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A CASE STUDY ON THE ABU DHABI FISHING BOAT OF SRI LANKA*

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Abstract

For the expansion of the exploitation of resources in the near shore and off shore waters of Sri Lanka, three classes of fishing vessels (80 gillnetters of 11m., 10 trawlers of 11m. and two combination vessels of 21m.) were introduced. through the North - West Coast Fishery Development Project implemented during early 1980's. The total estimate of the project cost was Rs. 171.0m. (in 1983). The foreign exchange component of Rs. 112.0 m. was met by a loan from the Abu Dhabi Fund.

The Abu Dhabi fleet is very much active and make considerable contribution to the overall fish catch from the off shore. However, with the experience gained from small multiday boats and Abu Dhabi boats, it may be possible to develop a better off shore boat for Sri Lanka

Key words : Abu Dhabi Boats, Offshore Pelagic Fishery

1. Introduction

Sri Lanka, an island of about 64,000 sq. kilometers, and with a coastline of about 1600 kilometres, lies at the tip of the Indian Ocean sub-continent (latitudes 6 — 10 North and longitudes 80 — 82 East). Although it contributes less than two percent to the national GDP, the fisheries sector is important in the economy of the country. According to the Food Balance Sheet (Dept. of Census and Statistics) fish contributed 65% of animal protein consumed in Sri Lanka in 1988.

The fishing industry provides fulltime employment to around 96,000 persons (according to the Fisheries Survey in 1989). Part-time employment is also provided to around 10,000 persons while a further 5000 people are provided indirect employment by the industry.

Marine fishing takes place all around the coast but is mainly confined to the continental shelf area which is rather narrow, its width averaging only 22 km. and rarely exceeding 40 km. The shelf area (upto 180 m. depth) of 26,000 sq. km. represents 11% of the total area of the EEZ of Sri Lanka. With the promulgation of the EEZ in 1977, Sri Lanka has sovereign rights over an area of 230,000 sq. km. of the sea.

The bulk of the fish production comes from the coastal fishery. The fishing fleet of Sri Lanka which consisted of over 28,000 crafts in 1988 comprised mainly small and medium size craft (less than 11 m.l.o.a. and 60 Hp.), exclusively owned and operated by the private sector. Forty six percent of the fleet was motorized.

Fish production in Sri Lanka from the marine and inland sectors are given in Table 1. Marine catches are further sub-divided into coastal (upto 40 km. from the shore), offshore (40-160 km.) and deep sea (>160 km.) sub-sectors.

Until the early nineteen fifties, the local fishing industry was confined to small, indigenous, non-mechanized crafts which operated not more than a few miles off the shore. The beach seine or shore seine fishery was the major fishery contributing to 46% of the total fish catch in 1952. Mechanization of traditiond crafts, introduction of new mechanised boats, and the introduction of synthetic netting material in late nineteen fifties were the major development activities that paved the way for a significant increase in fish production. These measures enabled the fishermen to extend their range of operations with new and improved fishing methods. The total fish catch has shot up from 40,132 tons in 1958 to 89,492 tons in 1962/63 and to 134, 222 tons in 1968/69 (Table 1).

Table 1. Fish Production in Sri Lanka (m. tons)

Year	Coastal Fishery	Offshore and Deep sea Fishery	Inland Fishery	TOTAL
1952				25,016
1955				30,846
1958				40,132
1960				49,008
1960/61	54,965	2,492	2,621	60,078
1962/63	82,385	2,737	4,370	89,492
1965/66	89,050	2,535	9,187	100,772
1968/69	120,909	4,901	8,412	134,222
1971/72	86,915	2,290	9,247	98,454
1976	120,849	539	12,343	133,731
1979	146,506	2,067	17,150	165,723
1981	175,075	2,178	29,590	206,843
1982	182,506	1,078	33,319	216,903
1983	184,026	779	36,063	220,868
1984	134,490	810	31,380	166,680
1985	140,266	2,400	32,740	175,406
1986	144,266	3,400	35,390	183,056
1987	149,278	4,259	36,465	190,002
1988	155,099	4,425	38,012	197,536
1989	157,411	8,155	39,720	205,286
1990	134,132	11,666	31,265	177,063
1991	159,151	15,080	23,832	198,063

Source : Administrative Reports (Ministry of Fisheries)

Production from the coastal fishery has declined after a peak in 1983, largely on account of the civil disturbances in North and East. Fishing effort in the coastal fishery is extended through gillnets (60%), bottom trawl (15%), surface troll (5%) and other miscellaneous gear (20%) such as beach seine, hand line, pole and line, traps, purse seine etc. The composition of the catch is roughly 26% large pelagics, 47% small pelagics and 26% demersal and semi-demersal species.

The most sophisticated and fastest growing sector in the fishing industry is the offshore fishery, conducted by 9 — 11 m. boats for pelagic resources such as tuna, billfish and sharks. These boats are able to fish to the extent of the EEZ of Sri Lanka and beyond. This case study refers to the role played by the 'Abu Dhabi' boat in this development.

2. Coastal Fishery and the Impact of 3 1/2 Ton Boat

Coastal fisheries, which account for nearly 85% of the total fish production have grown at an annual average of 8.5% during the period 1970 to 1982 (Table 1). The increase is mainly due to the larger number of motorized boats introduced during this period and to better utilization of existing crafts.

The issue of 9.0 m. 3 1/2 ton boats to individual fishermen on a hire purchase scheme commenced in 1958/59 and the number of boats issued reached 997 in 1961/62, 1541 in 1965/66 and 2105 in 1969/70. Fishing co-operatives were the major beneficiaries after 1970 and the total number of boats issued since the commencement of the scheme exceeded 3000 during 1977. The fleet of 3 1/2 ton boats has contributed to nearly one third of the coastal fish catch (Table 2).

