Report of the Scientific Committee for the Conservation of Antarctic Marine Living Resources, 2004, Annex 4. CCAMLR, Hobart, Australia.

1.4. Summary

This report considers a number of types of IUU fishing, including illegal and unlicensed fishing in EEZs, incursions into EEZs by vessels fishing in adjacent high seas waters or licensed to fish in adjacent country waters; and unregulated fishing in high seas waters undertaken both in areas of RFMOs by non-parties or in contravention of the conservation efforts of those RFMOs, or any fishing in areas not covered by RFMOs.

IUU fishing continues to be a problem worldwide, and is seen by many developing countries as a significant constraint to their attempts to sustainably manage their resources and provide food security or fisheries income. There are significant regional differences, particularly between open ocean states (islands, particularly Oceania), which are usually mostly concerned with tuna poaching, and continental states (including those around Africa), which are mostly concerned about demersal and shrimp poaching.

2. Methods for estimating IUU catch

This section examines past attempts to quantify IUU catch, and explains our methodology.

2.1. Previous studies

A variety of methods have been used in the past to estimate the extent of IUU fishing activity. These can be conveniently subdivided into "top-down" approaches that result in global estimates directly, and "bottom-up" approaches that focus on the adding together of estimates made from more detailed information at a lower scale.

2.1.1. Top-Down Approach

The most common top down approach uses global estimates of the proportion of unreported catch. Pauly & McLean (2003)[12] provide estimates of unreported catch as a proportion of the total global reported catch in the range of 25-30%. The average of estimates of IUU catch in our study of sub-Saharan Africa expressed as a proportion of reported catch was 19%(Section 4.1.2.5 and Annex B).

It is tempting to use percentages such as these to estimate total global IUU catch. The total declared world catch from marine capture fisheries was about 84 million tonnes in 2002[13] (64% of total production including aquaculture and inland fisheries, 133 million tonnes). If we assume the IUU catch to be 19% of declared catches, the world catch of IUU would be 16 million tonnes. However, while 19% is an apparently reasonable level given the results of our case studies, this may not give a reasonable overall estimate. The percentage varies substantially from country to country and from region to region. Reported data often only include estimates of % IUU from instances where there actually is some detectable IUU catch, but not from countries or fisheries where IUU has not been detected (i.e. it is assumed to be zero or very close to zero). The average, however, should include zeros[14]. Values in the range 19 to 30% are therefore more likely to provide overestimates than underestimates of the total IUU catch at the global level.

In terms of value, FAO reports that in 2002, the estimated first sale value of fisheries was about US$78bn, 64% of which was from marine capture fisheries. We can apply our estimated IUU proportion of 19% to this figure, arriving at an estimate of US$9.5bn for total value of IUU catch. Net exports from developing countries were worth US$18bn in 2001. Performing the same calculation, one might estimate that the net lost export value to developing countries of marine capture IUU fishing was US$2.2bn. Once again, however, we expect that these values are more likely to be overestimates than underestimates, for the same reasons as described above.

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[12] Pauly D. and J. Maclean, 2003. In a perfect ocean. Island press.

[13] (1) FAO, 2002. State of World Fisheries and Aquaculture (SOFIA), 2002. FAO, Rome. (2) FAO, 2004. Overview of fish production, utilisation and trade based on 2002 data. S. Vannuccini, FIDI, November 2004.

[14] Added to this, given the likely skewed distribution of IUU catch as a percentage of legal catch by state (i.e. there are many more low values than there are high values), using the simple arithmetic mean to calculate a global value is likely to provide an overestimate.

2.1.2. Bottom-Up Approaches

As the name implies, the bottom-up approach involves analysis of more detailed information at a local scale in an effort to build a more accurate picture of IUU fishing activity and particularly the variation in vulnerability to such activity from state to state. Estimates obtained in this way are added together to develop an overall estimate of IUU catch. The problem with this approach is that it is time consuming and information is both very patchy and hard to collect. There are therefore many gaps to fill that require analytical methodologies of varying degrees of complexity. Even when these are used, it is still likely that some types of IUU catches will be missed. Whereas the top-down approaches might be considered to result in maximum overall estimates of IUU catch, the bottom-up approaches probably provide minimum estimates.

Bottom-up methods applied previously include:

- extrapolations from surveillance spotting of IUU activity (CCAMLR);
- Monte-Carlo interpolation from direct observer data (Pitcher et al 2002);
- simulation modelling of IUU behaviour (Agnew & Kirkwood 2002, 2005);
- comparison of trade and landing statistics (ICCAT and IOTC method); and
- target species population modelling techniques (e.g. Plagányi and Butterworth (in prep) [15]).

Only a few of these methods deliver information that is of sufficient quality to make an estimate of the IUU catch. Most papers on IUU fishing (including most of those presented to the FAO meeting in Sydney in 2000 and the OECD meeting in Paris in 2004) simply discuss the IUU problem in general terms. Very few papers or reports present quantitative estimates, or sufficient data from which quantitative estimates can be derived. While a few detailed studies do exist (e.g. Pitcher et al 2002[16]), the problem remains that estimates are not available for current estimates of IUU fishing in a large number of countries.

The most common information available, i.e. reports of single incidents or groups of incidents of IUU fishing, contains very little data to enable assessment of the potential IUU catch. However, this type of data is still useful in evaluating the scope of the problem and was gathered by the University of British Columbia's Seas Around Us project and used by Sumaila (2004[17]) in a paper presented to the OECD workshop in 2004. A combined plot of the number of vessels incriminated for fishing illegally between 1980 and 2003 is shown in Figure 3. Although these data are now several years old, they do emphasise two important points:

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[15] Plagányi E.E. and D. S. Butterworth (in prep.) A spatial- and age-structured assessment model to estimate poaching and ecosystem change impacting the management of South African abalone (Haliotis midae) . MARAM (Marine Resource Assessment and Management Group), Department of Mathematics and Applied Mathematics, University of Cape Town, Rondebosch 7701, South Africa.

[16] Pitcher, T. J., Watson, R., Forrest, R, Valtýson, H. P., and Guénette, S. (2002). 'Estimating illegal and unreported catches from marine ecosystems: a basis for change. Fish and Fisheries, Volume 3, Issue 4, pp 317 – 330.

[17] Sumaila, U. R., Alder. J. and Keith, H. (2004). The Cost of Being Apprehended for Fishing Illegally: Empirical Evidence and Policy Implications. In OECD (2004). Fish Piracy. Combating Illegal, Unreported and Unregulated Fishing. Paris: OECD.

1. IUU activity in its most general sense is a global phenomenon; and

2. Ignoring the incidents in the Southern Ocean (which are all toothfish vessels), hot spots of arrests for illegal fishing are concentrated in Central and Pacific South America, East Africa, South East Asia and the North West Pacific.

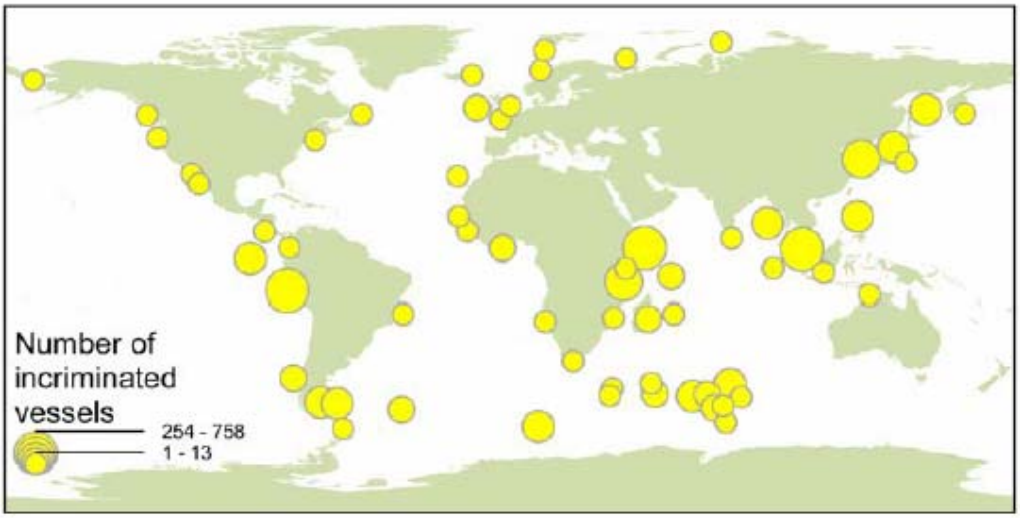

Figure 3 Number of Vessels Incriminated for Fishing Illegally Between 1980 and 2003, from Sumaila 2004[18]. Source: Based on Sea Around Us IUU database; **www.seaaroundus.org**. Figure courtesy Rashid Sumaila.

2.2. Methods used in this study

2.2.1. Introduction

There are insufficient studies or data to adopt a rigorous scientific analytical approach to estimating the magnitude of IUU catch, which would provide confidence intervals around estimates. In the absence of a widely applied, robust method, we have used several different *ad-hoc* bottom-up approaches for obtaining a quantitative, illustrative overview of the magnitude and distribution of the IUU problem, and factors that influence it.

As discussed in the previous section, the problem with bottom-up approaches is that reliable country level data are hard to obtain, and there is a high risk of missing information, and therefore of underestimating the size of the problem. To counter this risk, we have used several complimentary methods to try to get as full a picture as possible. Firstly we used a method we dubbed the “Big Issue” approach. This was essentially a literature search for big issues in IUU fishing that proved to be the best method of compiling data on high seas IUU catches. It was also effective in

[18] U.R. Sumaila 2004. The cost of being apprehended fishing illegally: empirical evidences and policy implications. OECD workshop on IUU fishing paper AGR/FI/IUU(2004)11

identifying and providing data on a number of key IUU activities within EEZs. Its results are given in Annex A. During the course of this work, however, it became clear that we would need to do some additional analysis to get a more accurate picture of IUU activity in EEZs. We therefore decided to look at a series of case studies in more detail in an effort to better understand the factors involved in states being more or less vulnerable to IUU fishing. In doing this we aimed to develop basic models of vulnerability that could be used to extrapolate to similar states that were not directly part of the case study analysis (Section 4).

To calculate an overall estimate of IUU catch and value we added together estimates from the Big Issue method (for high seas and EEZs) and the Case Studies method (for EEZs only). In compiling data from such a wide range of sources, there is clearly a risk of double counting – i.e. that the same IUU catches would be counted twice in calculating an overall total. This was a particular concern in the case of the EEZ estimate that might include values from both the Big Issue method and the Case Studies and case studies that might include some Big Issue tuna fishing data. In an effort to avoid this, while the Big Issue method provided information on a large number of IUU activities in EEZs (see Annex A), when calculating overall IUU catch levels we used only major examples of IUU fishing that were not covered by the Case Studies method (bearing in mind that the Case Studies method itself involves inferences and extrapolations outside the actual case studies themselves). The IUU fishing activities in EEZs for which we used catch estimates from the Big Issue method were cod, sturgeon, holothurians (sea cucumbers) and abalone. Cod and sturgeon are outside the area of the case studies, which focussed primarily on countries in Africa (see Section 2.2.3). IUU fishing on holothurians is prevalent in Annex A, but occurred in only some of our case study countries. IUU fishing for abalone is estimated to be of very high value, but in our case study region, occurs only in South Africa (which was not one of the actual case studies). All other IUU activities in EEZs were deemed to be covered by the Case Studies method.

The following sections provide additional details on the Big Issue and Case Studies methods used during this study. The results of implementing these approaches are presented in Section 3 (primary results) Annexes A and B, and Section 4 (analysis of case studies), which elaborates a detailed data analysis based on the case studies. Annex A summarises all the information compiled under the Big Issues method. A detailed presentation of the case study results is provided in Annex B. Estimates of the value of IUU catch on a global scale are discussed in Section 6.

2.2.2. The Big Issue method

The Big Issue approach refers to a comprehensive search through the literature, press articles, web pages and other reports for information on IUU fishing. Where possible, we identified the following items of summary data for each case:

- Area in the world where the activity took place
- Country where the IUU incident occurred
- Target species of the IUU activity
- Period when the activity took place
- Type of IUU (including whether high seas or EEZ)
- IUU flag states implicated in the IUU fishing
- IUU catch (tonnes, annual)
- IUU catch as proportion of legal catch
- Estimated value of IUU catch (Million US$)

- Summary description of the incident
- Reference: source of the information

We have converted available data into estimates of the dollar value of the IUU catch, and separated these into high seas and EEZ IUU fishing. Quantities were converted into estimated value using representative commodity first-sale values (Table 1).

Table 1 Representative fish product prices (tonnes whole weight equivalent) used in this study.

Target fish and source	$/t whole weight
Tuna purse seine	1000
Tuna longline	7000
Tuna general	1500
Shrimp[19]	8000
Octopus	8000
Shark (for fins)	265
Demersal	1500
Demersal discards	750
Bêche-de-mer[20]	1500
Small pelagics	450
Squid	1200
Orange roughy[21]	8000
Abalone	35000

However, there are substantial inherent problems with building overall estimates of IUU catch from a collection of incident reports. The following example illustrates the difficulties and uncertainties involved: In January 2005, Fishing News international (FNI) reported on the arrest of 9 Chinese squid jiggers fishing illegally in Peruvian waters and transhipping to reefers in international waters (Anon, 2005)[22]. Recent annual catches of Jumbo flying squid in the SE Pacific have been in the region of 50,000 t to China, 70,000 to Japan, 20,000 t to Korea and more than 100,000 t to Peru (FAO, Fishstat, 2002). If these jiggers had been operating in Peruvian waters for a month, then at average catch rates of 40 t/day (a modest jigger catch rate), they may well have taken 7000 tonnes of squid or more, worth about US$8M. However, in making this calculation we are making a number of very large assumptions about catch rates, days at sea, etc. Only detailed examination of the specific case of the Peruvian squid fishery would tell us whether this estimate was reasonable.

An important point to note is that the reports gathered in this part of the study are not all examples where a specific IUU incident has been confirmed through legal action. In some cases this may have occurred, but we did not limit our research to only these

[19] The shrimp price is very variable, being highly dependent upon size and quality. A single representative price has been selected based on market experience.
[20] The Bêche-de-mer price is highly variable, between $5 and $40 / kg dried weight, which equates to between $500 and $4000 / t wet weight. A single representative price has been selected based on market experience.
[21] New Zealand landings and economic data: source, New Zealand Ministry of Fisheries.
[22] Anon (2005) Fishing News International Vol. 44. No. 1 p.35 Jan 2005; see Annex A also.

cases[23]. The purpose of the exercise was to build up an overall image of where, when, how and by whom illegal fishing has been conducted, not to confirm or otherwise the facts of a specific case. We have, however, documented the source of the information in each case, to enable researchers to follow up on specific incidents if desired.

We also note that a feature of this approach is that it is very difficult ever to describe the searching process as complete. There is a large number and variety of potential sources of reports of IUU fishing, and particularly with the growth of web based information systems, it is possible to spend an enormous amount of time searching through them. However, there is clearly an issue of diminishing returns, and we have therefore attempted to gather only as much information as necessary to build a reasonably representative overall picture rather than attempt to exhaust all possible avenues of research. In this regard we relied on our experience of gathering information on fisheries to steer us to those sources that were likely to be the most fruitful. It would clearly be possible to find more examples than those listed in our results, but our expectation is that they would not add substantially to the conclusions we are able to draw from this component of the study.

The results of the Big Issue method are presented in Sections 3.1 and 3.2 and Annex A.

2.2.3. The Case Studies

To fill gaps in our knowledge on IUU fishing in EEZs, we identified several developing country case studies. The case study examples were selected on the basis of existing knowledge to provide a range from those which have good MCS and control over the IUU problem, to those with almost no control and substantial vulnerability to IUU fishing. The primary regional focus of the case studies was Africa (Figure 4), although two non-African examples (Seychelles and Papua New Guinea) were selected to provide some contrast with the African examples[24].

Detailed data were obtained on the IUU fishing problem in these countries, its drivers, its effects and potential solutions. Country based experts provided reports and data for use in our study. The detail of these reports must remain confidential, but the results of our analysis of these data are reported here. The case studies were analysed to provide insight into the impacts of IUU, the vulnerability of different countries and the most relevant solutions. In addition to these very detailed case studies, we were able to compile sufficient information on IUU fishing in *Namibia* and *Somalia* to include them as partial case studies.

The case study countries were:

- Guinea
- Liberia
- Sierra Leone

[23] In fact it would be almost impossible to develop a reasonable picture of the scope of IUU fishing by studying only those cases that are confirmed through the courts, because many prosecutions that are brought against companies and individuals for offences relating to IUU fishing are settled out of court and the details of these settlements are generally not publicly available.

[24] Although Seychelles may be considered to be geopolitically African.

- Angola
- *Namibia*
- Mozambique
- Kenya
- *Somalia*
- Seychelles
- Papua New Guinea

The results of the Case Studies approach are presented in Section 3.3 and Annex B. The analysis of data from the case studies is presented in Section 4.

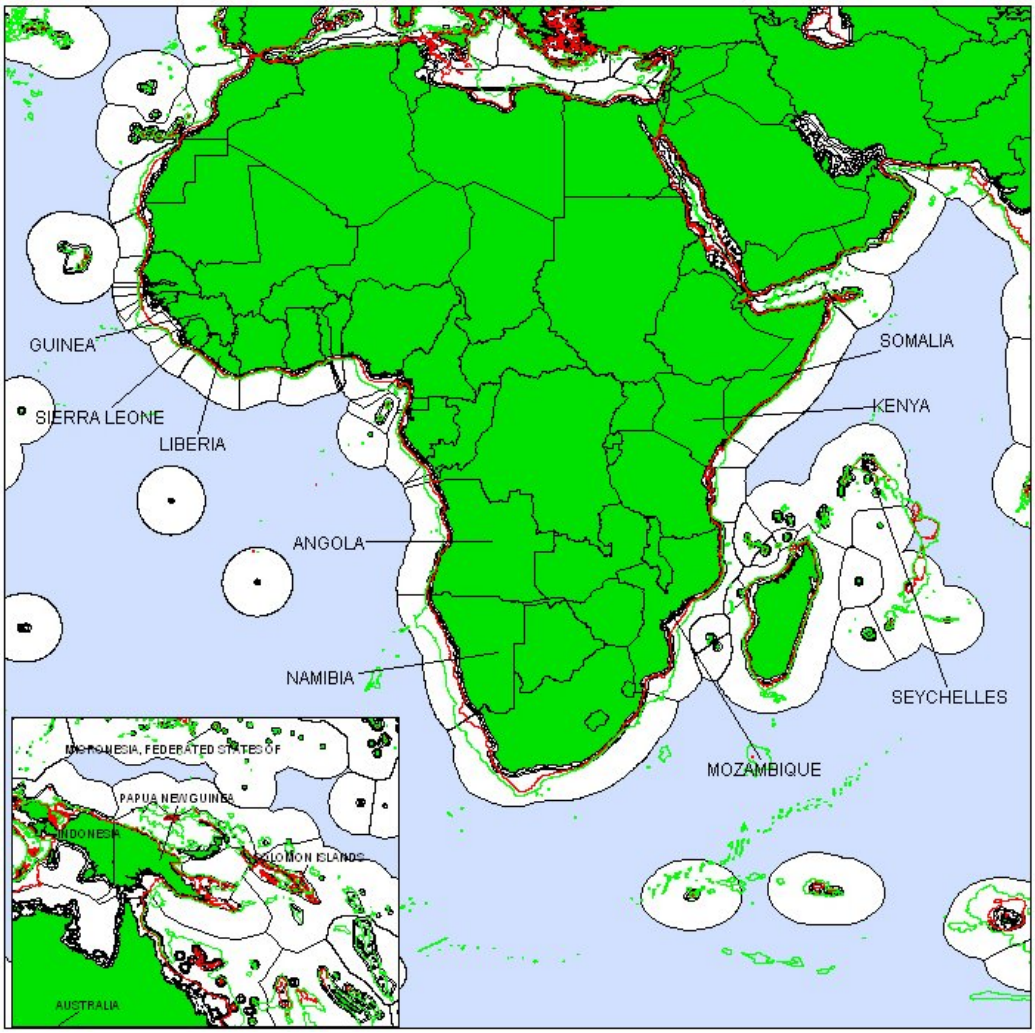

Figure 4 Map of EEZs in the study area with case study countries marked (EEZ boundaries from Global Maritime Boundaries Database 2005. General Dynamics Advanced Information Systems).

3. Primary results of the methods used in this study

In this section we discuss the primary results of the methods we used in this study.

Firstly we discuss the results of our "Big Issue" approach to estimating the scale and distribution of world IUU fishing. The detailed results of the literature search are presented in tabular form in Annex A. In the sections below we discuss some of the big issues in IUU fishing that are listed in Annex A and present estimates of the overall value of IUU catches that have resulted from this analysis. The discussion of the big issue results is separated into two main sections; one dealing with high seas IUU fishing, and the other dealing with IUU fishing in EEZs.

Secondly we summarise the results of our case studies approach that helps to fill in gaps left by the Big Issue approach, particularly with respect to IUU fishing within EEZs. Additional detail on the case studies is provided in Annex B. The results of the case studies are subject to a detailed analysis that is presented in Section 4.

Following these sections, there is a discussion of overall IUU catch value and the potential for coastal states to recover this, or part of it, by reducing IUU fishing.

3.1. Big Issues in High Seas IUU

Information that relates to high seas IUU fishing is highlighted in Annex A. Table 2 provides estimated total value of IUU fishing by major target species group calculated from these data[25]. Below we discuss high seas IUU fishing in each of these major areas.

Table 2 Estimates of annual value of High Seas IUU catches

Species group		annual value ($m estimated)
Tunas and tuna-like fish	Bluefin	33
	yellowfin, albacore, bigeye	548
	Chilean Jack Mackerel	**45**
Sharks	Sharks	192
Groundfish	Toothfish	36
	cod high seas	220
	Redfish	30
	roughy/alfonsino	32
Cephalopods	Squid	**108**
	Total	**1244**

[25] No information on IUU catch of salmon on the high seas was sourced during the course of this analysis. The main areas of potential high seas salmon catch are covered by international treaty (the North Pacific Anadromous Fisheries Commission and the North Atlantic Salmon Conservation Organisation). Little effort was directed at seeking information on IUU catch of salmon because this was considered to be of less importance than other species in the context of developing countries.

3.1.1. Tunas and tuna-like fish (large pelagics)

Since most tuna fisheries are now covered by RFMOs (Figure 5) IUU fishing for tuna is largely either unreported, because all vessels flagged in states that are party to these organisations should report catches, or unregulated by virtue of the flag states not being party to the relevant RFMO. IOTC and ICCAT both make estimates of IUU tuna catch. In the ICCAT Regulatory Area there remain small levels of IUU fishing for bluefin tuna, although since the introduction of the bluefin tuna document system this has dropped to relatively low levels of about 1% of the reported catch (Restrepo, 2004.[26]). The IUU catch of bigeye tuna has also dropped since the introduction of the document scheme, although it is still estimated at about 5% of reported catches. If we assume the same for yellowfin tuna, we can estimate that there may be between 5000 and 10000 t of these tunas being taken by IUU vessels in the Atlantic. There are no estimates for skipjack tuna IUU in the Atlantic.

In the Indian Ocean, IOTC estimates IUU catches (NEI) to be about 10% of reported catches amounting to about 130,000 tonnes annually (Herrera 2003[27], OECD, 2005[28]). At a conference organised by the International Collective in Support of Fishworkers (ICSF) and the International Ocean Institute (IOI) of India in 2001, Willman[29] also suggested that for the Indian Ocean, IUU fishing amounted to 10% of all reported landings of tuna and tuna-like species, in this case nearly 100,000 tonnes. CCSBT estimates IUU amounts to about 33% of its reported catches (OECD, 2005[30]), although this may now have dropped to about 10% with Taiwan recently gaining membership of the Commission.

In the Western Pacific, the bulk of IUU fishing probably occurs within EEZs and in particular within the waters of FFA members. This is mostly conducted by the vessels of distant water fishing nations, and there is likely to be some fishing by open register vessels in high seas waters (Richards 2004[31]). FFA has not yet made an assessment of IUU fishing in its region, because of problems of standardising methodologies, but intends to initiate such a study in 2005 (A. Richards, pers. comm.). Greenpeace[32] has estimated the IUU catch in the Pacific to be between 100,000 and 300,000 t with an estimated value of $134 - 400M, although this is a general estimate “assuming a conservative 5-15% IUU”.

All these tuna estimates include catches on high seas and within EEZs, because they are ocean-wide estimates. They do not, however, make the distinction and so for the purposes of this paper are considered to be primarily high seas catches.

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[26] Estimation Of Unreported Catches By ICCAT, OECD Workshop On IUU Fishing Paper AGR/FI/IUU(2004)20

[27] Catches of industrial fleets operating under flags of non-reporting countries in the IOTC Area of Competence: An Update Miguel Herrera (IOTC Secretariat). IOTC meeting internal paper

[28] Draft Synthesis Report On IUU Fishing Activities. AGR/FI(2004)18

[29] Willman, R. (2001). International Instruments for Managing Fisheries in the Indian Ocean. Conference on Coastal Communities and the Indian Ocean’s Future. IIT Madras, Chennai.

[30] OECD 2005. Draft Synthesis Report On IUU Fishing Activities. AGR/FI(2004)18

[31] Richards, A.H. Fisheries monitoring, control and surveillance in the western and central pacific. FFA report 03/25.

[32] http://weblog.greenpeace.org/pacific/background/pirate_threat.html

Finally, there has been increasing interest in high seas fishing for Chilean Jack mackerel since 2000, mostly by Chinese vessels. The estimated catch value is based on FAO catch data for 2003.

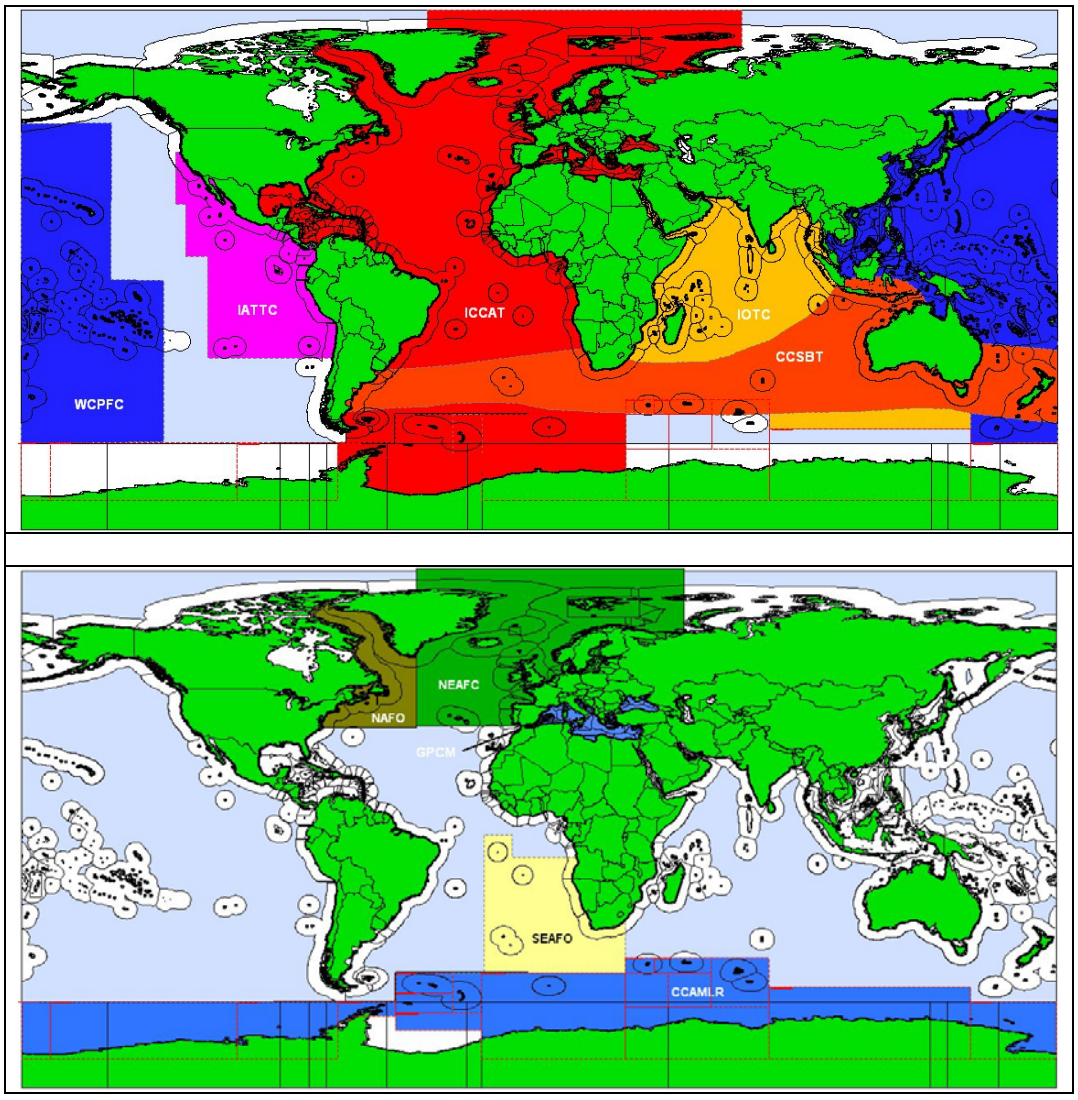

Figure 5 State of high seas governance for tuna and billfish species (top) and other marine resources (bottom). Only NAFO, NEAFC, SEAFO and CCAMLR have a remit that includes all marine fish, leaving vast areas of high seas available for unregulated fishing on pelagic and demersal fish [33].

[33] We note that in addition to RFMOs that cover all marine fish, there are several other high seas fisheries organisations that focus specifically on a single species, or group of related species that are not tuna or salmon. Examples include the International Pacific Halibut Commission, and the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea.

3.1.2. Sharks

Tuna organisations usually cover tuna and billfish, but they do not cover other pelagic resources such as sharks. A recent study of the shark fin trade in Hong Kong estimated that the total catch of sharks must be between 3 and 5 times that reported to FAO, between 1.1 and 1.9 million t per year[34]. S. Clark (pers. comm.) estimates that this catch is worth $292-476 in shark fin value alone. Between 66% and 80% of the total catch is therefore unreported, and probably 50% of the total catch derives from high seas waters. Many tuna longliners are now taking large quantities of shark as bycatch, or may even be targeting shark (e.g. Section 9.6 the case study report for Mozambique). In recognition of the potentially high catches of shark that may be taken specifically for the shark-fin trade, and in response to the FAO's International Plan of Action on Sharks, ICCAT has agreed a recommendation limiting the shark fishing activities in fisheries managed by ICCAT. The recommendation is that "CPCs [Contracting Party Countries] shall require their vessels to not have onboard fins that total more than 5% of the weight of sharks onboard, up to the first point of landing. CPCs that currently do not require fins and carcasses to be offloaded together at the point of first landing shall take the necessary measures to ensure compliance with the 5% ratio through certification." The practicalities of supervising this process will be a considerable challenge due the storage process i.e. fins are normally dried offshore then frozen in large sacks which may be difficult to detect/easy to conceal during the landing process unless provision for adequate monitoring is in place.

At the 72nd Meeting of the Inter-American Tropical Tuna Commission (IATTC) in June 2004, two proposals were put forward regarding sharks, one from the EU and the other from Japan. Both proposals expressed concerns of excessive shark fishing and presented a series of management measures: special licenses; clear operational guidelines aimed at reducing the volume of landings of shark fin and a 72 hour notification port landing system which would facilitate monitoring of catches. Although most CPC participants expressed their agreement to regulate the removal of fins of sharks onboard vessels, neither proposal was approved. However, the issue remains on the agenda and will be revisited in subsequent meetings.

The Commission for the Conservation of Southern Bluefin Tuna (CCSBT) has also expressed similar concerns through work by the Ecologically Related Species Working Group (ERWG) investigating trends in bycatch species associated with the fishery. They have conducted a sensitisation exercise and produced literature for fishers to encourage reporting and data submission. However, there are no definite resolutions in place and only request fishers to collect and submit data according to their flag state authorities' instructions.

3.1.3. Groundfish

By contrast with the large pelagics, very little of the world's high seas areas are covered by RFMOs that include responsibility for demersal resources (Figure 5). The Southern Ocean is one of the few exceptions, coming under the jurisdiction of CCAMLR. IUU fishing for toothfish in the Southern Ocean has received a great deal

[34] Clarke, S.C, M.K. McAllister, E.J. Milner-Gulland, G. P. Kirkwood, C.G.J. Michielsens, D.J. Agnew, E.K. Pikitch, H.Nakano and M. S. Shivji (submitted) Global Estimates of Shark Catches using Trade Records from Commercial Markets. Proceedings of the National Academy of Sciences (submitted).

of attention over the past few years. At its height, in 1997, CCAMLR estimates that 32600 t was taken illegally with a value of $160M (Agnew 2000[35]). Since then, IUU catch has dropped: in 2004 CCAMLR estimated that the catch was about 3000 t, which equates to about $40M[36] (CCAMLR 2004). Thus, even at its height the value of this IUU catch was not particularly significant in world terms. The reason why this fishery attracted so much publicity is probably that IUU was well estimated and publicly discussed by CCAMLR and publicised by a number of NGO and industry groups (e.g. ISOFISH[37]). The majority of this IUU catch was taken from EEZ areas within the CCAMLR Convention Area. A growing enforcement presence has forced IUU vessels to fish more in high seas parts of the Convention Area, especially close to the Antarctic continent.

Several years ago there was concern about IUU fishing in two high seas areas surrounded by EEZ waters – the famous donut hole in the Bering Sea, bounded by the EEZs of Russia and the US, and a smaller peanut hole in the middle of Russian EEZ waters in the Sea of Okhotsk. The "Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea" – also known as the Donut Hole Agreement - was signed in Washington on June 16, 1994, by China, South Korea, Russia, and the United States with Japan and Poland signing later that year. Under this agreement, the Donut hole has been closed to fishing since 1997. The peanut hole was closed to fishing the following year by Russian action. US and Russian patrols are frequent and have not detected significant IUU fishing in these areas in the last few years.

Regarding the north Atlantic, NEAFC has reported IUU fishing for redfish within its area. This was estimated at about 15000 t in 2004 OECD, 2005[38]. In the Barents Sea there is an area similar to the Bering Sea's donut hole, called the loophole, between the EEZs of Russia and Norway. There are continuing allegations about illegal cod catches from this stock (WWF, 2004 [39]), and although most of these appear to be illegal (unreported) catches taken in the Norwegian and Russian EEZs they amount to an estimated 100,000 t each year.

Another important groundfish species that is caught in high seas areas is Orange roughy. Fisheries for this species developed first in New Zealand in the 1980s, then in Australia in the late 1980s and in other Namibian and European waters in the 1990s. Few of the early stocks survived initial exploitation, stimulating exploration by many flag states, including Australian and New Zealand vessels, in high seas areas such as the Madagascar ridge. In addition to catches of orange roughy these vessels also took oreos and alfonsinos[40]. Catches from the Madagascar ridge were probably in the region of 10,000 t per year between 1999 and 2002, but have reportedly

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[35] Agnew, D J, 2000. The illegal and unregulated fishery for toothfish in the Southern Ocean, and the CCAMLR Catch Documentation Scheme. Marine Policy. 24: 361 – 374

[36] Note there was a substantial increase in the price of toothfish between 1997 and 2004.

[37] Fallon, L.D & L.K. Kriwoken 2004. International influence of an Australian non-governmental organisation in the protection of Patagonian toothfish. Ocean development & international law 35, 221-266.

[38] OECD, 2005: Draft Synthesis Report On IUU Fishing Activities. AGR/FI(2004)18

[39] Esmark, M & N. Jensen, 2004. The Barents sea cod - last of the large cod stocks. WWF Norway report 4/2004: www.wwf.no/core/pdf/wwf_codreport_2004.pdf

[40] Lack, M., Short, K. and Willock, A. 2003. Managing risk and uncertainty in deep-sea fisheries: lessons from Orange Roughy TRAFFIC Oceania and WWF Australia. ISBN: 1875941568

declined since then. However, significant exploratory activity is ongoing in other deep-sea high seas areas, particularly in the Pacific. FAO data (FAO 2003) show non-EEZ catches of orange roughy and alfonsino of about 2000 t per year, including areas in the SW Indian Ocean. Comparison of these figures with other reported data from the SW Indian Ocean suggest that catches of orange roughy were under-reported. The current high seas (unregulated) catch of roughys and alfonsinos is probably closer to about 4000 t per year, or $32million.

3.1.4. Cephalopods

There is a significant high seas fishery for the squid *Illex argentinus* in the south west Atlantic ocean, which is jointly estimated by Argentina and the UK to be about 50-100,000 t per year (Barton et al 2004[41]). The presence of IUU squid jigging vessels in high seas waters can be detected relatively easily through satellite surveillance because of the very bright lights that these vessels use (Boyle & Rodhouse, 2005[42]). A relatively large fleet of Taiwanese, Korean and Chinese jiggers, and Spanish trawlers, on the high seas just outside the Argentine and Falkland Island zones has lead to instances of poaching in adjacent non-high seas areas (see Annex A).

There are other high seas fisheries for squid, principally in the Pacific and there have been very recent reports of an illegal driftnet operation by Chinese vessels in the north pacific targeting neon flying squid *Ommastrephes bartramii* (T. Ichii, pers. comm.[43]). This method of fishing is banned by UN resolution. At its peak (1982 – 1992) this fishery caught between 100,000 and 200,000 tonnes annually (Ichii *et al*, submitted[44]). The high seas fishery for Jumbo flying squid (*Dosidicus gigas*) off the coasts of Peru and northern Chile has also raised some concern. FAO statistics show that the China is a recent entrant into this fishery, taking a reported 81,000 t of squid in 2003. This compares to 40,000 caught by Japan and 5000 tonnes caught by Korea, mainly within the Peruvian EEZ under licence. Although the main fishery takes place in Peruvian waters, some of these catches are from high seas waters (up to 300 nm from the coast[45]), and are therefore unregulated (there are currently no high seas RFMOs which regulate significant squid fisheries: only SEAFO and CCAMLR are capable of doing so). Recent arrests indicate that at least some of the Chinese catch, possibly about 40,000 tonnes (our estimate), is taken in high seas waters.

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[41] Barton, A.J., D.J. Agnew & L.V. Purchase 2004. The Southwest Atlantic; achievements of bilateral management and the case for a multilateral arrangement. In, Management of Shared Fish Stocks, A.I.L. Payne, C.M. O'Brien & S.I. Rogers (Eds.), Blackwell, pp 202 – 222. [Proceedings of the Symposium on International Approaches to Management of Shared Stocks – problems and future directions. Centre for Environment, Fisheries and Aquaculture Science (CEFAS), Lowestoft 10-12 July 2002].

[42] Boyle, P & P G Rodhouse 2005. Cephalopods: Ecology and Fisheries. Blackwell.

[43] see also http://www.fra.affrc.go.jp/pressrelease/pr16/161027/syasin3.pdf, http://www.fra.affrc.go.jp/pressrelease/pr16/161027/zu2.pdf

[44] Ichii, T., Mahapatra, K. and Okada, Y. (submitted) Stock assessment of the autumn cohort of neon flying squid (*Ommastrephes bartramii*) in the North Pacific based on the past large-scale high seas driftnet fishery data. Fisheries Research (submitted).

[45] Taipe, A, C. Yamashiro, L Mariategui, P Rojas and C. Roque 2001. Distribution and concentrations of jumbo flying squid (*Dosidicus gigas*) off the Peruvian coast between 1991 and 1999. Fish. Res. 54, *21-32*

3.2. Big Issues in IUU fishing within EEZs

As explained in Section 2.2.1, while Annex A identifies several important sources of IUU (illegal) fishing within EEZs, for the estimation of total IUU catch and value in this part of our analysis we focussed on four main IUU issues. These are listed, alongside their estimated values, in Table 3[46]. Economically, besides cod, two of the biggest issues in EEZ IUU fishing are sturgeon catches in the Caspian Sea and a worldwide illegal fishery for abalone (Gordon & Cook 2003; Hauck & Sweijd 1999[47]) which may be worth $130million. IUU fishing for the four species groups listed in Table 3 is discussed in more detail below. In Section 3.2.5 we also discuss the problem of mis-reporting of caches by domestic vessels operating in EEZs.

Table 3 Estimated annual value for four major targets of IUU fishing in EEZs.

EEZs	annual value ($m estimated)
cod	66
sturgeon	48
holothurians	12
abalone	129
Total	**255**

There are many reports in Annex A of general groundfish or shrimp poaching, but we will not make an estimate of their value or volume at this stage. We prefer instead to address the inclusion of these catches in our overall estimate through the case studies. Similarly, there are reports (e.g. Figure 26, Annex B) of large-scale illegal catches of tuna in EEZs. However, to avoid double counting we will not include them as EEZ catches, but under the ocean-wide estimates made by the tuna commissions, as discussed in 3.1.1. Unfortunately their inclusion in the case study estimates is unavoidable and leads to some possibility of double counting.

[46] Note also that IUU catches of tuna from inside EEZs are included in estimates for the high seas (see Section 3.1.1).

[47] M. Hauck, and N. A. Sweijd 1999. A case study of abalone poaching in South Africa and its impact on fisheries management, ICES Journal of Marine Science, 56: 1024–1032.

3.2.1. Cod

There are numerous instances of illegal fishing within EEZs. Of particular topical interest is the under-reporting of whitefish in the northeast Atlantic. Several references to this are made in Annex A. It is not possible to quantify all of these, but the most high profile has been cod. Recent reports (for example, *Net Benefits: A sustainable and profitable future for UK fishing: 2004. UK Government Prime Minister's Strategy Unit)* suggest that up to half of the cod landed in the United Kingdom is landed as "black fish" - i.e. misreported. There is also significant IUU fishing for cod in the Baltic Sea, estimated by ICES 2004 to have been about 40% of the legal catch from 2000 to 2003.

The European Commission has recently reported[48] that there was a significant increase in the number of compliance infringements reported by Member States in 2003. Of the 9502 infringements (up from 7298 in 2000, 8139 in 2001 and 6756 in 2002) 88% were reported by only 5 Member States (Greece, France, Spain, Italy and Portugal) the last three being by far the most important. The major infringements were unauthorised fishing or fishing without a licence, i.e. IUU fishing. We have no estimate of the catches associated with these incidents.

3.2.2. Sturgeon

Historically high legal and illegal levels of exploitation in addition to habitat degradation have resulted in serious depletion of sturgeon stocks, particularly in areas such as the Caspian Sea. The global sturgeon catch declined from a peak of 32,078 tons in 1978 to 2,658 tons in 2000 (Catarci, 2004).[49] This has generated an increase in demand for less expensive caviar from poaching and smuggling (Catarci, 2004).[50] Approximately 75% of the global sturgeon catch comes from the Caspian Sea, which is fished by Azerbaijan (71 tons), Iran (1000 tons), Kazakhstan (est. 270 tons) and Russia (648 tons) (Catarci, 2004).[51] Golding, 2001[52] reported that the sturgeon poached in Kazakhstan in 2001 amounted to almost two thirds of the official quota produced by Kazakhstan each year, totalling approximately 180 tons. In Iran, the strict implementation of the CITES regime and tightening of controls on poaching and smuggling are thought to have had a beneficial impact against illegal activities (Catarci, 2004)[53]. Therefore, if Iran's catches are excluded, the estimate of IUU for the Caspian Sea region is 659 tonnes, being 989 tons multiplied by two thirds (66.67% - estimate of Kazakhstan IUU catch). Similarly a ballpark estimate for the global IUU is in the region of 1,105 tonnes per annum.

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[48] EC 2005. Reports from Member States on behaviours which seriously infringed the rules of the Common Fisheries Policy in 2003. Brussels, 30.5.2005 COM(2005) 207 final.

[49] Catarci, C. (2004) World markets and industry of selected commercially-exploited aquatic species with an international conservation profile. FAO Fisheries Circular No. C990. 212pp.
[50] ibid Catarci (2004)
[51] ibid Catarci (2004)
[52] Golding, P. (2001) Sturgeon poachers netted. 5 June, 2001. BBC News Online. Available at: http://news.bbc.co.uk/1/hi/world/asia-pacific/1370267
[53] op. cit. Catarci (2004)

Calculating the equivalent export value is a little more complicated as this is predominantly in the form of caviar, and price varies for caviar from different sturgeon species and from different regions. Caviar is illegally exported from Russia, or may be repacked and falsely labelled in Eastern Europe before appearing on European retail markets (De Meulenaer and Raymakers, 1996)[54]. In Germany, this type of caviar sells at a fraction of the usual price. In one case, caviar that should retail at US$700 per kilo was sold for as little as US$150 per kilo (De Meulenaer and Raymakers, 1996)[55], but prices can be as high as US$3,000 per kg or as low as US$20 per kg (Golding, 2001)[56]. Inconsistent retail prices in various locations also suggest illicit caviar trade (De Meulenaer and Raymakers, 1996)[57].

However, if the export value of IUU is equivalent to two thirds of the legal export value of all caviar from the Caspian Sea Region (see Catarci, 2004)[58], then this could amount to US$48 million. Alternatively, if calculated as two thirds of Caviar quotas for the region (approximately 11,000kg calculated from CITES (2004)[59]), the range could be from US$0.2 - 33.1 million depending on the sale price per kilo (US$20-3000/kg).

3.2.3. Holothurians

There is clearly a significant amount of illegal poaching of sea cucumbers and trochus. Many tropical areas in the Indo-Pacific region are heavily overfished for holothurians[60,61] and much of this fishing is illegal. Sea cucumber illegal fishing is also a problem in the Seychelles and other Indian Ocean countries, and in central America. However, although individually very valuable (up to $40/kg dry weight) the total catch of bêche-de-mer is small in terms of tonnage. For instance, the total catch of tropical sea cucumbers from all oceans was about 8000t (FAO Fishstat statistics) the value of which is about $12million, and the IUU catch is unlikely to be greater than this (See also Section 9.10 on Papua New Guinea).

3.2.4. Abalone

Illegal trade in abalone has been reported for a number of countries including Australia, South Africa, New Zealand, United States, Mexico, Japan, Canada, Korea, Philippines, Taiwan and some other Indo-Pacific countries (DAFF, 2005; Gordon and

[54] De Meulenaer, T. and C. Raymakers (1996) Sturgeons of the Caspian Sea and the International Trade in Caviar. A TRAFFIC Europe Report. Summary available at: http://www.traffic.org/publications/sturgeons.html
[55] ibid De Meulenaer, T. and C. Raymakers (1996)
[56] op. cit. Golding, P. (2001)
[57] op. cit. De Meulenaer, T. and C. Raymakers (1996)
[58] op. cit. Catarci (2004)
[59] CITES (2004) Press Release. CITES authorizes 2004 export quotas for Caspian Sea caviar. Bangkok, 8 October 2004.
[60] Gordon, H. R. and Cook, P.A. (2003). World Abalone Supply, Markets And Pricing: Historical, Current And Future Prospectives. Opening Speech: 5th International Abalone Symposium, Quingdao, China October 2003.
[61] http://www.spc.org.nc/coastfish/News/BDM/21/Uthicke-Conand.pdf

Cook, 2003)[62]. Figure 6 gives an indication of what proportion of the world illegal catch (MT adjusted to 'in shell' weight), illegal catches from each country represent.

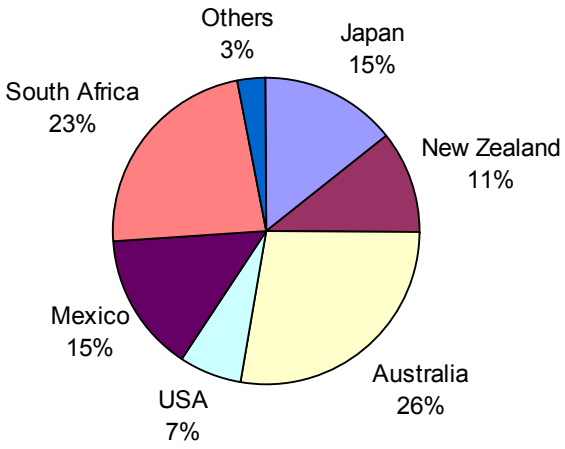

Figure 6 Illegal abalone catch as a percentage of the world total (3696t), as of 2002. Others includes Korea, Philippines, Solomon Islands, Oman, Taiwan. (Reproduced from data in Gordon and Cook, 2003[63]).

Various factors make abalone an attractive illegal commodity. These include high market value (US$26-300 per kg depending on form[64]); high value to weight ratio which makes it relatively easy to smuggle and transport in commercial quantities; the strong overseas and domestic demand from purchasers uninterested in product origin and additionally the ease of harvesting, from shallow inshore waters requiring little capital, often in remote areas where illegal collection is likely to go undetected (DAFF, 2005[65]).

In recent years, Australia's stake in the global supply has increased following the decline of abalone populations in other parts of the world, including Japan, Mexico,

[62] Department of Agriculture, Fisheries and Forestry, Australian Government (2005) Effective Export Controls For Illegally Harvested Abalone. Discussion Paper, March 2005. 31pp. Available at: http://www.daff.gov.au/fisheries/abalone/illegalexportpaper;

[63] Japan, 536 t; New Zealand, 400t; Australia, 1000t; USA, 250t; Mexico, 550t; South Africa, 850t; others, 110t.

[64] Prices for abalone range from US$30-40/kg for live abalone at import since 1996 (US$32/kg in 1999 (Hauck and Sweijd, 1999, see footnote 12); US$300/kg for dried abalone in 2000; US$80-86/kg for frozen, shucked (shelled) abalone and US$26/kg for frozen in-shell abalone during 200/01 season.

[65] Op. cit.

South Africa and the United States (California)[66] as a result of negative environmental conditions, limited stocks, illegal fishing and poor fisheries management (Tailby and Gant, 2002[67]). However, the increasing pressure on Australian fisheries to meet continuing demands has created greater incentives for people to supply the black market with illegally harvested abalone (DAFF, 2005)[68]. With profits from the harvest and sale of illegal abalone for one Australian poacher estimated to be in excess of $1 million per year (Neales 1997[69]) it is unsurprising that the abalone trade is beginning to attract the interest of some organised crime figures (Tailby and Gant, 2002[70]).

