PD-ABD-331
ISN 74168

ANALYSIS OF FISHERIES EFFORT AND ENVIRONMENT ASSESSMENT

Project: Djibouti Fisheries Development (603-0003)
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Scoping Statement:

Scoping Statement (submitted 8 July, 1981 see reftel Djibouti 1516) as follows:

"The EA will consider those topics mentioned in paragraph 2 and 3 in State 132088 that is:

A. Increased Fishing Effort

1) Update of current and projected sustainable yield

2) Current and projected catch including discussion of yield versus catch

3) Impacts on:
   (a) marine mammals
   (b) endangered or threatened species
   (c) non-target fish species

4) Wording of convenant for inclusion in project agreement

B. Oyster Culture Sub-Project

1) Assess potential negative impacts of culture techniques

2) Impact of future extension to large areas

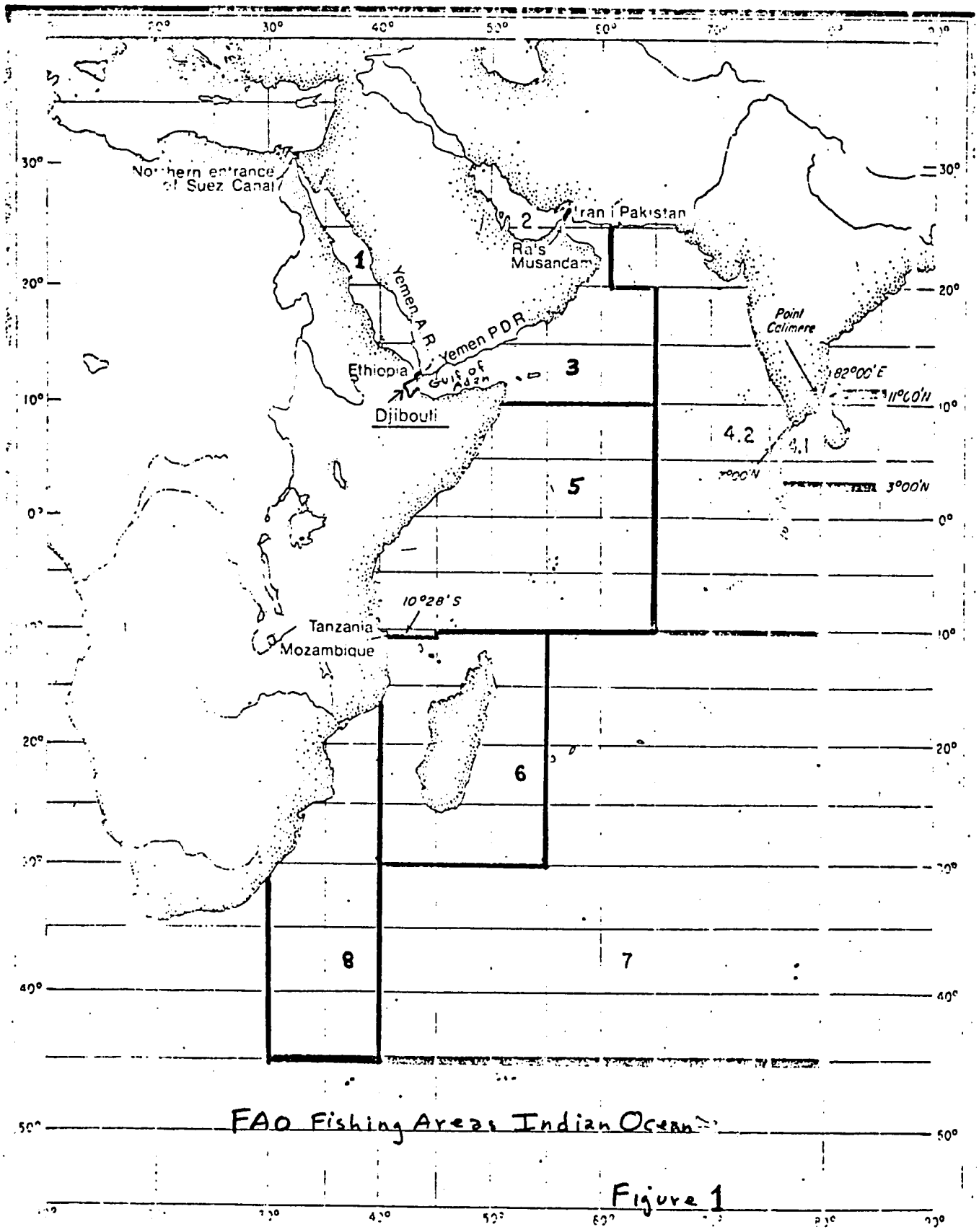
3) Under what conditions should such project be abandoned?"

I. INTRODUCTION

A. Local Climate and Marine Fish Production

The Republic of Djibouti is a small country with a volcanic terrain. It has a semi-arid climate with two main seasons (1). From the late summer to the end of March the cold season (22.5 - 28.7°C) is dominated by the northern sea winds which bring scant rainfall (130 mm over 26 days during March and also in November). The hot season between May and October is dominated by the southern monsoon which brings hot daily temperatures (30.5 - 40.4°C). These two seasons have a large effect on local fish production because of their effect on marine conditions (2). The hot summer season induces a current off the coast of Somalia which in turn results in a summer upwelling with nutrient-rich water coming to the surface from the depths (100-200 m). This creates ideal conditions for significant offshore production. Off the Djibouti Coast in the Gulf of Aden (Fig. 1) the water warms up and a thermocline develops at 20-30m (Table 1). Because of the presence of this warm, nutrient-rich water a good fishery develops for pelagic fish (e.g. sardines) which become especially abundant along the coast (see Fig. 2 for distinction of types of catches). Later, the cooler weather causes the thermocline to sink (Table 1) and with this the pelagic and demersal species disperse. The surface water is now cooler and there is a passage of warm, highly saline profundal water from the Red Sea into the Gulf of Aden.

This saline layer at a depth of 300-1000 meters is low in oxygen (1 ml/l) and is probably responsible for the dispersal of fish at this time.