Table 2. Coastal Fish Production by 3 1/2 ton boats.

	1969/70	1979	1983	1987
(a) Coastal Fish catch (m. tons)	88,097	146,506	184,026	146,278
(b) Production by 3 1/2 ton Boats (m. tons)	25,073	50,405	57,375	50,960
%	28.5	34.4	31.2	34.1
(c) No. of 3 1/2 ton boats operating	1,600	3,109	2,861	2,657
(d) Catch/boat (m. tons)	15.7	16.2	20.0	19.2

Source : Administrative Reports (Ministry of Fisheries)

The impact of 3.5 ton boats in the coastal fish production is clearly, reflected in the increased tuna production (Table 3). Before the introduction of this boat and synthetic gillnets, the annual tuna production was less than 5000 tons. It had increased to over 17,000 tons in 1962 and 20,000 tons in 1967.

Table 3. Annual production of tuna and its percentage contribution to total fish production in Sri Lanka, 1951 — 1988.

Year	Total Fish Production (M. tons)	Production of Tuna (M. tons)	% Production of Tuna
1951	35,653	2,001	5.6
1957	39,617	3,497	9.6
1962-63	89,492	17,741	19.8
1966-67	118,777	20,222	17.0
1975	127,106	25,425	20.0
1980	187,678	29,191	15.6
1982	216,902	34,115	15.7
1988	197,536	26,745	14.1

Source : Joseph (1984)—Administrative Reports (Ministry of Fisheries)

Some of the 3 1/2 ton class mechanised boats have carried out drift gillnet fishing since mid 1960s. However, it was the successful drift gill net fishery conducted by the 11 ton class (11.7 metres) vessels belonging to the Ceylon Fisheries Corporation (CFC) in the late 1960s that acted as a stimulus in the popularisation of this method among the 3.5 ton class of boats. Most of these boats followed the larger boats in exploiting tunas up to the fringes of the off-shore range, resulting in a sharp increase in production. Since the late 1960s, the fishing effort on tuna has changed significantly with a shift from pole and line and trolling methods to drift gillnetting by the mechanised boats. (Table 4).

Table 4. Percentage Distribution of effort on tuna fishery and species composition of catch (1963 - 67 and 1968 - 70)

Fishing effort	Percentage	
	1963—67	1968—70
Troll line	66	22
Pole and line	18	04
Longline	11	07
Gillnet	05	67
Species		
Skipjack tuna	44	55
Yellowfin tuna	12	31
Kawakawa	20	07
Frigate/Bullet tuna	24	07

Source : (Sivasubramaniam, 1970)

Consequently, there occurred a change in the species composition of the tuna catch, with the species abundant in gillnet catches, skipjack and yellowfin) becoming the dominant species in the country's tuna fishery.

The high fuel costs since mid 1970s adversely affected the operations 3 1/2 ton boats. The Ministry of Fisheries suspended the subsidy scheme for the issue of these boats and encouraged increased use of non-motorized craft in the coastal fishery. An evalation of the profitability of different craft types in the coastal fishery was undertaken by the Ministry of Fisheries in 1984 (Table 5).

Table 5. Profitability of different crafts in coastal fishery.

Type of Craft	Capital Cost Rs.	Subsidy Component Rs.	Capital Less subsidy Rs.	Annual Profit after Dep. Rs.	Return on Investment %
3 1/2 t boat	212,465	74365 (35%)	138,100	28595	13.5
17 1/2-23 boat	59,930	20975 (35%)	38,955	13950	23.2
21'FRP craft (Pattara oru)	17,455	15710 (90%)	1,745	7130	40.8
19' FRP Lagoon craft	9,500	8500 (90%)	950	10235	107.7
18 1/2' FRP canoe (for inland fisheries)	10,000	9000 (90%)	1,000	16750	167.5

Source : Fisheries Development Strategy (1984)

The return on investment was lowest for the 3 1/2 ton boats, mainly due to heavy operating expenditures from high fuel costs (Table 6.)

Table 6. Operating profit of 3 1!2 ton boat

	Rs.
(a) Revenue — 22m. tons at Rs. 12,000/- m ton	264,000
(b) Operating costs	
Fuel — 54 litres/dayX200XRs. 8.13/1	87,800
Oil — 1/2 litre/dayX200 daysXRs. 17/lit.	1,700
Food for crew — 4 peopleX200 daysXRs. 10/-	8,000
Crew share 1/2 (gross revenue minus running cost)	83,250
Repair and maintenance of hull, engine and fishing gear (5% of total cost)	10,625
Replacement of fishing gear (1/3 of total cost of gear)	20,000
Insurance — 2 1/2% of the total cost	5,315
Incidental costs	2,000
	218,690
(c) Profit before depreciation	45,310
(d) Depreciation	
— Hull 4435 (15 years)	
— Engine 12280 (07 years)	16,715
(e) Profit after depreciation and before interest	28,595

Source : Fisheries Development Strategy (1984)

The above analysis is based on an average annual catch of 22 m. tons made during 200 fishing days. The crew share worked out to a monthly average of Rs. 1,734 per man.

The annual cost of a 3.5 ton boat engaged in gillnet/drift longline fisheries during 1980 was estimated at Rs. 41,600 to 44,700 (Fernando, 1984). The average production cost per kilo of fish was estimated at Rs. 8.67 and fuel cost at Rs. 2.00 per kilo. The net income was just over Rs. 50,000 for a boat with drift nets and over Rs. 96,000 for a boat with drift nets and longlines. Munasinghe (1984) has estimated an average annual net income of Rs. 79,000 for craft owners of 3.5 ton boats and Rs. 1,792 monthly income per crewman. The data for the above estimates have been collected during a survey conducted by the Marga Institute in 1980.

