OVERVIEW AND ANALYSIS OF SOCIO-ECONOMIC AND FISHERIES INFORMATION TO PROMOTE THE MANAGEMENT OF ARTISANAL FISHERIES IN THE BCLME REGION - ANGOLA

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FINAL REPORT & RECOMMENDATIONS (ANGOLA)

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EXECUTIVE SUMMARY

This report is part of a suite of reports that describe the fishing activities and socio-economic conditions pertaining to artisanal and informal fishing sectors along the coastal component of the Benguela Large Marine Ecosystem (BCLME). This report relates particularly to the Angolan artisanal fisheries sector. The Republic of Angola is the northern most of the BCLME countries and mainly the southern part of the country is directly affected by the Benguela current, although high levels of productivity are maintained along the entire coastline in response to oceanographic events related to the presence of the current and its interaction with the warm Angola current. Industrial and artisanal fishing activities take place along the entire length of the 1 650 km coastline.

Angola was a Portuguese colony from the 15th century until attaining independence in 1975. Like many African countries, the indigenous people of Angola suffered significant disruptions and hardships during this colonial period. Long before independence there was an active industrial fishery along the coast, dominated by foreign vessels and foreign nationals, based mainly on the capture of small pelagic species. A large fishmeal industry supplied by purse-seine fleets was developed in the early 1950s with total catches exceeding 300 000 tons by the middle of that decade and reaching nearly 600 000 tons in 1972. There was also a very active artisanal or inshore fishing sector that provided both food and income to the local coastal population. A brief history of the early fisheries is provided. The war of independence and the subsequent civil war resulted in the collapse of the industrial fisheries sector in Angola and large scale shifts in the population to the coastal regions. Much of the existing infrastructure was destroyed in the wars. A large proportion of the population still has no access to water, basic sanitation, medical care and education, and all forms of communication networks are in poor condition. Offshore industrial fisheries were gradually re-established after independence and the cessation of civil hostilities. Pressure on nearshore fish resources has steadily increased because there are very few alternative livelihood options. In the 1980s, foreign aid from Norway instituted fisheries surveys designed to improve the management of both the industrial and artisanal fisheries sectors. The results of these surveys are briefly described.

Along the coast there are currently 102 organised artisanal fishing communities, the greatest number being found in the northern provinces of the country. In these communities men generally go to sea and catch the fish and women perform most of the activities related to the processing,

and sale of the fish. Between 130 000 and 140 000 people are engaged in artisanal fishing and related activities.

Total exploitable biomass of the fish resources of the Angolan coastal zone continues to be determined by annual surveys that evaluate separately small pelagics, large pelagics, demersal stocks and a basket of other species. These surveys have indicated an exploitable biomass of around 700 000 tons, but a cautious management approach by the Fisheries Ministry has reduced this to 560 000 tons. Recent, more detailed biomass estimates indicate that between 1996 and 2003 there has been a decline in the estimated biomass of all fish groups except *Sardinella* and a decline in the estimates of total fish biomass. This downward trend in biomass indicates that catches may be unsustainable.

The main goal of the fishing policy in Angola is to maximise the benefit to the Angolan population of the long term sustainable exploitation of marine resources in the Economic Exclusive Zone (EEZ). This policy includes both industrial deepwater fisheries and artisanal shallow water fishing activities. Artisanal fishing activities are defined as those fishing activities carried out within four nautical miles of the shore by boats up to 14 metres in length with little capacity for processing or freezing the catch. Fishing takes place from canoes, chatas (planked boats) which may or may not have an engine, and catrongas (whale boat types) which have an inboard engine. Artisanal fishing methods typically include hand lines, beach seine, gillnets of various types and poling for tuna. The most serious constraints on artisanal fishing are mainly a result of the following factors: the absence of cleaning, storage and processing facilities at landing sites; the lack of infrastructure that would allow access to wider markets; and the limited financial capacity of the fishers. The Institute for the Development of Artisanal Fisheries (IPA) has been established and support structures have been created by government to optimise this sector.

Every year the Fisheries Research Institute, through data from scientific cruises and with external statistical support, assesses the biomass of the main commercial species and proposes TACs to the Fisheries Minister along with any other appropriate industrial fisheries conservation measures. A proportion of the total TAC (150 000 tons per year) is allocated to the artisanal sector. Three factors directly regulate the activities of artisanal fishers: (1) the length of boat used, (2) the distance from shore where fishing activities can take place, and (3) a mesh size limitation for gill nets although this is seldom enforced. Although artisanal fishing boats require an annual permit, the fishery is open access with few other limitations relating to gear, catch, timing or area. Artisanal fisheries management focuses mainly on the implementation of a monitoring and data capture programme that indicates the extent of the total artisanal catch and fishing effort along the Angolan coast.

Since 1996, the artisanal fishery sector has been monitored by a sampling programme based at a number of the fishing communities along the coast. Currently 55 fish landing beaches are monitored. Data collected by monitors include total catch by the vessels on each beach, species specific catches, and effort data (time, number and type of boats at sea). These data are entered into a fisheries database (ArtFish) designed by FAO fisheries scientists, and which allows a fairly sophisticated level of data analysis. However, although some analyses are undertaken annually, there appears to be a lack of understanding of relevant analyses that would allow more effective use of the data and system.

One of the key aspects of this study was to undertake detailed quantitative analysis of fisheries data collected since 1996. However, a number of difficulties were encountered in acquiring data from the sampling program. A substantial proportion of the data from the sampling program between 1995 and 2005 is either irretrievably lost or misplaced but is still potentially available in original form. Ultimately, the analysis was based on a good data set for the period 2002-2005. It was found that the ArtFish database system used to store the data was not well suited to the general statistical investigations contemplated, and as a result a data extraction tool was developed in Excel and Visual Basic to transfer the data into the SPSS statistical platform. ArtFish appears well suited to providing estimates of total catches based on sample data. This is an important function that needs to be carried out by IPA, and its value should not be diminshed in any way.

A series of statistical analyses were carried out aimed at removing systematic effects from the annual nominal mean CPUE such that an index best reflecting resource biomass trends could be calculated. This involved the dual application of binary logistic and GLM techniques. These statistical analyses were limited to an attempt to standardize the data in order to detect residual information relevant to trends in population abundance for the 10 species that make up about 70% of the annual catch. A number of technical obstacles, such as a high proportion of records reflecting a zero catch for particular species, were dealt with using standard approaches. The final results appear to be quite optimistic – only one species seems to show a clear decline over the period considered. Furthermore, 7 out of 10 species show a strong upturn in CPUE for 2005. This upturn is based on 2005 data up to July and so it seems likely to be a good omen for the balance of 2005. **However, it must be noted that the window of time 2002-2005 is very short and**

hence any trends observed could be the result of favourable interannual trends in resource availability and may not necessarily reflect trends in resource abundance. **The work reported here should be treated with some caution, given its somewhat preliminary nature. A large amount of additional work would be required to gain confidence in the trends presented.** In particular, the acquisition of additional earlier data would significantly strengthen any statement of trends. Also, a number of diagnostic checks and modifications to the standardized results presented here fall outside the scope of this study but should be contemplated for future studies.

Although surveys that focus on socio-economic information have been conducted on a biannual basis since 1996, in general terms, there is a paucity of documented information relevant to the socio-economic characteristics and conditions of the artisanal fisheries sector, and it appears that this information has not been systematically captured, analysed and documented. This is partly due to lack of human resource capacity as well as a lack of customised software to analyse these data. Information on the total number of boats of different types and the number of fishers in the artisanal fishing communities along the coast has been recorded. Some provinces have shown a steady increase in the number of fishers and boats with time, while numbers have declined in some of the other provinces. However, there is probably some effort creep even in provinces where numbers are declining, because more boats are acquiring engines and there is better access to nets and repair materials. Average daily catches for canoes are approximately 60 kg of fish per day, 100-200 kg per day for chatas and about 500 kg per day for catrongas. For a number of reasons it is difficult to evaluate the standard effort capability associated with the various boats.

Fishing operations differ considerably from north to south. In the southern and central provinces a variety of techniques are used and handlines provide a significant proportion of the catch. In the north, gillnets are the principal fishing gear. Beach seines are used extensively in the area between Luanda and Namibe. Fishing is conducted every day if the sea is calm. Because of the warm weather, fish spoil very rapidly after capture. Few boats carry ice to preserve fish, and much of the fish is salted either at sea or on shore. Most of the fish caught is consumed in the country. Catches include a wide array of species, ranging from small pelagic shoaling fish to demersal and reef fish, sharks, invertebrates and large pelagic predators. More fish are caught in the southern provinces than in the north. Catches are highly seasonal, with better catches in winter than in summer.

Artisanal fishers claim that large sophisticated industrial vessels targeting shrimp and demersal species do not respect the inshore coastal zone limits (4nm) imposed by their permits. These vessels impact on both artisanal fishing activities and resources by operating in the inshore region. These large vessels pose a physical danger to small artisanal boats in the inshore region and frequently damage artisanal sector nets. There is little infrastructure in Angola to manage licensing agreements, particularly with respect to monitoring and surveillance. Government should thus seek to upgrade its offshore enforcement capabilities as rapidly as possible. Furthermore there is a need to improve government's capacity to respond to complaints from the artisanal fishers linked to illegal fishing in the restricted area.

Based on the review and analysis of available socio-economic and fisheries data relevant to the management of the artisanal fisheries sector, a number of conclusions and recommendations are made. The most significant of these are highlighted below.

Artisanal fisheries in Angola constitute a critical sector that underpins the livelihoods and contributes to food security for a significant proportion of the coastal population. It is thus imperative that these resources be managed on a sustainable basis. To achieve this, good management systems and capacitated management staff are fundamental requirements. Appropriate governance arrangements that involve the fishers in management activities and decision-making are also critical conditions to ensure the long-term sustainable use and management of the resource.

There is a paucity of documented information relevant to the socio-economic characteristics and conditions of the artisanal fisheries sector. There is considerable value in capturing and analysing the existing data from the socio-economic census surveys that have been conducted since 1996. However, before such a study is contemplated it is essential to undertake a feasibility study to ascertain whether historic data is usable. Furthermore, appropriate software to analyse the survey data needs to be sourced.

The facilities and infrastructure needed to support a progressive artisanal coastal fisheries sector are either completely inadequate or in a severely degraded state as a result of the protracted civil war. Government needs to continue to prioritise the functioning of integrated fishing centres that support artisanal fisheries and at same time to repair critical infrastructure. There is an urgent requirement for investment in the fisheries sector in general, and sourcing investors and capital should be prioritized. However, management authorities need to be mindful of the fact that improved infrastructure will almost certainly result in increased pressure on fisheries resources. Therefore initiatives to improve infrastructure need to be aligned with greater regulatory measures. Awareness raising and educational programmes to inform fishers of the need for management measures is required to ensure both understanding and buy-in of the regulatory environment.

The current management approach of setting a 150 000 ton limit for the artisanal sector is management at a coarse level and may be insufficient to prevent over-exploitation of a number of the stocks that are important components of the artisanal fishery. Field information from fishers indicates that fishing pressure from various sources is already negatively impacting artisanal fish resources. From a fisheries perspective informed by the current South African situation, the following are recommended:

- Instituting fishery controls on the capture of largely resident reef fish and possibly other species of line fish is an urgent requirement;
- The widespread use of gillnets is cause for concern. Because of their unselective nature and their effectiveness as fish capture devices, gill nets are likely to have a rapid negative impact on fish stocks;
- A detailed examination of the data pertaining to catch species composition with time on an area specific basis should be undertaken;
- A detailed examination of the data pertaining to changes in area specific fishing gear types with time should be undertaken;
- Undertake research in order to collect species-specific biological data for vulnerable species, so that appropriate models may be developed to ensure sustainable resource use. Length frequencies, growth rates, age-length keys, breeding cycles and size at maturity are some of the essential data requirements;
- Management authorities should seriously consider revising the artisanal sector management strategy so that the fishery is managed with input controls around space and time rather than output controls such as total catch.

In principle the sampling program developed by FAO for the artisanal fisheries sector in Angola is highly sophisticated and has the potential to provide valuable information to inform fisheries management. However, there are some concerns regarding the implementation of the sampling programme and an evaluation of the survey design may lead to modifications and simplification of the program without compromising the value of the information for management decisions. It is recommended that this evaluation be a collaborative effort between relevant research scientists and managers from Angola and South Africa.

There are certain inadequacies with the current data management system. This includes capture, storage, management and analysis. There is great value in attempting to recreate the historical data set represented by the information collected by the artisanal fisheries monitoring programme, in order to study long-term trends across a whole range of variables in the artisanal fishery. However, any such attempt should be subject to a feasibility study to ascertain whether it is possible to recreate these data sets for the years 1996 to 2001.

There is a lack of adequate hardware and software capability within IPA to manage a sophisticated data set such as that derived from the artisanal sampling programme. There should be an evaluation of the IT resources, requirements and capability within IPA to conduct analyses that are currently required in terms of both the Artfish programme as well as the more advanced statistical analyses proposed, such as GLMs that remove biases from datasets. It is recommended that IPA staff involved in data entry and analysis participate in specially designed short course training programs aimed at understanding broad fisheries management principles and analyses relevant to the artisanal fishing sector. Ideally these training courses should be linked to real time data and situations, and any follow-up projects that result from this initial study.

Although there are limited transboundary implications with respect to fish stocks important to the artisanal sector, Angolan, Namibian and South African fisheries scientists should pool their expertise, particularly with regard to the management of species such as sparids, sharks and many reef fish, which may have complex life histories and are easily over-exploited. Many demersal and reef fish species similar to those occurring in Angola have been exploited by the South African line fishery to levels at which their reproductive capabilities are seriously compromised. Angolan authorities in particular would do well to learn from the lessons of their South African counterparts. It is recommended that regular demersal and line fish working groups that incorporate fisheries management staff from all three countries be implemented as soon as possible.

The management of the industrial fisheries sector is inextricably linked to the management of the artisanal sectors, since many of the resources targeted are shared between the two sectors. Fisheries management in general would benefit from a more integrated approach that saw the resources as single stocks with multiple users. It would also be of benefit to evaluate which species are key species in terms of both the industrial and artisanal economies, and which species would provide the best indicators of ecosystem health.

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ABBREVIATIONS

BCLME – Benguela Current Large Marine Ecosystem (Programme)

CPUE – Catch Per Unit Effort

DRC – Democratic Republic of Congo

EEU – Environmental Evaluation Unit

EEZ – Exclusive Economic Zone

EU – European Union

FADEPA - Fundo de Apoio ao Desenvolvimento da Indústria Pesqueira

FAO – (United Nations) Food and Agriculture Organisation

FNLA - Front for the Liberation of Angola

GEI – Group of Economic Interest

GLM – Generalised Linear Model

IMF – International Monetary Fund

IPA - Instituto de Desenvolvimento da Pesca Artesanal (Angola)

MPLA - Movimento Popular de Libertaĉao de Angola

MSC – Monitoring, Surveillance and Control

OLRAC – Ocean Land Resources Assessment Consultants

SADC – Southern African Development Community

SADCC - Southern African Development Co-ordination Conference

SIDA – Swedish International Development Agency

TAC – Total Allowable Catch

UCT – University of Cape Town

UNDP – United Nations Development Programme

UNICEF - United Nations Children's fund

UNITA - União Nacional para a Independência Total de Angola

VMS – Vessel monitoring system

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1. INTRODUCTION

Angola, located on the West Coast of Africa, is a large country with a land area of 1 246 700 square kilometres and a coastline of 1650km in length. The country is richly endowed with natural resources, including a variety of mineral deposits in particular oil and diamonds, fertile soils and a highly productive marine ecosystem. Although the fishing industry produces only 3% of Angola's GDP and employs approximately 4% of its labour force, it produces an important share of the staple foodstuffs of the country. Furthermore, it contributes to the livelihoods and food security needs of several thousand coastal dwellers.

Angola's socio-political history, in particular the anti-colonial war which erupted in 1961 ending in 1975, and followed by the 27 years of civil war, ravaged Angola, its infrastructure, agriculture and human capital. In the chaotic political and economic conditions that followed independence in 1975, most of the European population fled, abandoning productive infrastructure, withdrawing their fishing fleets, as well as skilled labour that dominated the fishing industry and much needed technical expertise.

As a result of this human exodus, investment and expertise, the Angolan fishing fleet and the entire fisheries industry in general, declined very rapidly. Foreign nations, in particular the Soviet Union and some European countries were quick to fill the vacuum left by the Portuguese since they were experiencing increasing difficulty in accessing sufficiently rich fisheries resources elsewhere in the world. The decade of the 1980s was thus marked by a complete inversion of trends, with the landings by great foreign industrial fleets constantly increasing, in contrast with the rapid fall of national production. Following the changes in economic policy in the mid-1980's, the government began rehabilitating the fishing industry. With the departure of the foreign fleets at the beginning of the 1990s, efforts were made to stimulate the fishing sector, by attracting private investment orientated towards the recovery of industrial production units, by supporting the formation of partnerships, and by creating favourable conditions for the strengthening of artisanal fisheries.

Artisanal fishing has a long tradition in Angola, both along the coast as well as in the inland water bodies of the country. Its fundamental significance resides in its contribution in terms of job creation, livelihoods and food security of the population. The fish capture by the artisanal fisheries sector represents about 20% of the total weight of fish captured in 2001 and about 39% in 2003, and it is estimated that its annual contribution towards the national economy is about USD 70 million. Following the post-war period, the government has increasingly recognised the value of this sector, and has shown significant interest in supporting the development of the artisanal fishing sector.

Until 1995, there was no data on the artisanal fishing sub-sector, although an assessment of this sector was carried out in 1991, financed by the Swedish International Development Agency (SIDA). However, the information obtained was inconsistent and unreliable largely due to the security issues associated with accessing fishing communities at the time. Consequently, the Instituto de Desenvolvimento da Pesca Artesanal (IPA – Institute for the Development of Artisanal Fisheries), with the support of France, initiated a survey with the aim of obtaining information on the sub-sector relating to fishers, boats, fishing methods and landing sites of the catches. In 1996, following the results obtained from the survey and with assistance from FAO, a database, 'ArtFish', was installed, with responsibility being assumed by the Ministry of Fisheries, via the IPA. During the period 1996-1999, out of a total of 102 beaches identified as supporting artisanal fishing communities, 28 were selected where samplers were placed to collect data on fish captures and effort. In 2000, another 27 beaches were included in the sampler program, thus increasing the number of fishing communities with samplers to 55.

The new fisheries law in Angola "Lei dos Recursos Biológicos Aquáticos" (Law of Aquatic Biological Resources) promulgated in 2004 defines artisanal fishing activities as those fishing activities carried out within four nautical miles (nm) of the shore by boats up to 14 metres in length (including boats propelled by oars, sails, outboard or inboard engines), with little capacity for processing or freezing the catch. Industrial fishing vessels may not fish inside the 4 nm limit. Artisanal fishing methods typically include hand lines, beach seine, longlines and gillnets and more recently lift nets.

This report focuses on fisheries information pertaining to the artisanal fishing sector (i.e. those fisheries operating within 4 nm of the shore), as well as on socio-economic information related to artisanal fishers and fishing communities along the Angolan coast. The fundamental objective of the report is to provide an overview of available information that is relevant to the future management of this sector, to evaluate the adequacy and usefulness of the information collected, and to assess the type of analyses that might be undertaken in order to improve management and ensure the sustainable use of the marine resource base. Fisheries information has mainly been obtained from the IPA database but secondary sources have also been used. It should also be noted that many of the fish stocks targeted by artisanal fishers are also targeted by the semi-industrial and industrial fleets operating along the Angolan coastline. It is unlikely that effective management measures can be proposed or instituted for the artisanal sector without taking into account the impacts the industrial and semi-industrial sectors have on the resources.

2. GENERAL HISTORICAL OVERVIEW

Like many African countries, the indigenous people of Angola experienced significant disruptions and dislocations to their societies over an extended period of time. These included a lengthy colonial period from 1575 until 1975, which led to political and economic growth to Portugal and its settlers, but imposed significant negative impacts on the indigenous people of Angola and the environment. Early colonial relations in Angola were based mainly on the lucrative slave trade. Historical records suggest that between 1600 and 1858, some 4 million people are estimated to have been extracted and transported from the colony to be slave workers elsewhere.

In 1884, in response to conditions set by the Berlin Conference of European Colonial powers, the territorial boundaries of Angola were defined and the Portuguese authorities set in motion a process to ensure effective occupation of the colony. New economic activities, including the start of a diamond mining industry, rubber extraction and an early fishing industry mainly for subsistence and dried fish trade, were introduced. The development of infrastructure, including roads, the building of the Benguela Railway, and the establishment of various towns were part of Portugal's attempts to develop a self-supporting economy that could be integrated into the Portuguese economy.

Following World War II, commercial production of coffee and other agricultural crops was vigorously produced. A significant marine fishing industry developed from the early 1950's and exploitation of marine resources was encouraged for export. By the mid 1950's Portuguese colonial political control was firmly entrenched in the country leading to progressive erosion of traditional indigenous socio-political institutions.

As the Portuguese repression intensified, and with the wave of political independence spreading across Africa from the mid-1950's, nationalist resistance in Angola resulted in revolution from 1961. Portugal's response to the uprisings was to intensify Portuguese Settlement in Angola. Angola's liberation movement comprised three main guerrilla groups. The Marxist-influenced Movimento Popular de Libertaĉao de Angola (MPLA), the Front for the Liberation of Angola (FNLA) and the União Nacional para a Independência Total de Angola (UNITA). Although representing different constituencies and embracing different political ideologies, each of the three ethno-nationalist movements claimed to represent the entire population of Angola. Thus despite their common interest to overthrow the Portuguese government, strong animosity developed amongst them. From 1961 onwards the war of independence waged until a military coup in Portugal in April 1974 overthrew the government. Pressure to disassemble the costly colonial empire followed. The signing of the Alvor Accord in 1974 was an attempt to establish a transitional government comprising the three principal nationalist movements – with Portuguese representation. The government of transition was formed in November 1974, and formally sworn-in in January 1975. The coalition government established in 1974 immediately experienced conflict and instability and soon collapsed. Portugal, not wishing to incur further responsibilities or costs, granted independence to “the people of Angola” in November 1975.

Despite the immense social disruptions and injustices of the colonial era, the legacy of the colonial development strategy was an economy of considerable strength. By the end of colonial rule, the agricultural sector was booming and Angola was a significant purchaser of cereals and meat. The diamond mining industry developed and by 1971 was producing 2.4 million carats and was the fourth most important producer in the world. The war of independence significantly disrupted production. From the mid 1950’s the extraction of oil became a major economic activity. Production increased from 2,5 million tons in 1969 to 8,2 million tons in 1973 and became the principal export of Angola.

Thus by the 1970’s, Angola’s economy had grown significantly and had been completely transformed. Its production base remained relatively narrow, however, and economic benefits continued to flow mainly towards the white settler community and the capital, leaving the majority of the indigenous people in a state of poverty and underdevelopment.

What followed after independence was a 20 year period of civil war, fuelled by the international interests behind the cold war. By 1976 the country was in complete chaos – it lacked a significant indigenous elite, its population was largely illiterate and lacked mature political institutions, agricultural plantations had been abandoned, few factories continued to operate, thousands of high-level managers and skilled workers had left the country, infrastructure had been destroyed, the trading network had been disrupted and administrative services were dysfunctional. Most economic production deteriorated and the government became totally dependent on the export of oil for revenues which was largely spent on defence. The war also severely disrupted the agricultural and fishing sectors, resulting in the need to import food. Disruption of rural transport infrastructure and the laying of landmine fields imposed severe constraints on land accessibility, mobility, production and marketing.

Although economic data for the 1980's is sketchy, it is apparent that a positive shift in levels of economic activity took place after 1987 following the liberalisation of the economy. At this stage, the MPLA was regarded by the majority as the legitimate government.

In March 1991, negotiations between Russia and the United States led to proposals regarding peace terms. The conflicting Angolan movements signed a peace accord at Bicessa in Portugal in November 1991 and elections followed in 1992. However, the UNITA leadership, returned to war and a state of civil and economic chaos followed. The continuing conflict resulted in famine as millions faced starvation as farmlands became inaccessible due to landmine fields. It is estimated that during these war years over three million people were internally displaced – many moving from the interior to the coast and from the rural areas to the towns and cities.

In October 1993, under the auspices of the United Nations, a negotiated settlement between the warring parties was reached in Lusaka, Zambia. The outcome was the Lusaka Protocol which came into affect in November 1994 and a government of national unity was established in April 1997. However, this agreement collapsed in 1998 and UNITA renewed war for the second time. In 1999, the Angolan military launched a massive offensive against UNITA significantly destroying its military capability. Significantly weakened, UNITA returned to a state of guerrilla warfare until February 2002 when Jonas Savimbi was killed. Various memoranda were signed and agreements reached to resolve political differences and finally in November 2002, the Lusaka Protocol was finally implemented.

3. GEOGRAPHIC AND OCEANOGRAPHIC OVERVIEW

3.1 GEOGRAPHICAL OVERVIEW

Angola, located on the west coast of Africa between latitudes 5 and 17 degrees south, is a large country with a land area of 1 246 700 square kilometres and an estimated population of 15 million people. Its coastline is approximately 1650 km in extent and the Economic Exclusive Zone (EEZ) covers an area of 330 000km^2. The natural environment of the country is richly endowed. Its geology of Precambrian, Palaeozoic, Mesozoic, Tertiary and Quaternary rock formations underpin a varied landscape and contain a range of major mineral deposits including oil and diamonds in particular. In addition, the economic geology provides significant resources of gold, iron ore, phosphates, manganese, copper, lead, granite, beryl, zinc and other base and strategic minerals.

The continental shelf in these latitudes is approximately 36 km wide except in the north where it extends to approximately 80 km in the vicinity of Cabinda. The coast is washed by two dominant, diverging ocean currents – the Angola and Benguela currents. They create a strong upwelling system that supports a high primary production of marine resources that are the basis of the Angolan fishing industry (see section 3.2).

In the west of the country the land rises in a series of steps from a narrow coastal plain averaging less than 160 km in width, to the Great Escarpment and plateau of Angola occupying much of the interior at elevations in excess of 1000 metres. Over its highest parts in the central reaches of the country the Plateau rises to over 2100 metres and it drops marginally in elevation eastwards towards Zambia and the Zambezi Basin and northwards towards the Congo Basin.

Rainfall varies across the country with relief and latitude. On the plateau, annual rainfalls range from 25inches to 60inches, higher in the north and the high central plateau decreasing southwards. The coastal regions, except for the northern extremity, are generally dry. The elevations of the plateau mean that temperatures, despite the tropical latitudes are moderate over most of the country. The coastal zone washed by the cold Benguela current is generally cool but becomes tropical in the north. The temperature and rainfall regimes taken in combination with a range of moderately fertile soils on the plateau and northern coastlands provide a potentially productive base for agriculture. The savannah lands of the central plateau, moreover, provide extensive grazing resources for cattle.

In terms of availability of natural resources, Angola is extremely well endowed by comparison to other countries in Africa.

3.2 GENERAL OCEANOGRAPHIC INFORMATION

The oceanography of the Angolan coast is dominated by the interaction of two currents, the cold Benguela Current and the warm Angola Current. The literature describes the main circulation off the Angolan coast as being dominated by the Angola Current flowing mainly southward and apparently formed by the southeast branch of the South Equatorial Current. However, it appears that the direction of the surface current over the shelf area is southward only in the (southern) summer season. During most of the autumn, winter and spring seasons a surface current flows northward along the coast causing inshore upwelling in various locations. The upwelling process which starts in May-June has its maximum in August-September and more or less ceases towards the end of the year. The upwelling results in intensified primary production of high significance for fish production and distribution. The small pelagic fish (such as sardinellas and horse mackerel) and juveniles of other species low in the food chain, are likely to be affected by these phenomena, and these fish in turn form a food source for other predatory fish.

The Benguela Current, part of the anticyclonic sub-tropical gyre of the South Atlantic and forming its eastern boundary, flows parallel to the south west African coast in a north to northwest direction. Streams of the Benguela Current proceed northward along the shore and reach 13°–14°S (Cabo de Santa Marta in southern Angola), and they form a divergence zone along 11°E from 17°S to 13°S, as a result of an interaction with the Angola Current. Strong seasonal variations are also a characteristic of the oceanography in this region (Cunene to Namibe). Variations consist in a displacement in a north-south direction of the frontal zone between water masses from the Benguela and the Angola Currents. In summer (February) the front moves south and in winter it is located further north. It should be noted that the system is characterised by both seasonal and long-term oceanographic variations that influence the behaviour of the species that sustain fisheries and whose predictability is still far from understood. There is thus a requirement for a concerted research effort from all the countries that border on this ecosystem (Namibia, South Africa and Angola).