FAO Fishing Areas Indian Ocean

Figure 1

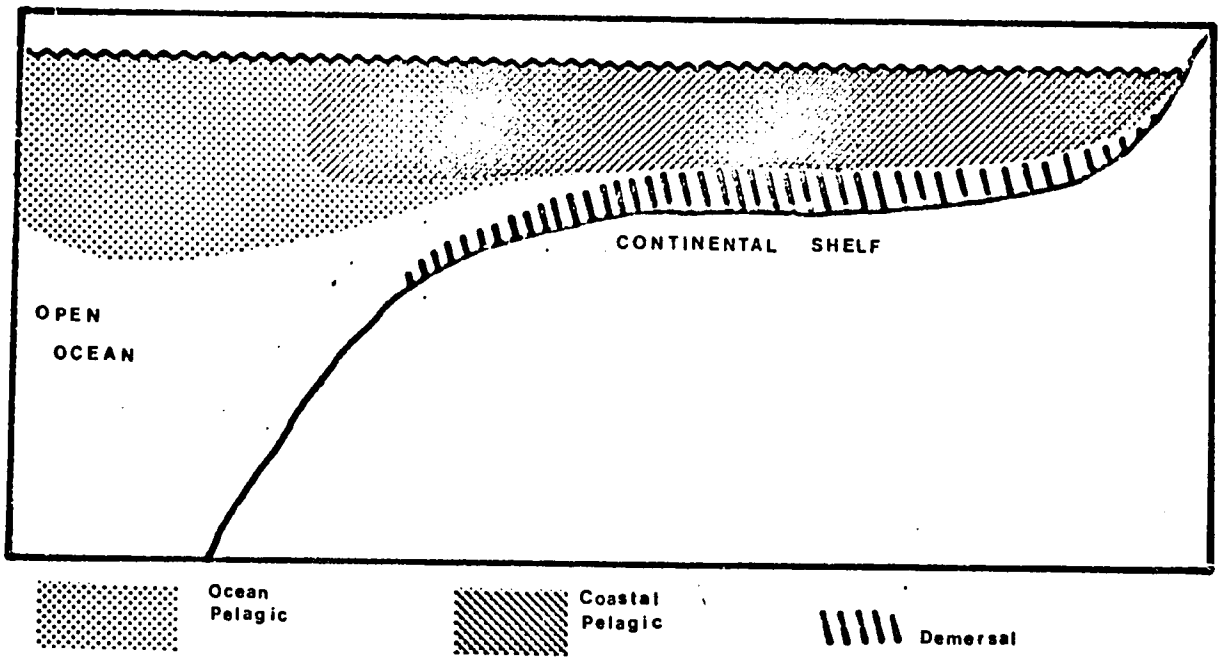


Fig.2. Basic distribution of catches on or above the continental shelf. Oceanic pelagic fish would include: tuna, krill; coastal pelagic sardines, makerel; and demersal jacks, groupers, etc.

Table 1.
Seasonal changes in thermocline and fishery in Gulf of Aden (adapted from 2 and 7).

Months	Monsoon	Thermocline	Gradient	Fishery Conditions
May-Oct (Summer)	South	20-30 m	0.40°C/m	Pelagic spp. concentrate along coast, hand lines used.
Oct-Apr (Winter)	North	100-200 m	0.15°C/m	Pelagic spp. diffuse, benthic spp. disperse, hand lines less useful must use bottom net

General Conditions:

	Surface	Deep Water
Temp (°C)	24-29	14-18
Salinity (°/oo)	35.8-36.8	35.2-35.8
Diss.O_2 (ml/l)	4-5	0.4-1.0
Phosphate (ug/l)	low	50-80

B. Present State of the Indian Ocean Fisheries

The Indian Ocean vicinity supports one quarter of the world's population, but provides only 5% of the world's catch. The countries in the Gulf of Aden (Yemen Democratic Republic, the northwest coast of Somalia and Djibouti) had a combined 1979 catch of 62,000 metric tons (mt). A large portion of this is due to an offshore tuna fishery, which is a major industrial fishery in the Indian Ocean carried out by fleets from eastern Asia. There is much information on this topic available from FAO (3,4) but many of the figures do not apply to the developing countries because the figures are based on offshore longline fishery data. For example, the FAO estimated 1978 catches for yellow fin tuna (Thunnus albacares, the most popular tuna caught in the Indian Ocean) at 52,000 mt. Of this only 20% was taken by surface catch, the remainder was by longline. The maximum sustainable yield (MSY) for this species is estimated at a little less than 40,000 mt, a figure already being approached by the longline industry. However, the total surface catch could still be increased especially if the effort is directed toward medium-sized yellow-fin.

Stocks of smaller tuna species such as skipjack have not been significantly exploited in this region. In addition there is a large potential for catches of small pelagic species (especially sardines). The FAO recommended an increase in fishing effort for coastal Africa using: longlining, trolling and driftnetting for tuna; and small scale pair trawling, or small and medium scale purse seining for small, coastal pelagic fish.

Although the broad surveys conducted by FAO do not provide the precise information needed in limited areas, the FAO is now pursuing intensive sub-regional surveys. This will eventually benefit most of the

member states of the Indian Ocean in Region 3 in which Djibouti is located (Fig. 1).

II. FISHING EFFORT IN DJIBOUTI

A. Present Catch Effort

The fishing effort in Djibouti is centered around inshore artisanal fishermen. In 1980 this consisted of 33 "houris" (small 7 meter boats) and 4 "boutres" (large craft) on lease from Somalia. The total effort of 70 fulltime fishermen resulted in a catch of 311 mt (Table 2).

Table 2. Total catch for Djibouti based on adjusted landings*

	1979 (mt)	1980 (mt)
Snappers	62.3	103.7
Tuna - Mackerel	49.0	73.6
Jacks	52.8	57.7
Barracuda	17.7	23.1
Other Bony Fish	30.8	28.9
Shark	4.6	6.0
Crab	11.5	8.7
Lobster	3.1	4.6
Shrimp	4.3	(est) 4.0
Squid	0.5	0.3
Misc.	14.4	0.7
Total	251.0	311.3

* Figures from monthly records kept by the Association Cooperative de Pêche Maritime

Most of the fish are taken within the regions marked on the map (Fig. 3) and the principal species are listed in Table 1 Appendix A . Other, less common species are listed in the surface pelagic and bottom (demersal) trawl catches in reported Tables 2 and 3 of Appendix A (from the Cruise Report of the Research Vessel "Dr. F. Nansen", March, 1981). The general distribution of these fish groups and local fishing techniques can be found in Appendix B which is from the 1978 Cox Report (9).

B. Fishing Effort Expansion

Development of Djibouti's artisinal fishing industry will occur through USAID assistance to small fishermen. The intention is to improve the nutritional status of Djiboutians and provide a better life for the 300 people connected with the fishing industry. The USAID project will provide a boat building and repair facility, and will compliment the IFAD program (International Fund for Agriculutre Development). Thus the estimates of the total catch per boat and the combined expected increase under both USAID and IFAD will be dealt with together in this assessment. The most recent calculation is shown in Table 3.