Offshore Fishery prior to introduction of Abu Dhabi boat

Fishing operations of some magnitude in the offshore and deep sea areas were conducted by the Department of Fisheries in the 1940's and 1950's. Some private sector operations were also conducted from time to time, but were not of much significance. Commercial fishing operations on a comparatively larger scale were conducted in the offshore and deep sea areas by the CFC commencing in 1964 and continuing into the 1980's; with a fleet of six stern trawlers fishing the Wadge Bank, 2 Oceanic tuna longliners and 40 medium size gillnetters (12.3m. ton class). The Cey-Nor Development Foundation also commenced some fishing operations with medium sized boats in the late 1970's and early 1980's, but these operations were not continued for long. The planned expansion of deep sea and offshore fishing operations did not take place. Until 1987, the highest production from the offshore and deep sea sectors was in 1969 when 4200 tons were landed, with the CFC accounting for 4160 tons. However, in no year did the production from this sector exceed 4% of the country's total fish production.

The operation of the fleet of 11 ton boats by the CFC was the first major attempt in developing an offshore fleet. It failed completely and all the boats sank or corroded along the beaches pretty quickly. Some information available on the production by this fleet are presented in Table 7.

Table 7. Fish Production by 11 ton boats of CFC (tons)

Year	Total	Catch/Boat
1965/66	29	
1966/67	278	
1967/68	798	
1968/69	1,007	25.2
1969/70	1,253	31.3

Source : Administrative Reports, Department of Fisheries

Assuming that the whole fleet was operating during the years 1968/69 and 1969/70, the catch per boat would be 25.2 and 31.3 tons respectively. Although these boats did not venture beyond the fringes of the offshore and conducted only single day fishing operations, they have played a catalytic role in extending the range of operations and production potential of the 3 1/2 ton boats in the coastal fishery.

A notable feature of the limited offshore and deep sea fishing activities by Sri Lankan vessels in the past has been the concentration on bottom trawling. However, the Indo-Sri Lankan Maritime Pact of 1975 resulted in Sri Lanka losing complete access to the traditional Wadge Bank fishing

grounds, loss of the northern portion of the Pedro Bank trawling grounds and a portion of Palk Bay/Gulf of Mannar fishing grounds. Further, with a relatively narrow continental shelf, the demersal resources are not large to present a substantial potential for expansion outside the coastal zone.

The need and the potential for development of pelagic fisheries of Sri Lanka beyond the coastal range were therefore felt more than twenty years ago. The success of the 3 1/2 ton boat in the coastal fishery also pointed to the direction of future development in Sri Lankan fisheries. However, the continued decline in production and inefficiencies in the state sector fishing operations led the Government in the late 1970's to promote the local private sector to undertake deep sea and offshore fishing. Inducements to invest were in the form of capital cost subsidies, tax concessions, investment relief tax holidays and soft loans.

The next major attempt in developing an offshore fishery was the introduction of a fleet of thirty (12.3 m.) GRP gillnetters through the Sri Lanka Fisheries Project (1975 — 1979), funded by the ADB. These boats which were designed by the White Fish Authority of U. K. and constructed in India, were expected to augment the production from exploitation of offshore fish resources. The boats were operated by 14 private companies. Disposal of the boats was very slow at the initial stages, with some boats lying idle for periods as long as 11 to 16 months. The targeted annual catch per boat was 80 tons. The performance of the ADB boats in fish production is given in Table 8. According to Joseph (1979), the 30 boats averaged 90 fishing days per boat in 1978 and landed 44.2 tons of fish per boat.

Table 8. Offshore Fish Production by South West Coast (ADB) boats (m. tons)

Year	No. operated	Catch	Catch/boat
1977	05	173	34.6
1978	23	979	34.7
1979	30	1040	34.7
1980	26	532	20.5
1981	19	427	22.5
1982	15	427	28.5
1983	15	427*	28.5
1984	15	427*	28.5
1985	15	427*	28.5

* Production assumed to be at 1982 level

Source : B. W. Perera (1987)

Equipped with insulated fish hold, crew accommodation, hydraulic net hauler and radio communication, these boats were ideally suited for larger fishing trips both in time and space. The scheme, however, flopped and the planned expansion of offshore fishing did not materialise. The poor financial and economic performance of these boats was attributed to technical defects (rolling, problems with gear box, fish hold etc.) and half of the boats were not operating three years after their introduction. Over one third of the fleet was converted to stern trawlers. (Forbes, 1986). However, their performance was also reported to have been effected by lack of proper planning in regard to training of operators, after sale services, warranty services etc. (Joseph, 1979).

Towards late 1970's, the Ministry of Fisheries also made an attempt-convert the 3 1/2 tonners to multi-day trip boats by insulating the fish hold and improving protection for the crew. Drawings and specifications were given to boatyards and state banks were persuaded to grant loans (Rs. 20,000) for installation of insulated fish holds. The Bank of Ceylon has granted only 28 loans and nothing significant happened until the late 1980's.

The Bay of Bengal Programme accquired an extended version (11 m.) of the 3 1/2 tonner in 1982 and equipped it with an insulated fish hold, basic crew accommodation, sail and low powered engine with the purpose of demonstrating better economy through multiday trips and fuel savings. The fishermen were not inclined to make longer than one day trips. Out of 175 fishing trips made in 1983, only 10 were of two day duration. It was only in late 1980's that this practice had become routine. The emphasis of BOBP's involvement in offshore fishery development in Sri Lanka by this time shifted towards demonstrating better safety and economics in offshore fishing.

Thus, in the early 1980's, when the North West Coast Fishery Development Project was initiated, the offshore fishery was still struggling to get off the ground. It is the considered view of many that the boats introduced into the offshore fishery through this project provided the necessary impetus which triggered the rapid development in the offshore fishery witnessed during the late 1980's.

