

Programme for the implementation of a Regional Fisheries Strategy for the
Eastern and Southern Africa and Indian Ocean Region

Programme pour la mise en oeuvre d'une stratégie de pêche pour la région
Afrique orientale-australe et Océan Indien



IUU FISHING ON LAKE TANGANYIKA

June 2012

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The Eastern-Southern Africa
And Indian Ocean Region

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Implementation of a Regional Fisheries Strategy
For The Eastern-Southern Africa and India Ocean Region

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region Afrique orientale-australe et Océan indien

IUU Fishing on Lake Tanganyika

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Acronyms and abbreviations used in this document

BIF	Burundi Franc, approx. US\$1 = BIF 1300
FBP	Fédération Burundaise de Pêche (Federation of fishers in Burundi)
DRC	Democratic Republic of Congo
DWFA	Department of Water, Fish and Aquaculture (Burundi)
IUU	Illegal, unregulated and unreported fishing
MCS	Monitoring and control and surveillance
MLFD	Ministry of Livestock and Fisheries Development (Tanzania)
LTA	Autorité du Lac Tanganyika (Lake Tanganyika Authority)
PRODAP	Projet d'Appui au Programme Régional D'Aménagement Intégré du Lac Tanganyika
TZS	Tanzanian Shilling, approx. US\$ 1 = TZS 1300
US\$	US Dollar

Vernacular names used in this document

Capitaine	Lates angustifrons Common : Lates mariae (name abuse for trade)
Dagga	In Tanzania, either <i>Stolothrissa tanganicae</i> (Lake Tanganyika) or <i>Rastrineobola argentea</i> (Lake Victoria)
Imbiya (Mbia)	<i>Limnothrissa miodon</i>
Isomvyi	<i>Clarias gariepinus</i>
Injombo, Imamba	<i>Protopterus aethiopicus</i>
Kahuzo	<i>Stolothrissa tanganicae</i> juvenile (30-40 mm TL)
Kahuzo-rumba	<i>Stolothrissa tanganicae</i> juvenile (40-55 mm TL)
Karumba	<i>Stolothrissa tanganicae</i> adult
Kungura	<i>Limnotilapia dardennii</i>
Mugara	Fry of Clupeids North : fry of <i>Limnothrissa miodon</i> (caught with mosquito nets)
Mukeke (Bdi), Migebuga (Tz), Bukabuka (Za)	<i>Luciolates stappersii</i>
Mukene (UG)	<i>Rastrineobola argentea</i> (from Lake Victoria)
Ndagala (Bdi), Kapenta (Za)	<i>Stolothrissa tanganicae</i>
Commercial mix of <i>Stolothrissa tanganicae</i> and <i>Limnothrissa miodon</i>	
Nonzi	<i>Lates microlepis</i> Common : large Lates
Nyamu-nyamu	<i>Luciolates stappersii</i> juvenile
Sangala	<i>Lates mariae</i>
Fishing:	
Agaweshuro	Strictly scoop nets with mosquito nets to catch Mugara in the northern part of the lake
Apollo	Large catamaran (6 fishers)

Equipe, kipe	Traditional catamaran (4 fishers)
Greeks	Semi-industrial purse seiner
Lusenga	Net Common: scoop nets with small meshes (including mosquito nets around Bujumbura)
Makila	Gill-net
Mukwabu	Beach seine
Mutimbo	Encircling ring net in Burundi (illegal)

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EXECUTIVE SUMMARY

This report has been compiled at the request of the IOC IRFS Programme (EDF 10) for an assessment of the current status of illegal, unregulated and unreported (IUU) fishing and trade on Lake Tanganyika, and the development of interventions that can be used to assist in improving monitoring, control and surveillance operations on the lake.

Lake Tanganyika represents the second largest lake in Africa, and is shared by the countries of Burundi, the Democratic Republic of Congo, Tanzania and Zambia. The lake covers a surface area of 32,600 km². In terms of jurisdiction, the DRC has control of 45% of the surface area, Tanzania 41% of the area, with Burundi and Zambia having control of 8% and 6% respectively. In terms of management structures, while the riparian countries are responsible for the management of their waters, the Convention on the Sustainable Management of Lake Tanganyika provides for the Lake Tanganyika Authority (LTA) to act as the overarching management body for the lake system.

In 2011, the LTA undertook a lake-wide frame survey that revealed that there are currently 93,214 active fishers on the lake operating out of 738 landing sites. The majority of these fishers are Congolese (53.6%) followed by Tanzanians (28.6%), Zambians (9.0%) and Burundians (8.8%). Fish processing and trading at the landing sites directly employs 38,765 and 23,090 people respectively. At present there are 36,675 vessels in operation on the lake, using a total of 68,113 gears. Fifty-eight percent of the vessels are located in the DRC (21,327 vessels), followed by Tanzania (11,506 vessels), Zambia (2,327 vessels) and Burundi (1,515 vessels). Of 5,331 lift-nets in use across the lake, 1,360 are estimated to be illegal, with the number of illegal nets in use being highest in the DRC (696 nets), followed by Tanzania (483 nets) and Burundi (181 nets). The number of illegal gill nets on the lake is of concern, and of a total of 51,011 gill nets recorded on the lake, 16,504 were estimated to be illegal. In absolute terms, Tanzania recorded the largest number of illegal nets (8,487 nets equating to 26.7% of the nets). In contrast, Burundi recorded 32% or 118 of their gillnets as illegal, and estimates for the DRC suggest that in that country, there are likely to have been in the region of 626 illegal nets. Of a total of 978 ring nets that were recorded in use on the lake, 80 nets representing 10.6% of the nets in circulation were estimated to be illegal. While the use of beach seines has been banned in all the countries, 1,778 beach seines were recorded in the survey.

The major threat to the fish stocks in the offshore zone is the use of lift-nets to target juvenile *Lucioides* and *Stolothrissa*. In the inshore areas, beach seines and Mutimbo ring nets both destroy the stocks and negatively impact the benthic environment. Most notably, these fishing practices destroy cichlid nests including *Boulengerochromis microlepis*, and target the juveniles of *Lates mariae* which are abundant in the littoral zone. In addition, the catch of young Cichlids, such as the Haplochromines, deprives predators of a high value food source. Scoop nets (mosquito nets) cause the depletion of the *Limnothrissa* stocks in the extreme north of the lake.

In terms of markets, there have been no recent marketing studies to establish the trade routes, and the volumes and value of the fish products that are traded on the lake. However, it was established that in broad terms, the trade routes are restricted by the poor status of the terrestrial infrastructure along the Central and Southern parts of the lake – most notably in the DRC, but also in Tanzania. This makes the terrestrial movement of products problematical, and thus much of the product has out of necessity to be moved on the lake. In general terms, the basic trade routes that are described are North / South, with products either moving from the central parts of the lake north to Kigoma (Tanzania) from whence they are exported inland or further north into Burundi / DRC; or alternatively product is shipped south to Kasanga (Tanzania) and Mpulungu (Zambia) for distribution in those and neighbouring countries. In addition to the North / South trade, it is reported that there is significant East / West trade with products from the DRC being exported across the lake to Kigoma for further regional distribution. Possibly, the major recent changes in the trade routes relate to changes in resource use patterns on the lake, and it would appear that local resource depletion / changes in resource patterns in the northern and southern areas of the lake are increasingly forcing fishers from Burundi, Northern Tanzania (Kigoma) and Zambia to move into DRC waters to fish. Likewise, improvements to the road infrastructure along the Tanzanian side of the lake will have assisted terrestrial transport routes. Finally, the cessation of hostilities in Burundi has re-opened trade routes in the northern part of the lake.

An analysis of the current capacity for the riparian countries to undertake MCS operations was undertaken. The analysis

revealed that the current capacity to undertake MCS operations across the region is constrained by a number of key factors, principal among these being:

1. A lack of financial resources, equipment and patrol platforms at all levels in the MCS system.
2. Insufficient numbers of MCS personnel to monitor fishing and IUU fishing activities, and limited capacity to undertake patrols.
3. A lack of coordination between the riparian countries to address MCS and IUU issues.
4. No capacity / mechanisms with which to undertake cross border patrols to address the issues of cross border fishing activities and piracy on the lake.
5. Poor application of existing regulatory frameworks (e.g. permitting, maintaining vessel registers and marking vessels).
6. Uncoordinated legislation / regulatory frameworks between the riparian states resulting in conflicting regulations (e.g. gear regulations vary between the countries).
7. Poor reporting systems, data collection and processing leading to a paucity of information that can be used to establish the efficacy of current MCS interventions and inform future MCS planning.
8. Undeveloped co-management institutions (beach management units / fisher associations) that can be co-opted to assist in compliance activities.
9. Undefined roles and responsibilities of those involved in MSC activities e.g. compliance officers, case officers, recorders, etc.
10. A lack of MSC training at all levels.
11. No centralized / coordinated sale of fishing gears, thus allowing the entry of illegal fishing gears into the region.
12. Inadequate sensitization of the fishers who are, for the most part, unaware of the details of the laws and regulations in force.

A series of interventions that are designed to improve MCS operations on the lake, reduce the levels of IUU fishing, and increase fish trade in the region were developed and discussed. These interventions focus on:

1. Providing MCS training for the riparian states
2. Removing illegal gears
3. Reducing the catch of immature pelagic fish
4. Improving fish processing and value addition
5. Increasing fish exports

RÉSUMÉ EXÉCUTIF

Ce rapport a été préparé à la requête du Programme IRFS de la COI (10^{ème} FED) dans l'optique d'évaluer le statut actuel de la pêche illicite, non déclarée et non réglementée (INN) et du commerce sur le lac Tanganyika, et le développement d'interventions pouvant servir à soutenir l'amélioration des opérations de suivi, contrôle et surveillance sur le lac.

Le lac Tanganyika est le second plus grand lac d'Afrique, partagé par le Burundi, la République Démocratique du Congo, la Tanzanie et la Zambie. Le lac couvre une surface de 32.600 kilomètres carrés. En termes de juridiction, la RDC a le contrôle de 45% de cette surface, la Tanzanie 41%, et le Burundi et la Zambie ont le contrôle respectivement de 8% et 6%. En termes de structures de gestion, alors que les pays riverains sont responsables de la gestion de leurs eaux, la Convention sur la Gestion Durable du Lac Tanganyika permet à l'Autorité du Lac Tanganyika (LTA) d'agir en tant qu'organisme de gestion principal pour l'ensemble du système lacustre.

En 2011, la LTA a entrepris une enquête-cadre sur l'ensemble du lac, révélant ainsi la présence de 93.214 pêcheurs actifs, opérant depuis 738 sites de débarquement. La majorité de ces pêcheurs sont congolais (53,6%), suivis par les tanzaniens (28,6%), les zambiens (9,0%) et les burundais (8,8%). La transformation et le commerce du poisson dans les sites de débarquement fournissent respectivement 38.765 et 23.090 emplois directs. Il y a actuellement 36.675 bateaux opérant sur le lac, employant un total de 68.113 engins de pêche. Cinquante-huit pourcents des navires se

situent en RDC (21.327 bateaux), suivie de la Tanzanie (11.506 bateaux), la Zambie (2.327 bateaux) et le Burundi (1.515 bateaux). Sur 5.331 filets de type carrelet utilisés à travers le lac, on estime que 1.360 sont illégaux, dont une quantité particulièrement élevée en RDC (696 filets), suivie de la Tanzanie (483 filets) et du Burundi (181 filets). Le nombre de filets maillants illégaux sur le lac est préoccupant : d'un total de 51.011 filets maillants répertoriés sur le lac, on estime que 16.504 sont illégaux. En termes absolus, la Tanzanie a enregistré le plus haut nombre de filets illégaux (8.487 filets, soit 26,7% des filets). A l'inverse, le Burundi a répertoriés 118 filets maillants, soit 32%, comme illégaux, et les estimations pour la RDC suggèrent que ce pays compte probablement autour de 626 filets illégaux. Sur un total de 978 filets tournants et coulissants enregistrés sur le lac, on estime à 80 filets, soit 10,6% des filets en circulation, le nombre de filets illégaux. Alors que l'utilisation de sennes de plage fait l'objet d'une interdiction dans tous les pays, 1778 sennes de plage ont été répertoriées par cette étude.

La menace la plus importante pour les stocks halieutiques au large est l'utilisation de filets de type carrelet visant les juvéniles de *Lucioides* et de *Stolothrissa*. Dans les zones côtières, les sennes de plage et filets maillants tournants Mutimbo déciment les stocks et ont un impact négatif sur l'environnement benthique. Principalement, ces pratiques de pêche détruisent les nids de cichlides, y compris de *Boulengerochromis microlepis*, et visent les juvéniles de *Lates mariae* qui abondent dans la zone littorale. De plus, la capture de jeunes cichlides, comme les Haplochromines, prive les prédateurs d'une importante source d'alimentation. Les filets-écopes et filets-moustiquaires causent l'appauvrissement des stocks de *Limnothrissa* dans l'extrême Nord du lac.

En termes de marché, il n'existe pas d'étude récente sur la commercialisation afin d'établir de nouvelles routes commerciales, ni sur les volumes et la valeur des produits de la pêche échangés sur le lac. Cependant, il a été établi que, de manière générale, les routes commerciales sont restreintes en raison du piteux état des infrastructures terrestres le long des régions centrales et méridionales du lac – principalement en RDC mais aussi en Tanzanie. Cela rend difficiles les mouvements terrestres des produits, ce qui fait que la plupart de ceux-ci doivent être acheminés sur le lac. De manière générale, les routes commerciales décrites se trouvent sur un axe Nord-Sud, et les produits sont acheminés depuis les régions centrales du lac, soit vers le Nord en direction de Kigoma (Tanzanie), d'où ils sont ensuite exportés vers l'intérieur du pays ou davantage au Nord vers le Burundi et la RDC ; soit alternativement vers le Sud en direction de Kasanga (Tanzanie) et de Mpulungu (Zambie) pour être distribués dans les pays avoisinants. En plus du commerce Nord/Sud, un important commerce Est/Ouest existe pour les produits de RDC, ceux-ci étant exportés à travers le lac en direction de Kigoma, avant d'être distribués davantage à travers la région.

Il est possible que les récents changements des routes commerciales soient liés aux modifications opérées dans les modes d'utilisation des ressources du lac, et il semblerait que l'appauvrissement des ressources locales et les changements dans les modes d'utilisation des ressources dans les régions septentrionales et méridionales du lac poussent de plus en plus les pêcheurs du Burundi, du Nord de la Tanzanie (Kigoma) et de la Zambie à se déplacer dans les eaux de la RDC pour y pêcher. De même, les améliorations des infrastructures routières le long de la rive tanzanienne du lac ont permis le transport terrestre. Enfin, la fin des hostilités au Burundi a permis de rouvrir les routes commerciales dans la partie Nord du lac.

Une analyse de la capacité actuelle des pays riverains à mener des opérations de SCS a été entreprise. L'analyse a révélé que la capacité actuelle à mener des opérations de SCS à travers la région est entravée par un certain nombre de facteurs clés dont les principaux sont :

1. Le manque de ressources financières, d'équipement et de plateformes de patrouille à tous les niveaux du système de SCS ;
2. Le nombre insuffisant de personnel de SCS pour assurer le suivi de la pêche et des activités de pêche INN, et la capacité limitée à entreprendre des patrouilles ;
3. Le manque de coordination entre les pays riverains pour traiter des problèmes de SCS et de pêche INN ;
4. L'absence de capacité/de mécanisme avec lequel mener des patrouilles transfrontalières pour traiter des problèmes liés aux activités de pêche transfrontalières et à la piraterie sur le lac ;
5. La faible application du cadre réglementaire existante (par exemple, l'octroi de permis, la tenue de registres des bateaux, l'immatriculation des bateaux) ;

6. La législation et le cadre réglementaire peu coordonnés entre les états riverains, avec pour conséquence des réglementations en conflit (par exemple, une réglementation sur les engins de pêche qui varie d'un pays à l'autre) ;
7. Les faibles systèmes de reporting, de collecte et de traitement de données, avec pour conséquence la rareté de l'information pouvant être utilisée pour déterminer l'efficacité des interventions de SCS actuelles et informer leur planification future ;
8. Le faible développement des institutions de cogestion (unités de gestion des plages/associations de pêcheurs) pouvant être cooptées pour assister les activités de conformité ;
9. La mauvaise définition des rôles et responsabilités de tous ceux impliqués dans les activités de SCS (par exemple, les agents de conformité, les enquêteurs, les agents verbalisateurs, etc.) ;
10. Le manque de formation en SCS à tous les niveaux ;
11. L'absence de vente centralisée ou coordonnée des engins de pêche, favorisant ainsi l'entrée d'engins illégaux dans la région ;
12. L'absence de sensibilisation adéquate des pêcheurs qui, pour la plupart, n'ont pas conscience des détails des lois et réglementations en vigueur ;

Une série d'interventions conçues pour améliorer les opérations de SCS sur le lac, réduire les niveaux de pêche INN et augmenter le commerce du poisson dans la région, ont été développées et discutées. Ces interventions se concentrent sur :

1. Proposer des formations en SCS aux Etats riverains;
2. Enlever les engins illégaux ;
3. Réduire les captures de poissons pélagiques non-matures ;
4. Améliorer la transformation du poisson et l'ajout de valeur ;
5. Augmenter les exportations de poisson.

1 INTRODUCTION

This report has been compiled at the request of the IOC IRFS Programme (EDF 10) for an assessment of the current status of illegal, unregulated and unreported (IUU) fishing and trade on Lake Tanganyika, and the development of interventions that can be used to assist in improving monitoring, control and surveillance operations on the lake. Specifically, the ToR calls for:

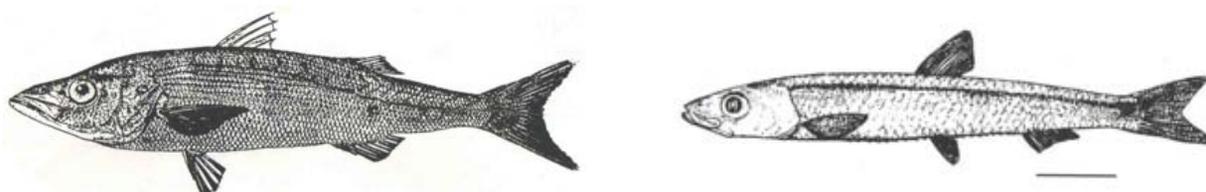
1. A brief overview of the fishery in Lake Tanganyika, including catches, markets, value, geographic distribution of catches and landing sites and markets, as well the role of the LTA in managing the fishery/s in Lake Tanganyika, including country and LTA management measures.
2. A description of IUU fishing in Lake Tanganyika, which should include inter alia:
 - An explanation of the illegal, unregulated and unreported components, taking into consideration the management regimes of the LTA and the countries bordering the lake.
 - An estimate of the number of IUU fishers, vessel types and numbers, gear types and numbers, species involved, and product/s.
 - The geographical distribution of IUU fishing on Lake Tanganyika.
 - A determination of where and how IUU fish enters the markets and the destination of fish and fish products.
 - A determination of the value of IUU fishing, and a description in terms of the direct loss to the value of the fishery, as well as the future potential value.
 - An indication of what potential biological impacts the current level of IUU fishing may have on the sustainability of the legitimate fishery.
3. A description of the current efforts of the LTA to combat IUU fishing, including recent training initiatives.
4. A description of the actions and/or programs of the countries bordering Lake Tanganyika, to combat IUU fishing on the lake, as well as efforts to stop the trade in illicit fish in their trade footprint area.
5. The provision of recommendations on what (additional) action/s are required:
 - a) for the LTA to establish, enhance or strengthen the combat of IUU fishing as well as the trade in illicit products.
 - b) for the countries in the region to establish, enhance or strengthen the combat of IUU fishing as well as the trade in illicit products.
 - c) to support, strengthen and/or harmonise with other existing projects in the LT footprint area.