Illegal activity in Australia (and similarly in other countries) includes poaching by unlicensed operators, breaches of quota limits/bag limits by licensed operators or recreational fishers, harvesting undersized abalone, illegally processing abalone (whether for domestic sale or export), exporting abalone without export permits, substituting illegal produced for legal product and misreporting goods (DAFF, 2005)[71].

In South Africa, the only targeted species of the three endemic abalone species present is *Haliotis midae*, commonly known as Perlemoen (Wilcock et al., 2004[72]). Over-exploitation since the late 1960s (Tarr, 1989[73]), illegal harvesting and environmental change have combined to severely impact the resource (Wilcock et al., 2004[74]). The environmental changes thought to be adding to the demise of wild stock abalone in South Africa, include the movement of rock lobsters in to traditional abalone grounds, affecting abalone breeding success by eating large numbers of sea urchins, which provide vital protection for early lifecycle stage abalone (Anon, 2004i, Hauck and Sweijd, 1999; Plagányi and Butterworth, in prep.[75]).

Illegal harvest of Perlemoen has been estimated to be between 25 and 100% of the commercial quota (403 t whole mass (118.5 t product mass) for 2002/03) (Wilcock et al., 2004[76]). In 2004, South African authorities confiscated 550,000 individual abalone of the 1.5 million believed to have been poached, while in January 2005, in a raid of two warehouses in Blackheath, Western Cape police found 14 tonnes of abalone

[66] The US abalone fishery was closed indefinitely in 1997, illegal catches however continued to rise to over 120 MT/year according to the California Department of Fish and Game (2002) see Gordon and Cook, 2003.
[67] Tailby, R. and Gant, F. (2002) The Illegal Market in Australian Abalone. Australian Institute of Criminology: trends and issues in crime and criminal justice. No 225. April 2002.
[68] ibid
[69] Neales, S. 1997, “The big steal”, Good Weekend, 11 October 1997.
[70] Op. cit.
[71] ibid
[72] Wilcock, A., Burgener, M. and Sancho, A. (2004). First Choice or Fallback? An examination of issues relating to the application of Appendix III of CITES to marine species. TRAFFIC International.
[73] Tarr, R. J. Q. (1989). Abalone. In: Payne, A. I. L and Crawford, R. J. M. (eds.) Oceans of Life off Southern Africa. Cape Town, South Africa.
[74] Op. cit.
[75] Anon (2004i) Woman jailed for ten years for Abalone smuggling. Fishing News International Vol. 43. No. 11 p.3 November 2004; Hauck, M. and Sweijd, N.A. (1999) A case study of abalone poaching in South Africa and its impact on fisheries management. ICES Journal of Marine Science, 56: 1024-1032; Plagányi, E.E. and Butterworth, D.S. (in prep) A spatial- and age-structured assessment model to estimate poaching and ecosystem change impacting the management of South African abalone (Haliotis midae); Plagányi, E.E. and Butterworth, D.S. (In press) Does classic stock assessment have a role in a failed case of reconciliation of fisheries with conservation?
[76] Op. cit.

worth around US$1.2 million (FIS, 2005d[77]). A recent model predicted a poaching estimate for four of the seven fisheries zones in South Africa, as 933 t for 2003 (corresponding to the assumption that, on average, 36% of all poached abalone are confiscated); more than seven times the legal 2003 commercial TAC for these zones (Plagányi, and Butterworth, In press[78]).

Over 90% of abalone harvested in South Africa is exported, primarily to Hong Kong, but also to China, Japan, Malaysia, the Republic of Korea, Philippines, Singapore and Taiwan (Wilcock et al., 2004[79]). Records from the Census and Statistics Department of Hong Kong show that over 200 000 kg of frozen shucked Perlemoen and over 100 000kgs of dried Perlemoen were imported into Hong Kong from Mozambique, Namibia, Tanzania, Swaziland and Zimbabwe during 2002 and the first six months of 2003 (Wilcock et al., 2004[80]). Since Perlemoen is endemic to South Africa, it is suggested that all of this imported Perlemoen was harvested illegally in South Africa and smuggled into the other African countries (the exception being Namibia[81]) and re-exported to Hong Kong (Wilcock et al., 2004[82]).

Taking Gordon and Cook's (2003) estimate of the world's illegal catch for 2002 as 3696t of in-shell abalone, and an average price of US$35/kg, a ball-park estimate of the total value of world IUU abalone catch is approximately US$129 million.

The rise in abalone poaching in recent years and the ensuing drop in abalone stocks has prompted TRAFFIC, an organisation set up to stop illegal trade in endangered species, and other environmentalist groups to call for the species to be given Appendix 3 status in the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) to help control illegal trading (FIS, 2005d[83]).

3.2.5. Misreporting by domestic vessels operating in EEZs

Thus far, our analysis has only considered instances of IUU fishing by DWF nations within EEZs – i.e. we have not factored in misreporting by domestic vessels, or discarding/highgrading. This is a substantial area of potential IUU activity and almost all developed and developing nation fisheries suffer from these problems, to a greater or lesser extent. For instance, several recent reviews have estimated that the quantity of unreported fish in EU waters may exceed 50% of declared catches for some species including cod, whiting and mackerel[84]. Rejwan et al (2001[85]) suggest

[77] Fish Information & Services (2005d) Authorities to clamp down on abalone poaching, South Africa, January 13, 2005

[78] Plagányi, E.E. and Butterworth, D.S. (In press) Does classic stock assessment have a role in a failed case of reconciliation of fisheries with conservation?

[79] Op. cit.

[80] ibid.

[81] Imports from Namibia in 2003 may be of legally farmed origin (Wilcock et al., 2004).

[82] ibid

[83] Op. cit.

[84] Several sources are relevant here. 1) Net benefits: a sustainable and profitable future for UK fishing. UK Strategy Unit report, March 2004. 2) FNI/EC reports presented in Table 1. 3) D. Pauly & J. Maclean, In a perfect ocean. Island press, 2003.

[85] Rejwan, C., S. Booth & D. Zeller 2001. Unreported catches in the Barents Sea and adjacent waters for periods between 1950 and 1998. In: D Zeller, R Watson, D Pauly (Eds.) Fisheries impacts on North Atlantic ecosystems: catch, effort and national/regional data sets. Fisheries

that the average unreported catch of NW Atlantic redfish, horse mackerel, haddock, herring, witch flounder and hake over the period 1950 – 1998 exceeded 25% of the declared catch, with peak unreported catch rates for most species being over 100% of declared catch. Pauly & Maclean also assert that Spanish vessels have underreported their catch of swordfish and NE Atlantic cod during some years. Castillo & Mendo (1987[86]) suggest that in 1970, just prior to its collapse in 1972 at least 25% of the probable total catch of 16 million tonnes of Peruvian anchovy was unreported. Pitcher *et al.* (2002)[87] suggest that underreporting of catches is commonplace and give examples from Peru, Malawi, Scotland, Spain, the Antarctic, Canada, France, Iceland and Morocco. The paper also reports the findings that where new fishing technology has been introduced to existing fisheries, it has made deep water or marginal stocks vulnerable with under reporting of up to 75%, while on the high seas, under reporting may be as high as 100%. If these estimates of under-reporting were to be included in our figures, the total IUU catch would clearly increase significantly.

3.3. Case Study results summary

As described in Section 2.2.3, several developing country case studies were conducted in order to examine the problems of IUU fishing in more detail. Countries were selected, primarily from Africa, to represent MCS capabilities and effectiveness ranging from good to virtually non-existent. In addition to the country case studies, a specific analysis was conducted on tuna resources that migrate through a large number of EEZs of African coastal states.

A total of 10 states were studied; eight from Africa, one from the western Indian Ocean and one from southeast Asia. Country based experts provided data and reports. The following countries were examined:

- Guinea
- Sierra Leone
- Liberia
- Angola
- Namibia
- Mozambique
- Kenya
- Somalia
- Seychelles
- Papua New-Guinea.

For each country, we provide in Annex B (page 136) an overall view of the fishery, followed by an assessment of the IUU problem and an estimate of the total IUU losses. The level of MCS capability and effectiveness is also discussed. The results are summarized in Table 4.

Centre Research Report 9(3), pp 99-106. [www.saup.fisheries.ubc.ca]. Cited from Pauly & Maclean 2003.

[86] Castillo, S. & J. Mendo 1987. Estimation of unregistered Peruvian anchoveta (*Engraulis ringens*) in Peruvian catch statistics, 1951-1982. In D Pauly & I Tuskayama (Eds.), The Peruvian anchoveta and its upwelling ecosystem: three decades of change. ICLARM Studies and Reviews 15, pp 109-116. Cited from Pauly & Maclean 2003.

[87] Pitcher, T. J., Watson, R., Forrest, R, Valtýson, H. P., and Guénette, S. (2002). 'Estimating illegal and unreported catches from marine ecosystems: a basis for change. Fish and Fisheries, Volume 3, Issue 4, pp 317 – 330.

Overall, we estimated that the total loss to IUU fishing in the case studies was $372M: 19% of the total value of the catch; or 23% of the declared value of the catch.

There were clearly two groups of problems, associated with the different types of fishery. Shrimp fisheries (Guinea, Sierra Leone, Liberia, Mozambique) suffered IUU fishing from industrial vessels from DWFN fleets. Although these vessels might have been unlicensed they were often licensed in a neighbouring state; if they were licensed they were often guilty of trawling in prohibited zones, especially those close inshore that are created for protection of artisanal fishermen. Shrimp fishing generates large quantities of demersal discards (estimated by our case studies as between 3 and 12 times the volume of shrimp) which otherwise would be available for artisanal fishermen. Although licensed shrimp fisheries also generate these discards, in some countries there are arrangements between licensed vessels and artisanal fishers for access to these potential discards, which are not in place with IUU vessels.

The second problem is tuna, experienced by some of the aforementioned countries and additionally Somalia, Seychelles and PNG. This type of IUU has more impact on the country economics than simply artisanal fishermen, because the usual licensed route of extraction is not artisanal fishermen but DWFN purse seiners and longliners operating under access agreements, which themselves generate government revenue from licensing. They create significant environmental impact not on demersals but on charismatic megafauna such as sharks, turtles and birds.

Not all IUU fishing is conducted by DWFNs by any means. Significant IUU fishing in our case studies is conducted by vessels from other developing countries, especially Sri Lanka and Kenya. The issue of control of flag vessels is addressed in Section 4.3.2.

Table 4 Summary of estimated IUU losses ($m) and state of MCS for each of the case studies described in Annex B.

Summary	Guinea	Sierra Leone	Liberia	Angola	Namibia	Mozambique	Kenya	Somalia	Seychelles	Papua New Guinea	Total
Demersal	17.2	21.2	4.5	0.0	0.1					16.5	59.4
Small Pelagic	0.0		0.0	22.5			2.9				25.5
Tuna general	4.8	3.0	6.4	0.9		3.2		90.0			108.3
Tuna purse seine									7.4	5.4	12.8
Tuna longline										3.4	3.4
Shrimp	27.2	4.5	0.8	11.8		27.0		4.0		3.3	78.7
Cephalopods	48.5										48.5
Demersal discards	7.6			13.7		7.6					29.0
Shark							0.9		0.1	2.4	3.4
Bêche-de-mer									0.0	3.2	3.3
Total	**105.3**	**28.7**	**11.7**	**49.0**	**0.1**	**37.8**	**3.8**	**94.0**	**7.5**	**34.2**	**372.1**
State of MCS	Poor	very poor	almost non-existent	moderate	very good	moderate	poor	almost non-existent	good	good	

4. Exploring causes and effects of IUU fishing

As described in Section 2.2.1, during the initial stages of our literature search, the results of which are presented in the previous section and Annex A, it became clear that we would need to do some detailed analysis of data collected during the case studies to get a more accurate picture of IUU activity within EEZs and hence the potential causes, impacts, and means of mitigation. This analysis is described in this section.

We begin our analysis by developing a regional summary, to put the issues discussed in our case studies into context. We follow this with a consideration of various features of developing countries that might cause them to be more or less vulnerable to IUU fishing, with a view to modelling possible quantitative relationships. The object of the modelling exercise is to examine relationships between hypothetical vulnerabilities and IUU activity, and to use these relationships to make reasonable inferences about vulnerabilities throughout the region, i.e. both within and beyond the case study countries. We then consider the potential total regional impact based on the predictions of the model. We conclude this section by presenting a brief summary of the socio-economic and environmental impacts that we have previously reported on.

The final part of this section is devoted to describing several external drivers (i.e. factors outside the control of coastal states) that play a role in the development of IUU fishing activity. For example, the likely trajectory of IUU fishing caused by economic factors such as the vessel bulge. We also present an analysis of the vessels and flag states involved in IUU fishing, and in particular an analysis of the influence of open registries. Vessels from open registers are implicated in a great deal of high seas IUU fishing (Annex A)

4.1. Vulnerability analysis

4.1.1. Regional summary

Our review has identified that some countries are quite vulnerable to IUU fishing, e.g. Guinea and Liberia, while others are less so, e.g. PNG and Seychelles. As discussed in Annex B, this is largely a consequence of their available MCS capability, but it is also dependent upon the existence of different types of fishery within their EEZs and the status of the access arrangements for these.

4.1.1.1. Central West Africa

The central western African states, from Guinea to Angola, have mostly shrimp and groundfish resources. Of these shrimp is a very valuable resource, and so they are vulnerable to shrimp IUU. This has the additional drawback of being a shallow water fishery, with consequent potential for conflict with artisanal fisheries.

4.1.1.2. North West Africa

North west African states have similar resources augmented by significant, valuable, octopus fisheries. However, the contrast in MCS capacity between Mauritania and Senegal on the one hand and Guinea to Sierra Leone on the other hand is enormous (see Annex B). Even though all these countries are part of the Sub-Regional Fisheries Commission which has joint surveillance capabilities, investment in MCS has been much higher in the northern countries than in the south. In Cape Verde, the Gambia, Mauritania and Senegal fewer IUU events are reported by Kelleher (2002[88]), and in general MCS capability is moderately good (although we note that an MCS system has still to be implemented for Mauritania). By contrast in Sierra Leone, Guinea and Guinea Bissau, considerable IUU fishing is suspected – 50-60% of total catch. Limited MCS capacity creates the problem, and in particular some vessels take advantage of contiguous fishing grounds on the border of Guinea and Guinea Bissau to evade detection or inspection by boundary-hopping. This is by no means a unique problem for the MCS authorities of Guinea and Guinea Bissau – boundary hopping by beam trawlers in the North Sea stimulated the initiation of "Operation Shark" (UK, Belgium, Netherlands), and the existence of "doughnut holes" of high seas waters bounded by EEZ areas has created problems in the SW Atlantic and Bering Sea. Other West African states, such as Mauritania and Senegal, continue to report border hopping as a problem as well as problems stemming from corruption. It is also probably significant that those with the better standard of MCS have all profited from long-term bilateral fisheries agreements, which have given a predictable income to allow such investment.

There is some possibility of IUU tuna fishing in the waters of the coastal states, and other IUU opportunities exist. All along the West African coast, as far south as northern Angola, there is an offshore tuna fishery. The coastal states have little awareness of its magnitude and no facility to monitor and control it. Use of ICCAT records (Annex B, Section 9.1) show that this is a considerable fishery and the countries appear to need some assistance in using these data.

Many of these states have fishing agreements, *inter alia*, with the EU and China and may licence vessels from the EU, China, Korea, and other West African states. A portion of catch is probably not reported by these licensees[89] and it is likely that discarding is quite high. For instance, Mauritania reports that fisheries agreement catch data are often reported very late and there is no provision for scrutiny of landing of catches outside Mauritania by Mauritanian officials. Cooperation in MCS is increasing, however, under the auspices of the Sub-Regional Fisheries Commission (Guinea Bissau, Guinea, Sierra Leone, Gambia, Mauritania, Cape Verde and Senegal). This Commission has issued a joint ministerial declaration on IUU fishing (Nouakchott Declaration) (Kelleher, 2002).

4.1.1.3. South West Africa

The situation of South Western African states Angola, Namibia and South Africa is quite different. Here the major fisheries are sardine, horse mackerel, general

[88] Kieran Kelleher, 2002. Robbers, Reefers And Ramasseurs. A Review Of Selected Aspects Of Fisheries MCS In Seven West African Countries. Sub-Regional Fisheries Commission Project AO/GCP/INT/722/LUX (AFR/013) Version 2. July 2002.

[89] There is an incentive to under report, for example when agreements specify a ceiling on the catch amount and a supplemental fee per tonne for catches above this limit.

demersal fish, hake and shrimp. Very little information is available on Angola IUU fishing, although the country has a fisheries agreement with the EU which prosecutes a profitable fishery for deepwater rose shrimp in Angolan waters[90]and it does have some MCS capacity. Other fishery resources are horse mackerel and small pelagics. In contrast IUU fishing is probably at a low level in Namibia and South Africa as a result of the high levels of MCS in those states. The exception is the domestic abalone fishery, which in South Africa is subject to very high levels of poaching (estimates from Gordon & Cook are for IUU to be twice the level of legal catch in 2002[91]) and the South African authorities continue to arrest illegal abalone and lobster operations (Anon, 2004g[92]). Namibian MCS activity is particularly high, with MCS expenditure in 2002 running at about 42% of revenue from fishing (Berg & Davis 2004, Sumaila 2004[93]). Finally, regional cooperation on MCS (especially between Namibia and South Africa) is good and likely to improve with the initiation of the Benguela Commission.

4.1.1.4. East Africa

Moving to the Indian Ocean, east African countries appear to suffer from IUU fishing of many resources including shrimp, but here tuna is of greater importance. Some of this IUU is from border-hopping activities – such as the reported IUU fishing by Kenyan shrimp trawlers in Somali waters – and some of it is DWFN activity, such as the Taiwanese longline activity in Tanzanian waters that in 2001 we estimate to have been worth about $20m (Annex A). Recent reports is that this has been brought under control by Tanzanian authorities, through improved licensing schemes, but this has yet to be validated and there are other aspects of IUU in Tanzanian waters that would bear scrutiny, such as possible underreporting by DWFN under access agreements. As with the situation in Sierra Leone, the rampant IUU activity (tuna and shrimp) in Somali waters is caused by low MCS capability but most importantly weak regulatory structures and corruption [94]brought on by the recent protracted civil war.

4.1.1.5. Summary

In summary, tuna is the great unknown, shrimp is the greatest form of conflict and, apart from unlicensed vessels and misreporting, fishing in the wrong place is the most frequent offence.

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[90] Offshore fisheries in Angolan waters: report for BP by RRAG, Imperial College, 2002.

[91] Gordon, H. R. and Cook, P.A. (2003). World Abalone Supply, Markets And Pricing: Historical, Current And Future Prospectives. Opening Speech: 5th International Abalone Symposium, Quingdao, China October 2003.

[92] Anon (2004g) Fishing boss jailed in US. Fishing News International Vol. 43. No. 7 p.2 July 2004

[93] Bergh, P.E., Davies, S.L. (2004) “Against all odds: taking control of Namibian fisheries”. In Sumaila, U.R., S. I. Steinshamn, M. D. Skogen and D. Boyer (Eds.). Namibian Fisheries: Ecological, Economic and Social Aspects. Eburon Deft, Netherlands, in press.; U.R. Sumaila The cost of being apprehended fishing illegally: empirical evidences and policy implications. OECD workshop on IUU fishing paper AGR/FI/IUU(2004)11

[94] Although there is not offshore surveillance capacity, there are reports of local warlords mounting *ad hoc* operations in the near-shore area, and the consequences of being caught can be severe. It seems likely, therefore that there is less IUU activity in the parts of the coastal fringe patrolled by these entities, out to perhaps 20 or 30 miles offshore.

4.1.2. Predicting IUU catch

In this section we aim to establish quantitative relationships by country between the estimated amount of IUU fishing and the values of indicators of vulnerability to IUU fishing. If we are able to show significant relationships using the case studies, it may be reasonable to use them to extrapolate to other countries in our study area (essentially sub-Saharan Africa and outlying islands). To do this requires the development of a series of indicators against which the various aspects of IUU, such as the magnitude of losses, can be assessed.

4.1.2.1. Potential indicators of vulnerability to IUU fishing

There are several potential indicators of vulnerability to IUU fishing:

1. The state of MCS resources. The presumption is that higher MCS capability will lead to lower vulnerability. MCS status was assigned an arbitrary scalar value from review of the case studies. MCS status was only available for the case study countries.

2. The state of governance of the country. The presumption is that the higher the state of governance, the higher rates of compliance will be, and therefore the lower the vulnerability will be. Since this is a particularly important indicator it is described in more detail below.

   Indicators for the current state of governance were estimated from a recent World Bank report (Kaufmann et al. 2005). The governance indictors measure the following six dimensions of governance:

   - *Voice and Accountability* – measuring political, civil and human rights
   - *Political Instability and Violence* – measuring the likelihood of violent threats to, or changes in, government, including terrorism
   - *Government Effectiveness* – measuring the competence of the bureaucracy and the quality of the public service delivery
   - *Regulatory Quality* – measuring the incidence of market-unfriendly policies
   - *Rule of Law* – measuring the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence
   - *Control of Corruption* – measuring the exercise of public power for private gain, including both petty and grand corruption and state capture.

In total, the report covers 209 countries and territories for years 1996, 1998, 2000, 2002 and 2004. In this study we have restricted the analysis to the sub-Saharan countries and the 2004 data only. The indicators are based on several hundred individual variables measuring perceptions of governance, drawn from 37 separate data sources constructed by 31 different organisations. Point estimates of the dimensions of governance are estimated, as well as the margins of errors for each country and period. The governance indicators are normally distributed with a mean of zero and a standard deviation of one in each period. This implies that virtually all scores lie between -2.5 and 2.5 (Kaufmann et al. 2004[95]). An example of "Control of

[95] Kaufmann D., A. Kraay and M. Mastruzzi (2004). "Governance Matter III: Governance Indicators for 1996, 1998, 2000 and 2002". World Bank Economic Review. 18:253-287.

Corruption" has been produced for all 209 countries, with the sub-Saharan countries highlighted in

Figure 7. This example demonstrates the range of Governance found within the region, which are mainly below average. Further details of the methods used to calculate each index can be found within Kaufmann et al. (2005[96]).

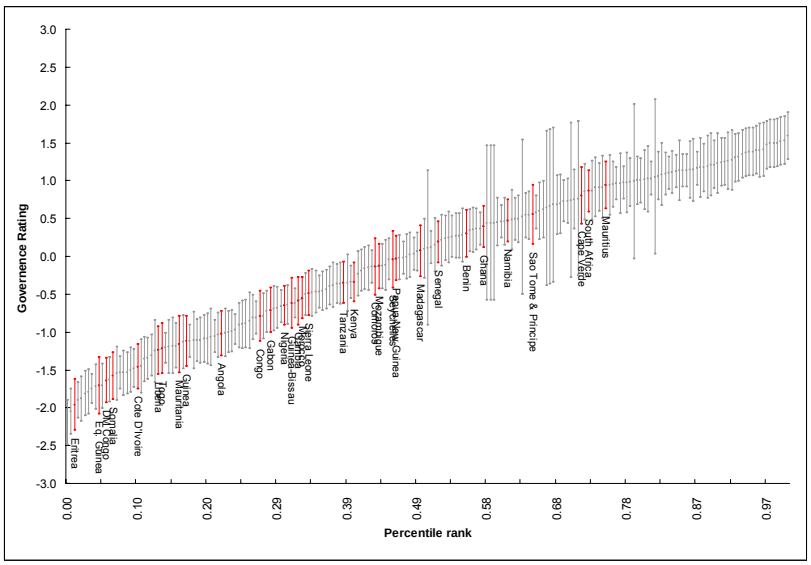
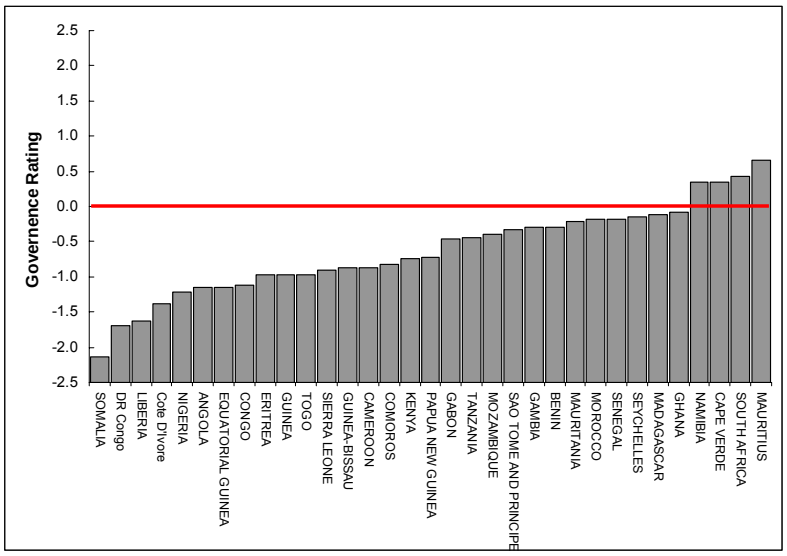


Figure 7 Governance Indicators: Control of Corruption, for 209 countries in 2004. Red lines highlight sub-Saharan countries. Vertical bars represent 95% confidence intervals.

To gauge the overall level of governance within the sub-Saharan region, we used an average of all six variables (Figure 8).



[96] Kaufmann D., A. Kraay and M. Mastruzzi (2005). "Governance Matter IV: Governance Indicators for 1996-2004". Draft World Bank Economic Review.

Figure 8 Average Governance Indictors for sub-Saharan countries for 2004.

3. The amount of tuna fishing in the zone and in adjacent high seas waters (Section 9). The presumption is that when there is a lot of tuna in the area, the state is more vulnerable to IUU fishing because it is more attractive to poachers[97].

4. Whether or not the country has an EU fisheries agreement. The presumption is that where there is an EU agreement there has been more investment in MCS, and there are more responsible fishing vessels, in the area. We are not interested, at this time, in the potential misreporting by EU fleets engaged in fishing in third country waters, simply in the potential for good compliance provided by the agreement.

5. The number of other agreements that the country has signed. This includes regional agreements (such as regional MCS agreements) and membership of RFMOs. Membership of all these agreement types is presumed to provide additional information and resources to a country to combat IUU fishing. The presumption is that the larger the number of agreements that a country has, the lower will be its vulnerability to IUU.

6. The size of the MCS problem: either the length of the coastline[98] or the size of the shelf. The presumption here is that the larger the area of the shelf, for instance, the more difficult the MCS task will be. There is obviously a difficultly in separating tuna from non-tuna resources here, especially with regard to island states. For that reason, overall EEZ area may also be used.

7. The value of the resource. The presumption is that a higher value resource is more attractive to poachers. Resource value was calculated by applying the average fishery product values from Table 1 to the total catches in the different categories, assigned by species from the FAO FishStat database for 2003. These data need to be used with caution because often there will be large catches of important species assigned as “marine fish nei (not elsewhere included)”. It was also necessary to remove the Namibian catch of fur seals from the data.

The primary indices are presented in Table 5.

[97] This is essentially a proxy for the total marginal value of the resources inside the EEZ. If the marginal value is high, then the pressure of IUU is high, especially if the number of licences available is much lower than the number of vessels seeking access.
[98] http://earthtrends.wri.org/text/coastal-marine/variable-61.html; http://www.seaaroundus.org/

Table 5 Indices of vulnerability and catch value used in the analysis. In this table the % IUU fishing is calculated as the case study (shaded) estimated value of IUU catch divided by the sum of the estimated value of current FAO declared catch plus the estimated value of the IUU catch.

Country	Case Study	RFMO memberships	Regional Agreement memberships	Access agreements	Status of MCS (capacity 0=poor, 5=good)	Length of coastline (km)	SQRT Size of EEZ (km^2)	Size of shelf region (km^2)	Tuna Vulnerability index	Average Governance score	Fisheries as % GNP (various sources)	Source	Total Catch (2003) (t0	Catch value calculated from FAO statistics (2003) $m	IUU as a percentage of the calculated total catch (reported + IUU catch)
Guinea	y	1	3	EU (octopus, shrimps, demersal, tuna longline, pole, seine)	1	1615	243	212	1	-0.97	1.8%	Ndia/FAO (2004)	114845	103	50.5%
Sierra Leone	y	0	2		1	1677	464	169	5	-0.90	3.5%	FAO (1998)	82926	81	26.1%
Liberia	y	0	2		0	842	500	133	5	-1.63	3.0%	FAO (1998)	7300	8	59.4%
Angola	y	1	2	EU (shrimp, demersal, tuna, horsemackerel)	3	2252	720	219	4	-1.16	4.0%	SADC (1999)	201539	205	19.3%
Namibia	y	3	2		5	1754	751	294	-1	0.35	10.0%	SADC, WB (1998)	634847	532	0.0%
Mozambique	y	1	1	EU (deepwater shrimp, tuna longline, tuna seine)	2	6942	761	307	6	-0.39	3.8%	NORAD (2000)	78129	215	15.0%
Kenya	y	2	0		1	1586	342	105	5	-0.74	0.2%	FAO (1998)	7095	15	20.0%
Somalia	y	1	0		0	3898	908	236	8	-2.13	2.0%	FAO (1990)	17850	31	75.0%
Seychelles	y	2	2	EU (tuna longline, seines)	4	747	1156	198	9	-0.15	20.0%	SADC	85787	137	5.2%
Papa New Guinea	y	3	3		4	20197	1766	302	3	-0.72	1.0%	FAO	174715	272	11.2%
Morocco	n	0	1			2009	524	232	-6	-0.19	3.0%	GOM(1999)	861362	734	
Mauritania	n	0	1	EU (octopus, shrimps, demersal, tuna longline, pole, seine, small pelagics)		1268	407	178	4	-0.21	12.0%	GOM (1998)	75000	193	
Senegal	n	0	1	EU (shrimps, demersal, tuna longline, pole, seine, small pelagics), Gambia (demersal)		1327	399	152	-1	-0.18	2.5%	FAO (2004)	428174	423	

Country	Case Study	RFMO memberships	Regional Agreement memberships	Access agreements	Status of MCS (capacity 0=poor, 5=good)	Length of coastline (km)	SQRT Size of EEZ (km^2)	Size of shelf region (km^2)	Tuna Vulnerability index	Average Governance score	Fisheries as % GNP (various sources)	Source	Total Catch (2003) (t0	Catch value calculated from FAO statistics (2003) $m	IUU as a percentage of the calculated total catch (reported + IUU catch)
Cape Verde	n	0	1	EU (tuna, pelagics)		1121	895	75	4	0.35	2.0%	FAO (2000)	8721	11	
Gambia	n	0	1	Japan (tuna), Senegal (demersal)		503	152	75	0	-0.30	12.0%	FAO (2000), Njie (2000)	34365	24	
Guinea-Bissau	n	0	1	EU (octopus, shrimps, demersal, tuna longline, pole, seine), China, Senegal (demersal), Italy		3176	352	198	0	-0.87	3.7%	FAO (1999)	4800	13	
Cote D'Ivore	n	0	0	EU (demersal, tuna longline, tuna seine)		797	420	101	4	-1.38	0.8%	GOM (1998)	45903	51	
Ghana	n	0	1			758	485	150	4	-0.08	2.5%	FAO (2000)	315756	252	
Togo	n	0	0			53	110	36	4	-0.96	4.0%	FAO (1998)	22489	20	
Benin	n	0	0			153	0	0	4	-0.29	0.5%		11893	14	
Nigeria	n	0	0			3122	466	206	4	-1.21	1.2%		300194	495	
Cameroon	n	0	0			1799	129	107	4	-0.87	1.0%	FAO (2000)	52802	37	
Equatorial Guinea	n	0	0			603	551	88	7	-1.15	0.4%		2500	2	
Sao Tome & Principe	n	0	0	EU (tuna longline, pole, seine)		269	362	44	5	-0.32	5.0%	FAO (Guesstimate no data)	3283	4	
Gabon	n	0	0	EU (demersal, tuna longline, tuna seine)		2019	450	187	5	-0.47	1.5%	FAO(2002)	35270	55	
Congo	n	0	0			205	176	89	6	-1.12	1.3%		26347	26	
DR Congo	n	0	0			177	40	40	5	-1.70	0.1%	neg	5000	4	
South Africa	n	1	1			3751	1034	394	0	0.43	1.0%	FAO (1998)	853025	626	
Madagascar	n	0	1	EU (tuna longline, tuna seine)		9935	1107	319	5	-0.12	7.0%	FAO (1995)	112731	247	
Comoros	n	1	1	EU (tuna longline, tuna seine)		469	405	39	5	-0.83	15.3%	FAO (1999)	14115	22	
Tanzania	n	0	1	EU (FPA)		3461	492	160	4	-0.45	0.9%	from FAO (1998)	62727	91	

Country	Case Study	RFMO memberships	Regional Agreement memberships	Access agreements	Status of MCS (capacity 0=poor, 5=good)	Length of coastline (km)	SQRT Size of EEZ (km^2)	Size of shelf region (km^2)	Tuna Vulnerability index	Average Governance score	Fisheries as % GNP (various sources)	Source	Total Catch (2003) (t0	Catch value calculated from FAO statistics (2003) $m	IUU as a percentage of the calculated total catch (reported + IUU catch)
Eritrea	n	0	0			3446	279	249	-6	-0.98	0.9%	from FAO (2000)	6695	13	
Mauritius	n	0	1	EU (tuna longline, tuna seine)		496	1134	170	4	0.66	1.0%	Mauritius Research Council (2001)	11136	18	
British Indian Ocean Territory	n	1	1			0	0	0	7	0.00	0.0%		0	0	
Saint Helena & Ascension Islands	n	1	0			0	0	0	5	0.00	0.0%		0	5	

neg = negligible.

Sources of information on GDP/GNP and fisheries as % of GNP.

FAO () FAO Country Fishing Profiles, http://www.fao.org/fi/fcp/fcp.asp

GOM (1998) Government of Mauritania Fisheries Profile

SADC (1998) SADC Marine Fisheries and Resources Sector. Country profiles (Namibia, South Africa, Mozambique, Tanzania etc). www.sadcfisheries.com,

WB (1998) World Bank Development Report (1998). Washington D.C.: International Bank for Reconstruction and Development/The World Bank and Oxford University Press. Other World Bank reports were also used, 2003 – 2005. GNP and GNI are World Bank Development Reports 2004 and 2005

MPEM (Ministère des Pèches et de l'Economie Maritime) 1998. Stratégie d'Aménagement et de Développement du Secteur des Pêches et de l'Economie Maritime, Document Présente a la Table Ronde des Bailleurs de Fonds Nouakchott le 16 juin 1998. Nouakchott, Mauritanie. (Government of Mauritania).

van Santen, G. (undated) Mauritania Integrated Framework. Volume II - Secteur de la Pêche

4.1.2.2. Measurement of IUU fishing (%IUU)

To provide a relative measure of IUU fishing, we have estimated the catch value from IUU fishing in a country's EEZ as a percentage of the total current catch value. The total current catch value is made up of the value of the IUU catch, which is calculated in the case studies (section 3.3), and the value of the reported catch. The latter figure can be calculated in two ways: using the FAO catch statistics and using the case study data.

Neither the case study nor the FAO data include the value of catches taken by other flag states within the EEZ of a country (except in the case of the Guinea case study, see Section 9.2).The non-IUU foreign catch in an EEZ is assumed to be extraneous in the predictive model, although it should of course be considered within the wider context of IUU fishing. The reason why it is assumed to be extraneous is that non-IUU catches by foreign vessels are not catches that the country would be able to take if IUU fishing were eliminated, and the coastal state is already receiving (presumably) revenue from those catches in the form of licence fees. Depending on the level of licence fees charged, the coastal state may be able to generate more revenue, for example by excluding foreign vessels and allow domestic vessels to take the catch instead (assuming it has the capacity), or by increasing the licence fee if it is too low (see Section 5.3). But this is not dependent on the elimination of IUU fishing. This potential additional revenue is taken into account in our index of "fisheries value as a % of GDP" but not in the calculation of percentage IUU.

There is a secondary problem for our calculations with respect to those countries which fish extensively outside their EEZ and declare the catches, as they are required to do, to FAO as the flag state. Since these catches are not taken inside the EEZ, including them (because they cannot be excised from the FAO statistics) introduces a possible distortion. Fortunately, of our selected case studies only the Seychelles has large scale catches outside its EEZ. A secondary problem could be declarations of catches caught on the high seas by open register vessels from open register countries in Africa (such as Equatorial Guinea), but in fact most of these catches are unreported as well as unregulated.

Similarly, issues of discarding or misreporting by the non-IUU fleet are ignored in the model. We are using the model to calculate the value of IUU catch that is currently being taken without a country's knowledge or outside of its control from which it could otherwise derive benefit in terms of food or revenue (i.e. if the IUU fishing were eliminated). Thus, it is legitimate to include discards associated with shrimp fishing where that fishing itself is IUU. But it is not legitimate to include discards in a non-IUU fishery, because we assume that these discards are an integral part of the fishing process and would occur whoever is catching the fish. This is not to say, however, that the issue of discards is not of concern and needs to be addressed as a potentially wasteful fishing practice.

For these reasons, we decided to use primarily FAO catch reports by country to calculate the value of the non-IUU catch. Despite the various caveats above, there is generally a good relationship between our calculations from FAO data and the estimates made in the case studies (Figure 9).

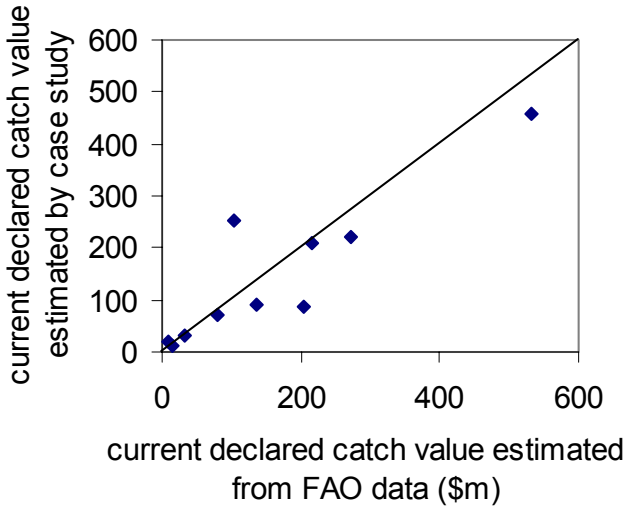


Figure 9 Estimated total declared (non-IUU) catch value made by using FAO data and case study data. In all cases except for Angola (which we calculate from FAO data to have a catch value of about $205m but from the case study only $89m) and Guinea ($103m and $254m respectively).

4.1.2.3. The relationship between compliance and MCS capability

Accepting these slight differences in non-IUU catch value, there is a clear relationship between the percentage of the total catch that is estimated to be IUU (%IUU) and the MCS capability of the country. This is to be expected, and implies that as MCS capability increases, the percentage of IUU decreases. This relationship holds whether the FAO catch data or the case study catch data are used in the calculation of %IUU.

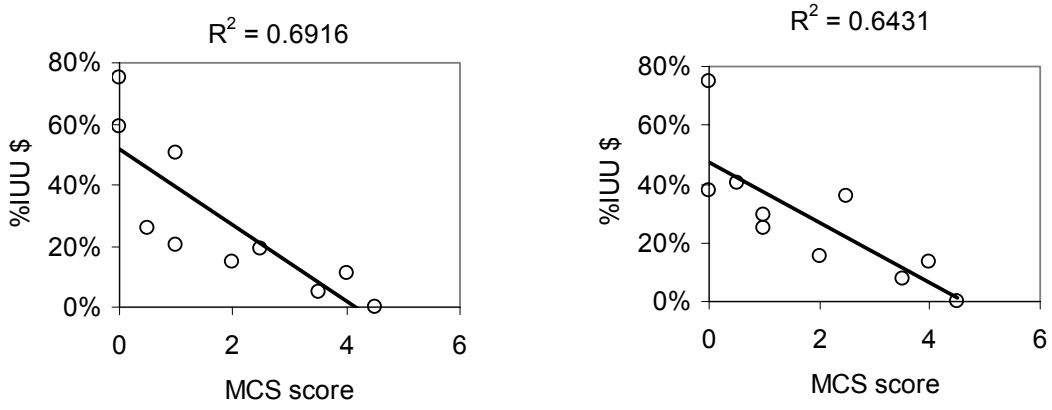


Figure 10 Plots of MCS score index against % IUU catch calculated from FAO data (left) and estimated by the case studies (right)

Rather than looking at the % IUU catch, we can look instead at the percentage of total catch value taken by licensed vessels. This is in effect a measure of the level of compliance. We would expect compliance to increase as MCS capability increases. We would also expect, however, that there is going to be a diminishing return on increasing expenditure on MCS. For a country with low MCS capability and low compliance, it should be possible to make a large improvement in compliance with a relatively modest increase in expenditure on MCS. However, the compliance score cannot go on increasing no matter how much we spend on improving MCS. We therefore model this relationship using a logistic curve, which reaches an asymptote. Note that the maximum level of compliance (essentially the asymptote) may be less than 1 (which would indicate perfect compliance), because it is likely that there will always be some low level of IUU activity even where MCS investment is very high. Figure 11 shows that such a relationship does exist for our case studies.

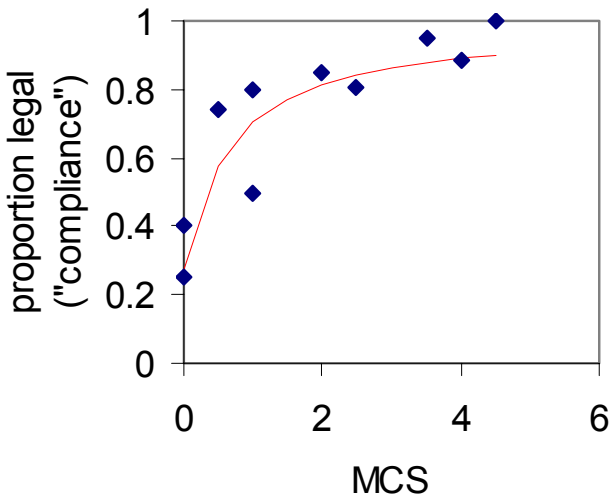


Figure 11 Relationship between compliance (1-%IUU) and MCS score. The fitted line is (100-%IUU) = a + M(1-a)/(M+b) , where %IUU is the percentage of the total catch taken by IUU calculated from FAO catch statistics, M is the MCS score, and a=.27 and b=.69 are parameters. The plot is equivalent to the left-hand plot in Figure 10 with its axes reversed.

4.1.2.4. Correlations between vulnerability indices

Table 6 presents the full (linear) correlation matrix for the vulnerability indices discussed in Section 4.1. The following significant correlations are indicated:

- between IUU activity and MCS capacity (described above),
- between governance and the total number of agreements; and
- between high resource value and other indices.

The reason for the positive correlation between MCS capacity and resource value is interesting. It implies that those countries which have a high resource value already have invested in MCS. It may also, of course, imply that those countries which have

high governance have invested in MCS and therefore now have high resource values.

Another interesting result is the negative correlation between %IUU and the total number of agreements. The total number of agreements was calculated as a sum of RFMO, regional and EU/other access agreements. This means that there is a significant advantage, in terms of reducing IUU fishing, to having a large number of wider fisheries agreements.

The very high correlation between MCS, governance, resource value and the number of agreements implies that these four issues are inextricably linked. In fact, we were unable to separate their various effects within this dataset. We conducted a rigorous linear model analysis in Splus, which showed that MCS on its own explained 69% of the variance in %IUU across case study countries. Addition of governance into the model made a significant improvement in the amount of variance explained (F test, $p<0.05$: final $R^2 = 85\%$), but addition of the number of agreements or catch value did not.

Table 6 Pearson's correlation coefficient for the vulnerability indices in Section 4.1. Significant relationships (P<0.05) are shown in bold underlined, n=10)

	MCS capacity	*Governance*	*Tuna*	*EU agreements*	*Total agreements*	*coastline km*	*sqrt(EEZ area) km^2*	*shelf area (km^2)*	*resource value*	*IUU as prop of FAO calculated total*	*IUU as prop of case study calculated total*
MCS capacity	1.00										
Governance	**0.79**	1.00									
Tuna	-0.36	-0.38	1.00								
EU agreements	0.18	0.22	0.14	1.00							
Total agreements	**0.84**	**0.63**	-0.49	0.38	1.00						
coastline km	0.41	0.04	-0.11	-0.18	0.42	1.00					
sqrt(EEZ area) km^2	0.62	0.16	0.18	-0.08	0.49	0.79	1.00				
shelf area (km^2)	**0.64**	0.40	-0.31	0.14	0.50	0.63	0.59	1.00			
resource value	**0.85**	**0.72**	**-0.63**	0.03	**0.65**	0.27	0.36	**0.76**	1.00		
IUU as prop of FAO calculated total	**-0.83**	**-0.90**	0.24	-0.20	-0.60	-0.22	-0.34	-0.38	**-0.66**	1.00	
IUU as prop of case study calculated total	**-0.80**	**-0.93**	0.40	-0.24	**-0.74**	-0.19	-0.25	-0.38	**-0.66**	**0.86**	1.00

4.1.2.5. Developing a predictive model

To predict what might be happening in the region as a whole, we need to create a model from the case studies that includes only vulnerability indices (referred to in the model as parameters) for which we also have data on non-case study countries. Unfortunately this means that we cannot use MCS as a parameter in the model since we determined this only for case studies.

The best model was one that included just a single parameter: governance. None of the other available vulnerability indices significantly improved the amount of variance in %IUU explained by the model.

One parameter did come close: sqrt(eez) ($\sqrt{eez}$) (we used the square root of the area of the EEZ because it provided a slightly more significant fit than just the EEZ area on its own: essentially this is translating a 2-dimensional to a 1-dimensional index). Below we present the statistics for the one parameter (governance) and two parameter (governance and sqrt(eez)) models.

One-parameter model: governance explained 81% of the variance, providing a very significant fit (Figure 12):

```
             Value Std. Error t value Pr(>|t|)
(Intercept)  0.0149  0.0588     0.2539  0.8060
     govern -0.3161  0.0545    -5.7986  0.0004
```

[i.e. % IUU = 0.0149 – 0.3161 x governance index]

Two-parameter model: governance and sqrt(eez) together explained 85% of the variance:

```
             Value Std. Error t value Pr(>|t|)
(Intercept)  0.1125  0.0895     1.2572  0.2490
     govern -0.3047  0.0522    -5.8346  0.0006
     sqreez -0.0001  0.0001    -1.3920  0.2065
```

[i.e. % IUU = 0.1125 – 0.3047 x governance index – 0.0001 x square root of EEZ size]

However, the increase from 81% to 85% achieved by the addition of sqrt(eez) was not significant (in a statistical sense). Furthermore, it is difficult to explain why IUU activity would be expected to be higher for states with smaller EEZs so that those with very large EEZs are least vulnerable – intuitively one might expect it to be the other way round.

As we did for the compliance vs. MCS relationship in Figure 11, we can also manipulate the governance and %IUU data and apply a logistic curve or a linear relationship. One might expect that the same tendency for diminishing returns with increasing governance score might apply here, hence the logistic curve might work well. However, unlike with the MCS capability score, a linear relationship appears to fit the data better than the logistic (Figure 12). Thus it seems that there is a good linear relationship between governance and %IUU, but the relationship between MCS score and %IUU is probably better described by a logistic curve.

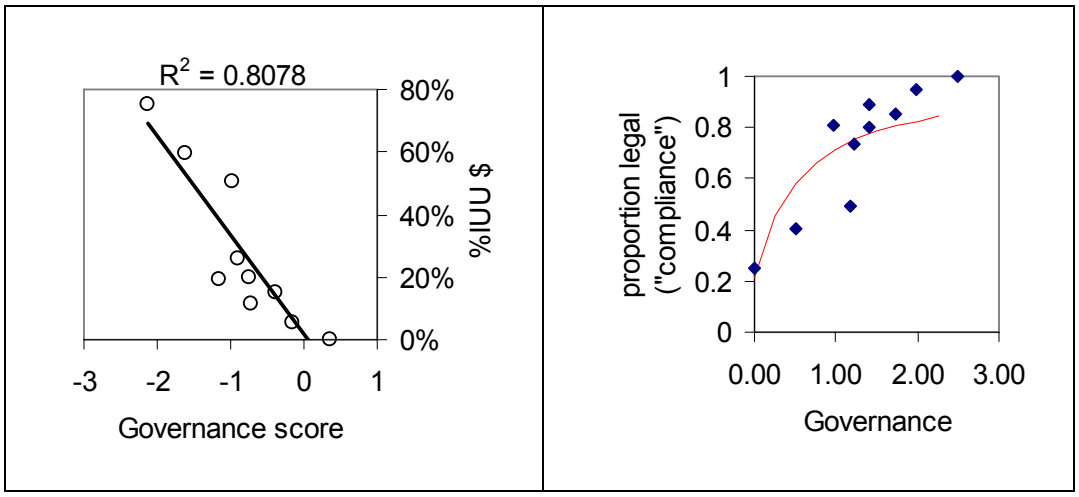


Figure 12 Governance plotted against % IUU calculated from FAO data (left) and the same data, transformed to the same scales as Figure 11 (compliance = 100- %IUU, governance axis shifted to run from 0 to 3 rather than -2 to 1), with a fitted logistic curve (right).

We do not have our own estimates of total catch value for every non-case study country in the sub-Saharan Africa region. We do, however, have FAO catch estimates and governance figures for these countries. Therefore we can extrapolate our results to all the countries listed in our tables using the relationships described above. This calculation suggests that the total projected IUU value is $0.9bn for the sub-Saharan Africa region. Table 7 shows the breakdown for countries included in this total estimate (note that Papua New Guinea is not included in the total because it is not in the region)[99]. These data are presented graphically in Figure 13.

95% confidence intervals were obtained through multiple simulation using the statistics of the model fit given above. These are $0.4bn – $2.3bn (median $1bn), which is quite a wide range.

Over the whole of the sub-Saharan region, the model estimated the value of IUU catch to be 16% of the total catch value for these countries: or 19% of the declared catch.

[99] Note that complete data are unavailable for the British Indian Ocean Territory and St. Helena. We have therefore excluded them from presentations of the results of the predictive model.