4. THE ABU DHABI BOAT

4.1 The North West Coast Fishery Development Project

The North West Coast Fishery Development Project was originally conceived to introduce a fleet of 150 shrimp trawlers (10.3 — 10.6 m.) into Palk Bay/Gulf of Mannar areas, 20 multi-purpose vessels (12.3 m.) and two 19.4 m. vessels. However, with the realization that the major potential for expansion of Sri Lanka fisheries lay in the

exploitation of the more abundant pelagic resources in the near offshore and offshore waters, the emphasis shifted from shrimp trawling to offshore pelagic fisheries.

The main components of the revised North West Coast Fisheries Development Project included,

(a) introduction of a fleet of 80 gillnetters (11 m.) for offshore pelagic fishery.

(b) introduction of 10 trawlers (11 m.) for exploitation of demersal stocks of Gulf of Mannar and Palk Bay.

(c) introduction of two combination vessels of 21 m. class.

(d) shore facilities.

The total estimated cost of the project was Rs. 171.0 m. (1983, estimate) and the foreign exchange component of Rs. 112.0 m. (20 m. UAE Dh.) was met by a loan from the Abu Dhabi Fund for Arab, Economic Development. Consequently the project was referred to as the Abu Dhabi Project and the boats introduced through this project came to be popularly known as the "Abu Dhabi" boats.

4.2 Role of the Project Management Unit (PMU)

The project was implemented by the Development Division of the Ministry of Fisheries. A Project Management Unit (PMU) was set up within this Division in mid 1981 and consisted of a Project Manager (Asst. Director level) and four Project Assistants (two from the Ministry and two casual staff). Two Marine Engineering Assistants (MEA) functioned as Marine Surveyors in supervision of construction of boats and major repairs. A fishing gear instructor also formed part of the technical support team. The PMU was assisted by a Consultant Project Advisor and a consultant Naval Architect for three years (1982 — 1985). Six fulltime staff were also allocated for secretarial duties. The Project Manager was directly responsible to the Director of the Development Division of the Ministry.

The PMU was responsible for ordering of imported equipment and supplies and its distribution to the boatyards constructing the boats.

The fleet of 80 gillnet/longline boats were constructed by 3 local boatyards and introduced into offshore fishing during the period 1982 to 1986. The schedule of issues is given in Table 9.

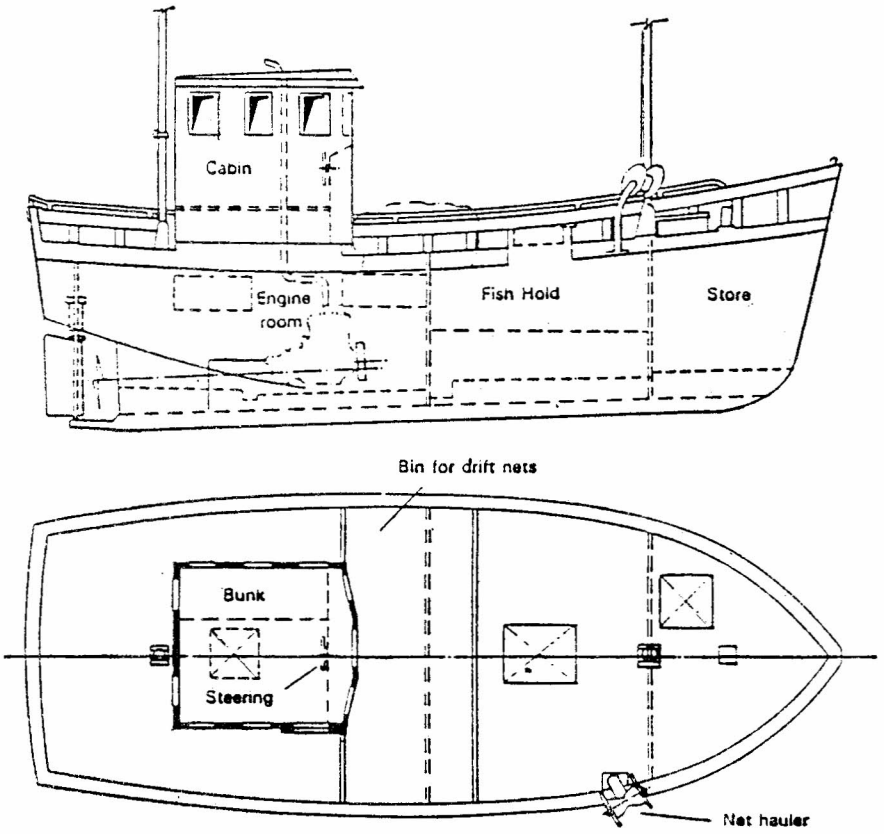

Fig. 1. General Arrangement and main characteristics of the Abu Dhabi Boat

Length overall LOA	10.4 m (34 ft)
Beam midship, B	3.75 m
Depth moulded to deck D	1.54 m
Cubic number LOA X B X D	60 m^3
Draft aft	1.35 m
Fish hold volume	7.5 m^3
Fish hold capacity – fish and ice	5400 kg
Fuel capacity	500 l
Fresh water capacity	400 l
Light ship displacement	10.5 t
Nets and longline	1.3 t
Fish and ice 50%	2.7 t
Fuel 50%	0.2 t
Water 50%	0.2 t
Crew and effects 100%	0.4 t
Total dead weight	4.8 t
1/2 load displacement	15.3 t
Engine model YANMAR 3 ESDE	56 hp
Power/displacement	3.7 $hp_/t$

Table 9. Issue of Abu Dhabi Gillnetters

Year	No. of Boats issued	Cum. total
1982	08	08
1983	16	24
1984	16	40
1985	31	71
1986	09	80

Source : Ministry of Fisheries

Ten prototype boats were first built and after trial fishing operations by the Ministry of Fisheries, changes were affected in deck arrangement, fish hold, engine installation, fuel system etc during the construction of the balance fleet of boats.