2 THE FISHERY ON LAKE TANGANYIKA

2.1 Overview of the fishery

Lake Tanganyika represents the second largest lake in Africa, and is shared by the countries of Burundi, the Democratic Republic of Congo, Tanzania and Zambia. The lake covers a surface area of 32,600 km². In terms of jurisdiction, the DRC has control of 45% of the surface area, Tanzania 41% of the area, with Burundi and Zambia having control of 8% and 6% respectively. The lake is also the second deepest in the world, reaching a depth of around 1,500 metres in the south.

The lake is known internationally for its endemic cichlid fish fauna that comprises a genetically diverse demersal community assemblage that contrasts to the relatively simple pelagic community. The demersal community includes more than 300 fish species of which over two-thirds are endemic. The pelagic fish community primarily comprises six endemic, non-cichlid species: two schooling clupeids, *Limnothrissa miodon* and *Stolothrissa tanganicae*, and their major predators, four members of the genus *Lates* (Family - Centropomidae), *L. stappersii*, *L. angustifrons*, *L. mariae*, and *L. microlepis*. *L. Stappersii* and *S. tanganicae* live exclusively in the offshore or “pelagic” zone and comprise 90% of the catches from the lake fishery.



Luciolates stappersii (left) and *Stolothrissa tanganicae* (right)

The fisheries on the lake are characterised as multi-species and multi-gear fisheries with both artisanal and subsistence components. The artisanal component primarily operates in the offshore areas targeting the clupeid and *Lates* species groups, with the subsistence fishers primarily operating in the inshore area targeting juvenile *Limnothrissa miodon* and the demersal components. Many of the inshore fishing grounds are quite shallow (< 8 m depth). The fisheries adjacent to human settlements are associated with high population densities, and are typically under heavy fishing pressure from a range of gears. There are indications of reduced catches, and changes to catch composition, and in some areas the fish stocks have already collapsed (SAP, 2000). These changes are most marked in the extreme northern and southern parts of the lake. In comparison with the inshore areas, the pelagic zone, while less rich in biodiversity, provides much of the production. It is reasonable to suggest that any collapse in the pelagic fisheries will have a dramatic knock-on effect on the littoral zone, notably through increased fishing pressure in the near shore areas.

Previous management interventions to control the lake fisheries have primarily focused on developing state legislation to limit fishing effort through licensing, placing size limitations on gear (e.g. mesh size restrictions), or banning particular gears such as monofilament nets and beach seines. Evidently this approach has not been successful and the reasons why these historical management measures have not proved successful are complex. However, amongst others they include difficulties in developing credible monitoring, control and surveillance systems and operational capacity, regional unrest, increasing numbers of fishers entering the sector, and possibly, fishermen switching gear without reducing overall effort. In light of the poor performance of past governance interventions, the riparian countries have started to adopt fisheries co-management systems as a mechanism with which to manage the fisheries. Co-management frameworks are a relatively recent intervention, and while all the countries have adopted them, their level of development, their efficacy, and the level to which management has been devolved to the local level vary considerably.

2.2 The Lake Tanganyika Authority

The Lake Tanganyika Authority (LTA) was established in December 2008 to implement the Convention on the Sustainable Management of Lake Tanganyika, and by doing so, provide the overarching management structure for the Lake system. The overall objective of the Convention is to ensure the protection and conservation of the biological diversity of the lake and its basin, and to promote the sustainable utilisation of the natural resources. The LTA comprises a Conference of Ministers, a Management Committee and a Secretariat.

To achieve the Convention's overall objective, a Strategic Action Program (SAP, 2000) was developed and endorsed by the four riparian countries. Clearly this first iteration of the SAP is now over ten years old, and while it has been adopted by the LTA, it is in the process of being updated. As of August 2011, the LTA has developed an implementation framework outlining their future activities. These interventions are in the process of being undertaken by the secretariat that is based in Bujumbura, Burundi, and through the National Coordination Units (NCUs) of the Lake Tanganyika Integrated Regional Development Programme (PRODAP) programme. The PRODAP programme provides the in-country technical support that is required to implement the LTA interventions. While the planned interventions encompass a wide range of issues, the activities that the LTA is in the process of implementing or are planning to implement, and that have relevance to this project, comprise:

a) Policy and Regulatory Frameworks: PRODAP to support the harmonization of national fisheries regulations and policies.

Currently fisheries policies and regulations between the four countries are disparate and have not been harmonized. Issues that need to be addressed include formalizing the status of the LTA into national fisheries legislation, formalizing legislation to enable the promotion of co-management systems, developing the legal and regulatory mechanisms to harmonise fisheries management procedures and policies, and developing the legal frameworks required to undertake multinational MCS operations. To address these issues, a series of national workshops will be undertaken in 2011, followed by a regional workshop in 2012.

b) Fisheries Development Framework Plan (PCAP): Revise and update the PCAP that was initially drafted in 2001.

In the 1990s, two successive projects, the Lake Tanganyika Research (LTR) project and the Lake Tanganyika Biodiversity (GEF/LTBP) project, supported fisheries research, and as a result of their research findings, developed a "Framework Fisheries Management Plan". This plan was originally endorsed by the CIFA - Subcommittee for Lake Tanganyika. However, due to the delays in the establishment of the LTA, this plan was never implemented, and now needs to be revised. The original plan identifies five critical components, viz:

1. Fisheries Policy, Planning, and Management
2. Fisheries Statistics and Information Systems
3. Monitoring, Control, and Surveillance
4. Promotion of Responsible Fishing Operations and Fishing Fleet Restructuring
5. Post Harvest Practices and Trade

FAO is currently providing technical assistance to the LTA, and this assistance will be used to revise the PCAP. A series of national workshops will be held in 2011 to validate the revised PCAP.

c) Development of a joint Management Mechanism (co-management) – PROPAD to support the development of a co-management system for the lake.

While all the riparian countries have started to institute co-management systems, they are all at different stages of development and efficacy, and have as yet not been harmonised. The LTA plans to develop harmonised co-management systems that can be adopted throughout the lake region. The initial work will focus on reviewing

current co-management practices on the lake. During the fourth quarter of 2011, a co-management specialist will be undertaking a review of the co-management systems being implemented, and make recommendations in terms of harmonising management systems. This work will be validated at a regional workshop in 2012. In collaboration with the LTA, PROPAD has recently initiated activities in DRC. In this regard, Mr N'sibula Mulimbwa has been appointed the Manager who is responsible for coordinating these activities. He is a scientist from the Research Institute (Uvira), and a specialist in Clupeid biology.

d) Fisheries statistical data collection – the development and harmonisation of a sustainable fisheries statistics system for the lake.

Currently, where fisheries data is being collected, it is undertaken at the country level and is not being collated or analysed on a lake-wide basis. It is evident that the different countries have different levels of available resources and capacity to collect and collate this information. For example, in Burundi, the Department of Water, Fish and Aquaculture (DWFA) has an extensive programme to collect fish landing and beach price data, but it no longer collects biological information (e.g. length / weight data) as it did until the mid-90s. In contrast, in Tanzania, the Ministry of Livestock and Fisheries Development (MLFD) collects limited biological data, but has developed a comprehensive marketing inspectorate that monitors exports; the Department of Fisheries in the DRC, does not appear to be collecting biological or landing data, however, some data is being collected by some of the fisher associations in that country (M. van der Knaap, FAO. Pers. com.). There is therefore a need to harmonise data collection systems such that it can be used to inform management decision-making processes. In this regard, a fisheries data collection system will be developed, and fisheries statistics and database development training will be provided to personnel in each country.

In terms of existing data, it is worth noting that in the 1990s, the Belgian Cooperation program performed exhaustive surveys of all fish species present in Burundi waters, and thus the species composition of the northern part of the lake is well described.

e) Fisheries surveillance – PRODAP to develop participatory surveillance mechanisms

At present there is no participatory lake-wide surveillance mechanism, and there is only limited surveillance capacity that is restricted to the individual countries. In future, it is anticipated that joint MCS activities will be developed between the riparian countries. This will require capacity building activities in each country, and the deployment of surveillance infrastructure (e.g. vessels) that can be shared by the countries to undertake cross border MCS activities – these interventions are required to address the issue of illegal fishing in the pelagic waters, the illegal movement of the pelagic fleets to fish in other countries' waters, and the increasing piracy and security issues that are being reported on the lake. Smaller, nationally based in-shore MCS operations will also need to be established or enhanced. To improve fisheries surveillance, a series of national workshops will be undertaken to develop an appropriate surveillance framework.

f) Fisheries surveillance – procurement of boats for each National Coordination Unit

In collaboration with the NCUs, a series of inshore patrol boats will be procured to assist in MCS activities. In Burundi, 10 small (15 hp) patrol boats have been ordered for this purpose, and in Tanzania, three larger patrol boats will be deployed in each of the four lakeshore districts, with a further three vessels deployed in the DRC, and one in Zambia.

2.3 Characterisation of the fishery

The 2011 frame survey revealed that there are currently 93,214 active fishers on the lake operating out of 738 landing sites. The majority of these fishers are Congolese (53.6%) followed by Tanzanians (28.6%), Zambians (9.0%) and Burundians (8.8%). Fish processing and trading at the landing sites directly employs 38,765 and 23,090 people respectively. In all the countries, fish processing (e.g. fish drying, smoking etc.) is primarily a female occupation with

female processors accounting for between 63% and 75% of the processing population. In Burundi, Tanzania and the DRC, women also primarily undertake the fish trading activities where between 62% and 75% of the fish traders are women. In contrast in Zambia, fish trading is predominantly a male occupation with women accounting for only 28% of the sector. In total, the fishing sector on the lake provides direct employment opportunities for a total of 155,069 people (fishers, processors and traders). It is important to note that this figure excludes those involved in the support service and supply industries such as boat building, repairs, transport, inland marketing etc. Currently, there is no information pertaining to the size of the support industries, and it is therefore difficult to estimate the number of people that rely on the fisheries for their livelihoods; however, the number is likely to be significantly greater than the 155,069 people that are directly involved in the sector.

Currently there are 728 landing sites on the lakeshore. At 361 sites, the Congolese have developed the most landing sites, followed by Tanzania that has 239 sites, and Zambia and Burundi with 98 and 40 landing sites respectively (Table 1). At present there are 36,675 vessels in operation on the lake, using a total of 68,113 gears. Fifty eight percent of the vessels are located in the DRC (21,327 vessels), followed by Tanzania (11,506 vessels), Zambia (2,327 vessels) and Burundi (1,515 vessels). It should be noted that there are a number of diverse fisheries on the lake, and thus there is considerable variation in the fleet composition at both the individual fishery and national levels. Furthermore, it is evident that the riparian countries employ different fishing techniques, levels of mechanisation, and gears to access the resources. Thus national vessel and gear numbers should be viewed with caution as they represent a poor indicator of effort and mechanisation in the national fisheries, and thus vessel, gear and employment figures should only be used as gross indicators of the size of the sectors in the various countries. A detailed description of the types of fishing undertaken and numbers of the gears in use in the riparian countries is presented in Table 2.

Table 1. Country involvement in the fisheries, boats, gears, and landing sites

Country	Fishers	Processors ¹	Traders ¹	Number of boats (All types)	Gear (All types)	Landing sites
Burundi	8 202	531(64%)	1 059 (28%)	1 515	1 572	40
Tanzania	26 612	11 127 (63%)	4 040 (62%)	11 506	34 408	239
Zambia	8 430	3 953 (64%)	4 329 (76%)	2 327	17 831	98
DRC	51 652	23 154 (75%)	13 662 (68%)	21 327	14 302	361
Total	93 214	38 765	23 090	36 675	68 113	738

¹ Percentages in parenthesis indicate the number of women involved in the activity

Table 2. Fishing gear currently in use on Lake Tanganyika (Frame survey, 2011)

Fishing gear	Country				Total	%
	Tanzania	Burundi	Zambia	DRC		
Long-line		447		4 864	5 311	7.8
Lift-net (Catamaran + Apollo)	1 892	710		2 729	5 331	7.8
Beach seine	66	5	110	1 596	1 777	2.6
Gill net	31 806	369	16 977	1 859	51 011	74.9
Hook and line		12		2 838	2 850	4.2
Mutimbo				81	81	0.1
Mutobi			512		512	0.8
Musipa		29			29	0.0
Epervier				52	52	0.1
Epuisette/Lusenga (nets)				13	13	0.0
Traps				38	38	0.1
EP				27	27	0.0
Ring Net	644		232	205	1 081	1.6
Total	34 408	1 572	17 831	14 302	68 113	100

Historically, the major fishing gears (the purse seines and the lift-nets) were introduced in the early 1950s. Until the mid-80s, only the industrial seiners operated beyond 5 km from the shore, while the traditional catamarans, with a crew of four men and one or two young aides remained closer to the shore. The seines, as high as 100 metres with mesh sizes increasing towards the bottom, aimed at catching *Stolothrissa* within the first 50 m of the water column. Below 50 m, the *Luciolates* were caught – in comparison with the *Stolothrissa* stocks, the *Luciolates* stocks are generally found in deeper waters. At this time, the catamarans were primarily catching *Stolothrissa* and *Limnothrissa*. In the late 1980s, up to 23 seiners were operating simultaneously in Burundian waters, with more being operated out of the major town centres of the coast (Uvira, Kalemie, Mpulungu, Kigoma).

After the mid 1980s, two phenomena drastically changed Lake Tanganyika's offshore fishery (Petit, 1995). Firstly, during the second half of the 1980s, outboard engines became widespread in the artisanal fishery in Burundi, allowing the catamarans to operate offshore in the same fishing areas as the purse seiners. For a number of reasons, the purse seiners became economically uncompetitive when compared to the catamarans, and between 1990 and 1994, most of the seiners ceased operations. Secondly, in 1990, an experiment was undertaken with a larger catamaran, the Apollo. In comparison with the catamarans that used the traditional lift-nets, which could be manoeuvred by young crews or old fishers, the Apollo nets were wider and heavier and their hauling required a crew of six strong men. The net was also cast deeper than the traditional lift-net, and could access the larger *Luciolates* stocks, and schools of immature fish (Nyamunyamu). The Apollos proved highly profitable, and were quickly adopted along the Burundian shores. Their use subsequently spread to Tanzania, where all the catamarans at Kigoma that were reported by this mission were of the Apollo type (Figure 1, Petit 1995).

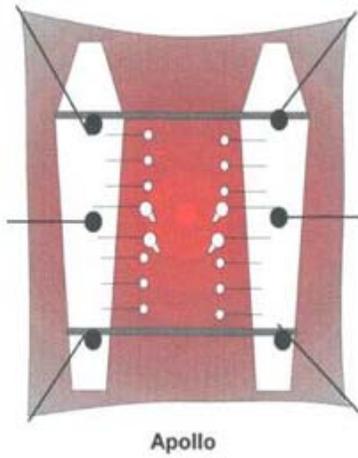


Figure 1. Apollo catamaran. Anchor lights are bright, wide focus lamps and the light penetrates shallow waters; Standard lights are of a narrow focus and the light penetrates deep into the water column (Petit 2005)



It is worth noting that, due to the physical demands required to operate the Apollo nets, gear owners, many of whom are not fishers, tend to hire physically strong men. This conflicts with the traditional habit of hiring relatives. As a result, the tradition for a fisher to be the son of a fisher is vanishing fast, and many fishers interviewed had no previous contact with the fishery when they were recruited. Over the past two decades, the number of fishers has increased in the artisanal fishery in Burundi - as 6-crew Apollos progressively replaced the older 4-crew catamarans. However, as a result of the changes in recruitment patterns, the number of former fishers that are now unemployed along the Burundian lakeshore has increased (Fédération Burundaise de Pêche, interviews with the fishers, August-October 2011).

Catamarans (all types) also use smaller boats: often, one pirogue carries the engine and trails the catamaran (sometimes two). To avoid pirates targeting their engines, and once on the fishing grounds, the pirogue with the engine often moves away from the catamarans to hide in the darkness. Typically, another small wooden pirogue called a renfort (reinforcement), loaded with powerful lamps, moves away from the catamaran, and attracts to it the fish which would otherwise not have come close enough to the catamaran to be caught. Thus, by using renforts, the area that can be fished by a catamaran is much larger than the arc of its own lights. In the past, the renfort boats were used to intercept the canoes that were used to attract fish to the seiners – typically, each seiner employed 4 or 5 canoes to attract fish. The renforts diverted the fish that had been attracted to the canoes towards the catamaran, essentially depriving the seiner of the catch. Clearly this was the main, if not only, cause of the collapse of the seining sector (Figure 2, Petit 1995).

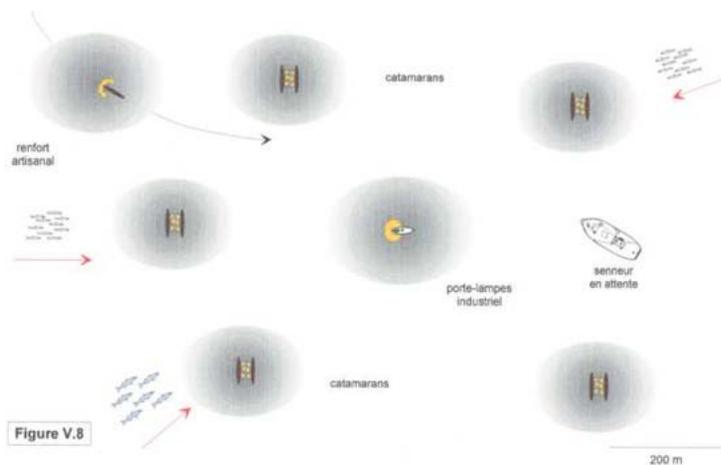


Figure 2. Artisanal catamarans operating offshore competing with vpurse seiners

A critical consequence of the adoption of more powerful outboard engines and stronger Apollo catamarans is the ability for fishermen operating from the south of Burundi to go deep into Tanzanian and Congolese waters while still being able to return to Burundi in the early hours of the morning to land their catches. Hence, since 1990 the total landings recorded for Burundian waters reflect less and less those catches made within Burundi waters, but rather encompass a much wider area (Figure 3, Petit 1995).