Table 7 Results from analysis of indicators of IUU fishing (one parameter model), extrapolated across the region. Note that these percentages are estimated IUU as a percentage of estimated total catch (i.e. estimated IUU + FAO reported catch)

Country	Catch value calculated from FAO statistics (2003) $m	Average Governance score	IUU as proportion of estimated total catch	IUU value
Guinea	103	-0.966	50.5%	105
Sierra Leone	81	-0.903	26.1%	29
Liberia	8	-1.626	59.4%	12
Angola	205	-1.158	19.3%	49
Namibia	532	0.347	0.0%	0
Mozambique	215	-0.393	15.0%	38
Kenya	15	-0.735	20.0%	4
Somalia	31	-2.134	75.0%	94
Seychelles	137	-0.148	5.2%	8
Papa New Guinea	272	-0.724	11.2%	34
			EXTRAPOLATED (one parameter model)	
Morocco	734	-0.189	7.5%	59
Mauritania	193	-0.209	8.1%	17
Senegal	423	-0.176	7.1%	32
Cape Verde	11	0.353	0.0%	0
Gambia	24	-0.296	10.8%	3
Guinea-Bissau	13	-0.872	29.1%	5
Cote D'Ivore	51	-1.383	45.2%	42
Ghana	252	-0.083	4.1%	11
Togo	20	-0.964	32.0%	10
Benin	14	-0.294	10.8%	2
Nigeria	495	-1.211	39.8%	327
Cameroon	37	-0.868	28.9%	15
Equatorial Guinea	2	-1.148	37.8%	1
Sao Tome & Principe	4	-0.323	11.7%	0
Gabon	55	-0.466	16.2%	11
Congo	26	-1.120	36.9%	15
DR Congo	4	-1.697	55.1%	4
South Africa	626	0.431	0.0%	0
Madagascar	247	-0.121	5.3%	14
Comoros	22	-0.827	27.6%	8
Tanzania	91	-0.451	15.7%	17
Eritrea	13	-0.977	32.4%	6
Mauritius	18	0.659	0.0%	0

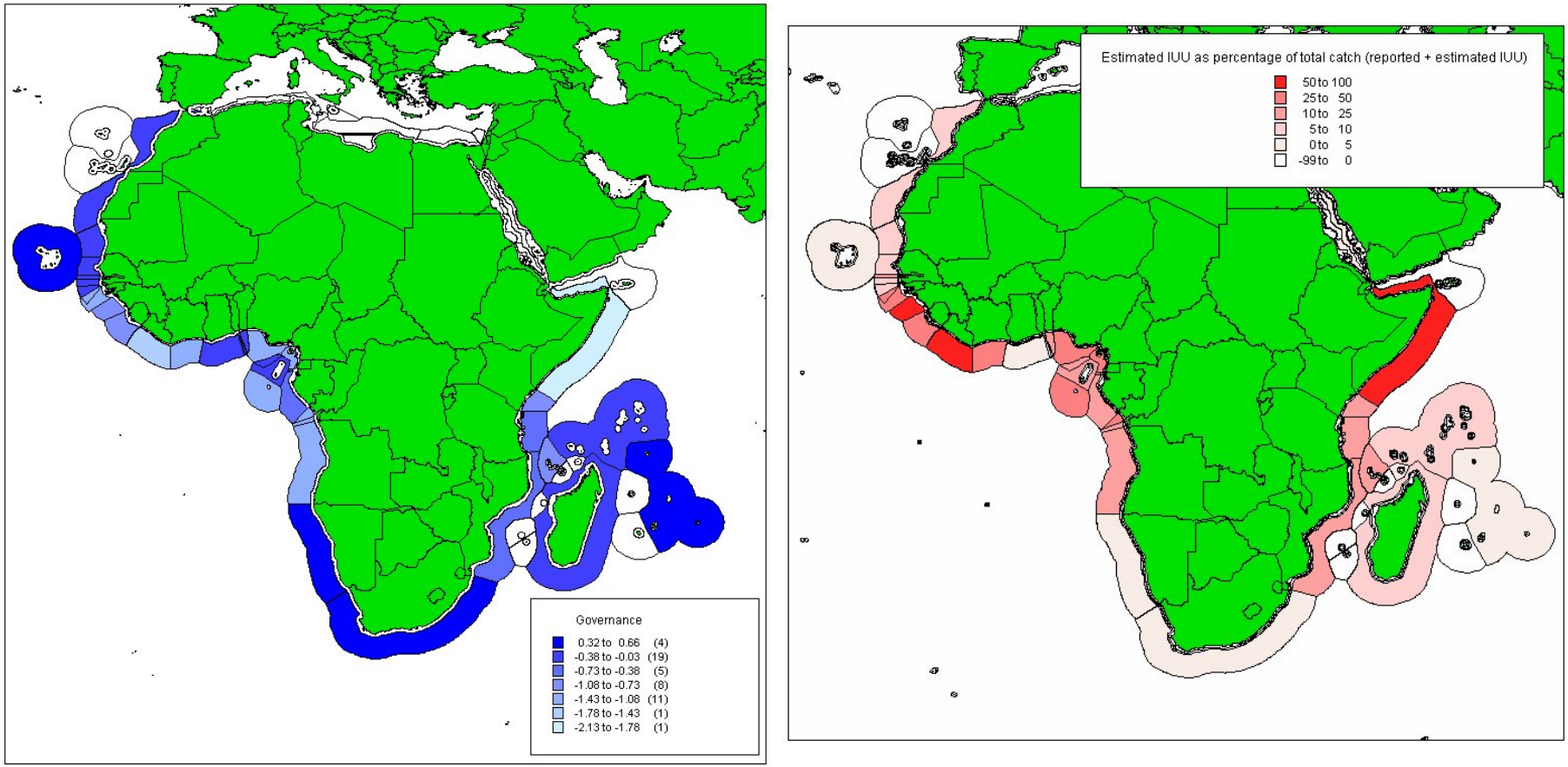


Figure 13 The governance index used in our analysis (high values indicate good governance) (left) and % IUU by country predicted from our analysis (right).

4.2. Impacts of IUU fishing

The effects of IUU on developing countries include financial, economic, social and environmental/ecological impacts. We have adopted the approach to assessing these impacts presented by Agnew & Barnes (2004[100]). We have divided the tables into economic, social and environmental impacts (Table 8 Table 9 and Table 10). There are important linkages between these three categories of impacts. For economic impacts we have concentrated on the macroeconomic impacts. Social impacts are presented separately, but they also relate to microeconomic impacts i.e. community and household impacts. Similarly the environmental and ecological impacts may have secondary economic effects, particularly in terms of reduced productivity of fish stocks.

4.2.1. Direct economic losses

The most obvious impact is direct loss of the value of the catches that could be taken by the coastal state if the IUU fishing was not taking place. Aside from the loss to GNP, actual revenue can accrue to the coastal state in the form of landings fees, licence fees, taxes and other levies which are payable by legal fishing operators. We have estimated in Section 4.1.2 that at a minimum $0.9bn of IUU catch is taken from EEZs of various countries in the sub-Saharan Africa region, the majority of which are developing countries.

In Guinea, for example up to 60% of vessels sighted during patrols in 2001 were fishing illegally. This, coupled with unreported catches in the shrimp fishery and illegal transhipments occurring within the EEZ, represents a significant loss of opportunity to generate national revenue. In addition to vessels operating without licences, licensed operators are also known to misreport catches. Under reporting can be as high as 50% in Kenya and even 75% within the shrimp fishery in Mozambique. Illegal transhipment of catches is also thought to occur within the EEZ of a number of developing countries, with further loss of opportunity to generate national revenue.

If one adds to this the IUU catches that we have identified in section 4.1.2 and Annex A then the total value of IUU catches taken inside national waters is likely to be in excess of $3bn worldwide. There are other secondary macroeconomic effects caused by the loss of fish and marine resources to IUU vessels. These include implications for government budgets (fish and other marine product exports and other taxes), and employment within the fishing and fish processing sector.

4.2.2. Secondary economic losses

In addition to direct macro-economic impacts, there are indirect and induced impacts. These include the impacts resulting from loss of income and employment in other industries and activities in the supply chain upstream and downstream from the fishing operation itself. On the upstream side, IUU fishing depresses the demand for

[100] Agnew, D. J and Barnes, C. T. (2004). Economic Aspects and Drivers of IUU Fishing: Building a Framework. OECD [AGR/FI/IUU (2004)2. in Fish Piracy: Combatting Illegal, unreported and unregulated fishing. OECD, 2004, Chapter 11, pp 169-200.

fishing gear, boats and equipment, and other inputs that otherwise might be present. Downstream from fishing there is fish processing and packaging, marketing and transport that may be negatively impacted. Any associated reduction in fishing incomes will also have impacts on the demand for consumption goods by fishing families.

Most IUU catches attributed to our case studies do not appear to be landed within the country from whose national waters they were taken. Instead they are often transhipped or landed elsewhere. Illegal shrimp and tuna catches from Liberia, for example, are thought to be landed within Cote d'Ivoire, where many foreign vessels already land part of their legal shrimp and tuna catch from the region, thus making misreporting relatively easy to undertake. At present, countries such as Kenya do not have any requirement for licensed vessels to enter their ports or land part of their catch, thus making inspections particularly difficult to undertake and the threat of misreporting very high.

If port activity is effectively reduced due to IUU fishing, this leads to a loss of secondary income – income from processing and re-export, port revenues, service revenues, transport and employment – which is both loss of value added income to the population, affecting their standard of living, and loss of tax revenues for the country. Secondary economic effects also include multiplier effects, such as the potential loss of activity in shipbuilding and re-supply, which may have much wider effects on the country's economy through loss of (or, rather, the lack of opportunity to gain) technological know-how.

Table 8 Economic Impacts of IUU Fishing

PARAMETER	INDICATORS	IMPACTS
Contribution of fishing to GDP/GNP	Value added; value of landings	IUU fishing will reduce the contribution of EEZ or high seas fisheries to the national economy and lead to a loss of potential resource rent.
Employment (this is also a social impact)	Employment in the fishing, fish processing and related sectors	IUU fishing will reduce the potential employment that local and locally based fleets may make to employment creation and the potential for employment creation. This is likely to be a major factor only in respect of EEZ IUU fishing.
Export revenues	Annual export earnings	IUU fishing by reducing local landings and non payment of access dues will reduce actual and potential export earnings. This will, of course have potentially serious implications for surveillance activities, where these are supported wholly or partly by export revenues (or port revenues, see below).
Port revenues	Transhipment fees; port dues; vessel maintenance; bunkering	IUU fishing will reduce the potential for local landings and value added.
Service revenues and taxes from legitimate operations	Licence fees, revenue of companies providing VMS, observer etc facilities, exchequer revenue from company taxes.	IUU fishing will reduce the resource which in turn will reduce the other revenues that would accrue from companies providing legitimate fishing services. This includes company taxes

PARAMETER	INDICATORS	IMPACTS
Multiplier effects	Multiplier impacts on investment and employment	The direct and indirect multipliers linked to fishing and fishing associated activities will be reduced with the loss of potential activities through IUU fishing.
Expenditure on MCS	Annual expenditure on MCS linked to IUU fishing.	The existence of IUU fishing will put budget pressures on MCS/fisheries management[101].
Destruction of ecosystems	Reduction in catches and biodiversity of coastal areas	Loss of value from coastal areas e.g. inshore prawn fishing areas and from mangrove areas that might be damaged by IUU fishing. Reduction in income for coastal fishing communities.
Conflicts with local artisanal fleets	Incidences recorded of conflict between IUU fishing vessels and local fishing fleets.	Reduction in the value of catches for local fishing fleets. Possible increased health and safety risks because of conflicts between the artisanal and industrial fleets.
Conflicts with MCS officers and vessels	Armed resistance by IUU vessels to MCS enforcement.	Spiralling loss of effectiveness of MCS activities. Costs of MCS escalate and there is a loss in cost effectiveness of MCS.
Food security	Availability of fish for local consumption (food and protein balance sheets)	The reduction in fish availability on local markets may reduce protein availability and national food security. This may increase the risk of malnutrition in some communities.

4.2.3. Social impacts

IUU fishing usually contributes to unsustainable impacts on both target species and the ecosystem. This is likely to reduce productivity, biodiversity and ecosystem resilience. This in turn is likely to lead to a reduction in food security for artisanal fishers. This is particularly important in those communities which are heavily dependent on fish as a source on animal protein, notably the coastal communities in countries such as Mauritania, Guinea Bissau, Guinea Conakry, Senegal, Liberia, Sierra Leone, Angola and other countries of West Africa and Somalia, Kenya, Tanzania and Mozambique in North Eastern, Eastern and Southern Africa. For example in Liberia, it has been reported that around 70% of pre-conflict licensed catches were landed in Liberian ports. Recent landings are reduced, which has important implications for the protein availability of this state.

Direct conflict between IUU and other fishery users can often occur. Kelleher (2002[102]) 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 common in Sierra Leone, because "*Fishing activity is concentrated in the inshore areas, i.e., on the continental shelf which narrows to a thin band towards the Liberian border. In this area trawlers frequently fish to within 100 meters of the shoreline. The main shrimp ground is in Yawri Bay, off Banana Is., and offshore from several important artisanal fishing villages. Gear conflicts between artisanal fishermen and trawlers are frequent as the trawlers fish inshore at night and damage the unmarked fishermen's nets.*" Drammeh (2000)[103] also

[101] Costs of fisheries management are often high but un-quantified. A useful discussion is given in "The cost of fisheries management, W.E. Schrank, R. Arnason & R. Hanneson, Ashgate, Aldershot, UK, 2003".
[102] Opp cit
[103] Drammeh, O. K. L (2000). Illegal, Unreported and Unregulated Fishing in Small Scale Marine and Inland Capture Fisheries. Government of Australia and FAO, Sydney, May.

reports that in the West African sub-region and in Madagascar 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 between IUU industrial and artisanal or semi-artisanal fishers are particularly prevalent in shrimp fisheries around Africa (Guinea; Sierra Leone; Liberia; Angola[104]; Mozambique; Somalia) as well as in the inshore fisheries of Mauritania and Senegal. 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. Witness the report by T. S. Bah, rural journalist with RTG - Conakry, Guinea[105]. *"Another fisherman from Bongolon, Mamadou Bangoura, known as Doyen, "the senior one", still remembers how his young brother died in 1998. "I lost my own brother at sea because of these incursions by the industrial trawlers. He died along with four others who were in the same canoe. When the trawler hit them, they were all killed, and our canoe was wrecked too. We lost everything. The surveillance teams went out to board the trawler, but it had made for the open sea before they got there. I had to take his family back to Matakang, our village, and they are still there, with nobody to really look after them. I do what I can, but it's difficult because I don't have my own canoe any more to go fishing. I live off the good will of my colleagues who take me along with them in their boats." "*

The incidence of armed resistance to surveillance and enforcement operations appears to be increasing. Reports of such activity have long been made from Somali waters, where vessels are reported to be armed with light and even heavy armaments (mortars, machine guns) to defend themselves against Somali militiamen, which they also use against Somali fishing vessel competitors[106]. There are also now reports that these same vessels, still heavily armed, are operating in Mozambique, leading to further armed conflicts and greatly increasing the difficulty of pursuing an effective MCS policy.

Countries vulnerable to IUU fishing tend to be those with poorer governance structures and law enforcement generally. IUU fishing further undermines the rule of law and other social values, and can also have an effect on gender issues (Table 9).

Table 9 Social Impacts of IUU Fishing at the National Level

PARAMETER	INDICATORS	IMPACTS
Nutrition and food security	Availability of fish on local markets at affordable prices.	In some cases IUU fishing through its negative impact on fish stocks and availability may have a detrimental impact on the availability of fish, an important source of protein in some countries.
Conflicts with local artisanal fleets	Incidences recorded of conflict between IUU fishing vessels and local fishing fleets.	Iincreased health and safety risks because of conflicts between the artisanal and industrial fleets. Loss of family/ community cohesion and workforce through conflict.

[104] Environmental Justice Foundation, 2005. Pirates and Profiteers.
[105] "Incursions by industrial trawlers into Guinea's coastal zone at last a sigh of relief from the small-scale fishers of Bongolon". Sustainable Fisheries Livelihoods Programme, seen May 2005. http://www.sflp.org/eng/007/pub1/103.htm.
[106] Pirates and Profiteers. A report by the Environmental Justice Foundation, 2005.

PARAMETER	INDICATORS	IMPACTS
Employment	Employment rates in marine fishing communities	IUU fishing may lead to lower employment if it has a negative impact on stocks and the activities of artisanal and local coastal fishing activities. Less opportunities for new generations of fishers to participate in fishing
Household incomes	Gross and net household incomes	IUU fishing through conflicts with local fishing fleets and by over exploitation of certain species may lead to reduction in household incomes and therefore exacerbate poverty. Possible negative impacts on income distribution.
Gender issues	Employment of women in fishing and fish marketing	IUU fishing may have a negative impact on shore fishing by women and on the marketing opportunities for women who in many societies have an important role in basic fish processing and marketing.

4.2.4. Environmental Impacts

Damage to fish stocks caused by overfishing induced by IUU activity tends to reduce future catching opportunities and therefore leads to a consequent loss of potential economic rent. The majority of our case studies indicate that excessive unregulated fishing effort means that overall catch levels rise above sustainable levels, leading to over-exploitation and depletion. Licensed shrimp trawlers in Guinea, for example, are thought to misreport catches by 20%. If the by-catch from this fishery is also very high (approx. 75%), a high proportion of the vulnerable part of demersal fish stocks (i.e. juveniles) is being exploited. However, due to a lack of information on catch composition, the impact on the demersal stocks is not yet known.

Fishing in general has the capacity to damage fragile marine ecosystems and vulnerable species such as coral reefs, turtles and seabirds. Regulation of legitimate fisheries aims to mitigate such impacts, but IUU fishers seldom comply with such requirements. For example, it is known that longliners can experience high levels of bycatch of threatened and endangered species such as seabirds sharks and turtles. IUU longliners not complying with the necessary mitigation techniques will pose a greater threat than legitimate operators who do comply. Within Angola, Mozambique and Papua New Guinea, it has been reported that high numbers of shark have been caught by illegal longliners. Other gears deployed from illegal vessels, such as gillnets, have been reported from Angola and have the potential impact on more vulnerable marine species such as turtles and marine mammals.

Damage to the marine environment, including marine ecology, can arise through the use of inappropriate gear and equipment in sensitive areas (coral reefs, fish breeding and spawning grounds)[107]. There are also reports, again from Somalia, of massive dumping of toxic waste (otherwise an expensive business) with consequent damage to ecosystems and human life, especially when it is washed up on the shore[108]. Longline operations can suffer from significant interaction with cetaceans[109] and there

[107] A summary of some of the ecological and scientific effects of IUU fishing is given in Table 10. This aspect of the impact of IUU fishing on developing countries will be the subject of in-depth analysis under Task 2.

[108] Ewan Dunn (RSPB), pers. comm., reporting on a statement by the Somali representative to COFI, 2005.

[109] M. Donoghue, R. R. Reeves, G S. Stone 2002. Report of the workshop on interactions between cetaceans and longline fisheries, Apia, Samoa, November 2002. New England

are reports of IUU vessels using explosives to keep them away from the line. Similarly, IUU fishers may use explosives of poisons or other destructive fishing practices which are not used by legitimate fishers.

Table 10 Possible Environmental Impacts of IUU Fishing on developing countries

ECOSYSTEM COMPONENT	IMPACT	EFFECT
Target species	IUU fishing outside quota in EEZ waters.	IUU fishing obviously impacts the target species negatively. Sumaila and Vasconcellos provide an example where IUU fishing in Namibian waters depleted target stocks to very low levels, which impacted on legitimate vessel catch as well as IUU vessel catch.
Target species	IUU fishing in high seas waters	Similar effect as for EEZ waters, but transmitted only if the species concerned are straddling or highly migratory, and the stock exists both in high seas and EEZ waters; of if the depletion of the stock in high seas waters reduces fishing opportunities for developing states in those high seas waters under RFMO agreements. For instance, many developing states in the Atlantic (e.g. St Helena) have some tuna/swordfish quota allocated them from ICCAT by virtue of their existence, rather than the occurrence of those tuna or swordfish in their EEZ waters. Over-fishing by IUU fleets on these stocks will have a direct effect on the amount of quota that is allocated to these states and therefore on their revenue, whether they catch that quota themselves or lease it to DWFNs.
Target species	Under-reporting catch, especially by DWFN in EEZ fisheries agreements	Under-reporting in any fisheries system (including the large-scale under-reporting in developed country waters) has the same effect as fishing outside of quota. Not only does it impact negatively on the stock, but it can also severely compromise scientific stock assessments, which usually rely on some reasonably good estimate of total extractions.
Target species	Unmonitored discarding.	The same issues relate to discarding as to under-reporting, but here impacts are often on the younger age classes of the stock.
Dependent and related species	Direct impacts of IUU fishing: bycatch	Large numbers of associated species can be caught in all fisheries. This has an effect on the populations of these animals. The issue is usually highlighted with respect to “charismatic megafauna” such as birds, seals, cetaceans and turtles; attention has spread recently to consider endangered and slow-growing fish such as sharks and skates/rays. But other species are similarly affected, and if they are slow-growing, bycatch can significantly affect their ability to recover. For instance the barn-door and common skates in the northern Atlantic. There is considerable concern amongst conservation groups that turtles are negatively impacted by IUU tuna and shrimp fishing (see e.g. Lewison et al 2004), and the development of IUU longline fisheries for tuna and demersal species has contributed significantly to the precipitate decline in populations of most albatross in the southern ocean. Obviously all fishing activity has the potential to cause these impacts, but IUU fishing is thought to be particularly destructive because IUU fishermen do not generally use management measures aimed at reducing the impacts, for instance turtle or seal/sea lion exclusion devices, streamer lines to keep birds away from nets and hooks etc.
Dependent and related species	Indirect impacts of IUU fishing: bycatch	These impacts are much more difficult to quantify than direct impacts. They arise because of the removal or overfishing of a target species (or bycatch species) which is a critical ecosystem component, causing a change in trophic functioning. Avoidance of this effect is

Aquarium Aquatic Forum Series Report 03-1. Available at http://neaq2.securesites.net/scilearn/conservation/LonglineReport2002.pdf

ECOSYSTEM COMPONENT	IMPACT	EFFECT
		often an objective of ecosystem management, and may be termed ***maintenance of the ecological relationships between harvested, dependent and related populations*** or *maintenance of ecosystem diversity function* – i.e. biodiversity
Habitats	Destruction of habitats by IUU vessels	Vessel gear, particularly trawls, may often destroy habitats, such as the deep water coral habitats now being discovered on many seamounts and deep shelf slopes around the world. Unregulated fishing in deep waters is particularly damaging, as the 2003 New Zealand Conference on Deep Water fishing exposed. As with other direct effects, IUU vessels are probably more destructive than licensed vessels because they ignore management actions such as closed areas which aim to reduce habitat destruction. Habitat destruction may have far-reaching impacts, because many sensitive habitats such as inshore shallow seas, maerl, coral and seagrass beds, act as nursery and settlement areas for other marine animals including juvenile fish. Destructive fishing practices may be used by IUU vessels.
Waste dumping and other negative environmenta l impacts	Availability of opportunity for dumping toxic waste	A breakdown of MCS and the rule of law in an EEZ, especially in terms of enforcement of MARPOL/London Dumping Convention rules will lead to other impacts on the environment, including dumping of waste, especially toxic waste.

4.3. External drivers

4.3.1. The IUU fishers

Depending upon how IUU fishing is defined, fishers from almost all fishing countries have conducted or are conducting some form of activity that can be classified as illegal, unregulated and/or unreported. A table documenting the most recent incidents of vessels engaged in IUU fishing over the last few years is given in Annex A. This includes incidents involving vessels from the following countries: Argentina, Azerbaijan, Belize, Bolivia, China, Equatorial Guinea, Ethiopia, EU, Falklands, Georgia, Ghana, Honduras, Indonesia, Japan, Kenya, Kenya, Korea, Mauritius, Mexico, New Zealand, Panama, Portugal, Réunion, Russia, South Africa, Spain, Sri Lanka, St Vincent and the Grenadines, Syrian, Taiwan, Thailand, Togo, Turkey, UK, Ukraine, Uruguay, USA, Vietnam.

In a number of cases, especially where high value resources are concerned, organised crime has become involved in domestic poaching. Examples include sturgeon and abalone (see Sections 3.2.2 and 3.2.4), and there are even suggestions that there is an organised crime component to IUU fishing for toothfish (Austral Fisheries, 2002[110])

Several RFMOs have developed lists of vessels presumed to have carried out IUU activities: CCAMLR, ICCAT, IOTC and IATTC (IATTC resolution C-04-04 has yet to produce a list). Although older records and lists may have identified a number of flag states as carrying out IUU activities we do not consider these lists to reflect current

[110] Austral Fisheries. 2002. The alphabet boats: A case study of toothfish poaching in the Southern Ocean. Austral Fisheries Pty Ltd, Mt. Hawthorn, Australia.

IUU activity. For instance, in the toothfish fishery Agnew (2000[111]) and Agnew et al (2002[112]) identified in the period between 1995 and 1999, the following non-Contracting Parties to CCAMLR to have flagged vessels engaged in IUU fishing in the Convention Area and specifically around South Georgia: Panama, Belize, Vanuatu, Portugal, Namibia, Seychelles, Faeroe Islands, Namibia, Argentina, Honduras and Bolivia. Since that time, Belize, Portugal and the Seychelles have prohibited their flag vessels from fishing in the Convention Area, Namibia took action against its vessel and has joined the Commission, the Seychelles has become a cooperating party and Argentina has taken action against its IUU vessels. Thus, a number of these flag states are no longer implicated in IUU fishing in CCAMLR waters. Table 11 provides details of the type of IUU fishing recorded for a number of flag states.

Some caveats need to be applied to the list in Table 11. It should not be considered to be exhaustive. Nor should it be regarded as an indictment of specific flag states or an indication that vessels flagged to these states are currently engaged in IUU fishing. It is simply a list of all the flag states that have appeared either in our table within Annex A, or in lists of IUU vessels maintained by RFMOs such as CCAMLR and ICCAT. We have prepared it in this study primarily as a tool to give an indication of the scale of the problem and to identify some specific potential problem areas. Many states, such as Spain, have made great efforts recently to curtail the IUU activities of their nationals and vessels. Some, including Spain, have developed their own plans of action on IUU fishing to support the European Commission's Plan of Action on IUU fishing. In addition, not all IUU fishing is the same; some IUU fishing is not illegal, but it is unregulated because there are no regulations in place in a particular area. There is an important distinction between those fleets that are regularly engaged in wide-scale IUU activities and those that are taking advantage of low-level MCS in some areas to engage in border-hopping and other opportunistic activities (in essence one can expect that the latter is much more easily solved than the former).

This list is, however, helpful in illustrating the range of examples of IUU fishing. For example, it is useful to see that some of these states listed are both developing states and open register (OR) states. In Section 4.3.2 we discuss open registers in more detail.

Clearly, all states engaged in IUU fishing, whether or not identified in Table 11, or as open registers, need to be encouraged to exercise increased flag state compliance with international standards, including the Code of Conduct and the UNFSA & Compliance agreements. For those countries which are not currently a party to UNFSA, the HSTF has recommended that increased pressure be brought to encourage them to become party to it (Belize, Japan, Poland, Bolivia, Korea, Saint Vincent, Cambodia, Mexico, Sierra Leone, Equatorial Guinea, Nicaragua, Vanuatu, Georgia, Panama, Venezuela, Honduras, Philippines)[113]. For those that are party to the UNFSA, more attention needs to be paid to their effective implementation of it,

[111] Agnew, D J, 2000. The illegal and unregulated fishery for toothfish in the Southern Ocean, and the CCAMLR Catch Documentation Scheme. Marine Policy. 24: 361 – 374.
[112] D. J. Agnew, G. P. Kirkwood, J. Pearce, An analysis of the extent of IUU fishing in Subarea 48.3 A report for the Government of South Georgia and the South Sandwich Islands By MRAG Ltd, February 2002. A subset of this report is available in D.J. Agnew and G.P. Kirkwood 2002. A statistical method for analysing the extent of IUU fishing in CCAMLR waters: application to Subarea 48.3. CCAMLR WG-FSA-02/4.
[113] HSTF paper on High Seas Governance, 25 Jan 2005.

including implementation of the Compliance agreement, which contains similar provisions with regard to flag state control.

Table 11 States of vessels identified as having participated in IUU fishing. From Annex A and "black lists" of RFMOs.

Flag State	Listed in	Type of fishing	Agreement status (U=UNCLOS 82; S=Straddling and highly migratory stocks 1995; C= Compliance agreement 1995)	Open Register Status ** = major ORV * = occasional ORV
Uruguay	CCAMLR[114]	Longline toothfish	U,S,C	
Togo	CCAMLR	Longline toothfish	U	
Honduras	CCAMLR	Longline toothfish	U	**
Equatorial Guinea	CCAMLR, ICCAT[115]	Longline toothfish, tuna	U	*
Georgia	CCAMLR	Longline toothfish	U	**
Netherlands Antilles	CCAMLR	Longline toothfish	U,S	*
Ghana	CCAMLR	Longline toothfish	U,C	
St Vincent and the Grenadines	CCAMLR, ICCAT	Longline toothfish, tuna	U	**
Seychelles	CCAMLR	Longline toothfish	U,S,C	
Bolivia	CCAMLR	Longline toothfish	U	**
Palau	ICCAT	Longline tuna	U	
Sri Lanka	Annex A	Inshore IUU in the Indian Ocean	U,S	
Indonesia	Annex A	Cross-border IUU	U	
Thailand	Annex A	Cross-border IUU		
Ukraine	Annex A	Cross-border IUU	U,S	
Turkey	Annex A	Cross-border IUU		
Mauritius	Annex A	Inshore IUU in the Indian Ocean	U,S,C	
Senegal	Annex A	Cross-border IUU	U,S	
Kenya	Annex A	Cross-border IUU	U,S	
Republic of Korea	Annex A	DWFN Unregulated in high seas, and IUU in some EEZ waters. Tuna, squid, other species	U,C	
Chinese Taipei (Taiwan)	Annex A	DWFN Unregulated in high seas, and IUU in some EEZ waters. Tuna, squid, other species		

[114] CCAMLR IUU Vessel Lists for the 2004/05 and 2003/2004 fishing seasons (2005), established pursuant to Conservation Measures 10-06 and 10-07.

[115] List of Vessels Presumed to Have Carried Out IUU Fishing Activities in the ICCAT Convention Area, Established pursuant to the 2002 Recommendation by ICCAT to Establish a List of Vessels Presumed to Have Carried out Illegal, Unreported and Unregulated Fishing Activities in the ICCAT Convention Area [02-23]

Flag State	Listed in	Type of fishing	Agreement status (U=UNCLOS 82; S=Straddling and highly migratory stocks 1995; C= Compliance agreement 1995)	Open Register Status ** = major ORV * = occasional ORV
China	Annex A	DWFN Unregulated in high seas, and IUU in some EEZ waters. Tuna, squid, other species	U	
Spain	Annex A	DWFN tuna purse seine, some under-reporting	U,C,S(European Community)	
Russian Federation	Annex A	DWFN tuna purse seine, some under-reporting	U,C	

4.3.2. Open registers

As shown above, many vessels conducting both Illegal and Unregulated fishing, especially in high seas areas, are registered with so-called "Flags of Convenience" – referred to here as open registers[116] (OR). The real problem with open registers is not that vessels are able to flag to them easily, or that vessels flagged to countries operating open registers are fishing in high seas waters, but that the flag states do not exercise (may not be capable of exercising or may not have the will to exercise) their responsibilities under international law with respect to control of the vessels[117]. In particular there is usually a lack of a *genuine link* between the country and the owners of the vessel.

Many of these open register countries are developing countries, and therefore any solution to the IUU problem which involves those countries must not only address the issue of IUU activity in their own waters but IUU activity by vessels flagged to those

[116] According to the FAO Report of the Expert Consultation on Fishing Vessels Operating under Open Registries and Their Impact on Illegal, Unreported and Unregulated Fishing (Miami 23-25 September 2003; FAO Fisheries Report No. 722) the relevant international instruments do not provide a legal definition for "open register" or "flag of convenience". In the experience of IMO, FAO and UNCTAD there are no legally accepted definitions of these terms, but both are widely used and have in a sense been "defined by usage". UNCTAD's working approach considers that an open register is the one including vessels owned by nationals of other countries. If the percentage owned by nationals of other countries is very high, above 99%, then one speaks of a flag of convenience. If the percentage owned by nationals of the country is high, above 80-90%, then the register is an international one.

[117] Open registry countries have usually not signed the Compliance Agreement or UNFSA, the former of which enshrines Flag State Responsibility in its Article III, which says:

1. (a) Each Party shall take such measures as may be necessary to ensure that fishing vessels entitled to fly its flag do not engage in any activity that undermines the effectiveness of international conservation and management measures.

……

3. No Party shall authorize any fishing vessel entitled to fly its flag to be used for fishing on the high seas unless the Party is satisfied that it is able, taking into account the links that exist between it and the fishing vessel concerned, to exercise effectively its responsibilities under this Agreement in respect of that fishing vessel (our italics).

countries if the country operates an open register. Either the operation of open registers must stop, or those countries must be enabled to exercise proper control over the vessels in the manner envisaged by the Compliance Agreement.

Fishing vessels which are listed on open registers have a number of advantages over fishing vessels flagged in other countries. Those that are flagged on open registries of states that are not members of RFMOs in general avoid compliance with international maritime law, conventions and management measures. In addition, they can be more difficult to monitor and control by coastal states. The fact that open register vessels can have lower compliance and transaction costs than other flagged vessels means that they can have a comparative economic advantage in terms of reduced costs of production and operation. They do, however, of course run the risk of being caught and suffering severe penalties if a effective MCS structure is in place.

The costs of re-flagging to an open register vary considerably, depending what is included in the charge. The one-off payment for an open registered vessel may be as little as US$ 2,000, which will often be a small sum in comparison with the cost savings for the fishing vessel's operators from avoiding the requirements of responsible flag states (including requirements of vessel safety, crew human rights and taxes; many open registry countries are also tax havens (OECD, 2004)) and the potential annual value of catches. There will usually be other costs associated with re-flagging, such as legal fees, which raise the total cost to probably nearer $10,000, but still this is a relatively small sum. In some cases, particularly where a vessel is attempting to avoid prosecution for illegal fishing activities, it may be re-flagged several times a year.

There are a number of drivers which create an incentive for some vessels to re-flag under open registers. The increasing costs of fishing, reduction in catch in relation to fishing effort, the globalisation of capital, increasing international and national regulation of fishing, and marine resource exploitation have encouraged IUU fishing and the use of open registers.

Because of the usual lack of a genuine link between an open register vessel and its flag state, the benefits (primary or secondary sales or taxes on these sales) from these catches rarely accrue to either the flag or the coastal state. Vessels deliberately using the open register system to conduct IUU fishing often also target high value species such as tuna and swordfish (OECD, 2004[118]). Beneficial ownership of the vessels (the ultimate owners, possibly through a number of shell companies) is often in developed countries.

There are different views on the number of states operating flags of convenience. The International Transport Workers' Federation[119], which has a campaign against Open Register Vessels, identifies 28 countries including fishing and merchant vessels (Antigua and Barbuda, Bahamas, Barbados, Belize, Bermuda, Bolivia, Burma/Myanmar, Cambodia, Cayman Islands, Comoros, Cyprus, Equatorial Guinea, Germany (second register), Gibraltar, Honduras, Jamaica, Lebanon, Liberia, Malta, Marshall Islands, Mauritius, Netherlands Antilles, Panama, Sao Tome e Principe, Sri Lanka, St Vincent and the Grenadines, Tonga, Vanuatu) (Gianni and Simpson

[118] OECD (2004). Fish Piracy. Combating Illegal, Unreported and Unregulated Fishing. Paris: OECD.
[119] See the ITF website www.itf.org.uk. They have a specific Campaign against Flags of Convenience.

2004[120]). The primary criteria the ITF uses in making such a designation is the extent to which there is a genuine link between the flag state and the owners of the vessels on its registry; that is, the extent to which vessels on the registry are foreign-owned. In classifying states as flag of convenience countries, the ITF also takes into consideration a state's ability and/or willingness to enforce international minimum social standards on its vessels. An FAO report (2002[121]) lists 32 states as operating open registers and also having fishing vessels on those registers.

Not all the vessels fishing under the flags of these states are engaged in IUU: Panama, St Vincent and the Grenadines, Honduras, and Belize as well as Bolivia, Vanuatu, and Sierra Leone have vessels that are listed on the ICCAT "white list" of vessels authorised to fish. Gianni & Simpson (2004)[3] go on to report that Belize, Panama, Honduras, and St Vincent and the Grenadines, the "traditional" OR fishing nations, had 1100 vessels on their registers, and that whilst the number of vessels on Belize's register was declining the number on Honduras' was increasing. A number of new FOC states are also "up and coming", including Georgia, Cambodia, Vanuatu and Bolivia. They consider the role that OR vessels play in relation to IUU fishing and propose 14 countries as being particularly active with respect to fishing vessels. They are in order of the total tonnage registered:

Belize, Bolivia, Cambodia, Cyprus, Equatorial Guinea, Georgia, Honduras, Marshall Islands, Mauritius, Netherlands Antilles, Panama, St. Vincent and the Grenadines, Sierra Leone, Vanuatu.

There are varying estimates of the number, tonnage and size of OR fishing vessels. Gianni and Simpson, using Lloyds data show that the total number of vessels for the 14 major ORV countries gradually declined from 1,449 in 1999 to 1,340 in 2001 and 1,279 in 2003[122]. This was accompanied by an increase in average gross tonnage and a slight decrease in average age. ICCAT, referring only to tuna vessels, estimates a total of 300 vessels in the world, of which 100 operate in the Atlantic Ocean. In 1999 it was estimated that ORVs caught at least 30,000 tonnes in the Atlantic Ocean and accounted for around 25% of the bigeye catch but as we report earlier this has now declined (Section 3.1.1).

The IOTC estimated that IUU fishing (classified as NEI (not elsewhere reported)) in the Indian Ocean amounted to 130,000 tonnes in 2001. In the Indian Ocean, the problem is particularly pronounced for small longline vessels and these vessels often do not report to their flag authorities or to the countries in which they are based (Taiwan-owned vessels below 100 GT). Similar problems with OR vessel fisheries are found in the Atlantic Ocean and the Southern Oceans.

The other issue with OR vessels is that many of the companies listed as owners are shell or dummy companies, an approach to hiding the real ownership of the fishing vessels. Some of these companies are owned by companies based in EU countries.

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[120] M. Gianni & W. Simpson 2004. Flags of Convenience, Transhipment, Resupply and at-sea infrastructure in relation to IUU fishing. Chapter 6 in Fish Piracy: combating Illegal, unreported and unregulated fishing. OECD, Paris.

[121] FAO (2004). The Cost of Being Apprehended Fishing Illegally: Empirical Evidences and Policy Implications. AGR/FI/IUU (2004) 11.

[3]

[122] This may or may not reflect a reduction in the number of IUU vessels, because not all fishing vessels are registered with Lloyds. The increase in tonnage is probably due to the new Spanish-owned purse seiners, which are large and more likely to be registered.

The specific advantages of open registers to the two parties are as follows. For the open registered fishing vessel:

- there may be avoidance of regulations on health and safety, insurance, classification, crew employment conditions etc
- avoidance or reduction of taxes, social charges
- avoidance of compliance with national and international legislation relating to fisheries, environmental and maritime laws and conventions.

For the state operating the open register, there is revenue from registering the vessel which may be in hard currency and therefore of particular interest to low income developing states such as Honduras, Vanuatu and Sierra Leone. However Gianni (2004)[123] considers that the benefits received by OR states are relatively small. We estimate that 20 open register countries obtain total revenue of nearly US$3.5 million per year (Table 12).

Table 12 Estimated annual revenue deriving to open registry countries from licensing of fishing vessels

	Number of fishing vessels on registry	Assumed annual revenue ($/vessel)	Total revenue from fishing vessels (US$ 000)
Antigua and Barbuda	1	2200	2
Barbados	5	2200	11
Belize	211	2364	499
Bahamas	6	2200	13
Bolivia	24	2000	48
Cambodia	43	2000	86
Cyprus	35	2731	96
Equatorial Guinea	55	2200	121
Georgia	53	2000	106
Honduras	486	2214	1076
Liberia	2	2500	5
Marshall Islands	11	2745	30
Mauritius	26	3000	78
Netherlands Antilles	14	2500	35
Panama	321	2283	733
St Vincent	130	2445	318
Sierra Leone	35	2000	70
Vanuatu	33	2609	86

Le Gallic (2004)[124], on the basis of his own research and that by Agnew and Barnes (2004)[125], points out the differences between ORVs and legitimate fishing activities with respect to their impacts on revenues and costs. These are summarised in Table

[123] Gianni, M. (2004). IUU Fishing and the Cost to Flag of Convenience Countries in OECD (2004). Fish Piracy. Combating Illegal, Unreported and Unregulated Fishing.
[124] Le Gallic (2004). Economics of IUU Fishing Activities. Chapter 1 in Fish Piracy: combating Illegal, unreported and unregulated fishing. OECD, Paris.
[125] Agnew, D. and Barnes, C. T. (2004). Economic Aspects and Drivers of IUU Fishing in OECD (2004).

13. It is clear from this table that significant advantages accrue to vessels using open registries even if they do not engage in IUU activities. Whether an OR engages in IUU fishing will depend in large part on the same economic calculations as for non-ORV vessels - the probability/expectation of being arraigned and or/arrested, the chances of pursuit, the potential value of the catch and how the operators balance expected total revenues including these risks against expected costs. However, because as Table 13 shows the operating costs are significantly reduced for ORVs, the disincentives (in terms of arrest etc) need to be proportionately higher for these vessels than for non-ORV vessels before the cost-benefit equation falls in favour of legal rather than IUU operations.

Table 13 The Implications of Open Registration fishing activities on Revenues and Costs

PARAMETER	**IMPACTS**	**COMMENTS**
Fishing revenues	Probably the same as legitimate vessels	
OPERATIONAL AND CAPITAL COSTS		
Taxation	ORVs may not pay taxes, licence fees and duties to the same extent as legitimate vessels; loss of revenue to coastal states	Tax evasion is likely
Crew costs	Lower than legitimate vessels	ORVs are not bound by/do not respect employment legislation and rights
MCS costs	No cost recovery from ORVs	
Flagging/Registration costs	Costs may be less for ORVs	
Insurance costs	Open registration may avoid paying insurance costs	They may not comply with legislation
Access fees	ORVs may not pay access fees (if they are IUU).	This represents a loss of revenue to coastal states which receive access fees as part of international and bilateral fishing agreements
Vessel purchase costs	ORVs may be cheaper than legitimate fishing vessels; they may be old decommissioned vessels with sub standard equipment.	
Repair and maintenance costs	These are likely to be lower for ORVs	ORVs o not respect national and international regulations and standards.
Safety equipment costs	These may be lower for ORVs	ORVs may not comply with international and national health and safety regulations.
Fraud costs	These may be higher for ORVs	Repackaging/re-labelling
Avoidance costs	These may be higher for ORVs. They may include operating costs – fuel and crew costs	They may have to sail longer distances to avoid patrols where there is effective MCS.

Figure 14 illustrates the economic advantage gained by an IUU vessel where operating and maintenance costs will be lower than for a legitimate fishing vessel. This means that all things being equal, the IUU fishing vessel will still make a profit (the difference between total costs and total revenue) with increased fishing effort while the profit at this level of fishing effort will decline for a legitimate fishing vessel which has higher operating and maintenance costs.

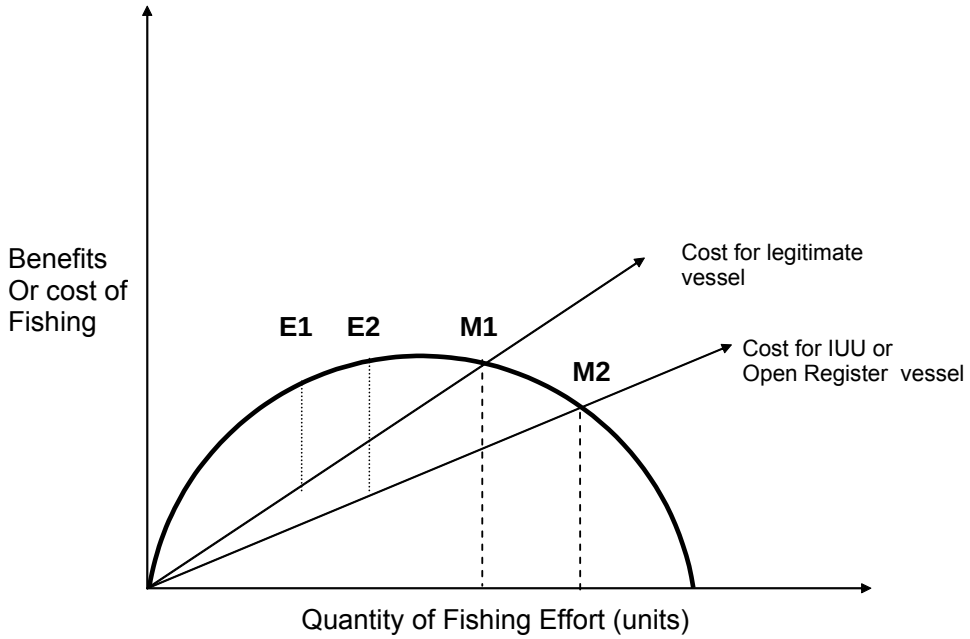


Figure 14 The Impacts on Revenue and Costs of IUU Fishing. The benefits from fishing (quantity and value of fish caught) follows a curved relationship with effort, here portrayed as a simple Schaefer model, such that benefits increase with increasing effort up to a maximum, after which increased effort leads to lower catches. Costs increase with effort faster for legitimate vessels than for IUU or open register vessels. This means that the optimum or efficient harvest point is at a higher fishing effort for IUU vessels (E2) than for legitimate vessels (E1), and is also at a higher profit level. Furthermore, the maximum effective fishing effort (the point at which costs start to exceed profits) is higher for IUU vessels (M2) than for legitimate vessels (M1). Thus, if regulated solely by economics, IUU vessels will make more profit, for longer, and do more damage to stocks than legitimate vessels.

Table 12 shows that operating an open register generates relatively little income for a country, while by contrast the resource rent lost to developing country coastal states is considerable. Registration revenue is relatively low, and states will usually not receive much, if any, benefit from fishing activities – either in terms of tax receipts or in terms of catch that is actually landed and/or processed. It is legitimate therefore to ask why countries operate such registers. There are two reasons. Firstly, some countries (Liberia, Panama) operate fisheries registers alongside merchant registers which generate vastly more income than the fisheries vessel registers. In other words, the fisheries register is a by product of the merchant register. Secondly, it is relatively inexpensive to operate a register, so even though the benefits are modest, it is money for (virtually) nothing. Because the state does not exercise any control over the vessels it registers, there is no expenditure on inspection, monitoring, data

reporting, membership of international agreements etc. Also, where corruption levels are high, the revenue will be concentrated in relatively few hands. Operating an open register can therefore be regarded as a short term gain strategy.

There are a number of measures which may be taken to curtail the activities of open registered fishing activities. Firstly, dealing with the ORVs themselves, it may be possible to

- increase the economic disincentives to ORVs by raising fines to the point that the risk of fishing is too high. In addition, provision should be made for the sequestration of assets of owners of ORVs;
- ban ORVs from ports (port state control);
- ban the landings and sale of fish and other marine products caught by ORVs them where, providing it is possible to identify them;
- strengthen international and national legislation on ORVs; and
- prohibit companies in developed countries from having links with open register vessels.

Persuading countries that operate open registers to abandon them may require some form of financial compensation for the revenue foregone. What is required of these countries is not a total cessation of registration activities, but an effort to take seriously their responsibilities under UNFSA and the Compliance Agreement. The necessary personnel, infrastructure, legal systems, organisation and technology need to be in place to enable this.

We have so far considered the financial implications of open registered fishing vessel operations. In addition, there is the wider issue of the economic impacts, including *externalities* which should be taken into consideration in assessing the impacts of open registered fishing vessels. While the reduction of transaction (legal, contractual and negotiation costs) and operating costs (licence fees, labour, health and safety, fuel etc) gives the financial rationale for using open registration in certain states, the economic impacts on marine resources are likely to be considerable, precisely because the flag states are not ensuring that the vessels fish responsibly. They include:

- damage to marine habitats and ecosystems with economic consequences – lower catches, damage to spawning grounds;
- health impacts to crews of poor working conditions and inadequate health and safety;
- an overall reduction of biomass and damage to sustainable fisheries through unregulated fishing techniques; and
- increased costs of monitoring, control and surveillance for coastal states many of which in Africa are low income economies.

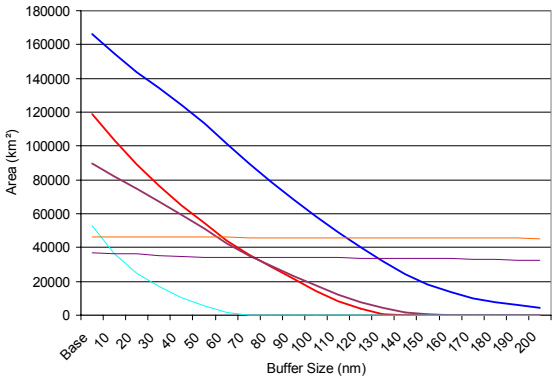
4.3.3. Inadequate high seas governance

The majority of marine fishing activity takes place in the productive continental shelf areas adjacent to the coast. For the most part, these areas fall within the 200 nautical mile zones (including exclusive economic zones, fishing zones, maritime zones and territorial seas) created under UNCLOS. There are however a few notable exceptions where there remains outside 200 miles a large area of productive shelf in depths that are able to be fished by industrial fishing vessels. Some of these areas are contiguous with fishing grounds inside national waters and the fish stocks

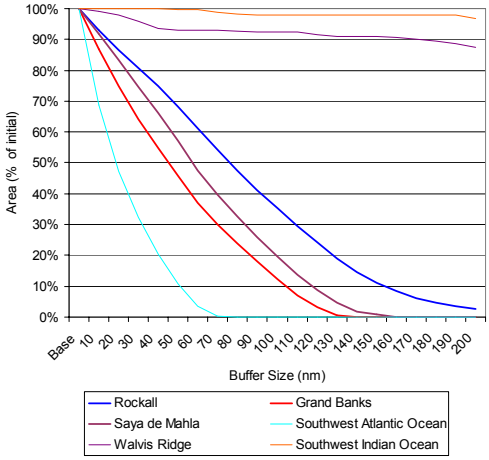
in these areas may straddle the boundary. It is therefore greatly in the interests of these coastal states to control fishing in these areas in a similar way to the control exercised within the EEZ. (e.g. cod and flatfish stocks on the Grand Banks).