It is reported (Ariyadasa, 1986) that the Ministry has experienced difficulties in finding suitable beneficiaries for these boats, particularly in 1983 and 1984. 17 boats were tied up for 4 — 5 months in 1984 for want of lessees. As the boats were slow in moving out of boatyards, it has affected the schedule of construction and delivery of the balance. With the Ministry of Fisheries relaxing the collateral requirements from individual fisherman and eligibility of co-operatives on grounds of non-payment of past fisheries loans, there have been increased demand in subsequent years.

The 80 boats were first leased out to individual fishermen (56 boats), fishery co-operatives (14 boats to 7 co-operatives) and to CFC (10 boats). The skippers and crew selected for these boats at the beginning of the project have been given two weeks training which included 1 - 2 days sea training and 2 days training with the engine supplier.

The boats made of FRP were provided with 60 hp engine, hydraulic net hauler, insulated fish hold, crew accommodation and SSB radio for communication facilities. General arrangement and main characteristics of the boat are given in Fig 1.

Mobile workshop units envisaged in the original proposal for the maintenance of the boats did not materialise due to lack of funds. The PMU co-ordinated the inputs of spares, material and men by the boat yards, engine agents and equipment suppliers to enable speedy repair of boats. The situation in regard to repairs and maintenance of the boats is reported to have improved considerably since 1985, with the deployment of three Technical Assistants to major fishing centres. They also assisted the PMU in monitoring the performance of the boats.

The PMU is also responsible for the seizure of boats for non-payment of lease rentals when the over-due rental exceed a certain number. Legal action is them initiated towards recovery of the balance. The number of overdue rentals allowed prior to seizure was 3 at the beginning. It was increased to 10 in 1989 as fishing was disrupted due to civil disturbance.

When a boat is seized, the technical staff of the PMU physically check the boat, equipment and gear, prepare condition reports etc. Necessary repairs are carried out at Ministry expense before it is valued and issued to a new lessee. In the case of all secondary issues, the down payment is Rs. 50,000 for individual lessees.

4.3 Financing, including subsidy and loan facilities

A fully equipped boat with 60 gillnets and 40 baskets of longline was priced at Rs. 1.3 — 1.4 m. The cost breakdown is given in Table 10, together with a revised estimated cost for a similar boat in 1988 (Gulbrandsen, 1991).

Table 10. Cost of construction of Abu Dhabi Boat, 1982 and 1988— (in SRL Rs)

	1982	1988
Hull	730,000	950,000
Engine Yanmar 3 ESDE	150,000	530,000
Nethauler	70,000	90,000
SSB Radio	40,000	100,000
Electrical System	60,000	80,000
Equipment	86,000	100,000
Total: Boat	1,136,000	1,850,000
Fishing Gear (60 nets, 40 baskets longline)	200,000	280,000
Total	1,336,000	2,130,000

Source : Gulbrandson, 1991)

The two State Banks (Bank of Ceylon and People's Bank) were to handle the credit scheme in connection with this Project. However, with the two Banks reneging on their original agreement to handle credit, the Ministry of Fisheries introduced a leasing scheme for the disposal of these boats. The boats were issued at 35% subsidy to individuals and 50% subsidy to fisheries co-operatives (subsidy on hull and machinery only). The remaining loan was repayable over 8 years with a 12.5% interest. The capital cost less subsidy and down payment was considered

as net value of boat for leasing. The lease terms for these boats included an initial down payment of Rs.70,000 and 96 monthly rentals of Rs. 14,820 for individual lessees. Fishing co-operatives were not required to pay a down payment and their monthly instalment was fixed at Rs. 13,330.

The essential feature of this scheme is that the Ministry of Fisheries retains the ownership of the boats until they are fully paid for. The Ministry retains full title to the boat, enabling it to seize the boat if the boat operator, i.e. the lessee defaults in lease rental payments or violate other conditions. The Leasing Agreement also incorporated certain management measures considered necessary for its successful implementation. The more important ones are :

— that the lessee accepts the Ceylon Fisheries Corporation (CFC) as the Agent of the Ministry implementing the Agreement.

— that the lessee will use the boat for the purpose intended and shall keep the Ministry of Fisheries informed of the fishing programme and movements from harbour to harbour.

— that the lessee shall keep the boat, engine, equipment and fishing gear in a good state of repair and will permit inspection by officials of the PMU.

4.4 Marketing, Insurance and role of Ceylon Fisheries Corporation (CFC)

The CFC function as the agent of the Ministry of Fisheries in the collection of rentals from the lessees for a payment of 5% commission on the interest component of rentals recovered. They are also the agents for the Insurance Corporation of Sri Lanka, and collect insurance premiums for a 5% commission. A separate unit manned by accounting staff was established within the CFC for this purpose. With this unit shifting its location to the Ministry of Fisheries premises in late 1984, there has been greater coordination between it and the PMU. The collection of rentals has increased from 25% in 1984 to 55% in 1986.

In marketing of fish landed by the project boats, there had been an agreement for CFC to purchase the entire catch at mutually agreed prices. Boat operators were unhappy with the grading of fish adopted by CFC and non-acceptance of certain varieties of fish. They were then allowed to auction their catch and private buyers were allowed to compete with CFC. In the end, the Project gave the boat operators a free hand in the marketing of fish. Fish on ice landed by the Abu Dhabi boats fetched lower prices compared to fresh fish landed by the coastal boats. Iced fish had low consumer preference and this situation

prevailed until about mid 1980's. With the escalation of civil disturbances in North and East, fish supplies dwindled and this helped in boosting sale of iced fish. In later years, with the development of offshore fishery, there had been greater acceptance of fish on ice. In order to offset the price differences that prevailed in different landing centres, most of the boat operators began sending their catches to Colombo and 8 to 10 operators are reported to posses their own refregerated trucks.

