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Collaborative Management of Sustainable Fisheries in Senegal

Governance Needs Assessment:

The Marine Fisheries Sector of Senegal

August 2011

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Cover Photo: Joal's fish landing site in Senegal

Credit Photo: James Tobey, Coastal Resources Center, University of Rhode Island

Project Contacts:
USAID/COMFISH Project
Cité Djily Mbaye – Yoff, Villa N° 306, BP 26740, Dakar – Sénégal
Tel.: (221) 33 820 51 94 ; Fax: (221) 33 820 83 88
Email : comfish@uri-comfish.org

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EXECUTIVE SUMMARY

DIAGNOSIS OF CURRENT GAPS: The following important gaps were identified in the Senegalese fishing sector, and need to be addressed by the Direction of Maritime Fisheries (DPM) so that it can fulfil its commitments under the Sectoral Policy Letter (Lettre de Politique Sectoriel).

- Weaknesses in stock assessment and provision of timely, in-depth biological studies, which make it more difficult for DPM to target sustainable fishing.
- General lack of bio-economic applications of stock assessments which impede fisheries management decision making.
- Weaknesses in fisheries management structures which target effort, capacity and gear management, but cannot address biological sustainability because of the mismatch between productivity of the stocks and fishing capacity and effort.
- Inadequate infrastructure and processing capacity, safety and hygiene in processing fish, particularly in the artisanal sector.
- Lack of updated strategic information about the gap between lower fish landings and the increasing demand for fish needed to achieve food security in Senegal.
- Insufficient educational resources and key personnel in fisheries biology, stock assessment, fisheries economics, fisheries management and gender management skills needed to implement sustainability in Senegal's coastal zone.
- Lack of financial resources needed to address the lack of insufficient educational resources and key pesonnel.
- Insufficient number of skilled Senegalese personnel working in Senegal who are trained to replace foreign experts when they leave as international funding ceases.

REMEDIAL ACTION: It is recommended that USAID/COMFISH construct a comprehensive Skills, Human Resources and Capacity Management Plan for Senegal's Fisheries Sector. To do this USAID/COMFISH should form a multiskilled team to conduct a full review of:

- the skills and capacities which Senegal needs in order to fill these gaps
- the exact areas/human capacities DPM wishes to develop
- the investments in education and manpower development needed to achieve the desired developments

This team should describe in more detail all the key gaps identified above and should, in collaboration with DPM and its partners, identify a "Skills, Human Resources and Capacity Management Plan" for Senegal's fisheries sector covering both short term (3-5 years) and longer term needs.

ACRONYMS

CDEPLAGE	Comité de Plage, Beach management structures created by IUCN which are analogous to CLPs
CFP	Common Fishery Policy of the EU
CLP	Comité Local de Pêche
CLPA	Conseil Local de Pêche Artisanal
CRODT	Centre de Recherches Oceanographiques de Dakar Thiaroye – Oceanographic Research Center- Thiaroye, Dakar
CV	Comité de Village
DPM	Département des Pêches Maritimes
EU	European Union
FAO	United Nations Food and Agriculture Organization
IFAN	Institut Fondamental D'Afrique Noir
IFIS	Integrated Fisheries Information System
IUCN	International Union for the Conservation of Nature
IUPA	Institut Universitaire de Pêche et d'Aquaculture- Université Cheikh Anta Diop
IRD	Institut de Recherche Durables
IUU	Illegal, Unregistered and Unreported Fishing
LPS	Lettre de Politique Sectoriel
MCS	Monitoring, Control and Surveillance
MEM	Ministère de l'Economie Maritime
WB	World Bank

1. - Introduction

This report was prepared for the USAID/COMFISH project in response to a request by the Department of Maritime Fisheries (DPM) to assess fisheries governance and capacity building needs. The goal of the USAID/COMFISH Project is to support the Government of Senegal's efforts to achieve reform of its fisheries sector by strengthening many of the enabling conditions necessary for improved governance and demonstrating effective tools and approaches for ecosystem-based collaborative management of its marine fisheries.

The findings are based on interviews with key informants and participation in a national workshop hosted by USAID/COMFISH in July 2011 on the status of fisheries projects, management, institutional structures and research needs.

The findings and recommendations fall in four categories:

- Fisheries research, database management, and analysis
- Fisheries management, institutional structures and capacity
- Industrial fishery and industrial fish processing
- Aquaculture

General conclusions and recommendations are presented on pages 16-18 of the report.

2. – Fisheries Research, Database Management and Analysis

2.1. Research oriented towards fisheries population dynamics

It is clear that there are many people in Senegal who are well educated and experienced in the population dynamics methods needed to inform a modern fisheries management system. However the present situation in Senegal, where so much emphasis is being placed on the bottom-up approach to management, and where there has been a great reduction in resources and a consequent dispersion of scientific personnel leading to more scattered and less coordinated research and information gathering, requires some clarification on how the planning of fisheries management research should be tackled.