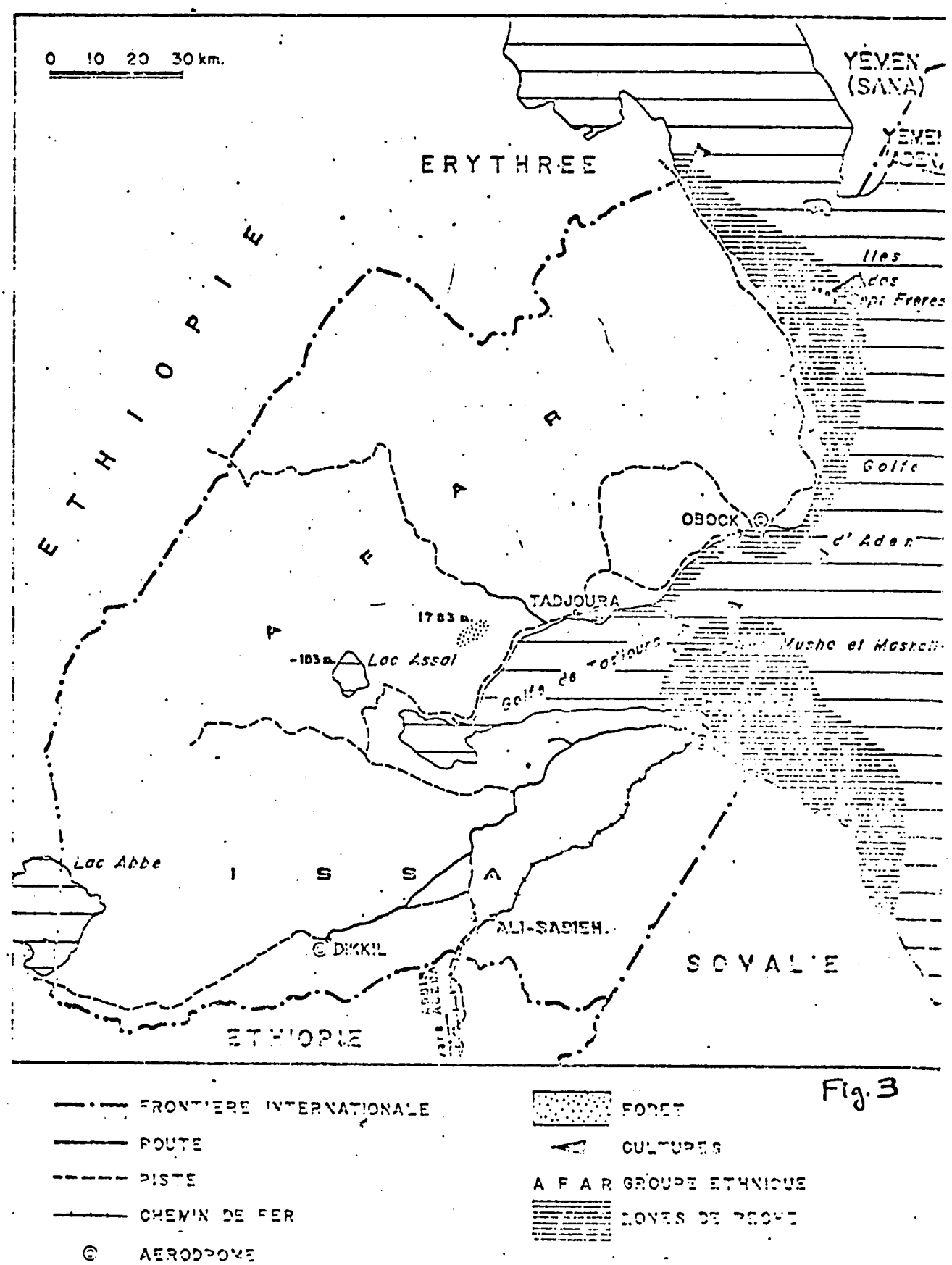

0 10 20 30 km.
YEMEN (SANA)
ERYTHREE
ETHIOPIE
Iles des Sept Freres
Golfe d'Aden
OBOCK
TADJOURA
1783 m.
-183 m.
Lac Assal
Golfe de Tadjoura
Musha el Maskali
Lac Abbe
ISSA
ALI-SABIEH
DIKKIL
SOMALIE
ETHIOPIE
FRONTIERE INTERNATIONALE
ROUTE
PISTE
CHEMIN DE FER
AERODROME
FORET
CULTURES
A F A R GROUPE ETHNIQUE
ZONES DE PECHE

Fig. 3

Table 3. Present and projected catches per boat and overall catch effort calculated by FAO. This represents a conservative (maximum) effort.

Type of Boat	Number of fishermen	Catch per boat (mt)	Total catch (mt)
PRESENT EFFORT (1981)			
Houris	33	12	396
Boutries	4	45	180
Total			576
PROJECTED EFFORT (after project expansion)			
Houris (33+10)	43	17	731
Boutries (4+2)	6	45	270
Total			1001

This indicates a doubling of total catch expected over the next few years as a result of project expansion.

C. Maximum Sustainable Yield (MSY)

As yet there is not enough information available in Djibouti to accurately calculate MSY. However a rough estimate can be made based on the fishing area, the present effort and the MSY predicted by FAO for the whole geographic region.

1. Total Area - The Djibouti coastline of 300 km is fished in essentially three local areas shown in Fig. 3 as:

Area A - from the southern frontier to Khor Ambado, with a shelf depth of 20-35 m and area of 820 m^2.

Area B - the main gulf (Gulf of Tadjoura) with a southern sector of 400m^2 and a larger northern sector (up to Obock) of 60km^2.

Area C - north of Ras Bir with a shelf of 30-50m dropping quickly to 200 m and comprising 100 km^2.

The total available area for fishing effort would be 2,280 km^2.

2. Total catch - If the catch based on landings (Table 2) is further corrected for the total catch throughout the country, then the overall conservative estimate (Table 4) would seem to be a reasonable figure. This places the catch at 576 mt per year and gives a total catch rate of 0.25 t/km^2 (0.17 for demersal; 0.08 for pelagic).

3. Local Estimated Yields (MSY) - The most accurate MSY based on the local FAO report, which is in turn based on local catches (7), estimated demersal stock MSY at 5000 mt.

4. Yields Estimated for the General Region - In the Indian Ocean the FAO estimated the demersal fish annual yield North of 5° latitude to be 2 mt/km^2 (5). In the less productive southern parts of the Indian Ocean it would be 0.5 mt/km^2 which can be taken as a maximum. If we take 2mt/km^2 as a rough average of MSY, then the Djibouti demersal annual catch could be increased by 8 times (from 0.17 mt/km^2 to 2.0 mt/km^2) or up to 4752 mt.

The pelagic resources in the Indian Ocean are more difficult to estimate, but the FAO suggested a potential increase would be possible of 1 to 4 mt/km^2 off East Africa (5). If we take 2 mt/km^2 as a rough average MSY, then the Djibouti pelagic annual catch could be increased by 25 times from (0.08 mt/km^2) or up to 4500 mt.

These rough calculations also agree with the recent FAO local report (7) which estimated potential demersal catches at 2000-4600 mt and pelagic catches at 5000 mt.

III. IMPACT OF INCREASED FISHING EFFORT

A. Impact on Target Species

1. Primary Impact - The present project intends to increase fishing effort with an emphasis on demersal species. These are generally large fish that are easier to handle, clean and market. In the other countries of the Gulf of Aden there is more emphasis on the pelagic fishes especially sardines (e.g., compare the per cent catches in Table 5).

Table 5. Comparison of Djibouti catch compisition to that of Yemen Democratic Republic (3).

	Djibouti % catch	Yemen % of catch
Snappers	33	-
Tuna-Mackerel	24	8
Sardines	0	46
Jacks	19	-
Barracuda	7	-
Other Fish	9	21
Shark	2	6
Squid	1	18

Thus, even though the projected increased demersal catch of 1000 mt will fall well below the calculated MSY of 2000-4500, there is still a danger in future years of overfishing the inshore demersals because the Djibouti fishery is too one-sided. It would be

wiser to eventually broaden the base of the fishing effort especially if (and when) the total annual catch ever approached 1000 mt.

Regarding the potential for pelagic fish, the experimental trawling (10) carried out in March 1981 reported densities of pelagic and demersal fish stocks along the north shore above Ras Bir (Figs. 4 and 5), even though the trawling was carried out in March prior to the migration to this area of the schooling pelagic fish (Clupeoids, Carangids and Engraulids). Personal sighting by M. Rose of the local aquarium also confirm that there are deep-water stocks of shark off the north shore in addition to pelagic clupeoids. As pointed out in the Project Paper (Annex IV-3 page 3) the withdrawal of Yemeni sardine fishing operations in this area leaves much room for development of the pelagic fisheries.

2. Secondary and Long-term Impacts - One large secondary effect of increased fishing would be an increase in fish waste. At present the offal from the fish processing activity at the cooperative market is simply collected and dumped outside the city in the refuse dump. Although this removes the offal as an immediate problem for the project, there is great interest from PVO aid organizations (Catholic Relief Services) is using this offal as fertilizer in tree-planting programs. Encouragement should be given to such a scheme because any future expansion of the fisheries will result in even more pressure to re-cycle such material, especially if the "profit margin" (i.e. cost-benefit) becomes more narrow.