The boats were initially insured for total loss cover with the Insurance Corporation of Sri Lanka. Since June 1984, they are also covered for partial loss, i.e. partial loss or damages to hull, engine, fishing gear etc. Accordingly, the boats were insured for total and partial loss at an annual premium of Rs. 34,000 per boat, payable in two instalments. While there were no claims for total loss prior to June, 1984, there has been a total of 108 claims during the period June 1984 to December 1986, 96% of which involved lost fishing gear.

5. CURRENT STATUS AND PERFORMANCE OF THE ABU DHABI BOAT

5.1 Current status of the Boat

Of the fleet of 80 Abu Dhabi gillnetters originally introduced, all except three are still in operation. Two boats were grounded and damaged while a third was lost due to terriost activity. Many boats have changed hands number of times, as a result of re-leasing after seizures or unofficial sale between operators. Records maintained by PMU shows that a total of 41, 35 and 4 boats are with the first, second and third lessees respectively. The three boats that were lost were operated by the first lessees at the time of loss. Unofficial sales have occurred in the case of 33 boats ; 15 boats registered under the first lessee, 17 boats registered under the second lessee and one boat registered under the third lessee.

A total of 31 seizures have been affected up to May 1989. 19 cases have been filled for non-payment of rentals and so far only two have been disposed of.

In 1991, the Government, with the approval of the Abu Dhabi Fund, reduced the loan component by 25% as the boats could not operate to their full potential due to continued civil disturbances. This concession represent a reduction in the number of rentals payable from 96 to 72. At the beginning of 1992, complete payment of 72 rentals have been made for six boats and over 50 rentals have been paid in respect of twenty boats. PMU records show that as at April 1982, 70% of the loan component has been settled in respect of the whole fleet.

5.2 Techno-Economic Performance of the Abu Dhabi Boat

An analysis of the performance of Abu Dhabi boats during 1983 -1984 by Joseph and Moiyadeen (1988) shows that although the proportion of day trips was initially high, there was a shift towards an increasing number of trips lasting more than a day. This is seen in the percentage breakdown of trips on the basis of number of days taken per fishing trip. (Table 11).

Table 11. Fishing Trips by Abu Dhabi Boats

Duration of Fishing trip	1983	1984
1 day trips	37.8%	27.7%
2 day trips	38.7	31.2
3 day trips	19.6	30.1
4 day trips	4.2	7.7
5 day trips	—	2.8
6 day trips	—	0.2
Total no. of trips	560	1074

Source : Joseph & Moiyadeen, 1988.

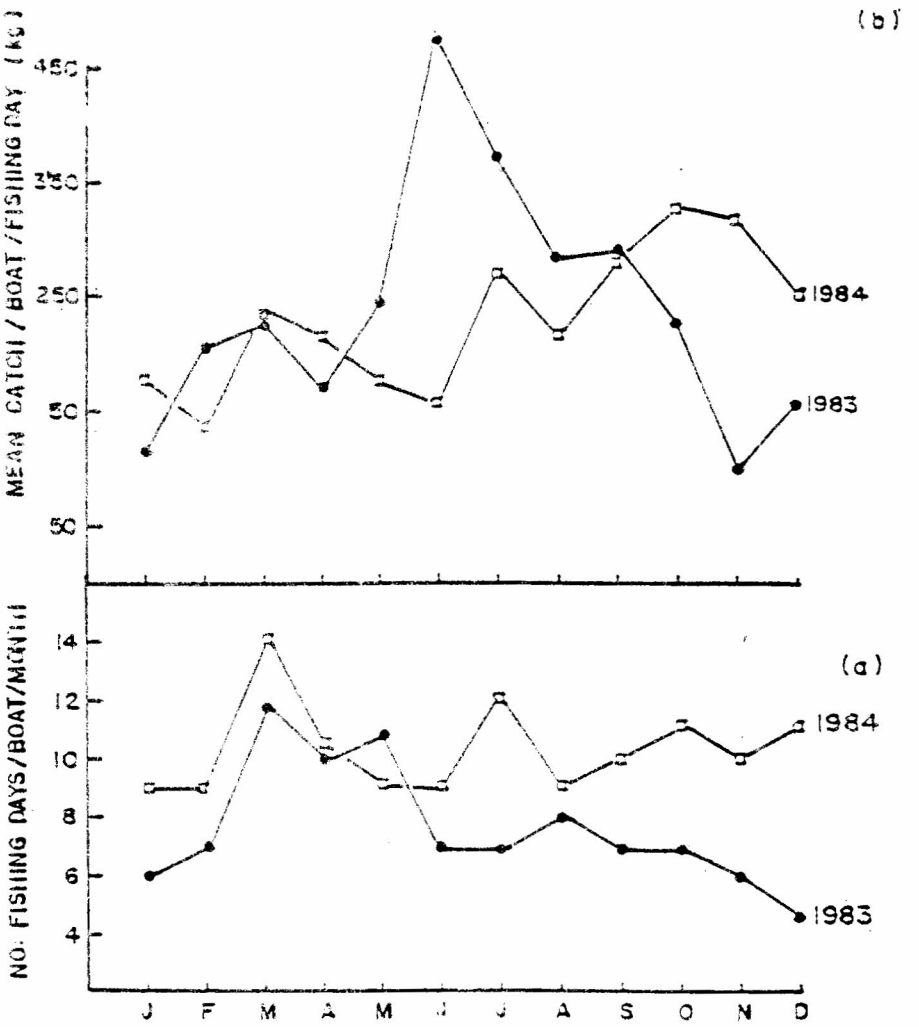

Fig. 2 (a.b) Monthiv variation in fishing effort and caton per unit effort in the flillnot/ longline fishery conducted by tne 11 metre boat.