Marine research is a costly exercise which competes for scarce funding with many other research and technical needs in Senegal. Therefore it can only be funded effectively through a highly focused decision making process which identifies all the key strategic needs which must be addressed if the LPS is to be met. Because of the highly focused but comprehensive nature of the research needed to inform fisheries management, fisheries research contains a very important top-down element. It should target research priorities which must ultimately be established very broadly by DPM in a top-down albeit highly consultative environment, acting through and in consultation with such agencies as the CRODT, IUPA and others. Once the broad framework has been established, however, the research must be planned in a much more bottom upwards environment. This is because applied stock assessment and fisheries research in general is very team-oriented, so that once the targets for applied research are chosen, the research must be carried out in a very consultative manner and should contain important bottom-up elements. For instance, species to be assessed and sustainable management bodies must be chosen in close consultation with fishermen, CPLAs, CPLs, etc.

Marine research, even when economic resources are available and well-organized, can lead to unplanned dispersal of effort, and thus often drifts away from the essentially applied type of work which is actually needed. Furthermore, this kind of dispersion of effort often makes it even more difficult to provide results which are demonstrably useful to the funding agency (in this case DPM and Government of Senegal), so that a cycle of poor funding based on misunderstandings about the role and usefulness of elements such as stock assessments in management may arise. This is perhaps one reason why the DPM may feel that it has not yet fully received the expected support from the CRODT.

Senegal is not alone in facing this problem: this kind of waste and dispersion of resources was identified by the European Union as a major problem in most of the EU fishing nations. The EU is trying to put order into this situation through the recent proposal by the European Commission in the latest reformed version of the Common Fisheries Policy (CFP). The proposed draft for the new CFP includes a full chapter dedicated to "The Scientific Base for Fisheries Management" which summarizes the kind of data needed for fisheries management. Certainly Senegal's fisheries have to be managed in a different way from EU fisheries, but the basic concepts remain the same. Fisheries research should be aimed in a precise direction, which is why the new proposed EU regulation instructs European Member states to:

> *"….. collect biological, technical, environmental and socio-economic data, manage them and make them available* ***in support of fisheries management****, enabling assessment of the state of exploited marine biological resources, the level of fishing and the impact that fishing activities have on the marine biological resources and on the marine ecosystems, and the socio-economic performance of the fishing, aquaculture and fish processing sectors within and outside EU waters*."

Many studies have been conducted in the past in Senegal on many of its fisheries, but most of them have a different philosophy from the one stated above. The work done in Senegal is usually of a more descriptive character and is often not oriented towards modern management of fisheries, but that does not mean that the existing knowledge cannot be reanalysed and used for that purpose. But at present there is no recent fully updated, published and comprehensive review of the status of Senegalese stocks. Research effort has to cover the evenly the whole Senegalese coast and this cannot be done until the data have been reviewed and revised where appropriate.

It was made evident and accepted as a fact during the Workshop that CRODT has been reduced in its human resources to a point where it is impossible for it to furnish the type of research results needed for modern fisheries management to be consistently applied to all of the stocks which need to be managed. This situation has to be reversed, and the strengthening of the CRODT with more of the experienced staff available in Senegal, either through recruitment of old staff, the addition of entirely new staff, or both is certainly priority number one for any policy intended to produce a sound management plan for Senegalese fisheries. The problem is how to do that, both in the short and in the long run, in a manner such that the research team and institutions can be sustained on their own once outside aid has finished.

It is proposed that a short kick-off project is put in place which will include recognized experts who will thoroughly examine all the existing data and produce:

a) A general report on the status of the stocks in all of Senegal based on the existing data and on field surveys

b) A report on the follow-up activities that need to be addressed in order to improve information on stocks, on the organization of the work and activities of CRODT and other research institutions

c) A research plan for the period 2012-2020 including all estimated human, material and financial resource needed for stock assessment institutions to provide DPM with information needed to achieve sustainable fisheries

d) A plan which will provide a strategic development pathway which, when implemented, will create a team of Senegalese experts who will gradually be incorporated into a sustainable research-based system which will provide scientific fisheries management on a permanent basis so that the work can be continued after all foreign support has been completed

2.2. Fisheries data management systems

Data are essential for all kind of studies, such as the assessment of the stocks or economic studies that may be used to support related bio-economic analysis of the stocks, as well as for sociological and marketing purposes. Many different sets of data currently exist in Senegal, from both the CRODT and DPM. CRODT takes fishery dependent data on landings and CPUE at many landing places which are used to estimate total effort. CRODT also has Fisheries Research Vessel data taken from fishery independent surveys which were carried out twice a year during the *Saison Fraiche* (around October to January) and the *Saison Chaude* (around June to September), although budgetary restraints have severely limited fishery independent surveys from 2007 onwards. Some of these data may be kept on digital archives and storage systems.