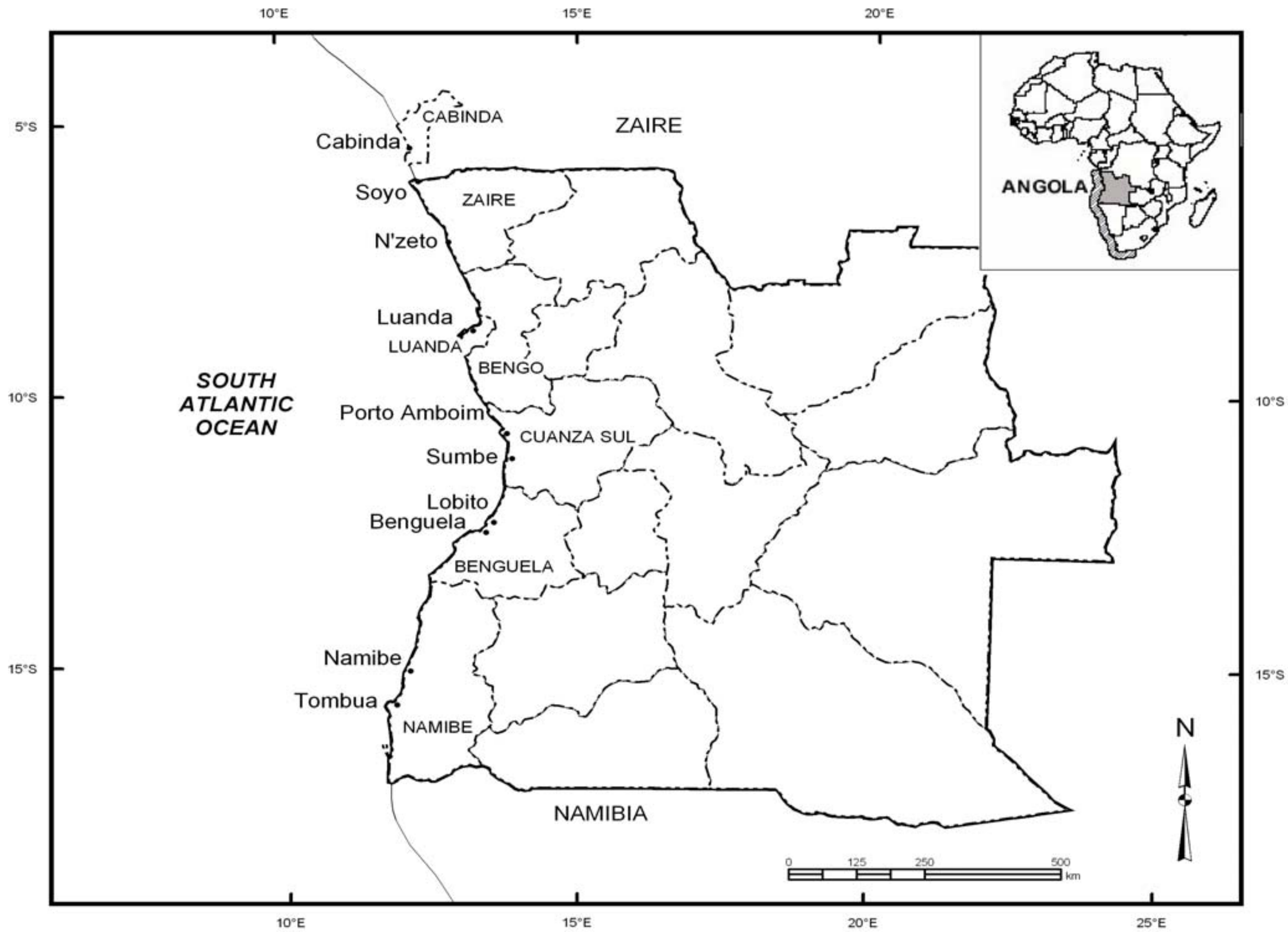


Figure 1: Map of Angola showing the location of the major cities and provinces

4. LEGAL FRAMEWORK GOVERNING THE ARTISANAL FISHING SECTOR

The present legal framework comprises the Fisheries Law from 1992 (LP) which has recently been revised, and several other decrees dealing with fisheries planning and management, fishing vessels and fishing companies, fisheries surveillance and quality control.

In recent years national authorities have not only acknowledged that existing legislation was outdated, but also that it did not reflect international and regional developments in the sector, and was sometimes incoherent and contradictory mainly due to the existence of several autonomous and unrelated laws.

In recent years, the political will of the new Fisheries Minister, together with international support, allowed for the full revision of the fisheries legislation. In 2003, a "new law" was drafted "*Lei dos Recursos Biológicos Aquáticos*" (Law of Aquatic Biological Resources) that established new principles and provisions regarding the sustainable management of aquatic resources. This new legal regime reflects international and regional developments in the sector including the need to integrate the management of marine resources with other national policies. This "new law" has just recently been approved by Parliament and will be enacted soon.

To make the new legal regime enforceable certain issues require further regulations to be promulgated, namely with regard to surveillance, research, recreational fisheries and licencing. New regulations covering these areas, as well as a general fisheries regulation, have been drafted. Once the "new law" is enacted the package containing the regulations will also be submitted for approval within this new legal framework.

The Angolan legislation differentiates artisanal fisheries from subsistence fisheries based on the objective of the fishing activity: for direct consumption by the fisher's family or for commercial purposes. The legislation distinguishes commercial from non-commercial fisheries, and establishes the following types of non-commercial fisheries in accordance with their purpose: subsistence, research, and recreational (Art. 4º).

Regarding commercial fisheries, it establishes that the distinguishing criteria between artisanal and industrial fisheries will be fixed by regulation taking into account the characteristics of the fishing vessel, catching capacity and autonomy as well as other social, economic and technical criteria (Art. 5º). The following main types of fisheries are defined:

- Subsistence fishery;
- Artisanal fishery using vessels of up to 10 meters in length (which are extended to 14 m in the new Law);
- Semi-industrial fishery using vessels of between 11 and 25 meters in length; and
- Industrial fishery using vessels of over 25 meters in length.

The "new law" defines artisanal fisheries, subsistence fisheries, industrial fisheries and semi-industrial fisheries. The characteristics of these different fisheries are described in Table 1 below.

Table 1: Types of Fisheries and Characteristics

Type of fishery	Size of vessel	Propulsion System	Fishing Gears	On-board refrigeration	Purpose
Subsistence (Art. 1/ 57)					Family consumption (occasionally sell surplus)
Artisanal (Art. 1/55)	≤ 14 m	Sail, paddles, onboard and outboard engines	Hand lines, gillnets and entangling nets	Rarely ice on board	Commercial
Semi-industrial (Art. 1/60)	≤ 20 m	Inboard engine	Hand lines, drifting longlines, nets, trawling, seine nets	Ice on board	Commercial
Industrial (Art. 1/58)	> 20 m	Engine	Mechanical	Ice and other processing methods on board	Capture specific species with high commercial value

The "new law" defines sustainable fisheries as "all fishing activities that may be undertaken in the long term at an acceptable fishing level regarding biological and economic productivity, without having ecological impacts that may impair the needs of future generations" (Art. 1/61). It further defines recreational fisheries as a not for profit activity (for leisure or for sport competition) (Art. 1º) and defines scientific research as the activities undertaken for research purposes.

In Angola, the fisheries legislation expressly defines, and makes special provision for artisanal and subsistence fisheries. The Institute for the Development of Artisanal Fisheries (IPA) has been established and support structures have been created by the government in order to optimise this sector.

Currently, artisanal fishing rights are registered by the Ministry of Fisheries in co-ordination with IPA. Chapter III of the new law deals exclusively with fishing rights to be granted to any individual or legal person, national or foreign, who fulfils the requirements established by law. It specifically provides that artisanal fishing rights can only be granted to “Angolan persons” (Art. 32/3), which are defined under Art. 1, as:

- an Angolan citizen;
- an Angolan company; and/or
- any other legal person composed by a majority of natural or legal Angolan persons.

According to the “new law”, commercial fishing boats, which include artisanal fishers, require licenses, whereas subsistence fisheries are not subject to such authorisation (Art. 43), which is based on the understanding that it constitutes an activity mainly to provide sustenance for the family. The “new law” also distinguishes between obligations of those acquiring commercial fishing rights as apposed to those holding subsistence fishing rights. The former are required *inter alia* to comply with the existing legislation, pay the license fee, provide information required by law, and co-operate in monitoring fishing activities and resources (Art. 38).

Those holding subsistence fishing rights are required to comply with the fisheries legislation especially with regard to the fisheries zones, fishing gear type, size of catches and protected species.

With regard to the payment of fishing licenses, the “new law” establishes the principle that artisanal fishers, undertaking investments on land, can require exemption from payment for a period of up to 5 years (Art. 53) but does not specifically specify the type of investment required. The “new law” defines the reserved zone for artisanal fisheries and prescribes that the four (4) coastal nautical miles are exclusively reserved for artisanal, subsistence, investigation and recreational fisheries

5. BRIEF HISTORY OF FISHERIES IN ANGOLA

5.1 HISTORICAL OVERVIEW

Prior to independence in 1975 the industrial fishing sector was dominated by foreign vessels and foreign nationals. A large fishmeal industry supplied by purse-seine fleets was developed in the early 1950s with total catches exceeding 300 000 tons by the middle of that decade (Campos Rosado, 1974a). After a decline in fish caught in 1960, the production increased and reached nearly 600 000 tons in 1972, but then the fishery collapsed during the war of independence. The withdrawal of the Portuguese commercial fishing fleet and its skilled labour that dominated fishing activity in Angola at independence caused the fishing industry to fall into disarray. The abandonment of part of the productive infrastructure in the ports contributed to the near collapse of the lucrative industry into the 1980s. By 1986 for example only 70 of the 143 fishing boats in Namibe, the port that normally handled two-thirds of the Angolan catch, were operable. Furthermore, most of the fish-processing factories were in need of repair. Once an exporter of fish-meal, Angola by 1986 had insufficient supplies for its own market (Davies, 2005).

Filling the vacuum created by the Portuguese withdrawal were fleets from other foreign nations including in particular the Soviet Union and some European countries. The benefits of this foreign fishing were doubtful. Some of the foreign fishing fleets operating in Angolan waters were required by the government to land a portion of their catch at Angolan ports to increase the local supply of fish. Fishing agreements of this kind had been reached with the Soviet Union, which operated the largest number of boats in Angolan waters, and with Spain, Japan, and Italy. Spain also agreed to help rehabilitate the Angolan fishing industry in exchange for fishing rights. In other cases, the government allowed foreign fleets to export their entire catch in exchange for license fees. The scale of fish catches attained by the foreign fleets is not clear from available data but it is evident that serious overexploitation of resources was being practiced in the extreme conditions prevailing (Davies, 2005). Following the changes in economic policy in the mid-1980s, the government began rehabilitating the fishing industry, especially in Namibe and Benguela provinces. The first priority was to replace and repair aging equipment. To accomplish this goal, the government sought foreign assistance. In 1987 the EEC announced plans to provide funds to help rebuild the Dack Doy shipyards and two canning plants in Tombua. Spain sold Angola thirty-seven steel-hull boats for US$70 million, and fourteen modern fishing boats were on order from Italy.

Historical fisheries information for Angola is very sketchy and is largely drawn from the FAO Yearbook of Fishery Statistics, Volume 74 and the Dr Fridtjof Nansen Programme 1975-1993. Catches along the southern coast between Namibe and Cunene were generally higher than on the Lobito coast (Campos Rosado 1974a). Pilchard (*Sardinops sagax*) dominated the high landings in the south in the mid 1950s, but this species declined in the early 1960s and was replaced by horse mackerels (*Trachurus t. capensis* and *T. trecae*). Further north annual catches of sardinellas (*Sardinella aurita* and *S. maderensis*) reached about 150 000 tons (1969) and 180 000 tons of horse mackerel were caught in 1966. The existence of a high potential of small pelagic fish was further confirmed by the yield of sardinellas and horse mackerel in a licensed USSR industrial fishery in Angola from the late 1970s to the late 1980s (information from Dr Fridtjof Nansen Programme 1975-1993). Prior to 1973, annual landings of sardinella in the regions of Luanda-Cabinda and Benguela-Luanda did not exceed 160 000 tons and were apparently at a very low level from 1974 to 1976 when fishing was resumed by licensed USSR factory expeditions. Total landings exceeded 200 000 tons in the late 1970s and in the mid 1980s, but then, at least partly as a result of management measures, declined to about 100 000 tons by the end of the 1980s.

Landings from the deep-sea shrimp fishery by Spanish trawlers increased from about 1 200 tons in 1967 to about 8 100 tons in 1972 and was reported as a mixture of three species: deep-sea rose, striped red and scarlet shrimp caught between a depth of 200 and 800 m. A licensed fishery was resumed in 1985 with catches of about 9 000 tons a year until 1988 when, partly following management restrictions, they declined to about 5 500 tons with a further decline to about 4 000 tons in 1992. Of this, roughly one-third was reported as striped red shrimp, the rest being rose shrimp (FAO Yearbook of Fishery Stat. Vol. 74; (Information from Dr Fridtjof Nansen Programme 1975-1993).

Angola also has a long tradition of artisanal fishing along the coast, mostly using traditional canoes made of tree trunks. Before independence shipowners, including those in artisanal fisheries, were mostly whites. In terms of the law there were no prohibitions on access to marine fishing resources on the basis of ‘race’. But due to the high levels of poverty amongst the local black population, ownership of boats was almost exclusively by whites. Angolans who lived in coastal fishing communities participated as crew members or workers, and received a survival wage. Although a system of co-operatives was in place, these were represented by the ship owners, and Angolan nationals were not members, nor did they receive any benefits from these organisations. This situation has changed significantly over the past 20 years and the vast majority of artisanal fishers are Angolan nationals. The result of 40 years of conflict in Angola has been large-scale population movements, with people mainly moving from the interior to coastal towns and cities (see section 6). Although there is very limited data on these population movements, the increase in population figures for the main coastal towns of Luanda, Lobito, and Benguela (Development Workshop, 2002) suggest that pressure on marine resources has increased significantly over this period.

5.2 SUMMARY OF SURVEY RESULTS 1985-1992 (INFORMATION FROM DR FRIDTJOF NANSEN PROGRAMME 1975-1993)

Between 1985 and 1993 the research ship Dr Fridtjof Nansen undertook a number of surveys of the fisheries resources of Angola. The surveys focussed on the distribution, composition and abundance of the stocks of small pelagic schooling fish. The original purpose of the surveys was to investigate the stocks of demersal fish on the northern shelf by bottom trawling using the swept-area method and evaluate the deep-sea shrimp and hake resources on the slope north of Luanda. In later surveys the swept-area programme for the assessment of demersal fish was extended to cover the regions Benguela-Luanda and Cunene-Tombua. More detailed objectives included the collection of data on size, sex and maturity of the main species for biological studies, collection of taxonomic material for the preparation of a national species guide and observations on the bottom substrate type from echograms. In 1989 a new survey programme was implemented with largely the same objectives as that of the 1985/86 surveys, but with the additional objective of obtaining assessments of pelagic sardinellas and horse mackerel resources. All surveys covered the shelf area from a depth of about 20 m along the shore out to the shelf edge at about 200 m depth. The slope down to 500 m depth was also covered extensively. For purposes of the survey the coast was divided into three main regions: Cunene River to Benguela, Benguela to Luanda and Luanda to Cabinda.

Earlier surveys to gather information on biomass estimates were largely to inform the management of the industrial sector. There was no dedicated survey programme for the artisanal sector prior to 1996, although the Nansen Programme survey results had relevance for the management of the artisanal fishing sector.

5.2.1 Small pelagics

Pilchard was always located inshore on the extreme southern part of the Angolan shelf. Biomass estimates from the surveys ranged between 0 and 210 000 tons with an average of about 50 000 tons. This average is not very meaningful since there is a seasonal migration pattern with the highest abundance in Angola in late winter-spring when the Benguela/Angola front is in its northernmost position.

Round sardinella (*Sardinella aurita*) and flat sardinella (*S. maderensis*) occur along the whole coast from Cunene to Cabinda. Mean biomass for all surveys were: Cunene-Benguela - 22 000 tons; Benguela-Luanda – 138 000 tons; Luanda-Cabinda – 123 000 tons.

Southern Angola forms the northern border for the Cape horse mackerel (*Trachurus t. capensis*) and also the approximate southern border of the Cunene horse mackerel (*Trachurus trecae*). Like the pilchard, the distribution of Cape horse mackerel in Angola is restricted to the Cunene region, while the Cunene horse mackerel is found over the entire Angolan shelf. The two species are mixed on the fishing grounds in the Cunene-Benguela area and may occur together in the catches. This has caused problems for the identification to species level of the commercial horse mackerel catches in this border region. Mean Cunene horse mackerel biomass for all surveys was: Cunene-Benguela - 84 000 tons; Benguela-Luanda – 95 000 tons; Luanda Cabinda – 41 000 tons. The main biomass is located in the southern regions.

Other carangids (included in this group are bumper (*Chloroscombrus chrysurus*), lookdown fish (*Selene dorsalis*) and false scad, hairtail (*Trichiurus lepturus*) and barracudas (*Sphyraena guachancho* and *S. sphyraena*) were mainly distributed north of Benguela. Hairtail occurred in abundance over a wide depth range. Bumper and lookdown fish were present in catches in shallow water while small catches of barracudas are frequently made. Scombridae were rare with bonito (*Sarda sarda*) and Spanish mackerel (*Scomberomorus trito*) occurring more often than chub mackerel (*Scomber japonicus*) and little tunny (*Euthynnus alleteratus*). Biomass estimates were in the region of 30 000–40 000 tons.

5.2.2 Demersal resources

The most abundant demersal fish of commercial interest on the Angolan shelf included seabreams, grunts, croakers, groupers and Benguela hake (*M. polli*). Biomass estimates for these conventional commercial demersal species (excluding big-eye grunt and Benguela hake) ranged from 65 000–122 000 tons. Other important demersal resources were big-eye grunt with an estimated biomass of 100 000 tons, hairtail with a biomass of 50 000 tons and Benguela hake with a biomass of about 30 000 tons. The total biomass of the demersal fishery resources was of the order of 300 000 tons.

With regards to species distribution, the area between Cunene and Benguela seems to represent a transition zone between the tropical regime in the north and the sub-tropical/temperate regime found further south. Other species in the southern shelf region were: the large-eye dentex (*Dentex macrophthalmus*), the African weakfish or geelbek (*Atractoscion aequidens*), the Cape hake (*Merluccius capensis*) and the Benguela hake. Less abundant, but common are the wedge sole (*Dicologoglossa cuneata*), the John Dory (*Zeus faber*) and the Red Pandora (*Pagellus bellottii*). Between Benguela and Luanda the main species were grunts (Sompat grunt or Atlantic spotted grunter -*Pomadasys jubelini* and Bastard grunt - *P. incisus*), seabreams (Sparidae) and largehead hairtail (*Trichiurus lepturus*). Of the grunts, the big-eye grunt (*Brachydeuterus auritus*) was the dominant species and this is by far the most abundant of the demersal fish on the Angolan shelf. Three *Pomadasys* species were less common. The seabreams were mainly represented by the Red Pandora, but various *Dentex* species were also common. Between Luanda and Cabinda the main species in the bottom trawl catches were big-eye grunt, hairtail, Red Pandora, seabreams (*Dentex* spp. and *Sparus* spp.), other grunts (*Pomadasys* spp.), croakers (*Pseudotolithus* spp., *Miracorvina angolensis, Umbrina* spp.) and groupers (*Epinephelus* spp.).

Seabream biomass was higher in the Cunene-Tombua area than in the northern regions, which demonstrates the high productivity of demersal fish as well as pelagics in this region of intensive upwelling. In this area the seabreams consisted mainly of the large-eye dentex, with some Red Pandora in shallow waters. From Benguela northwards, the seabream species composition is much more diversified. Between Benguela and Luanda trawl catches consisted of 50% Red Pandora (*Pagellus bellottii*), 15% large-eye dentex (*Dentex macrophthalmus*), 15% Angola dentex (*D.angolensis*) and 7% Barnard dentex (*D. barnardi*). In the area between Luanda and Cabinda species composition was *Pagellus bellottii* 30%, *Dentex angolensis* 18%, *Dentex congoensis* 12%, *Dentex canariensis*, 10%, *Dentex gibbosus* 7%, *Dentex barnardi* 3%, *Dentex macrophthalmus* 2%, *Sparus caeruleosticus* 7%, *Boops boops* 4%. Seabream biomass estimates ranged between 35 000 tons and 84 000 tons for the years between 1986 and 1992.

In the southern region croakers are represented mainly by the African weakfish found down to 200 m depth but in the northern regions, particularly north of Luanda, a number of species of the genus *Pseudotolithus* are especially important. Longneck croaker (*Pseudotolithus typus*), cassava croaker (*P. senegalensis*), bobo croaker (*P. elongatus*), Angola croaker (*Miracorvina angolensis*) and Canary drum (*Umbrina canariensis*), were common north of Luanda, especially in the shallow waters. Total biomass estimates ranged between 9 000 tons and 36 000 tons in the Luanda-Cabinda region.

Groupers are commercially valuable fish, but restricted to the northern part of the shelf and are less abundant than other groups of fish. Total biomass was estimated at only 2 000 to 3 000 tons but this may be an underestimate as groupers prefer a rocky, untrawlable bottom. Groupers were mainly represented by the white grouper (*Epinephelus aeneus*) and the dusky grouper (*E. guaza*).

Benguela hake occurs in mixed populations with Cape hake found from the Cunene River to Tombua and are the only hake species found on the slope further north from Benguela to Cabinda. Total biomass estimates ranged between 22 000 tons and 42 000 tons between 1986 and 1992. Benguela hake is caught as a by-catch in the deep-water shrimp fishery and it is likely that part of an observed decline in the biomass has been caused by the increasing effort in the shrimp fishery.

Fishing activity currently occurs along the whole of the Angolan coastal strip. During the three and a half decades since independence, fisheries have played a significant political role. This has been not so much because of the potential exceptional wealth of the marine resources in the ocean bordering the extensive coastal line, but because the prolonged and hard war devastated the Angolan territory and destroyed a great part of its industrial and agricultural production capacity. Thus, there were few alternatives available for Angolans to feed themselves or engage in any other economic activities. According to estimates made in the mid 1980s, fish captures exceeded 500 000 tons, with foreign fleets accounting for more than 400 000 tons of this and national production barely reaching 85 000 tons. However, since political stability returned to the country, the situation has been reversed as a result of a policy orientated towards the re-establishment of the Angolan national fishing fleet and the development of the artisanal fishing sector.

6. BRIEF SOCIO-ECONOMIC CONTEXT OF ANGOLA

In the three years since the end of the civil war, the major objective of the country has been to consolidate the peace and regain economic and social stability as it turns to development and reconstruction after 27 years of destructive hostilities. The government's economic strategy, apart from continuing to promote the interests of extractive industries (particularly oil and diamonds), has been focused on promoting growth in non-petroleum sectors. These include agriculture, livestock and fishing, transportation (road, port and railroad), energy (generation, transmission and distribution), water supply and sanitation, housing and public services (schools and health clinics). Economic indicators show that in the new environment economic growth has been significant across most sectors though it has varied in extent from sector to sector. Progress, though slow and partial, has been achieved in stabilising government relations expanding production and in improving social welfare.

Gross Domestic Product has increased annually (if variably) from 2000 when it stood at US$ 9 billion, to reach a level of US$ 17 billion in 2004 (UNDP, 2005). Inflation has been drastically reduced though at 30% it remains high in relative terms.

Though spread over many sectors the economy remains tightly focussed. The oil industry, retaining linkages between private oil companies and the state through the agency of Sonangol (the national oil company), remains the most significant sector. With rising prices it is growing rapidly. The industry now produces over 1 million barrels per day, second only to Nigeria in Africa. It accounts for 51.7% of GNP, 90% of exports, and 90% of government revenues. Oil production remains largely offshore and has few linkages with other sectors of the economy (Davies, 2005).

Diamonds make up most of Angola's remaining exports. A recent IMF study (IMF, 2005) indicates that Angola is ranked fourth largest producer of rough diamonds in the world. However, there is concern over the low contribution of the diamond sector to State revenue, although figures suggest this contribution is increasing from 45 million USD in 2001 and 2002 to 112 million USD in 2003. In the post civil war process of reconstruction, the government is grappling with finding a balance between the interests of the large foreign operators, the small artisanal diggers and those of the state, and at the same time increase tax collection and improve reporting systems (UNDP, 2005). Table 2 provides an overview of selected economic indicators for the period 2000-2005.

Table 2: Angola: Selected Economic Indicators 2000 to 2005

Indicator	**2000**	**2001**	**2002**	**2003**	**2004**	**2005a**
Population millions					13.9	
GDP US$ Billions	8.9	9.5	11.2	12.1	17.3	24.4
GDP per capita US$	715	743	858	901	1251	1711
Real GDP Growth percentage year on year	3.3	3.2	15.3	3.0	11.7	11.6
Inflation percentage year on year	325.5	141.2	118.7	98.2	43.5	30.0
Labour force millions	4.8	5.0	5.1	5.3	5.4	5.6

An EIU forecast. Source: Site: http://www.dfat.gov.au/geo/fs/ango.pdf

Angola is slowly re-integrating into regional and global markets and is reforming domestic policies. The country has adopted the Southern Africa Development Community (SADC) Free Trade Protocol and has enacted a new investment law that provides investment incentives, identifies targeted investment sectors, and seeks to reduce the bureaucratic process for investment (Davies, 2005). The attraction and easing of procedures for foreign investment though are not without their critics. Customs procedures are being reformed. Controversially the government remains highly centralised and is an active player in the economy through its parastatal institutions and individually as owners of private firms (Davies, 2005). Conflicts of interest exist and worry over the lack of transparency in transactions is now a major concern. The IMF (2005) estimates that approximately 15% of revenues (nearly $1 billion in 2002) cannot be adequately accounted for annually.

The IMF (2005) estimates that the economy outside the extractive sector is currently growing by about 9 percent per year. Angola's GDP has grown by 12.2% in 2004, a rate attained mainly by the contribution of oil production which grew by 14%. GDP from Non-oil sectors of the economy grew by 9 percent. GDP from the Agriculture, Forestry and Fisheries sector too grew by 9 %. This, though encouraging, was a level of growth not sufficient to meet national needs (Site: www.angola.org.uk/newsletter106.htm).

During 2003, over 3.8 million war-affected persons resettled or returned to their areas of origin. Hundreds of thousands of persons, however, remain temporarily resettled. Despite extensive landmine fields and devastated infrastructure, which continue to restrict the availability of cultivable land, seed and fertilizer and impede marketing, agricultural production (largely carried out by individual households) has recently begun to recover (IMF 2005). Data for later years have not been available. The rate of growth in agricultural GDP, however, remained relatively low (1,4%) and subsistence agriculture and dependence on humanitarian food assistance sustain the large majority of the population. According to a recent UNDP economic report (2005) farming, livestock and artisanal fishing employ two-thirds of the country's workforce, yet agriculture only accounts for 8% of GDP. Table 3 provides an indication of the contribution of the different sectors to the GDP for the years 2001-2003.