Source - Joseph and Mciyadeen (1988)

The mean number of fishing days per boat per month is plotted in Fig. 2 (a) for 1983 and 1984. The mean during 1983 ranged from 4.7 to 11.8 days per month, while some boats achieved 17 to 18 fishing days during certain months. The mean values obtained during 1984 are higher than those obtained during 1983, with a range of 9 to 14 days per month. Some boats have been able to achieve 21-22 days fishing

during certain months in 1984. However, for the two year period, the mean number of fishing days per boat per month has not exceeded 15. The mean values give a total of 92. 2 days fishing per boat during 1983 and 123 days fishing per boat during 1984.

The mean catch per boat per fishing day on a monthly basis is plotted on Fig. 2 (b) for 1983 and 1984. The values ranged from 104.0 kg. to 480.5 kg. in 1983 and from 138.5 kg. to 327.0 kg. in 1984. Highest catch rates were obtained between May and October in both years. The estimated mean number of fishing days per boat per month and the mean catch rates give an annual production of 22.5 t and 28.9 t per boat, during 1983 and 1984 respectively. An average annual production of 40 tons per boat is being used by the Ministry of Fisheries for purpose of estimating fish production by the Abu Dhabi fleet in recent years. In 1990, the fleet has landed 2680 tons, equivaient to 23% of the total offshore catch.

The targeted annual catch for the Abu Dhabi boat was 100 tons. With the boat operators having to pay a 1 - 5% Turnover Tax, it is believed that the catches and earnings of the Abu Dhabi boats have been grossly under reported. Even allowing for such under reporting, the boats have not performed to the expected targets. Catch data provided by a couple of reliable operators from Negombo and Galle points to a maximum annual catch of 65 - 70 tons per boat.

The following are the key factors presumed to have influenced the performance of Abu Dhabi boats.

— inability to operate in the East coast. In early 1980's the boats have operated from major fishery harbour around the country : South (Tangalle and Mirissa), South West (Galle), West (Colombo and Negombo), North West (Kalpitiya and Kandakuliya) and North East (Trincomalee). With the onset of civil disturbances in North and East, the boats could not operate from the East coas during the northeast monsoon period. The inability to benefit from seasonal availability of the resources from both western and eastern coasts is reported to have affected the performance of the Abu Dhabi boats.

— High operating costs. The Yanmar 3ESDE engine has an indirect fuel injection system giving a high specific fuel consumption. In combination with the power required to push the heavy, beamy boat, the fuel cost per kg. of fish caught is twice as high as in smaller multiday boats (Gulbrandson, 1991).

— The boats, originally designed for three day long fishing trips, soon began to spend 7 - 9 days at sea, particularly during the lean season. With most boats having inadequate insulation in the fish hold (Gulbrandsen, 1991) the quality of fish was inferior compared to that from smaller multiday boats conducting 3 - 4 day long trips. This has affected income and crew shares.

— Repairs taking longer time and thereby reducing fishing days.

— Problems with engine spares. The engine supplier has long since stopped stocking up essential running spares and the boat operators are forced to rely on inferior substitutes.

It is contended that the above factors, in addition to affecting the fish production and income from the boats, also resulted in an exodus of competent boat operators and fishermen from the Abu Dhabi boat to other smaller multiday boats that provided better economic returns.

Table 12 gives a comparison of economic performance of different multiday boats, including an Abu Dhabi boat. Although it is difficult to say how typical the operation of these boats are for offshore boats in Sri Lanka, they represent a good cross section of the different types (sizes, engine horse power etc.) of multiday boats in operation for an analysis as a case study. Data are available in respect of the following boats ;

NW — 4 — Abu Dhabi boat operating from Galle during 1986/87 and 1987/88.

SRL/34 — 10.3 m. (25 hp. engine) Neil Marine boat operated by BOBP from Beruwela.

SRL/15 — 9.7 (20 hp. engine) boat operated by BOBP in Galle.

NM — 237— 10.3 m. (30 hp. engine) Neil Marine boat operating from Galle.

Table 12. Economic Performance of Multiday Boats in Sri Lanka

Boat Type	Abu Dhabi NW — 4	Abu Dhabi NW — 4	32ft. Neil Marine /BOBP SRI/34	9.7 m. SRI/15 (BOBP)	32 ft. Neil Marine NM — 237
Period of Operation	Nov/86 Oct/87	Nov/87 Oct./88	May-Nov./1987	Nov/87-Oct./88	Feb-Oct/88
Base of Operation	Galle	Galle	Beruwela	Galle	Galle
(A) Period of operation (months)	12	12	7	12	9
No. of trips	52	37	45	54	46
No of Sea days	N.A.	223	104	214	165
No. of Fishing Days	207	188	90	173	137
No. of Fishing Days/trip	4	5.1	2.0	3.2	3.0
(B) Catch—gillnet (t)	—	32.2	11.3	25.2	27.1
Drift longline (t)	—	10.4	4.1	3.2	1.7
Troll line (t)	—	1.4	1.1	1.6	1.4
Total catch (t)	70.6	44.1	16.5	30.3	30.2
Catch per trip (kg.)	1359	1192	368	561.5	656
Catch per fishing day (kg.)	341	235	184.1	175.3	220.3
Catch per sea day (kg.)	—	197.8	159.3	141.7	182.9