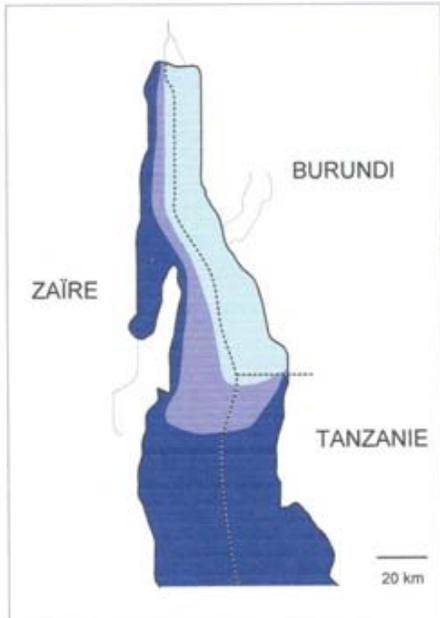


Figure 3. The operational area of the artisanal fishery in Burundi in 1988 (light blue) and in 1994 with the Apollos (violet)

The traditional or subsistence fishing activities employ several gears. Beach seines catch a mixture of small fish of low intrinsic value, mostly Cichlids (Petit, 1995). Mutimbo ring-nets (Figure 4) are a destructive fishing method in which an area of lake is partly encircled from the surface to bottom with a ring-net (small meshes). A fisher slams the water at the open end of the encircled net to frighten the fish forwards and into the net. In this regard, it is worth noting that the shock waves produced can kill the smaller fish in the area. The use of such nets in Lake Edward has caused the quasi-extirpation of the fish stocks in the lake (Petit, 2006). It appears that Mutimbo nets have been effectively withdrawn from Burundi waters, and none were observed during the current mission. Furthermore, former Mutimbo owners confirmed in meetings that these gears are no longer in use. The same applies to DRC waters where the damage caused by the Mutimbo nets is now widely acknowledged by the fishers, the majority of whom have now become hostile to their use. As a result, Mutimbo have become rare and their numbers continue to decrease (Mulimbwa, Uvira Research Station, pers. comm. 2011).

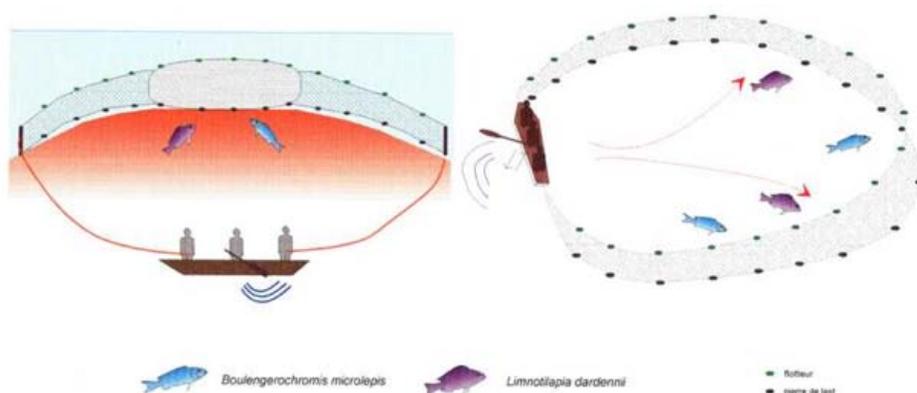


Figure 4. Mutimbo nets in Burundi

Musipa nets are used to target the largest catfishes such as *Protopterus aethiopicus*. Scoop nets are used in shallow waters in sandy or marshy areas, particularly in the extreme north and south of the lake where fish stocks have been severely depleted by their use. Gill-nets are used all along the lake at various depths according to the species targeted

(*Microlepis stomsis*, *Auchenoglanis occidentalis*, *Boulengerochromis microlepis*, *Malapterurus electricus*, *Synodontis* and *Bathybathes* spp). In addition, a number of small species are caught by the smallest, illegal mesh sizes. Hook and line, and long lines target the predators, notably the catfish in the inshore areas and the large *Lates mariae* in the offshore zone. Traps are set in the tributaries and the deltas rather than the lake itself.

Beach seines have been illegal since before independence. However, the law was poorly enforced, and their use was tolerated by other fishers who viewed the fishing gear as suitable for destitute fishers who had no alternative livelihood options (Petit, 1995). As a result of recent improvements in law enforcement, the number of beach seines has reduced significantly along the Burundian shores. In Tanzania, the seizure of beach seines (as well as other illegal nets) is also a frequent occurrence. However, in Tanzania, compliance operations are hampered by the length of shore to be patrolled and the small number of sites that can be easily accessed. In addition, beach seiners use old discarded lift-nets for their panels. Nets that are recycled in this manner cost very little and can be sewn together in just 48 hours, making the fishers practically indifferent to their occasional seizure (J. Mzee, Doria, Kigoma, pers. comm.).

The situation is obviously worse in the DRC, where 1 600 beach seines were observed during the 2011 frame survey. As the seining crews generally comprise destitute riparian people from different households, the removal of the gear would inevitably deprive several families of a source of livelihood. Realistically, the long-term removal of the seines will require the development of alternative livelihood options for the fishers. However, as the number of unemployed and poor people in the region is high, it is likely that the removal of a seining crew from the system will result in another emerging to take its place. (Mr Mulimbwa, Research Centre, Uvira, pers. comm).

Gill-net fishers in Lake Tanganyika, from Zambia to Burundi, are notorious for understanding the habitats and behaviours of the fish, and they target them with an extreme selectivity, targeting just five or six species according to mesh size (Figure 5, Petit, 1995).

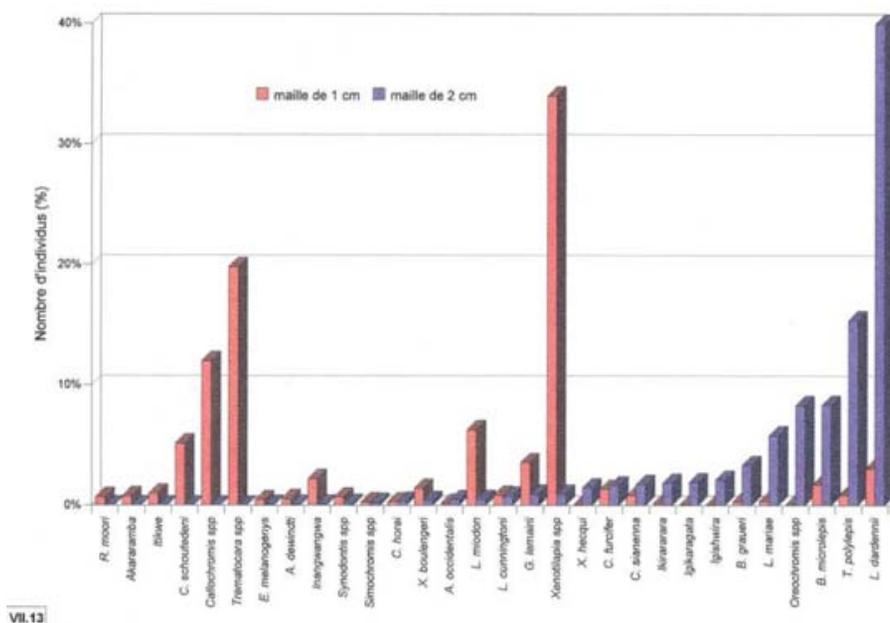


Figure 5. Gear selectivity: The contribution of the different littoral species in the catch of gill-nets using either 1 cm or 2 cm mesh sizes

VII.13

3 IUU FISHING ON LAKE TANGANYIKA

3.1 The distribution of IUU fishing across the riparian countries

The distribution of the legal and illegal gear used in the fisheries across the riparian states is presented in Table 3. The analysis is restricted to gill nets, lift-nets, ring nets and beach seines, and accounts for 86.9% of the total gears reported in the 2011 frame survey. Of the remaining 13.1% of the gears in use, 11.9% can be attributed to legal hook / lines and long lines, with the remaining 1.2% being attributed to 7 traditional fishing gears.

In Tanzania, a total of 1,892 lift-nets were recorded in the 2011 frame survey. Of these nets, 483 (25.5%) were illegal. In Zambia, the clupeid stocks are fished using mutobi and ring nets. The number of lift-nets in use was not recorded in Burundi or the DRC, but the number of nets matches the number of active Apollo and catamarans that were recorded in these countries. Taking vessel numbers into account, the total number of lift-nets in use on the lake is 5,331. Unfortunately there is no information pertaining to the incidence of illegal nets used on the Apollo or catamarans in Burundi or the DRC; however if it is assumed that illegal nets are used at a similar rate as that observed in Tanzania (25.5%), it follows that of the 710 and 2729 lift-nets in use in Burundi and the DRC respectively, 181 and 696 were of an illegal mesh size. Thus, of 5,331 lift-nets in use across the lake, 1,360 are estimated to be illegal, with the number of illegal nets in use being highest in the DRC (696 nets), followed by Tanzania (483 nets) and Burundi (181 nets). It should be noted that due to reductions in CPUE in Burundian waters, reductions in mesh sizes were observed as early as the late 80s.

The number of illegal gill nets on the lake is of concern. Of a total of 51,011 gill nets recorded on the lake, 16,504 were estimated to be illegal. Of the illegal nets recorded, and on a percentage basis, Zambia recorded the highest incidence of illegal nets (42.3% equating to 7,273 nets). In absolute terms, Tanzania recorded the largest number of illegal nets (8,487 nets equating to 26.7% of the nets). In contrast, Burundi recorded 32% or 118 of their gillnets as illegal, and estimates for the DRC suggest that in that country, there are likely to have been in the region 626 illegal nets. Evidently the use of illegal gill nets is of serious concern throughout the lake system, and in terms of absolute numbers, it is of particular concern in Tanzania and Zambia.

Of a total of 978 ring nets that were recorded in use on the lake, 80 nets representing 10.6% of the nets in circulation were estimated to be illegal. While no ring nets were recorded in Burundi, the incidence of illegal ring net use was clearly lower than that observed for the other fishing gears in this analysis. Of the 232 ring nets in use in Zambia, 40 (17.2%) were recorded as illegal. In contrast in Tanzania, 30 nets equating to just 4.7% of the ring nets were reported to be illegal. Estimates for the number of illegal nets in the DRC suggest that of the 102 ring nets in operation, 10 were likely to be illegal (Table 3).

While the use of beach seines has been banned in all the countries, a significant number of beach seines were recorded in the survey. In total, 1,778 beach seines were recorded in use in the lake. By far the majority of these nets were recorded in the DRC (1597; 89.8% of all seine nets), followed by Zambia where 110 nets (6.1%) were reported, 66 (3.7%) in Tanzania, and just 5 (0.3%) in Burundi. Clearly, the use of illegal seine nets is of particular concern in the DRC.

Table 3. The distribution of legal and illegal fishing gears across the riparian countries

Lift-net ¹				
	legal	illegal	total	% illegal
Tanzania	1 409	483	1 892	25.5
Burundi	529	181	710	25.5
Drc	2 033	696	2 729	25.5
Zambia			-	
Total	3 971	1 360	5 331	25.5
Gill net 2				
	legal	illegal	total	% illegal
Tanzania	23 319	8 487	31 806	26.7
Burundi	251	118	369	32.0
DRC	1 233	626	1 859	33.7
Zambia	9 704	7273	16 977	42.8
Total	34 507	16 504	51 011	32.4
Ring nets ³				
	legal	illegal	total	% illegal
Tanzania	614	30	644	4.7
Burundi	0	0	0	0
DRC	92	10	102	10.1
Zambia	192	40	232	17.2
Total	898	80	978	10.6
Beach Seines				
	legal	illegal	total	% illegal
Tanzania	0	66	66	100.0
Burundi	0	5	5	100.0
DRC	0	1 597	1 597	100.0
Zambia	0	110	110	100.0
Total	0	1 778	1 778	100.0

¹ For the purpose of this analysis, it is assumed that the level of legal gear was similar in Burundi and DRC to that recorded in Tanzania.

² The number of illegal gill nets in the DRC was not reported in the Frame Survey report. To estimate the number of illegal nets in the fishery, the mean of the average level of illegality in the three countries was applied (33.7%).

³ The number of illegal ring nets in the DRC was not reported in the Frame Survey report. To estimate the number of illegal nets in the fishery, the mean of the average level of illegality in Tanzania and Zambia countries was applied (10.1%).

3.1.1 Tanzania

In Tanzania, the frame survey revealed that the distribution of illegal fishing is uneven along the coast. Illegal lift-net use centres around the northern part of the lake in Kigoma. In Kigoma Ujiji and Kigoma DC; illegal nets account for up to 81% and 25.1% of the nets respectively (Table 4). However, as Kigoma DC represents the centre for lift-net fishing in the country, in real terms there are more illegal nets in this area (228 nets) as opposed to Kigoma Ujiji (198 nets). In the southern districts of the lake the number of illegal nets diminishes rapidly. For example in Nkasi, although there are 395 nets recorded in the frame survey, just 2 (0.5%) were found to be illegal, and in the far south in Sumbawanga, no illegal lift-nets were recorded. Concomitant with the pattern for illegal lift-nets, the distribution of illegal gill nets is again lowest in the far southern districts of Mpanda, Nkasi and Sumbawanga, and again highest in Kigoma DC and Kigoma

Ujiji where respectively between 55.4% and 35.6% of the nets were found to be illegal. In contrast to the lift-net and gill net fisheries where respectively 25.5% and 26.7% of all the nets were found to be illegal, only 4.7% of the nets in the ring net fishery were found to be illegal. While the majority of the fishing effort in this fishery is based in Nkasi, only 1.2% of the nets in that area were found to be illegal. The areas that showed the highest number of illegal nets was Kigoma DC followed by Mpanda to the immediate south. With respect to the beach seines, relatively few (66) were found during the frame survey, and of these, 83% were found in Kigoma DC. In terms of promoting MCS activities along the lakeshore, it is evident that the major fishing effort is concentrated in the Northern districts of Kigoma Ujiji and Kigoma DC, and it is in these areas that the majority of the illegal fishing activity is taking place.

Of the 11,506 vessels that are in the fishery, only 2,538 are registered, suggesting that 8,968 or 78% of the vessels are unregistered. While the fisheries legislation requires vessels to be registered, this requirement is evidently not being met and vessel registers are not being kept by MLFD: Fisheries Division. The high number of unregistered vessels has been attributed to the increasing levels of piracy on the lake, and the concomitant desire for the fishers to keep their vessels / equipment from being identified by the pirates. Piracy is an increasing problem that has been identified as a major constraint to the fishers and trade throughout the lake (M. Van der Knaap, FAO, pers. com.).

Table 4. The use of illegal fishing gears in Tanzania (2011 Frame Survey)

Lift-net						
legal ($\geq 8\text{mm}$)	44	831	107	395	32	1409
illegal ($< 8\text{mm}$)	198	228	55	2	0	483
total	242	1059	162	397	32	1892
illegal (%)	81.8	21.5	34.0	0.5	0.0	25.5
Gill net						
legal ($\geq 8\text{mm}$)	1385	7387	5032	8328	1187	23319
illegal ($< 8\text{mm}$)	1722	4085	1077	1073	530	8487
total	3107	11472	6109	9401	1717	31806
illegal (%)	55.4	35.6	17.6	11.4	30.9	26.7
Ring nets						
legal ($\geq 8\text{mm}$)	1	94	41	333	145	614
illegal ($< 8\text{mm}$)	0	20	6	4	0	30
total	1	114	47	337	145	644
illegal (%)	0.0	17.5	12.8	1.2	0.0	4.7
Beach seine						
illegal	3	55	1	3	4	66
Vessel Registration						
Registered	250	737	153	1270	128	2538
Unregistered	436	3359	865	3413	895	8968
Total	686	4096	1018	4683	1023	11506
Unregistered (%)	63.6%	82.0%	85.0%	72.9%	87.5%	78%

3.1.2 Zambia

The 2011 frame survey report does not provide geographic information describing where the illegal fishing gear was recorded (Table 5). Nevertheless, it is apparent that the major issues in terms of the use of illegal fishing gears accrues to the use of illegal gill nets, and to a lesser extent, the use of mutobi and seine nets. Of the 16,977 gill nets that were recorded in the fishery in 2011, 7,273, representing 42.5% of the nets were found to be illegal. In contrast, just 214 (41.9%) and 110 (100%) of the mutobi and seine nets respectively were reported to be illegal.

Table 5. The use of illegal fishing gear in Zambia (2011 Frame Survey)

District Gear ¹	Mpulungu			Kaputa	Total	Number of illegal gears	Percent illegal
	Area 1	Area 2	Area 3	Area 4			
Active boats	322	635	603	767	2 327	-	-
Ring nets	22	80	43	87	232	40	17.4%
Gill nets	1 627	6 915	907	7 528	16 977	7 273	42.5%
Mutobi nets	35	226	76	175	512	214	41.9%
Beach seine nets	31	5	7	67	110	110	100%

¹ Illegal gear defined as ring, and mutobi nets with a mesh smaller than 8 mm, gill nets with a mesh smaller than 76 mm and all beach seines

3.1.3 Burundi

Of the 396 gill-nets that were recorded in the fishery, 118 (32%) were estimated to be illegal, and of those, the majority were found in the Bujumbura-rural district (Table 6). The use of small mesh illegal gears in this region is consistent with the small size of the species that are targeted in this area. Recently, fishers have started to use monofilament gears en masse, which are normally forbidden, as “no fish can ever see them, so none escapes and they destroy the stocks” (Department of Water, Fish and Aquaculture). In 2010, the spread of these nets, combined with the knowledge that the new legislation forbidding their use had yet to be enacted, resulted in a Burundian radio campaign in which the populace were told to avoid eating fish from the littoral zone as they had been caught “using poison”. In response, the FAO fisheries’ experts received alarmed calls from Bujumbura residents. After an investigation, it was revealed that the radio campaign was an attempt to ruin the monofilament gill-net fishery, and convince the fishers to move back to using multifilament gears (Petit P. & Kiyuku P., pers. comm. 2011).