Table 3: Structure of GDP (at previous year's prices) (%)

	2001	2002	2003
Agriculture, Forestry and Fishing	8.4	8.7	8.1
Mining (crude oil, diamonds etc.)	57.9	54.4	51.2
Manufacturing	4	4.1	3.8
Electricity	0	0	0
Construction	3.7	3.8	3.5
Trade and Commerce	15.8	15.5	15
Non-Trade Services	10.1	11.6	15.9
Import Rights	0.1	2	2.5
All sectors	100	100	100

Source: 2004 OGE Ministry of Finance in UNDP, 2005

In spite of its wealth in natural resources and considerable income earned from oil production, Angola remains a poor country and the overall picture of socio-economic development levels remains dismal (Davies, 2005). Its GDP of more than 1000 US$ per person in 2004 is misleading. Table 4 provides available information on some basic socio-economic and development indicators. Although Angola's human development index has improved slightly from .377 in 2003 to .381 in 2004, (UNDP Global Human Development Report, 2004), it ranked 166 out of 177 countries on the Human Development Index. Approximately 50% of the work force is unemployed. Data from the household budget survey of 2000-01 suggest that the urban unemployment rate is 46% while approximately 30% of children between the ages of 5-14 years are currently working (MICSII, 2001 in UNDP, 2005). The key constraint to finding employment is a lack of education and marketable skills. About 70% of the population were estimated to be living below the poverty-line in 2003. Some 95% of the people are supported by less than US$1 per day. Data from the household budget survey of 2000-2001 (IDR, 2000-01 in UNDP, 2005) indicates that income inequality is rising. According to this report the Gini Coefficient has increased from 0.54 in 1995 to 0.62 in 2001[1]. Thus although some socio-economic indicators are showing signs of improvement they are generally among the worst in Africa.

During the 40 year conflict in Angola, social and development spending were neglected. At the end of the war the country faced a humanitarian and development crisis. Nearly 3 years after the war ended, the World Food Programme reported at the end of 2004 that there was still a 47% food

[1] Note 1. Gini Coefficient values above 0.3 are indicators of significant imbalances in income distribution.

security deficit, and 1.1 million people still needed emergency food supplies. Deep poverty remains widespread in Angola and the implementation of a poverty reduction strategy is one of most urgent development needs (Davies, 2005).

Table 4: Basic Socio-economic indicators

Population, million	14.7
Population Density, per Km^2	11.8
Population ≤20 years	60%
Human Develop. Index 2004	0.381
Ranking by HDI	166
Population living below the poverty line	68%
Exports in 2004, billion USD	12.2
External Debt, billion USD	7.9
State fiscal income in 2004, billion USD	7.1
GDP in 2003, billion USD	12.5
GDP growth rate in 2003	3.5%
Source: IDR 2000-01; MDG-R 2003, Human development Report, 2003; IMF; OGE in UNDP (2005)	

The ongoing conflict resulted in essential infrastructure and services such as transport and communication networks, schools and hospitals being partially or completely destroyed. Housing shortages and massive population movements exacerbated the situation in the towns and cities.

The population distribution in Angola is very different today from that of 40 years ago. However, there have been no systematic or comprehensive studies of the migration. It is known that there were large-scale population movements attributed to the 40 years of conflict, but there are little accurate data available. The last full-scale census was in 1970, and only a partial census was conducted in 1983 and 1984. The total population is estimated to be 15 million. Between 1992 and 1994 it is thought that some 3 million people were internally displaced and a further 1 to 3 million displaced between 1998 and 2000. In the 1980s rural areas were particularly insecure and people fled to small towns, inland cities and main centres along the Atlantic coast. In 2000, the population of the coastal towns Luanda, Benguela, Lobito and Lubango (considered the safest cities) was estimated to be 40 to 50 times that of 1940. Table 5 below highlights the changes in the population of the main urban centres in Angola for the period 1940 to 2000.

Table 5: Population numbers in the main cities of Angola from 1940 to 2000.

	Luanda	Huambo	Lobito	Benguela	Lubango
1940	60 000	16 000	13 000	14 000	8 521
1960	224 000	38 000	50 000	23 000	15 086
1970	480 613	61 885	59 528	40 996	31 674
1985	1 138 000	NA	338 300	219 000	104 847
1995	2 100 000	NA	600 000	355 000	NA
2000	3 276 991	300 000	NA	NA	400 000

Source:Cain et al 2002 (NA – Not Available)

The country's population is concentrated in the urban centres, particular the coastal urban centres, where people have become highly dependent on marine fisheries resources for their livelihoods.

Today many of the urban centres are lacking in socio-economic infrastructure and the fiscal shortages at central government level mean that there is minimal maintenance and new development of infrastructure and social services. Table 6 gives a summary of recent social indicators for Angola. The natural population increase coupled with the rapid influx of people displaced during the conflict years has led to the over-utilisation and decline of existing services. The UNDP Human Development Report of 2003 reported that as a whole 62% of the population lack sustainable access to an improved water source and 56% have no access to improved sanitation.

Table 6: Social Indicators

Life Expectancy at birth (years)	42.4
Under-five mortality rate (per 1000 live births)	250
Total fertility Rate per woman	7.2
HIV/AIDS prevalence	5.5
Population who know where to get an HIV test	23%
Population correctly stating 3 main ways to avoid HIV infection	17%
Adult illiteracy rate	33%
Maternal mortality rate, per 100,000 births	1800
Net Primary school attendance rate	56%
Population who use a safe drinking water source	62%
Population who use a sanitary means of excreta disposal	59%
Source: IDR 2000-1; MDG-R 2003 in UNDP, 2005	

The educational system is also in state of disarray. Nearly 60% of the Angolan population is illiterate. Schools are poorly equipped, there is a scarcity of teaching materials and a general lack of teachers, particularly in the rural areas resulting in teacher/pupil ratios as high as 75:1 in some areas (Davies, 2005). There are various other obstacles to accessing education including the fact that thousands of children are not registered at birth and cannot be enrolled at school without a birth certificate (in 2001, only 29% of children aged 0-5 months were reported registered), distance to schools, poor road infrastructure and transport (UNDP, 2005).

Health services are equally dilapidated and there are many challenges ahead. Despite gains in some health indicators, the infant, under five and maternal mortality rates remain high, even when compared to the average rates for other low human development countries (Table 7). Life expectancy is low (42,4 years of age). Primary health care services, immunisation and basic hygiene programmes have collapsed, the number of hospitals has declined, there is a shortage of health care professionals and the distribution of health care facilities is skewed. The majority of the health care facilities are found in urban centres while rural areas are severely lacking in health services and facilities. There is also a lack of accurate health statistics. The principle causes of death are reported to be malaria, diarrhoea, acute respiratory aliments and measles.

HIV/AIDS is another challenge facing post war Angola. At present, there is very limited reliable information available on the status of HIV/AIDS in Angola. The current prevalence rates were estimated at over 8% for 2003 and are expected to rise to 18% by 2010 (UNDP, 2005). However, lack of statistical information and the reluctance amongst the population to undergo HIV testing, suggests that the actual prevalence rate is much higher.

Table 7: Some trends in health indicators for Angola

	Under 5 mortality rate (per 1,000 live births)		**Infant Mortality rate (per 1,000 live births)**		**Maternal mortality ratio (per 100,000 live births)**		**Undernourished people (as % of total population)**	
	1990	**2001**	**1990**	**2001**	**1995**	**2003**	**1990/92**	**1998/2000**
Angola	260	260	166	154	1300	1,700	61	50
Low HDI countries	176	164	112	104	972		19	15

Source: UNDP Human Development Report, 2003, and UNICEF, state of the World Children Report, 2004.

The physical infrastructure is also in a state of disrepair. Roads that were not destroyed or damaged in the war are in desperate need of repair, and they currently cause extensive wear and tear on the vehicles. The country's road network is limited and many of the roads are impassable in wet weather. The public is reliant on private vehicles for transport and the transportation of goods, as there is no formal road transport system.

Angola has approximately 2,700 kilometres of railways. However, much of the railway is unusable because of land mines as well as extensive destruction of the tracks and bridges. The railway network extends into the interior from Luanda, Port Amboim, Lobito and Namibe. However, only the lines from Luanda and Lobito are operational and then only to a limited extent. Additionally, only a small portion of Angola's 70,000 kilometres of road is usable due to the threat of land mines, poor conditions and damaged bridges. Angola's telecommunications sector is also in need of significant investment to increase telephone and Internet connectivity with the rest of the world. The proportion of people with access to electricity or potable water remains low even in Luanda. There are some communities that do not have access to electricity and are reliant on natural resources for fuel.

The extended periods of conflict saw the once strong and diverse agricultural sector dwindle. Angola was once self sufficient in the production of staple foods but most of the agricultural infrastructure has been destroyed, farmers have been displaced and land is not accessible as a result of the numerous landmines, which are remnants of the periods of conflict. Much of the land is also overused and non-productive. Many of the displaced people who moved to coastal urban centres have become dependent on marine resources for their food and livelihood.

7. CHARACTERISATION OF THE SOCIAL AND ECONOMIC SITUATION OF THE ARTISANAL FISHERS

Since 1996, information on the socio-economic characteristics and conditions of coastal artisanal fishers and fishing communities has been gathered through various means. Firstly, with the assistance of the French government a survey of all fishing communties, except those in Bengo, still affected by the war, was undertaken and basic information on numbers and types of boats and nets, as well as men and women engaged in fishing and fish processing, was ascertained (Insituto Para O Desenvolvimento Da Pesca Artesanal, 1996). A modified version of this survey (known as the census) has been carried out bi-annually since 1998, and certain socio-economic data is extracted and used by the IPA. However, this information has not been systematically captured and analysed, and there are no reports documenting the findings of these surveys.

Information on fishing communities is also obtained from the samplers who are stationed at 55 fishing communities. Although their focus is on gathering information on fish catches, they are also able to provide useful socio-economic information.

In addition, information on socio-economic characteristics and conditions of fishing communities and issues facing these communities, can be obtained from the IPA representatives working in the various provinces. However, the above socio-economic data has not been systematically captured, analysed and documented. Information presented in this section of the report is thus not complete and has been gathered from these various sources.

7.1 THE ORIGIN OF THE ARTISANAL FISHERS

The results gathered during the surveys at the level of fishing communities along the coast indicate that:

- Many artisanal fishers along the coast of Luanda (Luanda Island) originate from the northern province of Zaire;
- In the southern region, the majority of fishers are of local origin, but some originate from the interior of the country as a result of the insecurity prevalent during the war period; and

- Occasionally there has also been some movement of boats, (i.e. ‘catrongas’) from one area to another as a result of the better fish price that can be obtained in the northern regions (Luanda, Bengo, Zaire, etc.).

Information from the census indicates that the average age of fishers is 40 years of age, and the number of years that individuals have been involved in fishing activities varies between 5 and 50 years. In artisanal fishing communities, sons start learning fishing skills from their parents at the age of 7.

7.2 COMMUNITIES

Along the coast there are 102 organised artisanal fishing communities, the greatest number being found in the northern provinces of the country, namely Zaire and Cabinda (see Table 8). A considerable number of these communities have their fishers organised in co-operatives, associations and pre-co-operatives (Table 9).

Table 8: Fishing communities along Angola’s maritime coast

Cabinda (18)	Zaire (20)	Bengo (12)	Luanda (15)	K. Sul (9)	Benguela (16)	Namibe (12)
Labi	Mussera	Ambriz	São Tiago	Praia Sousa	Cuio	Cabo Negro
Luvassa	Impanga	Kinkankala	Boa Vista	Kikombo	Gengo	Praia Amélia
Funga	Tombe	Binge	Hotanganga	Sumbe	Chiome	Saco Mar
Caio	Kifuma	Pambala	Cacuaco	Salina	Chamume	Mucuio
Lombo-	Kungo	Catumbu	Samba	Foz R. Longa	Vitula	Bentiaba
Lombo	Kinzau	Barra Dande	Ramiro	Praia Dengue	Baía Farta	Baía das pipas
Chinga Xangi	Mucula	Sobe desce	Benfica	Torre Tombo	Kasseque	Chapéu
Futila	N´Zeto	Sangano	Barra Kuanza	Sumbe sede	Macaca	Armado
Buço Mazi	Ponta Padrão	Cabo Ledo	Mirador	Karimba	Senga	Tômbua sul
Malembo	Maradeira	São Braz	Casa Lisboa	P. Amboim	Cabaia	Tômbua sed
Cacongo	Kipai	Kitoba	Chicala		Saco	Porto Pesqueiro
Bembica	Kivanda		Barra Bengo		Coata	Lucira
Tchafi tungo	Kakongo		Buraco		Damba Maria	
Landana	Tomboco		Capossoca		Praia Bebé	
Chicaca	Kinfinda				Lobito Velho	
Sangu Simuli	Muango				Compao	
Techississa	Kingombo					
Massabi	Kimpanga					
	Kintaku					
	Lucumba					
	Missanga					

Table 9: List and composition of co-operatives, associations, and groups of economic interest (GEI) existing in the country

Province	District	Community	Designation (name)	Composition	
				Men	Women
Cabinda	Cabinda	Lombo-lombo	Assoc. pescadores de Malembo-Chinfuca Assoc. pescadores de Fútila-Mbuco Mazi Assoc. de Cabinda (APESCAB)	108	
Zaire	Soyo	Lucata Mtampa Kipai	GEI Tuzolana GEI Angola Nova GEI Kipai 1	33 16 10	 1
	Tomboco	Kinzau	GEI Kintuadi GEI Luzolana GEI Esperança GEI Ntemu a Kazai GEI Kinsala GEI Saka	18 15 12 14 18 25	1 3 1 2 21
Bengo	Kissama	Cabo ledo Kissama Sangano São brás Longa	Coop. Pescadores Cabo Ledo (COPESCALDO) Coop. Pescadores and Armadores da Kissama Coop. Da Boa Esperança Coop. Nosso Sonho GEI Longa	39 40 50 40 30	1
	Dande	B. do Dande	Coop. Pescadores Barra D, SCRL (Mukengueji) GEI Úlua GEI Ibêndua	16 30 30	4
	Ambriz	Ambriz	Coop. Sanga Kia Nganga Ponta Coop. Nfinda Moyo (Kinkakala) Coop. Pescadores Yembe	60 40 40	8
	Catete	Ombo	GEI Ombo	30	
Luanda	Samba	Buraco Camuxiba Areia branca Macoco	Coop. Pescadores do Buraco GEI Camuxiba GEI Areia branca GEI Macoco	130 30 30 30	135

	Cacuaco	Hotanganga	Coop. Hotanganga	31	
		Sarico	Coop. Pesca Artesanal Paz	30	
			Coop. Pesca Artesanal Kamungua	30	
		B. pescador	Coop. Pescadores do Kilamba Kiaxi	46	
		B. pescador	GEI	30	
		B. do Bengo	GEI Barra do Bengo	30	
		Pure	GEI Pure	30	
		Trab. and luta	GEI Trabalho e Luta	30	
	Ingombota	Ilha do Cabo	Coop. Pescadores Ilha de Luanda (COPIL)	48	2
			GEI Casa Lisboa	30	
		Casa Lisboa	GEI Boavista	30	
		Boavista			
	Sambizanga	S. Pedro B.	GEI São Pedro da Barra	30	
	Viana	Calumbo	GEI Calumbo	30	
		Tombo	GEI Tombo	30	
K. Sul	P. Amboim	Zona Norte	Coop. Pescadores Artesanais (CAT)		
		Gilco	Coop. das Mulheres Transformadoras		
		Gilco	Coop. Comerciantes do Porto Amboim	36	
		P. amboim	Coop. Pescadores do Porto Amboim	80	1
		Bambala	GEI de Bambala	30	
	Sumbe	Quicombo	Coop. Boa Sorte	78	15
		Quicombo	Coop. 7 de Julho		
		Quicombo	Coop. Pescadores do Quicombo		
		NGangula	GEI Ngangula	30	
		Golalombo	GEI Golalombo	30	
Benguela	Benguela		Coop. Pescadores Artesanais (COPESCA)		
			Coop. Pesca Artesanal de Apoio as Comunidades		
			Coop. Agro-pecuária e Pesca (CAPACDA)	105	43
			Sociedade de apoio à Pesca Artesanal (SOCAPABE)		
	Lobito		Coop. Agro-pecuária and Pesca Egipto praia (CAPEP)		
	Baía Farta		Coop. Pescadores da Vitula	70	2

Namibe	Namibe	Saco Mar Namibe Saco Mar Praia Amélia	Coop. Pescadores Kilamba Kiaxi no Coração Coop. Pescadores do Namibe Coop. Pescadores Welwitchia Coop. Mero	32	
	Lucira	Lucira	Coop. Pesca da Lucira (COPAL)		
Lunda Sul			Coop. Pesca Txiti	30	
Malange	Kalandula	Kalundula Kalundula	GEI GEI	30 30	
Moxico	L. Kameia	Txivinda Txiesso Fogo Lucusse	GEI Txivinda GEI Txiesso GEI Fogo GEI Lucusse	52 52 24 30	
K. Kubango		Cuelei	Coop. Pesca Cuelei	30	
Cunene	Ombaja	Shangala Manquete	GEI Shangala GEI Manquete	30 30	
Huambo	Huambo	Cuando	GEI Cuando	30	
	Caála	Gove	GEI Gove	30	
Total				**2278**	**240**

With the support of the Sub-programme for the Organisation of Fishing Communities, including inland artisanal fishing, 33 co-operatives, 4 associations and 38 groups of economic interest have been established in Angola. These latter groups will evolve into co-operatives of artisanal fishers.

7.3 INVOLVEMENT OF WOMEN IN THE ACTIVITIES OF THIS SECTOR

In general women do not go out to sea but perform most of the activities related to the processing, preservation and sale of the fish. Women have a greater involvement in inland fishing activities, especially in small rivers.

The participation of women in the co-operative movement is still rather weak, as highlighted in the following table (Table 10).

Table 10: Gender composition of co-operatives/associations

Province	Co-operatives/Associations	Total Associates	Men	Women
Luanda	Co-operative in Buraco	260	130	130
	Co-operative in Hotanganga	13	12	1
	Co-operative in Sarico	115	110	5
Bengo	Co-operative Mukengeji	20	16	4
	Co-operative Sanga Kia Nganga	68	60	8
	Co-operative Cabo Ledo	41	40	1
Kuanza Sul	Co-operative of Women in the Processing and Commercialisation of Fish in Porto- Amboim	36	0	36
	Co-operative of Fishers in Porto-Amboim	81	80	1
	Co-operative of Fishers in Quicombo	93	78	15
Benguela	Co-operative for the Support of Artisanal Fishing in Benguela	148	105	43
	Co-operative of Fishers in Vitula	72	70	2
Namibe	Co-operative of Kilamba Kaiaxi Fishers in Coração	100	85	15
Total		**1047**	**785**	**261**

Note: Only associations which include women are mentioned and in these the percentage of women is only 25%.

The IPA has been engaged in capacity building and education sessions to encourage the involvement of women in the artisanal fisheries sector. In doing so, the IPA has promoted the following actions:

- Providing incentives for projects linked to the development of artisanal fishing
- The organisation of women processors and sellers into co-operatives, associations, etc.
- The promotion of micro-credit
- Capacity building amongst women who process fish to improve technologies for processing and transformation (construction of ovens and bunks for the smoking and drying of fish etc.)
- Improvements to the system of commercialisation of the fish (with the construction of benches for display, for the sale of fish in acceptable hygienic conditions)
- The inclusion and in places, employment of women in the gathering of fishing data

However, there is very little information on the socio-economic circumstances as well as the roles and responsibilities of women involved in the artisanal fisheries sector. In addition, there is no documented information on the needs of fishworkers and the difficulties they experience in participating in this sector.

7.4 EMPLOYMENT

Fishing activities depend on the season. In maritime fishing the greatest number of jobs, (more than 60%), are provided by enterprises based in the provinces of Luanda and Benguela. In the other provinces employment is mainly confined to small scale local fishing, with artisanal fishing being the main employer. If the fishers that help to operate beach seines are included, the total number of people that engage in coastal fishing activities amounts to between 130 000 and 140 000, without taking into account those who work in the areas of distribution and commerce. There are about 50 000 inland fishers.

7.5 PROCESSING, MARKETING AND DISTRIBUTION OF FISH PER PROVINCE

A large part of the artisanal fish production is consumed in the country and the rest is sold at the northern borders to neighbouring countries (Table 11). The fish consumed in Angola is either fresh or dried, depending on the size of the population at the beach landing sites. Most of the fish sold at the borders and consumed by neighbouring countries is dried. Fish products are mainly distributed by women, who also perform most of the drying and smoking activities related to catches of conger eel, shark and sardine.

Table 11: Main species, processing technology, markets and distribution

Province	Main species	Processing techniques	Market		Distribution
			Local	International	
Cabinda	Sardine, shark, conger, croaker & large-eye dentex	Fresh	Cabinda & Cacongo	DRC & R. of Congo	Mainly by the informal sector, by women
Zaire	Croaker, southern meagre, crevalle jack, catfish, African threadfin & large-eye dentex	Fresh, dried, and smoked	Soyo, Cabinda, Uige & Malange	DRC	Mainly by the informal sector, by women
Bengo	Croaker, sardine, catfish, shark, grouper, sea-bream & lobster	Fresh and dried	Luanda		Mainly by the informal sector, by women
Luanda	Sardinella, little tunny, large-eye dentex, horse-mackerel, sardine, sea-bream, shark, grouper & prawns	Fresh, frozen, dried and smoked	Luanda, Uige, Malange, Lundas north and south	EU, DRC & R. of Congo	As in Cabinda, but there is also a network of fisher-women retailers
K. Sul	Sardinella, grunt spp., large-eye dentex, conger, & croaker	Fresh & dried	Sumbe, Gabela, Quibala, P. Amboim, Luanda, Uige and Malange	DRC	As in Cabinda and by dealers with refrigerator vehicles
Benguela	Sardinella, horse mackerel, large-eye dentex, yellowtail, grouper, bigeye grunt, ballyhoo halfbeak & croaker	Fresh and dried	Lobito, Benguela, Huambo, Luanda & Cabinda	DRC & R. of Congo	As in Cabinda. The dried fish from more remote areas is transported by boat to Benguela
Namibe	Large-eye dentex, croaker, horse mackerel, sea-bream, tunas & shark	Fresh and dried	Namibe, Lubango, Huambo & Cabinda	DRC & EU	As in Cabinda and by dealers with specialised vehicles

The main markets for fresh fish are the big cities and suburban areas along the coast. There are also some dealers who transport the fish to the large inland centres such as Lubango, Malange, Huambo and Uige. The export of fish derived from artisanal fishing is mainly oriented towards neighbouring countries to the north of Angola, namely the DRC and the Republic of the Congo. The European Union and Korea are the countries that buy some of the best fish and shark fins.

Research undertaken in the market of the city of luanda, mainly on the island in Cacuaco, and in the Samba municipality, indicates that good quality fish and crustaceans do not really have a fixed price. Prices vary as a function of supply and demand, particularly for small pelagics that are unloaded in great quantities. However, the average price of 5 USD/kg can be maintained for the 'noble' (i.e. better) species such as dusky grouper, croaker, southern meagre, etc. This average price is lower in the southern provinces such as Benguela and Namibe, probably due to the weak buying power of the local populations. Lobster sells for between 14 - 20 USD/kg. A box of 30 kg of fresh horse mackerel is negotiated as a function of the market and will range between 30 and 40 USD, and a box of sardinellas between 15 and 20 USD.

7.6 SOCIO-ECONOMIC DATA COLLECTION AND ANALYSIS

In 1996, with assistance from the French government, a survey of coastal fishing communities was undertaken. This survey focused on obtaining information on the number and type of boats and nets used by fishers, whether boats were used mainly for fishing and/or for transport, and the materials used in construction of boats. Detailed information on the above for all communities surveyed[2] is documented in a report (Insituto Para O Desenvolvimento Da Pesca Artesanal, 1996).

Thereafter, according to IPA officials, the survey (known as the census amongst artisanal fishing communities) has been undertaken bi-annually since 1996 - in 1998, 2000 and 2002. Over the years the survey has increasingly focused on socio-economic information. A translated version of the most recent census questionnaire is provided in Appendix 1. However, it appears as though the data gathered during these surveys have not been systematically captured, analysed and documented according to IPA representatives. Information on specific issues, at specific localities, is extracted from the raw data when required. However, when such information was requested, it was found that the survey forms have been stored in an archive and many of the forms are damaged and unusable. There are various reasons why this information has not been captured and analysed. These include lack of computer facilities, appropriate software, human resource

[2] Surveys were not conducted in Bengo due to the instability in these areas.

capacity – especially in view of the time required to process all the information – and lack of funding to support personnel to undertake the work.

8. INSTITUTIONAL ARRANGEMENTS FOR MARINE FISHERIES MANAGEMENT

8.1 OVERVIEW

The Institute of Fisheries Research of the Fisheries Ministry has, among other functions, to evaluate marine resources. Every year the Institute, through data from scientific cruises and with statistical support, assesses the biomass of the main commercial species and proposes to the Fisheries Minister the TACs and other appropriate conservation measures.

The advisory body of the Fisheries Minister that deals with matters related to coastal planning and management of fishing resources is the technical council (Conselho Técnico). This Council is composed of the National Directors of the main areas of the Ministry and Institutes and by the representatives of the Fishing Associations. The main functions of the Council are 'to advise on the adequacy of the fishing capacity and fishing effort in relation to the exploitable potential' and 'to analyse technical measures for the conservation of species'. Based on the advice of the Council, the Fisheries Minister determines the quotas for the different fishing species, committing the National Directorate of Fisheries (Direcção Nacional das Pescas) to license the industrial and semi-industrial fishing vessels and committing the Institute of Artisanal Fisheries (Instituto da Pesca Artesanal) to license the artisanal fishing vessels. Priority in licencing is given to the national vessels. The remaining licenses are negotiated with the mixed and foreign fleets. The licencing of foreign fleets requires association with national partners, with the exception of licenses granted under inter-governmental agreements. The value of a license depends on the type of gear and on the tonnage of the fishing vessel. Usually, each license indicates the type and the size of the mesh, the fishing zones, species that can be caught, catch quantity, and the closed season, if there is one. The licenses are not transferable from one fishing vessel to another. There is a further limited concession of licenses for fishing crustaceans and demersal species. A closed season of one month a year for the crustacean fishery has been established.

The National Directorate of Surveillance (Direcção Nacional de Fiscalização) is responsible for the enforcement of fishing legislation, the control of fishing vessels and gear used, and the transshipment of fish catches. Currently, enforcement is inadequate but a satellite surveillance system is being installed.

Angola is a member and participates in the meetings of ICCAT and joined the Regional Convention (Convenção Regional) relating to Fisheries Cooperation (Cooperação Haliêutica) between the Atlantic Ocean Coastal African States. The Angolan Fishery Sector has benefited from the technical assistance of several countries and International Organisations, such as the European Union, Sweden, Norway and some of the United Nations agencies such as FAO, UNDP and IFAD.

8.2 ORGANISATIONAL STRUCTURE OF THE NATIONAL FISHERIES AUTHORITY

All marine fishing activities in Angola are under the authority of the Fisheries Ministry, while inland water fisheries depend on the Ministry of Agriculture. The Fisheries Ministry is headed up by a Minister and supported by two Vice-Ministers. It has two National Directorates. The first is the Directorate of Fisheries (Direcção das Pescas) that takes care of the licenses for industrial fishing vessels, processing industry, commercialisation, and the ports and maintenance infrastructure. The second is the Directorate of Surveillance (Direcção de Fiscalização), which ensures compliance with the existing laws and regulations. In the central services of the Fisheries Ministry the staff comprises 429 persons (including supervisors and crew of the surveillance vessels). There are a further 493 staff in the Institutes, Schools and Support Fund, and 303 persons in the regional delegations.

The Ministry of Fisheries has several offices, namely the Legal Office, which deals with legal aspects; the Office for Studies and Planning (Gabinete de Estudos e Planeamento), responsible for planning and monitoring investments and statistical data; the Office for International Exchange (Gabinete de Intercâmbio Internacional), which is responsible for the relationship and cooperation between the Fisheries Ministry and similar organisations from other countries as well as from International organisations; the Secretariat General (Secretaria Geral) which ensures the necessary administrative, financial and logistic support; and lastly the Inspection Office (Gabinete de Inspecção) charged with ensuring the organisation and functioning of the Ministry's services mainly with regard to the legal aspects of its activities, and the efficiency and rational use of resources.

Three Institutes complete the Ministry's activities. These include the Scientific Research Institute (Instituto de Investigação Científica), dealing with technical and scientific research for the development of fisheries; the Artisanal Fisheries Institute (Instituto da Pesca Artesanal) concerning the development of artisanal fisheries; and the Institute for Supporting Fishing Industries, related to the advancement and development of fishing industries. The Fisheries Ministry also has two schools for the training of its own staff, one in Namibe and another in Luanda, each with the capacity for 200 students. There are also regional delegations of the Fisheries Ministry in each coastal province (Cabinda, Zaire, Bengo, Luanda, Kwanza-sul, Benguela and Namibe).