DPM has also two sources of data. First, fishery dependent data on landings and CPUE are taken at many landing places and used to estimate total effort. Additionally, an entirely independent data set on the sales of fish by *mareyeurs* throughout Senegal are collected and sent to DPM. These data could be used to provide alternative information on the amount of fish sold and consumed in Senegal.
Modern fisheries management needs to have flexible, comprehensive and readily accessible data bases, but there are a few basic principles which should be addressed when establishing a national data system or as it is called nowadays an Integrated Fisheries Information System (IFIS), including the following:

1. Data entered into IFIS must serve in the assessment of biological, technical, environmental and socio-economic studies and must be ***readily available to all stakeholders*** in order to provide sound fisheries management. Also they must be available on a timely basis with a delay which should not go beyond six months: modern systems may allow data to be available on a monthly basis, and sometimes data can be accessed over even shorter periods.
2. IFIs data entered must be as accurate and reliable as the situation permits, and for economic and obvious reasons ***duplication of data collection for different purposes must be avoided at all costs***. This issue was raised at the workshop and there was general agreement on this point.
3. Safe storage of IFIS data must be ensured and appropriate protection and confidentiality must also be assured. Also a validation mechanism for the incoming data must be envisaged in order to verify the timely transmission and quality of the data.
4. The IFIS data bases ***must be as comprehensive as possible***, including the storage of scientific data, however an adequate access system must also be envisaged in such a way that selective access to data is established for each potential user. IFIS data entry must only be made by specialized personnel.
5. A ***legal framework*** may be necessary for the IFIS in order to make it compulsory for all those authorized to fish or participate in the fishery at any level (i.e. processing industry, storage, exports etc.) to provide the required data.
6. The IFIS technical system should provide an efficient transmission of the data from sampling site to the storage and data base site(s). The method of transmission must be adapted to the situation of Senegal. Who owns and runs the Integrated Fisheries Information, who is responsible for taking data, and how the physical transmission is made, must all be planned clearly and in advance. Installation of a modern system requires a significant investment so the system created is stable and designed to last at least 10 years without any important

conceptual changes. No important structural changes should be made after the initiation of the project[1]. All of this needs planning with a wide perspective.

7. The IFIS must be based on recognized technical standards and must ensure compliance with the obligations with regard to international organisms (i.e. FAO) or any international regulatory organisations on fisheries.
8. The above safeguards are essential and there will always be a need to keep parts of the IFIS confidential using all of these safeguards (such as personal information, income information, etc.).
9. Nevertheless the primary objective of an Integrated Fisheries Information System is to make data accessible and to facilitate analysis and reanalysis as needed by stakeholders.

In the case of Senegal, CRODT and DPM, data must be carefully analysed in order to see to what degree they are complementary and also in order to assess their strengths and weaknesses. It is essential to try to calibrate and pool these different data collection systems and data sets, so as to create a single modern integrated data and information management system. This has to be done at the same time that the analyses needed to manage Senegalese fisheries on the basis of "best currently available data and assessments" are being carried out.

This proposed IFIS should be linked to and should interact with the Fisheries registration data system now being developed in Senegal.

Attention has to be focused on the fact that common sense and realism are absolutely necessary when designing an IFIS. The thinking in most parts of the fisheries world is that data input should be made by producer organizations and validation is made by specialized governmental agencies. In the case of Senegal, if a bottom up approach is going to be the management model, then the CLPs and/or CLPAs should also play an important role. In this case one has to bear in mind that the establishment of such an IFIS may imply computerizing the recording systems of these organisms and at the same time may require establishment of a network to link CPLs, CLPAs etc. with DPM and CRODT, allowing for fluid data transfer and communication between all of these institutions.

An IFIS of this kind will also imply that all of the structures mentioned above must be supplied with the necessary equipment and trained staff for the handling of data on fish landings and sales as well as for the production of all the daily, monthly and annual reports required by DPM and CRODT. Such equipment should also include fish-sales related data taken from accounting systems run by various mareyeurs which can be digitally transferred over internet links by landline or mobile telephone. Therefore the technical capabilities in each landing site must be assessed so that they can comply with these requirements. Of course this implies the need for a written system which may be difficult since many fishermen are functionally illiterate (a fact which brings attention once again to the need for educated personnel if CLPAs and CLPs etc. are to be integrated into a UDG based management system).

The idea proposed here for an Integrated Fisheries Information System (IFIS) should be reviewed in detail. During the kick-off period it is recommended that the following preparatory work be done by USAID/COMFISH:

a) A meta data analysis[2] of the different sets of data which exist in Senegal, including both CRODT's data base as well as DPM owned data bases, in order to study their synergies and to establish the basis for the definitive Fisheries Information System for Senegal.