Generally, the fish caught inshore are sold to the riparian population, and very few of the fish reach the central markets of Bujumbura. Only five illegal beach seine nets were recorded in the survey, and these were found in Makamba district. Fishers confirmed that most beach seines had been withdrawn, but reported that at least one was still in use by unemployed residents of Kanyosha, who reportedly had “no alternative source of income” (FBP group interview, 2011).

Table 6. The use of illegal fishing gear in Burundi (2011 Frame Survey)

	District			Total	Number illegal	Percentage illegal
	Bujumbura-rural	Bururi	Makamba			
Total Boats	582	354	579	1 515	-	-
Apollo (lift-net)	61	264	142	467	n/r	n/r
Catamarans	112	75	74	261	n/r	n/r
Long lines	n/r	n/r	447	447	-	-
Hook and Line	n/r	n/r	12	12	-	-
Gill nets 1	233 (75)	66 (21)	70 (22) 2	369	118 2	32%
Musipa nets	19	9	1	29		
Beach Seine	0	0	5	5	5	100%

¹ Figures presented in parenthesis represent the number of illegal gears (monofilament and encircling gillnets)

² The number of illegal gill nets at Makamba was not reported and thus was estimated using the average rate of illegal gears that were reported from Bujumbura-rural and Bururi.

The legal status of the Apollo and catamaran lift-nets was not reported, and thus it is not possible to determine levels of compliance in this fishery. Despite a degree of itinerancy in this fishery in which fishers follow the clupeid and Centropomid stocks on a seasonal basis, the major focus of this fishery is in the Central and Southern Districts of Bururi and Makamba. Throughout the 80s and 90s, the artisanal and industrial fishers have had to move deeper into the southern regions to maintain good catches. In this regard, the bottleneck caused by the isthmus of Fizi, a zone occupied at night by lift-net fishers from both the Congolese and Burundian shores, is believed to act as a major blockade for the migration of the fish northwards. As an illustration, although 100 catamarans are registered at Gitaza (30 km south of Bujumbura), few are ever seen there as most of the vessels operate on a continual basis much further south.

Scoop nets made of mosquito nets (Agaweshuro) are used in the northern parts of the lake to target the fry of *Limnothrissa miodon* (Petit, 1995). These fish are considered a delicacy and in the past fetched high prices in the markets of Bujumbura. Although these mosquito nets were not recorded in the northern part of Burundi during the frame survey, fishermen from this region unanimously confirm that these nets are still in “as much use as ever”.

In general, scoop nets use stretched meshes of 2 cm or less, and are being used extensively along riverbanks, in the deltas, and in the swamps. Catches primarily comprise juvenile *Oreochromis* Spp. and *Clarias* Spp. The total number of gears in use and the corresponding catch volumes are unknown. However during this study, catch observations near the mouth of the Ruzizi river using a Lusenga nets suggest that about 2 kg of juvenile tilapia can be caught in a morning's fishing.

3.1.4 Democratic Republic of Congo

The distribution of the fishing gear in the DRC is presented in Table 7. Unfortunately the frame survey makes no mention of the levels of illegal gears in use; however, it is evident that the major fishing effort is distributed unevenly throughout the country. Specifically, the Catamaran and Apollo fleets that target the clupeids are concentrated in the Southern districts of Kalemie and Moba where 75% and 71.5% of these respective fleets are based. The ring net fishery is also concentrated in these districts where it accounts for 98.5% of the gear in this fishery. Furthermore, the long-line fishery that targets the Lates spp. also predominates in the southern district of Moba where 73% of the long-

line fishery is based. Evidently the concentration of fishing effort in these districts that are serviced by transversal roads that do not run along the lakeshore, provides the major rationale for the movement of processed fish products by boat to the larger urban centres of Kigoma, Bujumbura and Mpulungu. Hook-and-line fishing predominates in Fizi and Kalemie with minimal effort being extended in this fishery in either Uvira or Moba. A total of 1,595 illegal beach seines were recorded in the 2011 frame survey, the majority of which were found in Fizi (467 nets), and the far southern district of Moba (633 nets), representing 29.2% and 39.4% of the nets in this fishery respectively.

Over the past decade, traditional fishing pressure has intensified in the northern Congolese waters, where several NGOs have become active in supporting the sector, paying their staff in dollars. The influx of cash has encouraged the fishers to target the high value specimens and as a consequence, the larger fish are reportedly becoming rarer (Mr Mulimbwa, Research Centre, Uvira, pers. comm. 2011).

Table 7. The distribution and use of fishing gear in the Democratic Republic of Congo (2011 Frame survey)

Gear Type / District	Uvira	Fizi	Kalemie	Moba	Total
Long-line	456	532	322	3554	4864
Lift-net (Catamaran)	199	346	1032	712	2289
Beach seine (day)	171	467	324	633	1595
Gill net	131	798	695	235	1859
Hook and line	22	1406	1403	7	2838
Apollo (lift-net)	21	104	186	129	440
Mutumbo	11	70	-	-	81
Epervier	1	48	1	2	52
Epuisette (nets)	-		10	3	13
Traps	-	19	19	-	38
EP	-	27	-	-	27
Ring Net	-	3	100	102	205
Beach seine (night)	-	1	-	-	1
TOTAL	1012	3821	4092	5377	14302

3.2 Biological implications of destructive fishing practices

One of the major threats to the fish stocks in the offshore zone is the use of lift-nets to target juvenile *Lucioides* and *Stolothrissa*. It is worth noting that the major concern is not the legality of the mesh size, which, even at 12 mm, would allow immature fish to be caught, but rather the capacity of the lift-nets to reach the juvenile fish stocks. During a site visit to Magara beach (40 km south of Bujumbura), the current mission observed juvenile *Stolothrissa* that had been caught by regular lift-nets not far from the littoral zone. It should be noted that before they entered into competition with the Apollos, catches of immature fish by purse seines were rare - the juveniles have a low market value. Currently, lift-net fishing is legally prohibited within 5 km of the Burundi shoreline - where most of the juvenile *Stolothrissa* are caught. However, at present there is no enforcement of this law. Increasing the mesh size of the lift-nets would enable the juvenile *Stolothrissa* and *Limnothrissa* to escape, and following the work of F. Roest in the 70s, recommendations have been made to increase the legal stretched mesh size of the nets from 12 mm to 15 mm (Mr Mulimbwa, Research Centre, Uvira, pers. comm.).

With respect to the fishing pressure accruing to the artisanal offshore lift-net fishery, approximately 28,000 sq. km of the lake is exploited by this fishery - the first 3 km from the shore are generally unproductive areas and can be discounted. Assuming that each of the 5,300 lift-nets in the fishery is cast 3 times a night, and that the fishery is active some 250

days a year; it follows that on average, a given square kilometre of pelagic waters is subject to 150 net hauls a year.

Beach seines and Mutimbo ring nets both destroy the inshore stocks and negatively impact the benthic environment. Most notably, these fishing practices destroy cichlid nests including *Boulengerochromis microlepis*, and target the juveniles of *Lates mariae* which are abundant in the littoral zone. In addition, the catch of young Cichlids, such as the Haplochromines, deprives predators of a high-value food source.

Scoop nets (mosquito nets) cause the depletion of the *Limnothrissa* stocks in the extreme north of the lake. In 2011, the *Stolothrissa* catches in this part of the lake over July and August (peak season) were abnormally poor, and while the fishers were unable to explain why this should have been the case, it was noted that in the absence of good *Stolothrissa* catches, the *Limnothrissa* could become a viable alternative catch. However this can only occur if the juveniles of this species are not overfished, and the continued presence of scoop net fishing could impact juvenile recruitment into the fishery. In addition to the negative impacts caused by the mosquito nets, casual scoop net fishing that targets the juvenile *Oreochromis* stocks in the shallow breeding grounds also cause major losses in productivity.



Figure 6. The *Limnothrissa* catch of one mosquito net near Bujumbura. Bottom right is also a small Cichlid

Overall, the major causes for the depletion of the fish stocks are the excessive numbers of artisanal boats and the associated catch of immature fish. While no stock assessments have been performed recently to confirm the status of the fisheries (one is currently being proposed to either the 9th or 10th EDF), the mission's observations at the landing sites suggested that the stocks have been depleted, confirming historical analyses that suggested that this was the case (Figure 7, Petit 1995); the situation is not expected to have improved since 1995.

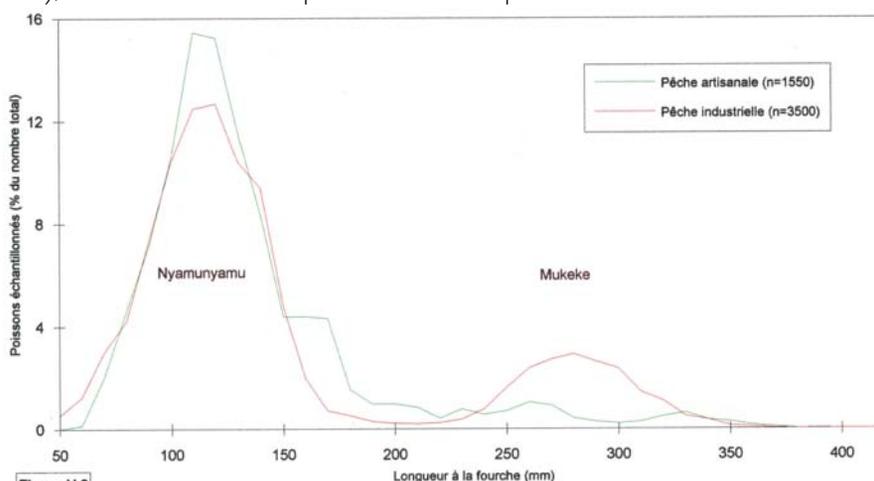


Figure 7. Catches offshore in 1990 of juvenile *Luciolates* (Nyamunyamu) and adults (Mukeke)

In addition to the illegal fishing practices that negatively impact productivity, there are other activities on the lakeshore that also impact the fish stocks. The extraction of sand and rocks for construction, notably in the riverbeds and in the shallow waters, has destroyed habitat in these zones. The uncoordinated expansion of Bujumbura has resulted in increased rates of erosion that, combined with the release of untreated urban wastes into the lake, have negatively impacted the fish stocks to the immediate south of Bujumbura. These impacts have caused the extinction of several fish species - evidenced by the fact that discussions with fishers about the status of the resources in this area typically elicited the following response: "the fish that you used to see before the war do not exist anymore". Furthermore, due to the civil war in Burundi, large swathes of reeds that were used as refuges by the combatants were destroyed and have never been replanted. Finally, the development of palm oil plantations along the shores of the lake, and the release of oil residues into the water have caused significant increases in mortality rates among the riparian fish communities. Fish mortalities have increased to a level at which the fishers themselves have reported the problem, and have requested that palm oil processing by-products are no longer disposed of in the lake.

3.3 Current efforts to combat IUU fishing

A review of the current capabilities to undertake MCS activities across the region was undertaken. The analysis is based on interviewing key informants in the riparian countries. Unfortunately, due to logistical reasons, it was not possible to interview informants from Zambia, and thus this analysis is based on the current situation in Burundi, Tanzania and the DRC.

3.3.1 Burundi

3.3.1.1 Legal and regulatory frameworks

The legislative framework that is used to regulate the fisheries in Burundi is currently under review. It is anticipated that in December 2011, a new Fisheries Act will be promulgated by Parliament. The new Fisheries Act will replace the out-dated 1937 Act (Decree of 21st April 1937), and the more recent regulations and ordinances that are associated with the Act. For the purpose of this analysis, the review of the legal and regulatory frameworks is restricted to the new legislation.

Fisheries management in Burundi falls under the remit of the Ministère de l'agriculture et de l'élevage. Direction des Eaux, Pêches et Pisciculture (Department of Water, Fisheries and Aquaculture - DWFA). While the enforcement of the regulations falls to the DWFA, the legislation authorises the environmental and judicial police forces and beach management units to partake in the enforcement of some aspects of the legislation (Table 8).

Table 8. Legislative framework

Issue	Name	Comment
Inspection Authorities	Ministère de l'agriculture et de l'élevage. Direction des eaux, pêches et pisciculture (Department of Water, Fisheries and Aquaculture - DWFA)	The Direction des eaux, Pêches et pisciculture is mandated as the primary legal inspection authority.
Enforcement Regulations (law / policy)	New fisheries regulations have been drafted and will be submitted to parliament in December 2011. (currently the regulations are under review by the LTA).	A new Fisheries Act that will replace the outdated 1937 Act (Decree of 21st April 1937), and the more recent regulations and ordinances has been developed. It is anticipated that this Act will be promulgated by Parliament in December 2011.
Authorised Personnel for law enforcement	DWFA staff Environmental / judicial police force	Articles 47 and 48 of the new law provide for the enforcement of the new Fisheries Act.
	Beach management units	

A review of the regulations that will be enforced under the new Fisheries Act that have pertinence to MCS is provided in Table 9. It is evident that in general, the regulations address those issues that would reasonably be anticipated in this type of legislation and include issues of gear limitation. Legal gears comprise passive gill nets (≥ 40 mm mesh, 1000 m), lift-nets (≥ 6 mm / 5 mm mesh), purse seines (≥ 6 mm mesh), pelagic trawl nets (≥ 6 mm mesh), long lines, hook and line, traditional Lusenga gears and traps. Illegal gears comprise beach seines, encircling gillnets, monofilament nets and mosquito nets.

Table 9. Regulations applicable to Monitoring, Control and Surveillance

Issue	Yes / No	Comment
Vessel / Gear licensing and limitations	Yes	Gill nets: min stretch mesh 80 mm Max length 1,000 m Lift-nets: Min stretch mesh 12 mm (panels); 10 mm (pocket) Pelagic trawl nets: Min 12 mm stretch mesh Purse seines: Min 12 mm stretch mesh Lusenga: Min 12 mm stretch mesh Illegal gears: Beach seines, monofilament nets, mosquito nets
Control access to fishing	Yes	All professional fishers require a licence to operate – at present this regulation is not being strictly enforced by the DWAF. Unlicensed fishing is punishable by a BIF 1 million fine (US\$ 800) and/or imprisonment for a period from 6 months to 5 years (Art. 55)
Permitted species and catch restrictions	No	There are no permitted species or catch restrictions
Closed areas	Yes	Article 34 of the new Fisheries Act identifies protected areas. Closed areas are already gazetted, but this process will be revised under the new legislation
Control of the capture of immature fish	Yes	Article 34 prohibits the fishing of juveniles of all species in Burundian waters
Powers to stop, seizure, search and arrest	Yes	Article 50 provides provisions to stop and search suspects / vessels / buildings Article 58 provides provision for the confiscation of illegal fishing gears / vessels
Powers to seize and destroy	Yes	No court order is required. Seized equipment is kept under administrative supervision until the case is treated.
Powers to revoke licence	Yes	
Powers of Arrest	Yes	
Power to prosecute	Yes	
Offence to obstruct / intimidate authorised compliance officers	Yes	Violence / intimidation of compliance agents is punishable by a BIF 500,000 fine (US\$ 400) and/or imprisonment for a period from 6 months to 5 years (Art. 57).
Offence to land, receive/sell illegally caught fish	Yes	
Regulate the sale of illegal fishing gear	Yes	All importers and sellers of fishing gears must be registered. The use of fishing gears that is not proscribed by law has to be validated by the Ministry.
Appropriate deterrents in place (fines, confiscation, prison)	Yes	Fines, confiscation, prison, may be doubled in some circumstances (Art. 61)
Regulate cross border fishing and trade	No	The 2011 law does not specify the conditions for cross border fishing and trade.

3.3.1.2 Compliance capability

Compliance with the fisheries regulations is the remit of the DWFA, which is assisted in its efforts by the marine police, the local authorities, and the recently established beach management committees. At present, compliance efforts are restricted to land-based operations, are uncoordinated, and appear to be undertaken on an ad hoc basis.

The DWFA head office in Bujumbura is severely understaffed and does not have trained personnel assigned to address MCS issues. It is evident that much of the burden for addressing IUU fishing issues falls to the Department Head (Ms Leonie Nzeymana) who deals with the day-to-day compliance issues. In the field, the DWFA employs 12 beach recorders (Table 10) whose primary task is to collect daily catch, effort and price data. While their primary task is to record data, discussions with fishers at the Kagongo beach site suggests that they also play a compliance role in that they report illegal gears to the beach management units and the police as and when it is observed. The recent introduction of beach management committees will likely have improved compliance at the beach sites, and there are reports of illegal gears being sized and destroyed by these committees (Ms L Nzeymana, DWFA, pers. com.). Unfortunately the DWFA does not compile this information and was unable to provide explicit numbers of the gears that have been removed in this manner. Nevertheless, the records indicate that a legal process is followed for removing illegal gears from the fishers. This process involves the production of a statement that is signed by representatives of the marine police, the DWFA, the PRODAP NCU, and the beach management units / fishers' representative. Currently illegal gears are either destroyed at the beach sites, or confiscated and stored at the DWFA office in Bujumbura for subsequent disposal. Illegal catches are distributed between the compliance personnel involved in the seizure.

The level of autonomy, the degree of devolution of management authority, and the management efficacy of the beach management units is difficult to determine. In terms of taxation, the fishers pay levies of approximately BIF 500 (US\$0.40) per 55-70 kg box of fish caught, and a small amount of the catch is paid "in kind" to the DWFA data gatherers. All fishing communities are supposed to be represented / managed by a "communal fisheries committee". Often the most influential members of these committees are administrative personnel from the villages who have little knowledge of the fishing industry. Clearly, this represents a barrier to the development of effective MCS measures.

In addition, there significant confusion arising from the regulations relating to net measurements. In the francophone countries (DRC and Burundi), the majority of the net panels that are imported are measured in yards, and the meshes in inches. With the exception of the academics, neither the fishing authorities, the heads of the Federation of Fishers in Burundi or the fishers appear to be aware of the conversion ratios for centimetres and inches. Thus, most uneducated fishers, working in good faith believe that 1 inch equals 1 "centimètre", and although the law is clear on the matter, the conversion needs to be explained to all fishers. In this regard the use of explanatory posters on administrative buildings at each fishing village would suffice.

To date neither the staff at the DWFA, the marine police, or members of the beach management committees have received any formal training in terms of developing compliance programmes or undertaking compliance activities.