8.3 MANAGEMENT OBJECTIVES

According to the Master Plan of the Ministry of Fisheries (2003), the main goal of the fishing policy in Angola is to 'optimize the benefit for the Angolan population of the long term sustainable exploitation of marine resources in the Economic Exclusive Zone (EEZ)'. However, it should be noted that in the sector programme to support the artisanal fishing, inland fresh water fishing will be included.

Within this broad goal of optimising benefits for the Angolan people, the principal objectives are:

- Rational exploitation of marine resources within biological sustainable limits
- Improvement in supplying the population with fishing equipment
- Poverty reduction and an improvement in the living conditions for fishermen and communities dependent on fishing activities. Areas that require particular attention in communities are the provision of jobs, medical clinics, schools, the provision of drinkable water and electrical energy, the rehabilitation of access routes, as well as improvements in the working conditions of the fishing communities
- Improvements in food security. Artisanal fishing, both inland and along the coast, can significantly contribute towards the government objective of providing food security for the entire population of the country
- Improvements in the security of the fishers at sea, their conditions of work, education and professionalism
- Increasing the use of salt and the production of dried fish
- Renovation of existing boats and other fishing gear that are currently not operational
- Increasing the income from fishing activities in order to at least cover the financing needs of this sector
- Increasing foreign currency revenue. Through well managed and implemented programmes artisanal fishing can contribute significantly in the short, medium and long terms towards the acquisition of foreign currency

- Development of subsidiary small enterprises, such as shipyards and factories to produce fishing materials
- The introduction of monitoring, control and surveillance
- The initiation of training programmes in the areas of fish handling, processing and marketing

8.4 STRATEGIES FOR THE DEVELOPMENT OF ARTISANAL FISHING

Proposed strategies for the development of artisanal fishing are as follows:

Institutional

- Institutional reinforcement and strengthening the capacity for intervention in the fishing communities
- Research and evaluation of resources along the coastal zone
- Improvement of knowledge of inland fishing

Physical Infrastructure

- Increasing and reinforcing local infrastructure to support fishing communities such as support centres, markets, access routes, electrification, drinkable water, fuel tanks, etc.

Credit

- Providing adequate mechanisms and conditions for micro-credit according to the reality/circumstances of artisanal fishing

Improving the productivity and the lives of the fishers

- Implementation of measures for increasing the safety of artisanal fishers at sea
- Fitting boats with refrigeration facilities that will improve the quality of fish landed by the artisanal fishing vessels
- Increasing the levels of motorisation and improving the status of navigation and fish detection equipment of artisanal fishing vessels along the coast

Improving capture, processing and distribution capabilities

- Establishment of a policy that integrates and harmonises the process of capture, processing and distribution
- Improvement in the management and optimal usage of infra-structure for fish processing
- Encouragement of innovation and utilisation of new technologies in the areas of processing and distribution
- Implementation of a programme for the gradual substitution of fishing methods and techniques that have an unacceptable negative impact on resources, for example beach seining and the use of grenades and other explosives

8.5 DEVELOPMENT PROGRAMMES

Since 2000, the Ministry of Fisheries, via the IPA, has established a programme for the promotion and development of artisanal fishing. There are several sub-programmes within this programme. These are:

- Organisation of fishing communities
- Creation of production infrastructure and support for artisanal fishing
- Sustainable management of fishing resources relevant to artisanal fisheries

Each sub-programme encompasses several projects that will be developed in 10 pilot communities, 2 in each of the coastal provinces. These projects include several actions/plans, such as:

- Setting up micro-enterprises, co-operatives and fishers' associations
- Training of extension workers
- Recovery and construction of integrated centres of support
- Repair or construction of small bridges, clinics, schools and access routes to fishing communities

8.6 SUPPORT PROGRAMMES

There are also some support projects in place that lend assistance to the artisanal fishing sector or the fishing sector in general. Some of these include:

- Project for the development of artisanal fishing for the Zaire province (Pesnorte) - IFAD loan fund of approximately USD 9 000 million
- Project for the development of artisanal fishing for the Ambriz Municipality and surrounding areas (Projecto Ambriz) – grant fund by UNDP of approximately USD 2 000 million
- Project for the creation of integrated centres for the development of artisanal fishing – BAD loan fund of approximately USD 9 000 million
- The recently finished Project for the development of artisanal fishing for the Namibe province (Pescart) – FADEPA fund of approximately USD 2 500 million

With the creation in the Southern region, of the Southern African Development Co-ordination Conference (SADCC), of which Angola is a member, the Fisheries and Marine Resources Co-ordination Unit (Unidade de Coordenação para as Pescas e Recursos Marinhos) was established with headquarters in Namibia. The main projects proposed or already being implemented, are related to research, quality control of fishing products, surveillance systems, training and marketing. In addition, through the Institute of Fishery Research (Instituto de Investigação Pesqueira), Angola participates in the BENEFIT project, together with South Africa and Namibia. The aim of the programme is to build capacity in the various regions and to increase understanding of the Benguela Current ecosystem.

The Support Fund for the Development of Artisanal Fisheries (Fundo de Apoio ao Desenvolvimento da Indústria Pesqueira – FADEPA) is a financial tool to support development, by financing investment projects in the priority areas defined by the Ministry.

Amongst regional programmes that support artisanal fishing, the Benguela Current Large Marine Ecosystem Programme (BCLME) stands out. The main objectives of the programme are to promote a greater understanding of the physical and biological variables of the BCLME itself and the way these affect the biological resources, and to examine transboundary issues that affect fisheries resource management in the three countries bordering the BCLME. The BCLME is of great importance to the countries in the BCLME region (Angola, Namíbia and South Africa) since it has conceptualised projects to solve some of the key questions that affect commercial and artisanal fishing in the Benguela Current region. The awarding of these projects has constituted an important step in the process of developing baseline scientific and economic information on fisheries in the BCLME, documenting how these fisheries are changing with time, and how the transboundary management problems associated with fishing, mining and oil exploration, coastal development, biodiversity, pollution and regulations, can be addressed across the entire Benguela region. With regard to artisanal fisheries of the region, it is necessary to find an equilibrium between the use of fish resources by impoverished fisher communities and the sustainable use of these resources.

8.7 CURRENT CONSTRAINTS ON THE ARTISANAL FISHING SECTOR

The most serious constraints on artisanal fishing are mainly a result of the following factors:

- Absence of support infrastructure on land and particularly at landing sites
- The weak development of fisher organisational structures, such as co-operatives, associations and fishing boat owners
- Poor product processing facilities, and little product enhancement and commercialisation of the captured resources
- Limited financial capacity of the fishers

- Poor state of access routes to much of the coast
- The absolute state of poverty of most fishers and fishing communities, which forces them to concentrate on survival rather than development

9. CURRENT APPROACH TO FISHERIES RESOURCES MANAGEMENT

9.1 OVERVIEW

According to the estimates made during the 1980s (Anonymous, 1980), total exploitable fish biomass was around 655 000 tons while 10 years later that biomass was estimated to be a minimum of 360 000 tons (FAO, 1999). More recently, the Study on the Development of the Fishing Fleet – Master Plan (Estudo sobre o Desenvolvimento da Frota Pesqueira - Plano Director), when referring to average values during the period 1985 – 2002, suggested potential captures of around 700 000 tons, but recommended that exploitation should not exceed 80% of that value (around 560 000 tons). Under these circumstances, Angolan fisheries management authorities have adopted a cautious approach and a harvest of 400 000 to 500 000 tons of fish has been allowed for the entire fishing sector (commercial and artisanal), with more than half of this total consisting of small pelagics (sardinella, sardine and horse mackerel). Total exploitable biomass continues to be determined by annual biomass surveys that evaluate separately small pelagics, large pelagics, demersal stocks and a basket of other species such as grouper and sparids. The information provided in the previous section provides a very general and condensed overview of the early status of the fish resources along the Angolan shelf. More detailed biomass estimates made since 1996 indicate that stock size in the different sectors has fluctuated with time (Table 12).

Table 12: Annual biomass estimates (1000 tons in rounded figures) of various groups of fish, calculated by survey cruises in Angolan waters by R/V Dr. F. Nansen

	Sardinella:	H. mackerel:	Croakers:	Sparids:	Grunts:	Groupers:	Hake:	Total
1996	363	360	18	49	16	5	14	825
1997	495	427	19	34	13	1	24	1013
1998	543	239	18	41	15	3	19	878
1999	363	321	19	34	9	2	6	754
2000	353	333	8	38	8	2	10	752
2001	434	89	3	23	7	0.5	10	567
2002	343	162	3	26	3	0.3	6	543
2003	432	166	13	18	11	1	12	653
Mean	**410**	**262**	**13**	**33**	**10**	**2**	**13**	

Significantly, there has been a decline in the estimated biomass of all fish groups except *Sardinella* between 1996 and 2003 and a decline in the estimates of total fish biomass (Table 6). In addition, mean estimates for the years 1996 – 2003 for most groups are considerably lower than the figures derived from the Dr Fridtjof Nansen cruises between 1985 and 1992 (see above). In 2003 the biomass of some of the groups increased relative to the previous year but was still significantly less than initial biomasses. This downward trend in biomass encompasses species caught by line, net and trawl, and should be cause for some concern.

9.2 STOCK ASSESSMENTS

Assessments of pelagic stocks are done by acoustic surveys and ground truthing trawls undertaken every year. Pelagic species (sardines, sardinellas and horse mackerel) are all assessed separately and a separate TAC calculated for each species. The biomass of all other pelagic species, such as the Carangids and Scombrids are estimated as a basket of species. Demersal stocks are assessed by swept area methods. Individual species biomass is calculated from fish densities integrated over the three main survey regions and the proportional composition of each species in the catch. A TAC is calculated by determining an optimum biomass and a TAC is set according to the estimated current biomass level (constant fishing mortality strategy). An amount of 150 000 tons is removed from the total biomass estimate as a precautionary approach before the TAC estimated. TACs are calculated for:

- Corvina (Croaker)
- Garoupa (Groupers)
- Dentex (Sparids)

- Grunts (Grunters)
- Two hake species. (Note: In ArtFish data records, all catches recorded as Pescada refer to hake {*Merluccius* spp.} in the provinces of Namibe and Benguela, but from Kuanza Sul northwards these catches refer to Barracuda {Sphyraena spp.}.
- Marionga (Big eye grunt)
- Mixed basket of rest of pelagics

Camarao (Prawns – *Parapenaeus longirostrus* and Gamba = *Erasteus varidensis*)

10. FISHERIES DATA COLLECTION

10.1 OVERVIEW

The industrial and semi-industrial fishing vessels have to supply data and statistical information about their catches, filling in the appropriate forms within established deadlines. The Office of Studies and Planning (Gabinete de Estudos e Planeamento) is responsible for the data processing. The artisanal fleet data, collected in different beaches under a defined sampling system is processed by the IPA, which uses the ArtFish software, supplied by FAO.

In the period between 1995 and 1998, procedures were put in place to gather information on the fishing communities and fish harvested by artisanal fishers along the Angolan coastline. Initially, 28 beaches were selected along the coast, and another 27 were added in the year 2000, totalling 55 fishing communities. To reach the set objective of monitoring 75% of the total number of artisanal fishing communities (102), it will be necessary to add at a later date another 15 communities to the 55 already selected.

The selection of fishing communities living adjacent to beaches was made bearing in mind the following:

- Ease of access to the beach for the monitor
- Techniques and methods of fishing utilised
- Quantity and type of boats utilised
- Volume of fish captured
- Number of fishers and boats
- Working conditions of the monitors or samplers

The coastal zone consists of seven provinces and within each province there are a number of municipalities (Table 13). Within each municipality there are a number of fishing communities. The selection of the fish landing sites was done by taking into consideration the extent of provincial territory, with 4 communities in the each of the largest provinces and 3 communities in each of the smallest provinces being selected for catch monitoring.

Table 13: Provinces and municipalities of the coastal zone of Angola

Province	Municipality
Cabinda	Cabinda
	Kakongo
Zaire	Tomboco
	Soyo
	N'zeto
Bengo	Ambriz
	Dande
	Kissama
Luanda	Samba
	Ingombota
	Cucuaco
Kuanza-Sul	Porto Amboim
	Sumbe
Benguela	Lobito
	Benguela
	Baia Farte
Namibe	Namibe
	Tombwa

A sampler was identified on each beach, taking into consideration the individual's literacy level and the comprehension capacity required for the activities of the programme, and his knowledge of the species caught, his familiarity with effort requirements for various vessels, and his knowledge of the type of fishing gear used. The working period of the sampler is 5 days a week, which corresponds to 20 records per month (20 days).

Each sampler has at his/her disposal a scale, a bucket, a calculator, and other small materials necessary to register the data. The fact that the sampler comes from, and lives in, the fishing community facilitates his work but his presence is sometimes resented by the fishers because of occasional delays in processing the catch that are caused by his sampling activities. Samplers report directly to provincial fisheries authorities.

A technical team from IPA visits the landing localities at least once a quarter in the provinces of Luanda and Bengo. During this visit records are collected, new record sheets are handed over and samplers are paid. In the remaining provinces, this task is the responsibility of the IPA's Provincial Representatives, who send the records to Luanda to be processed. Currently a major problem in the Bengo and Luanda provinces is the lack of adequate transport (4x4 vehicle) for regular visits to the fishing communities.

Currently all data analyses are done by IPA in Luanda. For the new version of the Programme 'ARTFISH INCORPORATED IN WINDOWS', the primary level of analysis will be done at municipal level, and secondary, more detailed analyses will be made at provincial level. Initially, the provinces of Benguela and Zaire will process the data in their respective areas and the IPA at national level will do the analysis of the other five provinces.

10.2 SAMPLING PROGRAMME

A sampler or fisheries monitor is a fisher. He may be an active fisher in which case his fishing gear will go to sea on a boat while he stays ashore and does the sampling. He may sometimes arrange for a replacement to do the monitoring if he goes to sea. The sampler records the number of boats going to sea on a particular day and he samples the catch on their return. If a number of boats come in together then there are problems because he cannot get to all the boats. If several boats arrive at the beach together he may not sample all the boats, in which case he will record a mean weight for the type of boats not sampled, based on the weights and species composition of the boats that he does manage to sample. When a boat arrives at the beach the sampler loads the catch into boxes. One box equals 20 kg. From the number of boxes of fish the total catch weight is calculated. Before weighing the catch the fishers take out the fish they are going to eat themselves. Thus these fish which are presumably the better quality eating fish are not weighed. The sampler then takes one box of fish and sorts it by species and weighs the catch of each species. Alternatively he/she may weigh the entire catch of a species if the catch is small enough. Apparently samplers have only just started counting the number of each species in the weighed catch. Together with a catch weight estimate, this will provide some indication of the size of individual fish. In Zaire a programme has been instituted to measure the lengths of individual fish but measuring lengths is very slow and is not well received by fishermen. A sampler will check three or four boats of a particular type, then three or four boats of another type. It is sometimes not possible for him/her to check every single boat and he/she would then allocate an average weight of fish caught per boat type to the remaining unchecked boats. A sampler would normally check and sample about 10 boats in a day for five days a week. He/she will not always check the same boats in a category but selects different boats. Multi-day fishing trips (length of trip and catch data) are recorded on a separate data sheet. A sampler is paid 35 USD per month out of a fishing levy and the payment is not a IAP function. The proposal is that samplers will eventually be paid by fishing co-operatives established in each village. The government will then take on three or four extension workers in each province to undertake further fisheries work. Samplers in Zaire are paid 50 USD per month because of the extra work associated with capturing biological data (length frequencies and sex). Samplers come from a community and stay in the community but extension workers will need to move between communities and will need transport and to be fed and housed wherever they happen to be located.

10.3 BOATS USED IN ARTISANAL FISHING

The following three types of boats are utilised in artisanal fishing. They differ in length, materials used to manufacture them and fundamentally in the navigation equipment on board.

- **Canoes** are boats whose length varies between 4 and 5.5 m and can be made from a single hollowed tree trunk or from wood (Figure 2). Canoes are made locally, however there is a lack of suitable trees for the construction of canoes. A tree for a canoe costs 8000 kwanzas and it costs 2500 K for someone to shape the canoe. The majority do not have engines and are propelled by oars and sails. Those that are motorised have outboard engines of up to 25 HP, although most engines are 10 – 15 HP capacity. The average capture of this type of boat varies between 50 and 100 kg per day. Due to the lack of safety in going to sea in this type of boat, fishing activities are carried out fairly close to the coast, especially during rough seas. Canoes are too unstable to be taken far out to sea.

Figure 2: Example of a canoe made of the 'mafumeira' tree by the Kinkakala Co-operative

- **Planked boats/punts ('chatas')** are boats 5 to 7 m in length but with a flat bottom (Figure 3). They are made of wood and fibreglass. They may or may not have an outboard motor with a capacity that varies between 25 and 40 HP (mainly 25 HP). The average daily capture of this type of boat varies between 100 and 150 kg. Due to their relative stability compared to the canoes, there has been an increase in usage of this type of boat in Angola in the last few years (Table 8). A 'chata' costs 2500–3000 USD and an engine is about 5000 USD.

Figure 3: Example of a 'chata' (planked boat/punt) made of fibreglass

'Catrongas' – these boats are longer than 'chatas', varying between 7 and 14 m in length (average length 12 m). They are generally shaped like a whaleboat and can be made of wood, fibreglass or steel, or a combination of these materials (Figure 4). They are all motorised with a central inboard engine that varies between 40 and 100 HP. Catrongas of 10 – 14 m length can have motors of up to 140 HP). This type of boat may or may not have a cabin and their average capture is estimated to vary between 500 and 1000 kg per day. (Note: Small purse seiners belonging to the semi-industrial sector may also be 14 m in length).

Figure 4: Example of several 'catrongas' with or without cabins, with inboard engines

Data describing the distribution and number of vessels in 2001 is given in Table 14.

Table 14: Number of boats (per type) distributed per province in 2001

Province	Canoe		Chata		Catronga	**Total**
	Without motor	With motor	Without motor	With motor	With motor	
Cabinda	934	1	9	66	33	**1059**
Zaire	114	3	24	77	20	**254**
Bengo	22	0	66	77	25	**198**
Luanda	270	0	945	690	80	**2015**
K. Sul	59	0	330	65	3	**509**
Benguela	415	0	1268	59	6	**1792**
Namibe	0	0	241	42	19	**346**
Total	1814	4	2883	1076	186	**6173**

Canoes constitute 90% of the fishing fleet in the northern Cabinda province and 48% of the fleet in Zaire, but their use declines markedly further south (12 – 14% of the fleet in each province except in Benguela province, where they make up 24% of the fishing fleet). In the extreme south of the country (Namibe), this type of boat is not used by artisanal fishers, probably because the sea in the southern region is rougher than elsewhere. The number of 'catrongas' is higher in the northern provinces of the country (Luanda, Cabinda and Bengo), with Luanda showing the greatest concentration of this type of boat. This is clearly a result of the more profitable fishing market in the northern part of the country, since the 'catronga' is the most effective of the fishing vessels described above. It should be noted that an artisanal license is issued to a boat and not a fisher, so in terms of documenting effort, the boat is the unit of choice by management authorities.

The total number of boats of different types and the number of fishers in the artisanal fishing communities along the coast of Angola are assessed every two years (Table 15). The boat and fisher census consists essentially of updating previously existing data both on the basis of the ArtFish programme and other archives in the IPA. In the census being carried out this year (2004), new elements of inquiry have been introduced in the respective forms, relating to socio-economic data on the fishers and women at fishing community level. The bad state of the road access to many of the communities, as well as a lack of four wheel drive vehicles, have constituted the greatest difficulties to carrying out this activity successfully.

Table 15: Number of fishers and boats per province from 1991 to 2003

	Cabinda		Zaire		Bengo		Luanda		K. Sul		Benguela		Namibe		**Total**	
	F	B	F	B	F		F	B	F	B	F	B	F	B	**F**	**B**
1991	516		2000		423		3175		3000		5000		1000		**15114**	
1995	1510	343	630	201	776	190	8101	1516	3478	536	7307	1734	1562	278	**23364**	**4798**
1998	1314	1029	613	224	549	168	7925	1985	2621	476	7307	1762	1244	316	**21573**	**5960**
2001	3110	1059	806	254	725	198	6247	2015	2070	509	5909	1792	1264	346	**20131**	**6173**
2003	2216	984	1446	438	1012	265	2617	1985	2070	402	5940	1658	1830	439	**17131**	**5171**

F: Fishers, B: Boats

Luanda and Benguela provinces are the provinces where there has been the greatest concentration of artisanal fishers and boats throughout this decade. However, trends in fishing effort are difficult to distinguish. Overall, the maximum numbers of fishers and boats occurred in the later part of the 1990s with a marked drop in numbers (+/- 20%) by 2003. However, in the various provinces, some have shown a steady increase in the number of fishers and boats over the years (i.e. Zaire, Bengo, Namibe), while numbers have declined in some of the other provinces (i.e. Cabinda, Luanda Benguela). It would appear that in some cases it has not been possible to update the data at each census and the information from the previous census has been used as a best estimate (e.g. the number of fishers in K. Sul in 2001 and 2003 and the number of fishers in Benguela in 1995 and 1998).

10.4 FISHING METHODS USED IN ARTISANAL FISHING

- **Handlines ('Linha')** involve the use of line and hooks and are used on board all three types of boats referred to above. This is a fairly selective fishing method and the number of hooks per line varies significantly (between 1 and 5) according to the species targeted. Clarity must still be obtained on species specific hook layouts. It is an important factor because it has a significant bearing on effort calculations. Handlines are used frequently by artisanal fishers because of their efficiency in the capture of the more valuable species. Handlines require the least capital investment of all the gear types, and this also partly accounts for the widespread use as a gear type. This method also tends to capture larger individuals. The size of the hooks generally used varies between 4/0 and 8/0. (Hook sizes of 1/0 to 3/0 are used in inland fisheries)

- **Beach seine ('banda banda')** is a fishing method where the net is normally pulled by collective effort of fishers of both sexes. A canoe or 'chata' is generally used during the placing of the net at sea. The net is loaded onto the boat and one end is attached to long ropes held by people on the shore. The net is rowed out to sea, deployed either blind or around a shoal of fish, and the other end is then rowed back to shore. The team of people or crew then pull both ends of the net towards the shore. There are no data available on mesh size. Angolan law envisages that the use of beach seining will be reduced and be substituted gradually by other fishing methods because there is a perception that the technique has a negative impact on populations of juvenile fish that are present in the inshore region.

- **Gillnet ('Emalhar')** of which there are two types utilised in artisanal fishing, namely:
  a) **Surface gillnet** is the method used by boats to capture small pelagics (i.e. sardinella, horse mackerel, sardine, African lookdown fish etc.). The nets are made of nylon, are often longer than 100 metres with a net depth that varies between 4 and 5 metres. The size of the mesh is defined by law, and ranges between 33 and 40 mm mesh (side).
  b) **Bottom gillnet** is the method used by boats for the capture of demersal species. The nets are made of cotton or nylon thread, with considerable length that may reach 3000 metres on larger vessels and a height of between 4 and 5 metres. The size of the mesh is also defined by law and generally varies between 40 and 60 mm mesh (side).

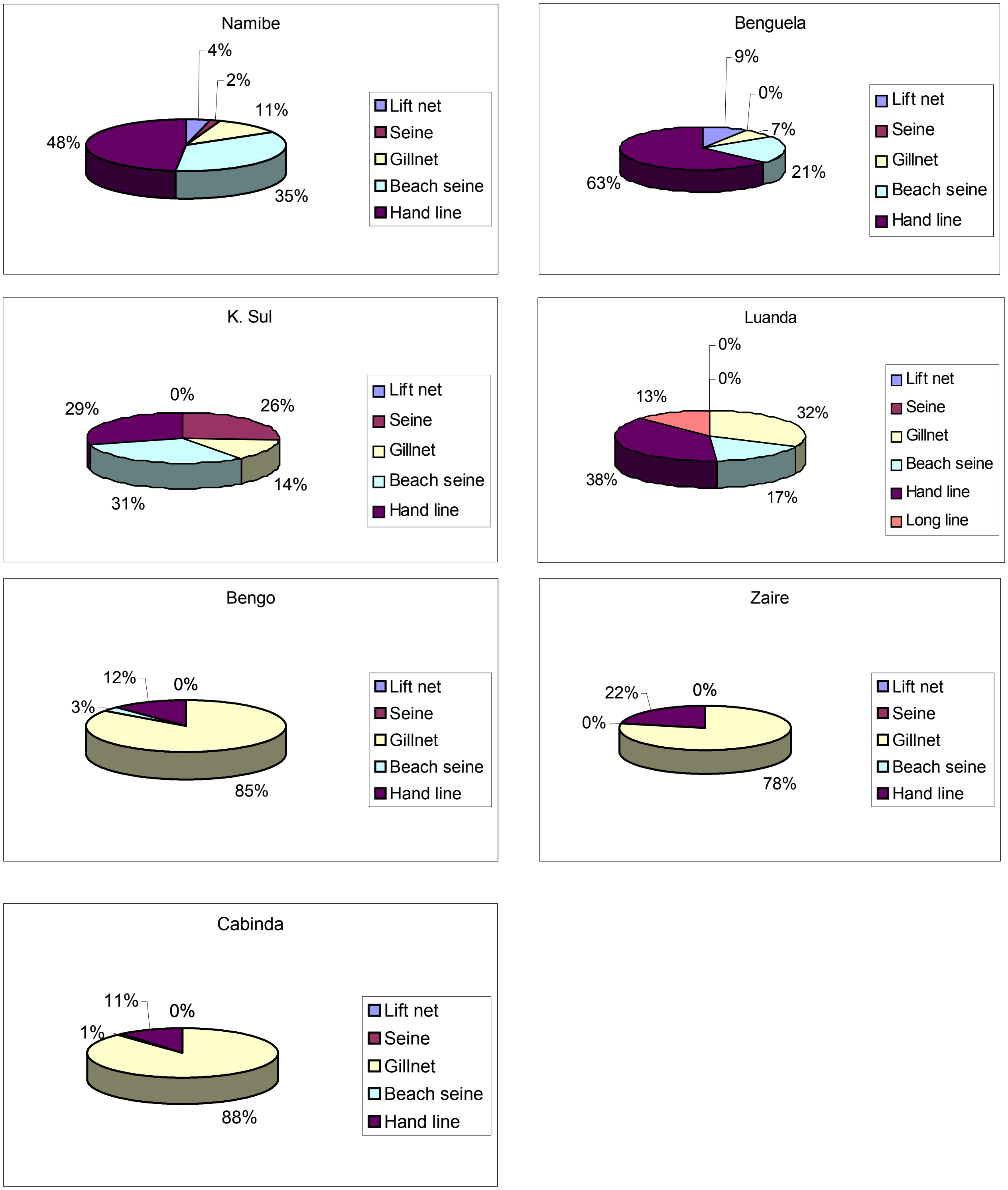
- **Seine net ('rapa')** is the method used for the capture of small shoals of pelagic fish by artisanal boats. It is used only in the southern provinces, (Kuanza Sul, Benguela and Namibe). A fairly small net is deployed to encircle a shoal of fish and then retrieved by hand by the crew of a single boat. There are no data available on mesh size.

- **Lift net ('Armação')** is a method similar to gillnetting and is aimed at capturing pelagic and demersal species. A very long gill net is deployed close to the coast and soak time may be as long as 2 days. The fishing operation may involve 4 or more 'chatas' or 'catrongas'. Nets are retrieved by a winch on the shore or by using a tractor. This type of method is used more in southern Angola (Benguela and Namibe) than in the central and northern provinces. The colder water of the southern provinces allows the soak time to be extended without risk of spoilage of fish trapped in the net. Apparently a similar method is used in Kuanza Sul but the net is laid at sea and not retrieved from the shore. Clarity must still be obtained on the operation of this gear type.

- **Poling ('linha-varra')** is a method used only for tuna. A baited hook or lure is attached to a pole by a short line. Hooked tuna are brought on board by means of a gaff.

Fishing operations differ considerably from north to south (Figure 5). In the southern and central provinces (Namibe, Benguela, K. Sul and Luanda), a variety of techniques are used including various seines. Handlines provide a significant proportion of the catch in these areas. The further north fishing communities are located the more they use gillnets as the principal fishing gear. These gill nets target mainly demersals and reef fish.