[1] Many ambitious projects of this kind have been delayed by several years because of attempts to redesign the information system. Some of them even failed ignominiously and had to be abandoned altogether at great cost for the same reason.

[2] I.e. a list of the kinds of data available

b) A critical review of the facilities existing in each landing site in order to establish the feasibility of incorporating the required technology.

c) An identification of the type of information required from other sectors of the value chain, other than fishing itself, such as buyers/vendors, sales organizations, processing industry, exporters etc.

d) An economic evaluation of the costs of establishing a system as well as the costs of maintaining and running once it is finally established.

e) An analysis of the data bases existing in CRODT, IUPA and other research institutions in order to evaluate the possibility of their incorporation in the IFIS as well as areas for improvement.

2.3. Fleet capacity study

Another important question is that of the management of the fishing fleet capacity. Although the registration program for pirogues is a very important first step, several issues must also be taken into consideration. Measures to constantly adjust the fishing capacity of the artisanal and industrial fleets are needed, in order to achieve an effective balance between fishing fleet capacity and their fishing opportunities (i.e. the productivity of the stocks and ecosystems which support the fleets/fisheries). This means among other things that a legal entry system must be in place in such a way that:

a) No new entries to the fleet may be permitted unless an equivalent ***effective*** capacity is withdrawn previously.

b) Fishing capacity corresponding to the vessels withdrawn with public aid cannot be replaced; this has to be made mandatory by means of an adequate legal framework.

c) An efficient system must be in place in order to assure that no exit from the fleet supported by public aid shall be permitted unless preceded by the withdrawal of the fishing license and any other fishing authorisations.

It is necessary that fishing capacity ceilings for the fleet, based on the precautionary approach and sensible arguments, should be established after a review of the historical performance of the fleet. But all this needs an accurate and agile fishing fleet registration, which must be constantly reviewed, and which requires an interactive connection to the Integrated Fisheries Information System described above. A review of the existing related data bases is thus needed in order to design how this registration, which must include all relevant data needed for fishing capacity analysis and estimation, will be made. This is no minor task since it has to be a fully operational system.

3. – Fisheries Management Planning and Institutional Capacity

3.1. Administrative approval of fisheries management institutions and fisheries management plans

It seems that there is not yet an easily operated pathway for establishing or approving of any of DPMs biologically sustainable management proposals (CPLAs, CPLs, etc.). Prefets and Sous Prefets, who report to the Minister of the Interior, are required to approve the existence of all CLPA, but these officers lack the technical know how to evaluate the proposals made by CPLAs/Chefs de Pêche and DPM. This is a very serious obstacle to the implementation of any fisheries policy or fisheries management plan. An effective and specific legal framework needs to be established for any of the bottom-up agreed rules or plans to be made mandatory and enforceable. The existing legal framework must be critically reviewed and adjustments should be suggested where necessary. One possibility is to train a cadre of officers who would work as or closely with Sous Prefets but are trained in fisheries management issues.

3.2. Education of local fisheries management officers to implement fisheries management

One important problem which must be realistically addressed is the question of educational qualification. We mentioned above that even important decision making officers may lack the necessary expertise to enable a timely evaluation of the management proposals and timely decision making. Any management of fisheries even at the very small scale needs people with a substantial degree of preparation, but many of the fishermen in small villages are illiterate. In these circumstances it may be difficult to find capable persons to run these institutions (CLPs and CLPAs). Such situations have been dealt with in many countries by means of the detachment of officials who can serve as extension officers. But all this has a cost and the public budget is limited; this means that a budgetary estimate would be needed to assess the cost of running these types of organisations and to estimate how many could be feasibly sustained with public and private funds.

3.3. Local capacity to maintain physical infrastructure and facilities

There have been many donor projects aimed to increase added value of the artisanal fleet by means of the installation of ports or cold storage facilities. We have been told that they remain largely unused because of the lack of skills and private financing to keep them in use. This remains to be confirmed but if true, it would tend to show that some basic (village level) structures may not be able to survive on their own, and may depend on loan agencies or (in their absence) DPM. If true, this would tend to confirm that an effective bottom-up management system may be limited by the actual capacity of some CLPs and CLPAs to organize and fund themselves in a sustainable manner. This would be an extra factor to take into account and may suggest that during the start-up period for an area where local structures are weak or non-existent, real management should be passed to more comprehensive organizations.

3.4. Sustainable financing

A socioeconomic analysis of fishing communities is necessary in order to determine the real capacity that these organizations have to finance themselves. Additionally, this analysis would help guide the creation of a sensible policy oriented towards promoting a minimum size for these local organizations, which is necessary to ensure an effective and efficient concentration of scarce human, material and financial resources. The determination of the minimum size and minimum management requirements is the only way by which a sound and sustainable bottom-up approach can be created. This study would have to include a system for sustainably financing of the basic institutions after any public aid ceases to exist.