B. Impact on Non-Target Species - The long-term benefits from the local fisheries will only accrue if careful records are kept and if some research is began in terms of: fishing techniques, statistical treatment

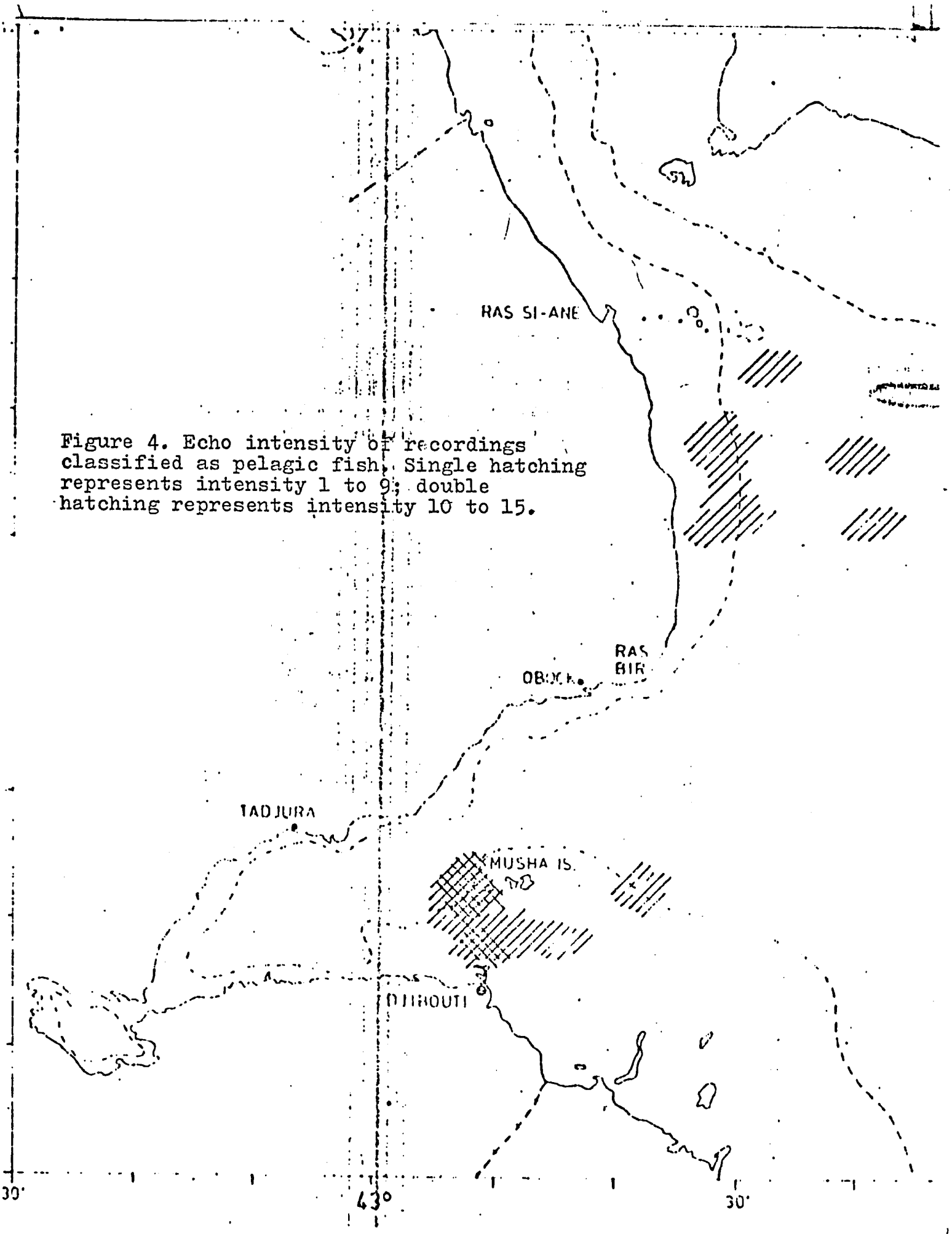


Figure 4. Echo intensity of recordings classified as pelagic fish. Single hatching represents intensity 1 to 9; double hatching represents intensity 10 to 15.

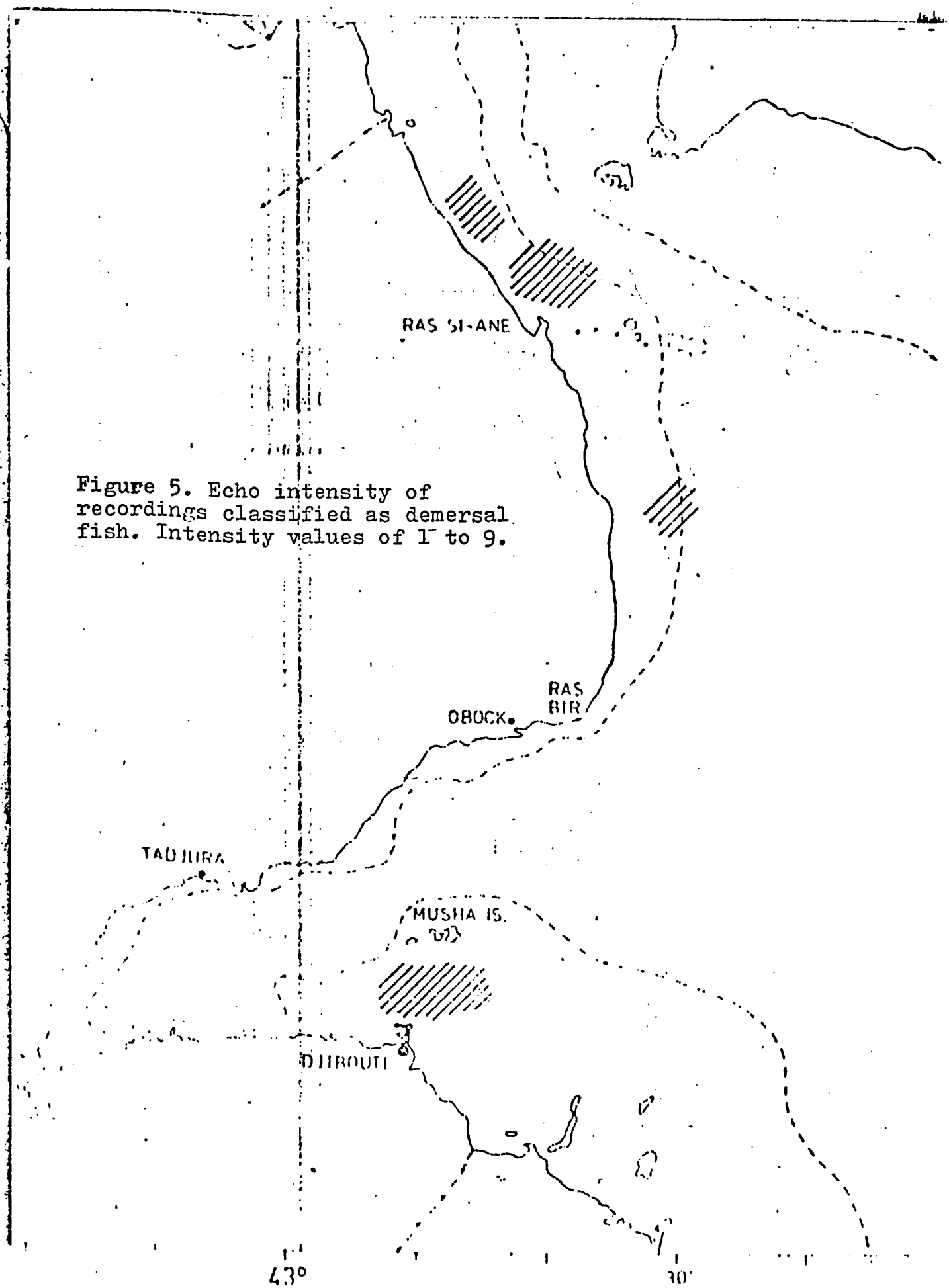


Figure 5. Echo intensity of recordings classified as demersal fish. Intensity values of 1 to 9.

of catch data, technical and scientific training, and ecological research on local fish species. All of these should be eventual goals for future research programs in Djibouti. At present we do know that the fish fauna of Djibouti consists of approx. 600 species (M. Rose pers. comm.) Some of these species will certainly be affected by continued pressure on inshore areas it should be assessed for impacts on the non-target species. In fact the assessment and management of coral reef fisheries along the African Coast is now a definite goal of FAO and the Indian Ocean Fishery Commission (5), thus, the advice of FAO should be sought in regards to future fishing effort and techniques.