Figure 5: Relative use of different fishing gears in seven provinces in Angola (2001)



10.5 FISHING OPERATIONS

Fishing operations tend to be carried out by young people as they are much stronger than old people. Fishing is conducted every day if the sea is calm but not often on Sundays unless it has not been calm enough to fish on the Saturday. Fishing operations appear to vary from community to community and the number of fishers per boat varies along the coast (Table 16). Gillnets may be set in the late afternoon and collected the following morning. A major constraint on fishing operations is that in the hot weather the fish spoil very rapidly in the net and in the boat after collection. Aside from the education campaigns that it has undertaken with the fishers, the IPA has, since 2001, initiated another campaign to promote the use of insulated ice boxes that are being provided on a credit basis in order to improve the quality of fish landed. The use of ice to preserve products after capture is practiced by some groups of fishers from fishing communities situated near cities such as Cabinda, Luanda, Porto-Amboim, Benguela (Baia-Farta) and Namibe. This ice is provided by private enterprises that buy the fish catch.

Canoes are rowed or paddled by a crew of two or three people and each trip may last only a few hours. Fishers do not venture very far from the shore and their home beach because of the unstable and unseaworthy nature of their craft. 'Chatas' carry a crew of 4-5 and stay at sea for a maximum of 24 hours (usually 6 - 8 hours). However, on line fishing boats the crew may carry bags of salt on the boat in order to salt the catch at sea and they may stay at sea for 4- 5 days. If the catch is not salted the fish would spoil over such a long time period. Line fishing and gill netting boats also sometimes carry ice. If the boat carries ice then a trip may last up to 4 days. If there is no ice and no salt then the trip lasts only about 8 hours. In some cases the 'catrongas' and semi-industrial boats only go out overnight and come back in the morning and only if there is no moon. It is not clear what fishing operation takes place in this instance but the method and timing indicate netting of small pelagics. Boats using seine nets do not use handlines. When gillnets are laid overnight, fishers often sleep on the boats out at sea to guard the nets, because the industrial and semi-industrial boats come in illegally close to the shore to fish, and either drag the gill nets or damage them severely with their propellers. Also, if the boat has an engine, fishers may stay out at night to economise on fuel in the hot season. Much of the landed catch is salted, particularly in rural areas because there are no buyers for fresh fish and no freezer capacity. Salted fish are baled and trucked out of the area at convenient intervals.

On multi-day linefish boat trips, each fisher keeps the fish he caught. When fish are removed from a line, each man chops the tail of his fish in a special way so that the individual catchers' fish can be distinguished when they are offloaded. Ashore the catch is sorted into individual catches and the women in the family of each fisher process the catch. In gill netting operations, the gillnet catch is shared among the fishers, with the boat owner also receiving a share of the catch for the use of the boat. Processing involves 'flecking' the fish (opening along the back with the belly acting as a hinge), salting in large concrete vats containing a strong salt solution and then placing the fish on a drying rack. Each fisher has his own drying rack.

Table 16: Fishing activity in relation to boat type and crew composition, and likely production per working shift

Boat	Method	Crew	Outings/week	Fishing hours	Ice	Production /day (kg)
Canoes	Handline	3	7	8	no	60
	Gillnet	3	7	8	no	60
	Beach seine	8	5	2-3	no	100
'Chata' (without motor)	Handline	4	7	8	no	90
	Gillnet	4	6	8	no	90
'Chata' (without motor)	Beach seine	5-10	6	2-3	no	120
'Chata' (with motor)	Handline	4	6	6-7	yes	250
	Gillnet	4	6	6-7	yes	250
'Catronga'	Handline	12-14	4	9	yes	500
	Gillnet	12-14	4	9	yes	500

Note: The data in Table 10 reflects fishing trips where no salt is carried. When salt is carried on the boats fishing trips last about five days.

10.6 EFFORT

Although the number of fishers and the number of boats is decreasing (Table 10), the efficiency of individual boats may be increasing through the gradual acquisition of outboard engines, better safety gear and better nets. Thus, effective effort is probably increasing. It would be useful to examine the changes in the proportions of each boat type that has an engine in the various provinces between 1996 and 2003 and any changes with time in the proportions of the various boat types in the provincial fleets. It is not possible to do this in this initial analysis, but is something that should be examined in more detail in a follow-up phase of the project.

There may also be some problems with the sampling programme in the recording of effort. In the earlier years the sampler assumed that all boats went out when in fact many of them were not functional. Even today, sometimes only half the number of boats present in a particular community are actually functional. Furthermore, in a fishing community, at any particular time only 20-30% of the fishers may be active mainly because of a lack of gear and boats. In addition, total and sectoral catches are estimated every year but the number of boats is surveyed only every 2 years. Thus, new or broken boats could be uncounted for as much as 24 months. Therefore, to obtain a meaningful effort estimate, it becomes important to assess effort and catch per unit effort on the basis of the number of boats and crew that are actually going to sea rather than the number of boats or fishers present in the fishing community. Current data collected by the samplers appear to record catch and effort at this level of precision. Improved availability of nets and improved availability of repair materials has also had a significant impact on effort. In some of the extrapolations made before 2000, if the sampler was not able to access an area for safety reasons, then the assumption was made that the effort capability was the same as the last estimate available. In some cases this may significantly over or underestimate effort. Clearly this has occurred in some areas (see Table 15).

It is difficult to evaluate the standard effort capability associated with a boat carrying gillnets. Often gillnets are torn and a crew member will bring along whatever operational net section he/she has. Thus there is not really a standard net length. Each fisher in a boat has his/her own net and may in fact have three or four nets or sections of net. Apparently there is also a change in netting practices with season. At certain times of the year fishers use monofilament nylon gill nets and at other times of the year multifilament nets are used. In summer nylon nets are used because there are fewer fish and fishing takes place far out at sea where the nets get damaged more easily. Monofilament nets are easier to repair and are thus preferred in these situations. However, fishers consider multifilament nets more effective as catching devices and, during the winter, when catches are likely to be better, they use them in preference to monofilament nets.

10.7 CATCHES

Artisanal fishers catch a wide array of species (Table 17). Species range from small pelagic shoaling fish to demersal fish and reef sharks, invertebrates and large pelagic predators. It has not been possible to identify with certainty all the species at this stage.

Table 17: Fish species captured by artisanal fishers on the Angolan coast (data from IPA and field observations)

Species	Common name	Angolan Name
Arius spp.	Catfish	Bagre
Galeoides decadactylus	African threadfin	Barbudo
Pomadasys incisus	Grunter	Bolo-Bolo
	Unknown	Bacalhau
Dentex + Sparus spp	Large-eye dentex + other sparids	Cachucho (Only small fish = Cachucho. Large Sparids = Pargo)
Umbrina canariensis	Canary drum	Calafate
Umbrina canariensis	Canary drum	Corvina Preta (In Namibe Province)
Aristeus varidensis *Parapenaeus longirostris*	Shrimps or prawns	Camarao/Gamba Camarao
	Unknown	Camuchilo
Brachideuterus auritus	Bigeye grunt	Camutungo
Carangid Spp.	Kingfish	Caranguejo
Trachurus trecae. Minor catches of *T. t. capensis*	Horse mackerel	Carapau
Scomber japonicus	Mackerel	Cavala
Pomadsysidae	Grunt spp.	Colo-colo
Pelates quadrilineatus *Pseudotolithus typus* *Pseudotolithus senegalensis* *Pseudotolithus elongates* *Miracorvina agolensis*	Croaker	Corvina
Coryphaena equiselios	Dorado	Dourado
Trichiurus lepturus	Hair tail/Ribbonfish/Snakefish	Espada
	African ilisha	Faneca
Lithognathus mormyrus	Sand steenbras	Ferreira
Various spp. grouper	Rockcods	Garoupa
Panulirus regius *Scyllarides herklotsri* *Jasus lalandi*	Lobsters. In the south only	Lagosta
Cynoglossus spp.	Sole	Linguado
Caranx spp Trachinotus spp.	Kingfish and pompano	Macoa

Pomadsysidae?	Grunt spp.	Matona
Unknown?	Grunt spp.	Marionga
Diplodus sargus capensis	White seabream/Blacktail	Mariquita
Euthynnus alletteratus	Little Tunny	Merma atum
Sparus pagrus *Sparus auriga* *Sparus africanus* *Sparus caeruleostictus.*	Seabream spp.	Pargo (Only large individuals) (See Cachucho for small sparids
Seriola lalandii	Yellowtail amberjack	Peixe Azeite
Belonidae albumes hians		Peixe Agulha
Plectorhinchus mediterraneus	Rubberlips grunt	Peixe Burro
Solene dorsalis	African lookdown fish	Peixe Galo
Merluccius spp. *Sphyraena spp.*	Hake Barracuda	Pescada (only in Namibe & Benguela). Pescada (K. Sul to Cabinda)
Argyrosomus hololepidotus	Southern meagre/Kob	Pungo (= v. big Corvina)
Raiidae	Ray spp.	Raia
Pomadsys jubeleni *Pomadasys incisus*	Spotted grunter or grunter	Roncador
Conger vulgaris	Conger eel	Safio
Sardinella aurita & madarensis	Sardine	Sardinha
Sardinops sagax	Sardine	Savelha
Sarda sarda	Blue bonito;katonkel	Serrajão
		serra
		Taco-taco
Liza Mugil etc	Mullet spp.	Tainha
	Shark spp	Tubarão
Branchiostegius semifasciatus	Zebra tilefish/Tile zebra	Zebra
	Others	Outros
Zeidae	John Dory	?
Sqatina africana	Angel fish	?

Note: Calafate and Corvina Preta are pooled for analysis. There are also some other inconsistencies in this table that cannot yet be resolved.

Total captures in each province vary considerably, with more fish being caught in the southern provinces (Namibe and Benguela) than in the north (Table 18). However, there are generally high catches in central Luanda because of the very high fishing effort associated with the large urban population. It is also evident that in many of the provinces there was a large increase in total catch in 2001 and 2002 compared with previous years. This can apparently partly be attributed to an increase in the use of lift nets (Armacao) and partly as a result of the repairing of numerous boats that were broken and could not fish in previous years. The increase may also be the result of considerable under-reporting of catches in earlier years. This has significant implications for any mathematical resource modelling and the ArtFish database will have to be examined in some detail to resolve these queries.

Table 18: Total catches (tons) by province between 1996 and 2003

Province	1996	1997	1998	1999	2000	2001	2002	2003	2004
Cabinda	7914	1328	1419	1098	1466	4813	3691	3807	8997
Zaire		459	660	952	2169	2238	5707	6286	15811
Bengo	2156	892	523	781	2188	7048	2032	833	2079
Luanda	12529	6885	5093	6159	8938	9768	25125	7995	14377
K. Sul	4169	2793	2441	2174	2918	6573	6844	12747	12407
Benguela	8648	12260	6888	7345	11933	9113	46561	29355	23925
Namibe	3512	5307	9041	9448	10278	10863	36619	29605	27364
Total	38928	29924	26065	27954	39890	50420	126579	90628	104960

N/A: Not available

The reduction in catches in Luanda, Benguela and Namibe in 2003 may be the result of one, or a combination, of the following factors:

- The reduction in the number of boats in these provinces
- The irregular submission of records on the part of samplers, caused by delays in the payment of their subsidies
- The reduction in the use of beach seine nets and the occasional shift of the seine net gear in Benguela from the artisanal fishery to semi-industrial control
- The problem of oil residue spills in the Bay of Namibe

Catches are highly seasonal, with considerably better catches in both the northern and southern provinces from May to November than in the summer months (Figure 6). This is probably a result of the winter reversal of the inshore current and higher levels of primary production as a result of upwelling. A large proportion of the total catch is made in Benguela and Namibe (Table 18). There is generally a fairly well marked separation of species captured in the northern and southern provinces, with a high proportion of small pelagics captured in the southern provinces of Benguela and Namibe and mainly bottom fish and tuna captured in the central and northern provinces.

The use of seine nets is confined almost exclusively to the provinces of Namibe and Benguela where small pelagics are common. However, significant numbers of these fish are captured by beach seine nets as far north as Luanda.

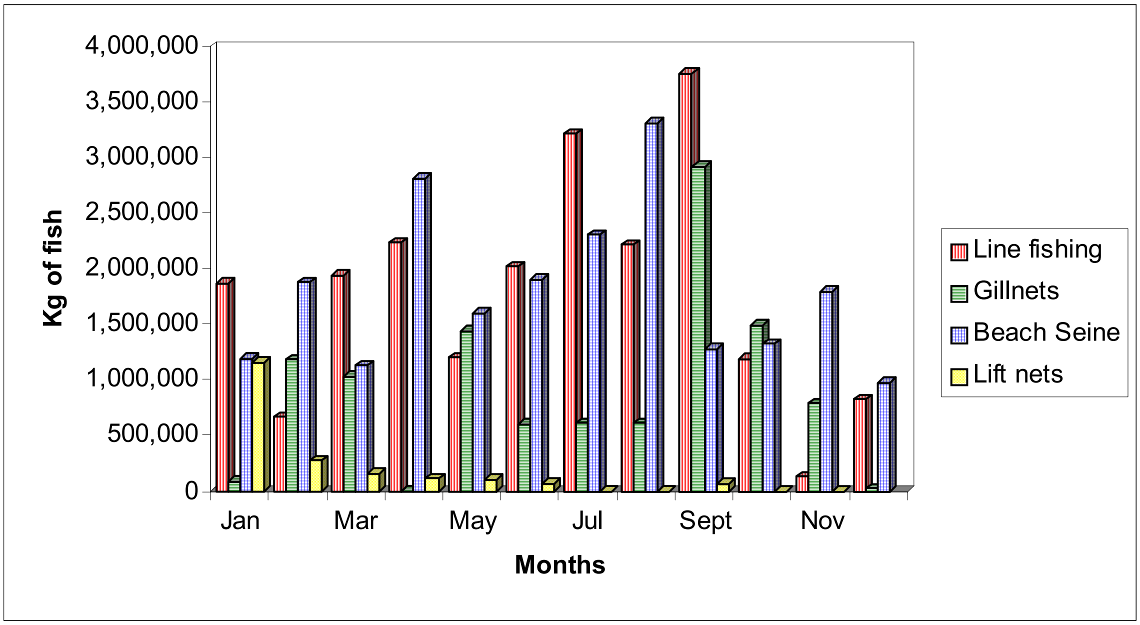


Figure 6: Total catches in 2002 for different gear types by season for the Benguela province

Invertebrates

There appears to be a fairly significant lobster fishery along the entire Angolan coast and catches amount to 100 – 200 tons a year and may be as high as 700 tons a year (Figure 7). In the provinces of Luanda, Kuanza Sul and Bengo, *Panulirus regius* appears to be the principal species captured. In the south it is likely that *Jasus lalandii* is caught but this is not yet certain. The highest catches appear to come from Luanda, Bengo and Kuanza Sul, however, lobster data are not reliable due to there being no control on the capture of lobsters. Some fishers deliberately target lobsters and lay nets across known lobster bearing reefs in the summer months. However, in many cases the lobsters are a by-catch of the gillnet fishery for reef finfish. The lobster fishery has the potential to be of considerable value but as is the case for all other species caught by the artisanal sector, access to markets is a major problem. Lobsters have an advantage in that animals do not die in the nets and they are often kept in shallow-water floating cages until a buyer appears. No annual lobster biomass survey is presently conducted.

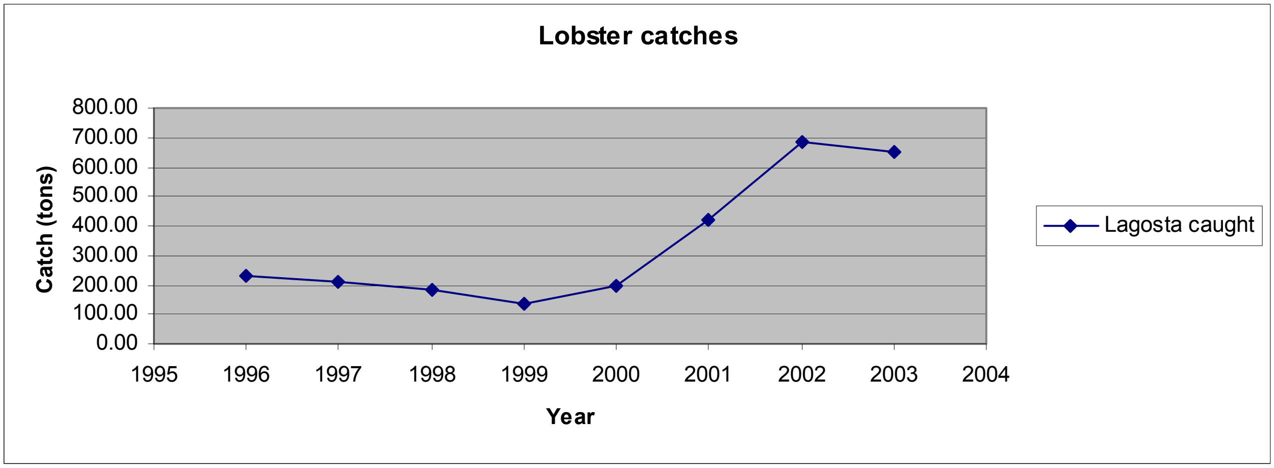


Figure 7: Lobster catches along the Angolan coast betwen 1996 and 2003

Cockles are caught in Luanda Bay and sold on the open market. There is no purification process and apparently the bivalves have high coliform counts, which limits their desirability for human consumption.

10.8 CATCH PER UNIT EFFORT

In general, the number of fish caught per fishing trip is dependent on the season and on the type of boat and gear used (Figure 6, Table 19). In summer there is not as much fish and a boat may only get 60-80 kg in a fishing trip. In winter the catch may be a ton for a single trip. Motorised 'chatas' catch about twice as much as those without motors and 'catrongas' catch considerably more fish per trip than 'chatas', presumably because these bigger boats carry more crew and larger nets (Table 19). The start of the 'good' fishing season is considered to be in May (Figure 6).

Table 19: Average daily captures for 2001 by boats using different types of fishing methods (kgs of fish per fishing trip).

Methods	January	March	April	June	August	November
'Chata' (without motor) - handline	107	180	205	169	256	236
'Chata' (without motor) - beach seine	456	615	207	356	268	215
'Chata' (without motor) - gillnet	67	69	325	107	170	201
'Chata' (with motor) - handline	242	280	507	351	563	333
'Chata' (with motor) - gillnet	123	103	68	176	343	256
'Catronga' – handline	339	567	356	562	568	713
'Catronga' – seine net	1023	2048	3737	613	1717	1789
Lift net ('Armação')	1127	1307	2364	1862	1300	1816

According to Table 19, the lift net and seine net methods show the best average capture rates during the period under consideration. It must be noted that these data are averaged across the entire artisanal fishery along the Angolan coastline. It would be useful to examine catch per unit effort (CPUE) by gear type on a regional basis. In addition it must be noted that catrongas carry more crew than chatas, and therefore have more lines in the water during linefishing operations, and can carry and manage larger nets.

Catch per unit effort is a complex fishery index and a careful analysis of the input data is required in order to achieve a realistic indication of fishery status, particularly in a mixed species multi-gear fishery such as the Angolan artisanal fishery. Some of the problems associated with CPUE indexes will be outlined in the sections on management, and initial analysis of available data on the Angolan artisanal fishery.

11 THE POTENTIAL USE OF THE IPA DATABASE FOR FISHERIES MODELING

This section is a preliminary examination of the management value that can be derived from the data gathered in the sampling programme for the artisanal sector. At this stage we do not make any assumptions about present or future management regimes for the fisheries, although it is accepted that these are not standard industrial/commercial type fisheries and hence the output controls typically used in those kinds of fisheries (e.g. TACs and individual quotas) are probably inappropriate – choices from the suite of input controls would perhaps be more appropriate.

It is understood that the critical data that are gathered are done so by means of two data forms, the first being a record of catches from landings sampled, and the second being a record of fishing effort, expressed as number of landings and the length of each fishing trip. 15 vessel/gear combinations are defined, and the data are gathered within these vessel/gear categories. There are 25 species/species groups used for data gathering purposes. Spatial/geographic information is represented by province (provincia), municipality (municipio) and beach (Local). Temporal information is limited to the date of landing and the length of the fishing trip. Fish quantities are expressed in kilograms, we assume this implies green weight. This information represents a sample only, and is not a complete record of all landings.

The data described above can be used to estimate total annual landings by species, by geographical delineation, and also to calculate catch-per-unit-effort. However, the data are limited because they only represent a sample, and therefore certain extrapolations would have to be made to estimate total catches. Hence the defensibility of the extrapolations are subject to the quality of the data and validity of the assumptions supporting the extrapolations.

With regard to catch-per-unit-effort, the data can potentially be used to obtain estimates of trends in the 'health' of particular species. It is suggested that the appropriate measure of CPUE is kg/landing. However, as is typical in CPUE information, the data that are gathered represent the CPUE from a mixture of different vessels and gear types, times of the year and geographic localities. It is therefore not adequate to simply calculate the average CPUE per year to estimate the inter-annual trends in catch rate, because each year the data may be balanced in a different way with respect to month and vessel-cum-gear types. The standard approach to dealing with these data is to employ a statistical technique called generalized linear modeling to simultaneously account for the effects of geography, time of year, year, vessel and gear type. Although this sounds like a very technical approach, it is actually very logical. For example, let us assume we wanted to calculate the mean CPUE for January and February, but in January we have 2000 records, and of these 50 records are from vessels with outboard motors on, and there are 4000 records in February, and 2000 of them are from vessels with outboard motors. Although one can calculate the monthly mean CPUE, it will not tell one much about the January to February trend in CPUE, because of the different mix of vessels with and without outboard motors in these months. So what one would probably want to do is split the dataset into two, one being the January and February dataset for vessels with outboard motors, the other dataset for January and February for vessels without outboard motors. Then one might calculate the percentage difference between January and February for data with and without outboard motors, and then average those two numbers to come up with a percentage of the average difference in CPUE between January and February. This all sounds logical, but consider how complicated it gets when one looks more closely and realizes that there were actually two ports sampled, and the one port is much closer to very rich fishing grounds than the other one. However, the January data was mostly collected at the port in the not so rich area, while the February data was collected mostly at the port near to the rich fishing area. Now, although one might want to follow a similar method to obtain a mean percentage change in CPUE from January to February, it becomes much more complicated, and this just involves 2 vessel types, 2 months and 2 ports. Imagine the complexity when there are 15 vessel/gear combinations, 25 species, 12 months, 8 years, >30 landing sites. It is clearly impossible to do this analysis using Excel, and hence the emergence of GLM software which automates these calculations.

An important conclusion from this preliminary study is that the data could be used to obtain the residual year effect from the CPUE data using a GLM analysis. There are a number of caveats. First of all, the ideal way that data should be recorded to lend itself most readily to GLM analyses, is that for each landing sampled, the following information is recorded:

1. Vessel name
2. Date of landing
3. Gear type
4. Some measure of the extent of deployment of the gear, e.g. number of days at sea, soak time.
5. Tonnages of fish of different species landed.

The two data capture forms that have been reviewed appear to record the data in this way. Although the catch and effort information is split into two forms, superficially the natural link that exists between the catch and the effort data appears not to have been broken. We must still investigate in more detail whether catch and effort data can be reliably re-united for calculation of CPUE. This depends on the integrity of the underlying database, and the exact structure of the database has not as yet been reviewed. An issue that is particularly important is whether the number of landings on the effort data sheet correspond on a one-to-one basis to the catch recorded on the catch form. For example, if on 3 January 2004, the effort form records 23 landings with vessel/gear 'Ca BB', is this a measure of all landings made on that day with that vessel/gear type 'Ca BB', or only those landings for 'Ca BB' for which catch samples and catch estimates were made? If the one-to-one correspondence exists, i.e. both catch and effort only refer to sampled landings, then one can calculate an average catch rate for that day and for that vessel/gear type. But even if this one-to-one correspondence is in place, there are a number of additional caveats. We must also establish clarity on the issue of the number of days at sea during each fishing trip, since this can have a bearing on the catch that is achieved. Typically, if a resource is declining, then fishers will deploy more effort to try to maintain catches. This may involve more days at sea, more use of salt and ice, longer or a greater number of gillnets – for example gillnets are commonly linked together, effectively doubling the fishing effort. None of the data forms have place for recording these changes which would imply deployment of greater amounts of effort per unit of landing. Therefore, any trends in CPUE that might be obtained from the GLM analyses referred to above, will potentially underestimate the extent of any declines in those resources that are under pressure. Nevertheless it is anticipated that the GLM analysis will reveal valuable first estimates of trends in the species that are exploited, and this analysis also has the potential to highlight whether there are areas where trends are worse than others, indicating areas that may need protection. The analysis also has the potential to highlight hotspot areas or times of the year, and these may correspond with spawning aggregations. These times and areas may also be deserving of special protection.

There are a number of statistical packages available which can be used for the GLM analysis, and given the current state of evolution of this technology, the actual analyses can be run off fairly quickly for each of the 25 species reflected in the data entry forms. Overall, the cost benefit trade-off for such a research exercise is anticipated to be in favour of benefits. One of the many outcomes of this analysis might be to refine any retrospective estimates of total landings by time, area and gear type. This would only be possible if estimates of time and area effort deployment can be obtained, i.e. not just the effort that has been sampled.

12 INITIAL ANALYSIS OF AVAILABLE DATA ON THE ANGOLAN ARTISANAL FISHERY

12.1 SUMMARY

A number of difficulties were encountered in acquiring data from a sampling program of catches and effort in the artisanal fishing sector in Angola initiated in 1995 with the support of FAO. Ultimately this study was based on data for the period 2002 – 2005. Data was also gathered for three months of 1996, but not integrated into the results presented here. We emphasise here the importance of long term data for fisheries population studies, and point out that any insights into long term trends for fish stocks is compromised by the relatively short time period covered by the bulk of the data gathered. We found that the ArtFish database system used to store the data was not well suited to the general statistical investigations contemplated, and as a result a data extraction tool was developed in Excel and Visual Basic to transfer the data into the SPSS statistical platform. ArtFish appears well suited to providing estimates of total catches based on sample data. This is an important function that needs to be carried out by IPA, so we do not propose to diminish its value in this respect. Our statistical analyses were limited to an attempt to standardize the data in order to detect residual information relevant to trends in population abundance for the 10 species that make up about 70% of the annual catch. A number of technical obstacles, such as a high proportion of records reflecting a zero catch for particular species, were dealt with using standard approaches. The final results appear to be quite optimistic – only one species seems to show a clear decline over the period considered. Furthermore, 7 out of 10

species show a strong upturn in CPUE for 2005. This upturn is based on 2005 data up to July and so it seems likely to be a good omen for the balance of 2005. **We caution that the window of time 2002-2005 is very short and hence any trends observed could be the result of favourable interannual trends in resource availability and may not necessarily reflect trends in resource abundance**. **The work reported here should be treated with some caution, given its somewhat preliminary nature. A large amount of additional work would be required to gain confidence in the trends presented.** In particular, the acquisition of additional earlier data would significantly strengthen any statement of trends. Also, a number of diagnostic checks and modifications to the standardized results presented here fall outside the scope of this study but should be contemplated for future studies.

12.2 INTRODUCTION

OLRAC, as part of its involvement in Component B of BCLME Project LMR/AFSE/03/01 undertook to provide a preliminary analysis of data collected as part of a coastwide programme in Angola to draw samples from the artisanal fishery. This is a multispecies fishery conducted using multiple gear types, at dozens of landing sites in the 7 coastal provinces of Angola.

According to records, the 'Sampling Programme for the Statistical Control of Fishing Catches and Effort in the Artisanal Sector' was started in 1995, financed by French co-operation and the support of FAO. Initially, 17 beaches in 6 of the 7 coastal provinces were selected (Zaire province was initially excluded). By 1998 the study involved 20 beaches in 7 coastal provinces. By 2000, a total of 55 beaches were being sampled.