Table 10. Personnel in the field that can assist in MCS activities

Province	Landing Site	Beach Management Units	DWFA fisheries data collectors	LTA patrol boat
Province of Bujumbura	Gatumba-Gaharawe			(planned)
	Katumba-Kibero			
	Kajaga			
	Cimental / Cadillac			
	Kibenga			
	Kanyosha			
	Nyamugari			
	Kabezi			
	Gakombera			
	Migera			
	Gasange			
	Gitanaza			
	Rutungu			
Province of Bururi	Nyaruhongoka			
	Makombe			
	Magara			
	Gatare			
	Shanga			
	Min-Kayengwe			
	Cugaro			
	Kagongo			
	Kizuka			
	Nyacijima / Zrhaps			
	Kinani			
	Rumonge			
Province of Makamba	Gatete			
	Karonda			
	Kigwena – Gikumu			
	Buzengo			
	Muguruka			
	Rubindi			
	Gwata			
	Mvugo			
	Kifuruzi			
	Nyanza-Lac			
	Gasaba			
Kabonga				

The equipment that is available for MCS operations is limited (Table 11). At present, the DWFA does not have any

patrol boats. However, the LTA is in the process of purchasing ten 15 hp craft to assist the Beach Management Units to patrol the inshore areas. To date these are on order but have as yet to be delivered. As such there are currently no patrol vessels available to monitor fishing on the lake. At present, the fisheries data collectors use standard reporting forms. However, there are no standard pro-forma reporting mechanisms for reporting illegal activities, or for the collection of evidence. In addition, enforcement personnel are not issued with appropriate gear to measure nets, or record evidence (e.g. cameras), or guidelines outlining the regulations and the use of illegal gears. Of considerable concern is the lack of vessel or gear registers making it difficult to monitor and assign ownership to fishing equipment.

Table 11. Equipment available to undertake MCS operations

Equipment	Present / absent	Comment
Vessels	No	The LTA is currently purchasing 10 small (15 hp) boats to assist the newly formed BMUs to set up inshore MCS operations. Initial operational costs will be funded by the LTA. The DWFA do not have any vessels / vehicles with which to undertake either shore based or water based compliance operations.
Safety equipment	No	
Reporting and record keeping (pro-formas etc)	No	Reporting records are written by hand and filed at the Department
Gear Assessment (e.g. net gauges / rulers)	No	
Fish measurement	No	
Cameras	No	
Binoculars	No	
Weaponry		
Reference documentation available to compliance personnel		
Vessel register	No	Licences are not being issued at present. No current vessel register exists.
Gear register	No	Licences are not being issued at present No current record gears are kept. Gears are unmarked making it difficult to attribute ownership
Regulations	No	Documentation to assist fisheries inspectors has not been developed
Fish identification guides	No	
Gear guidelines	No	

3.3.1.3 MCS Activities

As discussed in Section 3.3.1.2, current MCS activities are restricted to ad hoc land patrols. A review of the actions that would typically be associated with these operations suggests that the only credible MCS activity that is currently being undertaken is the check for illegal gears (Table 12). While licence checks are reportedly undertaken on an annual basis (Ms L. Nzeymana, Director, DWFA, pers. com.), the fact that the DWFA is no longer issuing licences or keeping an up

to date record of fishers suggests that such an intervention will make no meaningful impact on management.

Table 12. Actions undertaken by compliance personnel

Activity	Yes / no	Comment
	Yes	Ad hoc patrols are undertaken
Land patrols	No	No capacity at present – the LTA is currently developing capacity in both the inshore and offshore (trans-boundary) areas
Lake patrols	No	No capacity
Air patrols	Yes	Annual – an annual vessel check is supposedly undertaken, however in the absence of a credible vessel register, there are serious issues pertaining to the efficacy of checking licences to improve MCS outcomes
Licence checks	Yes	Gears are checked for illegal mesh sizes, types, material
Gear Checks	No	No vessel register is kept
Verification of registration	No	
Crew checks	No	An unspecified number of vessels are marked with the letters “BDI” to signify that they are Burundian vessels. There are no individual markings to identify vessels and the DWFA does not keep an up to date vessel register
Vessel markings	No	Individual gears are not marked and cannot be traced to owners
Gear markings	No	No recorded by the DWFA
Location of fishing activity	No	Vessel log books are not kept.
Vessel log books	No	The DWFA beach monitors record the amount of fish that is landed per boat on a daily basis, and the prices attained at the beach. They do not keep records of the landings accruing to individual vessels.
Evidence: photographic	No	No capability
Evidence sealed and logged	Yes	Illegal gears are either destroyed in situ or transported to DWFA for storage and subsequent destruction. There are no formal protocols for collecting evidence
Records of inspection		The DWFA keeps records of inspection

3.3.1.4 Implications for MCS

A. Legislative and Regulatory Frameworks

1. The legislative framework that will be promulgated in December 2011 provides a suitable framework for the development of MCS activities on the Lake.
2. The legislation allows for the devolution of management responsibilities and the development of a “bottom

up” approach to fisheries management through community based structures (beach management units / fisher associations), local and district authorities.

B. MCS capability - human resources

1. 1. The DWFA is understaffed and has not been trained to develop, design and operate effective MCS programmes. There is no dedicated MCS unit at the DWFA, and staff have not been sensitised to the role of MCS in fisheries management. There is a need to develop capacity at the DWFA in terms of compliance officers, case officers, recorders etc. Roles and responsibilities need to be clarified.
2. 2. The role of the DWFA beach monitors could likely be improved in terms of undertaking MCS operations. At present there are only 12 monitors for a total of 40 landing sites. The monitors have not been provided with MCS training.
3. 3. While there are good communication systems between the beach monitors and the DWFA in Bujumbura, the information that is required to assist in MCS activities is absent – for example licence and vessel registers are not kept up to date, and are unavailable to the fisheries monitors / BMUs.
4. 4. The role of the marine police in undertaking MCS operations needs to be clarified, and the possibility of developing joint MCS operations with the DWFA could be considered. The Marine police have not been trained in the role of MCS in fisheries management, and MCS procedures. The possibility of designating specific marine police officers for training, and to assist in MCS activities, could be considered.
5. 5. The development of Beach Management Units is a new development in Burundi. To date they have received no formal MCS training, and although they are reportedly undertaking limited compliance activities in terms of identifying and confiscating illegal gears, they require support, and their role in providing effective MCS should be enhanced.
6. 6. The judiciary will need to be sensitised to the new fishing regulations. At present, illegal gears are being removed, but fishers are not being formally prosecuted for transgressions. In particular, and although it appears trivial, it is suggested that the judiciary, customs and police are trained to identify illegal gears - as illegal gears are currently traded under the guise of legal ones.
7. 7. Prior to the extended civil war (1993-2009), the local authorities were on occasion being extremely effective in reducing the use of illegal beach seines and mosquito netting. At times, they banned all fishing activities for a period of two days when a beach seine was discovered, and was being used with the tacit agreement of the whole community. To our knowledge, the local authorities are no longer so proactive.
8. 8. At present, surveillance appears to occur primarily during the daytime. During the day, most of the illegal nets, especially the mosquito nets, have already been hidden in houses. Similarly, the frame survey was performed during the daytime, and thus the presence of these types of illegal gear is likely to be unreported. Evidently in the far north of the lake, there is a need to patrol the lake at nighttime. The stretch of coast that needs to be patrolled is small, and the illegal fishing units are non-motorised, and would thus find it difficult to evade coordinated patrols. In particular, the use of Lusenga nets - which likely number some dozens of units around Bujumbura – could be significantly reduced by the deployment of simultaneous compliance units.
9. 9. As experience has shown, and as reported to this mission in both Burundi and Tanzania, fishers along the lake are well networked (in Burundi waters, mobile phone coverage is everywhere and while it is patchy in Tanzania, it covers most key villages). Fishers warn each other of the departure of patrolling boats, and thus compliance activities have to adapt to this strategy.
10. 10. A visit to the suburban Bujumbura markets revealed that two kilograms of immature Tilapia can be sold for BIF 8,000 (US\$ 6). Under this paradigm, a casual illegal fisher fishing 22 times a month and selling his whole catch can

earn 130 dollars a month – a high wage by Burundian standards. Considering the shortage of job opportunities in Burundi, the number of refugees that still need to be reintegrated into society, and the low levels of income accruing to the agriculture sector (which occupies more than 90% of the active population), it is evident that illegal fishing activities will only be reduced if MCS capabilities are improved and viable alternative livelihood options are developed for the fishers.

C. MCS capability – available resources

1. 1. Due to inadequate resources, lake-based MCS activities are currently absent, and land-based operations are undertaken on an ad hoc basis. There is a lack of resources, equipment and patrol platforms at all levels in the MCS system.
2. 2. The absence of standardised MCS manuals / procedures and protocols hamper those MCS efforts that are being undertaken.
3. 3. Records of inspections are not formalised and compliance data is unavailable for analysis. It is therefore difficult to monitor the efficacy of the current operational procedures.

3.3.2 Tanzania

3.3.2.1 Legal frameworks

Fisheries in Tanzania fall under the jurisdiction of the Ministry of Livestock and Fisheries Development (MLFD, Table 13). The principle legislation that is applied to fisheries relates to the Fisheries Act (Act 22 of 2003) and the Fisheries Regulations (GN 308, 2009). The Fisheries Act (2003) broadly outlines the overarching framework with which to regulate the sector, and as would be expected, the Fisheries Regulations (2009) are more specific and identify permit requirements, the translocation of exotic species, and other sector-specific regulations to control fishing, processing and trading operations. As far as regulations are concerned, they are relatively formulaic and cover the basic issues that are usually found in such legislative / regulatory frameworks.

Table 13. Legislative frameworks

Issue	Name	Comment
Inspection Authorities	The Ministry of Livestock and Fisheries Development (MLFD)	The MLFD is the authorised entity that is responsible for MCS operations. The MLFD has established a National Surveillance Unit (NSU) based in Mbegani (near Dar es Salaam), and a regional office (Doria) in Kigoma to undertake surveillance operations on Lake Tanganyika.
Enforcement Regulations (law / policy)	Fisheries Act (Act 22 of 2003) Fisheries Regulations (GN 308, 2009)	
Authorised Personnel for law enforcement	MLDF Surveillance and Patrol Unit (Doria) MLDF Marketing Inspectorate Local Police District fisheries officers BMUs	The Doria Surveillance and Patrol Unit is the primary agency that is responsible for undertaking MCS operations on the lake

3.3.2.2 Regulations applicable to MCS (Government Notice: 308, 2009)

The regulations that are applicable to MCS operations are outlined in Table 14. The regulations call for vessels to be registered and licensed, and for this information to be maintained in appropriate registers. It is evident that while the MLDF keeps vessel and licence registers, the incidence of unregistered vessels is high (according to the 2011 frame survey, 78% of vessels are unregistered), and in addition, the fishers are not marking their vessels according to the regulations, thus making vessel identification on the lake problematic. Entry into the fishery requires the payment of a licence fee; however there are no effort or quota controls, and thus the fishery is essentially an open access fishery. While fishing gears are not registered or marked, the definition of illegal gears is clearly stated in the regulations. Species restrictions and areas that are closed to fishing are clearly demarcated in the regulations. Compliance personnel have appropriate powers to stop, seize and arrest, and appropriate deterrents are in place to fine and imprison offenders. The sale and importation of illegal fishing gear is an offence as is the unregulated export and import of fishery products.

Table 14. Regulations applicable to MCS activities

Issue	Yes / No	Comment
Vessel register	Yes	Article 4: requires all vessels to be registered. 4 (4) requires vessels below 11 m to be registered through a BMU / village committee. Article 15: requires licensing officers to maintain a register of all fishing vessel within their jurisdiction. Articles 6 and 7: requires engines and vessels to be identifiable (engine numbers, vessel's identification marking). Article 10: A central register of all vessels will be maintained
Gear Restrictions	Yes	Article 66 stipulates restricted gear. This includes: a) Monofilament nets, b) modified seine nets, c) cast nets, d) gill nets less than 76 mm e) beach seines f) drift net fishing "tembea", g) Dagga fish nets less than 8 mm mesh, h) trawl nets, i) electric fishing Articles 47 and 48 ban the use of poisons and explosives to catch fish
Gear register	No	
Vessel / Gear Licensing	Yes	Article 11 requires all vessels to be licensed. Under schedule 2, current licence fees are US\$10 for artisanal vessels up to 11m; US\$15 for semi-commercial vessels up to 11m; US\$45 for semi-commercial / commercial vessels between 11 and 45m. Gear is not licensed.
Control of access to fishing	Yes	Article 13 requires fishers to be licensed.
Permitted species and catch restrictions	Yes	Article 67: The Third Schedule of the regulations identifies those species that cannot be fished, held, processed or marketed. On Lake Tanganyika these species comprise: <i>Barbus platyrhinus</i> ; <i>Byrconaeithiops boulengeri</i> ; <i>Kneri wittei</i> ; <i>Lestes grandisquanus</i> ; <i>Tanganikallubes mortiauxi</i> . There are no catch restrictions in the commercial food fishery on Lake Tanganyika.
Closed areas	Yes	Article 54 (1, 2): Critical habitats can be closed either permanently or temporarily (e.g. spawning events). On Lake Tanganyika there is a general restriction of fishing within 800 m of a river mouth and 1,000 m into the lake, and designated regulations for individual rivers. There is a ban on all near-shore fishing on sandy beaches up to 300 m from the shore.
Control of the capture of immature fish	No	No explicit provisions are made in the regulations that apply to freshwater fisheries
Powers to stop, seize and arrest	Yes	Article 145 enables authorised officers to stop, search and confiscate illegal vessels, gears and catches, allows the use of reasonable force and provides for powers of arrest. Article 50 outlines procedures for seizure and disposal of fishing equipment and fish.
Offence to obstruct / intimidate authorised compliance officers	No	No explicit provisions are made in the regulations
Offence to land, receive and sell illegally caught fish	Yes	A number of articles apply including Articles 61 and 91.
Regulate the sale of illegal fishing gear	Yes	Article 54 (3), 66 (1g): the manufacture and sale of beach seines is prohibited. Article 66 (1a): The manufacture, import, possession, storage, stocking or selling of monofilament nets is prohibited. 66 (1f): The manufacture import, possession, storage, stocking or selling of gill nets less than 76mm is prohibited.
Appropriate deterrents in place (fines, confiscation, prison)	Yes	Article 128 provides for appropriate fines to be imposed for specific infractions of the regulations. For crimes for which penalties have not been set there is provision for TZS 200,000 – 1 million fines or prison sentences for 2-5 years for first offenders.
Regulate cross border fishing and trade	Yes	Article 91 regulates the import and export of fish products. Article 92 (b) stipulates that fish may only be imported into the country if they have a certificate to demonstrate that they were not caught using IUU fishing practices. Article 95 provides for the inspection of exported fish products. Import and export permits and licences apply and royalties / tariffs for exporting products have to be paid.

3.3.2.3 Compliance capability

In 2004, the Fisheries Compliance Division (MLFD) developed the Doria Surveillance and Patrol Unit based in Kigoma. The Doria unit is funded by the MLDF: Fisheries Division in Dar es Salaam, and operates as a component of the National Surveillance Unit (NSU) that is based in Mbegani (near Dar es Salaam). The Doria Unit is responsible for undertaking MCS activities on Lake Tanganyika and the rivers and lake systems of Western Tanzania.

Six personnel currently staff the Doria unit, and with the exception of a short course focusing on the legal aspects of fisheries management, the staff has not received any formal MCS training. Nevertheless, two of the staff have national diplomas in fisheries management, and a further two hold national diplomas in marine engineering.

At present the Doria unit has two vessels that are available for MCS activities, and at times, has access to an army patrol vessel that can be seconded to MCS operations (Mr Kashushu, MLFD, pers. com.). The range of the Doria vessels is restricted by the poor operational status of their 11 m vessel, and thus operations are restricted to their 7 m vessel that operates in the Kigoma district, and is not used in the districts in the central and southern parts of the lake. Compliance activities in the southern districts are currently undertaken in collaboration with the army, and use one of their patrol vessels. It should be noted that the Lake Tanganyika Authority (LTA) is currently addressing the lack of compliance capability in the southern districts of Mpanda, Nkasi and Sumbawanga. In this regard, the LTA is in the process of constructing compliance offices in each district, and will be equipping each district with a compliance vessel.

The police patrols are primarily focused on reducing the incidence of theft and piracy on the lake, and do not check for the use of illegal gears. In contrast, the Doria Unit patrols focus on illegal fishing activities, gears and vessels. In practice, the Doria Unit and the police often undertake joint patrols. In terms of equipment availability, the Doria Unit has the basic equipment required for undertaking regular but restricted MCS operations (Table 15), and there is a well defined reporting and record keeping system in place to lodge infractions, collect evidence and bring cases to court.

While there are 239 landing sites within the Tanzanian boundaries of the lake, there are only 22 beach management units in operation, and thus, with the exception of the district fisheries officers (that are not trained to undertake MCS activities), local governance structures at the community level are effectively absent, and thus play no meaningful role in promoting compliance. In the past, the Fisheries Division has attempted to introduce beach management units using the model that has been developed on Lake Victoria. Unfortunately, these attempts have proved unsuccessful. Nevertheless, the Fisheries Division has recently started a new initiative to sensitise communities to the concepts of co-management and developing beach management units. To date, only five communities have expressed an interest in developing these structures, and the initiative appears to have stalled (Ms B. Marwa, MLDF: Marketing Inspectorate, pers. com.). Nevertheless, the Fishing Regulations (2009) are explicit in terms of developing co-management systems and the legal requirement for each fishing community to be represented by a beach management unit. While the Fisheries Division is in the process of addressing this regulatory requirement, its efforts are clearly constrained by its lack of resources – both technical and financial. However, there remains the possibility that while a large number of BMUs may be developed (up to 239), they will not be adequately resourced, and thus their efficacy to promote co-management will be limited.

It should also be noted that the fishers have not formed fisher associations, and thus in terms of compliance, the only formal representatives with which to engage the fisher communities on MCS issues is the 22 existing, but arguably poorly functioning BMUs on the lake.