A measure of control has been achieved in some cases through Regional Fisheries Organisations (e.g. NAFO covers the Grand Banks). An alternative means of managing the fisheries of these regions, which has been discussed from time to time, is for adjacent coastal states to extend their zones beyond 200nm. Such action by coastal states is clearly a highly contentious issue and one that some states have great difficulty with. However, it is interesting to consider by how much the zones would need to be extended to cover the areas of interest. To investigate this, we have selected six examples of high seas shelf areas from around the world (listed below and shown in Figure 16), which are probably the six most important in terms of fishing activity. Using a GIS, we have digitally extended the adjacent 200nm zones in 10nm increments up to a maximum of an extra 200nm (i.e. a total of 400nm from the published baseline points), calculating at each increment the decrease in the fishable shelf area that remains available on the high seas. The results are plotted in Figure 15.

Bank	Coastal States Concerned
(a) Rockall Bank	United Kingdom, Ireland and Iceland
(b) Grand Banks ('nose' and 'tail')	Canada
(c) Southwest Atlantic Ocean	Argentina and the Falkland Islands (UK)
(d) Saya de Mahla	Mauritius and Seychelles
(e) Southwest Indian Ocean	Madagascar
(f) Walvis Ridge	Namibia, South Africa and Tristan da Cunha (UK)



(a) Effect on absolute area (km²)



(b) Effect on proportion of initial size

Figure 15 The effect of increasing EEZ boundaries, presented as nautical mile extensions from the current 200nm EEZs, against fishable area less than 1,500 m deep that remains in high seas waters.

The current total high seas area of these banks is 520,000 km^2. Figure 15 (a) and (b) show that where the high seas shelf areas are continuations of banks and/or shelf

areas within the adjacent 200 mile zones (i.e. Rockall, Grand Banks, Saya de Mahla, and SW Atlantic Ocean), the high seas area available to fishing can be reduced to 50% of initial size by increasing the zones to 300nm (i.e. an additional 100nm) and to zero by extending them to 200nm.

The other two cases (Walvis Ridge and SW Indian Ocean) are composed of networks of offshore banks associated with underwater ridges and are not contiguous with shelf areas under national jurisdiction. Such offshore banks can be found away from continental land masses and as such are often smaller in absolute area. Increasing the extent of the zones of national jurisdiction does therefore have as pronounced an effect in these cases. The control of these areas is better served through international agreement in the form of a Regional Fisheries Organisation, such as the recently formed Southeast Atlantic Fisheries Organisation which covers Walvis Ridge and the Southwest Indian Ocean Fisheries Commission which will cover the Madagascan Ridge in the southwest Indian Ocean.

Nevertheless, extension of EEZs from the current 200nm to 300 nm would reduce the area of effective demersal high seas fishing opportunity from 520,000 km^2 to 186,000 km^2 (a reduction of 64%). An extension to 400 nm would virtually eliminate the area of opportunity altogether (making it 83,000 km^2, or 16% of its current size).

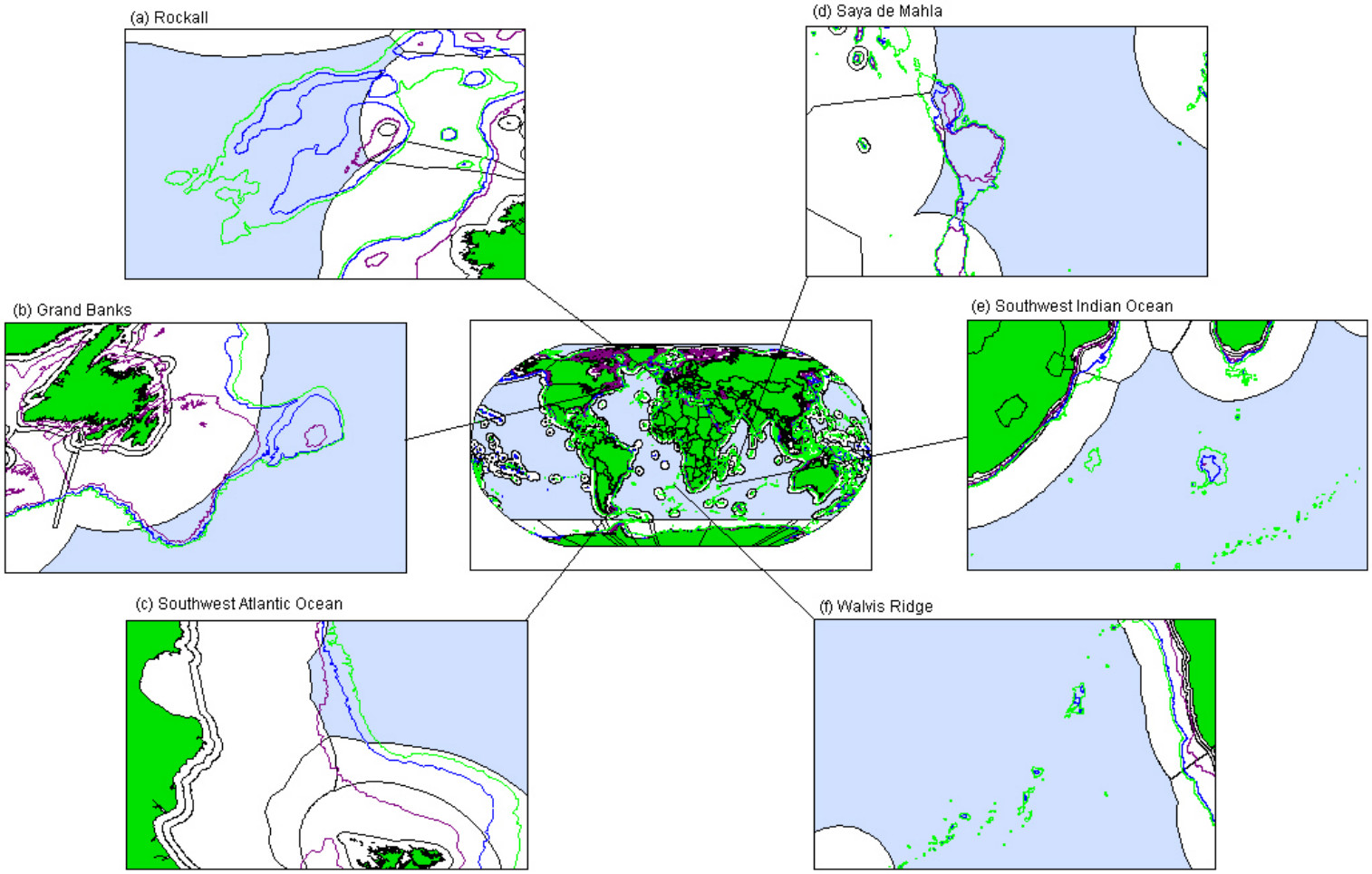


Figure 16 Areas of depth less than 1500m on high seas with six test areas highlighted (green line indicates 1,500 m contour) (Depths from GEBCO Atlas; EEZ boundaries from Global Maritime Boundaries Database 2005. General Dynamics Advanced Information Systems)

4.3.4. DWFN fleet overcapacity and the role of subsidies.

FAO (2004) report that about 50% of fish stocks around the world are fully exploited, and that there has been an increase in the proportion of stocks that are overexploited (including depleted and recovering stocks) from 10% in the mid-1970s to about 25% today[126]. There is a general acceptance that overcapacity in the world fishing fleet has significantly contributed to this problem. Overcapacity is the mismatch of fishing effort to available resources. Effective fishing effort is increased both by both increasing the number and size of fishing vessels and increasing their technological ability to catch fish. Garcia and Grainger (2004[127]) and FAO (2004) have shown a number of trends which have contributed to the development of a peak or bulge in fishing vessels – the so called 'vessel bulge'. Key trends have included:

- An increase in the number of decked vessels over the period 1970-2000;
- A bulge in new registrations in the early 1980s and a peak in overall fleet size in the late 1980s. New registrations are projected to decline and stabilise from 2005, while fleet size is predicted to decline fairly dramatically over the period 2005 to 2035 (vessels over 100 tonnes);
- The extension of EEZs, the development of fishing agreements and the subsidisation of distant water fishing fleets were all factors. However there were also changes in fleets which resulted in the contraction of the large pelagic subsidised fishing fleets of the former Soviet Union and COMECON countries. To some extent there has been an expansion of subsidised fleets from other countries – France, Spain, the Netherlands and Ireland in the European Union and the expansion of the East Asian fishing fleets (China/Taiwan, Japan and Korea).

Subsidisation of distant water fishing fleets is considered to be an important factor in stimulating the development of IUU fishing because it artificially reduces the capital value of new and old vessels, and therefore increases the profitability of fishing vessels. However, the effect of subsidies does not end there. Any subsidised vessel will have an artificially reduced value throughout its life, meaning that the increase in effective profitability is transmitted throughout the vessel's life, including its potential entry into the IUU fleet.

The effect of the vessel bulge referred to above, and the legacy of subsidies, means that there are now, and will be for some time, a large number of extremely cheap vessels, nearing the end of their life as suitable legitimate vessels, for sale to IUU operations. By cheap we mean only hundreds of thousands of dollars for a vessel to fish IUU on high seas waters, rather than the millions or tens of millions of dollars that an efficient, seaworthy legitimate vessel would cost to build. There is no-where for these vessels to go, apart from to IUU operations, because their age and seaworthiness means that they are unsuitable for operations in well managed fisheries and are unable to compete with newer more efficient vessels in these fisheries.

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[126] FAO, 2004. The state of world fisheries and aquaculture. FAO, Rome, 2004.

[127] Garcia, S. M. and Grainger, R. J. R. (2005). Gloom and doom? The future of marine capture fisheries. *Philosophical Transactions of the Royal Society*, 360, pp 21-46.

In this regard, output subsidies (subsidies for buybacks or decommissioning) are almost as damaging as input subsidies (subsidies for building vessels) because they further undermine the effective capital cost of vessels, and if they come to be anticipated by fishermen, will generally have a negative effect on economic performance and resource conservation[128]. It is also extremely important that under no circumstances should decommissioned vessels be sold – reductions in capacity must mean just that – otherwise they are likely to be attractive to IUU operations.

The root cause of overcapacity is open access, or poorly defined fishing rights, or clearly defined rights that are not effectively implemented (e.g. poor surveillance). Until this underlying problem is tackled, any net increase in revenue, whether resulting from a subsidy, increased efficiency (e.g., from technological improvements) or from price increases will tend to be dissipated on overcapacity. Improved governance and resource management will tend to minimize the potential harm to the resource arising from many economic influences that encourage overfishing, including subsidies.

The case of Namibia, for example, demonstrates the positive contribution of an effective regulatory environment, including conditionalities in the activities of fishing fleets[129], a comprehensive resource assessment program with long-term commitment to fishery-independent surveys, and commercial data collection.

Good resource stewardship therefore has two main components:

- Establishing and effectively implementing well-defined fishing rights[130]
- Implementing an effective resource assessment and management program

These approaches are likely to reduce fleet sizes over time and promote economic efficiency and will tend to reduce the perceived need for subsidies, at least for fishing vessels actively involved in fishing.[131]

[128] Clark, C.W., G.R. Munro & U.R. Sumaila 2005. **Subsidies, buybacks, and sustainable fisheries** Journal of Environmental Economics and Management, Volume 50, Issue 1, July 2005, Pages 47-58 Colin W. Clark, Gordon R. **Munro** and Ussif Rashid Sumaila

[129] These conditionalities could comprise a number of options, including a requirement for foreign fishing vessels to set up joint ventures with local companies and requirements for fish caught in the EEZ to be landed in the developing country. These elements form part of the Namibian fisheries management model.

[130] Note that there are many ways in which such rights can be structured, and this does not automatically assume the intervention of a centralized government. Community-based management and customary marine tenure are examples of systems with the potential to establish effective limitations on fishing inputs that reduce incentives leading to overcapacity.

[131] The need for financial support for disadvantaged communities and fleet-reduction schemes is likely to remain.

4.4. Summary

Our analysis suggests that some $0.37bn IUU is taken from the EEZs of our 10 case study countries. Significant relationships exist between the amount of IUU fishing, the state of MCS (monitoring, control and surveillance), and the state of governance of a country. Indeed it is possible to extrapolate our case studies to the whole of sub-Saharan Africa using the relationship with governance, to estimate a total IUU value for this region of $0.9bn.

IUU fishing has significant economic and social impacts on developing countries, which include from the economic loss of the IUU fishing itself, the loss of food and impact on livelihoods, conflicts (including destruction of property and death) between artisanal fishers and poachers in industrial vessels.

Many IUU vessels are flagged to Distant Water Fishing Nations (DWFN), which are China, Taiwan, Korea, Spain and Russia. However, there is also significant IUU fishing, both in high seas and EEZs, by vessels flagged to developing countries. The principal problem with all these vessels is a lack of control by their flag states which leads to IUU fishing. Many of these are so-called “open register” developing countries which appear to derive very little economic benefit from their activities, whereas the vessels themselves derive very significant economic benefit through avoidance of normal operating costs, including payment of taxes and other dues to the open register country.

Other factors which significantly contribute to IUU fishing the overcapacity of the current world fishing fleet, and the fact that this overcapacity was created largely with the assistance of subsidies in the 1970s and 1980s, and has now lead to a glut of old uneconomic vessels ideally suited to IUU fishing.

Finally there are significant gaps in the governance of the high seas that encourage IUU fishing. Although most tuna and salmon resources are covered by RFMOs, very few other resources are (Figure 5), including almost all demersal fish such as orange roughy and alfonsino, sharks and squid. The extension of EEZs to cover all significant high seas waters cannot be achieved either practically or politically, so a complete set of RFMO or other governance mechanism is urgently required for all high seas areas.

5. Lessons Learned and Solutions

In this section we will first summarise the lessons learned from the case studies (Annex B). We then take these lessons and develop a set of solutions to the problems caused by IUU fishing in developing states. Finally, we look at what the consequences of solving the IUU problem would be for developing states – how much would they benefit, and what would be the value of those benefits compared to their costs. These considerations are used to examine what might be the regions and countries that would most benefit from international development assistance on IUU fishing.

5.1. Lessons Learned from the Case Studies

The first and foremost lesson learned from the case studies is that IUU fishing has had and is having large economic and downstream social impacts on developing countries. It is also evident that there are solutions to the problem of IUU fishing that have a proven record of success in the study region. Assistance to developing countries that helps to reduce IUU fishing is therefore likely to reap significant economic, social and environmental benefits, both regionally and nationally.

In the remainder of this section we consider several more detailed lessons learned that lead us towards specific types of solutions.

5.1.1. General Characterisation of the Fisheries

The case studies (Annex B) can be separated into two groups. The two groups tend to have different issues with regard to MCS and the incidence and nature of the IUU problem. The first can be termed “mixed” fisheries because there are several major resources which include, in various proportions, demersals, small pelagics and tuna. In these countries shrimp are always important. In this group we place Guinea, Sierra Leone, Liberia, Angola, Namibia and Mozambique. Small pelagics tend to be less important with respect to IUU activity in the waters of countries within this group (although as a resource they may be plentiful). The IUU activity in the second group of countries is centred on tuna with the other fisheries being less important. In the present case, this group includes Seychelles, Kenya, Somalia and PNG although Mozambique may also share some of the issues of the “tuna” group as well as the “mixed” fisheries. For some countries in this group, IUU fishing for shark is becoming an issue and Bêche-de-mer (BDM) can also be important IUU vulnerability particularly for small island states.

5.1.2. IUU in Mixed Fishery States

The critical demersal and shrimp resources are shelf-based and as such relatively inshore with most fishing carried out within 50nm of the coast except where the shelf is particularly extensive, such as in Guinea. This is particularly the case in the shrimp fisheries which tend to be furthest inshore, particularly in the vicinity of large river inflows and their estuaries because of their important role in the life cycle of the shrimps. Namibia is the least affected by shrimp fisheries because of its lack of estuaries. The closer the fisheries are to the shore the more open they are to

sightings and apprehension, even by limited patrol facilities. In Angola, community observer schemes have been introduced to assist with this.

By contrast, the offshore IUU activity for tuna requires long-distance aerial surveillance or ocean going long-distance patrol vessels, although VMS, coupled with port state control can modify this.

In general, unlicensed foreign vessels do not seem to be a major problem for demersal and shrimp fishing. The exception to this is Guinea where 33% or more of all vessels fishing are illegal. The same may be true of neighbouring Sierra Leone, which together with Guinea stands out amongst the West African case study countries (See Table 17, Annex B). By contrast, illegal fishing appeared to be at a much lower level in Senegal, Guinea Bissau and Mauritania. Indeed, Mauritania, with probably the highest MCS capability in the region, had levels of 1-4% illegal vessels (Kelleher 2002[132]). The situation in Sierra Leone, apart from the snapshot surveys of Table 17, is undocumented because of the civil war but there is little doubt of the high level of illegality here and this probably extends to Liberia for very similar reasons. However, the reports from our correspondents do seem to suggest that levels of unlicensed, illegal vessels elsewhere is more consistent with the low levels indicated in the surveys of the neighbouring West African States (Table 17; Kelleher 2002; Jones 2004[133]). The greatest number of illegal infringements, mainly from shrimp vessels, is border-hopping from neighbouring countries.

Most of these countries with low levels of infringements have, or have had a series of well established bilateral arrangements with other countries . The evidence suggests that where vessels pay realistic license fees they tend to resent intrusion by unlicensed vessels and can provide another layer of eyes and ears for the surveillance system. A certain amount of self-policing becomes built into the system.

- **Lesson 1.** A reasonably effective, realistic licensing system, for foreign and national vessels, is a precursor for proper control of a fishery.

An analysis of the nature of infringements in virtually all the “mixed” case studies showed the most common form of IUU fishing was incursions by vessels into prohibited areas, most frequently the inshore artisanal zone, or marine protected areas. Most of the coastal states in this group have important artisanal fisheries, employing tens of thousands of people and catching large quantities of fish, which go directly into the local market and often provide the cheapest form of high-grade animal protein for these states. For example, the artisanal fishery in Sierra Leone takes over 40,000 tonnes per annum. Consequently, they play an important role in the food security of these countries. Every state in our case studies has a coastal strip from which industrial fisheries are excluded, although the distance from shore varies.

This sets up a particular conflict with the shrimp fishers. They are tempted to go as far inshore as possible in pursuit of shrimp and there are repeated stories of shrimp vessels fishing right up to the shore and of damage to artisanal craft, even with loss of life as a result of the shrimp vessels activity. Ironically, the artisanal fishers have little use of shrimp but the major negative impact on the artisanal grounds is that of bycatch. Along with shrimp are trawled up demersal fish, juvenile fish and

[132] Robbers, reefers and ramaseurs, Opp cit.

[133] **Austin Jones, Presentation Of The Surveillance Operations Coordinating Unit (SOCU) – Activities And Programmes Confidential report to SRFC, 2004**

invertebrates, the damage being accentuated by the small meshes required for shrimp trawling. It is the bycatch which damages the present and future stocks in the artisanal zone that is the main point of contention. This is being intensified by the repeated reports of the shrimpers increasingly transhipping at sea, thereby maximising their operational range and reducing the opportunities of inspecting their catches in local ports. In most countries unauthorised transhipment at sea has been made illegal but it is hard to enforce.

Since artisanal fishermen are highly impacted by IUU they have potentially most to gain from its elimination. Cooperation with MCS authorities might therefore be expected to yield good results against IUU. This is indeed the experience of a 2 year trial recently initiated under the Sustainable Fisheries Livelihoods Programme of DfID to equip and train fishermen to identify and report to the MCS authorities (National Fisheries Surveillance Centre (CNSP)) the activities of IUU vessels fishing inshore on their artisanal fishing grounds. This allowed CNSP to target its scarce resources more effectively, and reportedly resulted in a reduction in industrial IUU activity in the areas of the trial[134].

- **Lesson 2.** There is a need to address the issue of regulating the shrimp fleets particularly in relation to their fishing location. This would reduce the conflict with the artisanal fleet in particular and reduce illegal activities within the artisanal zone and conserve stocks in this area. This is an area where VMS and participatory fisheries surveillance including the artisanal fishermen themselves can be effective.

One of the perennial problems, and one which is particularly relevant to the shrimp and demersal fleets is one of under reporting. It is a particularly difficult one to estimate, especially with transhipment at sea. There are virtually no records of the degree of unreported or misreported catches. Licensing arrangements do not guarantee log book returns and this has to be supervised. The EU fleet although well-licensed is remiss in its returns. Only in one case, that of Guinea, was it possible to compare a direct estimation of the rate of fishing, obtained by our correspondent, with the recorded catch. In the case of demersal and cephalopod vessels the match was good, suggesting relatively little underreporting, perhaps surprisingly.

There is evidence that vessels operating under access agreements do not necessarily declare all their catches under these agreements. This is less of a problem in the Indian Ocean, where most of the vessels (purse seine tuna) land and are inspected in Mauritius or Seychelles (see discussion under Lesson 4 below), than in the Atlantic where a number of vessels either tranship to reefers which land at Las Palmas or land there themselves, and may not be thoroughly inspected.

It was probably significant, however, that although the MCS capacity of Guinea in not well-developed it does have comprehensive observer programme. The total estimates of catch (Kelleher 2002) came from observer reports, not from catch reports from the vessels. Observers are purely recorders and although they do identify under-reporting they seem to play little part in detecting the many illegal vessels. In Mozambique, there is a suggestion that the range of the observers is

[134] T. S. Bah." Incursions by industrial trawlers into Guinea's coastal zone at last a sigh of relief from the small-scale fishers of Bongolon". Sustainable Fisheries Livelihoods Programme, seen May 2005. http://www.sflp.org/eng/007/pub1/103.htm. See also M. Diallo, and C. Breuil, Participatory fisheries surveillance in Guinea: a striking example for others to emulate. http://www.sflp.org/eng/007/pub1/123.htm.

extended by transfer between fishing vessels at sea. However, whether this is to help deal with illegal vessels or just to extend the range of reporting in not clear. Where there are poorly trained observers, however, there are numerous stories of their being suborned or intimidated by fishing vessel crews. Guinea has also been experimenting with participatory fisheries surveillance activities conducted through cooperation between MCS authorities and the artisanal fishermen themselves.

- **Lesson 3.** The deployment of well-trained and motivated observers can greatly reduce under-reporting or at least help to assess the magnitude of the problem. While observers should not be involved directly in enforcement, they record what they observe and this information can provide useful guidance to the surveillance system, for example in the verification of landings and transhipments, and help to build up profiles of illegal offenders for later action through diplomatic channels or the creation of “black lists”.

There remains the problem within the mixed fishery group of offshore tuna. Most of the African cases have some tuna offshore and several issue purse seine and longline licenses, but none have any idea of what is there or what is being taken and have absolutely no offshore MCS capacity. Some coastal states have had some assistance from development projects, such as the EU SADC MCS project, which have provided snapshot over flights or occasional patrols by friendly foreign navies, but it remains a great blind spot. The lack of understanding of the resource, which is of course very valuable, also limits the negotiating position of the coastal state in its negotiation of licensing arrangements with third country tuna fleets.

We have tried to shed some light on this issue by conducting an analysis of the historical distribution of catch reports to the RMFO tuna commissions, ICCAT and IOTC (Annex B, Section 9.1). The resulting plots show surprising amounts of tuna declared in coastal African EEZs; surprising because one would have expected there to be an incentive for vessels to declare catches taken inside poorly patrolled EEZs as having been taken on the high seas outside EEZs to avoid potential access costs. Many of these vessels, particularly purse seiners, probably hold nominal licenses but there will always be a temptation to under report because of the RMFO quota systems and also because declarations outside EEZs are safer than those inside. Nevertheless, within the context of the case studies, the order of magnitude of tuna catches even in mixed fishing examples as in Figure 21 and Figure 22 (Annex B), demonstrate the tuna hotspots, such as the EEZs of states bordering the West African upwellings, and conversely, why Angola will never have huge tuna catches since it is largely outside the tuna belt, with the exception of Cabinda and its northern provinces.

It is also not clear that this information on locational catches by EEZ is made available to the coastal state in this form, even if the state is a member of ICCAT or IOTC.

- **Lesson 4.** Some offshore capability should be developed in coastal states to help regulate and fully include the offshore tuna resources within their controlled fisheries. This is particularly valuable in the initial establishment of the credibility of the control system. Establishment of a VMS would also be of great longer term value in this regard.

5.1.3. IUU in Tuna Fishery States

The tuna fisheries of the world are largely offshore and are pursued by industrial fleets of purse seiners and longliners. Artisanal involvement is minimal and there is little direct conflict with the artisanal sector. Initially, fleets were largely DWFN but many states are now increasing local commercial involvement, as in PNG and Seychelles. Agreements with third country vessels are usually by number of vessels, with or without a quota limit, at a fee which should relate to the potential value of the resource.

The majority of tuna catch is taken by purse seiners which, because they are large and valuable vessels, tend to prefer to be licensed. An exception is Somalia where the fragmented nature of the state means licensing, where present at all, has an uncertain status. There are more opportunistic vessels amongst the longliner fleets although they tend to take less than 10% of tuna catches in the cases considered. Even the strongest of the tuna cases considered, PNG and Seychelles, have a relatively limited offshore MCS capacity. Seychelles now has virtually no regular offshore aerial or sea patrols, although they did operate daily air and sea patrols some years ago, which was valuable in establishing the credibility of he licensing regime. PNG has some aerial patrols by agreement with Australian and New Zealand, mainly on shelf-based fisheries, and occasional sea patrols by the PNG Defence Force. What Seychelles does have currently, however, is stakeholder participation in surveillance. By encouraging stakeholders to radio in to the central fisheries control centre sightings of illegal fishing the limited support provided by the Coastguard vessel can be targeted and results in a significant number of inspections and apprehensions each year. Similarly PNG has a community surveillance scheme called the 'wantok' system although this is more shore-based. Nevertheless the seaborne patrols do make a significant number of arrests each year and it was probably the arrest by PNG of a US purse seiner in the early years of the tuna fishery which helped galvanise the purse seine fleet into becoming legitimate. The ability to show an occasional "bite" is important in encouraging compliance with licensing requirements.

One further element in the relatively successful regulation of the tuna fishery is that purse seiners usually need to tranship or land their catches in port, although the ex-Russian fleet routinely tranships at sea. In Seychelles, some 80% of the purse seine caught tuna passes through Victoria, primarily because of the large canning plant there. There is also some transhipment in PNG ports to service canneries in Thailand. This enables comprehensive port inspections to take place and vessels landing obviously must be licensed.

This is not the case with longliners. They are harder to pin down and although they tend to take a smaller proportion of the catch this is of generally much more valuable fish. Those of the more responsible DWFN, are adequately licensed in Seychelles, PNG and Mozambique although probably not in Kenya and Somalia. Generally, however, there is more scope for interlopers. Longline vessel operators tend to be more risk prone than purse seine operators. Their vessels are much less valuable, therefore they have less to lose if caught, and also they are harder to catch in the first place, because they do not remain attached to their fishing gear while it is deployed.

In addition, longliners tend to have different transhipping requirements to purse seiners. Their catch rates are lower and they remain at sea for much longer periods. They rarely land in Victoria in the Seychelles. All frozen tuna is shipped by sea back to home ports. Longliners do tranship in PNG ports which allows some checks to be

made there. Fresh swordfish and sashimi tuna is landed at ports with good air links to markets in Europe and the far east.

- **Lesson 5.** Tuna agreements should be transparent, equitable and of a value related to the value of the resource in question. Reporting requirements should be specific and backed up by port inspections. The ability to effectively enforce compliance through a credible threat of penalties is important in ensuring that DWFN seek a licence.

Tuna fisheries are far ranging and the industrial fleets tend to follow the shoals around the ocean. Thus, many of the vessels in the Mozambique fishery will be the same as those fishing in Tanzania, Kenya, Somalia and Seychelles. Purse seine tuna companies tend to buy licenses in all possible EEZs through which the tuna shoals may pass, but where they actually fish may vary from year to year. The existence of the circulating tuna fleet means that linkages between neighbouring countries is very important. Sharing information and building up profiles of transgressing vessels and companies helps to identify offending vessels which may sooner or later fall to inspection of one country or another in the chain. This can manifest itself as a regional 'black list', although PNG prefers a 'white list', i.e. vessels given preferential treatment when licences are distributed by virtue of their good record.

Clearly, it makes most sense if these linkages are formed through an RMFO such as IOTC or ICCAT. In West Africa, RMFOs are not particularly strong or well-supported. In southern/eastern Africa SADC is almost becoming a *de facto* RMFO with the formulation of the SADC Fisheries Protocol, although for tuna IOTC is quite effective. PNG is a member of FFA, SPC and, more recently, the WCPTC, all of which are well-established and have served the region well. An RMFO is only as strong as the commitment and completeness of its membership.

- **Lesson 6.** Linkages between states in a tuna fishery should be good in order to share information on perpetrators and also management information. This is best done through an RMFO which has the commitment of all stakeholders.

Under reporting and misreporting from fleets which operate away from most surveillance zones will always be a problem. It will be less so if the fleet unload in a territorial port such as Victoria in the Seychelles but in situations, such as Kenya, where virtually nothing is known of the fleet or the resource, the temptations must be great for skippers. Nevertheless as the records of IOTC show (Annex B, Section 9.1) fleets do declare significant catches but usually to the flag state (and thence to the RMFO), rather than to the coastal state. Tuna vessels are often suspected, however, of declaring catches taken within an EEZ as coming from just outside the zone in the high seas. Inspection of the distribution of catches in the Indian Ocean with regard to EEZs and their border areas has some suggestion of this (Figure 21 and Figure 23, Annex B). In our assessment we have assumed quite a high rate of misreporting of this type, particularly off more vulnerable countries with low MCS capacity.

It might be thought that VMS would be useful in detecting misreporting. Indeed, it is of value in establishing the presence of fishing vessels in prohibited areas, as the case of the EU purse seiners found in a Mozambique national marine park showed. But it is not easy to prove conclusively in law that fishing was being carried out by a vessel detected by VMS, without additional corroborative evidence such as a sighting by an inspector.

With purse seiners there is probably only low level of total non-reporting of catch, perhaps 2-3%, but a higher level of misreporting especially when the licence is catch-dependent.

- **Lesson 7.** Under reporting and misreporting of the tuna fleets is difficult to detect particularly in the EEZ of states with little port contact. Assistance may be required in assessment, negotiation and surveillance.

A further commonly found infringement of the tuna fleets, particularly longliners, is to fish outside the terms of their license. Most commonly this is in relation to shark where the increasing demand for shark has meant that longliners with licenses for tuna may, in fact, start targeting shark either whole or for finning. This has been commented on in all our case studies involving tuna fisheries. In extreme case the vessels may switch gear and there are examples in Mozambique of Chinese longliners seen fishing with gill nets for shark and running the risk of taking large amounts of turtle as bycatch.

- **Lesson 8.** Shark should be brought into the regulated fishery of coastal states as has been done recently in PNG.

5.2. Solutions based on Lessons Learned

5.2.1. Strengthening MCS and governance

The results of our analysis of the case studies (Section 3.3 and Annex B) indicate that the most important actions in terms of reducing IUU fishing are

- to create good MCS systems;
- to underpin these systems with good governance; and
- to engage in active cooperation with local and regional management bodies.

This may seem self-evident, but it was strongly supported by the case study lessons (Section 5.1). A strong MCS is created by having:

- realistic and equitable licensing systems with clear reporting requirements;
- good regulation of fisheries with good underlying assessments to underpin the licensing and management systems;
- trained and motivated observer programmes that are able to monitor catches of target and bycatch species, especially in foreign fisheries governed by access agreements;
- offshore MCS capability especially in those states vulnerable to encroachment of DWFN fleets from high seas tuna fisheries;
- A VMS capability to control the area infringement of shrimp vessels and reduce conflict with the artisanal sector which may also assist with offshore tuna vessel monitoring;
- good mechanisms for sharing information with neighbouring countries and the region;
- membership of regional bodies, including RFMOs; and
- full reporting of data from foreign fleets.

The single strongest correlate with IUU fishing that we discovered was the state of governance of a country. This may also seem self-evident, but it is important to realise just how significant a factor this is, influencing not just basic MCS capability but also issues of implementation, such as corruption of licensing practices, local coordination of MCS activities, enforcement etc.

The most useful interventions to solve IUU problems in developing countries will be those that tackle, at heart, the issue of governance. MCS systems must be improved through targeted actions, but unless funding addresses inadequate governance, the potential benefits to fisheries management systems, including MCS, science and management functions will be undermined. If governance remains poor, it is likely that funding for MCS will fail to create the anticipated levels of change within the system and therefore will fail to deliver desired outcomes.

5.2.2. Training and regional cooperation

Much of the assistance required is in terms of training and human resource development. This can be directed at inspectors, observers, negotiators and legislators. It should also be acknowledged that stock assessment at an appropriate level is virtually part of the MCS system since it underpins the task of negotiators and managers by framing their efforts to define the realistic licenses whilst optimising the financial benefits to the host country. It has been notable within the case studies how relatively successful control, e.g. Seychelles and PNG, has been achieved without expensive surveillance platforms. It is particularly true that, whilst aerial surveillance has been extremely useful to assess the IUU problem on a snapshot basis, it has rarely been responsible for arrests in our case study countries. It is probably, therefore, not a top priority for longer term control.

The importance of regional actions cannot be over-stressed. The case of West Africa is very instructive in this regard. Although there is a regional MCS body, called the Surveillance Operations Coordinating Unit of the Sub-Regional Fisheries Commission (SOCU-SRFC[135]) this body faces significant challenges in coordinating activities because of a lack of political will in certain states, including the unwillingness of certain surveillance administrations to effectively control the activities of their licensed vessels, political instability in some states – in other words, uneven governance – and a lack of suitable resources in some states to undertake maritime surveillance (Jones, 2004[136]).

This unevenness has been at least partly brought about by unevenness in donor support. In the north of the region, Mauritania, Senegal and Guinea have received prolonged and substantial donor contributions for fisheries management development from Germany, France and Canada. Gambia, Guinea-Bissau, Guinea, Sierra Leone have received later contributions from the Grand Duchy of Luxembourg. Cape Verde, Mauritania, Senegal, Guinea-Bissau and Guinea have EU fisheries agreements, Sierra Leone does not. As a result of investments in fisheries management, and improvements in governance, IUU fishing is now less of a problem

[135] Cape Verde, Mauritania, Senegal, Gambia, Guinea-Bissau, Guinea, Sierra Leone
[136] Austin Jones, Presentation Of The Surveillance Operations Coordinating Unit (SOCU) – Activities And Programmes Confidential report to SRFC, 2004

in the north (Mauritania and Senegal) than it once was (Kelleher, 2002[137]), but the problem has largely moved south into Guinea and Sierra Leone, with many vessels taking advantage of the lax licensing and surveillance conditions there to engage in border hopping.

Clearly international development assistance should be directed towards enhancing both individual country fisheries management and MCS together with that of the region. This combined approach is the most likely to be successful. Furthermore, it is essential that aid associated with fishing agreements is tied to improvements in fisheries infrastructure and training.

Improving MCS systems (including MCS platforms, training, observers, VMS, management and control structures, catch reporting and accounting), participation in regional fisheries management initiatives and improved governance will allow developing countries to maintain greater control over their fisheries, their fishing vessels and foreign fleets. This will of necessity mean that they have greater ability to control the activities of their flag vessels in high seas waters. Though participation in regional organisations, including RFMOs they should be encouraged to sign and implement the key high seas fishing agreements, UNCLOS and UNFSA, and cease to be open registry countries.

5.2.3. Market/trade controls and the Lacey Act

In addition to measures that seek to prevent IUU catches directly, trade restrictions, through such mechanisms as Port State Control or certification schemes[138], can provide a strong disincentive to IUU fishing by restricting the opportunities for selling the catch and potentially reducing its value. However, there are several difficulties with trade restrictions which should be considered.

Firstly, the imposition of blanket restrictions on import of products from a particular exporting country, simply because that country does not apply the same environmental standards as the importing country, was challenged in the famous Dolphin-Tuna cases of Mexico vs. the USA (1991, 1994)[139]. However, targeted restrictions on import of product from countries or individual vessels not conforming to internationally agreed environmental conditions do seem to be acceptable. Examples are the ICCAT bluefin tuna and CCAMLR catch documentation schemes, which have been used to refuse individual shipments of product.

A second problem with market measures to combat IUU fishing is ensuring traceability. The fish product must be distinct enough, or well enough traced, for customs authorities to issue customs codes and easily identify relevant shipments. Documentation schemes have been created to enable this traceability in some cases. However, the products currently subject to IOTC, ICCAT and CCAMLR documentation requirements are all relatively straighforward to identify. The presence of many similar products, which cannot be separated easily by import customs

[137] Kieran Kelleher, 2002. Robbers, Reefers And Ramasseurs. A Review Of Selected Aspects Of Fisheries MCS In Seven West African Countries. Sub-Regional Fisheries Commission Project AO/GCP/INT/722/LUX (AFR/013) Version 2. July 2002.

[138] Port State Control is considered in detail by the High Sea Task Force, http://www.high-seas.org/. Most of the tuna RFMOs and CCAMLR operate labelling or certification schemes for their species that are most at risk from IUU fishing.

[139] Summary available on the WTO website: http://www.wto.org/english/tratop_e/envir_e/edis04_e.htm

officers, will present much more of a problem for market schemes. Traceability can be enhanced through the identification of specific genetic markers for various populations or species, although these may not always be easily determined and are almost always difficult to apply.

A third problem is associated with destination markets. It is easier to apply trade measures in curtailing non-compliant practices where there is one destination market (such as Japan or Europe) rather than where there are many destination markets. This is because it is less hard to gain the agreement to impose import conditions by a small number of destination market countries, compared to a large diffuse set of markets.

We should note also that there are non-government traceability schemes, associated for instance with Marine Stewardship Council certification, or implemented by individual retailers or fishing companies. These are more focussed on specific product quality and sourcing fish from "sustainable" fisheries rather than identifying illegal product. They are likely to be less useful in reducing illegal catch, because they are market driven and not regulated by government, which of course controls imports and exports, although they do have a role to play in consumer pressure for improved fisheries management.
Bearing in mind these problems, how might one use a market scheme to address IUU fishing in developing country waters? Firstly, one might require certification and traceability of fish from that country, which would force the authorities to implement rather onerous traceability schemes themselves. This would necessarily require increased control and management of their fisheries. There are drawbacks, however, Not only would such action open the possibility of a challenge under the WTO rules, but also it would not be effective in reducing IUU fishing by DWFN, because these vessels by and large tranship their catch and land it elsewhere – therefore the catch does come under the direct control of the coastal state at any stage. An effective trade scheme would require a region-wide documentation scheme for all product resulting from a particular fishery. This would ensure the traceability and certification of all legally caught product. Once again, this implies the involvement of coastal states in RFMOs. This would cover the issues of traceability and WTO legitimacy, but not the problem of multiple destination markets.

The measures suggested above would help to effectively block un-documented product from an area or country. In addition to this, the country itself might benefit from assistance with bringing prosecutions against IUU fishermen for IUU product imported into another country. Such action would require legislation like the US Lacey Act[140]. In a recent case (Bengis v NOAA Fisheries 2002), the US government

[140] The US Lacey Act (USC Title 16, Chapter 53) was passed in 1900 and was named after its sponsor, Iowa Congressman Lacey, a well-known naturalist. Its original purpose was to outlaw inter-state traffic in birds and other animals illegally killed in their state of origin. Plants were only included under the Act at a later date. SS 3372(2a) of 'Prohibited Acts' under the Lacey Act makes it 'unlawful for any person … to import, export, transport, sell, receive, acquire, or purchase in interstate or foreign commerce … any fish or wildlife taken, possessed, transported, or sold in violation of any law or regulation of any State or in violation of any foreign law' (Duncan Brack, Kevin Gray & Gavin Hayman 2002, Controlling the international trade in illegally logged timber and wood products. Royal Institute of International Affairs, London. http://www.riia.org/viewdocument.php?documentid=4576). The 'Lacey Clause' has also become recognised in the fight against illegal, unregulated and unreported (IUU) fishing. The provision basically makes it unlawful to import fish that has been taken contrary to the laws of another country, in order to buttress cooperation in enforcement to stem illegal fishing operations. A common example of violation of the laws of another state is

brought a successful prosecution of Arnold Bengis and Jeffrey Noll, in New York, for a scheme to over-harvest massive quantities of South African rock lobster and Patagonian toothfish (known as Chilean seabass) illegally and then illegally import the fish into the United States[141].

The defendants pleaded guilty in March 2004 to one count of conspiracy to violate the United States' Lacey Act and to commit smuggling, and three separate counts each charging them with violating the Lacey Act. The Indictment alleges that the lobster and toothfish had been harvested in violation of both South African law and international convention. The case followed detailed investigations by both South African and US police and customs officials and required that South Africa declare that the fish had been taken in violation of South African conservation measures[142].

With the exception of so-called 'marking' offences, none of the offences under a 'Lacey clause' stand on their own. As there must be a violation of an underlying law, so a successful prosecution requires the need to prove foreign law and in this respect, the need for an expert witness on, or the availability of certified copies of, the foreign law in question. Thus, cooperation of the level shown in the Bengis case (above) is required. It would be relatively easy to set up a mechanism for such cooperation with developing countries affected by IUU fishing, provided that

- the fisheries law of that country is sufficiently well developed, and the conservation measures/regulations sufficiently explicit, that a case of violation can be proved;
- the surveillance and investigative powers of fisheries and criminal law enforcement in the country is capable of investigating such violations of its law; and
- legislation equivalent to the Lacey Act exists in the importing country.

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the taking of fish without a licence where such licence is required by that state's fisheries legislation.

[141] United States Attorney, Southern District of New York, 2 March 2004. U.S. announces guilty pleas by South African executive Arnold Bengis and Jeffrey Noll in massive seafood poaching and smuggling scheme. http://www.colto.org/DOJ_BengisNoll_02March04.htm. Seen May 2005.

[142] According to the Indictment, since at least 1987 and up to August 1, 2001, Bengis, Noll, and their co-conspirators (including Bengis's son, defendant David Bengis), allegedly engaged in an elaborate scheme first to harvest illegally large quantities of South and West Coast rock lobster and Patagonian toothfish, far in excess of applicable quotas, and then to export the illegal fish from South Africa to the United States. It is also alleged the defendants under-reported the fish harvest to South African authorities, and bribed South African fisheries inspectors to help them carry out their illegal harvesting scheme. The indictment also accuses the defendants of submitting false export documents to South African authorities to conceal their over-harvesting. In May 2001, South African authorities seized and opened a container of illegally harvested fish that Arnold Bengis and his co-conspirators were attempting to export to the United States. Following that seizure, according to the indictment, Bengis and his co-conspirators engaged in a series of elaborate deceptions designed to avoid detection and perpetuate the scheme. Among other things, Bengis and his co-conspirators allegedly altered and destroyed documents indicating the actual quantity of seafood harvested by fishing vessels in South Africa. The defendants were also accused of removing large quantities of rock lobster from Hout Bay's storage facility in Cape Town, South Africa, and concealing them from the authorities. The indictment also alleged the scheme involved transporting large quantities of lobster from a storage warehouse in Newark, New Jersey, to Massachusetts, and diverting an illegal shipment from its intended destination of Manhattan to Singapore and Hong Kong in order to avoid seizure by United States authorities.

For instance, it is conceivable that an equivalent of the Lacey Act in major importing countries could be used not only to prohibit the import of illegal fish from developing countries, but also impose penalties on those attempting to traffic in IUU caught fish, in order to assist developing countries in combating IUU fishing in their waters. This would amount to a trade-based method of prohibiting IUU catch that would be case specific and would therefore not be vulnerable to a challenge under WTO rules.

5.3. Cost-Benefit considerations

Where might aid be most efficiently directed to gain the greatest benefit for the developing countries concerned? One way of looking at this is to examine what potential increase in GNP could result from addressing the IUU problem, or what difference it would make to livelihoods. Simply by multiplying the %IUU by percentage contribution to GNP[143] currently made by fisheries, or the per capita consumption of fish by the population[144], we can see what difference solution of the IUU problem would make to the country. The results are shown in Table 14, together with a relative ranking of benefit.

Increases in GNP are of course not the only consideration in terms of directing funding. Table 14 also presents results for increases in per capita fish consumption. The same caveats apply as for GNP in that not all IUU catch would end up as food for poor people if IUU was eliminated. However, it is interesting to note that the importance rankings for increases in fish consumption are rather different from those based on GNP. Whilst the former emphasise west and east Africa, the latter emphasise central west Africa (although some of the countries in west and east Africa still feature).

[143] Various sources: World Bank Development Report (2003). World Development Report 2004. Washington D.C.: International Bank for Reconstruction and Development/The World Bank and Oxford University Press. World Bank Development Report (2004). World Development Report 2005. Washington D.C.: International Bank for Reconstruction and Development/The World Bank and Oxford University Press. FAO Fishing Country Profiles from http://www.fao.org/fi/fcp/fcp.asp. SADC from www.sadcfisheries.com, SADC Marine Fisheries and Resources Sector. MPEM (Ministère des Pèches et de l'Economie Maritime). 1998. Stratégie d'Aménagement et de Développement du Secteur des Pêches et de l'Economie Maritime, Document Présente a la Table Ronde des Bailleurs de Fonds Nouakchott le 16 juin 1998. Nouakchott, Mauritanie. (Government of Mauritania). van Santen, G. (undated) Mauritania Integrated Framework. Volume II - Secteur de la Pêche neg = negligible.

[144] Per Caput Supply: Data under this category indicate the per caput food-fish supplies available for human consumption during a given reference period. It is derived by dividing the Total Food Supply by the Population. Laurenti, G. (2004) 1961-2001 fish and fishery products: world apparent consumption statistics based on food balance sheets. FAO Fisheries Circular. No. 821, Rev.7. Rome, FAO. 2004. 425p.

Table 14 Calculations of potential increase in GNP and per capita consumption of fish arising from solving the IUU problem (assuming that all IUU revenue or fish product accrues to the state); and cost-benefit analysis, assuming that 2% of the fisheries value (calculated using FAO fisheries data and our estimates of the IUU value) is required to achieve an MCS capability of the same quality as Namibia's. Potential increase based on %GNP to fisheries is the contribution of fisheries to GNP (column 4) multiplied by the value of IUU as a % of current declared catch (column 2); note that this is a different expression of the value of IUU fishing from that used in Table 7. We present two values of benefit, the first where all IUU catch is captured by the state and th second where only 5% of its value is captured.

Country	IUU as proportion of current legal	GNP Gross National Product (US$ billion) 2003 (World Bank)	Fisheries as % GNP (various sources). See Table 5	Per capita fish consumption (kg/yr)	Potential increase based on %GNP to fisheries	Rank	potential increase in per capita consumption of fish (kg)	rank	Additional expenditure required to raise MCS to Namibia's level and eliminate IUU (% of catch value)	annual additional cost to eliminate IUU ($m)	benefit minus cost assuming full IUU value accrues to developing country ($m)	benefit minus cost assuming only 5% benefit accrues to developing country ($m)
Guinea	102%	3.0	1.75%	12.8	1.78%	**5**	13.05	**1**	1.06%	2.21	103.0	3.056
Sierra Leone	35%	1.0	3.50%	14.6	1.24%	**8**	5.17	12	1.01%	1.11	27.6	0.328
Liberia	146%	0.4	3.00%	5.6	4.38%	**3**	8.18	**5**	1.59%	0.31	11.4	0.271
Angola	24%	10.0	4.00%	14.6	0.96%	11	3.49	14	1.21%	3.08	45.9	-0.630
Namibia	0%	4.0	10.00%	14.0	0.00%	30	0.00	30	0.00%	0.00	0.0	0.000
Mozambique	18%	4.0	3.80%	2.5	0.67%	14	0.44	28	0.60%	1.51	36.3	0.382
Kenya	25%	13.0	0.22%	5.6	0.06%	29	1.40	20	0.87%	0.17	3.7	0.025
Somalia	300%	n/a	2.00%	2.1	6.00%	**1**	6.30	**9**	2.00%	2.51	91.5	2.194
Seychelles	5%	0.6	20.00%	57.6	1.10%	**9**	3.16	15	0.40%	0.58	6.9	-0.200
Papua New Guinea	13%	3.0	1.00%	19.6	0.13%	25	2.47	17	0.86%	2.64	31.6	-0.929
Morocco	8%	40.0	3.00%	8.4	0.24%	22	0.68	27	0.43%	3.43	55.7	-0.469
Mauritania	9%	1.0	12.00%	11.5	1.06%	**10**	1.01	25	0.45%	0.94	16.1	-0.091
Senegal	8%	6.0	2.50%	29.2	0.19%	23	2.22	18	0.42%	1.92	30.3	-0.312
Cape Verde	0%	0.7	2.00%	21.9	0.00%	31	0.00	31	0.00%	0.00	0.0	0.000
Gambia	12%	0.4	12.00%	23.5	1.46%	**7**	2.86	16	0.52%	0.14	2.8	0.006
Guinea-Bissau	41%	0.2	3.70%	2.1	1.52%	**6**	0.86	26	0.98%	0.17	5.0	0.083
Cote D'Ivore	82%	11.0	0.75%	15.0	0.62%	16	12.37	**2**	1.39%	1.29	40.5	0.800
Ghana	4%	7.0	2.50%	29.7	0.11%	27	1.27	22	0.35%	0.91	9.9	-0.372

Country	IUU as proportion of current legal	GNP Gross National Product (US$ billion) 2003 (World Bank)	Fisheries as % GNP (various sources). See Table 5	Per capita fish consumption (kg/yr)	Potential increase based on %GNP to fisheries	Rank	potential increase in per capita consumption of fish (kg)	rank	Additional expenditure required to raise MCS to Namibia's level and eliminate IUU (% of catch value)	annual additional cost to eliminate IUU ($m)	benefit minus cost assuming full IUU value accrues to developing country ($m)	benefit minus cost assuming only 5% benefit accrues to developing country ($m)
Togo	47%	1.0	4.00%	11.1	1.88%	**4**	5.21	11	1.06%	0.32	9.2	0.162
Benin	12%	3.0	0.47%	8.8	0.06%	28	1.06	24	0.52%	0.08	1.6	0.004
Nigeria	66%	43.0	1.15%	7.6	0.76%	13	5.02	13	1.26%	10.32	316.4	6.017
Cameroon	41%	10.0	1.00%	13.6	0.41%	18	5.54	**10**	0.98%	0.51	14.7	0.245
Equatorial Guinea	61%	0.4	0.44%	12.8	0.27%	21	7.77	**6**	1.21%	0.04	1.1	0.021
Sao Tome & Principe	13%	0.1	5.00%	13.7	0.66%	15	1.81	19	0.54%	0.02	0.4	0.002
Gabon	19%	4.8	1.50%	44.1	0.29%	20	8.53	**4**	0.66%	0.43	10.2	0.102
Congo	58%	2.0	1.32%	18.3	0.77%	12	10.70	**3**	1.18%	0.50	15.0	0.277
DR Congo	123%	5.0	0.10%	6.0	0.12%	26	7.37	**7**	1.65%	0.13	4.2	0.087
South Africa	0%	126.0	1.00%	6.2	0.00%	32	0.00	32	0.00%	0.00	0.0	0.423
Madagascar	6%	5.0	7.00%	7.6	0.39%	19	0.43	29	0.38%	0.98	12.8	-0.291
Comoros	38%	0.3	15.30%	18.6	5.85%	**2**	7.11	**8**	0.95%	0.29	8.1	0.132
Tanzania	19%	10.0	0.90%	7.4	0.17%	24	1.38	21	0.64%	0.69	16.3	0.155
Eritrea	48%	1.0	0.90%	2.4	0.43%	17	1.15	23	1.07%	0.21	6.1	0.108
Mauritius	0%	5.0	1.00%	22.9	0.00%	33	0.00	33	0.00%	0.00	0.0	0.046

We can take this analysis further to look at cost-benefit. Ideally we would use a relationship such as is shown in Figure 17 build this into a cost benefit model. We start off from the assumption that Somalia which has the lowest MCS capability is not investing anything in MCS and that Namibia, which has the highest, and which is investing between 1% and 2% of total fisheries value in MCS[145]. This is somewhat below the OECD average of 4% (OECD, 2003[146]). Theoretically, then, we can work out what the relative benefit of increasing MCS might be. One can see that the greatest benefits are going to accrue by putting in small amounts of money when MCS is low or non-existent, due to the shapes of the curve.