It would appear that the primary management tool in this fishery is an output control on the total annual catch summed across all species and artisanal gear types. Output controls in such fisheries, when used as the sole management measure, are not generally thought to be effective, and this statement carries the implication that the fishery is at risk of further depletions in some of the key species. Fisheries such as this, in which there are a large number of independent users (numbering in the thousands rather than the tens), and in which there is such a high degree of dependence by the user group on the resource base for daily survival, are perhaps better managed by means of input controls, primarily time and space closures, and/or gear restriction. Nevertheless, as a result of the apparent overarching management measure, the artisanal fisheries sampling protocol seems designed to obtain an estimate of the total annual catch, to determine whether the threshold tonnage is being exceeded. This is evident from the structure of the sampling programme which is being conducted, and the supporting software. The latter lends itself to extrapolating annual catch estimates based on samples, but it does not facilitate the use of the data for other statistical aims, such as for example, carrying out long term population studies. As a result of this, little effort has been made to preserve the data since the start of the sampling program, and it seems that some data has been either lost, or would require substantial investment to recover. Most population studies are best based on data gathered from long term monitoring programs. Had such goals been considered as part of the sampling program, then the preservation of the data would have been of paramount importance.

At an early stage of this project OLRAC's strategy was to try to gather the raw data from the sampling program, even though summaries of the data were available in a variety of different formats. At that stage our strategy regarding the data was motivated by a view that such data had the potential to form the basis for GLM (Generalised Linear Model) analyses of the CPUE data. Such analyses are standard first steps in obtaining estimates of trends in resource abundance. Experience has shown that GLM analyses should be based on the data in its raw form, since summarized versions of the data in effect corrupt many of the key assumptions underlying GLMs.

As it turned out, **the acquisition of the data has proved to be by far the most challenging aspect of the study**. We attempt to present to the reader some of the reasons for the difficulties that were encountered. Aside from any of the technical details, problems of communication across a language barrier was a major factor

Once a significant proportion of the available data was in hand, the next step was to carry out certain numerical studies on the data as precursors to the application of GLM technology. In particular, it was necessary to verify whether the most fundamental assumptions underlying GLM analyses were satisfied. In this regard, the ArtFish database system used for storing the data, and its associated data extraction tools were found to be unsuitable investigative tools, since this system has hardwired into it the basic intention of carrying out catch estimation, necessitating appropriate weighting techniques designed to extrapolate the samples up to a full year of coastwide catches. For purposes of GLM analysis it is necessary to have access to the unweighted raw data. We were unable to access this in a user friendly manner from the ArtFish database. Instead, a decision was made at a relatively early stage to develop custom built data extraction software to extract the data and transfer it into a powerful multipurpose statistical platform. The SPSS software tool was chosen as the tool for the statistical work. This product offers the breadth of data preprocessing and data analysis functionality suited to a fisheries research environment.

12.3 DATA ACQUISITION

Based on discussions with lead researchers in BCLME Project LMR/AFSE/03/01B and with researchers in the artisanal fisheries sector in Angola, it is understood that since about 1996, Angolan authorities have been engaged in a sampling program aimed at artisanal fisheries involving sampling at beach level. However, the initial tranche of data that was supplied to OLRAC via the EEU at UCT only involved data for three years, viz. 2002, 2004 and 2005. The frequency distribution of these data is shown in Table 20.

Based on the frequency distribution in Table 20 it was concluded that it was improbable that the initial tranche of data represented the entire dataset that had been collected since 1996. However, numerous attempts by IPA representatives to copy additional data off their computers failed to produce additional or different data.

As a result OLRAC, in collaboration with UCT, sent Mr Klay Martens of SPSS-South Africa to IPA in Angola to carry out onsite data extraction. This yielded additional information for the period 2002 – 2005, as shown in Table 21.

Table 20: Frequency of landings sampled by year in the artisanal data initially made available to OLRAC

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2002	68	1.0	1.0	1.0
	2004	6007	92.3	92.3	93.3
	2005	436	6.7	6.7	100.0
	Total	6511	100.0	100.0	

Table 21: Frequency of landings sampled by year in the artisanal data collected in August 2005, specifically for the period 2002 – 2005

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2002	11633	43.0	43.0	43.0
	2003	7532	27.8	27.8	70.8
	2004	6195	22.9	22.9	93.7
	2005	1691	6.3	6.3	100.0
	Total	27051	100.0	100.0	

In addition, Mr Martens was supplied with three stiffy discs purportedly containing data for the years 1996, 1997 and 1998. A subsequent analysis of the information copied while in Angola for the period 1996, 1997 and 1998 showed that the 1996 disc only contained information for October, November and December 1996, and no actual data for 1997 and 1998. It seems that the 1996 – 1998 data was stored using a DOS version of the ArtFish software, while the 2002 – 2005 data was stored using a Windows version of the ArtFish software. For reasons unknown, the original transfer of the 1996 to 1998 data onto stiffies for safe-keeping was unsuccessful in respect of 1997 and 1998, and subsequently the computer on which the original data was stored has fallen into disrepair. It is by no means certain that the 1996 data for October to December represents a full account of all data that was captured for the year 1996, whether on paper, or subsequently onto a digital format of some sort. Efforts are underway to have the hard disc of said broken computer removed and physically transported to Cape Town for analysis and possible data extraction purposes. These efforts have not arrived at any conclusion at the time of writing.

Aside from these factors, Mr Martens was informed by Angolan researchers that there was no data available for 1999, 2000 and 2001. The director of IPA recently confirmed that the data was lost when IPA acquired new computers and no backup of this data exists. Hard copies of the CPUE data for this period is however, available.

A further difficulty is that the format of the DOS data for 1996 is very different to the format of the Windows version of the ArtFish database, hence at this stage no integrated analysis of the 1996 and 2002 – 2005 data is presented here, or is contemplated within the scope of the present project. The necessary integration is relatively easy to achieve, albeit time consuming.

Lastly, it became evident at a late stage that there were some inconsistencies between the first tranche of 2002 – 2005 data (earlier supplied to OLRAC via EEU, UCT) and the second tranche that was obtained as a result of Mr Marten's visit to Luanda. The key difficulty that we encountered was that site names and gear-vessel codes as well as province names and some species names differed between the two tranches. Since upper and lower case is sufficient for a computer to see two names as different, this presented something of a difficulty with respect to integrated analyses. This should be seen as a serious shortcoming of the database system. In typical database applications this kind of problem is avoided by the use of drop-down lists with a set of predefined names in one and only one format for storage in the database.

At this point, in order to be able to analyse the data without the constraints and limitations of the ArtFish software system, OLRAC developed a custom designed data extraction utility which was able to extract the data from the ArtFish database system into native SPSS datafiles. This data extraction utility was developed in Excel using VBA. There were basically four operations that had to be implemented. The first was changing the Spanish/Portuguese convention for numeric variables, using commas to denote decimals, to the English/American convention using decimal points to denote decimals. All files subsequently created had to be checked to verify that the correct conversion was achieved (about 300 files). The second operation was to extract catch and species data linked by key variables to the sampling framework using VBA commands. The third operation was loading the actual frame, activity and effort data, and the fourth task was simply loading in the active days data from ArtFish. This gave rise to three files which were then merged into a single file using SPSS functionality.

The reason that OLRAC chose to expend the resources to develop this software solution for data extraction is that ArtFish is a system which has basically been designed, so it appears, with a view to developing, via a process of extrapolation, estimates of annual catches and CPUE based on a subsample represented by the available data. Consequently, ArtFish records information pertaining to the effort that could be expended at particular fishing sites per month or per year, and it is easy to see how one might extrapolate from the records in which effort and catch is linked, to all effort that might have been deployed.

As such the ArtFish data capture software, and its associated reporting tools, do not lend themselves to other types of investigation. SPSS is a powerful statistical tool which does accommodate a very broad range of statistical investigations, hence the efforts to transfer the raw ArtFish data into native SPSS format seemed to be warranted. The power of SPSS to provide researchers with powerful statistical options was demonstrated to Angolan scientists who were impressed with the capabilities thus made available. The duplication of site names, species names, vessel and gear types and province names in slightly different formats, but which are obviously viewed as completely different by the computer, became evident when we started to analyse the tranche 1 and 2 combined dataset as extracted in SPSS by this data extraction utility. However, it seems important to consider exactly how ArtFish views these duplications, and whether the necessary integration is occurring within ArtFish for purposes of producing reliable estimates of annual catches. Our preliminary analysis of this indicates that since there is no duplication within a particular year, this is not a problem from the point of view of catch and effort estimates. However, it obviously becomes a problem when long term analyses are required, such as were contemplated by the authors.

There are no technical obstacles to rectifying this problem inside the SPSS software environment, it is just a matter of having the time and being able to confer with persons knowledgeable about Angolan fisheries to agree on what sets of names actually refer to one and the same thing. OLRAC has made a first level attempt at eliminating these duplicates. This should be regarded as a preliminary analysis since it was not possible to engage with relevant experts in the Angolan artisanal fishery at this stage of the project. Such an exercise should be shelved for a later, possibly more detailed, study.

Our emphasis on attempting to extend the length of time covered by the data by making significant efforts to gather legacy data sets reflects our intention to try to use the data to carry out analysis which might provide insight into population trends. Such trends can only typically be reliably detected over time scales of at least 5 to 10 years.

The data extraction/conversion utility involved two different types of extracts. The first focused on catch information from samples, and the second focused on the sampling intensity. The following variables were extracted to the SPSS .sav data file dealing with both types of data, which were merged into a single datafile:

1. Year
2. Month
3. Day
4. Major Stratum (province)
5. Minor Stratum (municipality)
6. Specific Site (a beach or other specific landing site for fishing vessels)
7. Vessel-gear combination (a single variable representing a combination of vessel types, e.g. canoe, and gear type, e.g. gill net).
8. 59 species specific catch sample variables (see Table 29)
9. Duration – i.e. the duration of the fishing trip in units of days (we found out later that this variable was also used at times to indicate accumulation of information recorded over a number of different trips and/or vessels).
10. Sample – the total weight of the catch sample across all species
11. Total – the total weight of the catch – in most cases Sample = Total
12. Units – the number of vessels that the sample refers to (most commonly a value of 1 is used).
13. Active Vessels
14. Sample Vessels
15. Active Frame
16. Active Days

Each record in the database represents one sampling event. A sampling event may however capture information dealing with multiple trips or days (if DURATION > 1) and it may also refer to more than one vessel (if UNITS > 1). The last four variables listed are the essential information which allows the information sampled to provide the basis for estimating the total catch along the Angolan coastline at sites that are sampled. The Active Frame represents the maximum possible number of vessels that could be involved in fishing activity on a given day. However, since it is uncertain whether all possible vessels are fishing, this must be determined for purposes of inferring total catch amounts. The 'Sample Vessels' variable is the number of vessels that were checked to see whether they were active or not. Ideally the entire Active Frame should be checked but this is impractical. In general most of the 'Sample Vessels' values are blank, implying (by strict definition in the database) that the entire Active Frame was checked. The number of Active Vessels represents the number of vessels that were eventually found to be active, out of those sampled to see whether they are active. To give an example, if there are a total of 34 vessels at a beach, then this is the Active Frame. On a given day the sampler checks 20 of these vessels to see whether they are fishing on that day. So Sample Vessels = 20. Out of these 20, 6 are found to be active, so Active Vessels = 6. The implication is of course that the total number of active vessels = 34 x 6/20, an assumption that would underly the extrapolation of the catch sample information to a total catch estimate.

12.4 INITIAL PERUSAL OF THE DATA

Some important features of the data are shown in Tables 22 - 29. For example, Table 22 shows a frequency table of the 'Duration' variable. At first sight, this table raise questions about the quality of the data in the database, given that 'Duration' is defined as the number of days for a fishing trip being sampled, and given that the artisanal vessels used do not generally have the capability of staying at sea for extended periods of time. Mr Martens followed up on this matter while in Luanda, and as a result we now understand that duration actually reflects recorded data which has been accumulated over more than one trip. The details of exactly how this is done prior to recording data on paper or digitally are not particular clear for now, however this means that all daily catch rates calculated from this data set have to be divided by duration to reduce them to an amount pertinent to a day's catch. In fact, given this, effort is defined as the product: DURATION*UNITS.

The major regional breakdown of the sampling data is shown in Table 24. This reflects a well balanced spread of data across coastal provinces. Table 29 shows the percentage breakdown of the catch by species, as well as the cumulative catch. This table shows that out of 59 species which are recorded, 15 species make up 80% of the total catch on a mass basis, while only 10 species make up 70% of the total.

12.5 SELECTED ANALYSES, AND THE POTENTIAL FOR RESEARCH BASED ON THE DATA

The data that has been gathered provides a wealth of information that can support fisheries management in a variety of different ways. However, for purposes of this document, it is taken to provide information on the catch rates of different fish species, i.e. CPUE data. CPUE in the context of the artisanal fisheries database is given by CATCH/(UNITS * DURATION). That is, we used catch in kilograms per day per vessel as a unit of CPUE. CPUE data is of importance in fisheries management because it contains information about the abundance of a stock. The more abundant the stock, the higher will be the CPUE.

A standard approach in fisheries management is to subject CPUE data to GLM methods. GLM methods are intended to remove bias in nominal annual CPUE mean trends. The sort of problem one runs into when failing to 'GLM standardize' CPUE data can be understood from the following illustration. Suppose that fishing is carried out in winter or summer, but catches in summer are much better than in winter. In 1999, suppose most fishing takes place in summer, while in 2000, most fishing takes place in winter. This is an extreme situation intended to illustrate a point. The problem is that, even if the fish population size has not changed between 1999 and 2000, because of the preponderance of winter fishing in 2000, the nominal CPUE in 2000 will be smaller than 1999, perhaps erroneously indicating a decline in resource abundance. (the word 'nominal' used in this context indicates that a straight average across all available records for 1999 and/or 2000 is calculated).

Table 22: Frequency of landings sampled by duration in the artisanal data made available to OLRAC

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	10	.0	.0	.0
	1	18656	69.0	69.0	69.0
	2	1186	4.4	4.4	73.4
	3	1859	6.9	6.9	80.3
	4	1031	3.8	3.8	84.1
	5	1359	5.0	5.0	89.1
	6	142	.5	.5	89.6
	7	76	.3	.3	89.9
	8	354	1.3	1.3	91.2
	9	46	.2	.2	91.4
	10	1275	4.7	4.7	96.1
	11	7	.0	.0	96.1
	12	70	.3	.3	96.4
	13	3	.0	.0	96.4
	14	3	.0	.0	96.4
	15	163	.6	.6	97.0
	16	6	.0	.0	97.0
	17	7	.0	.0	97.1
	18	1	.0	.0	97.1
	19	2	.0	.0	97.1
	20	452	1.7	1.7	98.7
	21	16	.1	.1	98.8
	25	86	.3	.3	99.1
	30	134	.5	.5	99.6
	34	1	.0	.0	99.6
	35	13	.0	.0	99.7
	39	4	.0	.0	99.7
	40	24	.1	.1	99.8
	42	5	.0	.0	99.8
	43	3	.0	.0	99.8
	45	1	.0	.0	99.8
	50	24	.1	.1	99.9
	60	10	.0	.0	99.9
	70	5	.0	.0	99.9
	80	4	.0	.0	100.0
	85	5	.0	.0	100.0
	90	8	.0	.0	100.0
	Total	27051	100.0	100.0	

Table 23: Frequency of landings sampled by 'UNITS' in the artisanal data made available to OLRAC

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	26587	98.3	98.3	98.3
	2	188	.7	.7	99.0
	3	30	.1	.1	99.1
	4	55	.2	.2	99.3
	5	10	.0	.0	99.3
	6	8	.0	.0	99.4
	7	11	.0	.0	99.4
	8	4	.0	.0	99.4
	9	3	.0	.0	99.4
	11	4	.0	.0	99.4
	12	4	.0	.0	99.5
	13	4	.0	.0	99.5
	14	3	.0	.0	99.5
	15	1	.0	.0	99.5
	16	4	.0	.0	99.5
	17	3	.0	.0	99.5
	18	7	.0	.0	99.5
	19	3	.0	.0	99.5
	20	10	.0	.0	99.6
	22	2	.0	.0	99.6
	24	1	.0	.0	99.6
	25	1	.0	.0	99.6
	26	7	.0	.0	99.6
	27	2	.0	.0	99.6
	28	8	.0	.0	99.7
	29	5	.0	.0	99.7
	30	5	.0	.0	99.7
	31	1	.0	.0	99.7
	32	2	.0	.0	99.7
	36	5	.0	.0	99.7
	37	26	.1	.1	99.8
	56	1	.0	.0	99.8
	60	11	.0	.0	99.9
	64	1	.0	.0	99.9
	67	1	.0	.0	99.9
	71	2	.0	.0	99.9
	74	1	.0	.0	99.9
	75	1	.0	.0	99.9
	77	1	.0	.0	99.9
	78	4	.0	.0	99.9
	80	1	.0	.0	99.9
	82	2	.0	.0	99.9
	84	2	.0	.0	99.9
	86	2	.0	.0	99.9

89	1	.0	.0	99.9
97	2	.0	.0	99.9
100	2	.0	.0	100.0
109	6	.0	.0	100.0
110	1	.0	.0	100.0
134	3	.0	.0	100.0
1066	2	.0	.0	100.0
Total	27051	100.0	100.0	

The GLM approach provides a means of removing such biases, also termed systematic effects. In the example just outlined, the GLM involves comparing like with like to get an estimate of the true change in abundance between the two years. So for example, one would calculate the ratios of catches in December 1999 to December 2000, November 1999 to November 2000, … up to January 1999 to January 2000. A ratio for 2000 versus 1999 would then be given by the average of all the monthly ratios. This average ratio would then be viewed as a fair indication of the change in population size between 1999 and 2000.

Table 24: Frequency of landings sampled by major strata in the artisanal data made available to OLRAC for the 2002 – 2005 period

MAJOR STRATA

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	BENGO (BGO)	1118	4.1	4.1	4.1
	BENGUELA (BGA)	4393	16.2	16.2	20.4
	CABINDA (CBA)	2197	8.1	8.1	28.5
	KWANZA SUL (KSL)	5806	21.5	21.5	50.0
	LUANDA (LDA)	3956	14.6	14.6	64.6
	NAMIBE (NBA)	5729	21.2	21.2	85.8
	ZAIRE	3852	14.2	14.2	100.0
	Total	27051	100.0	100.0	

Table 25: Number of valid and missing records for the 'ACTIVE VESSELS' variable in the dataset

N	Valid	22901
	Missing	4150

Table 26: Number of valid and missing records for the 'SAMPLE_VESSELS' variable in the dataset

N	Valid	22901
	Missing	4150

Table 27: Number of valid and missing records for the 'ACTIVE_FRAME' variable in the dataset

N	Valid	22901
	Missing	4150

Table 28: Number of valid and missing records for the 'ACTIVE_DAYS' variable in the dataset

N	Valid	26829
	Missing	222

This general approach must of course be extended to consider situations involving a mixture of different systematic effects. In the case of the Angolan artisanal fisheries data, the systematic effects involve different months, years and fishing locations, as well as different vessels and gear types. The additional complexities that arise when there are multiple effects such as this necessitate the use of sophisticated computer algorithms, and these are developed on the basis of a general mathematical and statistical statement of the problem which is not repeated here. For our present purposes, the following key elements of a GLM analysis are:

(1) the specification of the main factors in a linear model, and

(2) the choice of statistical assumptions.

A major problem in a multispecies fishery such as the Angolan artisanal fishery, from the point of view of standardizing the CPUE data, is the occurrence of a large proportion of zero catches for each of the species under consideration. This means that it is not possible to log-transform the CPUE data under the assumption of lognormality. CPUE data invariably show features typical of a lognormal distribution, but this is also frequently complicated by the occurrence of zero catches, something that the continuous log-normal distribution does not permit. Note that by logtransforming the data one of the assumptions of the GLM, that residuals are normally, or symmetrically distributed, is satisfied; i.e. when the raw data is lognormally distributed.

In order to deal with the problem of zero catches, the analysis was done in three parts (following an approach that is typically used in fisheries science where zero catches are frequently encountered).

Table 29: Cumulative catches by species. Readers are referred to Table 17 for common names (Note there are inconsistencies with regard to the relationship between species and Angolan names that cannot be resolved within the scope of this document.)

1	**Cachucho**	*Dentex + Sparus spp.*	17.89	17.89
2	**Corvina**	*Pelates quadrilineatus*	14.44	32.33
3	**Carapau**	*Trachurus trecae*	10.71	43.04
4	**Sardinha**	*Sardinella aurita/S. madarensis*	9.22	52.26
5	**Garoupa**	*Grouper spp.*	3.44	55.69
6	**CorvinaPreta**	*Umbrina canariensis*	2.99	58.68
7	**Espada**	*Trichiurus lepturus*	2.82	61.50
8	**Savelha**	*Sardinops sajax*	2.76	64.26
9	**Tubarao**	*Shark spp.*	2.63	66.88
10	**Burro**	*Plectorhinchus mediterraneus*	2.30	69.18
11	**Pungo**	*Argyrosomus hololepidotus*	2.25	71.43
12	**Bagre**	*Arius spp.*	2.24	73.66
13	**Pargo**	*Large Sparus pagrus*	2.01	75.67
14	**Cavala**	*Scomber japonicus*	1.85	77.52
15	**Barbudo**	*Galeoides decadactylus*	1.79	79.31
16	**MermaAtum**	*Euthynnus alletteratus*	1.70	81.01
17	**Outros**	*Other spp.*	1.66	82.67
18	**Camutungo**	*Brachideuterus auritus*	1.56	84.23
19	**Linguado**	*Cynoglossus spp.*	1.42	85.65
20	**Galo**	*Solene dorsalis*	1.28	86.94
21	**Roncador**	*Pomadasys jubeleni*	1.20	88.14
22	**Safio**	*Conger vulgaris*	1.13	89.27
23	**Raia**	*Raiidae* spp.	1.01	90.28
24	**Marionga**	*Unknown Grunt spp.*	0.88	91.16
25	**ColoColo**	*Pomadasys* Grunts	0.86	92.02
26	**TacoTaco**	*Sarda sarda*	0.81	92.84
27	**Macoa**	*Caranx /Trachinotus spp.*	0.78	93.62
28	**Ferreira**	*Lithognathus mormyrus*	0.70	94.31
29	**Pescada**	*Sphyraena spp.*	0.66	94.97
30	**Tainha**	*Mullet spp.*	0.61	95.58
31	**Matona**	*Pomadasys*? grunts	0.60	96.18
32	**Lagosta**	Lobster spp.	0.59	96.77

33	**Agulha**	*Belonidae albumes*	0.48	97.25
34	**Serrajao**	*Sarda sarda*	0.43	97.69
35	**Caranguejo**	*Caranx spp.*	0.42	98.10
36	**Azeite**	*Seriola lalandii*	0.34	98.44
37	**Camuchilo**	*Unknown*	0.29	98.73
38	**Mariquita**	*Diplodus s. capensis*	0.22	98.95
39	**Camarao**	*Prawn spp.*	0.19	99.14
40	**Serra**	*Sarda sarda*	0.16	99.30
41	**BoloBolo**	*Pomadasys incisus*	0.13	99.43
42	**Bacalhau**	*Unknown*	0.13	99.56
43	**Mero**	*Unknown*	0.07	99.63
44	**Dourado**	*Coryphaena equiselios*	0.07	99.70
45	**Merma**	*Euthynnus alletteratus*	0.07	99.77
46	**Atum**	*Euthynnus alletteratus*	0.04	99.81
47	**Caboz**	*Unknown*	0.04	99.86
48	**Choco**	*Unknown*	0.03	99.89
49	**Godinho**	*Unknown*	0.03	99.92
50	**Cerra**	*Unknown*	0.02	99.94
51	**Cacolo**	*Unknown*	0.02	99.95
52	**Calafate**	*Umbrina canariensis*	0.01	99.97
53	**Gaiado**	*Unknown*	0.01	99.98
54	**Zebra**	*Branchiostegius semifasciatus*	0.01	99.98
55	**Piaz**	*Unknown*	0.01	99.99
56	**Liro**	*Unknown*	0.01	100.00
57	**Plombeta**	*Unknown*	0.00	100.00
58	**Tabanqueiro**	*Unknown*	0.00	100.00
59	**Samarrote**	*Unknown*	0.00	100.00

1. Firstly, records of fishing days in which a positive catch was taken were isolated and the usual GLM analysis was conducted on these records to produce standardised CPUE series subject to the occurrence of a non-zero catch. CPUE in this case is defined as the catch in kilograms for each record divided by effort, where effort is the product of the DURATION and the UNITS variables.

2. Secondly, a binary logistic regression was conducted to produce a standardised series of the probability of occurrence of fishing days with non-zero catch, i.e. the probability that a given fishing day will yield at least some measurable catch of the species concerned.

3. Thirdly, the first series (1 above) is multiplied by the second series (2 above) to obtain a standardised series of expected CPUE which has been corrected for systematic effects.

Given limitations on the scope of this research, we present a limited set of estimates. The following main effects were considered for both the GLM and the binary logistic regression, on a species by species basis:

1. Vessel-gear,
2. Year,
3. Season (i.e. quarter, where q1 = Jan, Feb, March, and so on).
4. Major stratum

Results based on this approach should be regarded as preliminary since no attempt has been made to address possible covariance between the catch rates of the different species.

Furthermore, we have not carried out any detailed diagnostic checks to verify that the assumptions of the GLM are satisfied. For example, because some records actually represent cumulative catches over more than one vessel (UNITS > 1) or more than one fishing trip (DURATION > 1), the residual variance is most likely inversely proportional to fishing effort (given by UNITS*DURATION). This complication can be dealt with by weighting each record by the inverse of UNITS*DURATION. This weighting has the potential to provide a more reliable and valid set of GLM results, however, such analyses were regarded as lying outside the scope of this study. Finally, no interactions were addressed (often spatial shifts in distribution interannually give rise to interactions in the GLM analysis), and the spatial location parameter that has been chosen is very coarse (province only). With regard to the latter, minor stratum (representing municipality) or site (representing beach) have the potential to provide greater resolution in the model fits, but we had a problem with the duplication or triplication of site names described above. Sorting out the site names is an exercise that requires expert input not available at the time of writing. We note however that in view of the probable sedentary behaviour of some of the species under consideration, as is the case for many reef species, local depletions might occur. Such effects would not be detectable at the level of province, but only perhaps at the Minor Stratum or Site level. Investigations at this level of spatial resolution represent an important opportunity for further work.

Another complication for the GLM analysis is that there may well be important correlations between the CPUE for different species. These correlations could arise in different ways, and have the potential to invalidate the GLM analysis. They may imply that in studying the CPUE of a given species, it becomes necessary to consider the CPUE of another species as a covariate.

Such an adjustment might be necessary where targeting for preferred species is taking place, but the extent of targeting varies over time. Such processes, when not properly addressed, have the potential to bias the estimates of resource trend obtained from the GLM analysis. We looked at this problem by studying the correlation matrix of CPUE by species. This matrix is presented as Table 30. It is clear from this table that there are few if any strong correlations between these 10 species for the CPUE variable. This suggests very generally that there is no need to consider the introduction of covariates into the GLM. There are various counterpoints to this statement which cannot be explored in any detail here. For example, it may be that a different conclusion will be reached if the analysis is conducted in the context of a GLM model. Considerations such as this have not been addressed here.

All the complicating factors that are listed above represent further work to be done which, if coupled with the acquisition of some of the data for the period 1995 – 2001, mean that there is still substantial potential to be unlocked in the data. Such investigations would be far more elaborate than those reported here, but it is recommended that they be given serious consideration. We also recommend that such work be conducted partially collaboratively with Angolan artisanal researchers, since it seems quite crucial to impart to this community an appreciation of the importance and value of preserving long time series of data.