Table 15. Compliance capability - Equipment

Equipment	Present / absent	Comment
Vessels	2 vessels	One 11 m diesel powered craft (max speed 9 knots and in poor operational condition)
One 7 m 200 hp vessel used for patrolling – patrols are restricted by finances.	Radios, lifejackets etc	Short wave / VHS radio
The army has a vessel that can be, and is, seconded to compliance operations	Yes	Article 50 of the Fisheries regulations requires seizure documents (Form 12 GN:308) to be filled out in triplicate, one for court purposes, one for the MLFD records, and one for the suspect. Pro-formas for the disposal of fish / fish products and illegal gears are applied (Form 13a, 13b: GN:308).
The regional surveillance unit (Doria) reportedly provides weekly, monthly and quarterly reports to the National Surveillance Unit (NSU) based in Mbegani.	Rulers	
Fish measurement	No	Control is via gears not fish size
Cameras	Yes	Photographic evidence is taken where appropriate
Binoculars	Yes	Night vision equipment is used, and the location of offences logged using GPS
Weaponry	Yes	Doria inspectors do not carry weapons. The local police / army carry weapons and are taken on surveillance patrols.
Reference documentation available to compliance personnel		
Regulations	Yes	Regulations including the gear guidelines have been distributed to the district local authorities and the police.
Fish identification guides	Not required	
Gear guidelines	Yes	

3.3.2.4 MCS Activities

Financial constraints at the Doria Surveillance and Patrol Unit limit the compliance activities that can be undertaken by the unit (Mr J. Mzee, Doria, pers. com.). Land patrols are currently restricted to Kigoma and are not undertaken in the Southern Districts, leaving these areas to be patrolled by the district fisheries officers. Lake based patrols are undertaken on an irregular basis, and there is no capacity for airborne patrolling. Compliance operations primarily take the form of vessel, licence and gear checks (Table 16). This process is clearly constrained by the lack of vessel markings, which, while a regulatory requirement, is not being undertaken by the fishermen who spuriously claim that it aids identification by the pirates and encourages piracy by enabling them to track their vessels. While vessel registers are reportedly being kept by the authorities, vessel registration rates are low (23%, 2011 frame survey), and marking regulations are not being enforced. There are also issues associated with cross border intrusions into the waters of the neighbouring countries, and in this regard, it was reported that while Tanzanian boats regularly fish in DRC waters, and in areas that are closed to fishing (B. Marwa, MLDF, pers. com.), they rarely appear to be caught. In terms of the efficacy of the current MCS operations, the 2011 frame survey revealed that in terms of absolute numbers, the Kigoma DC District where the Doria unit is based recorded the highest number of illegal gill nets, lift-nets and beach seines of

all the fishing districts (Table 4). While fishing effort is evidently greatest in this region and accounts for 36.9% of all the gears in the fishery, it is the region that has the highest level of compliance resources available, and thus, where the compliance activities are concentrated. Were the compliance efforts proving effective, the incidence of illegal fishing gears could reasonably be expected to be lower in this district.

Table 16. Compliance activities

Activity	Yes / no	Comment
Land patrols	Yes	Land patrols are currently restricted to Kigoma and for logistical / financial constraints are not undertaken in the Southern Districts of Mpanda, Nkasi and Sumbawanga
Lake patrols	Yes	Due to financial constraints, lake patrols are undertaken on an irregular basis (2 - 3 times a month). Doria complains that their patrol boats are tracked from the lakeside villages and illegal fishers are warned of their coming.
Air patrols	No	Currently there is no capacity for air patrols.
Licence checks	Yes	Each fisher is licensed at a cost of US\$10. District and municipal officials provide the fishing licences and export licences. District fisheries officer retains a list of the licence holders.
Gear Checks	Yes	The presence / use of illegal gears is checked as a component of the monitoring protocol
Verification of registration	No	Vessels' registration details are not routinely checked (see vessel markings below).
Crew checks	Yes	Vessels are licensed for a given number of fishers and not for the fishers themselves. Fisher numbers on each vessel are verified as a component of the monitoring protocol.
Vessel markings	No	Vessels are registered and vessel registers are maintained. However, in contravention of the regulations, fishers elect not to display the registration details of their vessels as they claim vessel identification aids piracy. The lack of clear registration markings on vessels makes it difficult for compliance officers to identify unregistered vessels. The incidence of unregistered vessels in the fishery is high (78%, 2011 frame survey)
Gear markings	No	Fishing gear is not marked
Location of fishing activity	Yes	GPS is available and the position of infractions is logged and reported.
Vessel log books	No	Vessels do not carry log books

3.3.2.5 Implications for MCS

A. Legislative and Regulatory Frameworks

1. The Fisheries Act (Act 22 of 2003) and the Fisheries Regulations (GN 308, 2009) provide a suitable legal and regulatory framework with which to develop effective compliance operations.

B. MCS capability – human resources

1. As a whole the Fisheries Department on the lake has a staff compliment of 44 (2011 frame survey) – over half of whom are based in Kigoma. The Doria Surveillance and Patrol Unit (Kigoma) has a complement of just six personnel and represents the primary agent responsible for compliance along a coastline of 669 km and 239 landing sites. While the District Fisheries Officers in the other four lakeside districts have responsibilities in terms of undertaking compliance operations, MCS coverage is clearly limited and focuses on Kigoma.
2. Linkages between the Doria and the centralised National Surveillance Unit (NSU) that is based in Mbegani (near Dar es Salaam) appear to be tenuous, and it is not evident that the reporting systems are being implemented effectively in terms of information collation and analysis, nor is it evident that this information is processed in a manner that can be used to inform and improve MSC activities.
3. 3. Linkages between the District Fisheries Officers who are responsible for compliance activities in the Southern Districts are weak and need to be improved.
4. Neither the Doria Unit nor the District fisheries or police Officers have been provided with credible MCS training; there is a need to establish who is responsible for what actions and provide appropriate training e.g. inspectors, compliance officers, assistants, boat handlers etc.

C. MCS capability – available resources

1. MCS activities on the lake appear to be undertaken on an ad hoc basis and are constrained by a lack of regular funding and the poor maintenance of the vessels.
2. The Doria Surveillance and Patrol Unit is based in Kigoma and has no meaningful assets in the other lakeshore districts.
3. The only serviceable vessel that is operated by the Doria Surveillance and Patrol unit is a relatively small boat (7 m) that is used in the northern part of the lake. It would not be suitable for undertaking long compliance operations in the Southern districts. Compliance in these regions can only be undertaken with the assistance of a police vessel, or alternatively it becomes the remit of the District Fisheries Officers / police that have no access to compliance vessels, and thus compliance remains a shore-based activity.

3.3.3 DRC

Due to the new visa requirements to enter the DRC, the field mission was not able to proceed to the country as originally planned. In the absence of the country visit, in October 2011, meetings were held in Bujumbura with fisheries experts from the Uvira Research Institute. These meetings were used as an opportunity to inform the mission of the current status of the fishery and MCS activities from Kalemie to the Burundian border.

3.3.3.1 Legal and regulatory frameworks

The legislative framework that is currently in use in the DRC dates back to the 1930s, and is based on the 1932 Decree on Exclusive Fishing Rights, the 1937 Decree on Fishing and Hunting (amended 1957, '58, '60), and the Ordinance No. 432/Agri. of 26 December 1947. Latterly, in 1981, regulations on fishing devices were established, and in 1979, an ordinance (amended in 1983) focusing on licensing and fees was promulgated (FAO, 2001).

At the national level, the 1932 Decree on Exclusive Fishing Rights allows competent authorities to grant exclusive fishing rights in a designated area. The decree outlines the general terms and conditions governing fishing practices, and outlines the rights and obligations of each contracting party. The Ordinance No. 432/Agri. of 26 December 1947 (as amended in 1952 and 1954) provides for deployment of fisheries officers to control fishing activities. The 1981 regulations prohibits the use of electro-fishing, explosives and toxic substances throughout the country, and provides

for the seizure of illegal fishing gears and any catches. Finally, the 1979 ordinance (as amended in 1983) specifies permit fees, and outlines the various issuing authorities. The ordinance provides for four categories of fishing permits, viz. industrial, artisanal, traditional, and sport fishing. State commissioners are responsible for the issue of commercial rights with artisanal rights being issued by regional governors. Local commissioners are responsible for the issue of traditional and sport fishing licences.

At the regional level, subsidiary regulations have been promulgated. In the Shaba region (Southern Lake Tanganyika), a 1958 regulation on net fishing identifies and controls three categories of fishing unit, viz.

1. Industrial fishing units - one or several boats, engine powered or not, using a seine net, one or several set nets whose total length or total combined length is more than 2,500 m, or lift-nets;
2. Artisanal fishing units - one or several boats, engine powered or not, using either a lift-net or set nets whose total combined length is more than 1,000 m but less than 2,500 m;
3. Individual fishing units - a pirogue or dugout using traditional fishing gear including a beach seine, set nets whose total combined length is less than 1,000 m or a lusenga (traditional scoop net).

Authorization is required for all types of fishing operations, and these are subject to the payment of a prescribed fee. Permit conditions include a ban on fish discards, the use of drag nets, or nets of a mesh size less than 4mm. Interestingly, the regulations allow for the use of beach seines, and industrial fishing is prohibited within 5 km of the shoreline. In 1958, a similar set of regulations was promulgated for Kivu (encompassing the northern part of Lake Tanganyika).

Evidently, since the first legislation was introduced in the 1930s, the fisheries management paradigm on the lake has changed markedly - evidenced by the fact that according to the 1958 regulations, the use of beach seines remains legal. The legislative framework is clearly outdated and requires revision. In this regard, it was reported that under the coordination of the LTA, the legislative framework is being updated (Mr Mulimbwa, Research Centre, Uvira, pers. comm.).

3.3.3.2 Compliance capabilities and MCS activities

In general, monitoring and compliance activities along the Congolese shores of Lake Tanganyika are at best infrequent (Table 17). This is certainly the case in the more remote parts of the lake, where as a result of poor security and two decades of conflict, the fish stocks are relatively unexploited and abundant. At present, there is no capability for aerial patrols on the DRC side of the lake, and currently there are no facilities for lake-based patrolling. In the past, the marine police had some capability to undertake boat-based patrols, but this is no longer the case. In this regard, the LTA is planning to procure three patrol boats for use in the DRC, and while this will no doubt elevate the problem to some degree, the DRC shoreline is 650 km long, and thus patrolling this area should be viewed as some considerable task. Land-based MCS activities are sporadic and are only being undertaken in the urban centres of Kelamie and Uvira. Fisheries personnel are often under-resourced and working in isolated environments where they are often urged / coerced by the communities not to report the presence of illegal fishing activities. In isolated areas, the seizures of illegal gears is difficult and potentially dangerous, and thus the local administrations often elect to sensitize the fishing communities to the problems associated with the illegal use of gears. To this end, there have been some successes, as evidenced by the decrease in the use of the most damaging Mutimbo ring nets.

While fishing licences are issued and the local municipalities register vessels, it is evident that the system is not functioning as designed. Evidently vessels are not being marked and checked, and the incidence of unregistered vessels in the fishery while high, remains unrecorded. Furthermore, it would also appear that piracy in DRC waters is of considerable concern, suggesting that the authorities have minimal control in the region. Notably, the resources in Fizi are now under control of a strong local leader, and Burundian fishers who have been fishing in these waters have indicated that it is increasingly difficult and dangerous to access the resources. Indeed, it was reported that fishers from Uvira (DRC) are now often forbidden to fish in Fizi waters. Piracy originating in this area was also reported during the current mission – in October 2011, two engines from Burundian crews were stolen in offshore areas of Fizi (Mr Mulimbwa, Research Centre, Uvira, pers. comm.).

Table 17. Compliance activities

Activity	Yes / no	Comment
Land patrols	No	Land patrols are currently restricted to the zones around the main town centres of Kalemie and Uvira
Lake patrols	No	Currently there is no capacity for lake patrols. Previously, the Marine corps was patrolling sectors of the lake but its capacity is now minimal.
Air patrols	No	Currently there is no capacity for air patrols
Licence checks	Yes	Municipal officials provide the fishing licences
Gear Checks	Yes	The presence / use of illegal gears is checked as a component of the monitoring protocol. Unregistered vessels are considered illegal as well as nets with undersized meshes.
Verification of registration	Yes	Vessels' registration details are not routinely checked.
Crew checks	No	
Vessel markings	Yes	The incidence of unregistered vessels in the fishery is high but could not be quantified
Gear markings	No	Fishing gear is not marked
Location of fishing activity	Yes	Local communities accept or refuse fishing to units coming from other areas. Access can be negotiated.
Vessel log books	No	Vessels do not carry log books

Source: N. Mulimbwa, pers. comm. 2011

4 TRADE ISSUES

There have been no recent marketing studies to establish the trade routes, the volumes and the value of the fish products that are traded on the lake. In 2002, the Lake Tanganyika Biodiversity Project published a Trans-boundary Diagnostic Analysis (TDA) that broadly outlined trade routes on the lake (LTBP, 2002). In broad terms, the trade routes were restricted by the poor status of the terrestrial infrastructure along the Central and Southern parts of the lake – most notably in the DRC, but also in Tanzania. This made the terrestrial movement of products problematical, and thus much of the product had out of necessity to be moved on the lake. In general terms the basic trade routes that were described were North / South, with products either moving from the central parts of the lake north to Kigoma (Tanzania) from whence they were exported inland or further north into Burundi / DRC; or alternatively product was shipped south to Kasanga (Tanzania) and Mpulungu (Zambia) for distribution in those and neighbouring countries. In addition to the North / South trade, it was reported that there was significant East / West trade with products from the DRC being exported across the lake to Kigoma for further regional distribution. It would appear that these general trade routes remain in existence. Possibly, the major changes that have occurred in the trade routes since the 2002 TDA analysis are changes in resource use patterns on the lake where it would appear that local resource depletion / changes in resource patterns in the Northern and Southern areas of the lake are increasingly forcing fishers from Burundi, Northern Tanzania (Kigoma) and Zambia to move into DRC waters to fish. Likewise, improvements to the road infrastructure along the Tanzanian side of the lake will have likely assisted terrestrial transport routes. Finally, the cessation of hostilities in Burundi will have re-opened trade routes in the northern part of the lake.

4.1 Tanzania

The trade of fish products on the Tanzanian side of the lake focuses on Kigoma. The MLDF operates a Marketing Inspectorate to regulate the movement of fish products, and while the volumes of trade moving through Kigoma could not be established, it was evident that fish is imported into Tanzania via Kalemie (DRC) and that considerable volumes of fish are caught by Tanzanian fishers inside the DRC waters and landed in Kigoma (Mr Kashushu, MLDF, pers. com.). In addition, fish products are transported to Kigoma from the central and southern areas of Tanzania (Mpanda, Nkasi) either by boat or alternatively on the improved lakeshore road. Products from Kigoma are either consumed within the local area, or shipped to other urban areas in Tanzania such as Arusha and Dar es Salaam where higher prices are attained. For example, dried *Stolothrissa tanganyicae* sold in Dar es Salaam attains a price of around US\$ 10.3 / kg as opposed to US\$ 6.0 / kg in Kigoma.

In addition to local domestic consumption, there is an export market for fish products from Tanzania. The mission reported that consignments of up to 10 tons of dried Dagga (*S. tanganyicae*) are ordered from Bukavu (West Kivu, DRC). Such shipments are sent from Kigoma by transport boat to Uvira (DRC), and finally overland to Bukavu. In addition, there is a significant trade to Burundi. Trade links with Burundi are either via boat or land. Approximately 90% of the exported fish is reported to be transported by boat to either Kabonga (the small border port) or Rumonge, which using wooden transport boats with outboard engines, are between one and two hours travel time from Kigoma. On landing, the fish is moved by land to the major markets of Bujumbura. The remaining 10% of the product is transported by land along the coastal road. It should be noted that in addition to the legal trade, there is also a sizable illegal trade in fish products. In order to circumvent Tanzanian export authorities, some fish products that are caught by Tanzanian fishers are illegally exported. The MLDF: Marketing Inspectorate, estimates that approximately 30% of the fish that is exported from Kigoma is exported illegally (Ms B. Marwa, MLDF: Marketing Inspectorate, pers. com.). Unfortunately, records outlining the volume or product type of the exported fish were unavailable. Nevertheless, it was reported that the tax revenue associated with exporting fish products from the lake ranged between TZS 150-200 million per annum (Ms B. Marwa, MLDF: Marketing Inspectorate, pers. com.). The Fisheries Regulations (2009) indicate that “Dagga” and “other fish” from Lake Tanganyika are taxed at rates of 0.072 and US\$ 0.025 / kg respectively. Based on a taxable income of TZS 150-200 million per annum (\pm US\$ 90,900 – 121,200), and assuming a product mix of Dagga to “other fish” of 50:50, it is reasonable to suggest that between 1,800 and 2,500 tons of fish are being

legally exported per annum. Assuming that 30% of the fish that is exported is exported illegally, between 770 and 1070 tons of fish are likely to be being illegally exported per annum. The associated loss of revenue due to this illegal activity would be in the region US\$ 37,350 - 51,600.

4.2 Burundi

The fish products that are sold in Burundi originate from three principle sources, viz. product that has been fished legally within Burundi waters by Burundi fishers, product that has been illegally fished in DRC / Tanzanian waters and landed in Burundi by either Burundi fishers or fishers of other nationalities, and product that has been imported from Tanzania or other regional centres.

While the landing of fish products that have been fished in other countries or landed by foreign nationals has been reported extensively (e.g. Petit 1995), and where appropriate, police reports are made to the DWFA, the Department does not keep collated records of the volumes or value of the fish that enters the country in this manner (Mr N. Joseph, DWFA: Statistics Section, pers. com.). In other words, the fact that a large component of the Burundian fishers' landings is harvested in foreign waters is not considered or recorded by the Burundian authorities. Nonetheless, should Tanzania and / or DRC decree to stop the entry and activity of Burundi fishers in their waters, it is probable that from an economic perspective, Burundi's pelagic fishery would collapse within a very short time. It is worth noting that while the movement of the Burundian fleet into Tanzania and DRC waters is a relatively new phenomenon, Zambian fishers have been fishing in southern Tanzanian and Congolese waters for decades.

In order to access DRC waters, the Burundian fishers often recruit Congolese nationals from the local riparian communities as crew, or provide the local Congolese leaders with items that are hard to obtain in that country (notably petrol). Furthermore, it appears that an impetus for the DRC fishers to land fish in Burundi relates to the current security situation in the region, and most notably the levels of piracy and extortion on the northern part of the Lake. In this regard, and in comparison with the DRC, the security situation appears to have improved in Burundi over the past few years, and thus it is safer for the fishers to land their products in Burundi. The fishers that were interviewed during this mission confirmed this assertion. However, as fish prices are reportedly higher in the DRC, there is a concomitant trade in fish products moving from Burundi into the DRC (Mr Prospero, FAO Burundi, pers. com.). Nevertheless, as a result of the exploitation of foreign fish stocks and fish imports from Tanzania, which are likely to exceed the volume of Burundian exports to DRC, it is reasonable to suggest that at present Burundi is a net importer of fish.