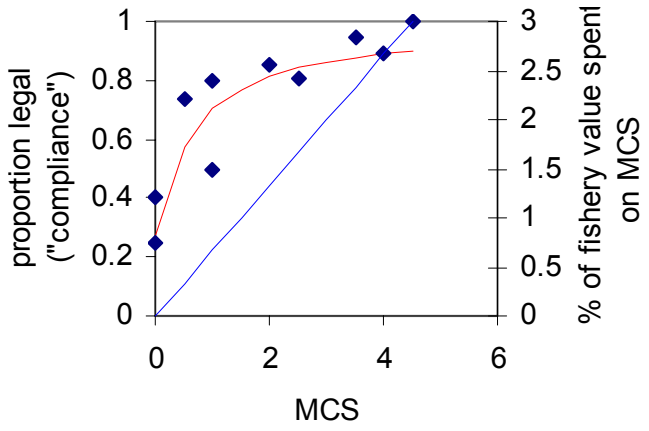

Figure 17 Plot of the results of the case studies: MCS capability (x-axis) plotted against the proportion of legal fishing (curved line in red) and the % of total fishery value spent on MCS, assumed to be a straight line (blue) linking Somalia at MCS=0 and Namibia at MCS = 4.5.

As we have shown above (section 4.1.2), although Figure 17 shows a theoretical non-linear relationship between compliance and MCS, the observed relationship between compliance and governance is better described by a linear rather than a logistic model. We have therefore calculated, for each country in the region, costs appropriate to reducing the percentage of IUU catch from current levels to those experienced by Namibia, assuming a linear relationship between governance and compliance, and assuming that an ideal MCS expenditure at Namibia's level is 2% of total fisheries value. For instance, we calculate that Guinea, with a current governance score of -.96, needs to move from that to a governance score of 0.34 (Namibia's). This is a distance of 1.31 governance units, which is 53% of the governance unit distance between Somalia and Namibia. The relative increase that is required is therefore 53% of the 2% of fisheries value spent by Namibia, i.e. 1.06% of fisheries value.

[145] We note, however, that Namibia is atypical for Africa in that it has no artisanal fishery and only two possible landing ports along a coastline of 1,750km. Bringing Namibia's fisheries under control therefore presents different, and possibly fewer difficulties than faced by some other African coastal states.

[146] OECD, 2003. The costs of managing fisheries. OECD, Paris.

These calculations assume that all revenue or catch currently lost to IUU fishing would be recovered by the country. There are two reasons why this might not be the case.

The first reason, we illustrate with the example of IUU fishing for tuna. Historically, a high proportion of the IUU tuna catch has been taken by open registered Taiwanese owned vessels[147]. Of possibly 250 open register tuna vessels active in 2000, 43 were scrapped and many transferred to the Taiwanese register following the actions of the Organization for the Promotion of Responsible Tuna Fisheries (OPRT). This is an organisation whose members include the tuna industries of Japan, Taiwan, Korea, Indonesia, the Philippines, the Peoples Republic of China and Ecuador. Thus, although some IUU effort will be removed, much of it will be re-registered, and the majority of IUU related catches would now be taken in high seas waters rather than domestic waters. The whole of the product taken by IUU tuna vessels will therefore not become available to other participants in the fishery, although, of course, some of it is taken in domestic waters, particularly that of Pacific Island States, and therefore would become available.

Secondly, in the case of IUU activity by DWFN in domestic waters, unless a domestic industry could have taken those fish, only a percentage of the product value would be recouped by the coastal state. This is referred to as the economic or resource rent.

As a first approximation, the maximum amount of rent that can be extracted from a resource is equal to the gross value of landings, over a specified period of time minus the harvesting costs and the resource management costs (because the coastal state has an obligation to manage the resource responsibly)[148]. This rent can be extracted in a number of ways, most commonly in the form of licence or access fees for fishing within the EEZ (see Parkes 1999[149] for a review). The proportion of this rent that a coastal state can expect to extract depends on a number of factors than can be summarised as the demand for access. This is driven by the balance between the extent and value of expected catch inside the EEZ compared to the extent and value of alternative harvesting activity available in the region. Clearly there is an upper limit beyond which commercial fishing entities will be unable or unwilling to pay the access fees. If fees are set too high, they may choose to fish elsewhere, or perhaps fish illegally within the EEZ. This would result in no licence revenue to the coastal State, as well as a substantial cost for surveillance and enforcement to ensure that unlicensed access is minimized. If fees are set too low, the coastal state is effectively subsidising foreign fishing. This can have the effect of encouraging overfishing and also means there will be less money available to spend on effective management of the resource.

Foreign fishers may have a variety of opportunities and options for where and when to fish. Many species occur in a number of neighbouring EEZs and/or adjacent high-

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[147] Hiroya Sano, Are private initiatives a possible way forward? Actions taken by private stake holders to eliminate IUU tuna fishing activities. OECD workshop on IUU fishing paper AGR/FI/IUU(2004)13

[148] There are other cost items that also need to be taken into account in this calculation, but this is sufficient for a general discussion.

[149] Parkes, G. (1999) The payment of fees for access to fisheries in Exclusive Economic Zones. In: Report of a Regional Workshop on Fisheries Monitoring Control and Surveillance. FAO FIMLAP. GCP/INT/648/NOR Field report, Rome. ftp://ftp.fao.org/docrep/fao/field/006/X1353E/x1353e08.pdf

seas areas. In these cases the level of fee (and hence the percentage of the value of the catch than can be realized as revenue) that can be charged is influenced by the relative potential profitability of fishing opportunities inside and outside the EEZ. The value of a licence is more accurately defined, therefore, by the advantage gained by a vessel with a licence, which can fish legally inside the EEZ, over a vessel without a licence, which cannot. In simple terms, if the catch rates inside are similar to, or lower than, the catch rates outside, then there is probably little or no advantage to be gained by buying a licence to fish inside the EEZ. In these circumstances, licence fee/catch value ratios would have to be low (probably in the region of 5% of catch value or less). If, however, the catch rates inside are significantly higher than outside, then there is a profit advantage and licence fee/catch value ratios would be influenced by economic operational considerations within the EEZ. Fees in this situation can be quantified in terms of the marginal differential between the catch rates, which effectively sets an upper limit on the value of the licence. If the marginal value is high and well estimated, the coastal state is in a strong position to extract a large proportion of the total resource rent available but only if it can enforce its will on poachers.

Generally the revenue level that can be realised by the coastal state is in the range 1 to 10% of the total value of the catch. Specific examples are hard to come by, but the Marshall Islands, for example, have previously claimed to collect about 5% of the value of the catch in licence fees (Kabua, 1997[150]). For particularly valuable resources that are only available within the EEZ, the percentage may be higher.

As coastal states have learned more about the value of the living resources in their EEZs, the percentage of the catch value realised has increased. Under the 1990-93 EU-Seychelles Agreement, the EU's reported tuna catch was estimated at $US 75 million, while the Seychelles earned $US 13.4 million ($US 11.1 million compensation), representing a rate of nearly 18% (Parkes 1999[151]). Rates of about 10% are common for Falkland Island fisheries (D Agnew pers. comm.). Unfortunately, some countries (e.g. Pacific Island countries (FFA)) although aware of potential rents find it difficult to negotiate higher rates. For instance, FFA countries' current agreement with Japan is for a 5% of sale value rate for access although some estimates of potential economic rent from this $2bn fishery suggest figures as high as 40-50% of net economic value (~ 20% of sale value) might be achievable.

Taking these considerations into account we used two benefit calculations:

a) the case where all IUU catches accrue to the country, and
b) the case where only 5% of the catch value accrues to the country. This latter situation assumes that the IUU problem is solved but that all catches are taken by foreign fleets under access agreements, for which the foreign fleets pay an access fee of 5% of catch value.

The results are also shown in Table 14. In all the cases (except Seychelles) which we have identified as being candidates for significant gain based on contribution to GNP, benefits outweigh costs. In some of the other countries, benefits are marginal or negative. We should note that our assumption of an optimal MCS spend of 2% of the total value fisheries first sale value, based on the Namibian case, seems rather

[150] Kabua, I. 1997. Welcoming address. in: Report of the Second Multilateral High-Level Conference on the Conservation and Management of Highly Migratory Fish Stocks in the Western Pacific. FFA.
[151] Op Cit.

low compared to the OECD experience. Were this to be higher (3 or 4%) the relative benefit would be negative for more countries.

Once again, it is instructive to examine these data through a GIS (Figure 18). This emphasises that although single countries have problems, there are also significant regional issues. It may therefore be better to direct funding to solve regional rather than single country problems. There would seem to be four important regions:

- West Africa (Guinea, Sierra Leone, Liberia and Cote d'Ivoire). There is good potential to increase GNP in Sierra Leone and Liberia, good potential to increase PCFC (per capita fish consumption) in Guinea and Cote d'Ivoire, moderate in Sierra Leone and Liberia and the benefit minus cost indicator shows potential inputs would give some of the highest returns here.
- Mozambique Channel (Mozambique, Comoros) - Comoros has the highest potential GNP gains, moderate potential to increase PCFC and Mozambique has a good benefit minus cost indicator
- Somalia - Moderate potential gains from GNP, very high benefit minus cost indicator showing the potential benefits from good management.
- Central Africa (Nigeria to Congo) - Equatorial Guinea has moderate potential to raise GNP through fisheries, Gabon and Congo have high potential to raise their PCFC, Nigeria has a high benefit – cost indicator, the others are moderate.

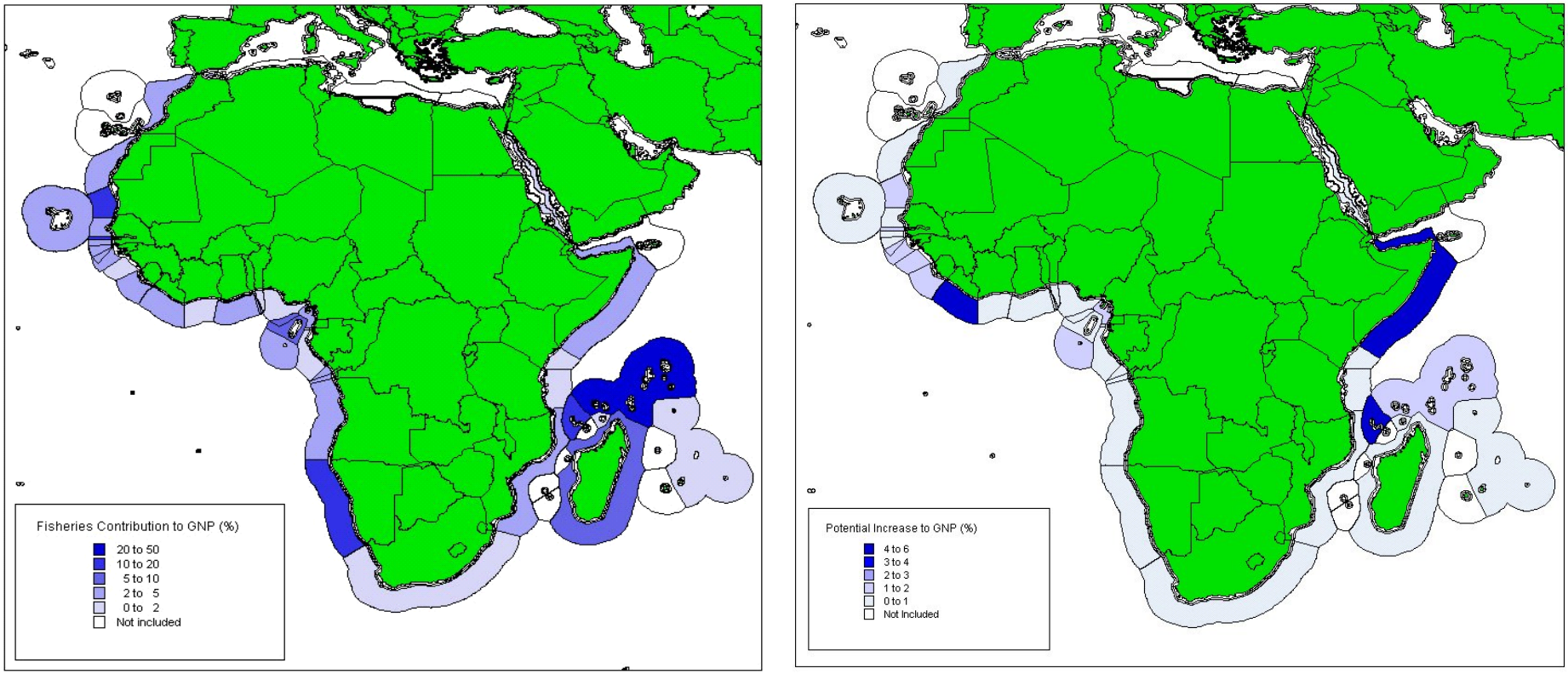

Figure 18 Fisheries as a % of GNP (left) and potential increase in GNP that might accrue to countries with elimination of IUU fishing (right)

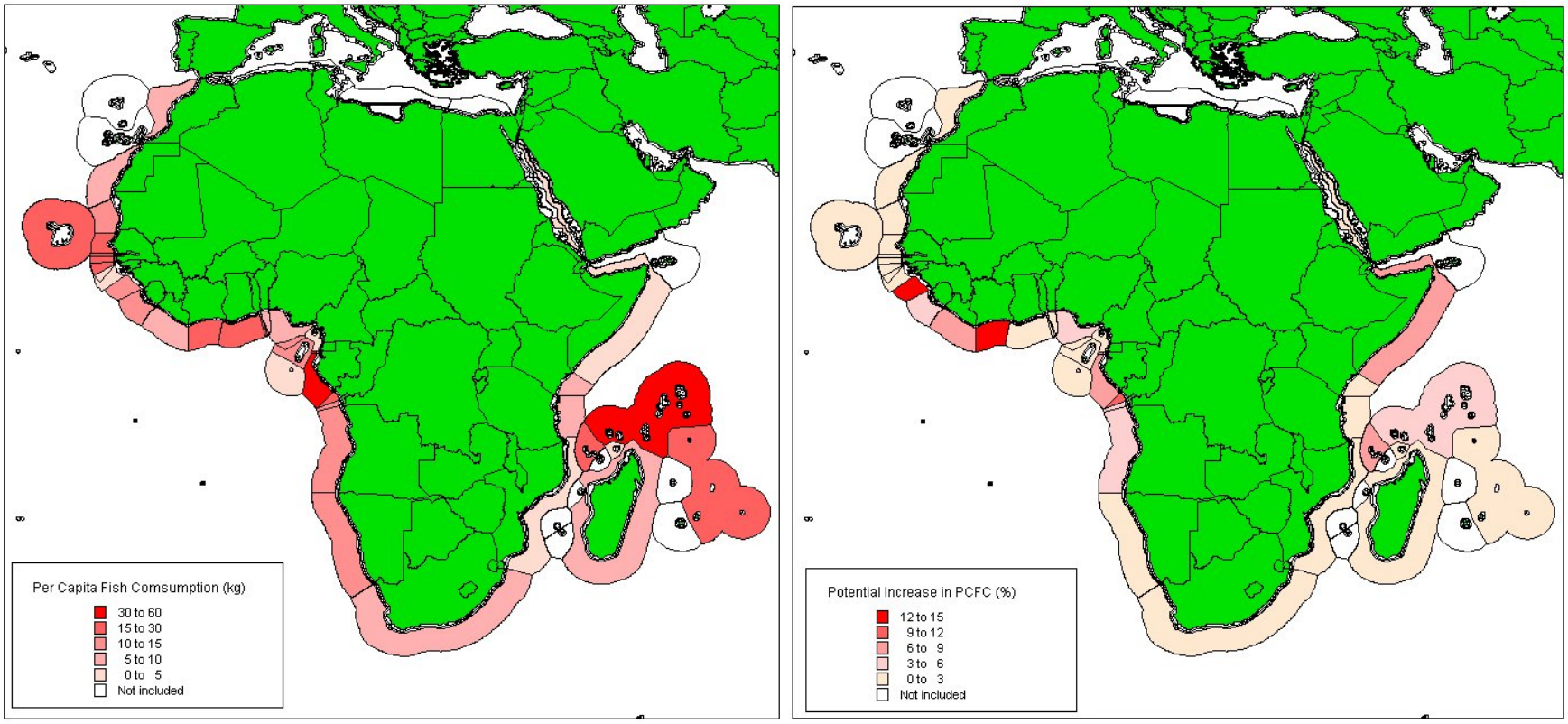

Figure 19 Per capita consumption of fish (kg/yr) (left) and potential increase in per capita consumption that might accrue to countries with elimination of IUU fishing (right)

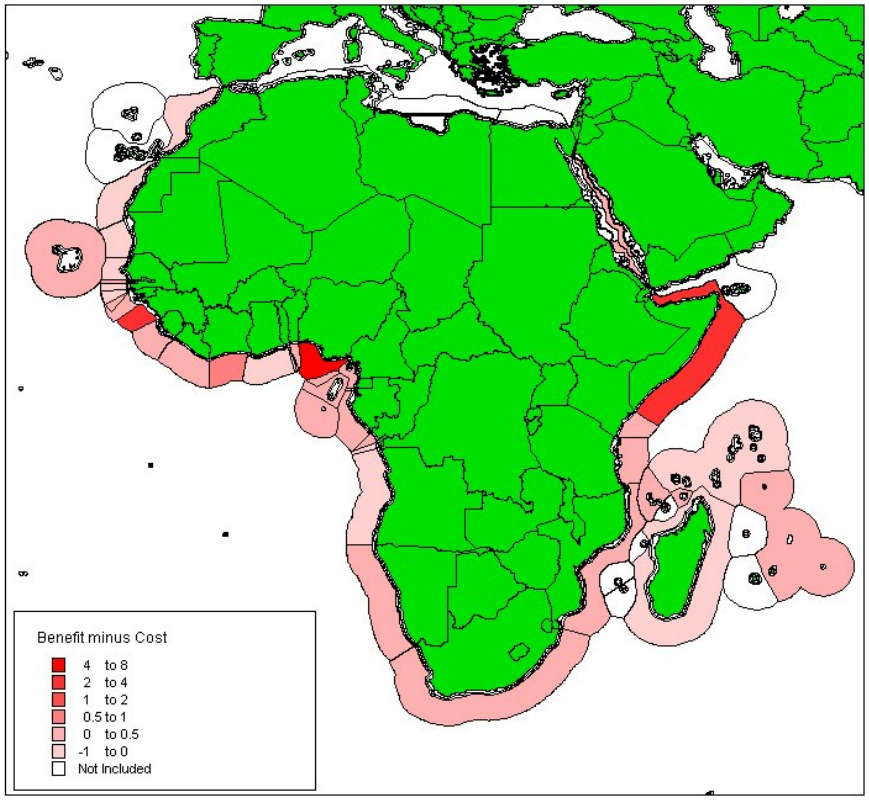

Figure 20 Cost-benefit of eliminating IUU fishing, assuming a linear relationship between governance and compliance, and that only 5% of the value of IUU fishing accrues to the country after it has been eliminated. Dark red is a high benefit minus cost.

5.4. Summary

The results of the case studies point to there being two different types of fisheries that require rather different solutions to the IUU problem: tuna and shrimp/demersal. However, most of the sub-Saharan countries would benefit positively from actions that reduce IUU, which are potentially able to increase GDP and food security (represented by increases in per capita fish consumption). These advantages are theoretical maxima – the amount of benefit a country gets will depend upon its current market and socio-economic dependencies. For instance, elimination of IUU in the Seychelles is not likely to lead to increased food consumption, as all tuna are processed and exported; however, elimination of IUU in Guinea and Sierra Leone is likely to release more fish and shrimp for artisanal fishers, which might either be eaten or sold on and exported for foreign exchange earnings.

In almost all the sub-Saharan countries solving IUU would be cost effective, taking into account the potential benefits, even where only 5% of the total value of the former IUU catch was realised by the country, for instance in licence fees. The areas where most benefit would accrue are:

- West Africa (Guinea, Sierra Leone, Liberia and Cote d'Ivoire). There is good potential to increase GNP in Sierra Leone and Liberia, good potential to increase PCFC (per capita fish consumption) in Guinea and Cote d'Ivoire, moderate in Sierra Leone and Liberia and the benefit minus cost indicator shows potential inputs would give some of the highest returns here.
- Mozambique Channel (Mozambique, Comoros) - Comoros has the highest potential GNP gains, moderate potential to increase PCFC and Mozambique has a good benefit minus cost indicator
- Somalia - Moderate potential gains from GNP, very high benefit minus cost indicator showing the potential benefits from good management.
- Central Africa (Nigeria to Congo) - Equatorial Guinea has moderate potential to raise GNP through fisheries, Gabon and Congo have high potential to raise their PCFC, Nigeria has a high benefit – cost indicator, the others are moderate.

6. Conclusions

6.1. The total value and impacts of IUU fishing

Within our case studies, we identified two principal types of IUU fishing:

1. Tuna

This is a particular problem for east coast & island states, such as Kenya, Tanzania, Somalia and Seychelles, as well as in the western Pacific, as shown by the PNG case study. There are tuna fisheries in the EEZs of west African states, but the level of IUU catches of tuna are likely to be lower there, although the problem in some extremely vulnerable states is more acute due to the lack of information and capacity. The IUU vessels are largely distant water fishing nations, some of which may be registered with open register countries. Their environmental impacts are shark bycatch and in some parts of the world (notably in the Pacific) also turtle catches, especially on longlines. Longliners are becoming a particular problem since vessels licensed for tuna are breaking the terms of their agreements and targeting shark, even switching gears, from lines to gillnets, to do this. The major problem faced by developing countries is the provision of offshore surveillance. This, however, can be targeted, hence the value of sensitising national and licensed fleets and encouraging them to report illegal activity. This can be supported by the negotiation of agreements with distant water fishing nations, based on the best estimated value of the resource, including the provision of proper reporting to the host state and the requirement to accept observers on all foreign vessels. These observers need to be well trained and properly motivated. Increased participation in RFMOs and regional surveillance activities is essential, particularly amongst the more vulnerable states.

2. Mixed Fisheries (Shrimp/Demersal)

This is a particular problem with west coast & south eastern coast African states. Illegal, i.e. non-licensed fishing is not a particular problem here (with certain exceptions, such as Guinea and Sierra Leone), largely because the fleets have to operate close to the shore where sightings are easier and where, in any case, licenses may be cheap. Most of the illegal catch is therefore taken by nominally legitimate vessels. The major infringements are zone violations, with foreign and domestic fleets fishing in prohibited areas, especially encroaching into the zone which most African states reserve for their vital artisanal fisheries and poaching their fish either directly or as bycatch. There is also a problem of underreporting which is increasing due to transhipment offshore, allowing the vessels to fish around the clock, all through the year. Associated environmental problems are high levels of demersal fish discarding (e.g. with shrimp fishing) and bycatch of turtles. In turn, high levels of extraction are likely to lead to over-exploitation of the resources and consequent depression of yields. High levels of discarding also occur with the currently licensed fleet, but in some cases these fish are “rescued” by local artisanal fishermen. No such possibility exists with illegal shrimp fishing, thus potentially reducing the local protein supply. The vessels conducting IUU fishing are often licensed in bordering states, or within the coastal state EEZ but in a different area, although, as with the “tuna” case (above) they may also be vessels from distant water fishing nations involved. States experiencing the ‘mixed fishery’ type problem also often have significant offshore tuna resources,

but have almost no information on this. The solutions to the mixed fishery problem include satellite surveillance, installation of VMS on all vessels fishing for shrimp to detect and deter encroachment on the artisanal zone, better use of trained and motivated observers and more active MCS. Regional MCS agreements including sharing information on the movements of vessels licensed in one state but transiting borders is also vital.

IUU fishing is common across our study region. We estimate that the average value of IUU catch is 19% of the total value of catch in the case studies, and 16% across sub-Saharan Africa (which is equal to 19% of current landed value). We estimated that the total value of all IUU is about $0.9bn in sub-Saharan Africa. This would mean that the total world IUU catch would have to be, at a minimum, the sum of our individual estimates, which is $2.4bn (Table 15).

Table 15 Estimate of total world IUU catch value calculated as a total of our big issue estimates of high seas and EEZ special issues, the estimate for sub-Saharan Africa.

	$m
High Seas (Big Issue)	1,244
EEZ special issues (Big Issue)	255
Sub-Saharan Africa EEZs	937
Total	2,436

In estimating the total value of IUU catch in the world we need to bear in mind that there are areas outside those covered in Table 15 in which IUU is also likely to be occurring (see for example Figure 3). Ideally, the case studies analysis undertaken in this project needs to be repeated from these other areas. In the absence of such studies, it is possible to speculate about an overall level. Extrapolating from our case study region to the rest of the world would require some very large and potentially invalid assumptions about the distribution and nature of IUU fishing across the globe. We have been able to extrapolate from our case studies to the whole of sub-Saharan Africa only because we have case studies in all representative areas and for all fishery and country governance types in this region. The same is not true for other parts of the world. Any global IUU catch value estimate that includes extrapolation of our case study results to regions outside of sub-Saharan Africa must therefore be accompanied by a very strong caution about its potential inaccuracy. Such estimates should be used for illustrative purposes only and in no way lessen the need to undertake more case studies in other areas to develop a more defensible global estimate.

Nevertheless, we can offer the following illustration of how an extrapolation might be made. We might, for instance, take the estimate for sub-Saharan Africa and use this as a first approximation of an estimate of the IUU catch value for two other regions of similar size and geopolitical make-up: South and Central America and Southeast Asia[152]. Under this assumption we would multiply the figure in Table 15 for sub-

[152] As an example of how invalid this assumption might be, it has been suggested that the pattern of illegal fishing in Thailand is quite different to those seen in the African case studies in this analysis. The main problem here seems to be domestic IUU activity such as the use of illegal fishing gears in the anchovy fishery and fishing in prohibited zones. The extrapolation might, therefore, give a quite distorted picture of the level of IUU catch in these other areas.

Saharan Africa by three. This would result in a global estimate (including our estimates of special EEZ situations and high seas IUU value) of $4.2bn.

As an alternative, using the "top down" approach described in 2.1.1, we can apply our estimate of average %IUU from the case studies to the whole world catch. For sub-Saharan Africa we estimate that 19% of current landed value is being caught by IUU fishing. In terms of value, FAO reports that in 2002, the estimated first sale value of fisheries was about US$78bn, 64% of which was from marine capture fisheries. We can apply our estimated IUU proportion of 19% to this figure, arriving at an estimate of US$9.5bn for total value of IUU catch.

By comparison, illegal logging is estimated to be 10% of the total global trade of $150bn – i.e. illegal logging may be worth $15bn[153]. Thus it would seem that although the value of IUU fishing is probably lower than the value of illegal logging, it is only marginally so ($4.2 - $9.5bn fishing compared with $15bn logging).

6.2. Governance as a driving force

Our analysis uncovered a strikingly clear relationship between the level of governance of a country and its vulnerability to IUU fishing. Good governance appears to go hand in hand with good MCS systems and procedures, the political will to enforce regulations, cooperation with neighbours on surveillance, the elimination of possibilities for IUU activity, and active participation in regional and sub-regional fisheries agreements. The consequences of good governance are a reduced threat to food security and especially to artisanal fishers' livelihoods, but unless aid targeted at improving MCS is accompanied by efforts to improve wider governance, the potential benefits in terms of reducing vulnerability to IUU fishing are likely to be undermined, particularly in the longer term.

There was evidence from our case studies that countries having EU-ACP or other agreements had better MCS and were more capable of controlling IUU than those that have never had agreements. However, there is also evidence that vessels operating under access agreements do not necessarily accurately declare their catches under these agreements. This is less of a problem in the Indian Ocean, where most of the vessels (purse seine vessels targeting tuna) land their catch and are inspected in Mauritius or Seychelles, than in the Atlantic where a number of vessels either tranship to reefers which land at Las Palmas or land catch there themselves, and may not be thoroughly inspected. We recommend that all agreements be strengthened to enforce electronic catch reporting and to allow joint inspections by DWFN and coastal state inspectors at the port of landing, to ensure that all data from catches caught within the EEZs of developing countries are reported directly and in near-real time to that country, irrespective of whether there are observers on the vessel or not.

Governance is also a particular problem for high seas fisheries, including high seas fisheries in which developing countries are or could be participating. Although there are RFMOs for tuna and billfish species covering most of the world's high seas ocean areas, there are very few RFMOs that are cover all other species. Only in the North Atlantic (NEAFC, NAFO), the southeast Atlantic (SEAFO) and the Antarctic (CCAMLR) do such agreements currently exist, although we are also aware of

[153] http://www.illegal-logging.info/briefings.php?briefingId=11, accessed 23 Feb 2005

current negotiations for Southwest Indian Ocean and Southern Pacific agreements. Of particular concern are deepwater demersal species such as orange roughy and pelagic species not covered by the tuna organisations such as squid and sharks (although resolutions are now in place to restrict shark bycatch during tuna fishing within some of the tuna RFMOs).

We consider all fishing on high seas outside the area of a particular RFMO to be unregulated. There is an urgent need to negotiate agreements in all these areas for all species, but this is likely to take considerable time. An obvious solution is negotiation of an implementing agreement under an operational international instrument such as the UNFSA which would deal with all high seas species unless they were subject to more specific consideration by an RFMO.

A significant problem for IUU fishing generally is the use of open registers. We estimate that the countries operating open registers derive only minimal benefit from that operation, whereas there is a huge economic benefit to vessels from not having to meet the standards required for registering in responsible flag states. Vessels seek to register with open registers states either because of the economic benefits that accrue, or because they are unable to register with a responsible flag state, for instance if that state has a limit on the number of high seas licenses it will issue.

7. Recommendations

1. Strengthen local capacity to manage fisheries and combat IUU

As a strategy to combat IUU in developing country waters, aid funds should be directed at the following:

a) Creating the institutional, management and technical MCS capacity for developing countries to effectively control their own vessels throughout the world and foreign fishing vessels fishing in their waters, including in specific cases of targeted offshore patrol facility and effective licensing schemes;

b) Funding and encouraging cooperative activities between licensed industry and artisanal fishermen to identify and target IUU fishing operations;

c) Funding observers on foreign vessels, and ensuring that access agreements include real-time submission of catch and effort data from these vessels;

d) Funding training programmes for observers and inspectors and providing training and support to negotiators and legislators;

e) Development of satellite based survey activities, including support for VMS particularly on shrimp and offshore vessels;

f) Assistance with science and stock assessments to assist the access negotiation process followed by more sustained capacity building.

2. Create more effective regional management and enforcement bodies

Development aid can also be directed at encouraging active and effective participation of developing countries in international fisheries governance through:

a) Fostering the active cooperation of developing countries with regional management and surveillance organisations at the same time as addressing specific country issues to avoid simply pushing the IUU problem elsewhere;

b) Encouraging membership of international fisheries management agreements, including consideration of providing funding and assistance for membership of RFMOs,

c) Requiring ratification and effective implementation of UNFSA and the Compliance Agreement and introduction of real enforcement of control on high seas vessels (linked to item 1(a) above) so as to eliminate the open register status of developing countries

3. Support improvements in MCS with efforts to address wider governance issues

It is clear from our analysis that solutions to the IUU problem for developing countries must be associated with a longer term increase their general level of governance. From this will flow greater stability, wealth, investment in fisheries management including MCS, greater control of flag and foreign vessels and more active participation in regional management and surveillance sharing arrangements.

However, it would undoubtedly be difficult, costly and time consuming to attempt to solve IUU fishing problems by attempting to improve a country's overall governance. Rather, we suggest that the demonstrated link between governance and vulnerability to IUU fishing needs to be considered when designing effective solutions. It is important to understand that providing support for improved surveillance and enforcement resources may not necessarily deliver the result that is anticipated – ie. a reduction in IUU – particularly in the longer term, unless some attention is paid to the associated governance factors, such as the level of corruption within the administrative system and the ability of the legal system to successfully prosecute illegal actions. In other words, the wider fisheries management system (including science, reporting, licensing etc), and its governance, must also receive attention. In the same way, encouraging cooperative surveillance activities – within a country and with other countries in a region – will support the local enforcement system and its governance.

With this proviso, we anticipate that real progress in combating IUU fishing can result from investments primarily directed at enhancing MCS systems, even if the overall level of governance of the country, and therefore the governance indices used in our analysis, are relatively unaffected in the short term. These indices include many aspects of governance that are not directly linked to fisheries management and MCS, which are likely to take longer to change in a way that would reflect in improved index scores.

In the worst affected countries, relatively modest inputs of aid could therefore make significant contributions in the short to medium term, with the possibility of getting better cost-benefit in countries that have very poor MCS systems compared to those currently having moderate or good systems. Significant long-term resource, ecosystem and economic benefit will only derive, however, from investment in the whole fisheries management system, including scientific assessment as well as MCS.

4. Take a regional approach

Our analysis has identified several critical regions in which aid should be targeted to have the greatest benefit in terms of government income (contribution to GDP), sustainable livelihoods (contribution to food security and per capita consumption of fish protein) and in terms of benefit for cost. These are:

- West Africa (Guinea, Sierra Leone, Liberia and Cote d'Ivoire),
- Mozambique Channel (Mozambique, Comoros),
- Somalia, and
- Central Africa (Nigeria to Congo).

The type of benefits that would accrue from elimination of IUU fishing are not the same in all countries. For instance, almost all IUU fish in Seychelles waters is tuna, and were tuna IUU to be eliminated the fish would be sold and exported rather than contribute to consumption in the Seychelles itself. On the other hand, in areas such as west Africa, where a considerable proportion of the IUU is inshore shrimp with an associated bycatch of demersal fish, elimination of IUU would increase the share of the catch going to artisanal fishermen and thereby contribute to national food security. Therefore we recommend that DFID looks at these areas in more depth before committing funds.

5. Consider additional trade-based measures

Additional trade-based measures could be used to support developing country attempts to eliminate IUU. These measures should be targeted against the products of IUU fishing that occurs in developing countries waters, but without further disadvantaging those states. Hence developing countries should not be excluded totally from markets because there is significant IUU activity in their waters. Regionally developed species and stock based documentation/traceability schemes would be the most effective vehicle for these actions, supported by suitable import legislation in developed countries.

An investigation of the potential for enacting US Lacey Act-style legislation in all major importing countries could also be initiated, together with an analysis of the support required by developing countries to enable them to cooperate in prosecutions brought by developed countries to bring about successful outcomes.

8. Annex A. Summary Table of IUU Incidents

These incidents were compiled through literature and press searches up to May 2005, and focus on IUU incidents in the periods 2004-2005 although some earlier references are also included.

West Africa									
Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Morocco	Pelagic (sardines: *Sardina pilchardus*)	1990s	Unreported (coastal)	None reported	66000	1.5	29.7	A retrospective analysis of two fisheries, Iceland (not reported here) and Morocco, using anecdotal and observer information, together with information on changes to fisheries management, to build a picture of IUU (under-reporting) and discarding.	Pitcher et al., 2002.
Morocco	Demersal (octopus and demersal fish)	1990s	Unreported (coastal)	None reported	9435	1.5	28.305	As above.	Pitcher et al., 2002.
Morocco	Pelagic (sardines: *Sardina pilchardus*)	1990s	Unreported (industrial)	None reported	4394	1.5	1.9773	As above.	Pitcher et al., 2002.
Morocco	Demersal (octopus and demersal fish)	1990s	Unreported (industrial)	None reported	14515	1.5	43.545	As above.	Pitcher et al., 2002.
Morocco	Pelagic (sardines: *Sardina pilchardus*)	1990s	Unreported (foreign)	None reported	64264	0.9	28.9188	As above.	Pitcher et al., 2002.
Guinea Bissau	shrimp, octopus and small pelagics	2000s	Illegal (DWFN in EEZ)	Korea, China	18000	0.3	98.0657	Reported highest IUU catches in the region. Problems of overcapacity and over-licensing. Control is weak and few benefits accrue to the state. IUU vessels make use of poor surveillance and confusion over licensing in Guinea and Guinea Bissau	Kelleher, 2002
Guinea	shrimp, octopus and small pelagics	2000s	Illegal (DWFN in EEZ)	None reported	16800	0.3	91.528	Problems of overcapacity and over-licensing. Control is weak and few benefits accrue to the state	Kelleher, 2002
Senegal	Tuna	2004	Unregulated catch	Ghana	800			Seizure by fisheries officers of 800 tonnes of tuna destined for Spanish cannery industry, from a Panamanian-flagged freezer vessel and caught by Senegalese and Ghanaian-flagged fishing vessels, which did not comply, with European Union (EU) regulations.	FIS, 2004a

West Africa									
Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Liberia	None reported	2004	Illegal (poaching)	None reported	None reported			All were fishing within the territorial limits of Liberia; however, none had permission or licenses to do so. This is a flagrant violation of Liberia's territory and an illegal exploitation of one of its most vital natural resources.	Anon, 2004a
Sierra Leone	shrimp and finfish	2000	Illegal (DWFN in EEZ)	Korea	14823.53	1.1	28.4275	Overflight produced a single snapshot estimate of vessels fishing in the Sierra Leone EEZ	Kelleher, 2000
Sierra Leone	tuna	2000	Illegal (DWFN in EEZ)	None reported	200		1.4	Major review of MCS in W African states	Kelleher, 2002
Sierra Leone	fish & shrimps	2004	Illegal (poaching)	Korean	None reported			6 South Korean vessels have been confiscated after crossing into EEZ and caught poaching fish & shrimps. A fine $30,000 each is expected and loss of catch.	Anon, 2004p

Southern Africa

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Namibia	sardines, anchovies	1960s	Uncontrolled (DWFN in non-exercised EEZ)	Various	382500	9.0	35	An extremely useful analysis of the long-term effects of IUU fishing before and after independence in Namibian waters	Sumaila & Vasconcellos, 2000; Bergh & Davies, 2004; Sumaila, 2004.
Namibia	hake	1970s and 1980s	Uncontrolled (DWFN in non-exercised EEZ)	None reported	360000	9.0	106.5	From 1990 Namibia took control. 42% of fishing industry revenue directed at control and surveillance; running costs for observer agency is NAD20m	Sumaila & Vasconcellos, 2000; Bergh & Davies, 2004; Sumaila, 2004.
Namibia	horse mackerel, mackerel	1980s	Uncontrolled (DWFN in non-exercised EEZ)	None reported	450000	9.0	21.6667	From 1990 Namibia took control. 42% of fishing industry revenue directed at control and surveillance; running costs for observer agency is NAD20m	Sumaila & Vasconcellos, 2000; Bergh & Davies, 2004; Sumaila, 2004.
Namibia	shark, tuna, swordfish & moonfish	2004	Illegal catches of species without licence	Spain	1.2			A ship, The Maral, was caught fishing with long-line gear, without a license to fish in Namibian waters, by the Nathaniel Maxuilili patrol vessel. In count, it carried 24 mako shark, 4 tuna fish, 21 blue shark, 10 swordfish, and one moonfish. It is illegal to fish for shark and swordfish, as these are no quota species, these species should only be fished in experimental waters, for which a special license is required. All vessels - irrespective of nationality - are required to obtain a license in order to fish commercially within Namibia's exclusive economic zone (EEZ).	Sasman, 2004

Southern Africa

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Namibia	mussels and limpets	2004-2005	Illegal poaching	China	2000 white mussels	80.0		A group of seven Chinese nationals living in Namibia were spotted in Langstrand with baskets and bags holding around 2,000 white mussels of varying sizes. In Walvis Bay, a 15-person group was intercepted by an official from the Ministry of Environment and Tourism after stripping the rocks of all limpets, at Paradise, near Swakopmund. Coastal Environmental Trust of Namibia (CETN) chairman Keith Wearn said that the wall of mussels in the Walvis Bay lagoon had been completely stripped, and added that the poachers also dug up clams from the sand and removed the insides of jelly fish.	FIS, 2005c
South Africa	mixed	2004	Illegal (poaching sold to China)	China (allegedly)	300 per vessel			Allegations have been made by the South African ambassador of the international Shark Project, Andy Cobb, that foreign trawlers are to blame for the depletion of marine resources around the KwaZulu-Natal coastline. Chinese vessels allegedly sneak in under cover of night and remove species such as turtles, swordfish and mako sharks at alarming rates. In contrast, Rob Broker, the conservation manager for Ezemvelo KZN Wildlife, the KwaZulu-Natal conservation authority, believes that these claims of illegal fishing are totally unfounded.	FIS, 2004h
South Africa	abalone	2002	Domestic Poaching	South Africa	850	2.0	29.75	Abalone poaching is a major form of IUU fishing in South Africa	Gordon & Cook, 2003
South Africa	abalone	2003	Illegal (poaching)	None reported	1000		350	Known as the new 'white gold', abalone poaching has become the recent crime of choice for organised cartels poaching and trafficking huge amounts of this prized shellfish on the black market. Arrests and seizures account for only 20 per cent of the estimated 1,000-tonne illegal harvest. Last year, authorities confiscated 600,000 abalone, suggesting that around 3 million were sent out onto the black market.	FIS, 2004p

Southern Africa

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
South Africa	abalone	2000-2003	Illegal poaching/smuggling	Canada	90 (between 2000 and 2003)		2	The female leader of an abalone smuggling syndicate has been jailed in South Africa for ten years, convicted under S. Africa's new racketeering laws. Elizabeth Marx, is believed to have bought and sold at least 90 tonnes of illegally harvested abalone worth $2 million through the syndicate between200 and 2003.	Anon, 2004i
South Africa	abalone	2005	illegal poaching	China	14 (not annual)		1.2	Western Cape police raided two warehouses in Blackheath and unearthed a booty of 14 tonnes of abalone worth around ZAR 7 million (USD 1.2 million) together with a stash of various drugs.	FIS, 2005d
South Africa	rock lobster (also hake)	May-June 2001	Illegal caught and smuggled - fish trafficking scheme-illegally caught lobster and toothfish were smuggled into USA and sold	None reported	None reported		0.46 (Hake 1.8)	Arnold Bengis - former head of one of South Africa's most prominent deep sea rock lobster companies - has been sentenced by a New York court to 3 years 10 months jail. The sentencing comes two years after his company, Hout Bay Fishing Industries, was prosecuted in South Africa and fined R39 million ($5.5 million) for catching excess rock lobster.	Anon, 2004g
South Africa / Mozambique	king mackerel; giant guitarfish plus shark fins	2004	Illegal (poaching)	Indonesia; Taiwan	50 (king mackerel)			Seven inspectors from Mozambique and three from South Africa were on a joint patrol when they found 2 vessels suspected of fishing illegally in Mozambican waters. One ship (Indonesian) had on board several km of fine mesh gill net, whilst the other (Taiwanese) was carrying large mesh demersal gill-nets when it is licensed to purse seine.	Anon, 2004o

East Africa

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Tanzania	None reported	2001	Illegal (poaching)	probably Taiwan	12600	1.0	18.9	Officials carried out a major patrol operation against illegal vessels and pirate ships in the country's Indian Ocean waters as part of a five-African nation programme sponsored by the European Union (EU).	FIS, 2004l; Bathwondi pers. comm., 2005
Tanzania	Mixed	2004	Illegal (unlicensed & within 12nm)	EU	None reported			22 European vessels were spotted fishing illegally within 12nm of the Tanzanian coast, this area is reserved for Tanzanian fishing boats. 1 vessel also did not have a license. EU estimates approx. 70 ships operating illegally, targeting tuna, kingfish, lobsters and prawns.	Ntetema, 2004
Kenya	Demersal (fish and prawns)	2004	Illegal (misreporting)	Kenya	None reported		0.04082	Investigations had established that some of the vessels with fish processing equipment were packaging fish caught in local waters as produce from other countries in order to deny Kenya revenue. No management response to date	Mayoyo, 2004
Somalia	skipjack tuna	2000	Illegal fishing licence	Spain	400 (not annual)			A Spanish trawler, Al-Bacora Quattro, fishing illegally in Puntland's territorial waters was seized on 16th April, 2000. The trawler, carrying 400 tonnes of Skipjack tuna, was said to have an illegal fishing licence authorised by companies that have no legal powers to grant licences to those wanting to catch fish in Puntland waters.	Somali Fisheries Society (2001a)
Somalia	None reported	2000	Illegal fishing (DWFN)	Italian owned/Kenyan registered	None reported			Somali militiamen captured a Kenyan-registered boat, Bahari 1, allegedly fishing illegally in Somali waters and detained a group of foreigners. A group of Italians, Kenyans and Somalis were arrested in connection with the incident. Somali militiamen regularly attack and seize foreign vessels they find fishing in their waters and hold the vessels and crew hostage for ransom. Foreign fishermen, however, frequently take advantage of Somalia's breakdown of central government by fishing within the country's maritime boundaries for shark, marlin and sailfish.	Somali Fisheries Society (2001b)

East Africa

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Somalia	None reported	2001	Illegal fishing (DWFN)	Syria, Taiwan	None reported			A Somali faction seized two Syrian vessels for allegedly fishing illegally in Somali waters and held the crews hostage pending an investigation. The Somali Salvation Democratic Front (SSDF) faction captured the vessels and boarded them near the northeastern Somali port of Habo on 20 January. SSDF officials said that a Taiwanese ship had also been impounded off the Somali coast 11 days ago and the 28-strong crew arrested on charges of illegal fishing.	Somali Fisheries Society (2001c)
Somalia	prawns	2004	Illegal (poaching)	Kenya	500		4	No action taken - lack of capacity	Mwacharo, 2004
Somalia	all	2004	Illegal (poaching)	Many	?			There are also an estimated 700 foreign-owned vessels that are fully engaged in unlicensed fishing in Somali waters. This illegal, unregulated, and unreported (IUU) fishing in the offshore, as well as in the inshore, with the difficulties it causes for legitimate Somali fishermen, causes great problems for monitoring, control and surveillance (MCS) of the Somali EEZ. It is impossible to monitor their fishery production, in general, let alone the state of the fishery resources they are exploiting. There is also strong suspicion of illegal dumping of industrial and nuclear wastes along the Somali coast.	FAO, 2005
Somalia	prawns and demersal fish	2005	Illegal (poaching)	DWFN, Kenya	90000			Conservative figures indicate 300 foreign owned vessels fish off the Somali coast. These ships conduct pirate fishing off the break-away Republic of Puntland coast and in 700 other small ports dotting the Somali coastline. They target high-grade marine products such as shrimps, lobsters and demersal fish that fetch high prices in international seafood markets	Anon, 2004b

Indian Ocean

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Seychelles	Tuna	1997-2002	Illegal (DWFN in EEZ) and Illegal (driftnets in zone)	Taiwan, Sri Lanka, France (Réunion), Indonesia, Iran	None reported	0.1	4	Anecdotal information from MRAG personal experience in the Indian Ocean	Ansell, 2005; Cofrepeche, 2001; Payet, 2001
Seychelles	Inshore: bêche-de-mer	1997-2002	Illegal (licence)	Malagasy	None reported			Anecdotal information from MRAG personal experience in the Indian Ocean	Ansell, 2005; Cofrepeche, 2001; Payet, 2001
BIOT	Inshore: demersal finfish	2002-2004	Illegal (licence)	Sri Lanka	None reported			Anecdotal information from MRAG personal experience in the Indian Ocean	Pearce pers. comm., 2005; BIOT arrest and court records
BIOT	Offshore: tuna	2002	Illegal (licence)	Indonesia, Mauritius	100		0.7	Anecdotal information from MRAG personal experience in the Indian Ocean	Pearce pers. comm., 2005; BIOT arrest and court records
CCSBT	SBT	1999	Unreported (High Seas)	None reported	1000	0.1	22	Details arising from the OECD workshop	OECD, 2005
IOTC	Tuna	2004	Unreported (High Seas)	None reported	130000	0.1	195	Details arising from the OECD workshop	OECD, 2005
South Africa landings	roughy, alfonsino, oreos, beryx	1999-2002	Unregulated	Russia, New Zealand amongst others	2000		16	Traffic report; catches 10000 per year from Madagascar ridge in period 1999-2002; probably 2000 t now.	Lack et al., 2003.