4.0 – Industrial Fishery and Industrial Processing

4.1 Inclusion of the industrial fishing sector

Adequate inclusion of the industrial fleet in the decision making process has to be assured but requires a responsible industrial fishing sector. Our visits to industrial facilities in Dakar showed that at least some of them are very well run by even the most stringent national and international standards. The ones we visited employed large numbers of women (one had a female general manager); all fish processing and value added was done in Senegal and each product was targeted towards the highest priced market in Europe where the species in question would fetch the highest value added. All capital was at least 51% Senegalese, and for one company more than 70% of the fish exported was bought from artisanal fishermen so that they would have a higher income and higher prices. This company

has introduced a socially responsible, fisherwoman/man sensitive and economically viable exploitation model into the Senegalese fishing sector. The company is aware that biological sustainability is essential and welcomes the idea of biologically sustainable management, which it has offered to support insofar as it is able to. Also we had the opportunity to see how the industrial sector purchases important amounts of artisanal catches and ensures, in this way, the best possible marketing for artisanal catches. Important synergies exist between industrial and artisanal fleets which often share and exploit the same stocks. These synergies need to be jointly and comprehensively planned so that all players may benefit optimally.

4.2. Foreign fishing fleet

It has also been reported that there is large scale activity by a foreign fleet using large industrial vessels (with overall lengths of around 100m) apparently with government authorization, which operate in Senegal's EEZ. It has been said that the total real (but perhaps not reported) catches of this fleet could be as high as 200,000 tons/year. Such activity would be absolutely inconsistent with the capacity reduction scenario envisioned for the Senegalese fleet in the Lettre de Politique Sectorielle.
Many studies have been carried out on the relative advantages of foreign venture fishing agreements where the fish is not landed, processed or sold in the coastal country. All such studies show that most of the value of fish taken under such agreements (usually around 80% or more) is taken by the offshore country. It is therefore most likely that Senegal obtains very little benefit from the operations of this fleet, other than an up-front fee for the right to enter and fish in Senegalese waters. Normally such fees are paid into the Treasury and do not benefit any of the DPM or MEM stakeholders. The fish taken are likely to reduce landings in Senegal's coastal artisanal fisheries and therefore to reduce small-scale fisherman incomes without bringing any benefits to them.

For all these reasons it is recommended that the following actions be taken to provide for management of fishing fleet capacity:

a) An analysis of the existing legal framework on fisheries in Senegal, in order to see what areas would have to be reinforced and further developed to allow fleet capacity management.

b) A comprehensive analysis of:

- the social decision-making structures existing at a community level
- their degree of literacy
- their capability to run their own economic and internal organizational affaires
- their capability to provide the necessary financial resources for running bottom-upwards CZM through fishery management structures in a sustainable manner

c) A general study of the status of the industrial fishery, including the processing sector, in order to study synergies between the industrial and artisanal sectors and to determine how capture of value added can be organised optimally.

d) An analysis of the current fishing vessel registration and capacity regulation surveillance tools, in order to set up an active fishing vessel registration which can be connected to the general IFIS, as described above. This system should be capable of ensuring sound estimates of capacity as well as surveillance and enforcement of any fishing capacity management policy in place.

e) A review of the present surveillance system in order to design a strategy to reinforce both the bottom up approach that is being proposed and also the system's capacity to effectively eradicate all kind of IUU in Senegal's jurisdictional waters.

f) A Fleet Capacity Management Plan for Senegal, so that the management of all of Senegal's fisheries can be carried out through the harmonisation of the productive capacity of the stocks with the capacity of Senegalese fleet (including offshore and IUU fishing fleets) to take fish sustainably.

4.3. Monitoring, Control and Surveillance (MCS) as a tool for controlling IUU fishing

No policy implementation is possible unless it can be properly enforced with a system of Monitoring, Control and Surveillance (MCS). The rules for a bottom-up system must be enforced, and any kind of Illegal, Unregistered and Unreported Fishing (IUU) must be eradicated. Certainly IUU also happens when local fishermen act in breach of the law but proper MCS in Senegal is particularly necessary to ensure that no unauthorized vessels fish in Senegal's jurisdictional waters. It has been reported that in offshore Senegalese waters boasts not licensed to take fish in Senegalese waters nevertheless do reportedly catch Senegalese fish. The volume of these IUU landings is not accurately known but anecdotal reports suggest that they may exceed total legal Senegalese landings. These IUU landings and effort will impact Senegalese stocks and reduce legal landings. This activity is utterly inconsistent with a scenario where a reduction of capacity of the Senegalese fleet is required. As a first step in this direction, USAID/COMFISH should take steps to estimate, even very roughly, the amount of IUU fishing (through an appropriate consultant, and in coordination with Navy and Coast Guard).