Other non-target (non-mammalian) species would be sea turtles of which there are 3 species in Djibouti waters. The hunting of, dealing in, and exportation of sea turtles and their eggs is now specifically prohibited by the Djibouti Presidential Decree (13 May 1980 see copy attached as a Appendix C). As this important Decree becomes more well-known to local fisheries and shell-collectors it will be a good step forward in the international conservation effort for these animals.

This report will therefore recommend that the Decree be more prominantly displayed and circulated so as to inform the general public as to the penalties for taking these animals.

C. Impact on Endangered or Threatened Species

Of the marine mammals, the most important one in this regard is a sirenian, the dugong (*Dugong dugon*). It is classified by the IUCN as "vulnerable", i.e., it is likely to move into the endangered category in the near future if the causal factors continue operating. At

present the artisinal fisherman's use of lines and shark nets result in a few dugongs being taken occasionally. However, fishing methods are bound to change and more efficient gear will be introduced with time.

The FAO "Draft Global Plan of Action for the Conservation, Management and Utilization of Marine Animals" states the case as follows:

"The dugong is hunted for subsistence throughout its circumtropical range, and is also threatened in many areas increasingly by incidental capture in fishing gears, especially nets." In Djibouti the general advertisement of the Presidential Decree (Appendix C) would help because this specifically prohibits the hunting of dugong. In the long-term, as part of its potential tourist industry effort and in support of its future fishing resource, the Government of the Republic of Djibouti should establish some basic marine research program as outlined in Appendix D. Part of such a research effort could be a local study of the life cycle, population sizes and movements of the dugong, as recommended by the FAO/UNEP Global Plan of Action (8).

Regarding other marine mammals, Mr. Rose, Conservator of the Tropical Aquarium of Djibouti informed me that the local dolphin populations are not very much disturbed by the present fishing effort. Of the three species in Djibouti one is considered rare to the Indo-Pacific region, but locally it is a more common animal. These cetaceans will benefit from the Presidential Decree, because it also specifically protects all dolphins in addition to the dugong. As a long-term measure the Advisory Committee of Experts on Marine Resources Research of the FAO proposed that protected habitats be established for cetaceans. The creation of

marine nature reserves off the islands of Musha and Maskali as outlined in the Presidential Decree will serve as a good basis for such cetacean sanctuaries. Djiboutian territorial waters.

D. Regulation of the Fisheries

In the original Project Paper a case was made for the development of an ecological "consciousness" among the fishermen and shell collection (PP Annex IV-3, page 3). For example the taking of undersized or egg-bearing spiny lobsters and the disturbance, collection and sale of corals and shells were cited as the most pressing problems. Some pressure on these resources will now be relieved by the Presidential Decree, because it specifically prohibits the collection of fish, shells and coral in Djibouti's new marine parks. It also prohibits the exportation of coral and shells from the country and provides for a certificate of origin for all shells being sold. The penalty for hunting protected animals (dugong, sea turtles, dolphins) is 3 months to one year in jail, and/or $1,700 to $1,400 fine. While the shell or coral export penalty is 11 to 90 days jail and/or $200 to $1,700. But, as pointed out above, the provisions of the Decree must be advertised especially in places where fisherman, shell collectors and skin-divers are more liable to see the penalties involved. Perhaps a more meaningful method would be to publish a small booklet locally or design a poster with some explanation of how these measures will be beneficial to fisherman and the general public in the years to come.

IV. OYSTER CULTURE SUB-PROJECT

1. Introduction - Oyster culture is a good possibility in Djibouti because previously the nets used in the experimental culture of red alga showed incrustations by several marine organisms including several local oyster species. ISEART at present does not have the equipment, facilities or personnel to carry out any expanded research program in aquaculture, however, because of Djibouti's increasing need for marine production for food supply, it was felt that at least the initial aquaculture trials using oysters should be started.

2. Technique - The oyster culture pilot project will be carried out using the standard technique outlined in the project paper amendment (9). This will involve importation of seed oysters by air freight and subsequent transfers at different growth stages. At maturity the oysters will be marketed at the cooperative facilities now in use for local fish distribution.

3. Impacts - The environmental impacts of marine aquaculture are generally small in countries where it is already practiced. Some possible problems could be:

a. Introduced species- An experimental alga species was introduced into Djibouti and is now being cultured for possible production of edible algae using the Indonesia species Eucheuma spinosum. No problems were encountered in terms of adverse effects due to this introduction. In fact, the problem is more one of protection! So many predators are present in Djiboutian waters that it is difficult to protect the original algal seed culture.

It is recommended in that the USAID oyster sub-project, some local species could be tried in addition to the introduced species. Also the introduced oyster seed

culture should be closely observed from the start to see if it will adversely affect local oyster species. The local species apparently grow on the algal culture racks and are faily easy to obtain for experimental use.

b. Introduced diseases or parasites- it is possible that the introduced seed oyster may carry diseases or endoparasites. For the sub-project it is recommended that the seed oysters be certified as being disease-free prior to shipping samples. They should also be dissected and observed to see if any obvious disease or parasites are present.

c. Culture extended to large areas- in the event that the experimental pilot cultures are successful, the commercial expansion of oyster culture in large areas must be done with caution and under the direction of ISERT. Culture areas to be considered for the pilot studies under the sub-project are indicated in Fig. 3. If these areas are later extended by commercial enterprises they should not be located so as to encroach on any of the new marine reserve areas. Also they should not be located in areas that are extensively used by fishermen as this will cause a disruption in traditional fishing patterns. Finally, they should be located in pollution-free regions, far from any sewage outfall. The ability of bivalves to accumulate bacteria, viruses and toxins is too well-known to dwell on here, but should be kept constantly in mind during project design and commercial expansion.

4. <u>Abandonment of the Sub-Project</u> - In the event that the introduced oyster shows any negative effect on local species in the initial observations or if any diseases or endo-parasites are obvious during the pilot stage, the residual material should be collected, destroyed and the sub-project abandoned.

5. Summary - Marine aquaculture has had several success stories in the tropics and certainly should be encouraged as a way of increasing food production in seaside countries. However, a certain degree of caution must be maintained by the project manager. It is assumed that the sub-project will be maintained at an experimental or pilot level, but if it does show any promise then the interest of local people should be encouraged in order to stimulate commercial production. Local research efforts should also be encouraged to look into other forms of aquaculture. Because of the large number of local marine fish species (over 600) Djibouti is blessed with a large potential for development of marine resources. The market for these resources (shrimps, mussels, giant prawns, mother-of-pearl, mullet, etc) indicates that growth and management of local marine species should be given high priority.

V. RECOMMENDATIONS

1. Fishing Effort

The present estimated catch effort (576 mt) as well as estimated projected catch effort (1000 mt) fall well within the estimated maximum sustainable yields for this region. However, if and when, the annual catch effort reaches 1000 metric tons, an attempt should be made to diversify the fishing effort to concentrate on coastal pelagic species especially sardines.

2. Conservation

Marine mammals, endangered species and the new marine nature reserves are now protected under Presidential Decree of 13 May 1980. This decree should be advertised and posted in places where it will be seen by shell collectors, fishermen, sportsmen, and the general public.

3. National Fisheries Strategy

A long-term research effort is needed to allow for the rational management of marine resources. Some research topics and suggestions arising from this report are listed in Appendix D and may be of help to ISERT in setting future research priorities, and in conserving non-target fish species.

4. Oyster Culture Sub-Project

The culture beds should be located: a) so as not to interfere with local fishing effort; b) outside of the protected marine park areas; and c) far from any source of pollution. Local oyster species should be tried in addition to imported species.