Table 30: Correlations of the CPUE between the 10 species contributing 70% of the total catch in the database (N = 27041)

		Cachucho	Carapau	Garoupa	Corvina Preta	Corvina	Sardinha	Espada	Savelha	Tubarao	Burro
Cachucho	Pearson Correlation	1	-.021(**)	.129(**)	.101(**)	.294(**)	-.021(**)	.080(**)	-.027(**)	-.003	.126(**)
	Sig. (2-tailed)		.000	.000	.000	.000	.001	.000	.000	.620	.000
	Covariance	75431.911	-1234.511	2389.648	1816.924	15029.372	-1281.394	2496.117	-610.556	-40.801	1599.091
Carapau	Pearson Correlation	-.021(**)	1	-.026(**)	-.002	-.032(**)	.170(**)	-.014(*)	-.012	-.017(**)	-.018(**)
	Sig. (2-tailed)	.000		.000	.791	.000	.000	.022	.055	.004	.004
	Covariance	-1234.511	44926.823	-376.648	-22.464	-1269.033	8181.236	-333.443	-205.285	-181.853	-171.501
Garoupa	Pearson Correlation	.129(**)	-.026(**)	1	.269(**)	.056(**)	-.023(**)	.160(**)	-.028(**)	-.026(**)	.390(**)
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000	.000	.000
	Covariance	2389.648	-376.648	4557.672	1195.991	698.840	-355.737	1220.812	-159.132	-87.471	1213.681
Corvina Preta	Pearson Correlation	.101(**)	-.002	.269(**)	1	.027(**)	.047(**)	-.010	-.012	.037(**)	.352(**)
	Sig. (2-tailed)	.000	.791	.000		.000	.000	.090	.058	.000	.000
	Covariance	1816.924	-22.464	1195.991	4322.211	332.978	694.408	-76.632	-62.875	120.292	1066.134
Corvina	Pearson Correlation	.294(**)	-.032(**)	.056(**)	.027(**)	1	-.021(**)	.091(**)	.044(**)	.113(**)	.051(**)
	Sig. (2-tailed)	.000	.000	.000	.000		.001	.000	.000	.000	.000
	Covariance	15029.372	-1269.033	698.840	332.978	34718.280	-888.740	1920.763	684.601	1033.677	441.230
Sardinha	Pearson Correlation	-.021(**)	.170(**)	-.023(**)	.047(**)	-.021(**)	1	-.011	.061(**)	-.011	-.017(**)
	Sig. (2-tailed)	.001	.000	.000	.000	.001		.082	.000	.066	.005
	Covariance	-1281.394	8181.236	-355.737	694.408	-888.740	51555.259	-271.367	1158.756	-124.956	-179.165
Espada	Pearson Correlation	.080(**)	-.014(*)	.160(**)	-.010	.091(**)	-.011	1	-.012	-.004	-.007
	Sig. (2-tailed)	.000	.022	.000	.090	.000	.082		.050	.558	.259
	Covariance	2496.117	-333.443	1220.812	-76.632	1920.763	-271.367	12772.04	-111.734	-19.815	-35.751
Savelha	Pearson Correlation	-.027(**)	-.012	-.028(**)	-.012	.044(**)	.061(**)	-.012	1	.048(**)	-.019(**)
	Sig. (2-tailed)	.000	.055	.000	.058	.000	.000	.050		.000	.001
	Covariance	-610.556	-205.285	-159.132	-62.875	684.601	1158.756	-111.734	6907.399	197.187	-74.422
Tubarao	Pearson Correlation	-.003	-.017(**)	-.026(**)	.037(**)	.113(**)	-.011	-.004	.048(**)	1	-.005
	Sig. (2-tailed)	.620	.004	.000	.000	.000	.066	.558	.000		.409
	Covariance	-40.801	-181.853	-87.471	120.292	1033.677	-124.956	-19.815	197.187	2421.982	-11.399
Burro	Pearson Correlation	.126(**)	-.018(**)	.390(**)	.352(**)	.051(**)	-.017(**)	-.007	-.019(**)	-.005	1
	Sig. (2-tailed)	.000	.004	.000	.000	.000	.005	.259	.001	.409	
	Covariance	1599.091	-171.501	1213.681	1066.134	441.230	-179.165	-35.751	-74.422	-11.399	2123.924

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed)

12.6 PRELIMINARY CPUE STANDARDIZATION RESULTS

A set of preliminary results of the GLM/binary logistic analyses are presented in Figs8a-j. Results are presented for the 10 species which make up 70% of the catch by mass, viz.:

1. Cachucho
2. Corvina
3. Carapau
4. Sardinha
5. Garoupa
6. CorvinaPreta
7. Espada
8. Savelha
9. Tubarao
10. Burro

Each Figure of 8a-j contains 5 different panels. These present the following results:

- Panel 1: Results of the binary logistic regression. The final estimates of the probability of achieving a non-zero catch.

- Panel 2: Results of the GLM analysis of the non-zero CPUE data. Results show the standardized CPUE estimates for non-zero catches of the species.

- Panel 3: The product of the values in Panel 1 and Panel 2. These should be read as the best estimates of trends in the CPUE, but corrected for the systematic effects mentioned. In carrying out the standardization median values were chosen for each of Vessel-gear, Month and Major Stratum. As a result the actual values would not necessarily compare meaningfully with nominal CPUE values.

- Panel 4: The nominal CPUE, i.e. the annual average CPUE on a per species basis per year. The extent to which trends in Panels 3 and 4 differ reflects the extent to which the systematic effects are thought to have biased the nominal CPUE trends.

- Panel 5: This result is identical in concept to the Panel 3 results, except that the plot is presented with respect to month instead of with respect to year.

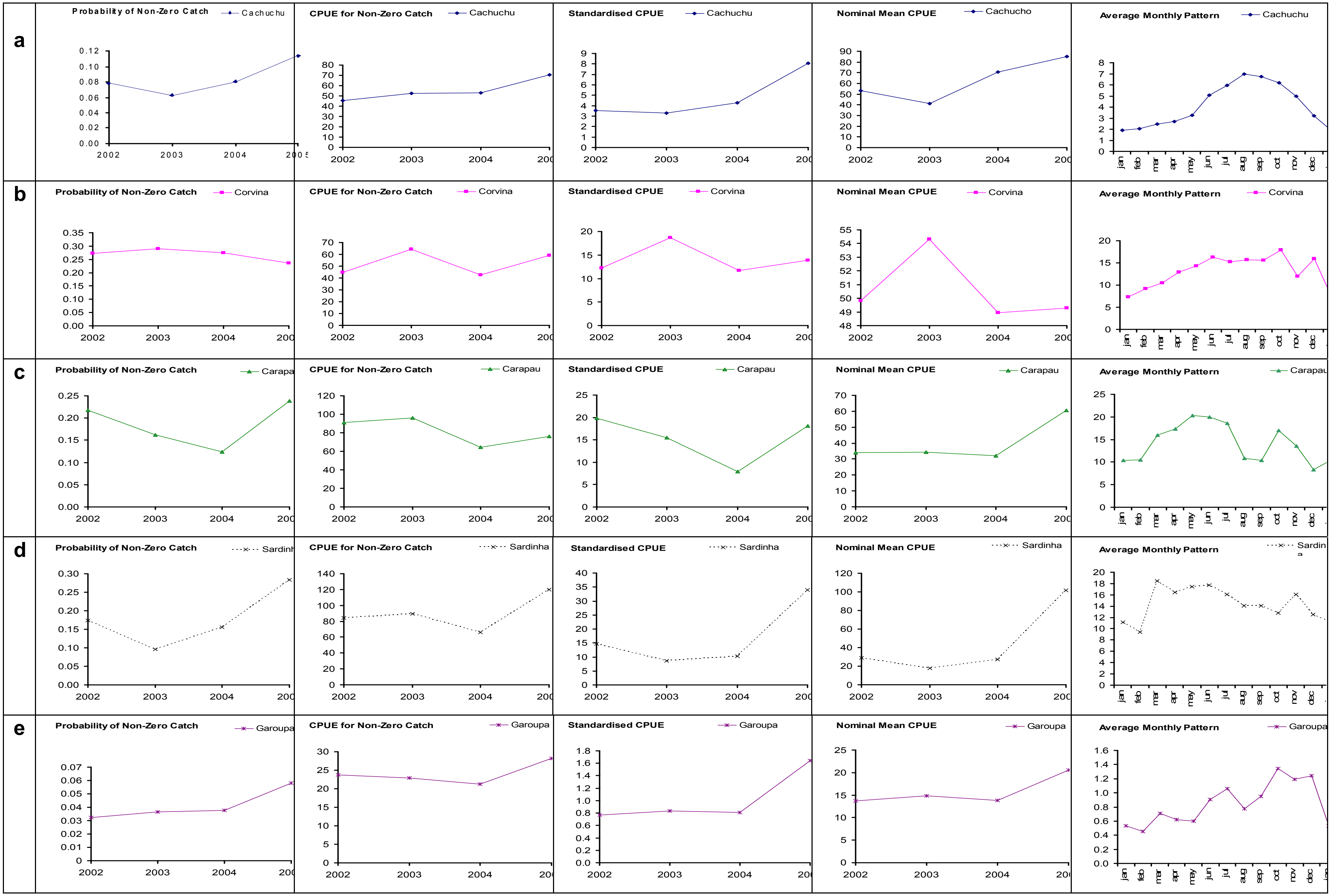
It is appropriate to view Panel 3 as the best available estimate of trends in abundance for each species from 2002 to 2005. In doing so it is also customary to recognize the presence of two types of error with respect to the relationship of this trend to the true population trend. The first is measurement error, which relates to the adequacy of the available sample, and the appropriateness of the models (GLM/binary logistic) for pinning down the trend with sufficient accuracy. The second is process error, which says that no matter how intense the sampling was, and even if the model used to standardize the data was perfect, there would still be error due to interannual variation in the catchability of the species in question. As a result it is only appropriate to infer some overall increase or decrease in the time series, and not to over-interpret particular annual features. Indeed, with such a short time series, even drawing conclusions about the presence of an increase or a decrease may overstate the quality of the data (we have not carried out any statistical tests for this here). This highlights yet again the additional value that one should expect to flow from complementing this study with data from the 1990's. Given these caveats, we note the following features in the trends:

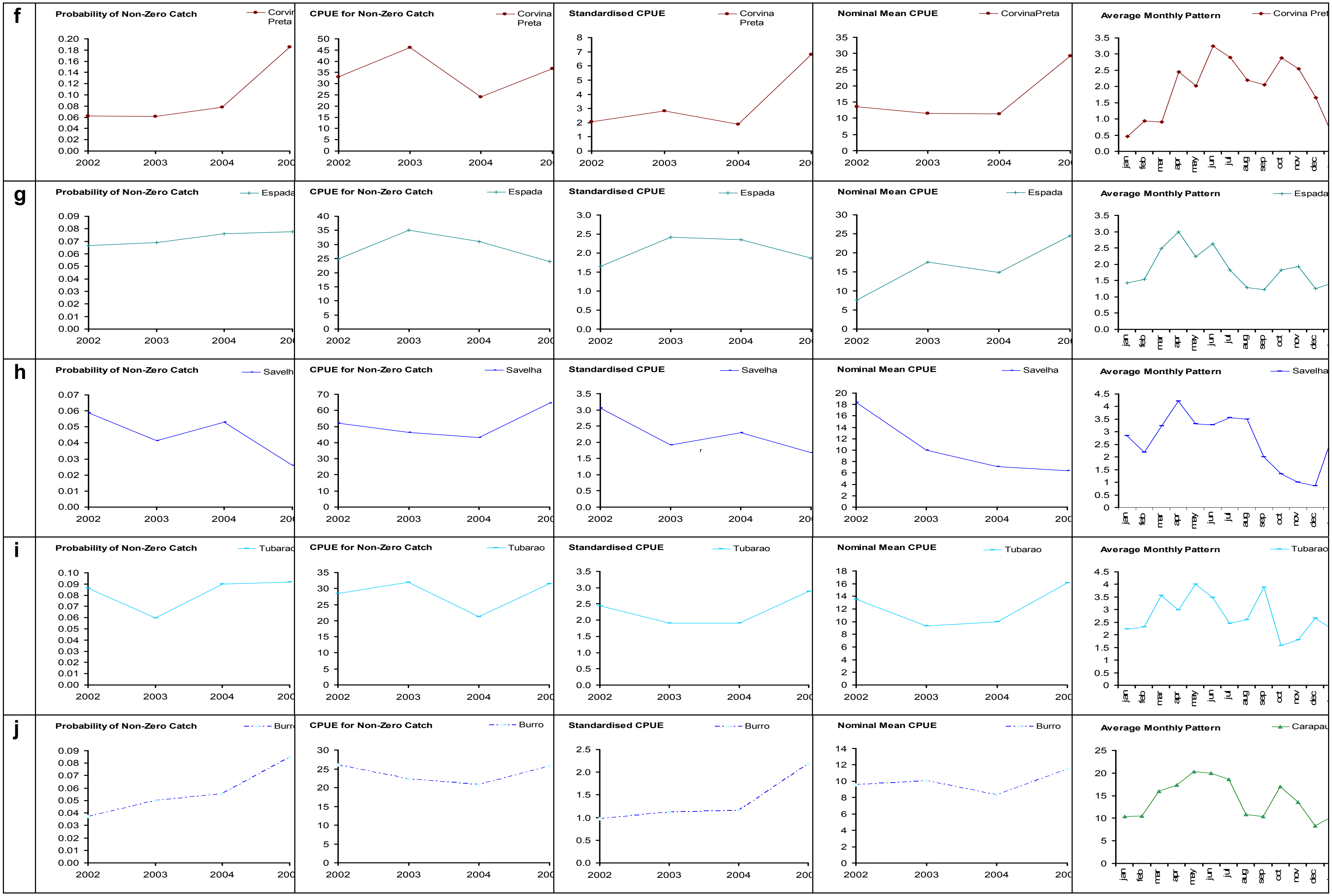
- 7 of the ten species show an upturn in 2005, suggesting that 2005 has been a good fishing year – it would be interesting to verify this perception against the perceptions of the fishermen. This may be a very good indicator that 2005 will be a good year overall, since it is based on data for the months of January – July for 2005.

- In general there seems little evidence for a decline over the period shown, with the exception of **Savelha**. However, viewed pessimistically, the shortness of the time series means that there might have been large declines prior to 2002, and it is just fortuitous that we have 'chosen' a window of time where catchability trends are such as to mask an ongoing decline in the abundance of the stocks concerned.

- The monthly trends are suggestive of certain interesting features. For example the good months for **Cachucho** are June to November, for **Corvina Preta** April to December (i.e. January, February, March are poor for **Corvina Preta**). For **Burro** winter is a better time than summer.

Figure 8: Results of GLM/binary logistic analyse




f
g
h
i
j
Probability of Non-Zero Catch
CPUE for Non-Zero Catch
Standardised CPUE
Nominal Mean CPUE
Average Monthly Pattern
Corvina Preta
CorvinaPreta
Espada
Savelha
Tubarao
Burro
Carapau
jan
feb
mar
apr
may
jun
jul
aug
sep
oct
nov
dec

12.7 PRELIMINARY CONCLUSIONS

1. We found that a substantial proportion of the data from the 'Sampling Programme for the Statistical Control of Fishing Catches and Effort in the Artisanal Sector' between 1995 and 2005 is either irretrievably lost or misplaced but still potentially available in digital form. We conclude that this reflects the fact that the value of long term data for artisanal fisheries management has not been a major priority in research planning in Angola and IPA. According to the director of IPA, the importance of managing long term data has now become a priority.

2. However, we were successful in obtaining a good dataset for the period 2002 – 2005. These data contain information which can aid in fisheries management at different levels.

3. The ArtFish database system is structured with a view to providing estimates of annual catches for different species in the fishery. This is an important line function of IPA and ArtFish seems to be designed to meet this requirement.

4. The ArtFish database system is not well suited to cater for a wide ranging and unplanned set of statistical investigations. Such investigations are better carried out on a statistical platform such as the SPSS base product.

5. OLRAC have developed a data extraction utility in Excel and Visual Basic and have created a denormalised datafile in native SPSS which is suitable for statistical analysis and is available to the project team, bearing in mind the Angolan researchers interests in the scientific value of this data and their rights in this regard.

6. A series of statistical analyses were carried out aimed at removing systematic effects from the annual nominal mean CPUE such that an index best reflecting resource biomass trends could be calculated. This involved the dual application of binary logistic and GLM techniques.

7. The final trends cover a very short window of time, i.e. only 4 points on a curve between 2002 and 2005. Their link to true trends in resource abundance should be treated with caution, for reasons described in the main text.

8. The trends are however, contrary to expectations, quite positive. For the ten main species, they do not support a view of declining resource abundance over the period 2002 – 2005, with the exception of Savelha, which does show a decline.

9. The binary logistic and GLM analyses provide other information. We present for example the intra-annual trends on a monthly basis and this gives a view on which months are good for each of the ten top species considered.

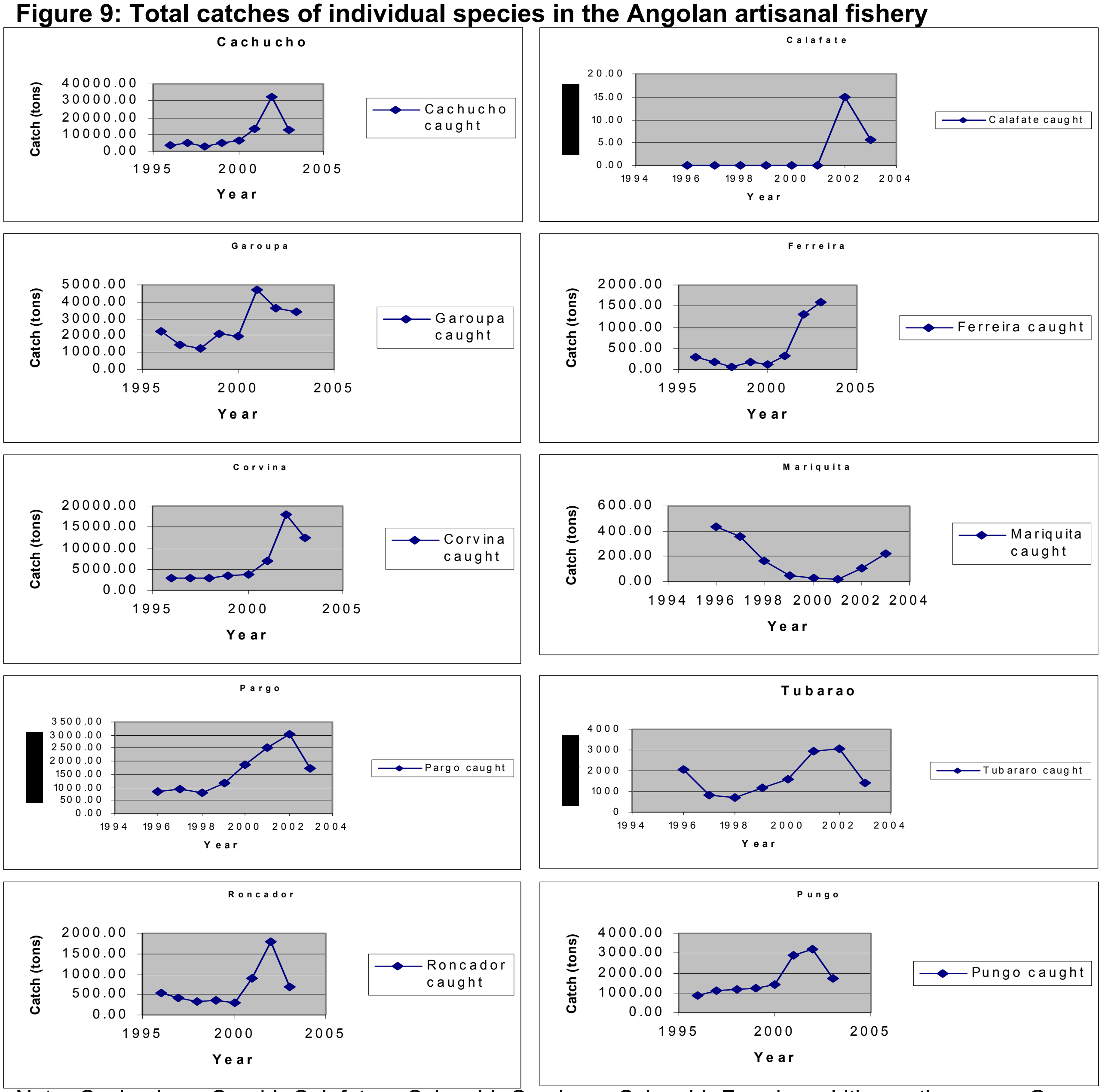
10. There is considerable potential in pursuing this work beyond the scope of this project. Such further work would involve (a) complementing this work with data from 1995 – 2001, assuming that further data can be located (b) a variety of refinements to the CPUE standardization work, (c) getting results at a finer spatial resolution than has been considered here (limited presently only to province, and much more. It is recommended that further work be contemplated.

13 MANAGEMENT

The ultimate purpose of this project is to contribute to better management of the fish resources targeted by artisanal fishers along the Angolan coastline. Currently fish stocks are assessed annually by IIM research based on pelagic and demersal stocks. However, the artisanal fishery in Angola is essentially an open access fishery. The major limitations appear to be on the length of boat used, the distance offshore that fishers may fish, and a limitation on the mesh size of gill nets. Fishers are also not supposed to fish in bays. Effectively the operational management plan is to impose some controls on the fishery related to catch and effort once total catches reach 150 000 tons a year. These controls will take the form of total catch limitations, closed areas, closed seasons and size limitations for some species (D. Augustino *pers. comm.*). Fisheries data indicate that artisanal fishers never reach the TAC of 150 000 tons, thus management authorities believe that there is not yet a stock availability problem with the artisanal fishing sector. However, this is management at a very coarse level and it may be insufficient to prevent over-exploitation of a number of the stocks that are important components of the artisanal fishery. A typical feature of the current management protocol might be the maintenance of historical catches and CPUE while individual stocks of more valuable fish were being depleted, with fishers responding by targeting less and less valuable stocks (a process of serial depletion). Over-exploitation of species that are vulnerable to heavy fishing pressure (e.g. some shark species, or reef dwelling species such as sparids and groupers, which are generally slow growing, take a long time to reach maturity and may have complex life histories) can take decades to reverse. Serial depletion of individual fish stocks is a common occurrence where management is limited to an examination of total catches only or CPUE at a multi-species level. Total catch data at a species level was examined for the years 1996–

2003 for certain species or groups of species that have shown themselves, either internationally or in the South African line fishery, to be vulnerable to high levels of fishing effort (Figure 9). This was an attempt at a very coarse level to evaluate whether current fishing pressure was impacting on Angolan fish resources. Data were initially analysed on a province by province basis but trends were obscure. Total catch of all provinces combined are presented in Figure 9. A major problem with the analysis is that monitoring effort and efficiency apparently increased markedly from 2001 onwards (D. Augustino pers comm.) and this clearly affects the interpretation of such data.

Figure 9: Total catches of individual species in the Angolan artisanal fishery



Note: Cachucho = Sparid; Calafate = Sciaenid; Corvina = Sciaenid; Ferreira = Lithognathus spp.; Garoupa = Groupers; Marquita = Sparid; Pargo = Sparid; Pungo = Sciaenid; Roncador = Pomadasid; Tubarao = Shark spp. A number of these species types have shown sensitivity to high fishing effort in other countries.

Since 2000, there have been substantial increases in the catches of all the resources shown in Figure 9. However this is likely to be an artifact of increased monitoring levels. Over the past one or two years, there have been declines in the total catches of all these resources (except Mariquita and Ferreira), which may be significant. Again, the interpretation depends on there being the same level of catch monitoring and reporting over the last two or three years.

Field information from fishers indicates that fishing pressure may already be negatively impacting artisanal fish resources. Fishers claim that the fish are no longer close to shore and they have to fish much further offshore and stay at sea much longer to achieve acceptable catches. An old fisherman claimed that in the past one could catch Pungo weighing 20–30 kg each close inshore and up to 500 kg of fish in a day. He claimed that today there are few big fish and if they get 50–60 kg of fish in a day they are lucky. Generally the fishermen claim other factors are responsible for the reduction in fish availability, such as oil spills, dumping of fish at sea by commercial boats, damage of the benthic environment by trawlers, lack of policing of foreign vessels that come and trawl close inshore. However, it is likely that artisanal fishing effort is at least a partially contributing factor to this perceived decline in fish availability, particularly as there is widespread use of gillnets which are unselective. Fishers believe that more sophisticated gear like engines, better nets and echo sounders will improve their catches to previous levels. Although this may be perhaps true, improvements will be short term and will only reflect effort creep. These interventions will hasten the decline of their resource base. There is thus a major need for a fisheries education programme.

In assessing the use of the IPA catch data base to indicate possible trends in, and impacts on, the artisanal fisheries resource, one of the major problems is that units of effort are difficult to define. This is also a problem when attempting to use the data base for mathematical modelling of individual resources. Although the IPA database records the number and type of boats in various municipalities and provinces, many of these boats are often not functional for some of the time or fishermen cannot fish because nets are broken and they are unable to repair them, either because of a lack of materials or because of a lack of funding to buy the materials. There does not appear to be a standard number of nets per boat type, net lengths vary, and soak times probably vary widely depending on weather conditions and the season. It is not certain that lift nets are all of the same design, there is no clarity on the number of hooks associated with linefishing or the number of lines individual fishermen use. The duration of a fishing trip varies greatly depending on whether ice or salt is carried or not. In addition, the recording of species captured needs clarification, since some species appear to be recorded under one name in some provinces and under another name in other provinces. The database needs to be interrogated in conjunction with Angolan data technicians in an attempt to disaggregate the effort data as far as possible and clarify issues mentioned above.

There has been an increase in the levels of monitoring since 2000, which also has important implications for evaluating the use of the IPA database for fisheries management purposes. The large increase in catches in 2001 and 2002 and the possible under-reporting of catches in previous years is cause for concern, and may limit the usefulness of the database with respect to absolute values if for example, there was a desire to examine a time series of total catch data as an indicator of sustainable resource use. If there has been under-reporting then only relative indices can be used.

From a fisheries perspective informed by the South African situation, the following points must be made:

- Instituting fishery controls on the capture of reef fish and possibly other species of linefish may be an urgent requirement;
- The widespread use of gillnets is cause for concern. Angolan management authorities perceive the use of beach seine nets as a possible threat to fish stocks, but gill nets are likely to have a much greater and more rapid negative impact;
- A detailed examination of the data pertaining to catch species composition with time on an area specific basis should be undertaken;
- A detailed examination of the data pertaining to changes in area specific fishing gear types with time should be undertaken; and
- It is necessary to engage in research and collect species-specific biological data for vulnerable species, so that appropriate models may be developed to ensure sustainable resource use. Length frequencies, growth rates, age-length keys and size at maturity are some of the essential data requirements.

It is necessary to carefully examine the current data collection protocols in order to determine the extent to which the data collected can inform management recommendations. However, it must be accepted that management of the artisanal fish resource base is inextricably linked with the management of the commercial sector, since both sectors target many of the same species and it is not possible to manage them simply on an inshore/offshore basis. Of particular importance are the agreements that Angola signs with foreign nations for the exploitation of the Angolan marine resource base, as such licencing entitles large sophisticated vessels to operate in Angolan waters. In many cases these vessels do not respect the permit conditions and impact on artisanal resources by operating in the inshore region. Many artisanal fishers attest to the fact that large trawlers for shrimp and demersal species do not be respect the coastal zone (field observation). There is little infrastructure in Angola to manage licencing agreements, particularly with respect to monitoring and surveillance. Bycatch of such vessels is also likely to become a problematic issue once stocks are fished down to levels where only annual production is available for harvesting.

14 CONCLUSIONS AND RECOMMENDATIONS

The current state of Angolan fisheries and the socio-economic conditions that underlie it is to a large extent a result of the political history of the country. The protracted war of independence and subsequent civil war destroyed much of the country's infrastructure, collapsing the industrial fisheries and causing a major shift in population to the coast where conditions were safer and the opportunities of obtaining food greater. Populations of the major towns and cities increased by four or five orders of magnitude because of demographic shifts related to the wars. Because of the concentration of people on the coast, artisanal fisheries assumed a major importance as government engaged in rebuilding the infrastructure destroyed in the war, while at the same time attempting to reduce poverty and provide basic food security. Along the coast there are currently 102 organised artisanal fishing communities, with numbers increasing from south to north. Between 130 000 and 140 000 people engage in fishing activities with men undertaking most of the capture related activities and women undertaking most of the processing related activities. Fortunately, the entire coast of Angola has an abundance of marine resources as a result of high levels of primary production caused by the oceanographic features of the coast.

Every year the Fisheries Research Institute, through data from scientific cruises and with external statistical support, assesses the biomass of the main commercial species and proposes TACs to the Fisheries Minister along with any other appropriate industrial fisheries conservation measures. A proportion of the total TAC (150 000 tons per year) is allocated to the artisanal sector. Three factors directly regulate the activities of artisanal fishers: (1) the length of boat used, (2) the distance from shore where fishing activities can take place, and (3) a mesh size limitation for gill nets although this is seldom enforced. Although artisanal fishing boats require an annual permit, the fishery is open access with few other limitations relating to gear, catch, timing or area. Artisanal fisheries management focuses mainly on the implementation of a monitoring and data capture programme that indicates the extent of the total artisanal catch and fishing effort along the Angolan coast.