4.4. Industrial processing capacity

Any mature and well developed country has in its fisheries structure a balanced mix of industrial and artisanal components. It is also common for there to be a cross investment between the industrial fleet and the processing sectors, although this does not happen in all cases. This is because both industrial fishing and fish processing need substantial capital to be able to develop and maintain a reasonably competitive state. Because of the link between the two sectors, adopting a controversial approach by developing one type of fishing fleet to the detriment of the other would not be a sound or beneficial policy. A balanced mix of industrial and artisanal fleets is normally the best model and it is likely the optimal strategy for Senegal as well.

It has been rightly said that freezer plants provide the technology necessary so that fish produce meets strict EU and USA hygiene standards. In Senegal, industrial boats are required to land all their catches into Senegalese ports, mainly in the fishing port of Dakar, where they are processed and sent to EU and other international markets. There is a close linkage between the industrial fishery and the processing sector and it is unlikely that the industrial freezer/processing sector would be commercially viable without the currently important industrial fishery.

No studies have been conducted which provide an estimate of the optimal size and technological status of Senegal's industrial fishery so that it can support economically successful exports from the artisanal and processing sectors while remaining competitive in a more and more globalized world fish market. One has to bear in mind that at present fishermen are "price takers" with very little influence on price fixing, unless through the quality of their products. There is a general feeling among industrial people that the industrial sector has already been substantially reduced over the last decade and may be near the lower level needed to maintain a vigorous export sector.

At the same time, many of these processing plants also receive a considerable amount of export-quality fish from the artisanal fisheries. These fish are provided to the plants through a tight network of buyers or "middle men" ("*mareyeurs*") which covers all inland and marine fish landings and which constitute an essential element in the marketing of artisanal fish. It is therefore clear that an efficient and competitive processing industry is essential for the marketing of all fish produced in Senegal.

One major issue concerns the ownership of both industrial boats and processing plants. The industrial fleet in Senegal works under the Senegalese flag but is largely operated and managed by overseas capital working in accordance with the requirements of Senegalese law. Nevertheless there is a limit to how much foreign capital can be included in these investments, and Senegalese law (like many other countries) limits this participation to no more than 49%. However, it is often the case that these

fleets are managed under the direction of the foreign partners, which normally provide technical know-how and knowledge of the foreign international markets.

In a global market world, determining who owns the capital in a particular enterprise may be of little importance. This might also be the case for developing countries, although this depends on several conditions. It is true that it is in the interest of developing countries to attract foreign capital for the development of sectors where no national capital exists. However, it is also in the interest of the host country to maximize the amount of value added which remains in the country. By requesting that all catches are landed in Senegal's ports, the amount of product processing and transformation completed in Senegal is maximized. In such a way, the development of a strong and competitive processing industry is a target for the Senegalese fishing industry.

A good network of storage facilities helps in the development of a sound internal market and increases the availability of fish to large portions of the population. All these factors would have to be studied in addition to the question of how to finance all those developments in a manner that would be sustainable in the long run. An analysis of the reasons for the failure of the cold storage facilities mentioned above may be needed in order to select the most effective measures in the processing sector (and in general on a sound structural policy for Senegal's fishing sector).

For all these reasons it is recommended that the following be carried out:

a) A survey of all the processing companies in Senegal in order to review their degree of capitalization, their equipment shortages, the role they play in the value chain of fish marketing in Senegal and their view on what measures are needed to gain more competitiveness in international markets.

b) A study on the status of the industrial fleet and possible optimum size for its capacity, based on past and present performance.

c) A study on the storage and processing facilities in the small landing sites and the reasons for past failures in order to recommend measures for a vigorous structural and market policy at all levels.

d) A feasibility study for adopting modern marketing practices like concentration of landings and sales in order to encourage a more vigorous competition between buyers, so that more value could be obtained for the small fishermen.

5.0 - Aquaculture

Aquaculture should not be considered an alternative to fishing, but rather an alternative use of Senegal's sea and her continental waters. Aquaculture is normally an activity that requires a high level of technical equipment and technical knowhow. There are several kinds of capital requirements for the initial development of aquaculture, depending on the type.

Aquaculture has yet to be substantially developed in Senegal. The Institut Universitaire pour la Pêche et l'Aquaculture (IUPA) is the designated centre for providing the Government of Senegal with advice on aquaculture research management and development. The institution was established in 2003, It is a very young institution and was established in 2003 and, according to the data provided during the Workshop, it is in charge of the education of generalists in all kind of fisheries techniques, and is the only existing institution with these characteristics south of the Sahara. It has ten researchers as well as a group of staff dedicated to teaching. There is currently no commercial venture working on aquaculture in Senegal. For the time being, it only is planned to address continental aquaculture. No marine activity is envisioned in the short-term.

The problem with commercial scale aquaculture is that it must be focused primarily on high value species which must have a well-identified place in the market. For example in Europe, the main cultured fish species are Atlantic salmon, Turbot and Sole, with the particularity that this is not the European sole but *Solea senegalensis*. Much of this production is aimed to the hotels, restaurants, and catering sector since this sector seeks a regularity of in supply and product size.