5. Cause for Abandonment of Sub-Project

If initial cultures of seed oysters show any adverse effect on local species, or signs of significant disease or endoparasites, the sub-project should be abandoned.

6. Environmental Determination

If the above recommendations are followed a negative determination is recommended.

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M. Jean-Michel Rose - Conservator, Aquarium Tropical de Djibouti,

Staff and Affairs Officer, USAID Mission,

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Table 1. Principal species caught. Based on data from the Assoc. Coop. de Peche Maritime and the Aquar. Trop. de Djibouti (M.Rose).

Scientific Name	Common Names English	French	Djiboutian
SNAPPERS			
Lutjanus bohare	Red snapper	Rouge a dents	Bohare
Lutjanus coccineus	Humped snap.	Rouget	Houmbouk
Lutjanus argentimaculatus	Red snapper	Dorade rose	Sifane
TUNA-MAKERELS			
Scomberomorus commerson	Kingfish	Thazar	Derake
Thunnus albacares	Yellowfin	Thon rose	Zenoub
Euthynus affinis	Tuna	Thonine	Chiroi
Rastralliger kanagurta	Indian Maker.	Maquereaux	Barra
JACKS			
Caranx spp.	Jack	Caranque	Houdar
Scomberoides lysan	Jack	Caranque	Dourabe
BARRACUDA			
Sphyraena barracuda	Barracuda	Barracuda	Akam
DORADES			
Lethrinus waigensis	Dorade	Dorade	Gahache
GROUPERS			
Epinephelus tauviana	Grouper	Merous	Couchar
Epinephelus chlorostigma	Grouper	Merous	Couchar
Epinephelus aerolates	Spotted group.	Mer.mouchete	Coul-coul
OTHER FISH			
Sardinella spp.	Sardine	Sardinelle	-
Mugil spp.	Mullet	Mulet	Arabis
Rachycentron canadum	Black K'fish	Cobria	Sakala
Elagatis ripinulata	Rainbowrunner	Gazelle d.Mers	Toume
Coryphenea hippurus	Dolphinfish	Coryphene	Honfluss
Haemulidae	Grunters	-	Coul-coul
SHARK			
Carcharhinus melanopterus	Shark	Requin	Loraol
Carcharhinus spp.	Sharks	Requines	Loraol
Dasyatis varnak	Ray	Rae	Rabis
SHELLFISH & SQUID			
Panulirus sp.	Lobster	Langouste	Langouste
-	Squid	Calmars	Aboumedado
	Shrimp	Crevettes	Rhorhabe
	Crab	Crabe	Aboumedado

TABLE 9. Pelagic trawls

Station Number		105	106	107	109	110	111	112	113	115
Date		2.3	3.3	3.3	3.3	3.3	4.3	4.3	4.3	4.3
Hour start		2345	0110	0440	2005	2300	0125	0350	1035	1845
Towing time (minutes)		30	30	30	30	30	30	40	15	30
Position N		11°38'	11°48'	11°46'	12°08'	12°12'	12°16'	12°18'	12°35'	11°59'
E		42°47'	42°49'	42°59'	43°27'	43°39'	43°45'	43°27'	43°16'	43°28'
Fishing depth, headline (m)		0	50	0	0	25	30	25	25	30
Bottom depth (m)		225	-	166-50	28-78	360	312	39	43	-
Total catch (kg)		1.60	38.00	3.00	0.10	17.00	11.20	2.10	6.10	48.50
Anguilliformes	(Larvae)				+		+	0.30	0.10	0.20
APOGONIDAE	Apogon sp.							+		
CARANGIDAE	Decapterus macrosoma							0.05		
	Selar crumenophthalmus			0.10		0.60		0.20		
	Seriolina nigrofasciata					+		+		+
CHAMPSODONTIDAE	Champsodon sp.									0.05
CLUPEIDAE	Sardinella sp.	0.05								
EMMELICHTHYIDAE	Emmelichthys nitidus				+			0.50		
ENGRAULIDAE	Stolephorus sp.			0.02				+		
GINGLYMIDAE	Epinnula orientalis		+							
MELAMPHAEOTONIATIDAE			0.25							
MYCTOPHIDAE		+	36.50			3.90	4.00			36.80
NOMEIDAE				0.03						
PARALEPIDIDAE	Lestidium sp.	+	0.45							2.20
Pleuronectiformes	(Postlarvae)					+				
SPHYRAENIDAE	Sphyraena (jello)			1.20						
	Sphyraena obtusata					2.60				
TRICHIURIDAE										0.30
Fish larvae and juveniles (various spp.)					+				+	
CEPHALOPODA	("Loligo")		0.05	0.03	+	3.90	2.50	0.70	0.10	2.35
CRUSTACEA	(Charybdis edwardsii)	1.55	0.75	1.60		6.00	4.70	0.35		6.60
	Krill				+					
Medusa	Jelly-fish								5.90	

Table 3. Bottom trawl catches. R/V "Dr. Fridtjof Nansen"s Djibouti Cruise; 2 - 5 March 1981.

Station Number		108	114	116
Date		3.3	4.3	4.3
Hour start (30 min. haul)		0735	1020	2305
Position N		11°38'	12°35'	11°38'
E		43°13'	43°15'	43°14'
Total catch (kg)		515	90	214
ARIIDAE	Arius (thalassinus)	-	-	2.00
BALISTIDAE	Abalistes stellaris	-	-	0.80
CARANGIDAE	Decapterus maruadsi	-	-	0.40
	Scomberoides commersonianus	1.00	-	-
	Scomberoides lysan	1.00	-	-
	Selar crumenophthalmus	-	-	14.80
CLUPEIDAE	Dussumieria acuta	1.00	-	1.00
	Sardinella (gibbosa)	1.00	-	0.80
ECHENEIDAE	Echeneis naucrates	-	-	0.20
GERREIDAE	Gerres filamentosus	3.00	-	0.20
LEIOGNATHIDAE	Gazza minuta	90.00	-	26.40
	Leiognathus leuciscus	1.00	-	0.20
	Leiognathus splendens	325.00	-	1.60
MULLIDAE	Upeneus sulphureus	2.50	-	-
NEMIPTERIDAE	Nemipterus japonicus	12.00	-	20.80
PLATYCEPHALIDAE	-	-	-	0.40
PSETTODIDAE	Psettodes erumei	5.00	-	0.30
SCOMBRIDAE	Rastrelliger kanagurta	-	-	0.40
SPHYRAENIDAE	Sphyraena (jello)	-	-	1.40
	Sphyraena obtusata	-	-	0.40
SYNODONTIDAE	Saurida (tumbil)	5.00	-	30.00
TETRAODONTIDAE	-	3.00	-	1.80
THERAPONIDAE	Therapon jarbua	-	-	0.20
	Therapon theraps	10.00	-	13.00
TRICHIURIDAE	Trichiurus lepturus	3.50	-	1.80
CARCHARHINIDAE	Carcharhinus albimarginatus	-	90.00	-
	Carcharhinus limbatus	-	-	13.10
	- (juvenile)	2.00	-	0.20
SPHYRNIDAE	Sphyrna sp.	8.00	-	-
MYLIOBATIDAE	Rhinoptera javanica	40.00	-	80.00
CEPHALOPODA	("Sepia")	-	-	0.30
CRUSTACEA	Penaeus sp. (large)	1.00	-	1.50
	- (small)	-	-	0.25
	Thenus orientalis	-	-	0.20

1. Fish distribution

Like most tropical areas, many different species are found here but only the most numerous ones of commercial value need be considered at this time.

a. Tunas: According to Abee (1976), four species of tunas are represented in the waters of Djibouti - albacore (Thunnus albacares), thonine (Euthynnus sp), tongol tuna (T. (Kishinoeilla) tonggol), and listao (Katsuwanis pelamis).