There are serious constraints on the ability of the sector to obtain maximum benefit from the fish resources. Among the most serious are the absence of storage and processing facilities at landing sites, which would a greatly increase the economic value of the fish captured, the lack of infrastructure that would allow access to wider markets, and the lack of resources available to fishers, which condemns them to harsh working conditions. To address these constraints there is an urgent requirement for investment in the fisheries sector in general, but sourcing investors and capital is a perennial problem. Conclusions and recommendations relevant to the artisanal fishing sector, that have emerged from the work carried out in compiling this report are listed below.

14.1 CONCLUSION

Artisanal fisheries in Angola constitute a critical sector that underpins the livelihoods and contributes to food security for a significant proportion of the coastal population. During the war years there was a significant migration to the coastal areas and fishing has now become a key livelihood strategy for many Angolans.

RECOMMENDATION

Given the critical importance to coastal communities of the inshore fish resources, it is imperative that these resources be managed on a sustainable basis. To achieve this, good management systems and capacitated management staff are fundamental requirements. Appropriate governance arrangements that involve the fishers in management activities and decision-making are also critical conditions to ensure the long-term sustainable use and management of the resource. Further, because the artisanal sector makes a major contribution to the achievement of the government's poverty alleviation and socio-economic development goals, the relative importance of the artisanal sector in relation to the industrial fisheries sector should be re-evaluated.

14.2 CONCLUSION

In general terms there is a paucity of documented information relevant to the socio-economic characteristics and conditions of the artisanal fisheries sector. Although surveys that focus on socio-economic information have been conducted since 1996 it appears as though these data have not been systematically captured, analysed and documented. Also these surveys tend to focus on information relevant to the fishery as well as selected economic and marketing issues. Little is known about the social characteristics and conditions of the fishers, especially the women who are mainly involved in processing and marketing the fish. There is also a lack of customised software to analyse these data, and it is extremely difficult to source socio-economic information and data relevant to coastal communities from the various government departments. However, IPA representatives that have been working in coastal areas have a considerable local knowledge with respect to certain aspects of the social and economic functioning and livelihood circumstances of these artisanal fishing communities.

RECOMMENDATION

There is considerable value in capturing and analysing the existing data from the censuses that have been conducted. However, before such a study is contemplated it is essential to undertake a feasibility study, since some of the raw data may have been damaged in the archives, and the extent of the usable data needs to be ascertained. Furthermore, appropriate software to analyse the survey data need to sourced. In addition, it would be prudent to re-evaluate the survey design as well as the focus of the questionnaires in the light of the information emanating from the socio-economic survey currently being conducted as part of the suite of artisanal fisheries projects under the BCLME program (LMR/AFSE/03/01 Component C), since the findings from this study should identify gaps in knowledge and provide guidance on what critical information is required to inform the future management of this fisheries sector.

14.3 CONCLUSION

The facilities and infrastructure needed to support a progressive artisanal coastal fisheries sector are either completely inadequate or in a severely degraded state as a result of the protracted civil war. Basic services such as potable water, sanitation, electricity, health care and education facilities are very limited. Although the Ministry of Fisheries through IPA has sought to address some of the basic problems related to fishing, such as the provision of salt, and the construction of cleaning tables and salting vats, there are numerous other issues and constraints that severely impact on the livelihoods of the coastal fisher population and their ability to effectively exploit their local resources. Lack of refrigeration facilities, the inaccessibility of many of the landing sites and current unhygienic conditions in which catches are sorted and processed are key issues. The inadequate road infrastructure in particular, limits access to markets and thus the economic value of the fish captured, and thereby reduces the potential of the fisheries sector to improve livelihoods.

RECOMMENDATION

Government needs to continue to prioritise the functioning of integrated fishing centres that support artisanal fisheries and at same time to repair critical infrastructure. Attempts should also be made to source funding that will address some of the other fishery related infrastructural requirements. There is an urgent requirement for investment in the fisheries sector in general, and sourcing investors and capital should be prioritized.

However, management authorities need to be mindful of the fact that improved infrastructure will almost certainly result in increased catches and thus increased pressure on fisheries resources. Therefore initiatives to improve infrastructure need to be aligned with greater regulatory measures for the artisanal fisheries sector, such as catch and effort restrictions, closed areas and better enforcement and compliance, to ensure that fisheries resources are not over-exploited. Awareness raising and educational programmes to inform fishers of the need for management measures is required to ensure both understanding and buy-in of the regulatory environment. Involvement of the fishers in setting the rules and regulations is likely to improve compliance.

14.4 CONCLUSION

During field trips, many artisanal fishers attested to the fact that large sophisticated industrial vessels targeting shrimp and demersal species do not respect the inshore coastal zone limits imposed by their permits. In many cases these vessels impact on both artisanal fishing activities and resources by operating in the inshore region. These large vessels pose a physical danger to small artisanal boats in the inshore region and frequently damage artisanal sector nets. There is little infrastructure in Angola to manage licensing agreements, particularly with respect to monitoring and surveillance. By catch of such vessels is also likely to become a problematic issue once stocks are fished down to levels where only annual production is available for harvesting.

RECOMMENDATION

It is of great importance that Angolan fisheries authorities review the nature and the extent of agreements that Angola signs with foreign nations for the exploitation of the Angolan marine resource base. Further, the rapid implementation of Vessel Monitoring Systems (VMS) on all foreign and Angolan industrial vessels is highly recommended. Government should also seek to upgrade their offshore enforcement capabilities as rapidly as possible. Government must define heavy penalties for all vessels that contravene permit conditions. Furthermore there is a need to improve government's capacity to respond to complaints from the artisanal fishers linked to illegal fishing in the restricted area.

14.5 CONCLUSION

Total exploitable biomass of the fish resources of the Angolan coastal zone is determined by annual surveys that evaluate separately small pelagics, large pelagics, demersal stocks and a basket of other species. Between 1996 and 2003 there has been a decline in the estimated biomass of all fish groups except *Sardinella* and a decline in the estimates of total fish biomass. In addition, mean biomass estimates for the years 1996 – 2003 for most groups are considerably lower than the biomass estimates between 1985 and 1992. In 2003 the biomass of some of the groups increased relative to the previous year but was still significantly less than initial biomasses. This downward trend in biomass indicates that catches may be unsustainable. The dependence of communities on an unsustainable resource base has obvious long term consequences.

RECOMMENDATION

The management of the industrial fisheries sector is inextricably linked to the management of the artisanal sectors, since many of the resources targeted are shared between the two sectors. Fisheries management in general would benefit from a more integrated approach that saw the resources as single stocks with multiple users. It would also be of benefit to evaluate which species are key species in terms of both the industrial and artisanal economies, and which species would provide the best indicators of ecosystem health. In addition a more detailed approach to individual stock status assessment is required. Objectives should include the collection of data on size, sex and maturity of the main species for biological studies. Apparently this has been done during the course of the most recent resource estimate cruises, but the analysis of these data and their application to stock status so far appears not to have informed management.

14.6 CONCLUSION

There are certain areas along the Angolan coastline including the bay areas that are designated protected areas. Although artisanal fishers are not permitted to fish in bays, this regulation appears to be disregarded except perhaps in the vicinity of major urban centres. There are no deepwater MPAs. Since pressure on both artisanal and industrial fish stocks is increasing consideration should be given to declaring MPAs.

RECOMMENDATION

Angolan management authorities should urgently consider the legislating of MPAs. MPAs are one of the most effective fisheries management measures for the conservation of fish biodiversity and the protection of breeding stocks that can re-seed over-exploited areas, particularly with respect to reef associated fish species. Management authorities should interact with South African and Namibian marine conservation authorities in order to determine optimal location of MPAs and how much area should be set aside for MPAs.

14.7 CONCLUSION

Of the 15 fish species that comprise almost 80% of catches by the artisanal sector, only seven can be considered pelagic (Cunene horse and Spanish mackerels, espada, tubarão, cavala and the sardine/sardinella group – Table 31). Transboundary issues associated within this subset of artisanal species are limited. Southern Angola forms the approximate boundary between stocks of the Cape horse mackerel that occur off Namibia and South Africa and the Cunene horse mackerel that occurs along much of the Angolan coast. However, some mixed catches are made in the Benguela – Cunene region. However, certain sardine (*S. sajax*) stocks are shared with Namibia and these transboundary stocks may require special management attention. *S. sajax* is replaced by the sardinella species north of the Benguela/Angola front, which is located in the south of the country. Thus the major component of the sardine stocks occur off the Namibian coast and the major component of the sardinella stocks occur off the Angolan coast.

Many of the demersal fish species that are important in artisanal catches (Table 31) do not occur in the cool temperate waters south of Angola, but there is possibly some overlap of shark and catfish species, baardman (*U. canariensis*), cutlass fish *T. lepturus* and kob (*A. hololepidotus*).

Table 31: Fish species making up almost 80% of the catch of the artisanal fishing sector. (2002 – 2005 data set extracted from ArtFish by OLRAC)

1	Cachucho	*Dentex + Sparus spp.*	17.89	17.89
2	Corvina	*Pelates quadrilineatus*	14.44	32.33
3	Carapau	*Trachurus trecae*	10.71	43.04
4	Sardinha	*Sardinella aurita/S. madarensis*	9.22	52.26
5	Garoupa	*Grouper spp.*	3.44	55.69
6	CorvinaPreta	*Umbrina canariensis*	2.99	58.68
7	Espada	*Trichiurus lepturus*	2.82	61.50
8	Savelha	*Sardinops sajax*	2.76	64.26
9	Tubarao	*Shark spp.*	2.63	66.88
10	Burro	*Plectorhinchus mediterraneus*	2.30	69.18
11	Pungo	*Argyrosomus hololepidotus*	2.25	71.43
12	Bagre	*Arius spp.*	2.24	73.66
13	Pargo	*Large Sparus pagrus*	2.01	75.67
14	Cavala	*Scomber japonicus*	1.85	77.52
15	Barbudo	*Galeoides decadactylus*	1.79	79.31

RECOMMENDATION

Although there are limited transboundary implications with respect to fish stocks important to the artisanal sector, Angolan, Namibian and South African fisheries scientists should pool their expertise, particularly with regard to the management of species such as sparids, sharks and many reef fish, which may have complex life histories and are easily over-exploited. Many demersal and reef fish species similar to those occurring in Angola have been exploited by the South African line fishery to levels at which their reproductive capabilities are seriously compromised. Angolan authorities in particular would do well to learn from the lessons of their South African counterparts. It is recommended that regular demersal and line fish working groups that incorporate fisheries management staff from all three countries be implemented as soon as possible.

14.8 CONCLUSION

Substantial catches of lobsters are made along the Angolan coast. This is a high value resource that has the potential to create significant economic benefit to coastal communities. After capture, lobsters can be kept alive for considerable periods in floating cages. Thus the fishery is not limited by the absence of immediately available markets for fresh product, which allows some flexibility in the marketing process. However, at present very little is known about the resource and its fishery. It appears as if at least three species are targeted. To maximise the benefits from the lobster resource and ensure a sustainable management regime for the lobster resource, all aspects of the fishery need to be evaluated as soon as possible.

RECOMMENDATION

A research program aimed at understanding the dynamics of the lobster fishery along the Angolan coast should be funded as soon as possible. The fishery in the southern provinces is probably different to that in the central and northern provinces and fishery dynamics of the different regions should be investigated. The program should include the identification of the various species caught, collection of biological data relevant to management, the sourcing of historical catch data, and the development and institution of an appropriate catch monitoring programme for the ongoing collection of catch statistics. Although lobsters are listed as a species for which catch data are collected under the current monitoring programme, there is no differentiation by species and there appears to be a lack of clarity with respect to the effectiveness of the data collection process for invertebrates. These factors and the design of the research programme should be investigated in conjunction with Angolan artisanal fishery management staff.

14.9 CONCLUSION

Current monitoring data indicate that the 150 000 ton limit for the artisanal sector has not been exceeded. The preliminary GLM analysis of available data for the period 2002-2005 indicates that stocks are not yet fully exploited. Catch data indicate an upward trend in CPUE. For the ten main species, there is no evidence of declining resource abundance for the period 2002-2005, except for Savelha, which does show a decline. However, we caution that the period 2002-2005 is very short hence any trends observed could be the result of favourable inter-annual trends in resource availability and may not necessarily reflect trends in resource abundance. It must also be stressed that catch per unit effort is a complex fishery index and a careful analysis of the input data is required in order to achieve a realistic indication of fishery status, particularly in a mixed species multi-gear fishery such as the Angolan artisanal fishery. The current management approach of setting a 150 000 ton limit for the artisanal sector is management at a coarse level and may be insufficient to prevent over-exploitation of a number of the stocks that are important components of the artisanal fishery. Field information from fishers indicates that fishing pressure from various sources is already negatively impacting artisanal fish resources.

RECOMMENDATION

From a fisheries perspective informed by the current South African situation, the following are recommended:

- Instituting fishery controls on the capture of largely resident reef fish and possibly other species of line fish is an urgent requirement;
- The widespread use of gillnets is cause for concern. Because of their unselective nature and their effectiveness as fish capture devices, gill nets are likely to have a rapid negative impact on fish stocks;
- A detailed examination of the data pertaining to catch species composition with time on an area specific basis should be undertaken;
- A detailed examination of the data pertaining to changes in area specific fishing gear types with time should be undertaken;
- Undertake research in order to collect species-specific biological data for vulnerable species, so that appropriate models may be developed to ensure sustainable resource use. Length frequencies, growth rates, age-length keys, breeding cycles and size at maturity are some of the essential data requirements;
- Management authorities should seriously consider revising the artisanal sector management strategy so that the fishery is managed with input controls around space and time rather than output controls such as total catch.

14.10 CONCLUSION

Field information from the current artisanal fisheries assessment program indicates that many fishers in the coastal communities perceive that catches and catch rates are declining. Fishers believe that more sophisticated gear like outboard engines, bigger and better nets, and echo sounders will improve their catches to previous levels. Although this might be true, improvements will be short term and will only reflect effort creep. These interventions will hasten the decline of their resource base.

RECOMMENDATION

There is a major need for fisher education programmes that will inform fishers of basic environmental and fisheries related issues and capacitate them to appreciate the necessity for current and future fishery controls and the need for compliance with these controls. Although fishers are involved in various aspects of management, through the Groups of Economic Interest and the Co-operatives, every effort should be made to include local fishers in all aspects of management of the resources, because in the short to medium term, far more active management of the coastal fish resources will be required than is currently the case. Angolan management authorities should work with South African educational institutions and NGOs, where numerous training course materials, both with respect to environmental and fisheries management as well as community based natural resource management, have already been developed.

14.11 CONCLUSION

In assessing the use of the IPA catch database to indicate possible trends in, and impacts on, the artisanal fisheries resource, one of the major problems that appeared as a result of field trips undertaken to various fishing communities is that units of effort are difficult to define. This also poses a problem when attempting to use the database for mathematical modelling of individual resources. Although the IPA database records the number and type of boats that are operating in any one day, there does not appear to be a standard number of nets per boat type or per fisher. Net lengths vary, and soak times probably vary widely depending on weather conditions and the season. Improved availability of nets and improved availability of repair materials has also had a significant impact on effort. Apparently there is also a change in netting practices with season. Monofilament nylon gill nets are used during some seasons and at other times of the year multifilament nets are used. It is not certain that lift nets are all of the same design, there is no clarity on the number of hooks associated with line fishing or the number of lines individual fishermen use. The duration of a fishing trip varies greatly depending on whether ice or salt is carried or not.

A typical feature of the current management protocol might be the maintenance of historical catches and CPUE while individual stocks of more valuable fish were being depleted, with fishers responding by targeting less and less valuable stocks (a process of serial depletion). Over-exploitation of species that are vulnerable to heavy fishing pressure (e.g. some shark species, or reef dwelling species such as sparids and groupers, which are generally slow growing, take a long time to reach maturity and may have complex life histories) can take decades to reverse. Serial depletion of individual fish stocks is a common occurrence where management is limited to an examination of total catches only, or CPUE at a multi-species level.

RECOMMENDATION

To obtain a meaningful effort estimate, it becomes important to obtain accurate information on number of boats and crew that actually go to sea, net lengths as well as number of nets per boat and per fisher. Otherwise data capture fields should also be included that allow the collection of data relating to variable net construction and soak times, variable net lengths and numbers per boat, and the line fishing capacity of individual fishers. In depth studies in selected fishing localities along the Angolan coast should thus be undertaken.

14.12 CONCLUSION

Monitoring effort is probably not standard across time scales of months and years. It is also evident that in many of the provinces there was a large increase in total catch in 2001 and 2002 compared with previous years. This can apparently partly be attributed to an increase in the use of lift nets (Armacao) and partly as a result of the repairing of numerous boats that were broken and could not fish in previous years. But the increase appears also to be the result of considerable under-reporting of catches in earlier years. This has significant implications for any mathematical resource modelling.

RECOMMENDATION

The ArtFish database will have to be examined in some detail to resolve queries related to the temporal variability in monitoring effectiveness. Ideally these queries should be dealt with as part of the same program to record and analyse the historical time series of catch and effort (see below). It is recommended that South African scientists work in conjunction with Angolan scientists and data management experts. Sufficient funds should be made available to do this job properly, because of the great value of the historical record and the importance of acquiring a realistic estimate of effort. At the same time data management and analysis capacity will be built in Angolan fisheries management institutions.

14.13 CONCLUSION

Although GLM modelling of a relatively short time series of data collected by the artisanal monitoring programme indicates positive results, the GLM evaluation must be treated with great caution because of the limited time series and the problems associated with the input data (see below).

RECOMMENDATION

There is great value in attempting to record and analyse the historical time series comprising the entire ArtFish data set. This would allow a much more realistic evaluation of trends in the stocks of fish that are the most important in the artisanal fishing sector (see below).

14.14 CONCLUSION

In principle the sampling program developed by FAO for the artisanal fisheries sector in Angola is highly sophisticated and has the potential to provide valuable information to inform fisheries management. The effort and foresight that have gone into implementing the programme are highly commendable and set an example for both developed and underdeveloped African nations. However, there are some concerns regarding the implementation of the sampling programme. These include:

1. The reliability of the data collected by the samplers, because they often appear to be absent from the beach sampling site;

2. Inconsistencies with respect to the identification and recording of parameters such as species, vessel and gear type;

3. An analysis of the data extracted by OLRAC from the ArtFish programme, indicates that samplers may be doing certain manual extrapolations of individual samples to multiple trips that have not been sampled. There is a strong possibility that these extrapolations might duplicate extrapolations that are hardwired into the ArtFish software in order to calculate total catch from the monthly sample. The result would be erroneous estimates of total catch.

RECOMMENDATION

The sampling program needs to be evaluated with respect to the sampling survey design. An analysis of the survey design might indicate that it is possible to significantly reduce the number of sites monitored, and still retain the capability to obtain robust and reliable results that inform the management of the fishery. It may also be possible to reduce the complexity of the sampling template and still collect information suitable for management decisions. Changes or additions to the sampling template that allow greater collection of in-depth data for particular species might provide a suitably sensitive indicator of stock status and ecosystem health. Other changes to the current sampling system would be the standardization of key sampling input categories via for example drop-down menus, in order to minimize errors and improve consistency. The framework or terms of reference that regulate the duties of beach samplers should be evaluated and it might be prudent to appoint a monitoring supervisor to check randomly on such working activities

14.15 CONCLUSION

The identification and recording of fish species captured by artisanal fishers needs clarification. Some species appear to be recorded under one name in some provinces and under another name in other provinces. Large individuals of a single species are recorded under one name while smaller individuals of the same species are recorded under a different name. A great deal of effort was invested in trying to match all available local names with species names in the initial fishery report, using the ArtFish data provided by IPA. Yet the OLRAC data evaluation produced 14 local names that were not recorded in the data provided to FieldWork and the EEU. A comparison of Table 17 and Table 29 indicates the high level of variability, since both derived from the data capture sheets of the ArtFish sampling programme but from different time periods.

RECOMMENDATION

The local names by which fish are known, should be standardised across the entire artisanal fisheries sector, in order to improve the reliability and usefulness of the data collected. It is impossible to make species specific management recommendations unless it is certain that the data used to inform these decisions refer to a single species. Such a standardisation programme would include: Fisheries research scientists interacting with IPA staff to try and clarify some of the species that appear to have several names. Fisheries scientists with taxonomic capabilities should then conduct field trips to several of the beaches that are monitored in each of the different provinces and interact with fisheries monitors and fishers during the course of fishing events, to define precisely the species represented by the various local names. Having decided on the standardisations required, fishery scientists should finally brief all beach monitors on the names that should be used for individual species. The data capture software should be amended to provide a limited standardised range of choices via drop-down menus.

14.16 CONCLUSION

There is a lack of capacity amongst IPA staff to harness the potential of the existing ArtFish data management system and to engage with other statistical platforms that might correct for biases that inevitably arise as a result of any sampling programme. Although the data are captured on a sophisticated database program, currently there appears to be a lack of understanding of relevant analyses that would allow more effective use of the data and system. Many of the analyses are simply mechanistically completed without comprehension of the possible biases in the raw data presented/collected. There is a tendency to aggregate rather than disaggregate data, there is no program to determine possible indicators of resource status, and there appear to be some problems related to the recording of units of fishing effort. These problems have the potential to compromise the usefulness of the monitoring programme.

RECOMMENDATION

It is recommended that IPA staff involved in data entry and analysis participate in specially designed short course training programs aimed at understanding broad fisheries management principles and analyses relevant to the artisanal fishing sector. Ideally these training courses should be linked to real time data and situations, and any follow-up projects that result from this initial study. This would ensure that such training initiatives contribute to improving aspects of the management systems and build institutional capacity. IPA staff tasked with analyzing data collected by the artisanal fisheries monitoring programme need to be trained with respect to the capabilities of the ArtFish software. This training should take the form of in situ working with real data. If a concerted effort was made to recreate the historical ArtFish data set using South African and Angolan technicians and scientists, this would create a valuable learning opportunity for IPA staff to become more familiar both with the ArtFish capabilities and the data requirements of more complex analyses. The current BCLME artisanal fisheries programme provides an opportunity for the informal and artisanal fisheries sectors in Angola, Namibia and South Africa to improve their respective approaches to management by combining their experience in monitoring, data capture and data analyses to the benefit of fisheries in all three countries. Ongoing and increased interaction of South African, Namibian and Angolan fisheries scientists is highly recommended. This co-operative venture should be expanded to include detailed joint analyses of existing data sources, particularly those in Angola

14.17 CONCLUSION

There are certain inadequacies with the current data management system. This includes capture, storage, management and analysis. The problems with analysis have been outlined above. While a large volume of potentially valuable data collected by the artisanal fisheries monitoring programme since 1996 to 1998 exist, certain raw data for some years appears to be missing. Other data appear to have been irretrievably lost due to computer malfunction, or have not been properly captured due to a lack of standardization of sampling categories, although CPUE data for the period 1999 to 2001 may be available. Within the scope of this project it has not been possible to thoroughly investigate the extent to which missing data might be retrieved.

RECOMMENDATION

There is great value in attempting to recreate the historical data set represented by the information collected by the artisanal fisheries monitoring programme, in order to study long-term trends across a whole range of variables in the artisanal fishery. However, any such attempt should be subject to a feasibility study to ascertain whether it is possible to recreate these data sets for the years 1996 to 2001. This should be done as a collaborative venture between SA fisheries scientists and IPA scientists to ensure that there is a building of capacity and transfer of skills in fisheries management. The creation of these data sets would then enable a variety of statistical analyses to be undertaken which would provide a more detailed assessment of the status of the various fish stocks targeted by the artisanal fishing sector.

14.18 CONCLUSION

There is a lack of adequate hardware and software capability within IPA to manage a sophisticated data set such as that derived from the artisanal sampling programme. The ArtFish database system is structured with a view to providing estimates of annual catches for different species in the fishery. This is an important line function of IPA, since management is essentially based only on total catch and ArtFish therefore seems to be configured to meet the requirement of total catch estimates. However, the ArtFish database system is not well suited to cater for a wide ranging and unplanned set of statistical investigations. Such investigations are better carried out on a statistical platform such as the SPSS base product.

RECOMMENDATION

There should be an evaluation of the IT resources, requirements and capability within IPA to conduct analyses that are currently required in terms of both the Artfish programme as well as the more advanced statistical analyses proposed, such as GLMs that remove biases from datasets.

14.19 CONCLUSION

It is unlikely that effective management measures can be proposed or instituted for the artisanal sector without taking into account the impacts the industrial sector has on the resources. In order to gain an overarching understanding of any individual fishery it is important to merge the data derived from the artisanal sampling program with data derived from the industrial surveys and catch data collection programmes in order to arrive at a sound management recommendations and decisions. If a statistically robust analysis such as the GLM model proposed for the artisanal sector is promoted for the industrial fisheries sector as well, the overall analysis of individual fisheries is likely to benefit from improved management protocols.

RECOMMENDATION

There is a need to improve the coordination of the data management and analysis of species that are relevant to both the industrial and artisanal sectors. Given the kinds of analyses that can be performed on the artisanal data, significant opportunities exist for enhanced understanding of the health and status of individual industrial fisheries, and these opportunities should be explored by both research and management institutions.

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APPENDIX 1

Angola – Questionnaire conducted by IPA – year 2000
Aimed at fishers and masters of fisheries

Family status
Single **Married** **No of children**

Do you engage in :
Fishing only **Fishing agriculture** **Other**

For how long have you been fishing …………..

Type of vessel:
Chata (plank boat) **Canoe** **Catronga** **Trawler** **Other**

Licence no: …………

Engine: **Yes** **No** **Capacity** **Make**

Possibilities for repairs: Yes No Where

Navigation equipment: Yes No Type:

Usage of ice to preserve fish: Yes No

Equipment to preserve fish: Yes No
Type: thermal box Isothermal box

Do you think it is important to use these equipments? ………………….
Why? ……………

Methods of fishing used:
Longline No of lines (??) No. of hooks per line

Palangre (French = Angling) How many palangres?………. Total no. of hooks ………

Nets:
No. Length Height Net size/mesh

Banda Banda: Length Mesh

Per-seine Length Mesh

Fishing net No:

Mid-water bottom trawl   **Type: Pelagic**   **Semi-pelagic**
Demersal

Supply of fishing materials: **Good**   **Average**   **Bad**

Who supplies the material?

Needs in materials:
Hooks   **Nets**   **Lines**   **fishing net**   **Engines Vessels**   **Thread/yarn**

<u>Crew:</u>   Yes   No   No of people on board

Members of family: Yes   No   Others

Do you go out every day: Yes   No

No of trips per week:……..   /month:……..

Duration of trip:…….   Hour of departure: Hour of return:

Fishing zone: varied   Well defined

Depth of the zone in metres: ………..

Is there migration of fishers: ……….. yes …………..   No …………..

Factors that lead to migration of fishers:

Do you have problems with industrial fishing   Yes   No

What type of problems: ……………………………………………………………

<u>Production:</u>
What are the most captured species and what are on average the quantities landed every day (in Kg):
Grouper ……   Large-eye dentex ….. Horse-mackerel……   Sardine …….
Croaker ………   Sea-Bream ……   Sole …. . Lobster …… Shrimp ……
Choco (squid?) ……..   Octopus ….. .   Pongo   Lirio

Total amount landed per day: Maximum   Minimum

Most favourable fishing period of the year   For what species

Quantities of fish reserved for personal consumption: ……… Species ………………….
<u>Commercialisation of the fish:</u>
Selling price per kilo

Grouper …… Large-eye dentex ….. Horse-mackerel…… Sardine …….
Croaker ……… Sea-Bream …… Sole …. . Lobster …… Shrimp ……
Choco (squid?) …….. Octopus ….. . Pongo …… Lirio ….. Conger …… Crevalle jack and pompano sp …..

Direct sale to consumer …. to co-operative ….. to women …. to wholesalers …

Priorities to family relatives to sell: ….. Best offer: …. Other ….

Cash payment credit payment other forms

<u>Daily responsibilities for exploration:</u>
Fuel: food: Bait: fishing equipment:

Others:

<u>Other economic possibilities besides fishing;</u>
Agriculture Industry Commerce

Reasons for choosing fishing as a profession:

Do you know of FADEPA: yes No
Do you access to FADEPA Yes No Why

Other forms of credit ……………