Aquaculture is also possible under certain conditions even for species whose prices are lower, such as mussels, but in these cases the culture is less intensive than for high value fish. In this case, the aquaculture system maximizes production using special cultural methods adapted to the prevailing conditions of the environment. An example of this is the case of mussel culture in Spain, and it is also the case in the exploitation of certain natural banks of shellfish that may be enhanced by intensive seeding produced in special installations.

It is often possible to carry out aquaculture activities aimed at supplying a certain domestic market which helps improve the variety of food in local or even regional markets. In each case local species are targeted in situations with a high local demand combined with local product scarcity.

We could very broadly classify aquaculture facilities in three groups:

1) **Subsistence aquaculture**, which involves aquaculture installations aimed to develop a very specific local market and based mainly on food security considerations. These systems may provide a complementary source of food and earnings to the local economies. A mini-hatchery model was developed by IGAFA (Instituto Galego de Acuicultura, Spain) to fit this type of small-scale, local, subsistence aquaculture (see Annex 1).
2) **Support aquaculture**, which is used to enhance recruitment from natural nursery grounds. This is particularly useful in restocking shellfish grounds and can be aimed at reducing the need to conserve a parental stock, which allows for a more intensive exploitation. Again mini-hatcheries are used for these purposes.
3) **Industrial aquaculture,** which focuses on producing important quantities of high value species. This can be done by means of a semi-culture technique (such as the mussel raft or long-line production, or salmon cages) and through capital intensive installations based onshore. These usually require costly and sophisticated water circulation and purification installations.

In principle it would be possible to develop any of these aquaculture systems in Senegal provided that the environmental conditions are adequate for the species selected. The type of system to be used is standardised and can easily be adapted to any species and environment, but there are very important requirements for the successful development of aquaculture, including:

- A sufficient amount of capital for the initial investment (which may be large),
- An adequate amount of time and resources to support the project before the pay back starts (as the investment capital may not be returned for at least two years because of the maturation time)
- A sufficient amount of resources to cover the operating costs during the investment period. These costs may be very high due to the fact that many properly trained personnel will be needed to start up a new aquaculture system, and these highly qualified and experienced people tend to be very expensive to hire.

Strict economic analyses are needed to justify implementing any of these pathways for aquaculture development in Senegal, especially if the new facilities are to be run using any public support. Even if the land and equipment are purchased with public money, the running costs may be too high in the long run for those operating the facilities. It is necessary to bear in mind that the level of education/training/experience for transferring and installing the new technology will be much higher during the development phase meaning that development costs will be proportionately higher during this phase than during the commercial implementation phase (supposing the development phase is

successful and the technology is "Senegalised"). Another consideration is that a culture of justifying actions before taking them, which is necessary in a publicly financed environment, is not conducive to the quick actions often needed to perform actions such as saving brood stocks or meeting commercial deadlines.

Additionally, the choice of species to be cultured must be carefully made for aquaculture development to be successful. Aquaculture does not respond well to large, sharp price oscillations, so a species must be chosen with stable market conditions in the medium- to long-term. However, it is likely that there are some species like oysters and mussels which could be the subject of aquaculture projects in Senegal, and it may also be possible to cultivate some African species such as Tilapia, catfish and others.

For those reasons it is recommended that:

a) A survey is carried out to determine the most suitable sites for each type of aquaculture installation;
b) A study is made on species that could be technically cultivated in Senegalese continental and maritime waters;
c) Once the previous two conditions are fulfilled, an economic study should be conducted to determine which one of the technically cultivable species could be subject to culture with positive economic results. Capital requirements as well as possible sources of financing, both public and private, should be part of this study.

6.0. – General Conclusions

Critical mass of skilled Senegalese fisheries scientists: Fortunately, there are a considerable number of highly educated fisheries experts in Senegal with a variety of experience and backgrounds who are very capable of dealing with most fisheries management techniques. However at the present moment there seem to be very few who can provide a strategic overview of the whole sector and there are considerable gaps in skills which must be closed before this can be done. These gaps currently impede the chain reaction which is normally expected when such a large number of such experienced and skilled people work together in the same field. This critical mass therefore needs to be focused towards filling certain gaps which now prevent successful integration of the fisheries sector.

Lack of a comprehensive, coordinated view: In general, there is a lack of coordinated action in the field of fisheries which may impair much of the necessary planning activity. It is evident that the people who are capable of carrying on this type of work are now dispersed in many different institutions. DPM, CRODT and IUPA have very limited resources and this may be the main reason that no compilation and analysis of all old and new data and publications have been done. There seems to be a lack of any comprehensive and coordinated team to lead the planning exercise, and this is something that should be corrected immediately.