The "albacore" and "thonine" are reported to be most numerous; however other tunas and tuna-like species are present in large numbers but are not taken by current fishing methods. The seasonal distribution and the behavior of the "albacore" change according to size. The young (1 to 4 kg) are found in greater numbers from April-May to November in the southern part of the Gulf of Tadjoura, moving in small schools on the surface. The medium size (4 to 5 kg) are found throughout the Gulf and on the Godoria Plateau from September to January in surface schools. From September to December, the larger size adults descend to the thermocline level (50 to 100 m deep) where they can be detected with an echo sounder.

The "thonine" are present in the Gulf from April until December with maximum numbers appearing in autumn in the southern part of the Gulf between Musha Island and the Ghubbet, as well as along the northern coast of Djibouti between Ras Duan and the Islands of the Seven Brothers.

b. Snappers (Lutjanidae)

Known locally as vivanaux, snappers are numerous in Djibouti. Several genera and species are reported. The most numerous and commercially important are vivanaux rouge (Lutjanus sanguineux) and vivanaux huntag (Aprion microlepus).

The vivanaux rouge (red snapper) is found in 20-80 m depths throughout Djibouti waters over rocky, irregular bottoms. From May to September they are in depths of 30 - 50 m, at the thermocline level. Often they will congregate on the surface in the open sea around Ras Duan and Ras Bir. For the rest of the year, the thermocline is deeper and not as well defined and the snappers are found on the bottom among the

rocks at depths of 80 m in the western zone of Tadjoura, and at 30 - 40 m on the plateau between Ras Bir and the Islands of the Seven Brothers.

The vivanaux huntag is more seasonal than the vivanaux rouge and from May to August is found between Ras Duan and Ras Bir in large numbers at the thermocline level. In the winter months, they have been taken in the Musha Island area at depths of 150 m by hand line.

c. Dorads (Lethrinidae)

The principla species Lethrinus waigensis is found throughout the year at depths of from 15 to 70 m all along the coastal waters including the shallow bottoms around Musha Island and on the Danakil shores as well, and in the deeper zones of the Gordoria Plateau.

d. Merous or groupers (Serrannidae)

The two main species, Epinephelus tauvian and E. chlorostigma, are found in the same areas as the ~~breams~~ dorads. The larger groupers (10 kg) are found along the continental plateau at depths of 50 to 80 m. A third species E. aerolates, the spotted grouper "kholl-kholl", is occasionally found in the open sea from April to June at depths of 30 to 50 m near Ras Duan and Ras Bir. During the remainder of the year they are found dispersed along the irregular bottoms in those areas.

e. Carrangues or jacks and travallys (Carrangidae)

These are present all year in the shallow waters along the coast from the surface to depths of 35 m. The greatest quantities are present between May and November and the size of the fish is the same in a school but varies from school to school.

f. Baracuda (Sphyrinidae)

~~Two~~ Several species are found in Djibouti waters. S. jello is present in coastal waters throughout the year except during the summer months when it is seldom taken. The other species, ~~S. [illegible]~~, ~~is~~ are more frequent in offshore waters and ~~is~~ are ~~also~~ present throughout the year.

A number of species of smaller size fish are present in Djibouti waters. However, with the exception of the sardinella taken by Yemeni fishermen, the rest have little commercial value except as bait for hand lines. The sardinella (several species) are found along the shores from April to June and from October to January. Another species of small fish, Leiognathers equiila, is abundant most of the year except during the summer months. It is found on muddy bottoms northeast of Djibouti.

These are the main fish of commercial interest. Other species appear in the catch such as mullet (Mugil), sea catfish (Aristes), various species of shark (Carcharinidae, Spyrnidae), and rays (Rajadae sp), but with the exception of the sharks, which are always present, there is no information on the seasonality or distribution of these other species.

An evaluation of the available data does not permit a more exact determination of the total volume of exploitable stocks. However, there is no doubt that the potential stock is large enough for a relatively modest fishery development project.

2. Fisheries background and statistics

The present fishery is carried out by artisanal fishermen operating almost entirely within local territorial waters. Although adjacent to the Gulf of Aden which supports a rich marine resource, the fishery does not extend into that area. Djibouti is not now or was ever used as a base for an off-shore fishing fleet.

There have been a number of surveys of the fishery and several programs for assisting further development of the artisanal fishery. The only important development was introduction of the outboard motor. The present fisheries are to be found at the City of Djibouti, Obock, Tadjoura, and Khor Angar, with the City accounting for around three-fourths of total landings. Obock (the original capital) is next in importance as it is located in what is agreed as the most productive fishing area. Tadjoura supports a smaller fishery. Khor Angar on the Red Sea provides a base for Yemeni fishermen during part of the year and sometimes for Djiboutians fishing for the local market.

Because of the relatively small size of Djibouti's fishery zone, fishing is quite limited and prospects for development must be tailored to fit the available resources. From extensive interviews with fishermen, discussions with fish sellers, market managers, fishery officials and others knowledgeable in fisheries, the total number of fishermen is estimated at approximately 200. Of this number, probably one-third or 65 can be considered full-time professionals; the others fish on a part-time basis. Fishing is a family affair and ~~sons learn from fathers and~~ fathers teach sons who in turn pass this knowledge on to their sons. Though at a low technical level, current fishing activity is effective and the fishermen are quite skilled in their methods.

The problem is one of inadequate equipment rather than method. Better nets of a more suitable design and material than those currently used will undoubtedly enable the fishermen to increase the present catch significantly. Since the local supply of fishing gear is limited to providing gear for sport fishing, the fishermen are dependent upon the Yemen for their nets, lines, floats, etc. This equipment is often not of the correct material nor of the right construction for the Djibouti fishermen but, as it is their only source, they must make do.

The most commonly used fishing gear are as follows:

a. Handlines.

These are monfilament of .80-1.4 mm diameter drain with stainless steel leaders, and usually with swivels. Hook sizes depend upon the species sought after - with only one hook per line. Sinkers are lead and the size (weight) of the sinker depends upon the depth fished. All this gear is available in Djibout where they are purchased by fishermen. Prices are high in comparison with those in the United States; but, considering freight, duties, etc., they are not excessive. The overall cost of handlines is not a deterrent to the fishermen; however, their efficiency could be improved by adding more hooks to the present single hook line.

b. Trolling lines.

These are usually made up of 100 m of cotton line to which sections of 140/100 m

monofilament nylon are attached at both ends. Swivels and 80 cm of wire leader with 5-8 cm hooks are attached. A 100 g lead weight is attached to the cotton line where it is joined to the nylon section. The hook is baited with a small fish (usually a mackerel) with the main body of the hook implanted into the body cavity with only the barb exposed. Some fishermen use artificial lures which they make themselves.

d. Nets.

Several kinds of nets are used by the fishermen. The straight net used as a seine for fishin in shallow water over the coral reefs is 60 to 70 m in lenght, 2 m deep and has a 25 mm mesh. The line net is a larger version of the straight net, measuring 100 m by 5 m and is used as a surrounding net. The trammel net is used for large fish and is made of two superimposed layers; the first measures 30 m by 2 m with a 40 mm mesh, the second is 30 m by 8 m with a 35 mm mesh.

Only the larger craft are able to fish with large gill nets. Most of the craft are small houris which are predominantly handliners; the amount of fish caught by this method is necessarily limited.

Fishing is carried out either day or night depending upon the sea and the phases of the moon. The line fishermen fish mostly around the Mascali and Musha Islands and the Loyada-Abomili zone. Those with motors go up as far as Ras Bir.

Statistics on the fisheries of Djibouti are weak and the best available represent rough estimates which themselves may vary according to the source. The statistics used in this report were derived in the main from cross-checking different sources of available figures, questioning industry people and by personal observation.