With respect to additional regional markets, fish prices in Rwanda are also reported to be approximately double those of Burundi. For example, frozen Mukeke (*Lucioides stappersii*) that is sold in the fish market in Bujumbura for US\$ 5.3 / kg reportedly sells for US\$ 9.80 / kg in Kigali. Considering the travel time (road) from Rumonge (a major landing site in Burundi) to Kigali is estimated at six hours, there is in all likelihood the potential to develop lucrative export markets (Mr Ibrahim, Avepombu Fishermen's Association, pers. com.). However, despite the potential, currently there is no reported organized trade in fish products from the lake to Rwanda. It is nonetheless worth noting that many passengers boarding light buses from Bujumbura or Kayanza to Rwanda carry with them a small load of fish (some kilograms) that are untaxed as it is considered "for personal consumption". However, on arrival in Rwanda, much of this fish will likely be sold. The global volumes of fish exported from Burundi are unknown, but it has been demonstrated that similar imports from Uganda to Rwanda by far exceeded the reported volumes of organized fish trade between the two countries (BCEOM 2008).

It should be noted that export licensing systems are in place in Burundi, and it is a relatively easy and inexpensive process to buy an export licence (Mr Prospero, FAO Burundi, pers. com.). Furthermore, with the possible exception of the customs services in the DRC, which are reported to be problematical, Burundian and Rwandan customs facilities are reported to work well, and represent no constraint to trade. However, traders do not appear to be developing the value-chain, and capitalising on the regional marketing opportunities. Possible constraints to the development of these markets include the costs associated with accessing the markets, and difficulties in accessing finance to develop these markets, a paucity of reliable and up to date marketing information (e.g. product specifications, costs, market size, etc.), and problems associated with developing the business networks required to develop the value chain. One constraint

to cross-border fish trade is the availability and use of ice by the fishers and the transport operators. An ice factory developed by a French donor programme to assist a fishers association in Rumonge has a capacity to produce 6 tons of ice a day. At present it is operating under capacity and merely manages to sell some hundreds of kilograms a day, the majority of which is used by the gill-net fishers who operate along the shores of the Ubwari peninsula in the DRC - where they stay for two days or more (per trip), primarily targeting *Dinotopterus cunningtoni*. Since August 2011 electrical power cuts have become a major issue in Bujumbura, and currently, ice cannot be kept for significant periods of time without the use of generators. As a result, the practice of maintaining fish products on ice for two days or more has become problematical. It is also worth noting that quality control systems / standards for fish products in Burundi have yet to be introduced, and thus consumers have no recourse to hygiene standards when making purchases. Thus, observations of fish gills and eyes are the only reliable determinants of quality and freshness that are applied.

In addition to the legal and illegal movements of Lake Tanganyika fish products within the region, there is also some illegal trade in fish products from Lake Victoria. Discussions with fish traders at the Bujumbura central fish market indicated that both Nile Perch (*Lates niloticus*) and Nile Tilapia (*Oreochromis niloticus*) were regularly being sold. It was reported that between 3 and 30 tons of Nile perch are imported from Uganda and a further 10 tons a month from Tanzania (Mr Ibrahim, Avepombu Fishermen's Association, pers. com.). While the Nile Perch from Uganda was reportedly of a larger size than that from Tanzania, approximately 90% of the Nile Perch that was observed in the market appeared to be under the 50 cm legal slot size in force on Lake Victoria (Figure 8). Furthermore, approximately 2 tons of Nile Tilapia from Lake Victoria is reportedly imported from Tanzania. According to the current Fisheries Regulations (2009), Nile Tilapia is viewed as an important source of food security in Tanzania, and there is an export ban in place for this species. Thus, the importation of this species into Burundi is illegal.



Figure 8. Undersized Nile Perch on sale in the Bujumbura main fish market (August 2011).

In terms of pricing, the imported Nile Perch and Nile Tilapia are sold in the market for 5000 BIF/kg (US\$ 4.5/kg) and 4500 BIF/kg (US\$ 4.1/kg) respectively (Table 18). Respectively, the prices for the frozen perch and tilapia from Lake Victoria are approximately 15% and 19% lower than the Lates and tilapia species that are caught from Lake Tanganyika. Furthermore, as the products are frozen, they command lower prices than their fresh or dried counterparts, suggesting that the fish that is on sale from Lake Victoria is of a relatively low market value.

Table 18. Comparative fish prices in the Bujumbura main market (August 2011)

Species	Local name	Origin	Product type	Price per kg (US\$)
Luciolates stappersii	Mukeke	L. Tanganyika	Frozen	5.3
			Fresh	6.1
			Dried	12.2
Lates angustifrons	Capitaine	L. Tanganyika	Frozen	5.7
Lates mariae	Sangala	L. Tanganyika	Frozen	4.5
			Fresh	8.1
Oreochromis Spp	Tilapia	L. Tanganyika	Fresh	7.1
			Frozen	4.9
Limnothrissa /+ Stolothrissa	Ndagala	L. Tanganyika	Dried	10.6 – 14.6
Lates niloticus				
Nile Perch				
L. Victoria				
Frozen				
4.5				
Oreochromis niloticus	Nile Tilapia	L. Victoria	Frozen	4.1
Rastrineobola argentea	Dagga	L. Victoria	Dried	1.6

In addition to the illegal Nile Perch and Tilapia products, a further 50 tons of Dagga (*Rastrineobola argentea*) is reportedly imported and sold to the rural communities in the north-east of the country (Kayanza, Muyinga, Gitega, Ngozi and Ruyigi). The Dagga from Lake Victoria is a low value dried product that is evidently being sold at around 2,000 BIF/kg (US\$ 1.6 /kg). In contrast, dried Ndagala (*Limnothrissa / Stolothrissa*) from Lake Tanganyika sells at between 13,000 – 18,000 BIF/kg (US\$ 10.6 – 14.6 /kg).

4.3 Zambia

The trade in fish products on the Zambian side of the Lake centres around Mpulungu and to a lesser extent Nsumbu. Access to, and the infrastructure present at, the landing sites is problematic with only 15.5% of sites being accessible by all-weather roads. Working jetties, electricity and cold storage are available at just 1.2%, 3.6% and 5.9% of the sites respectively. With the exception of the commercial processors, processing facilities at the landing sites are also poor with drying racks, smoking kilns and concrete processing tables being reported at only 2.2%, 32.1% and 8.3% of landing sites respectively. Obviously, with such poor facilities, the quality of the processed fish available on the local markets in the vicinity of the Lake is likely to be poor. Nevertheless, there are five processing companies in operation on the lake. These companies distribute their fish to the urban centres including Lusaka, Ndola, and the copper belt. In the past, fish products were exported to Lubumbashi (DRC) and to Malawi (LTBP, 2002). Unfortunately it could not be confirmed whether these export markets remain operational. The processing companies collect fish from 32 of the 96 landing sites on the Zambian side of the lake (Zambian frame survey, 2011), and it has been reported that 75% of the fish that is landed in the countries is fished in neighbouring DRC and Tanzania waters (IRIN, 2011). Fish are either moved to market by land or via a fleet of 295 fish-carrying vessels. In 2010, the commercial processors processed 46.6 tons of dried fish, 74 tons of Bukabuka (*Luciolates stappersii*) and an unreported quantity of dried Kapenta (*Limnothrissa miodon / Stolothrissa tanganicae*; IRIN, 2011).

4.4 Democratic Republic of Congo

The trade of fish products in the DRC is severely constrained by the lack of access to the lakeshore and the associated marketing and processing infrastructure. The DRC has a lakeshore of 650 km, of which only 15% is accessible by road. Those areas that have road access primarily comprise the urban centres of Uvira, Baraka, Moba and Kalemie. As a result, the majority of the 361 landing sites recorded in the 2011 Frame survey are only accessible by boat. In addition to the poor logistics, services along the lake are also poor with electricity supplies being limited to the cities of Uvira, Kalemie and Moba. In most areas along the lake, fish processing is restricted to smoking, salting and sun drying, with ice / cold storage facilities being restricted to the urban centres of Uvira, Kalemie and Moba. The 2011 Frame survey revealed that while the salting of fish is commonplace, the use of smoking ovens is restricted to Moba and Kalemie, and drying racks are only reported to be in use in Uvira and Kalemie. The lack of drying racks would suggest that significant quantities of fish would likely be dried on the ground, resulting in poor quality products. The lack of proper ovens and drying racks was confirmed to the mission, and in terms of maximising the value of the fishery, improvements to the processing equipment (smoking and drying), and the concomitant processor training was viewed by personnel at the Research Centre in Uvira as a top priority (Mr Mulimbwa, Research Centre, Uvira, pers. comm.).

The 2011 Frame survey further cites a general lack of administrative capacity in the DRC to collect reliable fisheries data, and it would appear that the only information describing the trade of fish products between the riparian countries remains anecdotal. In this regard, it would appear that while fish products from Fizi are regularly landed in Burundi, products from Kalemie are transported to Kigoma for further distribution within the region. In the southern part of the Lake (Moba), it is reported that fish from the DRC is landed, and sold to the processors in Mpulungu. From Mpulungu it is then marketed to the urban centres such as Mbale, Lusaka and the copper belt (LTBP, 2002).

Smoked or dried fish is also irregularly transported between Kalemie and Lubumbashi by trucks on a road, which although in a very poor condition, is now considered safe. It is likely that improvements to this major transport route would stimulate fish trade between the lake and the major city centre of Lubumbashi, which is estimated to have a population of 1.5 million.

In October 2011, the retail price of fresh Mukeke and Ndagala sold in Uvira at US\$ 4.5-5 / kg. These prices are similar to those found in Bujumbura. The similarity in prices is no doubt due to the close proximity of the two cities. It is however worth noting that large quantities of fish that is landed in Uvira is transported and sold to Bukavu (South Kivu) where, due to the large volumes on the market, the fish from Lake Tanganyika can at times be cheaper than in Uvira. Similarly, the best fish landed at Uvira is transported and sold in Bukavu.

A nuance that was noted was that, while smoked Mukeke fetches a higher price than fresh Mukeke in Burundi, in the DRC the selling price for smoked Mukeke is lower, this despite the fact that the smoking operation requires additional production costs (Mr Mulimbwa, Research Centre, Uvira, pers. comm.). A similar anomaly has been observed along Lake Albert (Petit, 2005).

5 FINDINGS AND RECOMMENDATIONS

It is evident from the assessment that IUU fishing is impacting legal fishing practices on the lake, and that the current capacity to undertake MCS operations are constrained by a number of key factors, principal among these are:

1. A lack of financial resources, equipment and patrol platforms at all levels in the MCS system.
2. Insufficient numbers of MCS personnel to monitor fishing and IUU fishing activities, and limited capacity to undertake patrols.
3. A lack of coordination between the riparian countries to address MCS and IUU issues.
4. No capacity / mechanisms with which to undertake cross border patrols to address the issues of cross border fishing activities and piracy on the lake.
5. 17. Poor application of existing regulatory frameworks (e.g. permitting, maintaining vessel registers and marking vessels).
6. Uncoordinated legislation / regulatory frameworks between the riparian states resulting in conflicting regulations (e.g. gear regulations vary between the countries).
7. Poor reporting systems, data collection and processing leading to a paucity of information that can be used to establish the efficacy of current MCS interventions and inform future MCS planning.
8. Undeveloped co-management institutions (beach management units / fisher associations) that can be co-opted to assist in compliance activities.
9. Undefined roles and responsibilities of those involved in MCS activities e.g. compliance officers, case officers, recorders, etc.
10. A lack of MCS training at all levels.
11. No centralized / coordinated sale of fishing gears, thus allowing the entry of illegal fishing gears into the region.
12. Inadequate sensitization of the fishers who are, for the most part, unaware of the details of the laws and regulations in force.

The Lake Tanganyika Authority is in the process of revising the Strategic Action Plan (2001), and in the short term (one to two years) the institution, provided it gathers the necessary funds, is setting up programmes to address many of the issues outlined above. Specifically the LTA have developed programmes that are designed to address:

1. The harmonisation of policy and regulatory frameworks
2. The promotion and improvement of co-management systems
3. The improvement of statistical data collection systems and the harmonisation of data collection and information systems
4. Improving MCS compliance platforms to improve the ability of the riparian states to undertake compliance activities

5.1 Developing interventions

Experience has shown that in the absence of alternative interventions, a reliance on the use of repressive techniques to combat illegal fishing has had little long-term impact on the fishing practices on Lake Tanganyika – as evidenced by the continued presence of beach seines, which have been banned for the past 70 years. However, past project experiences have also shown that the fishers are an adaptable group, and that there are no fundamental impediments to persuading them to stop using damaging fishing practices. In particular, the recent insistence by the fishers in Burundi that palm oil residues were endangering the littoral fish stocks, and that their release into the lake had to be stopped is an encouraging sign. For these reasons, it is highly recommended that any MCS and compliance activities that are developed be undertaken in a participatory manner, possibly under co-management frameworks.

The best opportunities for obtaining fishers' active collaboration arise if 1. the compliance programme is coordinated

with an incentive programme, 2. the major concerns of fishers and their interests are being addressed. Fishers indicated to this mission that their main concerns in the fishery relate to the obvious decrease of the fish stocks, the increasing operational costs, most notably fuel, a lack of access to finance, the forced reliance on unstructured commercial networks, and the absence of technologies for value addition – currently the drying, smoking and salting of fish are viewed as preservation techniques that while adding more costs, add little value to the products. A programme aiming at supporting the fishing communities with capacity building, training and education, and market development, while at the same time improving compliance could address the core constraints currently experienced by the fishers. It is worth noting that in Burundi and the DRC, many fishers have organised themselves into legal entities (e.g. fisher / processor associations) that are used to represent their interests, and in particular improve their access to credit or funding. In contrast in Tanzania, the villagers/fishers are rarely organized into structured groupings, and thus they are poorly represented. In this regard, the lack of representative fisher / processor associations in Tanzania is something that needs to be resolved.

As a result of the shared nature of the resources on the lake, the mission was warned to be cautious when planning or developing projects which would favour a given country or community. Evidently, in order to maintain acceptable catches, the fishers from Burundi have to operate in Congolese or Tanzanian waters, and the same applies to Zambian fishers in the south of the lake. In this regard, the current situation in the productive fishing grounds of Fizi indicates that the Fizi residents are becoming increasingly hostile to strangers fishing their diminishing stocks. Thus, if interventions were made to assist Burundian fishers, and to the exclusion of the Congolese fishers, it is likely that increased hostilities would ensue.

5.2 Potential Interventions

5.2.1 Training

The findings suggest that there is a need to develop training materials and undertake training programmes in all the riparian states. At a national level, the Fisheries Departments and associated groups that are involved in compliance (e.g. beach management units, police, judiciary) are in need of MCS training, and there is neither the capacity nor the resources available to develop / undertake such training programmes. Importantly, the LTA is currently focusing their immediate interventions on establishing the conditions under which MCS activities can be initiated on the lake; however to date, no resources have been allocated to MCS training. This provides the opportunity for the current project to provide MCS training materials and services.

In terms of delivering training programmes, it would be appropriate to channel any training programmes through the LTA, and link these into the existing and planned MCS activities. In this regard, this mission has established that while there is considerable variance in the current capacity to undertake MCS activities across the riparian countries, all the countries identified human resources and training as a major constraint to their activities. Notably, in those cases where personnel have been employed to undertake MCS activities, they have in general either been exposed to minimal or no specific MCS training. In terms of training needs there is evidently a need to develop programmes for all levels of personnel involved in MCS. In this regard, and at a minimum, there would be a need for:

1. Introductory MCS training for MCS field personnel and for representatives of beach management units that are tasked with co-management and compliance. In terms of training beach management units, there are 738 landing sites along the shores of the lake, and thus logistically an intervention at the BMU / landing site level would require trainers (e.g. NGOs, Fisheries Department personnel) to be trained, and subsequently deployed to educate the communities.
2. Management training for managers to enable them to develop effective MCS plans, and improve their management and operational skills.
3. Patrolling vessel training for personnel that are either using existing vessels that are already deployed on the lake,

or will be deployed as a component of the LTA programme. This training should include training personnel in the cross border MCS activities that are planned by the LTA programme. At a national level, where marine police are involved in MCS activities, consideration should be given to their inclusion in the programme.

4. Training pertaining to fisheries offences and the prosecution of offences is required. It is apparent that across the region, MCS offences are not being prosecuted effectively and that where MCS activities are being pursued, the majority of cases involve the simple removal of illegal gears. In this regard, MCS personnel, the police and prosecutors have not been provided with specific training in terms of dealing with fisheries offences and prosecuting offenders.

5.2.2 Removal of beach seines

The continued presence of the beach seines that remove juvenile fish from the fishery has serious long-term implications for the sustainability of the fisheries in the lake. The removal of beach seines would require engaging fishers at the community level, and where appropriate providing sufficient compliance incentives. As outlined previously, the number of unemployed people is numerous, and alternative livelihood options so scarce, that in the absence of some form of community-based incentive, the simple removal of beach seines will likely result in their rapid replacement. Thus to be successful, a programme would have to sensitize whole communities to the issue of illegal fishing. This would involve demonstrating to the community the harmful effects that beach seines have on the fish stocks and fish supplies, and dispel the commonly held belief that the removal of the beach seines merely results in valuable fish stocks being under-exploited. In this regard, it can easily be shown that the catch of juvenile *Bagrus dogmac*, *Lates mariae* or *Boulengerochromis microlepis* is detrimental to production. For example, when beach seines are used to catch specimens that are less than 25 cm in length, they fetch low market prices. In comparison an adult of these species currently command prices of US\$ 15 or more.

With respect to a development model that could be applied to remove the beach seines, the methods developed to resolve the issue along the DRC shorelines of Lakes Albert and Edward (2005 – 6) are instructive. In this case, beach seiners were educated about the problems associated with the use of their beach seines, and at the same time were provided with good quality alternative equipment, namely MUSTAD hooks and UFM nylon gill-nets (at the time, all easily available in Uganda). The distribution of the new gears was made conditional on the complete removal of the beach seines over a given area that was under community control. Nylon nets were previously unknown to Lake Albert fishers, and it was found that initially the fishers were sceptical about the efficiency of the alternative gears. However, after about 3 months, they became supportive of the initiative and are now the main clients of the UFM factory in Uganda. Combining hooks of various sizes (numbers 3 to 7) with appropriate net meshes ensured selectivity in the fishing pressure, and the survival of the juvenile fish.

The initial community engagement was undertaken by a scientist (ichthyologist) who proved to be more convincing than a trained technician who had limited knowledge of the issues. However, with time, technicians working closely with the scientist developed the necessary skills to convince the community of the issues and importance of removing the illegal gears. It was also found to be critically important to include all sectors of the community in the engagement process (processors, fishmongers, community representatives, adults and children) as in the long term the success of the programme was based on getting the whole community to agree to the new dispensation.