Economic and social importance of fisheries: Most countries with such large fishing sectors spend from 2.5-5.0% of total fishing revenues on fisheries management and the research necessary to do it sustainably. In Senegal, the government budget allocation appears to be a considerably smaller percentage of total fishing sector revenues.

The broad nature of fisheries management: Again, we must stress that management is more than fisheries modelling and stock assessment through analyses. We must manage men and communities, and therefore long-term fishery planning is also about behaviour. Macroeconomics is much needed to manage fisheries but microeconomics, that is to say men, women, enterprises and revenues are of equal importance. Indeed, because a co-management bottom-up scheme has been chosen for the

regulation of Senegal's fisheries, it is even more essential to be able to determine the size, financial power, and organizational schemes of the base organizations.

Human resources management: Another important point is that it is difficult to keep trained human resources – people – in the positions where they are most needed. This may be one of the reasons behind the reduction of human resources in research organizations and could explain why CRODT has lost so many resources over the last few years. It should be assumed that, on the contrary, the more Senegal advances in the management of its fisheries, the more there will be a great need for sophisticated research and human resources. This again has to do with long term planning, and these are questions that must be tackled when establishing a long-term fisheries management plan.

Lack of a strategic human resource plan for Senegal: In summary, Senegal has not yet made a comprehensive analysis of her fishing sector and industry from a strategic or "global" skills and capacity point of view. Until now there has been insufficient "global" team spirit due to this lack of a comprehensive view. Much important work has been carried out on many independent small projects which are disconnected from any general framework. The lack of an overview has also lead to a certain lack of realism in many of the proposed approaches that only pay attention to the artisanal fleet and disregard the important role that the industrial sector plays in the overall fisheries scenario.
In addition, the following gaps were observed:

A. Weaknesses in stock assessment and the provisions of timely and in-depth biological studies
B. General lack of bio-economic applications of stock assessments which can be used to coordinate biological and economic policy to more fully inform DPM on the available management options and the available pathways for fisheries management and policy implementation.
C. Weaknesses in the legal and social CZM structures which currently target effort, capacity and gear management, often supported by other management measures such as closed seasons and areas at the village level. These village level structures (whether CPLs, CVs, CDEPLAGE and others) even where they are grouped into CPLAs, cannot address biological sustainability issues because of the mismatch between biological productivity of the stocks and the available fishing capacity and effort.
D. Inadequate infrastructure and processing capacity, safety and hygiene in processing fish, particularly in the artisanal sector.
E. Lack of updated strategic information about the technical possibilities which can become the base for public and private aquaculture development, which may be used as another pathway for meeting the gap between the lower landings of fish now being experienced and the greater need for fish to address food security and livelihood problems in Senegal.
F. Insufficient educational resources and key personnel needed in fisheries biology, stock assessment, fisheries economics, fisheries management and gender management skills, (i) to meet the needs for strategic fisheries research and (ii) to implement sustainability at the UGD/CLPA/CLP level in Senegal's coastal zone.
G. Lack of key financial resources needed to address F above in the UGDs, CPLAs, etc. as bottom-upwards and top-downwards management is established in a pragmatically balanced manner in the field.
H. Insufficient number of skilled Senegalese personnel working in Senegal who are trained during the life of a project which has been developed and put successfully in place using temporary foreign personnel and budgets which cannot be sustained over the long run.

7.- Recommendations

The foregoing remarks show that Senegal needs a general and synthetic review of the skills and capacities needed to support the implementation of its Lettre de Politique Sectorielle and to address these strategic gaps.

Therefore it is recommended that USAID/COMFISH form a larger team which will conduct an in depth review of:

- the skills and capacities which Senegal needs
- the gaps which it must fill

This team should address in more detail all the key gaps identified in Section 4 A-H and the smaller gaps mentioned in the body of the report, and should construct a comprehensive *Skills, Human Resources and Capacity Management Plan* for Senegal's Fisheries Sector. This *Skills, Human Resources and Capacity Management Plan* should address both short term (3-5 years) and longer term needs. The team chosen should include expertise in (a) Fisheries Management, (b) Population Dynamics and Assessment, (c) Integrated Fisheries Information Systems (d) Aquaculture and (e) Human Behaviour/Integrated Coastal Zone Management. The exact mix of skills should be chosen in close consultation with DPM.

The above mentioned *Skills, Human Resources and Capacity Management Plan* is likely to cover more ground, and to require more funding, than any one of the loan and funding agencies/donors can easily provide. Should this be the case, different funding agencies can choose in consultation with DPM which areas they will fund, and DPM will coordinate the work of the resulting projects. USAID/COMFISH will continue to implement its project as approved after leveraging these ideas about skills and training which lie outside its TOR but which must be addressed by other projects if its TOR is to be fully implemented.

Annex 1: Mini Hatchery Installations Developed by IGAFA, Spain

(Instituto Galego de Formación en Acuicultura, Galician Government, Spain)