Annual landings by Djibouti fishermen are around 350 tons and possibly even as high as 400 tons. No breakdown according to species are available. Tunas, breams, jacks and shrimp were in good supply in the market.

All landings were made in the City except for around 50 tons made in Obock, Tadjoura and minor points. Though added into total catch in several country reports, we have not included an estimated 200 tons of migrating sardine-like species taken by Yemeni fishermen.

REPUBLIQUE DE DJIBOUTI

UNITE - EGALITE - PAIX

VISAS : PREMIER MINISTRE

MINISTERE DU COMMERCE, DES TRANSPORTS ET DU TOURISME

DECRET N° 80-062/PR/MCTT

portant sur la protection de la faune et des fonds sous-marins

LE PRESIDENT DE LA REPUBLIQUE

CHEF DU GOUVERNEMENT

VU Les lois constitutionnelles n° 1 et 2 du 27 juin 1977 ;

VU L'ordonnance n°77-008 du 30 juin 1977 ;

VU Le décret n°78-072 du 2 octobre 1978 portant nomination des membres du Gouvernement ;

VU La délibération n°262/7°L du 12 mai 1972 relative à la protection des richesses naturelles et des gisements préhistoriques ;

VU L'arrêté n°72-1363 du 20 septembre 1972 fixant les mesures de protection de la faune et des fonds sous-marins ;

VU La décision n°72-450/P.C.G. du 24 mars 1972 portant création d'une Commission de Sauvegarde de la Faune et des Fonds sous-marins ;

VU L'avis de cette commission en date du 7 novembre 1979 ;

SUR Proposition du Ministre du Commerce, des Transports et du Tourisme ;

Le Conseil des Ministres entendu en sa séance du 13 Mai 1980

DECRETE

INTERDICTIONS :

ARTICLE 1ER / La chasse sous-marine en scaphandre ou avec fusil à gaz carbonique comprimé est interdite dans les limites des eaux territoriales.

2c

ARTICLE 2 / La chasse, le commerce, l'exportation des cétacés, des dugongs, des tortues de mer et de leurs oeufs est interdite dans l'ensemble du territoire marin et terrestre de la République.

ARTICLE 3 / Le parc territorial de MUSHA est maintenu. Il s'étend sur la base médréporique située à l'Est d'une ligne rejoignant le Phare de MUSHA à la pointe Ouest de l'Ile du Large, à l'exception du Banc Dankali : les activités de pêche, sous quelque forme que ce soit, le ramassage du corail et des coquillages y sont interdits.

ARTICLE 4 / Il est créé une zone de réserve intégrale à MASKALI SUD zone comprise entre le phare de Maskali et le grand banc de sable de la côte au tombant. Toutes les activités aquatiques et subaquatiques y sont interdites.

RESTRICTIONS :

ARTICLE 5 / La chasse sous-marine est interdite dans le Gouhet entier passes comprises, aux Seba (Sept Frères) tous les récifs et côtes de l'archipel, baie de Ras Syan y compris et la totalité du massif corralien de Maskali (voir carte).

ARTICLE 6 / La chasse sous-marine est momentanément restreinte dans l'ensemble de la République, aux espèces figurant à l'annexe jointe.

ARTICLE 7 / L'exportation des poissons de coraux ainsi que la collecte des coquillages sont momentanément suspendues.
La vente des coquillages est soumise à la production d'un certificat d'origine étrangère.

ARTICLE 8 / La chasse sous-marine est réservée aux personnes âgées de plus de 16 ans.

ARTICLE 9 / Toute personne voulant se livrer à la chasse sous-marine devra se faire délivrer une attestation gratuite, comportant son nom, son prénom et son adresse.
Cette attestation sera délivrée par l'Office de Développement du Tourisme qui, à cette occasion remettra à l'intéressé un exemplaire du présent décret.

ARTICLE 10 / Restent autorisées les pêches et collectes effectuées à titre scientifique sous le contrôle du Président de la Commission de Sauvegarde de la Faune et des Fonds sous-marins.

MESURES D'APPLICATION :

ARTICLE 11 / Sont habilitées à constater les infractions au présent décret les personnes suivantes :

- Les Commissaires de la République
- Les Officiers de Police Judiciaire
- Le Chef de Service de l'Elevage et des Pêches
- Le Chef de Service des Affaires Maritimes
- Le Directeur de l'I.S.E.R.S.T.
- Le Directeur de l'O.D.T.

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- Le Conservateur de L'Aquarium Tropical
- Les Gendarmes Maritimes

ainsi que tous les Agents spécialement assermentés à cet effet.

ARTICLE 12 / - Les infractions aux articles 1 à 4, peine de 4e catégorie soit 3 mois à 1 an d'emprisonnement, et de 300 000 à 2 millions de FD, ou l'une de ces 2 peines seulement.

- Les infractions aux articles 5 à 9 peine de 3ème catégorie au lieu de 2ème catégorie :
de 36 000 FD à 300 000 FD et de 11 jours à 3 mois d'emprisonnemc ou l'une de ces 2 peines seulement.

- En outre, la confiscation des armes de chasse, scaphandres et des embarcations qui ont servi à commettre l'infraction pourra être décidée par le Ministère Public, le Juge d'Instruction ou la Juridiction saisie.

ARTICLE 13 / Le présent décret abroge l'arrêté n°72-1363 du 20/9/1972 fixant les mesures de protection de la faune et des fonds sous-marins.

ARTICLE 14 / Le Ministre de la Justice, le Ministre de la Défense Nationale, le Ministre de l'Intérieur, le Ministre de l'Agriculture, le Ministre du Commerce, des Transports et du Tourisme, sont chargés chacun en ce qui le concerne de l'application du présent décret.

ARTICLE 15 / Le présent décret sera exécutoire dès sa publicatic qui interviendra selon la procédure d'urgence.
Il sera également publié au Journal Officiel de la République.

Djibouti, le 25 Mai 1980

HASSAN GOULED APTIDON

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A N N E X E

ESPECES AUTORISEES A LA CHASSE SOUS-MARINE

Classe des Chondrichthyens ou poisson cartilagineux

- Toutes les espèces de requins sont autorisées à l'exception des requins vivant sur le fonds (requins tapis - requins nourrices - requins de sable).

Classe des Osteichtyens ou poisson osseux

Ordre des Mugiliformes
- famille des mugilidae (mulets)
- famille des sphyraenidae (barracudas)

Ordre des perciformes
- famille des carangidae (caranx)
- famille des coryphaenidae (coryphène)
- famille des scombridae (thon, thazard)

Sont interdites donc toutes les autres espèces y compris les rolos, murènes, perroquets, mérous, daurades, napoléons, etc...

Langoustes : à la main seulement et en apnée.

Appendix D

Long-term Research Effort in Fisheries

1) Surveys should be carried out if the major inshore fishing areas to define the future maximum sustainable yield for Djibouti.

2) Off-shore experimental FAO trauling should be encouraged to further define potential fisheries.

3) Present catch statistics should be reviewed by FAO and/or local fish experts to define the most common species and to refine the statistical techniques.

4) An ecological inventory of the local marine fauna should be initiated by the local marine aquarium along with permanent collections for future research use, as well as a tourist resource.

5) A research library and research facilities for study of the marine fauna should be initiated under the care and direction of a permanent conservator of the marine aquarium.

6) Assessment and management guidelines should be drawn up for the marine reserve areas, coral reefs and future protected areas.

7) Training Djiboutians should begin at several levels in terms of fisheries and marine resources. There is a real need here for practical training to increase fishing effort as well as research/training to identify and manage present marine resources as well as future marine aquaculture projects.

8) In order to develop these long-term recommendations, it would be worthwhile to inquire about the possibility of distance from FAO, World Bank, and bilateral aid agencies.