As a multi-gear fishery, it was also found that in order to reduce rivalry between fisher groups, and to ensure compliance across the community, the existing gill-net and hook fishers had to be included in the programme. It is worth noting that gill-nets, hooks and twine spools are inexpensive. Currently, a set of 100 hooks costs US\$ 3-5 in Kampala, while a 90 m net or a 500 g nylon twine spool also cost US\$ 3-5. Nets were ordered in bulk from Uganda Fishnets Manufacturers at Kampala, where they were manufactured. As nylon nets were ordered, it was possible to specific net colours, and use the colours as a mechanism with which to mark the nets. Colour coding the nets between the communities helped track the nets and ensure that, on the rare occasions when nets were stolen, they could be easily recovered (Petit, 2005). A pair of fishers was provided 5 nets of 100 yards each (total 450 m), 2 spools of a similar ply for repairs, and three spools of a thicker thread for the bottom and upper lines. Leads for weighting the nets or floaters were not provided as they increased the chance of theft, and local materials were available.

At project inception, all the gear that was required for each community was procured and stored in the project warehouse. In the first instance, only one third of the gear was distributed to the fishers. Village leaders were invited to check (at will) that the remaining two thirds of the gear was duly stored in the project warehouse. The conditions under which the remaining gear would be distributed were strict and simple: if, within two months following the first distribution, illegal gears were observed in the given area, the remaining two thirds of the gears would be distributed to other communities that had shown better levels of compliance. After two months, gear surveys were undertaken, and if satisfactory, the remaining stocks of gear were distributed without pre-conditions. Furthermore, additional supplies such as brushes and good knives to clean the fish, crafting tools (hammers, saws, etc.) and strong plastic crates (60 to 80 litres) were also supplied in two tranches, the second tranche being conditional on compliance in the fishery. The programme worked well, and a similar method has since been utilized in other places, including Rwanda. It is worth noting that the programme was successfully expanded to include tools for shipwrights and fish crates for traders – both of which were of a poor quality in the DRC at that time.

An additional component of the Lake Albert project was the provision of 160 good quality fishing boats. It is worth noting that fishers on Lake Albert primarily use gill nets, and thus require small vessels. However, the storms on Lake Albert are unpredictable and dangerous - in a single night in the late 90s, hundreds of fishers succumbed to storms and drowned. In response the boats that were built were constructed to higher specifications than the local boats, and it was found that in addition to assisting the fishers, during daytime they were also used as transport vessels, adding value to the beneficiaries. Importantly, the boats on Lake Albert were all numbered (3 planks were burned with a unique numerical), and distributed with the appropriate fishing gear, in this case to widows in the community who despite not being fishers themselves, became gear owners and recruited fishing crews among the unemployed. It was reported that basing this component of the programme on the economically marginalised, attained community buy-in for the programme as a whole (Petit, 2005). The building of the boats required supporting 10 shipyards, which at the end of the project remained operational. Potentially, the LTA and partners could develop a similar programme - possibly as a phased programme with the initial focus being on removal of the illegal fishing gears.

A similar project could be implemented to remove the illegal gill nets in Tanzania, where their high numbers is also of concern. However, in contrast with the DRC, the incentives may have to be different, for example improved processing equipment (racks, ovens) and corresponding training could be considered.

5.2.3 Reducing the catch of immature pelagic fish

Prior to the 1990s when the fish stocks were plentiful, the majority of the artisanal fishers elected to not target immature fish. The process that was adopted to avoid catching juveniles was simple: at the beginning of the night, the bubbles that are observed rising to the surface signify the presence of fish and provide a very clear indication of the types of fish present beneath the boat. Mid-sized bubbles are, for example, attributed to Nyamunyamu (juvenile Luciolates), and the number of bubbles reflects its abundance. Thus, when a fishing team observed that the fish beneath the boat comprised Nyamunyamu, it usually moved to another location in search of larger fish. In this manner, it was possible for the fishers to reduce the catch of low value juvenile fish. However, with the demise of the adult stocks, the catch of these juveniles started to increase. At the same time, the number of Apollo rigs in operation increased dramatically. The Apollos are expensive to operate, and as increasing pressure was put on the resource, they became increasingly unprofitable. Evidently, the drop in adult catches provided the impetus to target the smaller fish, which despite receiving a market price that was 33 to 55% lower than their adult counterparts (2011), remain a marketable commodity.

In the short term, active units need to start to voluntarily reduce their catches of juvenile fish. This can be achieved by developing sensitization programmes for the population using radio / TV media, and using fisheries personnel from the Fisheries Department to sensitise the population (especially at the landing sites and the markets) about the impacts that catching or buying a crate of immature fish has on the future viability of the stocks. It should be noted that such a propaganda operation is unlikely to result in a major decrease in the juvenile catch rates - as the artisan crews are primarily motivated by economics of their operations - however, it will slowly condition the population to the fact that buying immature fish is negatively impacting the resource, possibly changing people's buying behaviour.

In the longer term, there is a need to develop interventions that restricts the sale of juvenile fish. This would require the seizure and destruction of all juvenile pelagic fish landed, transported or put up for sale. Indeed, it is likely that prohibiting the sale of juvenile fish is the only method that would have an impact on reducing the fishing pressure on the juvenile resources. However, the political implications for elected leaders could prove problematical and difficult to bear if interventions are made in an insensitive manner and without previous sensitization and warnings.

Reducing the number of boats in the fishery is another mechanism with which to reduce fishing pressure. However, at the current rate of decline in individual catches in the south of Burundi (observed during the mission), it is reasonable to suggest that many of the Apollo rigs are becoming increasingly uneconomic, and many gear owners are likely to become bankrupt during 2012. In this regard, it is interesting to note that in October 2011, many units reported that they could not go fishing as they lacked the financial resources to replace or repair faulty equipment such as their engines, and could not afford the petrol required to run their engines.

Consideration could be given to banning lamparo fishing during reproductive seasons – principally May and November (Petit, 1995). However, at these times, abundance levels are high and it would be difficult to persuade fishers not to fish during these periods. Moreover, to be effective, the adoption of closed season would have to be respected by fishers from all the riparian countries. In this regard, restricting fishing in specified areas would be easier to implement. For example, banning catamaran fishing in the northern part of the lake (north of Gitaza, 30 km South of Bujumbura) in July-August, which is a growth period for *Stolothrissa*, could be feasible. Low yielding catamarans that remain in the northern part of the lake could be banned at this time. In this regard, several group meetings were held during the mission with fishers from these areas, and it appeared that they would be in favour of a ban in fishing at this time. Such an intervention would be supported under the proviso that the fishers are provided an alternative source of income during these periods. Considering this, mobilizing large numbers of people through HIMO works has revealed a very efficient and cost effective alternative – assuming that a worker is paid US\$ 2 a day, mobilizing 1,000 workers during a month costs less than US\$ 50,000. During the dry season of July – August, track roads for example, can be worked upon, or household and field gardening can be supported in a manner similar to recent FAO interventions in Burundi. To illustrate the potential of this option: if it is assumed that 1,000 fishers or their relatives are mobilized to HIMO work between mid-June to mid-August (two months), the US\$ 100,000 spent on the project would represent the difference in value between 90 tons of fish caught as adults in September, and the same quantity of juveniles caught in June.

Since the late 1990s, a number of fisheries biologists have suggested that it would be appropriate to institute a ban on lamparo fishing north of Nyamugari (16 South of Bujumbura) and its counterpart in DRC. Such a measure would effectively make the extreme north of the lake a protected area. While the biological and economic implications of such a measure have yet to be established, it is likely that if successful, the fishing ban would enable the stocks of *Limnothrissa miodon* and *Lates mariae* to recover. In this regard it is interesting to note that the Greek fishers who originally fished this area in the 1950s indicted that *Lates mariae* and *Limnothrissa miodon* were abundant at that time, and as late as the early 1990s the catch of *Lates mariae* on hook and lines was still a major source of income for fishers (Petit, 1995).

It is worth noting that in the extreme north of the lake, the pelagic fish stocks are already heavily depleted - Congolese scientists from Uvira reported to the mission that these stocks had been "exterminated". Thus the economic loss associated with the closure of the fishery in this region would be small. If the pelagic fishery in this region is closed, the littoral fishing must simultaneously be supervised, as a major loss to the fishery is gill-net catches of juvenile *Lates mariae*, a high value fish when an adult, and *Limnothrissa miodon* larvae that are caught in large volumes by mosquito nets that are used along the shores in the morning. The use of scoop nets with small meshes also needs to be controlled to protect *Oreochromis tanganicae* and the commercial catfish species. The deployment of both land and lake-based patrols would be required to ensure compliance in both the nearshore and pelagic environments.

5.2.4 Improved processing and value addition

Many fishers declared that their dried *Stolothrissa* was only edible for seven days post drying, indicating that in many cases the drying processes that are being employed are sub-standard, resulting in lower prices and losses. In general, the fishers mix dried fish from various origins and processors, and as a result the quality is poor and the product cannot be exported to foreign markets and sold at premium prices (Figure 9). Training in improved processing, improving hygiene standards, packaging and marketing would increase product value and allow products to be exported to the higher value regional markets (e.g. Rwanda and the urban markets in the DRC).



Figure 9. Standards of hygiene can improve drastically (Central market – Bujumbura)

The canning of cleupid stocks in locally produced oil is worth investigating. Of the two cleupids in the lake, the *Limnothrissa* represents the best candidate for canning – it is a larger species than the *Stolothrissa*, and when sold fresh, it is of a lower value (Figure 10). The canning concept was first considered in the early 1990s, when one industrial purse seine owner expressed an interest in canning on a small scale; however, with the collapse of the purse seine sector, the initiative was abandoned. The required technical and commercial feasibility studies have yet to be performed, and in particular, suitable canning oil needs to be identified, and the potential for adding spices investigated (canned sardines with added spices sell well in Central Africa). In addition, the reliability and seasonality of supplies needs to be established. The export of dried or salted *Stolothrissa* is also another obvious opportunity, and in this regard spiced dried Mukene (*Rastrineobola argentea*) is already exported as a specialist product to the UK from Uganda.

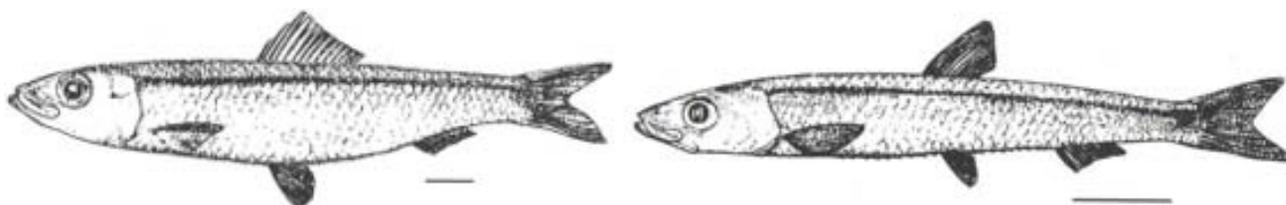


Figure 10. Adult *Limnothrissa* (left) and *Stolothrissa* (right). The scale bar below each picture is 1 cm long.

5.2.5 Increasing fish exports

The export of fresh *Lucioides* is worth investigating. It is a product that is widely acknowledged and valued by the expatriate community in the region. Prior to developing an export market the issues of poor product hygiene on vessels (urine is a major contaminant), and the cost / logistics of storage, and deliveries to the foreign markets needs to be addressed. A market and value chain study would need to be performed to establish the viability of this opportunity. To interest major buyers there will be a need to improve handling and hygiene / processing conditions, and ensure the reliability of supply. For example, the Rwandese embassy, when asked why there was so little fish trade from Burundi to Rwanda, replied to the Burundi fishing groups that there were no obstacles to trade "if they could each deliver 10 tons a month of Ndagala (*Stolothrissa*), 10 tons of Mukeke (*L. Stappersii*) and 10 tons of Nonzi (large Lates)". Unfortunately the fishers were unable to guarantee these volumes - despite the fact that an average beach in the south of Burundi could easily support such production volumes. It is evident that regional markets could be acquired for Lake Tanganyika's fish with a minimum level of organization and networking. As an example, the Hôtel Club du lac Tanganyika (Bujumbura) recently established a delivery contract with a fishers' association in Rumonge following the coincidental discovery of its existence. Previously, the hotel had resorted to imports from Uganda. It should however be noted that the trade of fish to distant markets (e.g. Kampala, Lubumbashi) may have an effect on local market prices at the lakeshore. As the pelagic stocks are collapsing in Lake Tanganyika, the development of export markets would significantly decrease the quantities of fish for sale at the local level, likely resulting in sharp price increases over and above the already high fish prices at the lakeshore. Under such a scenario, it is not unreasonable to suggest that the development of these export markets would likely provoke protectionist measures from the riparian communities.

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LIST OF PUBLICATIONS – LISTE DES PUBLICATIONS

SmartFish Programme

1. *Report of the Inception / Focal Point Meeting of the SmartFish Programme – Flic en Flac, Mauritius, 15th-16th June 2011*. REPORT/RAPPORT: SF/2011/01. August/Août 2011. SmartFish Programme. Indian Ocean Commission (55 pages).
2. *Report of the First Steering Committee Meeting of the SmartFish Programme – Flic en Flac, Mauritius, 17th June 2011*. REPORT/RAPPORT: SF/2011/02. August/Août 2011. SmartFish Programme Indian Ocean Commission (51 pages).
3. *Rapport de la réunion de présentation du programme SmartFish aux points focaux – Flic en Flac, Ile Maurice, 15-16 juin 2011*. REPORT/RAPPORT: SF/2011/03. August/Août 2011. SmartFish Programme. Indian Ocean Commission (55 pages).
4. *Eco-Certification for the Tuna Industry, Technical Assistance for Implementation of a Regional Fisheries Strategy for ESA-IO (IRFS)*. REPORT/RAPPORT: SF/2011/04. May 2011. SmartFish Programme. Indian Ocean Commission (40 pages).
5. *Regional Market Assessment (Supply and Demand)*. REPORT/RAPPORT: SF/2012/05. March/Mars 2012. SmartFish Programme. Indian Ocean Commission (264 pages).
6. *Trade Assessment Study*. REPORT/RAPPORT: SF/2012/06. March/Mars 2012. SmartFish Programme. Indian Ocean Commission (120 pages).
7. *Gouvernance des Pêches Maritimes dans l'Ouest de l'Océan Indien*. REPORT/RAPPORT: SF/2012/07. June/Juin 2012. SmartFish Programme. Indian Ocean Commission (101 pages).
8. *Value Chain Assessment of the Artisanal Fisheries – Mauritius*. REPORT/RAPPORT: SF/2012/08. June/Juin 2012. SmartFish Programme. Indian Ocean Commission (85 pages).
9. *Kenya Fisheries Governance*. REPORT/RAPPORT: SF/2012/09. June/Juin 2012. SmartFish Programme. Indian Ocean Commission (36 pages).
10. *Training Needs Analysis – Quality and Hygiene*: REPORT/RAPPORT: SF/2012/10. June/Juin 2012. SmartFish Programme. Indian Ocean Commission (95 pages).
11. *A Review of Somalia's & (Semi-Autonomous Regions) Fisheries Legislation and Management*. REPORT/RAPPORT: SF/2012/11. June/Juin 2012 SmartFish Programme. Indian Ocean Commission (49).
12. *Assessment of IUU Activities On Lake Victoria*. REPORT/RAPPORT: SF/2012/12. June/Juin 2012 SmartFish Programme. Indian Ocean Commission (130 pages).
13. *Review Of The Legal Framework for the ESA-IO Region*. REPORT/RAPPORT: SF/2012/13. June/Juin 2012 SmartFish Programme. Indian Ocean Commission (149 pages).
14. *Comprehensive capacity review to implement effective MCS in the ESA-IO Region*. REPORT/RAPPORT: SF/2012/14. June/Juin 2012 SmartFish Programme. Indian Ocean Commission (101 pages).

15. *Assessment of IUU Fishing in Lake Tanganyika*. REPORT/RAPPORT: SF/2012/15. June/Juin 2012 SmartFish Programme. Indian Ocean Commission (58 pages).

La bonne gouvernance et de la gestion des pêches et de l'aquaculture permettent d'améliorer la contribution du secteur à la sécurité alimentaire, au développement social, à la croissance économique et au commerce régional ; ceci en assurant par ailleurs une protection renforcée des ressources halieutiques et de leurs écosystèmes.

La Commission de l'Océan Indien (COI) ainsi que la COMESA (Common Market for Eastern and Southern Africa), l'EAC (East African Community) et l'IGAD (Inter-Governmental Authority on Development) ont développé des stratégies à cette fin et se sont engagés à promouvoir la pêche et l'aquaculture responsable.

SmartFish supporte la mise en œuvre de ces stratégies régionales en mettant l'accent sur le renforcement des capacités et des interventions connexes visant à :

- mettre en place des mécanismes pour la gestion et le développement durable des pêches ;
- développer un cadre de gouvernance des pêches au niveau régional ;
- renforcer le suivi-contrôle-surveillance pour les pêcheries partagées ;
- développer des stratégies et supporter des initiatives propres à accroître le commerce régional du poisson ;
- contribuer à la sécurité alimentaire en particulier par la réduction des pertes après captures et la diversification de la production.

SmartFish est financé par l'Union Européenne dans le cadre du 10^{ème} Fond Européen de Développement.

SmartFish est mis en œuvre par la COI en partenariat avec la COMESA, l'EAC et l'IGAD et en collaboration avec la SADC. Une collaboration étroite a également été développée avec les organisations régionales de pêche de la région. L'assistance technique est fournie par la FAO et le consortium Agrotec SpA.

By improving the governance and management of our fisheries and aquaculture development, we can also improve food security, social benefits, regional trade and increase economic growth, while also ensuring that we protect our fisheries resources and their ecosystems.

The Indian Ocean Commission (IOC), the Common Market for Eastern and Southern Africa (COMESA), the East African Community (EAC) and the Inter-Governmental Authority on Development (IGAD) have developed strategies to that effect and committed to regional approaches to the promotion of responsible fisheries and aquaculture.

SmartFish is supporting the implementation of these regional fisheries strategies, through capacity building and related interventions aimed specifically at:

- implementing sustainable regional fisheries management and development;
- initiating a governance framework for sustainable regional fisheries;
- developing effective monitoring, control and surveillance for transboundary fisheries resources;
- developing regional trade strategies and implementing regional trade initiatives;
- contributing to food security through the reduction of post harvest losses and diversification.

SmartFish is financed by the European Union under the 10th European Development Fund.

SmartFish is implemented by the IOC in partnership with the COMESA, EAC, and IGAD and in collaboration with SADC. An effective collaboration with all relevant regional fisheries organisations has also been established. Technical support is provided by Food and Agriculture Organization (FAO) and the Agrotec SpA consortium.

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