Note: Shaded areas highlight High Seas IUU incidents

Australasia

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Australia; Philippines	Bêche-de-mer	2005	Unregulated	Indonesia; Philippines	None reported			Ashmore Reef in Australia is heavily fished by Indonesian fisherman. In 1988; The Philippines are one of the largest bêche-de-mer exporters but reports on fishing are insubstantial and poaching in marine protected areas is suggested to be common;	Uthicke and Conand, 2005
Australia	shark (fins) or sea cucumbers	Jan 2003 - Mar 2004	Illegal (poaching)	Indonesia amongst others	None reported			Members of the local fishing sector have criticized the government, claiming that out of more than 1500 illegal foreign vessels sighted in local waters in the 15 months prior to March 2004, just 168 were apprehended by authorities. According to official data from the federal government, there were 1588 sightings during this period, 253 vessels were positively identified as illegal fishers.	FIS, 2004e
Australia	coral trout	2 weeks in 2004	Illegal (poaching by nationals?)	None reported	None reported			Rising prices for coral trout in Hong Kong are predictably leading to a rise in poaching of this species. Just over the past two weeks, seven fishing boats have been seized in north Queensland for extracting coral trout illegally.	FIS, 2004o
Australia	reef fish	2004	Illegal (poaching)	None reported	None reported			Following the seizure of an illegal fishing vessel, equipped with a global positioning system (GPS) and a large freezer capacity for storing their illegal catch onboard, fisheries authorities are to continue their heavy presence in Northern Waters, according to the Fisheries Department.	FIS, 2004q
Australia	shark fins and fish	2005	Illegal fishing	Indonesia	None reported			More than 20 foreign boats and some 200 crew have been netted in Australia's largest air and sea operation against illegal fishing. The boats were thought to be part of a large-scale operation involving several Asian countries and were stopped over a period of nine days in Australia's northern waters under Operation Clearwater - a joint initiative by customs, navy, and immigration officials. Most of the boats involved, came from Indonesian fishing ports, but there is some suggestion that the masterminds come from further a field.	FIS, 2005p
Australia	shark fins	2005	illegal fishing	Indonesia	0.05 (not annual)			See above	FIS, 2005q

Australasia

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Australia	shark fin and fish	2005	illegal fishing	Indonesia	2 (fish)			Fifteen of the boats seized in Australia's Gulf of Carpentaria were large vessels capable of storing fish on ice. Two boats each had one tonne of fish, and prized shark fin. Poachers used to employ traditional fishing methods, but in recent years the wooden fishing boats have been fitted out with more sophisticated technology, such as global positioning systems, sonar and ice storage, to increase catches.	CNN, 2005
Australia	dried reef fish, fish and shark fin	2005	illegal fishing	Indonesia	0.1 (dried reef fish); 0.3 (fish on ice); 0.01 (dried shark fin)			Last week an Indonesian fisherman was fined a record Australian $130,000 ($100,000) after his boat was caught off the north coast with over 100 kilograms (220 lb) of dried reef fish, 300 kilograms (660 lbs) of fish on ice and 10 kilograms(22 lb) of dried shark fin.	CNN, 2005
Australia	abalone	2004/2005	Export of poached goods	None reported	None reported			The South Australian Fishing Industries Council (SAFIC) has accused the Queensland-based abalone export companies of overlooking the poached origin of their products. This accusation has come after recent reports showed that Queensland abalone exporters recorded the highest abalone shipments abroad for the country, despite having no local sources for wild or cultured abalone. Asian tourists have been implicated as couriers for exporters, exploiting a loophole in export regulations. This breach allows them to take home up to five kilos of dried abalone meat.	FIS, 2005b
Australia	trochus	2001	Illegal DWFN in EEZ	Indonesia	1-2 (not annual)			A Memorandum of Understanding (MOU) was developed in 1974 between Australia and Indonesia, to permit Indonesian traditional fishers to exploit an area of more than 1500 square nautical miles inside the Australian Fishing Zone (AFZ). However, Indonesian fishers, are known to poach Trochus during low tides from reefs outside of the agreed MOU area of the King of Sound. A moderate-sized trochus boat can carry 1 to 2 tonnes of trochus.	Saunders, 2001

Australasia

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
New Zealand	barracouta (*Thyrsites atun*), gurnard, spiny dogfish	2005	illegal discarding, and misreporting by national	New Zealand	8 (6 dogfish)			The Skipper of a fishing vessel spotted in coastal waters south of Kaikoura, was charged for not reporting the dumping of a catch (~eight tonnes) of barracouta, gurnard, and spiny dogfish (six tonnes). Dogfish can be returned to the sea as long as it is reported, but barracouta, and gurnard dumping is considered illegal.	FIS, 2005s
New Zealand	fish (species unspecified)	Aug-Sep 2002	illegal fishing in EEZ	Japan	700 (not annual)			The manager, Hidemitsu Yoshimura, 55, and captain Tsugihiko Urata, 50, both pleaded guilty to four charges involving 700 tonnes of fish related to two trips in August and September 2002.	FIS, 2005f
New Zealand	paua (shellfish)	2003-2004	Illegal (poaching sold to China)	None reported	1000	0.9	60.35	The New Zealand trade commissioner based in southern China, Don Maclean, has announced that an official government approach may be the only way to stop illegal sales of paua to China. He states that although officials have discovered large amounts of black-market paua being commercialised on the Chinese market, the current legislation allows this to continue as long as the product is legally imported, reports the newspaper, Stuff.	FIS, 2004g
New Zealand	None reported	2004	Fishing without a permit and registration certificate and catch misreporting	None reported	170 t misreported, 950 t caught/bought over 3 months			New Zealand fisheries officers seized two purse seiners and raided five seafood firms following a probe into illegal fishing and catch misreporting.	Anon, 2004d

Central and Western Pacific

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Tonga	sharks and shark fins	2002	Illegal catch (non-compliant with tuna licence)	None reported	13.5 sharks, 1.3 fins (not annual)		0.02359	Tonga will no longer tolerate illegal fishers," Hon. Tuita, minister for fisheries, has said at Nuku'alofa, Kingdom of Tonga. He said: "Tonga is getting tough on illegal fishers," as he announced that he had cancelled the licence of Ching Fong Hwa No. 1 which also had to forfeit her catch of 13.5 tonnes of sharks and 1.3 tonnes of shark fins. The minister recently established a multi-agency Operational Task Force under his Ad Hoc Ministerial Fisheries Council to address illegal fishing in Tongan waters.	Anon, 2004h
New Caledonia	probably tuna	2003	Illegal (poaching)	Taiwan	None reported			Skipper Lin Ven Chang was arrested after allegedly fishing illegally in New Caledonian waters, attempting to escape and removing identification from his vessel Shang Sheng. The vessel and crew were escorted to Noumea.	Anon, 2004n
Fiji, Papua New Guinea, New Caledonia and the Solomon Islands	trochus	1972-1992	Unregulated ??	None reported	1442 (28,842 over 20 yrs)		26	Trochus, *Trochus niloticus*, have long been exploited for both subsistence and export in the South Pacific, but very few countries have harvest controls, such as restrictions on the size of shell that can be taken and reporting of exports is scant and sometimes under-reported. In addition, the information available does not reflect the quantities actually collected because a percentage of poor-quality shells are discarded.	Sant, 1995
Guam/USA	shark fins	July 2004	Illegal offloading	Japan	520 (not tonnes) shark fins			The first US federal arrests and convictions for shark finning took place recently in Guam.	Anon, 2004l
West Central Pacific	tuna (albacore, bigeye, skipjack, yellowfin)	2002	High Seas and FFA country EEZs	None reported	100,000 - 300,000 t	5-15%	300	IUU tuna fishing in the West Central Pacific	Greenpeace, 2004; Richards, 2004

Note: Shaded areas highlight High Seas IUU incidents

Eastern Pacific

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Peru	fish (unspecified)	2004	Illegal catches of species	None reported	60000		60	The Ministry of Production estimates that by mid-June, all wooden, industrial ships will be fitted with satellite tracking systems to help them keep tabs on the industrial fleet - this is part of the ongoing attempts by authorities to make progress into the management of fisheries and in their struggle against illegal fishery, which in the coastal region robs the Peruvian artisanal sector of some 60,000 tonnes of fish, yearly.	FIS, 2004j
Peru	jumbo flying squid	2004	illegal/poaching, within EEZ (194nm off coast)	China & South Korea	690 (not annual); Annual estimate: 1 month fishing at 40t/day = 10000 t	0.1	8.4	Nine squid jiggers escorted into Callao, Peru on Nov 19 2004 after being intercepted allegedly working inside Peruvian waters, to supply factory ships in international waters. According to the preliminary inspection carried out by the Peruvian government, the six Chinese and three South Korean vessels had stored 690 tonnes of flying squid and squid, which had been extracted at 194 miles off the coast. Peruvian authorities said that the crewmembers from the nine vessels tried to resist, carrying out dangerous manoeuvres to avoid being caught. They also ruined the vessels engines and threatened to cut the ropes the Peruvian naval inspectors would use to descend from the helicopters.	FIS, 2004u Anon, 2005
Mexico	Bêche-de-mer (*Isostichopus fuscus*)	1999	Unregulated	Mexico	None reported			Despite the increasing interest of this sea product in the world markets, the only approach has been an unregulated extracting fishery, which has led only to a serious depletion of natural populations of species Isostichopus fuscus in the sea of Cortez (Gulf of California), Mexico	Gutiérrez-García, 1999
Ecuador	sea cucumbers	2004	Illegal catch	None reported	2.3			The recent seizure of an illegal catch of more than 100,000 sea cucumber in Isabela Island, in the Galapagos archipelago, has led Galapagos National Park (PNG) technicians to issue a recommendation to ban the fishery of this species this year, reported the Environment Minister, César Narváez.	FIS, 2004r

Eastern Pacific

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Ecuador	sea cucumbers	2004	Illegal catch	None reported	300000	0.1	4.5	The fishing season in these islands ended on 10 June, with a total catch of around 5 million sea cucumbers. Given that the Ecuadorian government had only authorised the extraction of 4.7 million sea cucumbers, this means that around 300,000 specimens were extracted illegally. (See World News, 25 June 2003)	FIS, 2004r
High seas	jumbo flying squid	2003	Unregulated fishing outside EEZ	China	40000		48	A part of the fishing area for jumbo flying squid lies outside the EEZs of Peru and Chile.	FAO reported statistics , 2004

North Pacific

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Russia / Bering Sea	pollock	2004	Illegal	Russia	333		0.4995	Patrol efforts of the Russian Border Guard for the pollock fishery in the northwestern Bering Sea have included five state marine inspections. In 2004, 3,700 vessels were checked, 24 vessels were detained on infringements of state law, 333 tons of illegal product have been confiscated, and fines amounted to over 67 million Rubles. In 2004, Russia did not observe any violations of fisheries in the central Bering Sea.	Cerne, 2004.
USA	sole, halibut	2000	Illegal under-reporting	USA	None reported			The Seattle-based Unimak Fisheries company, pled guilty to having concealed and discarded halibut bycatch while fishing for sole and other species in the Gulf of Alaska and Bering Sea in the year 2000. The crew of the 185-foot Unimak reportedly hid halibut bycatch, which regulators use to determine the closing of the fishery, from a federal fisheries observer logging catches aboard the vessel.	FIS, 2005g
USA	crab	2004	Illegal (poaching) by Canadian vessels in US waters	#REF!	None reported			Canadian federal officials are working closely with the US Coast Guard in an attempt to stop illegal cross-border fishing, according to Canada's Department of Fisheries and Oceans (DFO).	Anon, 2004j
USA	brown king crab	Feb 2002-Feb 2004	Exceeded quota cover up, through processing location	USA	898	9.0	13.2 (over two years)	The National Marine Fisheries Service (NMFS) accused Seattle-based Icicle Seafoods company of drastically out-stepping the brown king crab quota, hauling in an excess of USD 13.2 million worth of shellfish in a two-year period. Between February 2002 and February 2004, the federal government claims Icicle exceeded its 221,000 pound annual quota of Aleutian brown crab by having it's two Adak-based companies (which were not subject to the same processing limits) process over 4.4 million pounds of crab, (about a third of the overall fishery's annual limit).	FIS, 2004w

North and Central Atlantic and Gulf of Mexico

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Ascension Is	None reported	2004	Illegal (poaching?)	Spain	None reported			Arrest of Spanish fishing master on "Suffolk Challenger"	Yon, 2005
Ascension Is	tuna	2004	Illegal (poaching)	None reported	None reported			Longline gear set 100m from the shore next to second largest green turtle nesting colony in the Atlantic. 10 miles of hooks removed by local fishermen and police.	Anon, 2004q
USA	crab	2004	Abandoned or illegal pots	None reported	8343	0.0		A recent 15-day cleanup operation has resulted in a total of 8,343 abandoned or illegal crab pots getting pulled from coastal waters. The North Carolina Marine Patrol officers, in charge of the operation, removed 7,703 pots and directed owners to remove an additional 640 pots, reports The Sentinel.	FIS, 2004n
Mexico	queen conch (also lanceta, tomburro, sacabocado and chacpel winkle)	2005	Illegal fishing (Domestic) of banned species	Mexico	None reported			Illegal extraction of the queen conch (*Strombus gigas*) along the coastline of Progreso, Yucatan, are depleting the resource's population, preventing its recovery. Extractive efforts are undertaken by divers at 130 km off the coasts of Progreso, and catches are then smuggled to other cities, hidden in the shipments of other products to be traded on the black market, Diario de Yucatán reported. Sergio Chan Lugo, delegate of the Federal Bureau of Environmental Protection (PROFEPA), thinks the illegal extraction of queen conch is being controlled by a mob, with around a dozen very fast boats, equipped with high tech devices and telephone systems.	FIS, 2005r
Canada (NAFO)	American plaice	2003	Illegal catches of species	Portugal amongst others	1500			Canadian authorities boarded five foreign trawlers (including two Portuguese vessels) in international waters in an anti-overfishing operation, as Prime Minister Paul Martin vowed to crackdown on "rogue" foreign skippers depleting fish stocks. Fisheries Minister, Geoff Regan said some 15,000 tonnes of American plaice had been caught illegally by foreign trawlers in 2003.	FIS, 2004i
Canada (NAFO)	redfish (*Sebastes*)	2004	Illegal (misreporting species)	Various	None reported			According to NAFO, the establishment of limitations on the redfish and thorny skate fisheries in the North Atlantic stemmed from the fact that some foreign vessels were overfishing protected species using unregulated species as a cover.	FIS, 2004t

North and Central Atlantic and Gulf of Mexico

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
NEAFC	redfish (Sebastes)	2004	Unreported (High Seas)	None reported	15000		30	Details arising from the OECD workshop	OECD, 2005
UK	Possibly haddock	2004	Illegal fishing in conservation area by Russian fleet	Russia	None reported			Skippers have accused Russian fishermen of illegally trawling in the 60 square-mile conservation no-take fishing zone around the island of Rockall, 200 miles from the Scottish coast, which is vital to the conservation of local haddock stocks, whose breeding grounds are located in the area, reports The Scotsman. Local fishermen claim that despite being reported, the Scottish Fishery Protection Agency did absolutely nothing to prevent the illegal fleet from plundering the local grounds.	FIS, 2004k
ICCAT	bigeye	2002	Unreported (High Seas) and Illegal	None reported	7580	0.1	53.06	Details arising from the OECD workshop	Restrepo, 2004
ICCAT	bluefin Tuna	1994-2002	Unreported (High Seas) and Illegal	None reported	500	0.0	11	Details arising from the OECD workshop	Restrepo, 2004

Note: Shaded areas highlight High Seas IUU incidents

South Atlantic

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Falklands	toothfish	2005	Possible illegal fishing without a license	unclear: Spain/Uruguay	None reported			The Elqui longliner, was allegedly targeting toothfish without a license out of the South Georgia toothfish season. It was first spotted in the toothfish fishery grounds by two cruise ships, the Explorer II and the Grigoriy Mikheev (which happened to be carrying Falkland Islands Governor Howard Pearce on board).	FIS, 2005m; FIS, 2005n
Argentina	squid	2004	Illegal (poaching) by Taiwanese jiggers	Taiwan	None reported			A battle of words is starting over a 'missile' attack' on a Taiwanese squid jigger allegedly poaching in Argentine waters. According to the Taiwanese press, Chin Hsing was jigging 'near' Argentine waters when hit and sunk by a missile fired by the Argentine naval ship Granville. Argentina claims that, while Granville fired warning shots, the jigger's crew set fire and tried to scuttle her.	Anon, 2004e
Argentina	squid	2004	Targeting bycatch species??	Argentina	1.400 (not annual)	5-10% above 10% bycatch ceiling		Fresh fish trawlers landed ~1,400 tonnes of squid (*Illex argentinus*) at the port of Mar del Plata in October 2004, despite the squid fishing season having been closed prematurely a few months before to preserve stocks. A number of vessels from the Argentine commercial fleet targeting common hake (*Merluccius hubbsi*) were authorised to catch squid as by-catch, but many vessels were thought to have targeted squid directly. According to unofficial data released by the National Directorate of Fisheries and Aquaculture (DNPyA), some of these fresh fish trawlers exceeded the 10 per cent squid bycatch ceiling set by enforcement authorities, registering, in some cases, up to "15 per cent, 18 per cent, and even 20 per cent."	FIS, 2004v

South Atlantic

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Argentina	Argentine shortfin squid, *Illex argentinus*	2005	Illegal fishing within EEZ	Taiwan	None reported			Officials of the ARA Guerrico corvette of the Argentinean Navy's Maritime Patrolling Division arrested a Taiwan-flagged squid jigger, Hsien Hua 6, for fishing without authorisation for Argentine shortfin squid (*Illex argentinus*) within the Argentine exclusive economic zone (EEZ) 250 km to the southeast of Puerto Deseado. The Taiwanese squid jigger, with a 30-member crew, was chased by the corvette that eventually succeeded in overtaking the vessel preventing its escape, ordering it to stop-down its engines.	FIS, 2005h
Argentina	Argentine shortfin squid, *Illex argentinus*	2005	Illegal fishing within EEZ	Taiwan	8.5 (not annual)	18%		The crew of the patrol vessel Prefecto Derbes, owned by the Argentine Coast Guard (PNA), apprehended a Taiwanese squid jigger, Chich Man 1, illegally fishing Argentine shortfin squid (*Illex argentinus*) within the Argentine exclusive economic zone (EEZ), off the Chubut coasts.	FIS, 2005i
Argentina	Argentine shortfin squid, *Illex argentinus*	2005	illegal fishing in EEZ	China	3 fresh (not annual) + 160 in hold			A Chinese-flagged vessel was arrested by crew of the Coast Guard vessel Prefecto Derbes, of the Argentine Naval Prefecture (PNA), and charged with poaching in Argentina's exclusive economic zone (EEZ), 199 miles off the city of Comodoro Rivadavia, in the Province of Chubut. The vessel Zhonz Yuan Yu I carried more than 160 tonnes of squid (*Illex argentinus*) in its hold, and three tonnes of fresh squid on deck, said a spokesperson for the PNA.	FIS, 2005k
Argentina	squid	2005	illegal fishing in EEZ	Korea	None reported			The Argentine Navy (ARA) corvette ARA Drummond arrested a Korean squid-jigger, Jae Sung, on 9 March, while poaching inside the Argentine exclusive economic zone (EEZ), some 350 kilometres (190 nautical miles) east of the Port of San Julián. Navy officers who inspected the ship, recorded several infractions in relation to the content of the hold and the documents requested.	FIS, 2005l
Argentina	squid	2005	Illegal fishing within EEZ	Taiwan	None reported			Officials of the Argentine Naval corvette ARA Drummond, arrested crewmembers onboard a Taiwanese squid-jigger, Win Lien Sheng III found poaching squid (*Illex argentinus*) inside the Argentine exclusive economic zone (EEZ), after a hot pursuit that ended with arson and sinking of the vessel.	FIS, 2005o

South Atlantic

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Argentina	Various fish species	2005	illegal fishing in EEZ	Spain	535 (not annual)			A Spanish-flagged vessel, José Antonio Nores, was arrested by Coast Guard authorities and accused of poaching 198 miles east of Rasa Island in the Argentine Exclusive Economic Zone (EEZ). When the Spanish vessels, with 33 crewmen onboard, were detained, the PNA staff inspected its hold and discovered around 535 tonnes of different species of fish.	FIS, 2005j
Argentina, Falklands	squid	2000-2004	Unregulated fishing outside EEZ	Taiwan, China, Korea, Spain, Argentina, Falklands	50000		60	A part of the fishing area for Illex squid lies outside the EEZs of Argentina and the UK. Both countries regularly make assessments of the catch in this area as part of their responsibility to assess the stock as a whole under the Straddling Stocks agreements.	SAFC, 2000, 2001, 2002, 2003, 2004; FIFD/Imperial, 2004; Barton et al., 2004.

Note: Shaded areas highlight High Seas IUU incidents

Europe / North Sea / Barents Sea / Baltic

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Spain	hake	2001-02	Misreporting and illegal landing	Spain, UK	182 not annual			The European Commission concludes that catch data transmitted by Spain to the commission, particularly for northern hake, are neither reliable nor complete. Over-fishing of northern hake is very likely to have occurred in 2001 and 2002.	Anon, 2003c
Scotland	herring, mackerel	2005	illegal fishing	Shetland registered	None reported		6.1	Prosecution of a Shetland-based skipper and mate for landing more than GBP 3.4 million worth of illegally caught herring and mackerel, alerted authorities to the increasingly sophisticated nature of the international racket that is known to involve surreptitious night-time fishing in remote areas, unlawful direct consignments to nationwide processors, and the involvement of processing firms in Denmark and Norway. By the official account, black fish, that go around the legitimate quayside auction system, has escalated in the region since quotas were imposed.	FIS, 2005t
UK	herring, mackerel, sole, plaice	2001-02	Misreporting of Catch location	UK	None reported			The EC claims to have noted "many cases where the UK has failed to take appropriate action against parties who do not comply with the rules, including misreporting. Pelagic species such as herring, mackerel, and demersal species such as sole and plaice are recorded as caught in one area when the vessels VMS records show that they were fishing elsewhere.	Anon, 2003d
UK	saithe, cod, hake, megrim, monkfish	2003	Misreporting of species (recorded as ling, forkhead, tusk and dogfish)	UK	None reported			The EC also reports misreporting of saithe, cod, hake, megrim and monkfish catches mainly as ling, forkhead, tusk and dogfish. While severe penalties may be imposed by the courts "the sanctioning system as a whole does not meet the level of deterrence required by EC legislation".	Anon, 2003e

Europe / North Sea / Barents Sea / Baltic

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
UK	cod	2003	Illegally landed	UK	10000		22	A damning leaked report claims that half of all North Sea cod sold is landed illegally - primarily by UK fishermen, reports the Daily Telegraph newspaper. Hamish Morrison of the Scottish Fishermen's Federation says: "I wont say there are no 'black' landings, but I would say this is likely to be a balancing figure designed to make up the rest of the arithmetic".	Clover, 2003
Eastern Baltic, EU waters	cod	2003	Under-reporting	Russia	20000	0.4	44	Eastern Baltic cod stock, Russian vessels fishing and underreporting in Estonian, Polish, Latvian waters	ICES, 2004
Norway	cod	2003/04	Illegal fishing (over TAC)	None reported	100000	0.3	220	WWF report on the state of Barents sea cod stocks	Esmark and Jenson, 2004
Spain	swordfish	2004	Illegal landing	None reported	None reported			Spanish swordfish prices have risen 45% since the country's government blocked imports of supplies caught outside of international fishery agreements (26% of container traffic in frozen swordfish).	Anon, 2004m

Note: Shaded areas highlight High Seas IUU incidents

Southern Ocean

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
Antarctic	toothfish	1997 - 2004	Illegal (DWFN in EEZ) and Unregulated (DWFN outside EEZ but within RFO)	Uruguay, Togo, Honduras, Equatorial Guinea, Georgia, Ghana, St Vincent and the Grenadines, Bolivia	32600t (1997) dropping to 2622t (2004)	275% dropping to 20%	36	This well-known IUU problem has been extensively documented by several authors, and appears to have been reducing in recent years. There is concern that some previous IUU toothfish longline vessels are now switching their targeting to sharks and swordfish.	CCAMLR, 2004; Agnew, 2000; Lack & Sant, 2001.
Australia	Patagonian toothfish	2003	Illegal (poaching)	Uruguay	85 (not annual)		1.1	Viarsa, a Uruguayan-registered toothfish longliner, was arrested by Southern Supporter with intervention from the Falklands islands-based Fisheries patrol ship Dorada and the South African tug John Ross, about 3500 km south-west of the Cape of Good Hope, after being spotted near the Heard and McDonald Islands which are 4500km southwest from Australia and part of her zone. Customs and Fisheries Officers on Southern Supporter suspected Viarsa of illegally fishing for toothfish and gave chase.	Anon, 2003a
High Seas	toothfish	2004?	Illegal (poaching)	None reported	None reported			High numbers of "black listed" fishing vessels authorised to operate in Uruguayan waters could increase international pressures and lead large fish buyers (e.g. US and Japan) to eliminate the Uruguayan companies from their quotas. Several of these vessels have authorised use of Uruguayan port services despite appalling international records, and apparently receive orders from international mobs of pirate fisheries headquartered in Spain, Chile and Russia.	FIS, 2004b

Southern Ocean

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
High Seas	toothfish	1999-2002	Illegal (poaching)	Ghana, Panama, USA, Uruguay, Belize, Portugal, Russia, Ethiopia, Bolivia, Korea.	18,800 (1999/2000); 28,100 (200/01); 25,600 (2001/02)		369 wholesale (2001/02); 148 landed (2001/02)	While the overall level of IUU fishing for toothfish may have gone down in the late 1990s after its peak in 1996/7 of about 40,000 tpa based on estimates of IUU fishing effort (or about 60,000 tpa based on trade information), increasing efforts by governments, licensed operators and the wider community to eliminate IUU fishing in the Southern Ocean have been unable to stop levels of IUU fishing increasing again over the last three years.	Anon, 2003f

World IUU catch nei*

Country	Species	Period	Type of IUU	IUU flag states	IUU catch (tonnes, annual)	IUU as proportion of legal	Estimated value of IUU (Million US$)	Summary	Reference
World	abalone	2002	none reported	None reported	3696	0.4	129.36	In addition to South Africa, Abalone poaching is important in Japan, New Zealand, Australia, USA, Mexico some other countries.	Gordon & Cook, 2003
World	tuna & swordfish	2000-2003	High Seas	None reported	85000	0.1	127.5	This is mainly a paper about ecological effects, but it does include an estimate of total tuna IUU catch	Lewison, 2004
High seas	orange roughy / alfonsino	2001-2003	Unregulated	None reported	2000		16	Data from FAO fishstat: all non-attributed (i.e. non EEZ) catches.	Esmark and Jenson, 2004

Note: Shaded areas highlight High Seas IUU incidents *nei not elsewhere included

Bibliography to Annex A

Agnew, D J. (2000). The illegal and unregulated fishery for toothfish in the Southern Ocean, and the CCAMLR Catch Documentation Scheme. Marine Policy 24: 361 – 374.

Anon (2003a). Fishing News International Vol.42. No. 10 p.5 October 2003 & FIS Feb 25, 2004.

Anon (2003b). Fishing News International Vol.41 No. 11. p.1 & 3. November 2003.

Anon (2003c). Fishing News International Vol. 42. No. 12. p.3, December 2003.

Anon (2003d). Fishing News International Vol. 42. No. 12. p.3. December 2003.

Anon (2003e). Fishing News International Vol. 42. No. 12. p.3. December 2003.

Anon (2003f). Fishing News International Vol.41 No. 11. p.44-45. November 2003.

Anon (2004a). UNMIL Patrols Liberian Coastal Waters. The Analyst, Monrovia, December 08, 2004. Available at: http://allafrica.com/

Anon (2004b). Fishy Goings On Off Somali Coast. The Nation, Nairobi. September 27, 2004. Available at: http://allafrica.com/

Anon (2004c). Korean Vessel Seized. Fishing News International Vol. 43. No. 2 p. 5 February 2004.

Anon (2004d). Seized Seiners are bombed. Fishing News International Vol. 43. No. 3 p.3 March 2004.

Anon (2004e). Navy fires on Taiwan jigger. Fishing News International Vol. 43. No. 3 p.3 March 2004.

Anon (2004f). Air and sea battle sinks Thai trawler. Fishing News International Vol. 43. No. 4 p.40 April 2004.

Anon (2004g). Fishing boss jailed in US. Fishing News International Vol. 43. No. 7 p.2 July 2004.

Anon (2004h). No more illegal fishing - Tonga. Fishing News International Vol. 43. No.8, p.3 August 2004.

Anon (2004i). Woman jailed for ten years for Abalone smuggling. Fishing News International Vol. 43. No. 11 p.3 November 2004.

Anon (2004j). Crack down on illegal crabbers. Fishing News International Vol. 43. No. 11 p.3 November 2004.

Anon (2004k). Russians shell Taiwanese ship. Fishing News International Vol. 43. No. 11 p.6 November 2004.

Anon (2004l). First US finning offences. Fishing News International Vol. 43. No. 11 p.36 November 2004.

Anon (2004m). Swordfish prices bounce back - after minister blocks illegal fish. Fishing News International Vol. 43. No. 11 p.24-25 November 2004.

Anon (2004n). Fishing News International Vol. 43. No. 1. p 2. January 2004.

Anon (2004o). Fishing News International Vol. 43. No. 5. p 2 May 2004.

Anon (2004p). Sierra Leone nabs S Korean boats. Thursday, 14 October, 2004 BBC News online. Available at: http://news.bbc.co.uk/1/hi/world/africa/3742180.stm

Anon (2004q). Ascension Islanders Continue Efforts To Repel Pirates And Reduce Impacts On Nesting Marine Turtles. Ascension Island Press Release, 8th February 2004.

Anon (2005). Fishing News International Vol. 44. No. 1 p.35 Jan 2005.

Ansell, N. (2005) pers. comm.

Barton, A.J., Agnew, D.J. & Purchase, L.V. (2004) The Southwest Atlantic; achievements of bilateral management and the case for a multilateral arrangement. In: Management of Shared Fish Stocks, Payne, A.I.L., O'Brien, C.M. and Rogers, S.I. (Eds.), Blackwell, pp 202 – 222. [Proceedings of the Symposium on International Approaches to Management of Shared Stocks – problems and future directions. Centre for Environment, Fisheries and Aquaculture Science (CEFAS), Lowestoft 10-12 July 2002].

Bergh, P.E. and Davies, S.L. (2004) "Against all odds: taking control of Namibian fisheries". In: Sumaila, U.R., Steinshamn, S. I., Skogen, M. D. and Boyer, D. (Eds.). Namibian Fisheries: Ecological, Economic and Social Aspects. Eburon Deft, Netherlands, in press.

BIOT arrest and court records.

CCAMLR (2004). Report of the working group on fish stock assessment. Available at: www.ccamlr.org

Clover, C. (2003) Half of North Sea cod is 'stolen' as stocks dwindle, Daily Telegraph (online) 7th August 2003. Available at: http://www.telegraph.co.uk

CNN (2005). CNN News Online April 20, 2005

Cofrepeche (2001). Etude de Faisabilite d'un projet pilote 8e FED: Pêche "surveillance control et suivi des Grands Pélagigues Migrateurs".

Cerne, M. (2004) United States Coast Guard Report. 9th Annual Conference of Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea.

Esmark, M. and Jensen, N. (2004) The Barents Sea Cod - the last of the large cod stocks. WWF Norway Report 4/2004. Tveteraas, A. (Editor)

FAO reported statistics.

FAO, 2005. Fishery country profile: Somalia. http://WWW.fao.org/fi/fcp/en/som/profile.htm. Viewed May 2005

FIFD/Imperial College (2004). Estimates of high seas catch of squid (L. Purchase pers. comm.).

Fish Information & Services (2004a). Canners demand more 'equitable' measures to control tuna imports, Spain, July 20, 2004.

Fish Information & Services (2004b). Serious consequences predicted, should Uruguay insist on protecting 'pirate vessels', Uruguay, February 10, 2004.

Fish Information & Services (2004c). Coast guard detains ship under Ukrainian flag for illegal fishing, Georgia, February 10, 2004.

Fish Information & Services (2004d). Uncontrolled poaching leads sturgeon along a clear path to extinction, Iran, December 07, 2004.

Fish Information & Services (2004e). Illegal foreign vessels on the increase in local waters, Australia, July 21, 2004.

Fish Information & Services (2004f). Coast Guard Administration cracks down on illegal vessels, Taiwan, July 09, 2004.

Fish Information & Services (2004g). Government to take official approach to stop illegal sales of paua to China, New Zealand, June 03, 2004.

Fish Information & Services (2004h). Foreign trawlers blamed for depletion of local resources, South Africa, May 18, 2004.

Fish Information & Services (2004i). Canadians board five foreign trawlers, claiming illegal overfishing, Canada, May 07, 2004.

Fish Information & Services (2004j). Installation begins of satellite tracking systems on wooden industrials, Peru, April 15, 2004.

Fish Information & Services (2004k). Russian trawlers spotted fishing illegally in conservation area, United Kingdom, April 15, 2004.

Fish Information & Services (2004l). Officials carry out major operation against illegal vessels, Tanzania, April 01, 2004;

Fish Information & Services (2004m). Indonesian troops sink Thai fishing boat in air and sea battle, Indonesia, March 10, 2004.

Fish Information & Services (2004n). North Carolina Marine Patrol pulls in over 8000 abandoned crab pots, United States, March 09, 2004.

Fish Information & Services (2004o). Rise in poaching of coral trout noted, Australia, February 25, 2004.

Fish Information & Services (2004p). Abalone poaching at the centre of organised crime cartels, South Africa, February 03, 2004.

Fish Information & Services (2004q). Poachers go high tech, Australia, January 28, 2004.

Fish Information & Services (2004r). Poaching risks sea cucumber populations in Galapagos, Ecuador January 12, 2004.

Fish Information & Services (2004s). Azeri fishing vessel sinks in skirmish with Kazakh patrol boat, Kazakhstan, November 12, 2004.

Fish Information & Services (2004t). Galician vessel owners consider FAO affects skate and redfish fisheries, Spain, September 21, 2004.

Fish Information & Services (2004u). Asian vessels to pay USD 2.5 million for poaching in Peru, Peru, November 23, 2004.

Fish Information & Services (2004v). Trawlers go over squid by-catch quota, Argentina, November 25, 2004.

Fish Information & Services (2004w). Seattle-based seafood company fined USD 3.4 million for cornering brown crab market, United States, December 01, 2004.

Fish Information & Services (2004x). Uncontrolled poaching leads sturgeon along a clear path to extinction, Iran, December 07, 2004.

Fish Information & Services (2005a). National crews using improperly certified Taiwanese vessels risk confiscation, Indonesia, January 06, 2005.

Fish Information & Services (2005b). Australia's abalone industry accused of exporting poached goods, Australia, January 05, 2005.

Fish Information & Services (2005c). Mussel poaching on the rise, as fingers point at Chinese nationals, Namibia, January 10, 2005.

Fish Information & Services (2005d). Authorities to clamp down on abalone poaching, South Africa, January 13, 2005.

Fish Information & Services (2005e). Vietnam urges China to take action after guards kill nine fishermen, Vietnam, January 17, 2005.

Fish Information & Services (2005f). Japanese captain, manager fined for illegal fishing in EEZ, New Zealand, January 18, 2005.

Fish Information & Services (2005g). Unimak Fisheries fined USD 500,000 for concealment of halibut bycatch, United States, January 25, 2005.

Fish Information & Services (2005h). Taiwanese vessel is arrested for illegal squid fishery, Argentina, February 11, 2005.

Fish Information & Services (2005i). Another Taiwanese squid jigger apprehended for poaching, Argentina, February 23, 2005.

Fish Information & Services (2005j). Spanish vessel arrested for alleged illegal fishing, Argentina, February 28, 2005.

Fish Information & Services (2005k). Chinese squid jigger arrested for poaching, Argentina, March 04, 2005.

Fish Information & Services (2005l). Navy apprehends Korean vessel for illegal fishing, Argentina, March 11, 2005.

Fish Information & Services (2005m). Trial date set for master and owners of longliner for alleged illegal toothfish efforts Falklands, March 17, 2005.

Fish Information & Services (2005n). Fines slapped on Elqui owners and master for illegal fishing in toothfish-rich waters, Falklands, April 21, 2005.

Fish Information & Services (2005o). Crew of Taiwanese squid jigger arrested after setting their vessel afire, Argentina, April 04, 2005.

Fish Information & Services (2005p). Australia nets 20 foreign boats in major drive against illegal fishing, Australia, April 20, 2005.

Fish Information & Services (2005q). Australia nets 20 foreign boats in major drive against illegal fishing, Australia, April 20, 2005.

Fish Information & Services (2005r). Dwindling stocks of queen conch in Yucatan due to illegal catches, Mexico, April 28, 2005.

Fish Information & Services (2005s). Fish dumper to pay USD 14,600 in fines and boat redemption fees, New Zealand, May 02, 2005.

Fish Information & Services (2005t). SFPA issues warning to illegal 'black fish' traders, United Kingdom, May 05, 2005.

Gordon, H. R. and Cook, P.A. (2003). World Abalone Supply, Markets And Pricing: Historical, Current And Future Prospectives. Opening Speech: 5th International Abalone Symposium, Quingdao, China October 2003.

Greenpeace (2004). Development without Destruction: Towards Sustainable Pacific Fisheries. 20 pp.

Gutiérrez-García, A. (1999) Potential culture of sea cucumber in Mexico. In: SPC Bêche-de-mer Information Bulletin #11 - March 1999.

ICES (2004) ACFM report 2004.

Pearce, J. (1995) pers. comm.

Kelleher, K. (2000) Report No. 1. Results of the aerial surveillance missions, February 2000. In: Support to the development of fisheries sector strategy in Sierra Leone, MegaPesca report.

Kelleher, K. (2002) Robbers, Reefers and Ramasseurs: A review of selected aspects of fisheries MCS in seven West African countries: Report for the Sub-Regional fisheries commission, project FAO/GCP/INT/722/LUX (ARF/013), July 2002.

Lack, M. and Sant, G. (2001) "Patagonian Toothfish: are conservation and trade measures working?" TRAFFIC Bulletin Vol. 19 No. 1. TRAFFIC International, Cambridge, UK.

Lack, M. K. Short and Willock, A. (2003) Managing risk and uncertainty in deep-sea fisheries: lessons from Orange Roughy. A joint report by Traffic Oceania & the WWF Endangered Seas Programme. 84 p.

Lewison, R.L., Freeman, S.A. and Crowder, L.B. (2004) Quantifying the effects of fisheries on threatened species: the impact of pelagic longlines on loggerhead and leatherback sea turtles. Ecology Letters 7: 221–231.

Mayoyo, P. (2004) Crooked Trawlers Cheating Kenya of Millions in Revenue. The Nation, Nairobi, June 22, 2004. Available at: http://allafrica.com/

Mwacharo, M. (2004) Kenya Urged to Crack Down On Illegal Fishing in Somali Waters. The East African, Nairobi, October 24, 2004. Available at: http://allafrica.com/

Ntetema, V. (2004) Tanzania probes illegal fishing. Monday, 2 August, 2004. BBC News online. Available at: http://news.bbc.co.uk/1/hi/world/africa/3529058.stm

OECD (2005). Draft Synthesis Report On IUU Fishing Activities. AGR/FI(2004)18.

Bathwondi, P. (2005) Pers. comm.

Payet, R. (2001) Illegal Fishing in Seychelles: A Review of its Implications for a Small Island Developing State. International Collective In Support Of Fishworkers (ICSF) International Ocean Institute (IOI), India. Forging Unity: Coastal Communities And The Indian Ocean's Future. Conference Organized At IIT Madras Chennai, India, 9 – 13 October 2001. Paper IO2001/D2/S1/05.

Pitcher, T.J., Watson, R., Forrest, R., Valtýsson, H. and Guénette, S. (2002) Ghoti. Estimating illegal and unreported catches from marine ecosystems: a basis for change. Fish and Fisheries, 3, 317-339.

Restrepo, V. (2004) Estimation Of Unreported Catches By ICCAT. Paper submitted to the IUU Workshop, OECD 19-20 April 2004. AGR/FI/IUU(2004)20

Richards, A.H. (2004) Fisheries monitoring, control and surveillance in the western and central pacific. FFA report 03/25.

Ritson, A. (2004) Bleak future for Kazakh caviar. Friday, 24 December, 2004. BBC News Online. Available at: http://news.bbc.co.uk/1/hi/business/4095349.stm

Sant, G. (1995) Marine Invertebrates of the South Pacific: An Examination of the Trade. TRAFFIC Network Report, October 1995. 81 p.

Sasman, C. (2004) Fishermen to Face Court. New Era, Windhoek, June 21, 2004. Available at: http://allafrica.com/

Saunders, K. (2001) SPC Trochus Information Bulletin #7 - January 2001.

Somali Fisheries Society (2001a). Somali Navy Impounds Spanish Trawler For "Illegal Fishing". General News, Somali Fisheries Society Feb 24 2001, from Kaaha Bari, Boosaaso 20 Apr 2000. Available at: http://www.soma-fish.net/stories.php?story=01/02/12/8391332

Somali Fisheries Society (2001b). Somalis capture foreigners on illegal fishing trip. General News, Somali Fisheries Society Feb 24 2001, from Reuters Dec 24 and 26, 2000. Available at: http://www.soma-fish.net/stories.php?story=01/02/12/8391332

Somali Fisheries Society (2001c). Indian Ocean News Letter. General News, Somali Fisheries Society February 24 2001. Available at: http://www.soma-fish.net/stories.php?story=01/02/12/8391332

South Atlantic Fisheries Commission (SAFC) assessments (2000-2004).

Sumaila, U.R. (2004) The Cost Of Being Apprehended Fishing Illegally: Empirical Evidences And Policy Implications. Paper submitted to the IUU Workshop, OECD 19-20 April 2004. AGR/FI/IUU(2004)11.

Sumaila, U.R. and Vasconcellos, M. (2000) Simulation of ecological and economic impacts of distant water fleets on Namibian fisheries, Ecological Economics 32: 457–464.

Uthicke, S. and Conand, C. (2005) Local examples of bêche-de-mer overfishing: An initial summary and request for information. In: SPC Bêche-de-mer Information Bulletin #21 - February 2005.

Yon, G. (2005) Ascension : Press Release - Fishing Vessel “Suffolk Challenger”. The Islander. 03.02.2005. Available at: http://www.the-islander.org.ac/artd_1424_02_2005_32.html

9. Annex B. Case Studies

9.1. Tuna

IUU fishing that targets tuna fisheries is of particular concern to coastal African states. These fisheries are some of the largest, both in terms of the value and volume of catches, in the tropical oceans. Tuna fisheries are dominated by distant water fishing nations (DWFNs) that may operate on the high seas and within the EEZs of coastal states without the vessels coming within range of shore based patrols and without visiting local ports to unload or tranship catches.

There are three different types of fishing vessel that commonly fish for tropical tunas, purse seiners, longliners and pole and line vessels. The first two dominate the catches with the pole and line vessels only operating in particular areas. The purse seine fisheries tend to occupy a latitudinal band between the tropics targeting yellowfin tuna (*Thunnus albacares*) and skipjack tuna (*Katsuwonus pelamis*) commonly with a smaller bycatch of juvenile bigeye tuna (*Thunnus obesus*) which may be misidentified as juvenile yellowfin and skipjack tunas. The longline fisheries are more spread out throughout the oceans targeting adult solitary yellowfin and bigeye tunas with bycatch of marlin, swordfish and other billfish.

The level of fishing by the purse seine and longline fleets inside the EEZs of coastal African states is often unclear, even for those coastal states with bilateral agreements with the fishing nations. Indeed the nature of these agreements may influence the reporting of the fishing nations with the financial compensation agreed under the agreement being dependent on the catch reported from the EEZ.

Data are available from datasets in the public domain from the relevant regional fisheries organisations (ICCAT and IOTC) that give the breakdown of purse seine effort and catch by species on a 1° by 1° basis and on a 5° by 5° basis for longline fisheries. These data have been aggregated for the most recently available periods to show the total range of fishing that can occur, as significant annual variations can occur in these migratory fisheries. The aggregated data have been plotted with the EEZs marked to show the potential overlap of each fishery with the Africa coastal state EEZs.

These summaries are shown in Figure 21 (Atlantic Ocean purse seine), Figure 22 (Atlantic Ocean longline), Figure 23 (Indian Ocean purse seine) and Figure 24 (Indian Ocean longline).

From these summary plots we have identified particular EEZs of concern where known catches of tuna have been declared inside the EEZs of the coastal states to the relevant regional fisheries organisations; where catches have been made in adjacent EEZs; in adjacent high seas areas; and IUU fishing by these fleets inside the EEZs is a possibility. It is possible with the fine scale purse seine data to estimate the catch by species taken within each EEZ. Each 1° by 1° grid square can be broken down into the relative proportions of area allocated to each coastal state EEZ or high seas area. The catch by species for each year can then be distributed amongst the grid squares assuming an equal distribution throughout the 1°x1° square. This is not possible with the longline datasets due to the size of the grid the data have been aggregated over in relation to the size of the EEZs, although some indication of those EEZs which may have significant tuna longline activity can be determined from a simple analysis of Figure 22 and Figure 24.

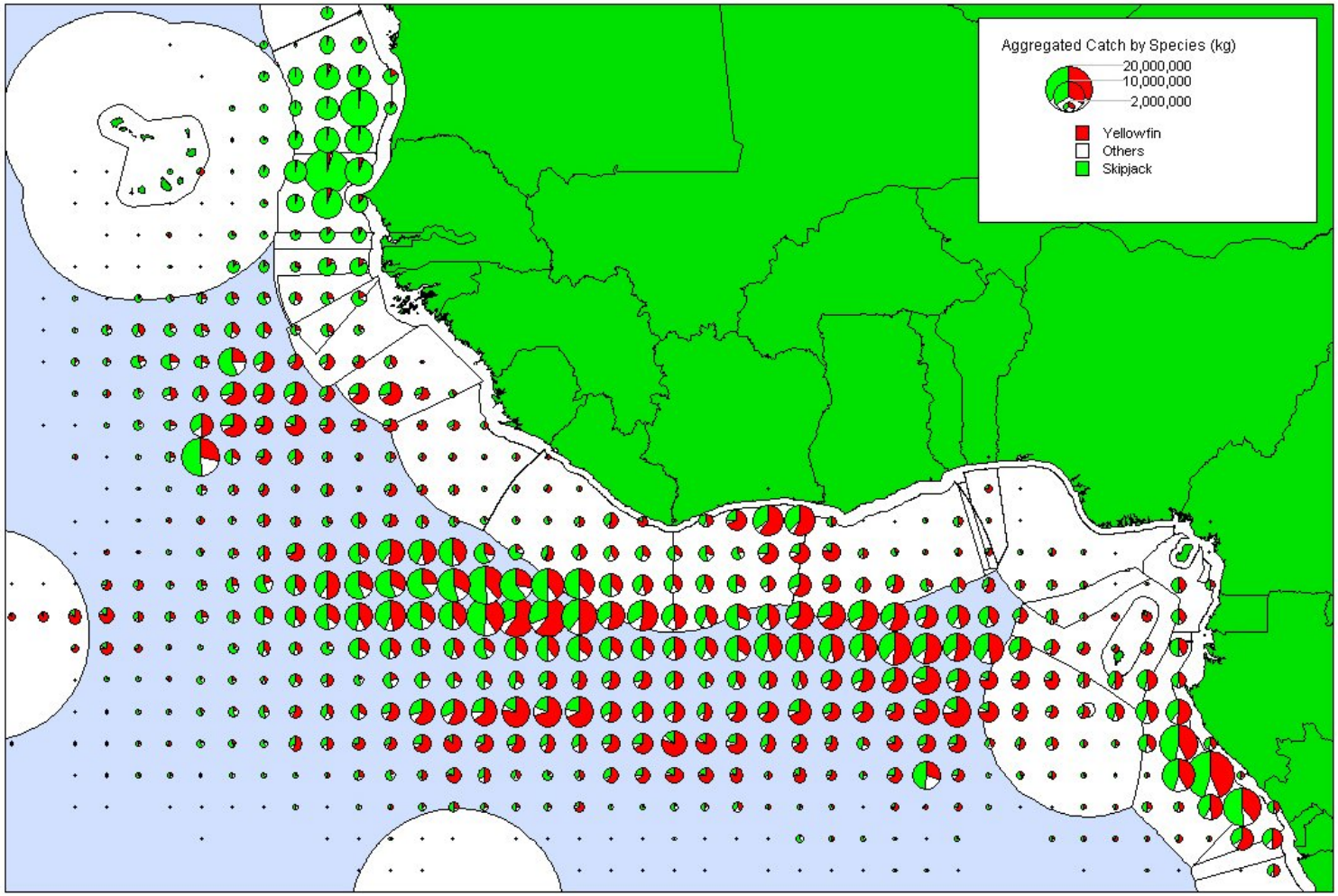

Figure 21 Total aggregate catch of yellowfin and skipjack tunas (1 degree squares) by purse seine vessels in the Atlantic Ocean 1990 – 2002 (Source: ICCAT purse seine catch and effort data).

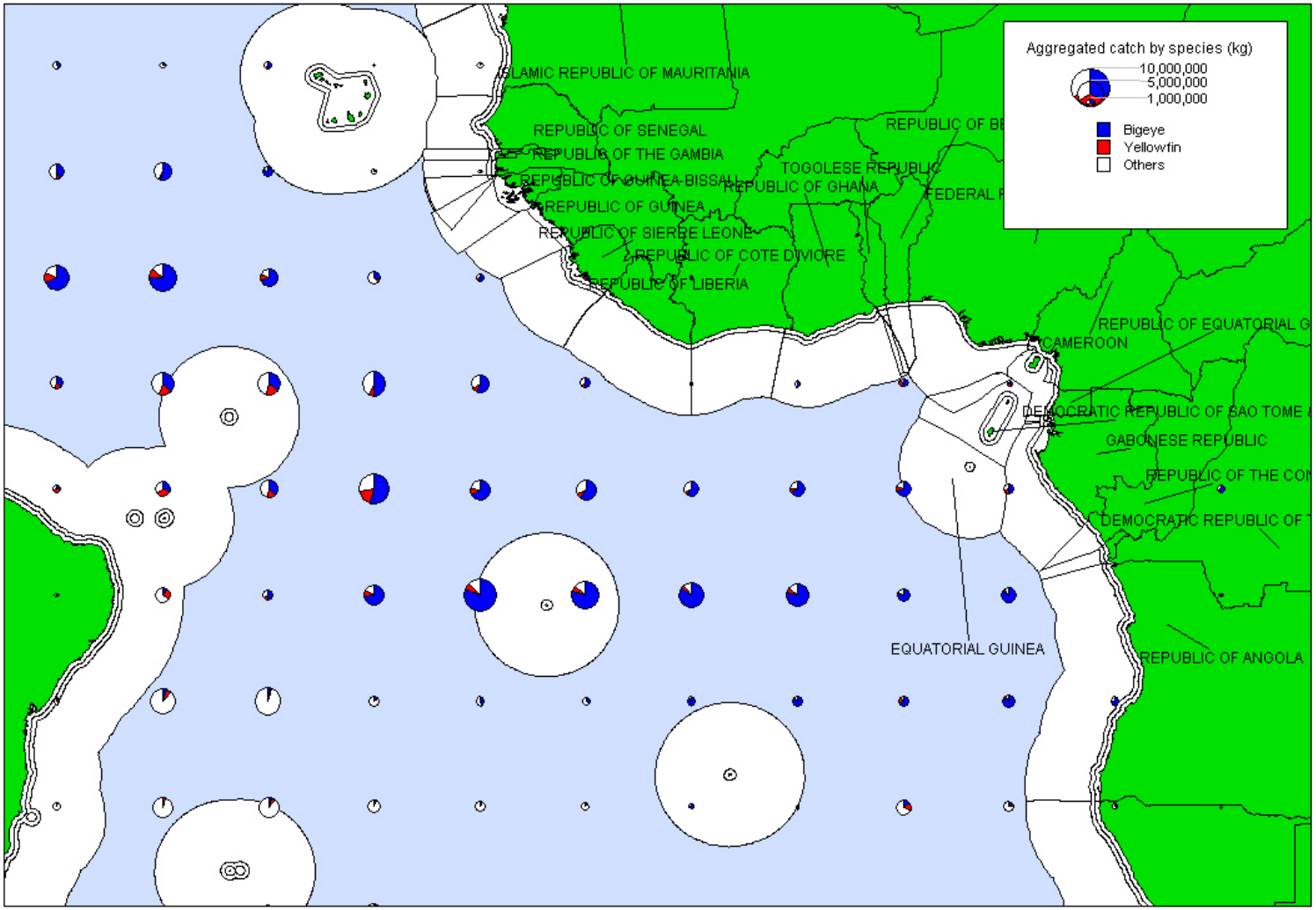

Figure 22 Total aggregate catch of yellowfin and bigeye tunas (5 degree squares) by longline vessels in the Atlantic Ocean 1990 – 2002 (Source: ICCAT longline catch and effort data).

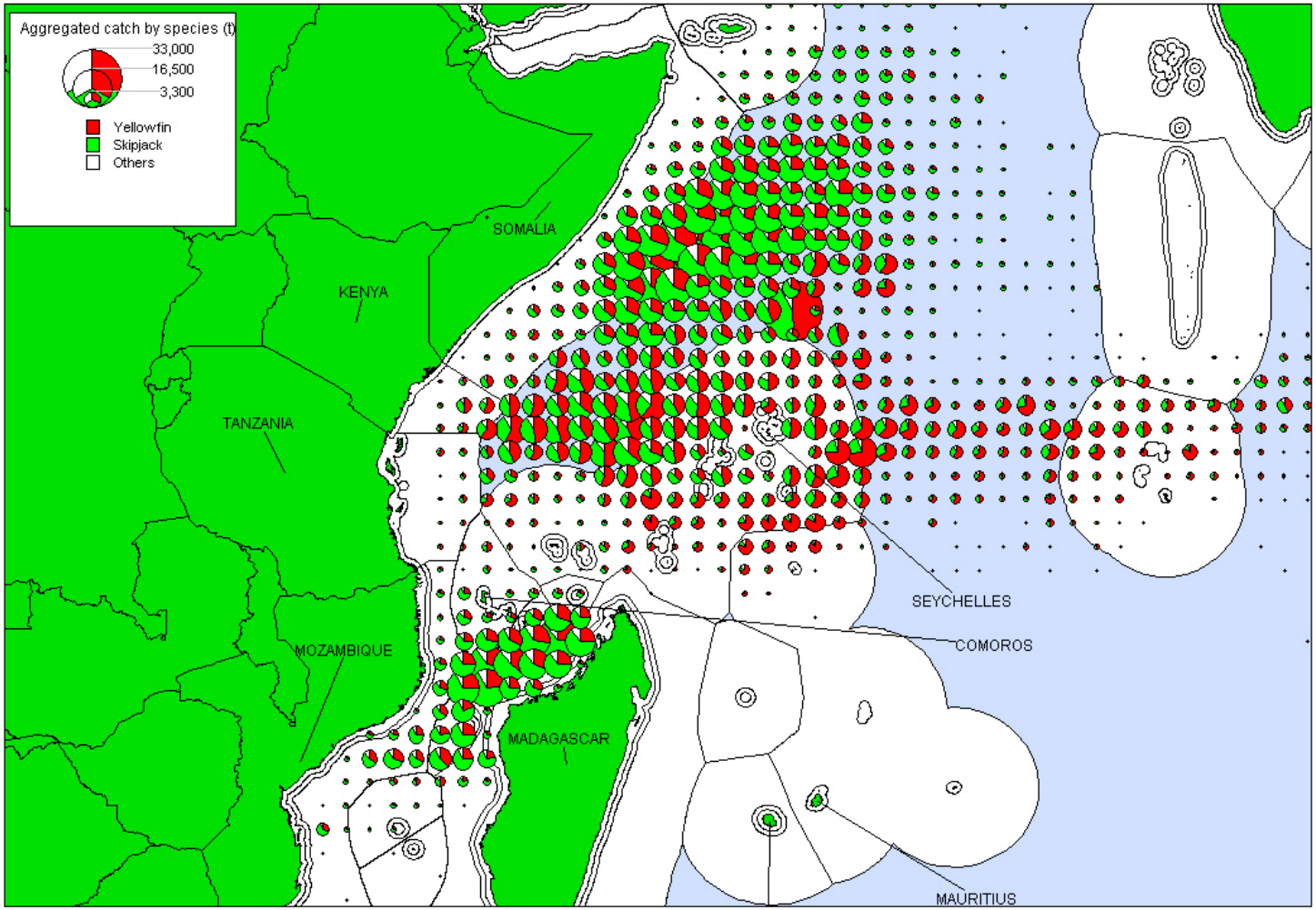

Figure 23 Total aggregate catch of yellowfin and skipjack tunas (1 degree squares) by purse seine vessels in the Indian Ocean 1983 – 2001 (Source: IOTC purse seine catch and effort data).

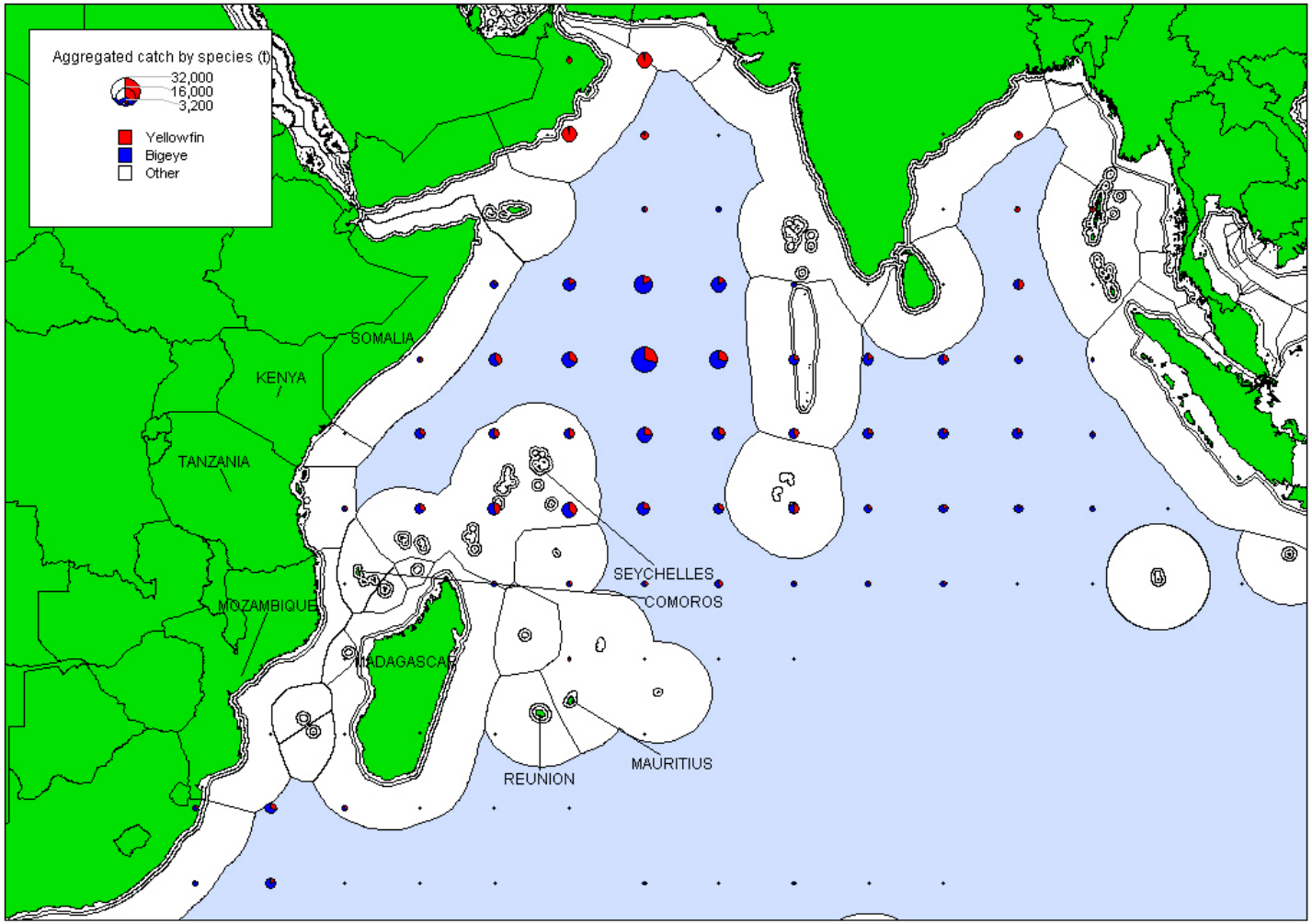

Figure 24 Total aggregate catch of yellowfin and bigeye tunas (5 degree squares) by longline vessels in the Indian Ocean 1990 – 2001 (Source: IOTC longline catch and effort data).

Table 16 Summary table of EEZs and potential activity of purse seine and longline tuna fisheries. Key: --- indicates absence, number of *'s indicates relative importance (*=lowest, *****=highest).

Linear Order	Coastal State	Purse Seine	Longline
1	Morocco	---	---
2	Mauritania	***	*
3	Senegal	**	---
4	Cape Verde	**	**
5	Gambia	***	---
6	Guinea-Bissau	***	---
7	**Guinea**	****	---
8	**Sierra Leone**	****	*
9	**Liberia**	****	*
10	Côte d'Ivoire	***	*
11	Ghana	***	*
12	Togo	***	*
13	Benin	***	*
14	Nigeria	***	*
15	Cameroon	***	*
16	**Equatorial Guinea**	****	***
17	Sao Tome and Principe	***	**
18	Gabon	***	**
19	Congo, Republic of	***	***
20	Dem. Rep. Congo	**	***
21	Angola	*	***
22	Namibia	---	**
23	South Africa	---	***
24	Mozambique	****	**
25	**Madagascar**	****	*
26	Comoros	***	**
27	Tanzania, United Rep. of	**	**
28	Kenya	***	**
29	**Somalia**	*****	***
30	Eritrea	---	---
31	Mauritius	**	**
32	**Seychelles**	****	*****
33	**British Indian Ocean Territory**	***	****
34	**Saint Helena (incl. Ascension)**	*	****

The main area of concern in the Atlantic Ocean appears to be with the purse seine fishery in the area just outside the EEZs of Guinea, Sierra Leone and Liberia. There is a mature fishery in operation in this area and the coastal states should be benefiting from the resource. Currently the European purse seine fleet that dominates this fishery lands all the catch from the area into Dakar, Senegal and Accra, Ghana. The main problem that currently exists with this fishery is the validation of the data that have been reported. There is an incentive for the fleet to underreport catches inside the EEZ compared to those taken outside and thereby devalue the resource value of the EEZ which will have a negative effect on the value the coastal states can obtain from future fisheries agreements.

Figure 25 shows the estimated level of catches of yellowfin, skipjack and bigeye tunas taken in the EEZs of Guinea, Sierra Leone and Liberia between 1990 and 2002. It is clear that the levels reported for the last five years reported in Guinea and Sierra Leone are small but relatively stable with annual estimated catches around 3000t per year. Liberia is slightly higher averaging about 5000t but the estimated catch has been dropping over the period.

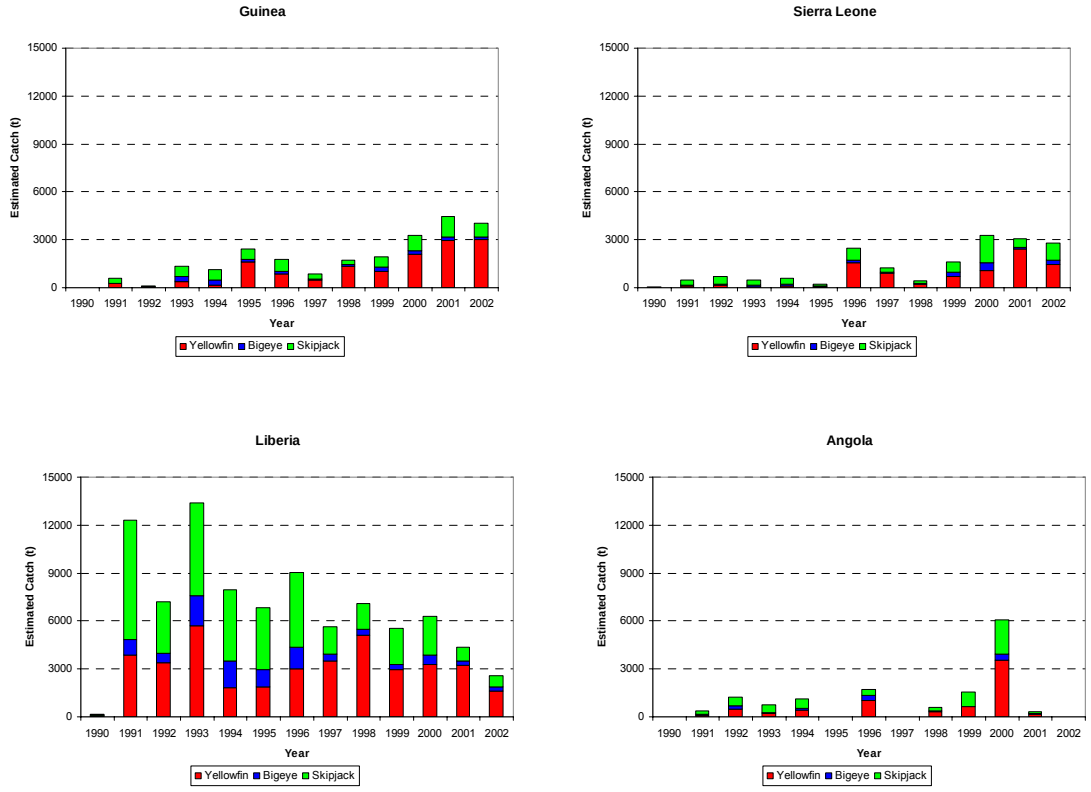

Figure 25 Estimated catches of yellowfin, skipjack and bigeye tuna for the Guinea, Sierra Leone, Liberian and Angolan EEZs, 1990 – 2002.

It has also been reported by our consultant that large catches of tuna were possibly being taken from the Angolan EEZ illegally. Figure 21 suggests that this might not be the case, showing that the Angolan EEZ is at the extreme southern range of the tuna purse seine fishery. The increased catches to the north of the Angolan EEZ may be due to the increased nutrients associated with the outflow of the Congo River into the Atlantic Ocean but due to the prevailing current patterns, the catches are all seen more to the north of this discharge.

A similar situation exists in the Indian Ocean with catches occurring along the entire east coast (Figure 23). In the Indian Ocean the tuna fleets tend to follow migrating tuna in a clockwise fashion around the Western Indian Ocean. In the first quarter, the fleets will be operating around the central Indian Ocean and in the high seas areas between the BIOT Fisheries Conservation and Management Zone (FCMZ) and

the Seychelles EEZ. In the second quarter, the fleets move towards the Mozambique Channel, fishing in the Southern Somali Basin and in the EEZs of Mozambique, Madagascar, Tanzania, France (Mayotte), Comores and Seychelles. Into the third quarter, the fleets will typically start moving north into the Somali basin (despite having no effective central government, a 200nm EEZ is generally recognised for Somalia) and the northern part of the Seychelles EEZ.

Some estimates have recently been made an IUU catch in Tanzanian waters of the order of 40,000 tonnes per year ($40 million). This is based on a snapshot of purse seine activity observed during an overflight by the SADC aerial surveillance plane, and has been incorrectly used to give estimates of tuna catches for a number of other EEZs. Based on the last five years of data reported to the IOTC, we have estimated that the catch actually taken from the Tanzanian and Kenyan EEZs (Figure 26) are closer to an average of 1,000 tonnes per year each, although in some years due to the highly variable nature of tuna fisheries, the catches may be significantly higher[154] or lower.

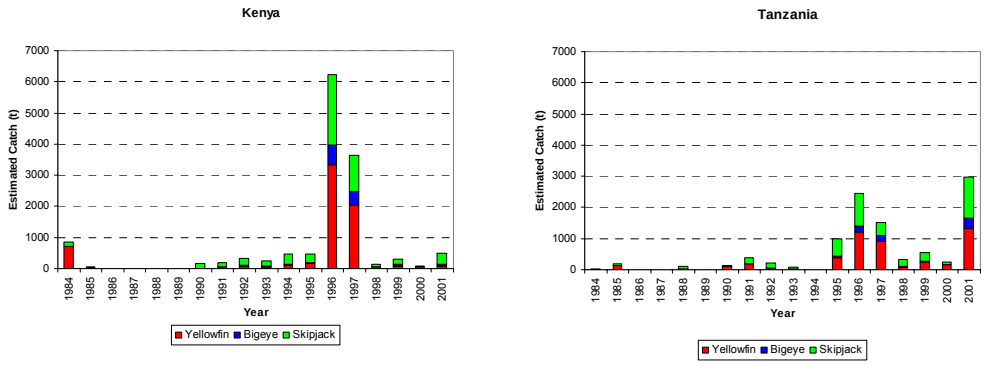

Figure 26 Estimated catches of yellowfin, skipjack and bigeye tuna for the Kenyan and Tanzania EEZs, 1990 – 2002.

9.2. Guinea (Conakry)

9.2.1. Status of the Fishery

Guinea presents a picture of a very productive fishing area. As with Mauritania and Senegal to the north and Sierra Leone to the south it shares the influence of the upwelling from the Canary Current with the consequent favourable conditions for small pelagics. It also has a broad shelf of over 100nm breadth providing trawling grounds for demersal fishes as well as cephalopods, which are currently much sought after. The EEZ also extends into northern equatorial tuna belt (see Section 9.1) in regions where the valuable yellow fin tends to predominate.

[154] There have been much higher catches of yellowfin taken by purse seiners in the Tanzanian EEZ over the past two years.

The national catch produces 90-110,000 tonnes per year including an artisanal catch of 48,500 tonnes (Kelleher, 2002)[155]. The commercial catch has been recorded at 72,357 tonnes (2001) or more generally at 54,000 (Kelleher 2002)[156]. Fisheries generally provide around 1.3% of GDP.

9.2.2. Assessment of IUU Losses

Guinea is acknowledged to have considerable problems with IUU fishing. A comparative survey by the LuxDev project (Table 17) showed illegal fishing to be highest of all neighbouring countries at around 60%. This was almost double that of Sierra Leone even though this country was incapacitated by a civil war.

Table 17 Comparison of results of aerial surveillance during 1995-96, 2000 and 2001.

	Cape Verde	Gambia	Guinea	Guinea Bissau	Mauritania	Senegal	Sierra Leone	Total
Infractions as % of sightings 1995-1996	8%	19%	59%	9%	4%	1%	2%*	11%
Infractions as % of sightings 2000	#	10%	60%	17%	2%	4%	32%	13%
Infractions as % of sightings 2001	#	8%	60%	23%	1%	9%	30%	15%

Source: AFR/010 database *Sierra Leone data unreliable for technical reasons.
No surveillance done in Cape Verde

The commercial fishery contains around 200 licensed vessels, depending on the number of licenses each year, about 20 of which are flagged in Guinea. The country has a number of agreements. There are bilateral agreements with the EU and China and there may be private agreements with Korean operators. The EU agreement has been for 38 tuna seiners, 16 longliners, 14 pole and line tuna vessels, and a number of shrimp and cephalopod vessels to an extent of 1,500 and 2,500 GRT/month. There are no details of the other agreements. The quotas are set in relation to GRT and all were licensed at catches less than the quota in 2001 except fin-fish, which is almost 2.5 times the quota set. There are no quota for tuna and no reported catch although we will use the ICCAT returns (see Section 9.1).

[155] Kelleher, K. (2002) Robbers, Reefers and Ramasseurs: A review of selected aspects of fisheries MCS in seven West African countries: Report for the Sub-Regional fisheries commission, project FAO/GCP/INT/722/LUX (ARF/013), July 2002.
[156] Op. cit Kelleher (2002)

The most recent full set of data available is from 2001. The commercial catches given by Kelleher (2002) differ significantly from those of the FAO totals (Table 18). This is because the FAO totals reflect only that landed or taken by Guinean effort[157].

Table 18 Vessels Licensed and Catches in the main Guinea Fishery 2001.

Fishery	Vessels Licensed (n)	FAO Catch (t)	Recorded Catch (t)	Recorded Discarded (%)	Quota (t)
Cephalopod	53	3,644	18,172	25	10,500
Shrimp	36	701	5,702	33	3,900
Demersal	68	10,648	34,334	27	3,500
Small Pelagic	3	52,695	14,148	6	26,000
Tuna	38 purse seines		(5,000)*		
	30 longliners				

* taken from ICCAT records within Guinea EEZ.

The recorded catch in Table 18 is specifically taken from observer reports on vessels and is consistent with the catches from this number of vessels. The fact that the FAO catches only exceed the recorded catches of Kelleher (2002) in small pelagics, specifically bonga, indicates the FAO statistics include the Guinea artisanal. Use of the recorded commercial catches will therefore be most appropriate for the assessment of IUU losses.

There have been a number of surveillance exercises in Guinea waters, including those shown in Table 17 indicating a level of 60%. A maritime surveillance exercise carried out by our correspondent in September 2001 showed that of the 17 vessels encountered, 6 (35%) were not licensed. All the vessels were apparently Korean shrimp trawlers. In a rather larger survey 7 (23%) out of 31 trawlers appeared unlicensed. Between January 2002 and July 200, the Gambian based Surveillance Operations Co-ordinating Unit (SOCU) undertook 26 aerial surveillance operations, during which 441 vessels were sighted. Of these, 149 (34%) were unidentified and therefore, almost certainly illegal (Jones 2004[158]).

In 2001 Guinea observer data showed 34 of 92 vessels (34%) seen were fishing in an prohibited zone, largely taking catch from the area designated for artisanal fishes and therefore illegal. This suggests that up to one third of legal vessels are taking their catch from illegal areas plus there is an additional 33% of unlicensed illegal fishing. All vessels are referred to as “trawlers” and so distinction cannot be made between shrimp, cephalopod or fish boats. The same ratio of assessment will therefore be used for all.

There is also the question of under reporting as a result of transhipping at sea onto reefer vessels. Our correspondent quotes a Korean skipper who states in approximately 50 fishing days they catch between 70 and 80 tonnes, which is transhipped to a reefer. The vessel only returns to Las Palmas after 2 years and may even be maintained at sea. Such a vessel could easily get in six such cycles a

[157] FAO attributes catches to flag states by FAO statistical areas – i.e. Guinean catches might not be entirely from within their EEZ and FAO would not record the catch of foreign fishing as being from within the Guinean EEZ.

[158] Jones, A. J. 2004. A presentation by the Surveillance Operations Co-ordinating Unit (SOCU): Activities and Programmes.

year, thus producing 450 tonnes per year. If this were typical of fish trawlers, of which there are 68 (Table 18), they would produce 30,600 tonnes. In fact, they reported a catch of 34,334 tonnes. Perhaps, then, under reporting is less of a problem here. The same appears true of cephalopod vessels.

With shrimp, under reporting of 20% would seem appropriate.

Whilst 2001 was a particularly good year for tuna catches according to the ICCAT records for the Guinea EEZ, an average over the most recent three years is around 3,200 tonnes. This will mostly be taken by purse seiners, essentially the licensed EU vessels. However, reports of tuna catches within EEZs may be greatly under estimated and there may be some unlicensed longline fishing. To allow for this the same amount again, as is recorded, will be allowed for as unreported to the licensing coastal state.

The assessed IUU losses are given in Table 19

Table 19 Assessment of losses due to IUU fishing off Guinea.

	Mean Catch (t)	Including Unreported (t)	Including Unlicensed (t)	Probable Loss (t)	Price ($/t)	Nominal Probable Loss ($m)
Shrimp	5,702	6,842	9,100*	3,398	8000	27.18
Illegal Discards				10,194	750	7.65
Cephalopods	18,172	18,172	24,229*	6,057	8000	48.46
Demersal	34,334	34,334	45,778*	11,445	1500	17.17
Small Pelagic	14,148	14,148	14,148	negligible	450	
Tuna (national)	Nil	3,200	3,200	3,200	1500	4.80
Tuna (ICCAT)	3,200					
Total				34294		105.25

* includes 33% for unlicensed vessels.

9.2.3. The State of Control and Regulation

Guinea does have some MCS capacity. Six coastal stations have 8-10 staff each and there is a reasonably extensive observer system for licensed vessels. The observers, however, purely monitor fishing operations and do not enforce compliance. There are 5, primarily inshore, patrol vessels, the largest being 12.6m. There appears to be no VMS system in place and patrols are occasionally carried out by two naval vessels. In 2001, 684 vessels were inspected and 14 arrests were made. These were, however, slower vessels less able to outrun the patrol vessels. Most of the arrests were for fishing in closed areas (37%) or for mesh offences (85%). Vessels from Korea and China are primarily responsible for most violations as indicated by direct sightings. This may be due to the less transparent nature of their fishing agreements. In addition, 188 licensed vessels were inspected in port, although most foreign vessels do not land their catch, transhipping at sea instead.

MCS is financed through treasury allocations, surveillance and observer levies and a share of fines. Fisheries income was $5.8 million from licenses, $837,000 from surveillance contributions, and $428,924 from observer contributions (Kelleher 2002). A further $2.96 million per year was obtained from the EU fishing agreement which has been in place for several years. It seems that, unlike in other similar coastal states, the EU agreement has not stimulated a more effective MCS system. The

data in Table 17 also indicate that the situation in Guinea is not shared by its neighbours to the north, where incident levels are much less. There appears to be some systemic institutional problem in Guinea.

In 2000, a 2 year programme was initiated under the Sustainable Fisheries Livelihoods Programme of DfID to equip and train fishermen to identify and report to the MCS authorities (National Fisheries Surveillance Centre (CNSP)) the activities of IUU vessels fishing inshore on their artisanal fishing grounds. This allowed CNSP to target its scarce resources more effectively, and reportedly resulted in a reduction in industrial IUU activity in the areas of the trial[159].

9.3. Liberia/Sierra Leone

9.3.1. Status of the Fishery

Liberia has a coastline of some 590km and a relatively narrow shelf with an average width of 31km and total area of around 18,400km^2. The shelf is slightly narrower in northern waters and rather broader in the south, where it virtually provides the starting point for the Gulf of Guinea. There is a more or less permanent thermocline with an average depth of some 20-35m which typically intercepts at mid-shelf and tends to separate two demersal fish assemblages: those dominated by Sciaenids (croakers) above the thermocline and therefore inshore, and the other dominated by Sparids (snappers) below the thermocline and therefore offshore (Longhurst 1965[160]).

Unlike the coastal regions to the north such as Sierra Leone and Guinea, Liberia is not affected by the upwelling effects of the Canary Current, which therefore limits its productivity, although it does receive heavy seasonal discharges from the numerous rivers and their estuaries. These do provide productive grounds for penaeid shrimp fisheries. The lack of upwelling does not favour the production of the small pelagic sardine-like species so plentiful further north but, never the less, they are sufficiently prolific as to provide a significant element in the fishery.

The Liberian fisheries were last reviewed and surveyed by FAO in the mid 1980s (Ssentongo 1987[161]) and since then a prolonged sequence of civil disturbance disrupted government activity in the fisheries, as well as all other, sectors in a way only recently resolved in the last year and a half. Whilst the initial capacity of the fisheries sector reported in 1987 was very limited, the subsequent lack of governance rendered Liberia fisheries vulnerable to outside influence.

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[159] T. S. Bah." Incursions by industrial trawlers into Guinea's coastal zone at last a sigh of relief from the small-scale fishers of Bongolon". Sustainable Fisheries Livelihoods Programme, seen May 2005. http://www.sflp.org/eng/007/pub1/103.htm. See also M. Diallo, and
C. Breuil, Participatory fisheries surveillance in Guinea: a striking example for others to emulate. http://www.sflp.org/eng/007/pub1/123.htm.

[160] Longhurst, A. 1965. Bioeconomics of the Sciaenids of tropical west Africa. Journal of Conservation CIEM 29:23-114.

[161] Ssentongo, G.W. 1987. Marine fishery resources of Liberia: a review of exploited fish stocks. CECAF/ECAF series 87/45. FAO. 42pp.

9.3.2. Assessment of IUU Losses

In pre-conflict times there was both an artisanal and industrial/commercial fishery (Ssentongo 1987). The artisanal fishery was based upon some 200 registered canoes which caught around 1,000 tonnes of fish annually, centred on small pelagics such as bonga, *Sardinella* species and Carangids. The total number of canoes was probably around 1,200 in 1983 and the last recorded catch was 2,140 tonnes for the total artisanal fishery.

By contrast, the recent re-instated survey for 2003/4 indicates an artisanal catch of 4,966 tonnes. This increase could be a survey artefact although it may well be a real phenomenon. During civil wars, as has been seen in Mozambique and Angola, large numbers of people tend to be displaced from the land in the interior and find their way to the coast where they take up fishing as the only livelihood available to them, which clearly puts more pressure on the inshore stocks. Even in 1987 it was reported that there was conflict between the artisanal fisheries and the licensed commercial vessels, particularly shrimpers, all competing for the same fishing grounds. An increase in artisanal activity due to the civil unrest with complete lack of regulation on commercial vessels would almost certainly increase competition to the further detriment of the artisanal fisheries.

The commercial vessels have typically targeted the demersal species, certainly in the pre-conflict period, relying mainly on the inshore sciaenid assemblage and, judging from the 2004 and 2005 catch records, are continuing to do this. In the pre-conflict era there were some 6 licensed trawlers and 12 licensed shrimp vessels, which were licensed through company agreements. Landings of fish from these companies varied between 4,000 and 9,000 tonnes per year with a total commercial sector catch between 10,000 and 11,000t (Ssentongo, 1987[162]). One source gives a further breakdown of Liberian industrial fishery of 5,500t and foreign industrial fishery of 2,330t. In addition, the valuable shrimp fishery, which had been yielding up to 1,700 tonnes per year in the early 1970's, was still producing around 450 tonnes per year in 1986. There is no indication as to the extent of discarded bycatch but, since shrimp is rarely more than 25% of the actual catch, some estimate for this is possible.

Our survey indicates that current commercial fish catches are recorded as 1,091 tonnes for 2004 and 3,283 tonnes for 2003, i.e. considerably less than in 1980s. The correspondent in Liberia actually estimates that the catches of fish were between 3,497 tonnes and 6,840 tonnes with an additional 187 to 250 tonnes of tuna which was not commented on in earlier accounts.

In addition, between 260 tonnes and 800 tonnes of shrimp were said to have been taken. The total number of trawlers and shrimpers licensed at the moment is 22, a not dissimilar number to the total before the conflict. The correspondent goes on to estimate that totals of commercial catches pre-conflict were between 12,000 and 15,000 tonnes (broadly corresponding to the levels given by Ssentongo (1987[163]), whilst during the war, and up to the present time, catches are around 4,000 to 8,000 tonnes and therefore there is a loss of around 6,000 to 7,000 tonnes of largely demersal species lost to the system and almost certainly taken by IUU vessels. In addition, 70% of catches of licensed vessels were required to be landed in Liberia; therefore there is a loss to the national fish supply. In actual fact the catches given in

[162] Ibid Ssentongo 1987.
[163] Op. cit. Ssentongo 1987.

the official statistics for 2003 and 2004 of 1,091 tonnes and 3,423 tonnes are rather lower than those estimated by the correspondent so losses may be higher, perhaps around 9,000 to 10,000 tonnes per year.

Even so, a comparison with the previous catches may not be sufficient to chart the losses. If there is no regulation there is every temptation for vessels to fish illegally without reference to any catch limits. In what is effectively an "open access" situation it may be more realistic to look at what the potential has been estimated to be since this could be closer to what has actually been taken. In the case of Liberia fisheries a review by Ssentongo (1987[164]) concluded with the following allowable volumes:

All demersals	15,000 tonnes
Sparid demersals	3,640 tonnes
Small pelagics	41,000 tonnes
Tuna – like species	Significant but unknown

With these values in mind the "possible losses" suffered by Liberia from IUU fishing if the full potential has been fished are summarised in Table 20.

Table 20 Assessment of losses due to IUU off Liberia.

	1987 Catch (t)	Present Catch (t)	Prob. Catch Loss (t)	Potential Catch (t)	Potential Loss (t)	Price/t ($)	Probable Loss ($m)	Possible Loss ($m)
Demersal portion	7,000	4,000	3,000	15,000	11,000	1500	4.50	16.50
Small Pelagic	2,100	5,000	-	41,000	36,000	450		16.20
Tuna (national)	?	250	4,250	?	?	1500	6.38	
Tuna (ICCAT)		4,500						
Shrimp	4	500+	100*	800+	100*	8000	0.80	0.80
Total			7,350		47,100		11.68	33.50

*token estimates
+MEY
*MSY

The probable loss due to IUU fishing, which is really a minimum, is therefore equal to $12m, compared to the value of the legitimate catches which are worth about $10m, i.e. almost as much again. The possible losses are high, although it should be said that there is no evidence of large-scale IUU fishing for small pelagics so this could be reassessed, reducing the estimate of the *possible* loss to $17m.

9.3.3. The State of Control and Regulation

The extent of IUU fishing was considered by the correspondent to have increased significantly through the civil war period. It was thought, for the evidence of artisanal fisherman and observers that there could be up to 100 vessels involved in this activity. Until recently, Liberia had no capacity for inspecting vessels. There are now 5 inspectors who sometimes go to sea on licensed vessels. A UN military surveillance plane conducted a 1hr 40min return flight, seven miles (11km) out to sea

[164] Ibid Ssentongo 1987.

and spotted 11 vessels fishing illegally. Given that the coast between Monrovia and Robertsport, the route of the flight, is less than 25% of the Liberia coast line and that 7 miles is only a third of the distance to the edge of the shelf, and also that the correspondent suggested that the southern area tends to be favoured by IUU activity compared to the north where the flight was, the number could well be between 60 and 100.

The general perception is that the illegal fishing is more prevalent in the south, near the boarder with Côte d'Ivoire. There is also a perception that many of the IUU vessels are based in Côte d'Ivoire. It is probably significant that the stated target for IUU activity is shrimp and tuna. Côte d'Ivoire has considerable landings of shrimp of its own therefore it would be easy to conceal those from Liberia. Similarly, Côte d'Ivoire has a tuna canning plant which will similarly create a local demand for tuna. In both cases there is no way of estimating the losses of tuna and shrimp, except that, as the most valuable commodities, there will be losses, therefore some token estimates are put into Table 20 consistent with the levels of catches known to be taken. Significantly, tuna does not feature in the 1987 review and some indication of availability in Liberia waters is given in the reported tuna catches to ICCAT, which are remarkably high (see Section 9.1). During the war it must have been a complete loss although 250 tonnes is currently mentioned from registered vessels. It is probable that the vessels exploiting the Liberian tuna are part of the fleet which fishes all along the West African coast for example, Ghana and part of which service the tuna canning plant in Cote d' Ivoir.

Legitimate vessels have frequently seen non-licensed Korean, Spanish, Greek, Ivorian, Sierra Leone and Chinese vessel fishing, particularly at night. However, the illegal vessels reported by the UN plane were not flying flags.

9.3.4. Capacity and Support

Liberia has no inspection platforms, only 5 inspectors and no VMS. It is essentially defenceless even in peacetime without any proper means of surveillance, minimal fisheries staff and unimproved legislation. It also has no stock assessment capacity to monitor its fisheries to determine their status or how much can be licensed.

The probability of an IUU vessel being caught in Liberia waters is marginal. The support given to Liberia has also been insignificant, amounting $200,000 for the Department for International Development (DfID) livelihood project and $500,000 from the EU for inland fish hatcheries, neither of which were relevant to MCS. A little support in this sector could easily add another $10 million to the value of the fishery sector and also protect the artisanal fisheries.

9.3.5. Comparison with Sierra Leone

Sierra Leone was not part of our in-country enquiries but it shares sufficient similarities with Liberia to make some extrapolation possible. It has a similar structure of fishing although rather more productive due to a much broader shelf in the north and also in its northerly waters, benefiting form the Canary current upwelling system which has Sherboro Island as its southern–most extremity.

Like Liberia, Sierra Leone has also just emerged from a long period of civil strife lasting over a decade when the Government was unable to regulate and benefit from

the fisheries. Before the conflict the fisheries were a major element of the economy. From the last statistics in 1986 there were some 79 registered vessels fishing in Sierra Leone waters, including more than 40 trawlers and 30 shrimpers, apart from purse seine and tuna vessels, many as part of a bilateral agreement with the USSR (Payne and Coutin 1988[165]). Licenses, however, were cheap so this does not necessarily entirely reflect which vessels were fishing in 1986, the total recorded catches were 155,643 tonnes, which has been rising steadily since 1959 (Payne and Coutin 1988[166]). Of this, 40,000 tonnes were from the artisanal sector, mainly sardine-like pelagics with the USSR taking another 87,000 tonnes of small pelagics. Of the 28,222 tonnes of demersals, USSR and other foreign trawlers declared 24,245 tonnes and local trawler companies 2,847 tonnes. Shrimpers produced 1,130 tonnes of shrimp with a by-catch of 550 tonnes of fish. At this time it was estimated that IUU vessels were taking another 10%. An overflight by the Lux–Development (LuxDev) Project during the time of conflict showed a high density of fishing vessels, 33% of which were illegal (Table 17). If the process used with Liberia is repeated, initially assuming that besides the artisanal fishery all the possible catch was being taken by IUU vessels due to the lack of governance, the losses are shown in Table 21.

Table 21 Assessment of losses due to IUU off Sierra Leone.

	1986 Catch (t)	Present Catch (t)	Probable Catch Loss (t)	Potential Catch (t)	Potential Loss (t)	Price/t ($)	Probable Loss ($m)	Potential Loss ($m)
Demersal	28,222=	14,111	14,111	45,096	30,985	1500	21.17	46.48
Small Pelagic	12,6421	40,000	86,421	133,000 *	93,000	450	38.89	41.85
Tuna (ICATT)	?	2,000	2,000	?	2,000	1500	3.00	3.00
Shrimp	1,130		565+	1,400	700+	8000	4.52	5.60
Total			103,097		126,685		67.58	96.93

+assume 50% since inshore and available
*based on biomass estimate of Stromme (1982[167])
= allow 50% as commercial fishery re-emerging.

Therefore, if all recorded catches apart from the artisanal were lost to IUU, this would amount to a loss of $68 million with a potential loss of $97 million. However, it is unlikely that the small pelagics have been taken by IUU which would reduce the probable loss to $29 million. This latter value (26% of total catch value as IUU) is comparable with the LuxDev estimate of around 30% illegal.

Like Liberia, Sierra Leone has very little capacity for MCS. It does have some aged patrol vessels but they are rarely operational, no VMS and a need for trained staff.

[165] Payne, A., I, & P. Coutin. 1988. An investigation into the status of the demersal fish stocks of Sierra Leone. Final Report of the ODA Fisheries Research Programme, London. 289pp
[166] Ibid.
[167] Stromme, T. 1982. Preliminary report on surveys with the R/V Dr. Fridtjof Nansen in West African waters 1981. Paper presentation at the CECAF Working Party on Resource Evaluation, Sixth Session, Dakar, 2-6 February 1982. Bergen Institute of Marine Research

9.4. Angola

9.4.1. Status of the Fishery

Angola has a rather narrow continental shelf which is some 50nm wide in the north, almost non-existent in the central regions and extends up to 12nm in the south. The Southern part of the coast is directly influenced by the Benguela cold current system and, with the domination of coastal upwelling and high biological productivity, has most of the biomass of the fishery resources. The resources in this area are mainly small pelagic species, with a high abundance but with very high seasonal and inter-annual variation. The species diversity is relatively small. There is a strong effect on the Benguela system related to El Niño, which can lead to great changes in productivity; this is reflected in fluctuating fish yields over time.

The northern area, with its wider continental shelf and influence from the warm Angola current, is characterized by higher resource diversity and by a greater abundance of demersal resources. Inter-annual variation is less, as is the biomass of small pelagic fish, due to the generally lower productivity.

The main fisheries resources are conventionally divided into pelagic, demersal and crustaceans, with the pelagic representing 80% of the biomass and the catches, particularly sardinella (round sardinella, *Sardinella aurita* and Madeirian sardinella, *S. maderensis*), horse mackerel (*Trachurus capensis*) and cunene mackerel (*T. trecae*). The demersal fisheries are fairly limited, due to the narrow continental shelf, and mainly target hake. There are also some shrimp fisheries which are located mainly around the outflows of the major rivers. Some tuna is also taken in offshore waters, although this is limited by the fact that Angola lies at the southern limit of tuna distribution. The fishery along this coast, centred on Angola, Namibia and Republic of South Africa (RSA) has historically produced up to 2.3 million tonnes.

Since independence in 1974 Angola has suffered from a long lasting civil war, which ended in 2002 and has caused a considerable destabilisation of government.

9.4.2. Assessment of IUU Losses

Vessels engaged in IUU activities include both those of DWFN and vessels flying flags of convenience as well as national and foreign vessels licensed to fish within the EEZ of Angola. There has been some border hopping from Namibia in the south and Spanish shrimp vessels from the Democratic Republic of the Congo in the north.

As an indication of the scope of the fishery, the EU paid $12.82 million per year, in a third party fisheries agreement with Angola between 3/5/2000 and 2/5/2002, to license 22 shrimp trawlers, some demersal trawlers, 18 tuna purse seiners, 25 surface longliners, some bottom longliners and 2 trial pelagic vessels, in what was termed a “mixed fishery” agreement. Clearly Angola is regarded as a major fishing opportunity by the EU for all but small pelagics. The agreement with EU, however, has been discontinued for 2005 due to non-compliance with Angolan government conditions.

There is a 4nm coastal zone set aside for artisanal fisheries, which commercial vessels, most often shrimpers, regularly intrude into. Angola does have some inspection capacity at sea, although this was much reduced during the civil war. Recently, however, airborne surveillance over a period of 25 days spotted 199

commercial vessels, of which 29 (14.6%) were involved in serious infringements. Whilst this is unfortunately high, it is much lower than levels detected during similar flights in other West Africa countries with no other surveillance resources (see section 9.2), such as Guinea and Sierra Leone where transgressions can be 50 to 60% (see appropriate sub-sections). Of these infringements, the most serious were fishing without a license, fishing with unauthorised gear (e.g. longliners using gill nets), intrusion into the artisanal zone and closed areas and fishing in closed season. Of vessels apprehended between 2003 and 2005, some 13% were fishing illegally without licenses. These were largely national pelagic trawl vessels but also included some Japanese longliners. A further 21% were caught during the closed season which indicates an invalid license and a lack of intention to declare catch.

Out of a total of 231 vessels, the present licensed fleet includes 37 shrimp trawlers, 47 demersal trawlers, 49 purse seiners, 43 tuna long-liners, and 30 tuna purse seiners, giving an indication of the level of effort deployed in the various fisheries.

EU and charter vessels are thought to make up 40% of fleet by numbers and probably account for an even higher percentage of the fishing effort, yet their reported catch is only 23% of the total by volume. This may indicate there is some under reporting, however, most of the EU vessels are tuna long-liners and purse seines which, although licensed to fish in Angolan waters, probably take only relatively low catches there, while most of the non-EU fleet are taking high volumes of small pelagics. The International Commission for the Conservation of Atlantic Tunas (ICCAT) recorded that catches of tuna in the Angola EEZ averaged around 500 tonnes per year, although there have been years when up to 3,500 tonnes have been declared (Annex B, Section 9.1)

Probably most of the unlicensed fishing in Angolan waters is for small pelagics. Our consultant estimates that the 8 pelagic vessels produce 24,000 tonnes of fish filets per year, representing a total unprocessed wet fish catch of 72,000 tonnes of small pelagics (assuming an average conversion factor of 0.33). The illegal catch was estimated to be equal to 13% of this total, although this would increase to 21% if fishing in the closed season is taken into account.

The main problems amongst shrimp vessels seem to be under-reporting, fishing in closed areas and high levels of demersal fish by-catch. The levels of these activities can be estimated by using corrections similar to those used for Mozambique (Annex B, Section 9.6). Unlicensed vessels do not appear to pose much of a problem.

The current breakdown of catches in Angolan waters is not currently available but they have been synthesized from recent FAO statistics.

As shown in Table 22 the probable value of IUU losses to Angola is about $49 million without taking into account loss from sharks and demersals. The levels of underreporting used in these calculations are likely to be minimum estimates. The loss attributed to IUU fishing of small pelagics in Table 22 is a little lower than that estimated by our consultant by a different method, but is of the same order of magnitude. Small pelagics are most commonly targeted by Angolan vessels. There are no indications of quotas or potential optimal yields with which to compare the corrected catches. The estimates above are based on current catch rates. The cumulative losses during almost three decades of civil war must have been enormous. There are no estimates of shark losses but many longliners have been spotted during aerial surveillance with large quantities of shark fins drying. Although ICCAT allows 20% by-catch of shark over a season, the volume of shark fins seen indicates that this was a targeted fishery.

Table 22 Assessment of losses due to IUU fishing off Angola

	Mean Recorded Catch (t)	Including Unreported (t)	Including Unlicensed (t)	Prob. Loss. (t)	Price ($/)t	Loss Value ($m)
National Commercial (reported)	138,844					
Foreign Fleet	32,652					
Shrimp	4,624	5,549*	6,104+	1,480	8000	11.84
Demersal discards			18,312	18,312	750	13.73
Small pelagic	113,856	136,627	163,951x	50,096	450	22.54
Tuna •	280	800≡	880	600	1500	0.90
Shark	?				265	
Demersal	?					
Total						49.02

* allow 20% under–reporting
\+ allow 10% unlicensed national vessel
x allow for 13% unlicensed plus one third 21% fishing in closed season (i.e. one third of year).
• yellowfin 150t plus little tuna 132t
≡ tuna catches indicated for ICCAT records.
Plus 10% for unlicensed

9.4.3. The State of Control and Regulation

Between 1980 and 1994 Angolan waters were patrolled periodically by single vessels. During this period over 100 illegal vessels were arrested and fined. Since 1995 there have been three patrol vessels available. During most of the 1990's however, much of the surveillance effort was disrupted and is only now becoming effective. In 2004 77 hours of aerial surveillance were conducted. 14.6% of sightings during overflights involved major infringements, giving an indication of its relative effectiveness.

The 3 offshore patrol vessels have a 5-6 day endurance limit and normally work within 60-80km of the coast. There are also 7 inshore vessels operating within 6nm of the coast. The sea- going patrol vessels managed 400 surveillance hours in 2004.

There is a total of 241 operational staff in the inspection and observer part of the Ministry. A fisheries Observer system commenced operation in 2001 in co-operation with the SADC MCS programme. The aim of the programme is to have observers on all licensed foreign vessels and on a minimum of 50% of national vessels. In addition, a system of "community observers" has been instigated with a remit to collect catch data and evidence on semi-industrial and industrial vessels fishing within the artisanal fishing zone, which extends to 4nm. There are numerous cases of loss of gear, small vessels and even lives in the artisanal fishing sector as a result of conflict with commercial vessels.

A VMS system was implemented in 1998 which must be installed on all licensed vessels, with the exception of vessels fishing under bilateral agreements or direct agreements with the Ministry. This system is currently being upgraded.

Of the 111 prosecutions in 2004, 39% were for entering a prohibited zone, 5.4% for unlicensed fishing, 6.3% for under reporting and 2% for fishing in a closed season. The low levels of unlicensed and underreporting may indicate a reasonable level of compliance. However, as in other coastal states, the greatest problem, at least amongst inshore vessels, is fishing in unauthorised places. Transhipment is prohibited without agreement of the Ministry.

The higher level of MCS capacity in Angola may reflect not just the productivity of the fishery but also the fact that the country has benefited from consistent third party agreements. For example, in over a decade Angola has received over $130 million from the EU agreements alone, a proportion of which has been reinvested in the fishery.

9.5. Namibia

9.5.1. Status of the Fishery

Prior to independence in 1990 it is estimated that approximately 20 million tonnes of pelagic stocks – sardine, horse mackerel and hake, were caught in Namibian waters by foreign fleets with hardly any benefit accruing to Namibia (Bonfil 1998[168]). This resulted in over exploitation of some stocks, contributing to their subsequent collapse, for example the sardine fishery in the 1960s and 70s.

Since independence, Namibia has pursued a policy of stock recovery aimed at long term sustainability, based on sound scientific information and principles. This has been coupled with a policy specifically aimed at increasing Namibian ownership and employment in the fishery sector. The main instrument for implementing this policy was the introduction of an access rights system and by offering rebates on quota fees depending on the degree of Namibian participation in the operation. The 1992 Sea Fisheries Act provides a complete account of the terms and conditions. The Namibianisation process was further encouraged by the allocation of quota (25% of the TAC) by the Ministry of Fisheries and Marine Resources (MFMR) to newcomer applicants. The importance of the fishery sector to the national economy is considerable: Fishing in Namibia approximates 13% (Lange, 2004[169]) of their GDP, of which hake is the biggest contributor.

Namibia benefits from its juxtaposition to the region of the SE Atlantic influenced by the Benguela current (lying between 14^0S and 37^0S). The region is characterised by eight coastal upwelling cells of cold nutrient rich water and high biological productivity. The seaward influence of the cells extends to 150 to 250km offshore and is the principal environmental factor that supports the large commercial fisheries. There is no artisanal sector which further simplifies management requirements and although the coastline is 1,572km long, the industrial sector is limited to only 2 harbours, which facilitates monitoring of the fishery.

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[168] Bonfil R. 1988. Case Study: distant water fleets off Namibia. In: Distant Water Fleets: an Ecological, Economical and Social Assessment. (R. Bonfil, G. Munro, U.R. Sumaila, H. Valtyson, M. Wright, T. Pitcher, D. Preikshot, N. Haggan and D. Pauly. Eds.). Fisheries Centre Research Report 6 (6), University of British Columbia Vancouver, Canada.

[169] Lange G. 2004. Economic value of fish stocks and the national wealth of Namibia. In: Namibia's Fisheries: Ecological, Economic and Social Aspects (U.R. Sumaila, D. Boyre, M. D. Skogen, S. I. Steinshamm. Eds.). Eburon.

The fishing grounds occur within 100nm of the coastline and are largely found in the northern Benguela ecosystem. There are five major species of commercial importance in the ecosystem:

- Cape anchovy (*Engraulis capensis*)
- Sardine (*Sardinops sagax*)
- Horse mackerel (*Trachurus capensis*)
- Shallow and deep water Hake (*Merluccius capensis* and *M. paradoxu*s)

Until recently, anchovy supported an important fishery, but since the mid 1990s very little has been caught and surveys indicate low biomass (Boyer and Hampton 2001[170]). The collapse of the sardine fishery has been attributed to both excessive fishing and recruitment failure, but recovery measures have not been successful. The mid-water trawl fishery for horse mackerel is currently the largest fishery by volume, with annual catches up to 450 000 tonnes. Juveniles are mainly reduced to fish meal, whilst 60% of adults are frozen whole. Over 90% of the annual catch is exported to regional markets.

Hake is now the most important fishery by catch value. The TAC is split between wetfish and freezer trawlers. Included in the wetfish allocation is 10 to 15% for longline operations. Recent advice regarding the economic status of the hake fishery recommended effort reduction and consolidation of processing effort.

A small line-fishery operates from the shore or from small boats (skiboats and lineboats 5 to 20m in length) operating in inshore waters. These are either recreational or small commercial concerns and their contribution to Namibia's GDP is relatively nominal compared to the industrial sector. The recreational linefish fishery is more economically productive than its commercial counterpart. A survey by Kirchner et al (2000[171]) estimated values of $6.5 million[172] and $8 million respectively.

All vessels - irrespective of nationality - are required to obtain a license in order to fish commercially within Namibia's EEZ. During 2000, a total of 309 vessels were licensed, 80% of which were Namibian flagged. Foreign flagged vessels can only operate in collaboration with a local rights holder and all fish caught by such vessels must be landed in Namibia and counted against the local right-holder's quota for that species. Catch taken by non-Namibian flagged vessels and landed in Namibia is attributed to Namibia rather than to the flag state of the vessel. Namibia may be unique in this regard.

A profile of the fishery has been sourced from statistics submitted to the FAO for 2000. They provide a breakdown of the fishery, the number and type of vessels involved and the respective catches for the fishery.

Demersal fisheries: around 126 wetfish and freezer trawlers (19-77m length), (27 foreign and 99 Namibian flagged vessels) were licensed in 2003/2004. Their principal

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[170] Boyer, D.C. and I. Hampton. 2001. An overview of the living marine resources of Namibia. In: A decade of Namibian Fisheries Science. South African Journal of Marine Science 23:5-35.
[171] Kirchner, C.H., Sakko, A.L. and Barnes, J.I. 2000. The economic value of the Namibian recreational rock-and-surf fishery. South African Journal of Marine Science 22: 17-26.
[172] US$ = 7 N$ approximately; Sumaila 2004, The cost of being apprehended fishing illegally: Empirical Evidences and Policy Implications. OECD, Agr/Fi/IUU(2004)11

target species is hake, caught in deeper water (trawling is not permitted in less than 200 m depth). Twenty-four demersal long-liners (19-55 m length range) also target hake, along with highly valuable kingclip and snoek.

Mid-water fishery: Twenty-six mid-water trawlers in the 62-120 m length range are licensed to fish for horse mackerel. This sub-sector has the largest proportion of foreign flag vessels (12-15 operating at any one time). However of these, at least 8 are wholly owned by Namibian nationals. The total horse mackerel catch in 2000 was 344,314 tonnes.

Tuna fishery: a fleet of 56 tuna vessels in the 6-79 m length range utilising long-line and pole-and-line gear are licensed to target albacore (*Thunnus alalunga*), bigeye (*T. obesus*), swordfish (*Xiphias gladius*) and skipjack (*Katsuwonus pelamis*). Pelagic sharks are also taken. Some 2,000 tonnes of tuna species and 290 tonnes of swordfish were landed in 2000.

The remainder of the licensed fleet is engaged in smaller but valuable fisheries for orange roughy, rock lobster, deep sea crabs and pelagics. There are a small number of Namibian flagged purse seiners licensed to fish Angolan waters targeting sardinella (*Sardinella aurita* & *S. maderenesis*) and horse mackerel.

Overall, Namibia lands in excess of 600,000 tonnes of fish per annum. Approximately 98% of production is exported in various product forms to European Union (in particular, Spain, France, Italy, Holland and Portugal), the US, south-east Asian markets such as Japan, as well as regional markets within SADC. Europe is comparatively the most important destination for Namibian fish. EU import data for 2002 shows that Namibia is the top supplier of hake into the EU, with 69,099 tonnes, worth N$ 1.71 billion ($259 million) – ahead of South Africa, Argentina, Spain and Chile (in that order). The total value of Namibian fisheries in 2000 was estimated by Lange (2003[173]) at $N3.2b ($457 million), a remarkable 39% increase in value from 1995, and our calculations based on assumed fish prices put the current landed value at about $530 million.

There is no bilateral agreement with the EU but Namibia participates in fisheries management locally and globally through it's involvement in Regional Fisheries Management Organisations (RFMOs) as a contracting party to Southern African Development Community (SADC) Protocol on Fisheries, International Commission for the Conservation of Atlantic Tuna (ICCAT), Commission for the Conservation of Marine Living Resources (CCAMLR) and the South East Atlantic Fisheries Organisation (SEAFO) which has its headquarters in Namibia.

[173] Glenn-Marie Lange 2003. The value of Namibia's commercial fisheries, DEA Research Discussion Paper Number 55 February 2003, Directorate of Environmental Affairs, Ministry of Environment and Tourism, Private Bag 13306, Windhoek, Namibia Tel: + 264 (0)61 249 015 Fax: + 264 (0)61 240 339 email: contact@dea.met.gov.na http://www.dea.met.gov.na

9.5.2. Assessment of IUU Losses

The historic incidence of IUU activity prior to independence primarily occurred under the stewardship of ICEASF with European DWR fleet the main perpetrators.

Following the declaration of an EEZ there was few resources to enforce national jurisdiction and as a result IUU activity continued offshore. The government's initial response through diplomatic channels proved ineffective, so air surveillance was deployed, resulting in the arrest of 12 Spanish and 1 Congolese registered trawler. This successfully demonstrated to the international community Namibia's commitment to protecting the resource and had the added value of creating a deterrent effect.

Since these initial arrests there has only been one further reported incident of unlicensed fishing activity: in 1999 the F/V Roselyn, a large pelagic vessel was intercepted but escaped.

Other recent IUU activity in Namibia has tended to be confined to contraventions of technical and conservation measures, for example gear infringements and fishing in controlled areas. Between 1996 and 2001, 14 infringements of this type were detected, resulting in average sanctions of $3,898. The trend in demersal and midwater fisheries over the past ten years had been a reduction in violations, with no clear trend in the pelagic fishery, although it is generally considered to be low based on number of violations (0.5) per inspection. Observer data confirm these trends. In the demersal fishery there were 3 violations recorded per 100 observer days in 2001 (Berg and Davies 2004)[174]. The total lost revenue to IUU is therefore very low, probably less than $100,000.

There is, however, greater concern for the propensity for under reporting. Weaknesses were identified in the inspection phase of the landing process during reviews of the systems used in separate studies by Blondal in 2000[175] and Iversen and Gilja in 2001[176]. They concluded that the systems would encourage under reporting and led to inaccuracies for calculating revenue generated. Blondal estimated that $106,400 was lost in bank interest in 1999 alone. If this figure is representative, an extrapolation to the period since independence gives a total of $1.6 million, but this is speculative and may be an under or over estimate.

A recent trend of large catches of small fish in the hake trawl fishery accompanied by reports of high grading and dumping of small fish raised concerns of under reporting, however, these have now been mitigated. In addition to the 110 mm stretched mesh size limit on the codend, trawler operators are now required to deploy excluder devices on their nets to minimise both the catch of small hake and bycatch of other species. In addition, bycatch limits are enforced on species such as monk and kingclip, which if exceeded, incur high levies (dumping is not permitted). The observer programme also provides 67% coverage and there are only nominal reports of infringements (see above).

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[174] Berg, E. P and Davies, S. 2004. Against All Odds: Taking Control of the Namibian Fisheries. In: Namibia's Fisheries: Ecological, Economic and Social Aspects (U.R. Sumaila, D. Boyre, M. D. Skogen, S. I. Steinshamm. Eds.). Eburon.

[175] Blondal, J. 2000: Report on Namibia's Fisheries Information System. Ministry of Fisheries and Marine Resources, Windhoek.

[176] Iversen, F and Gilja, A. 2001. Internatl report on landings routines and management of landings data. MFMR, Windhoek, 37pp. Quoted in Berg & Davies, opp cit.

9.5.3. The State of Control and Regulation

In 1991, the responsibility for implementing MCS became the responsibility of the newly established Ministry of Fisheries and Marine Resources (MFMR). Historically, the legal framework for supporting fisheries management has existed and has been recently enhanced by the Marine Resources Act 2000. Therefore emphasis was put on accruing capital assets (surveillance platforms, infrastructure development/improvements and strengthening fisheries institutions through training programmes using external expertise e.g.

- Fisheries Inspector and Observers Course (9 months duration);
- Commercial Sampling Programme for Fisheries Observers (3 x 2 weeks);
- Cadet Programme for patrol boat officers (4 years);
- Scientific Technical Assistance course (6 months).

The cost of developing MCS capacity and capability in Namibia has benefited from participation in the EU funded SADC MCS programme but initially from bi- and multi-lateral assistance. This has culminated in 3 dedicated fisheries patrol vessels; aerial surveillance (Cessna F406) providing an annual average of 500 hours coverage; a vessel monitoring system (VMS) and a reporting and information infrastructure. By October 2002, monitoring and surveillance coverage was provided by a dedicated staff of 353 individuals

However, there remain areas for improvement. To improve the deterrent value of prosecutions the sanction administered by the judiciary should reflect the value of the benefit of illegal activity. The main problem appears to be the lack of awareness by the judiciary of the importance of illegal fishing. This could be simply remedied by conducting sensitisation exercises.

A review by European Bureau for Conservation and Development (EBCD) and GOPA in 1996[177] noted that the fisheries reporting and information system was not compatible for monitoring and surveillance outputs. This precluded compilation and subsequent analysis for the evaluation of performance. Such an exercise would contribute to more cost effective and efficient monitoring and surveillance operations. A solution could be provided by a distinct system for MCS purposes.

The costs for the MCS operations compare favourably with the revenue generated by the fishery. The revenue raised in 1999 and 2000 was N$109 million ($16.5 million), 77% of which came from quota fees, 7% from bycatch fees, 11% from the Marine Resource fund and 5% from the Fisheries Observer Fund levies (Lange 2003[178], Wiium & Uulenga 2003[179]). This is a relatively small percentage of the overall value of the fishery (i.e. about 3% of $500 million), although it is estimated to be about 20% of realised rent, calculated here as the catch value minus industry operating costs, including normal profit, due to the industry[180] (Lange 2003[181]). During the same period

[177] EBCD and GOPA. 1996. Feasibility study for SADC monitoring control and surveillance of fishing activities. Project No 7. AVCP RPR 484: Windhoek.
[178] Op. cit. Lange 2003.
[179] Wiium, V. H. and A.S. Uulenga (2003) Fishery management costs and rent extraction: The case of Namibia. In: *Costs of marine fisheries management.* Schrank, W.E., R. Arnason and R. Hannesson (Eds.). Ashgate Studies in Environmental and Natural Resource Economics.
[180] See Section 5.3 for further discussion of resource rent.
[181] Ibid. Lange 2003

the average MCS cost was N$40 million ($6 million), 37% of total revenues. Within this, the cost of the observer programme was N$20 million ($3 million).

In 2001 and 2002 MFMR utilised 72% and 76% of the revenue generated from industry for fisheries management of which 42% was used for MCS purposes. This can be broken down into the following components:

Patrol vessels	32%
Land inspections	29%
Observer coverage	23%
Recreational fishery and air surveillance	8%

Analysis by Berg and Davies (2004) demonstrated that the level of compliance was positively affected by the allocation of financial resources.

Namibia has been proactive in collaborative management with neighbouring states: The first joint fisheries-surveillance operation between South Africa and Namibia took place in early December 2004. It was organised and funded by SADC's MCS programme. During the patrol in South African waters, a total of 16 vessels were observed, of which six were inspected and two were fined. Infringements included one expired licence and carrying nets of incorrect mesh size. This was the first time that licensed fishing vessels have been inspected off-shore by South African inspectors.

An earlier joint patrol in Angolan waters, took place in April and May 2004. During that voyage, 19 vessels were inspected and six were seized for serious infringements of Angolan fisheries laws.

9.6. Mozambique

9.6.1. Status of the Fishery

With the exception of the tuna fishery, fishing off Mozambique takes place within about 15-20nm of the coast. This is largely carried out by joint venture fishing companies (between large foreign companies and the state as a major share holder), national fishing companies or by national license owners with chartered vessels on short term contracts. The EU briefly had a tuna agreement with Mozambique in 1992-93. This was re-established 2004-2006. The tuna fishery is probably contiguous with that of neighbouring Tanzania. There is some demersal and artisanal fishing over the St Lazarus bank in the north, where there have also been some incursions by artisanal boats from Tanzania and Comoros. There is no significant fishery for small pelagics.

The fishing is largely for shallow-water shrimp which is commercially regarded as the most important in Mozambique. There is some demersal fishing in this area and, more recently, long-lining for sharks both illegally by foreign vessels and legally by local fishers to supply local foreign buyers.

To the south of the Save River, where the shelf again becomes narrow, there is some fishing for tuna and also for deepwater prawns (gamba) and crayfish. Most interest in these fisheries is local, with little interest, to date from foreign operators. Also in this region is the national park of Bazaruto, a 10nm reserve around the

Bazaruto Archipelago, and the Quirimbas Marine Reserve also with surrounding protected waters.

The tuna fleets follow the tuna when migrating through the EEZ of Mozambique not only along the coast but also offshore according to temperature zones and local currents.

9.6.2. Assessment of IUU Losses

The major IUU problem in Mozambique is thought to be with licensed vessels not declaring or mis-declaring their catches. This is certainly true for trawler/shrimp vessels, although unlicensed vessels accounted for 21% of infringements detected between 1999 and 2004. This, however, is only for shrimpers since there is no capacity to intercept or inspect vessels further offshore in the tuna fishery. The current numbers of licensed vessels and catches, from 2000-2004 are shown in Table 23

Table 23 Mean catches, vessel licenses and quotas for the shrimp fishery in Mozambique 2000-2004

	Mean number of vessels Licensed	Mean Annual Catch (t)	Mean Quota (t)
Shallow w. shrimp	52	7470	8977
Deep w. shrimp	21	493	2424
Tuna Purse Seine	34	3265 (5176)	29300*
Tuna long-line	56		(40800)+
Artisanal shrimp		1733	-
Demersal	?	?	?

* Based EU 8000t and others 21,300t (2000-2003)
+ Based on £300+ per vessel x 136 vessels = total number of tuna vessels, i.e. purse-seine + long liners (2004).

Approximately 80% of vessels in the shallow water shrimp fishery are “national”, i.e. operated through Mozambique joint ventures. Up to 14 nationalities may take part in the deepwater shrimp fishery, without any one being particularly dominant. The tuna purse-seine fishery is dominated by EU vessels (currently 18 Spanish and 15 French) accounting for 61%, and Seychelles with up to 18 vessels licensed. Japan dominates the tuna longline fishery with 60 vessels licensed in 2004 (73%); Spain had 8 and China also had 8.

To assess the IUU losses in the shallow water shrimp fishery we need to consider both the catch of the unlicensed vessels (21% by number of vessels) and underreporting of catch (estimated at 20%) by licensed vessels (Klepsvik 2005[182]). In addition, there is a loss of demersal fish due to discarding that may be as high as 75% of the catch. The commercial valuable fish in the bycatch are not discarded, and some of the small none commercial fish are collected by artisanal fishermen but with uncertain reporting. The losses due to bycatch are therefore difficult to estimate.

[182] Klepsvik (2005) Report of a short term mission to Mozambique on the Impact of IUU fishing. NORAD/CDCF, Bergen. 21pp.

Since there is no check on offshore tuna vessels there is no indication of ratio of unlicensed vessels or of the degree of under-reporting. A derivation of the losses is shown in Table 24.

Table 24 Assessment of losses due to IUU fishing off Mozambique

	Mean Recorded Catch (t)	Including Unreported (t)*	Including Unlicensed (t)+	Prob. Loss (t)	Price $/T	Loss Value ($m)
Shallow water shrimp	7470	8964	10846	3376	8000	27.01
Demersal discards x				10128	750	7.60
Tuna(national) Tuna (IOTC)	3265	5176	5389	2124	1500	3.19
Shark	?					
Total				15628		37.79

* allow 20% under reporting Klepsvik (2005)
+ allow 21% unlicensed/unreported
x allow fish/shrimp 75%-25%

There is no information on demersal catches and therefore no estimate of losses due to IUU fishing. Also, the losses in the tuna fishery are purely an order of magnitude and there are no data for shark. It should be noted, however, that the unlicensed and unreported catch in the shrimp fishery (Table 24) that this takes the probable total catch well over the quota given in Table 23.

The total value of the Mozambique catch in 2004 was $272 million, consisting of $60 million from the “industrial fishery”, $36 million from semi-industrial and $176 million from the artisanal. This corresponded to a catch of 91,297 tonnes from the industrial fishery, including 18,510 tonnes of kapenta from the Cahora Basa dam, and 64,341 tonnes from the artisanal fishery. Removing the freshwater component reduces the total value to $209 million.

Regarding revenue received by the Mozambique Government from license sales and other sources, in 1992-93, the EU paid Mozambique the equivalent of $300,000/year to license 42 tuna purse seiners, which is close to the number currently operating. The current agreement with the EU covering the period 2004-2006 provides the equivalent of $4.95 million to license 35 purse seines, 14 longliners and 10 deepwater shrimp trawlers. Other licensing arrangements for foreign tuna vessels bring in a further $1 million per year.

9.6.3. The State of Control and Regulation

The waters of Mozambique are subject to IUU fishing from DWFN and cross-border hopping from neighbours although the former is by far the most important. The country has a total of 57 inspectors distributed along the coast and they have profited from training under the EU SADC MCS project, which has also provided with some basic kit. The inspectors go to sea onboard the industrial or semi-industrial vessels for up to 30 days and may transfer at sea to the increase surveillance coverage. This, together with the willingness of those who have paid for a license on the shrimp grounds to provide reports, gives a reasonable surveillance of unlicensed vessels on these grounds.

Under-reporting still appears to be prevalent. The observers will sometimes go aboard mother ships since transhipment at sea takes place and, in fact, has increased on the Sofala Bank particularly after the introduction of a 3 month closed season in 1999 and the trawlers that would visit port once a month now stay at sea for up to 6 months and largely fish continuously.. The job of the observers is thus much more difficult and there is an increased reliance on data submitted on vessel logbooks. The situation has been exacerbated by the increase in the protection zone for the artisanal fishery from 1nm in 1987 to 3nm in 1997 and to the whole coast in 2004. Industrial and semi-industrial vessels feel that prime shrimp grounds are within 2-4nm of the coast. These measures have increased non-compliance.

As mentioned previously, the most common infringements are not lack of licenses but fishing in the wrong place, i.e. encroaching in the artisanal zone, or at the wrong time, i.e. inside the closed season. There are also frequent incidents of licensed vessels abusing their status and using unauthorised gear. For example, two foreign vessels were recently apprehended which were licensed as tuna long-liners but were caught using gillnets for shark. The use of gillnets in this way also has the added danger of high levels of turtle by-catch.

There have been several incidences of IUU foreign vessels fishing in protected areas, particularly within the waters of the Bazaruto and Quirimbas National Parks. On two occasions, one in 2005, a number of vessels were sighted by the Navy and provincial officers in the waters of Bazaruto Park, and on both occasions the authorities were fired on with small arms from the vessels which subsequently escaped. A photograph has also been obtained of a registered EU purse seiner in Quirimbas, as shown by the GPS in the same frame. Anecdotal information from residents indicate that this is a regular occurrence.

To deal with these area transgressions, the country has introduced a VMS system. Currently some 67 Mozambican vessels out of 88 have installed a blue box with Inmarsat-c and all third country vessels will be obliged to comply by 2005 particularly tuna and gamba vessels.

Mozambique has instigated port state control measures and has intercepted several vessels from South America and Europe attempting to launder catches of toothfish from the Southern Ocean (CCAMLR Area) with volumes of 102-180 tonnes seized.

Mozambique has no inspection platforms, although it does have plans to purchase some. As a result, the offshore tuna fishery is currently virtually uncontrolled.

9.7. Kenya

9.7.1. Status of the Fishery

The Kenyan EEZ lies within the northern gyre of the Indian Ocean System. It has a 640km coastline consisting of a relatively narrow shelf forged with coral reefs and mangroves which occur around river outflows. The only area of trawling is in the North Kenya Bank apart from some trawling for shrimp takes place in Malindi and Ungwana Bays.

The Kenya fishing zone is influenced by the seasonal change in current systems which carry pelagic fish stocks onshore and northward during the SE. Monsoon (May to October) and southward offshore during the NE Monsoon (November to April).
The whole of Kenya's fisheries is said to have a potential for 115,000 tonnes of catch, although at present the recorded catch is around 7,000 tonnes. Although the sector is currently regarded as small it is estimated to employ 27,000 people with a further 60,000 in secondary employment. There may be up to 12,000 small boats in this fishery, the majority of which are in the national artisanal sector taking a mixture of demersal and reef species along with some lobster and shrimp. The offshore resources are thought to be considerable since Kenya, like all the East African tropical coastal states, is in the main Indian Ocean tuna belt.

There is a small commercial fishery for shrimp in the bays mentioned above but no national effort in the offshore tuna fishery. Although some transhipment does take place in Mombassa, the majority occurs at sea and is not recorded. Current and potential catches for tuna are largely unknown.

9.7.2. Assessment of IUU Losses

It is reported by our correspondent that there are likely to be up to 200 DWFN vessels fishing in Kenya waters, only 40 of which are licensed. Presumably these 200 vessels refer to the international fleet of tuna purse seiners and longliners habitually fishing across the Indian Ocean, including neighbouring territories. The fishery is described by our correspondent as virtually 'open access' with no inspections, no VMS, no observers, no proper fishing agreements and only a nominal licensing system with no catch reporting. The IOTC records an average of almost 1975 tonnes of tuna taken from Kenya waters whilst the recorded catch from Kenya is 163 tonnes of skipjack and no yellowfin, whereas the IOTC ratio is around 60% yellowfin. It remains to be seen how much of this essentially purse seine catch is illegal, i.e. unlicensed, but the temptation to under report or misreport to IOTC fishing from within the EEZ as originating from outside must be great, so up to 50% misreporting in the Kenya zone should be allowed. IOTC reports indicate that the Kenya licensing system does not pay proper regard to its considerable national resources.

There are 4 shrimp trawlers operating in Kenya but there is little indication of major illegal activity on what is essentially a minor resource here.

The overall assessment of IUU status is shown in Table 25.

Table 25 Assessment of losses due to IUU fishing off Kenya

	Mean Recorded Catch (t) (National)	Mean Recorded Catch (t) (IOTC)	Including Unreported (t)	Including Unlicensed (t)	Probable Loss (t)	Price/t ($)	Nominal Probable Loss ($m)
Tuna	163	1,900+	2,063	2,104*	1,941	1,500	2.91
Shark	171•		513	N/A	392	265	0.91
Shrimp	530		Low	Low	Low		neg.
Demersal	1,946		?	Low	Low		neg.
Bêche-de-mer	789≡		?	N/A	?		?
Total	3,599						3.82

+ Allow another 50% misreported
* Allow 40 licensed vessels are purse seiners and very little illegal long-line catch (2%)
• Assume treble tuna catch from re-directed long-liners etc.
≡ Allow 10% for dried product.
neg. = negligible

Although the losses of $3.81 million appear small in comparison with other coastal sates, they still amount to 20% of the nominal value of presently exploited resources.

9.7.3. The State of Control and Regulation

A major issue for Kenya will be to take control of its offshore resources. Until recently Kenya had virtually no MCS capacity and only a nominal licensing system. There were some port inspections in Mombassa although very little of the tuna passes through there. Recently, however, Kenya has obtained 3 coastal patrol vessels, has committed to the installation of VMS, become a paid-up member of Indian Ocean Tuna Commission (IOTC), has committed to a full catch-reporting scheme, is a member of Southwest Indian Ocean Fisheries Commission (SWIOFC) and has ratified the UN Highly Migratory Species agreement. As yet Kenya has no third party fisheries agreements although some preliminary discussions have begun with the EU.

9.8. Somalia

Somalia was not the subject of a specific case study. However, the information obtained from various other sources, including the Kenya case study, clearly indicates that there is considerable IUU fishing for tuna (offshore) and probably also shrimp. Until 2003 the EU purse seine fleet reported catches in Somali waters to IOTC, which amounted to about 90,000 tonnes. There are almost certainly other IUU activities; Annex A identifies allegations of shrimp and groundfish trawling by unlicensed vessels crossing the EEZ boundary from Kenya, and by many (700 in one FAO estimate) foreign vessels of a wide variety of flag states.

We have not been able to substantiate these reports, or make a quantitative estimate of losses. Kenya reports about 500 tonnes of shrimp caught annually and assuming

a similar quantity for Somalia would give a total IUU value of about $94 million. If all the reports in Annex A are taken into account this would seem to be a very conservative estimate.

Somalia has no coordinated MCS. Several reports are given in Annex A of arrests made by militias, and reportedly DWFN vessels do not approach within 40km of the coastline, although the EU purse seine fleet on a number of occasions have paid "licence fees" to a number of militias for rights to fish. However, the militia reach does not extend offshore to the tuna grounds. Furthermore, there are multiple reports of IUU vessels carrying arms in Somali waters and using them to avoid control even by the militia vessels inshore. Therefore, to all intents and purposes Somalia, like Liberia, does not have any MCS capability.

9.9. Seychelles

9.9.1. Status of the Fishery

The Seychelles islands lie just to the south of the equator at the boundary of the southern gyre of the Indian Ocean, and which also incorporates the Nazareth and Saya de Malha Banks. As such, the most important fishery is for tuna, predominantly yellow fin, skipjack and bigeye with some albacore. Other large pelagic species are also taken such as swordfish and marlin. The combined measured catches of purse seines and longlines were 407,684 tonnes and 6,273 tonnes in the record year of 2003, giving a total of 413,957 tonnes. The total catch of the purse seine fleet in 2003 (407,684 tonnes) was said to be $407 million which amounts to $1000 per tonne of tuna.

It is important to note that the total catches reported above are not all taken in the Seychelles EEZ since many vessels which may have been fishing outside the EEZ land their catch at the main port Victoria. Our correspondent recorded the declared catches for the EEZ over 2003 and 2004 to be 90,024 tonnes and 58,250 tonnes respectively with 2003 giving not only the highest catches ever in the Western Indian Ocean but also within the EEZ. The lowest catch within the EEZ was 1998 at 23,539 tonnes.

Amongst the purse seine fleet the Spanish predominated with 43% of the catch and France at 26%. Seychelles flagged vessels are the only other major player in this fishery, with 31% of the catch. There are currently 48 longliners in this fishery. FAO statistics indicate 80,000 tonnes of tuna were taken by Seychelles in 2003, about 20% of the catch, and roughly equivalent to the total catch taken by all vessels within the Seychelles EEZ in that year. Thus, in terms of calculating the total value of all fisheries in the Seychelles EEZ, estimates based on the declared catches by Seychelles are likely to be fairly accurate.

In the longline fishery there can be up to 415 vessels registered, with Taiwan, Japan and South Korea predominant. In 2003 92% of longline vessels returned a logbook but in 1998, when 199 vessels registered, only 63% returned logbooks. In 2001 this level was only 26%. This demonstrated how tuna vessels often pick up licenses within an ocean system, to maximise their opportunity for access, but may not necessarily enter all EEZs depending upon opportunities elsewhere.

There is also an artisanal fishery for which the catch has been relatively stable for some years with catches ranging from 5,781 tonnes in 1991 to a low of 3,334 t ones

in 1998. The most important element of this is the trevally which can account for 30%, the remainder are a mixture of demersals, reef fish and associated pelagics.

A recent development is the emergence of a fishery for sea cucumber (bêche-de-mer) which is currently producing 129,421kg at a value of SR2.1.million ($399,000).

9.9.2. Assessing IUU Losses

The Seychelles industrial fishery is extremely valuable. It is currently earning over SR300 million $57 million regularly for all aspects, including licences (SR39 million; $7.4 million) and revenue from the 88% of the tuna catch landed in Victoria. It also contributes over 90% of national exports and amount to over 35% of GDP. With the exception of EU vessels all licenses are at a flat rate. EU vessels pay an additional rate when catches exceed 40,000 tonnes. There is an incentive, therefore, to declare catches below this although the amount payable per ton is quite low. The EU alone has paid at least Euros 35 million ($44.1 million), over the last decade for access rights.

The high proportion of landings in Victoria has enabled port inspectors to inspect virtually all foreign fishing vessels, even on weekends and public holidays. Under-reporting is therefore difficult. Patrolling at sea is irregular but is greatly assisted and targeted by information from local fishers. Of the 33 cases of IUU acts in recent years, 13 were the result of information received. Of the 13, since 1994 apart from 8 vessels in that year, no purse seiner has been without a license with the one recent exception of an Iranian vessel. Illegal fishing can probably be taken as minimal by purse seiners whilst perhaps allowing 10% for under reporting.

Transhipment at sea is not permitted but losses through such illegal actions are not unknown. It is largely longliners or artisanal Sri Lankan vessels that have been caught. Longliners make a limited contribution to the overall catch, around 15%. It could be estimated, therefore, that around 10% of longliners might be unlicensed from the numbers apprehended. The capacity of the Sri Lankan vessels is very limited and, in any case, their incursions seem to have been reduced as a result of a memorandum of understanding (MOU) signed with the Sri Lanka government. The longliners might also be taking shark. Some illicit action in the bêche-de-mer fishery has also been noted by Sri Lanka, Madagascar and Seychelles fishers, although these inshore vessels are probably the easiest to observe.

Table 26 Assessment of losses due to IUU fishing off the Seychelles.

	Mean Recorded Catch (t)	Including Unreported (t)	Including Unlicensed (t)	Prob. Loss (t)	Price/t ($)	Loss Value ($m)
Tuna	74,137	81,550	81,550	7413	1000	7.41
Bêche-de-mer	72.3	80	88	15.7	1,500	0.02
Shark +				169+	385	0.06
Total				7598		7.5

+ From BIOT, allow shark 3% of tuna longline catch.

What the values in Table 26 show is that when allowing for no illegal fishing from the purse seiners and only a modest amount of under reporting, around 10%, the volume of this extremely valuable commodity means losses are very sensitive to this factor.

Thus, although careful checks are done in part, if purse seine vessels under report by only 10%, Seychelles looses over $17 million annually. Generally, however, the fishery is quite tightly regulated, largely because so much is landed and inspected in Victoria.

9.9.3. Status of Control and Regulation

Seychelles is a member of IOTC and IOC and has signed up to all the major maritime and fisheries conventions. It has a number of formal fishing agreements with the EU, Mauritius, Taiwan Deep Sea Tuna Association, and Japan Tuna. The licensing has strict reporting, VMS and catch reporting requirements.

In recent years Seychelles has earned around $10 million per year in license fees alone out of annual fishery revenue of around $100 million. The personnel engaged in MCS in Seychelles is quite limited with around 12 in total associated with the fisheries monitoring centre, including 3 inspectors and 2 license administrators. Inspections at sea are limited but all vessels coming into Victoria, which includes the purse seine fleet, are inspected.

Capacity for sea patrols and aerial surveillance are limited to use of coastguard vessels, but are highly targeted. A major feature of the surveillance system is local island residents and licensed fishing vessels. This stakeholder participation is publicised and promoted. As a result virtually all arrests are as a result of alerts by stakeholders followed by targeted interception by coastguard vessels.

Seychelles now has VMS and feels that this has offered considerable improvement since all local and foreign licensed vessels must comply. The VMS has already successfully led to the apprehension of IUU activity by longliners. However, the VMS was also involved in a recent apprehension of an Iranian purse seiner and the most frequent violations are still by local and Sri Lankan small vessels.

9.10. Papua New Guinea

9.10.1. Status of the Fishery

Papua New Guinea (PNG) comprises the eastern half of the worlds largest tropical island plus an archipelago of further 600 islands lying between approximately 1^0 to 12^0S and 141^0-157^0 E in the Western Pacific Ocean. It has a total coastline of approximately 17,000Km and an EEZ variously estimated at 2,437,480 km^2, 23 million km^2 or 3.12 million km^2. There are some coastal deltas but much of the coast, particularly around the island, has fringing coral. The shelf is quite well developed in some areas, particularly in the Torres Straits between PNG and Australian.

The extensive coastal area supports a rich artisanal fishery which produces around 26,000t annually and employs between 250,000 and 500,000 people. The artisanal catch is thought to be made up of 30% coastal bay, lagoon, and reef fishes; 10% pelagics with the remainder being crustacean, molluscs other invertebrates and seaweed. It has been valued at $20 million based on a typical price to consumers. There is also a PNG domestic commercial fishery which includes, in order of commercial value, shrimp, bêche-de-mer, sashimi grade tuna, lobster, trochus and other shells, sharks, demersals and coastal pelagics. The prawn fishery largely

takes place in the Gulf of Papua, where there is shallow water and a riverine inflow, and two other main grounds. This fishery is fairly heavily regulated and recent catch reductions are due to effort reduction regulations. Catches average over 4000mt. per year and exports are worth about USD 5.9 million.

Bêche-de-mer (BDM) production peaked in 1991 at 700t dry weight (7000t green weight) but has reduced to a lower level. By far the biggest resource in the EEZ of PNG is for tuna, which is said to have a potential yield of 300,000-400,000t/yr. Currently catches average around 110,000mt of which 85,000 is taken by foreign registered vessels. There are both purse-seiners and long-liners in the tuna fleet. The foreign fleet often tranship onto reefer vessels in the PNG ports of Wewak, Manus, Kavieng, Rabaul, Lae and Madang for shipment to canneries in Thailand, Philippines and American Samoa.

There has also been a dramatic expansion in the long-line fishery for shark. From the mid-1990's to 2000 the amount of shark landings from long-liners grew from less than 200t to at least 1685t of frozen shark meat and 125t of shark fin. Figures for 2001 were 1420t and 141t respectively. In 2000 the domestic longline fleet was landing as much shark as tuna, indeed vessels licensed for tuna fishing were actually targeting sharks. This lead to the development of a shark fishery management plan and the direct licensing of a limited number of domestic vessels for shark fishing..

PNG is now establishing a formally licensed fishery for shark with a national TAC. The TAC has yet to be formalised but will likely be set at around 1500t dressed weight, which is additional to the 20% bycatch allowance in the tuna longline fleet. Shark exports are worth approximately $1.2million to PNG.

The extent of unreported or under recorded and discarded bycatch in the tuna purse seine fishery has been a problem. However, fisheries observer data now allow estimation of bycatch quantities for all vessels.

The contribution of the fishery sector to GDP is $48.77 million or approximately 1.4% of the total. The gross value of the fisheries output, estimated in 1994, was USD98.5million although this excludes the 85,000t tuna taken by foreign vessels.

9.10.2. Assessing IUU Losses

The major concerns of IUU fishing in PNG include the following:

- illegal access by Indonesian vessels (trawling and line fishing) into the area of the PNG EEZ in the Torres Strait known as the dogleg;
- cross border incursions by Indonesia vessels on the north western boundary of the PNG EEZ;
- a reported unlicensed cross-border trade with Indonesia in live aquarium fishes; and
- illegal access to the fringes of the PNG EEZ by unlicensed open register vessels (vessels not on the FFA Regional Register).

The main IUU fishing issue in the PNG EEZ is the incursion of multi-method small Indonesian vessels engaged in trawling, netting and line fishing. These vessels are probably in competition with the artisanal and local commercial fishery for demersals and possibly shark. Of the 65 intercepts made in PNG waters in 2004, 83% were of Indonesian vessels. Of these, 5 illegal Indonesia boats were arrested, i.e. 8% of the

total. It is estimated by the NFA that only 5% of illegal vessels are detected by the fishery patrol. If this is the case then the total number of illegal Indonesian vessels would be at least 100. Assuming a catch of 150t per vessels per year this would amount to an illegal catch of 15,000t per year of largely demersal fish. A proportion of these may be shark boats, possibly about 8%. Such vessels might produce10t of shark product per trip, although potentially considerably more. If only the fins were taken (say 2% body weight), then this could amount to 4000t of whole shark.[183]

As described above, a targeted shark fishery has also developed within the tuna longline fleet. It is estimated that about 10% of longline effort is targeted at shark. Log sheet data for trips targeting shark suggested that around 300t of shark is taken per year. However, if we take the total reported export of shark meat and apply a conversion factor of 1.8, this gives a total green weight catch of about 2500t per year. This suggests there is an unreported catch of around 2200t per year. In addition there will be a small catch of shark, around 3%, from longline fishing that is not targeted at shark, i.e. about 40t. The total unreported shark catch may therefore be as much as 6200t.

Amongst the major tuna purse seine and shrimp fisheries there is probably very little illegal unlicensed fishing due to the relatively good compliance of these fleets. There are, however, concerns about under-reporting, including from the purse seine fishery, which primarily include:

- Under-reporting of purse seine tuna catches;
- Under-reporting of purse seine by-catch;
- Under-reporting of tuna longline by-catch
- Under-reporting in the shark longline fishery;
- Under-reporting in the bêche-de-mer fishery

The purse seine tuna fishery is by far the largest fishery in the EEZ producing around 130,000t per year from some 105-128 licensed vessels, although with occasional peaks over 260,000t. The catch is approximately 70% skipjack and the vessels most commonly operate under access agreement with Taiwan, Korea, the Philippines, China and domestically based foreign vessels.

The extent of under-reporting by the purse seine fleet is difficult to asses. Our consultant quoted senior management estimates from PNG ranging from 2% to 25%. However, the problem is perceived to be declining and it would seem likely that given the log book coverage, the part inspections and the risk to such valuable vessels that, in line with most larger purse seine fleets, compliance is reasonable and down more towards the 2% of the spectrum as it appears to be in the Indian Ocean. Perhaps 4% could be allowed for this.

The long line tuna fishery has averaged around 620t/yr from around 30 locally licensed vessels, including locally based Taiwanese vessels. Until relatively recently it was suspected that under-reporting was a major issue when the logbook catch amounted to only 10% of the equivalent export of derived tuna products. However, by 2001 this had risen to 71% thus leaving around 30% as unreported. The long line

[183] In practice, shark vessels keep both fins and meat. Meat is discarded at the beginning of a trip (to save freezer space) and at the end of a trip when fishing may continue for fins even though the freezers are full. The conversion factor for fins is used here to give an approximate green weight of shark, bearing in mind that the estimate of shark product per trip is possibly an under-estimate.

fleet is also implicated in the under reported shark fishing which has been assessed above.

Under the terms of the Fisheries Management Act 1998 the bêche-de-mer (BDM) fishery is reserved for PNG nationals. This extends not only to harvesting, but also trading in BDM. Recently two "Asians" were apparently fined a total of K20,000 ($6,300) for trading in BDM[184]. The two men were not licensed and were caught buying them from villagers and processing and storing BDM.

Exports of BDM peaked in 1991 at 700t dried product, equivalent to about 7000t green weight. However since then the catch has declined and in 1994 the total export was 370t dry weight with a value of $3.9million. The declared FAO catch for this year was 1,188t green weight, equivalent to some 118.5t dry product, rather less than half the export figure.

More recently, the opening of the market to new species that traditionally had no commercial value[185] has dramatically impacted on the volume of export. Figures for 2000 showed PNG exported about 607t of product valued about K16.2 million ($6million). Of that, the low value species accounted for 61% (370mt) and high value species made up the remaining. In 2001 PNG exported 484t with a total value of about K17.2 million ($5.1million[186]) and again the low value species accounted for more than 60% of the total export.

The records on the seizure of marine products in PNG show the following for BDM:

2004	5,566 kg
2003	6,527 kg
2002	3,539 kg
2001	11,288 kg

This is a significant percentage of the declared catch but it is often included in the export figures, because confiscated products are auctioned to exporters. Nevertheless, the discrepancy between exports and declared catch suggests that the actual catch is perhaps double the declared catch.

Taking all such allowances into consideration, the IUU losses for PNG can be estimated as in Table 27. This shows a significant IUU loss, representing almost a quarter of the estimated total value of the fishery ($98million). However this total value excludes the 85,000t of foreign caught tuna, which would increase the nominal value of the non-IUU catch to around $185million, reducing the IUU proportion to perhaps 14%.

[184] http://www.png-gossip.com/news/g040708.html#ss2

[185] In the past only a handful of bêche-de-mer species were considered most valuable, but rapid declined in abundance of these group in the last 20 years has led the less favoured species being harvested increasingly. Today there are currently 20 different species being harvested commercially in PNG. There has been a marked declined in the volume of high value species and an increase in the volume of the low value species taken.

[186] Note there was a shift in the exchange rate between 2000 and 2001. The average in 2000 was 2.8 PNG Kina to $1, while in 2001 it was 3.36 PNG Kina to $1.

Table 27 Assessment of IUU Losses for PNG

	Mean Recorded Catch (t)	Including Unreported (t)	Including Unlicensed (t)	Probable Loss (t)	Price ($/t)	Nominal Loss Value $
Tuna purse seine	135,744	141.173 [X]	141.173	5429	2200	11.94
Tuna longline	1115	1450	1594	479	7000	3.35
Shrimp	4162	4578*	4578	416	6650	2.7
Shark	300[+]	2490	6490[≡]	6190	385	2.38
Bêche-de-mer	1544	3090	3708	2164	1054	2.28
Demersals/ Coastal	10,000	10,000	11,000[•]	11,000	3990	3.9
TOTAL						**26.55**

+ Log book data
* allow 10%
≡ allow for Indonesian vessels
[X] allow 2%
• Unknown but allow 20%

9.10.3. The State of Control and Regulation

PNG has strong regional links to help deal with IUU activity. It is a member of the FFA, SPC and the newly formed WCPTC. Aerial surveillance is provided by Australia and New Zealand, with twice weekly flights over the Torres Strait and occasional flights in the wider EEZ. PNG is also part of the VMS system co-ordinated by the FFA. There is an agreement between the National Fisheries Authority (NFA) and the PNG Defence Force for 10 seagoing patrols of 10 days duration per annum. These may not be fulfilled but patrol boats do make intercepts and arrests. In 2004 there were 68 recorded sightings by air and sea of which 29 were made by the boats and in the same year, 5/8 foreign vessels, 4 from Indonesia and one from China were arrested and prosecuted. There is, therefore, some patrol capacity.

Within the NFA there is a dedicated MCS function with a small core team of national enforcement officers and empower enforcement officers within each maritime province. There is a large observer team with around 74 control observers and 24 contract part-time samplers. There is also an audit and certification team to issue certain types of licenses. Access licenses bring in $5-6million per year. There is also the 'Wantok' system of effectively community observers at the provincial level. They can be involved in the BDM fishery and also in the transhipment ports.

There are examples of IUU fishing for BDM by PNG fishers outside PNG waters. Prior to the 1985 Torres Strait Treaty between Australia and PNG, the traditional fishing zone of Warrior Reef in the Torres Strait lay in PNG waters. The treaty placed part of the reef in Australian waters, but acknowledged the traditional fishery and allowed fishers in Western PNG to continue to fish the northern section of the reef in a traditional manner. However, PNG fishers started to fish illegally on the Australian side of Warrior Reef in 1991. The motivation for this activity was the low catch rates of the more valuable, larger sandfish (*Holothuria scabra*) in the legal fishing area. As a consequence, Australian authorities stepped up their patrols resulting in the

apprehension and prosecution of fishers and confiscation of fishing gear. Illegal fishing continued through the closure of the PNG fishery, and though it decreased after Australian patrols were increased, and after the apprehension of large numbers of fishers, it did not completely stop (Lokani, 1996[187]).

As the Torres Strait Treaty stipulates, responsible parties' costs were effectively transferred back to the country of the offending fishers, and endorsement of legal cross-border fishing was jeopardized. Additionally, because of legal costs, PNG introduced a short-term moratorium on BDM fishing, which was extended to 18 months, to try to curtail the illegal fishing. This resulted in loss of income to fishers estimated at approximately USD$300,000 (equivalent to K1.0 million) in addition to loss of gear, government revenues of $450,000, and export revenue to companies of $900,000 (Lokani, 1996[187]). Closing the fishery was apparently not the most appropriate action to protect the resource economically, nor necessarily biologically. This example demonstrates the necessity of understanding the social and economic consequences of fisheries management strategies and their enforcement, and the importance of "buy-in" buy the affected users and communities.

[187] Lokani, 1996. Illegal fishing for sea-cucumber (bêche-de-mer) by Papua New Guinea artisanal fishermen in the Torres Strait protected zone. SPC Bêche-de-mer Information Bulletin 8:2-6.

10. Annex C. Terms of Reference

Terms of Reference for Study and Workshop with Key Event on:
The Impacts Of Illegal Fishing with Particular Focus on Developing Countries

Introduction

Illegal, Unregulated and Unreported (IUU) fishing is an insidious phenomenon with global impacts. Within EEZs, IUU may either involve infringement of regulations by licensed vessels or by vessels which are fishing quite legally, but which are neither regulated nor required to report catch. IUU fishing may also be taking place by unlicensed vessels fishing in a managed location. Fishing on the high seas may be unreported, unregulated and undesirable, but entirely legal due to the shortcomings of high seas governance.

Crucially, IUU fishing undermines efforts to conserve and manage fisheries and leads to the loss social and economic opportunities and on occasion negative effects on food security. IUU fishing can lead to the collapse of a fishery or impair efforts to rebuild stocks through new management initiatives. Few data exist on the extent of illegal fishing, although tentative estimates have indicated levels of around 30 million t/yr.

Existing international instruments addressing IUU fishing have (similarly to UNFSA) been weakened by lack of political will, priority, capacity and resources to ratify or accede to and implement them.

Developing countries are a significant factor in the development of domestic and international policies aimed at combating IUU fishing for a number of reasons.

- It is believed that IUU fishing, both on the high seas and as a spill-over in EEZs, has a significant adverse effect on the fisheries and economies of developing countries.
- Developing countries are more vulnerable where they lack the capacity to control IUU fishing.
- A vicious circle is created when inability to control IUU fishing as a result of relatively weak domestic governance creates conditions in which IUU activity is able to thrive.

In this context, the OECD[188] launched, in late 2003, a new Ministerial *High Seas Task Force*[189] aimed at identifying the legal, economic, scientific and enforcement drivers which facilitate IUU activity and determine how these can be modified to minimise this activity. Recent exchanges between DFID and the HSTF team (and earlier with SIFAR), have resulted in increasing recognition of the need to develop a rigorous understanding of the impacts of illegal fishing on developing countries.

As a result, HSTF have agreed that "in developing measures to address the problem of IUU fishing on the high seas it is essential that the interests, needs and aspirations of developing countries to use renewable natural resources to facilitate economic development are taken into full account."

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[188] It is noteworthy that OECD has recently been very active in two interrelated areas that also have key impacts on international development: *coherence* (Policy Coherence In Fisheries - a Scoping Study – Neiland 2004); *trade* (Liberalising fisheries markets: scope and effects - OECD 2003).

[189] http://www.oecd.org/document/51/0,2340,en_2649_201185_20897011_1_1_1_1,00.html

HSTF urgently needs to address these problems if they are to succeed. If the policies and recommendations developed by the HSTF are not capable of being implemented by developing countries, they are likely to be substantially less effective.

Proposal

It is now proposed to implement a joint DFID/HSTF activity with three main outputs:

2. Impact analysis of IUU fishing on developing countries;
3. Empirical assessment of issues related to ecosystem and management
4. A technical workshop combined with 'key event' for raising the political profile and defining mitigation options for tackling IUU.

A. Impact assessment:

The Consultant will:

- Identify the key impacts of IUU fishing on developing countries using a range of potential sources and approaches to derive best available knowledge (empirical and anecdotal).
- Derive a better understand the areas of vulnerability that enable IUU activity to thrive.
- Identify specific forms of assistance to enable developing countries to better implement their responsibilities in respect of IUU and high seas fisheries.

A series of **case studies** (possible candidate sub regions[190] may be: West Africa, Indian Ocean, Western Pacific) which would aim to quantify the effect of IUU fishing on the high seas (including impact on and overlap with EEZ fisheries) on the developing countries in the sub region.

An overall **synthesis study** will be prepared based upon the case study findings. This will present a set a key conclusions and (where possible) make recommendations on potential mitigation measures from the developing country perspective.

It is proposed that case studies are carried out by competent nationals from the candidate sub regions with appropriate guidance (especially guidelines on a consistent methodology) provided by the Consultant. The Consultant will agree the synthesis statements in consultation with the case authors.

[190] To be agreed with DFID and HSTF