Table 12. Economic Performance of Multiday Boats in Sri Lanka

Boat Type	Abu Dhabi NW— 4	Abu Dhabi NW —4	32ft. Neil Marine /BOBP SRI/34	9.7 m. SRI/15 (BOBP)	32 ft. Neil Marine NW — 237
Period of Operation	Nov/86 Oct/87	Nov/87 Oct./88	May-Nov./1987	Nov/87-Oct.88	Feb-Oct/11
Base of Operation	Galle	Galle	Beruwela	Galle	Galle
(C) Value of catch (Rs.)	1,007,239	828.228	306,957	605,473	616,877
Value per/kg. (Rs.)	14.26	18.77	18.52	19.97	20.44
Operational cost (Rs.)					
Fuel	226,496	172.765	27,366	47,648	51,761
Food	90,850	57,650	17,800	45,650	34,000
Ice	102,720	94,350	20,680	29,850	34,300
Bait	—	1,157	—	21,436	1,015
Others	—	28,050	3,033	7,162	26,700
TOTAL	420,066	353,972	68,879	151,746	147,777
Operational Cost/kg. (Rs.)	5.95	8.03	4.16	5.00	4.90
(D) Net earnings (Rs.)	587.173	474,256	238,078	453.727	489,100
Crew Share	293,586	237,128	119,039	226,864	234,550
Crew Share/member/month	4893.40	3592.13	4251.39	4726.33	6515.27

Source : Joseph, L. (1989b)

The Abu Dhabi boat is reported to have operated with only 40 nets in 1988, resulting in a significant drop in production compared to 1986/87 when 60 nets were used. The operational cost of producing one kilogram of fish (fuel, food, ice etc.) is Rs. 6 - 8 in the Abu Dhabi boat and Rs. 4 - 5 in other smaller boats. The fuel cost of producing one kilogram of fish is Rs. 3.2 - 3.9 in the Abu Dhabi boat and Rs. 1.6 - 1.7 in the other boats.

Table 12 also shows that crew share from the Abu Dhabi boat will be equivalent to that of other smaller multiday boats only when the catch is high. When the catch is low, the smaller boat guarantee better economic returns due to comparatively low operational expenditure.

Using data from NW-4, Gulbrandson (1991) has also shown that this type of boat would remain at sea until a catch of about 1.8 t has been achieved. When catches are low, fishing trips may last upto eight days.

The cost of building an Abu Dhabi boat today would be around Rs. 2.1 m. (Table 10). An economic evaluation by Gulbrandson (1991) brings out the following main points,

(a) With a realistic annual catch of 64 t, the rate of returm is only 3% and the boat is not economically viable at current prices (Annexe I).

(b) The crew share of 50% of net return is higher for multiday boats with heavy investment. A reduction to 40% would increase the rate of return to 7%.

(c) With the crew share of 50%, the boat need to catch an impossible 100 t to achieve a rate of return of 15%, to be eligible for bank financing.

(d) With the 35% subsidy, the boat would give a 15% return on investment with a catch of 80 t which is also not realistic.

In mid 1990, NARA (National Aquatic Resources Agency) modified an Abu Dhabi boat with the objective of achieving 240 sea days per annum and 8 -10 day long fishing trips (Suraweera, 1990). The fuel and fresh water capacity was increased and facilities for crew improved. The envisaged catch of 72 tons is expected to give a rate of return of 15.8% (Annexe II). No reports are available on the performance of this boat.

In spite of such economics, in technical terms (capacity, endurance etc.) the Abu Dhabi boat is still considered the best boat available for offshore pelagic fishing in Sri Lanka. The hull, based on a British North Sea type with a high beam to length ratio, is very stable and Gulbrandsen (1991) considered it a key factor that contributed to its success in multiday fishing. Over the years, the strongly constructed hull has stood up to rough handling and lack of proper maintenance.

6. IMPACT OF ABU DHABI BOAT

No new 'Abu Dhabi' boats have entered the offshore fishery outside the 80 boats originally introduced, as the boat is very expensive to acquire and operate, and a number of cheaper versions have become available in recent years.

However, it is the successful operations of Abu Dhabi boats that triggered off the rapid development in the offshore fishery in Sri Lanka. There may have been other factors that influenced this development. With increased operational costs and lower catches for the coastal day boats, the need to extend the fishing range and economise operations through multiday fishing was more acutely felt than before. Dwindling fish supplies from the North and East may also have stimulated venturing into hitherto under-exploited offshores for increased catches.

It is therefore somewhat difficult to assess the role played by the Abu Dhabi boat in this development. However, the catalytic role played by the Abu Dhabi boats in the establishment of an offshore fishing fleet is particularly significant when viewed against the backdrop of previous failed attempts. The impact of this development is evident in many spheres.

6.1 BIOLOGICAL IMPACT

Offshore fish production has increased from 2,000 t in 1981 to 8,000 t in 1989 and to over 15,000 t in 1991 (Table 1). Gillnets, drift longlines and troll lines contributed to 79.5%, 16% and 4.5% of the offshore catch respectively. (Table 13).

Table 13. Offshore fish catch by gear (1987 - 1988)

Boat	Drift Gillnet	Drift Longline	Troll Line
SRL/34	11.3	4.1	1.1
NM/237	27.1	1.7	1.4
SRL/15	25.5	3.2	1.6
NW—4	32.3	10.4	1.3
Total	96.2	19.4	5.4
Percentage	79.5	16.0	4.5

Source : Joseph (1989b).

With the development of the offshore fishery, the range of operations of local small boats extended to 100 - 150 n miles in 3 to 4 day long fishing trips. In more recent years, some of the larger boats, including the Abu Dhabi boats are reported to engage in 8 - 10 day long fishing trips, especially during the lean fishing season. Although the newly developed offshore fishery has extended the range of local fisheries and contributed to increased fish production, the resource exploited (pelagic resources of tuna, shark and billfish) is the same as that being exploited by the 3 1/2 ton day boats in the coastal fishery (Table 14).

Table 14. Percentage Species composition in coastal and offshore fisheries

Species	Offshore fishery			Coastal fishery
	NW-4	SRL/15	NM-235	
Tuna	65.7	72.8	74.1	65.6
Shark	27.4	18.5	13.6	16.5
Billfish	6.0	7.3	11.5	11.7
Others	0.9	1.3	0.7	6.2

Source : Joseph (1989b) and Dayaratne (1990).

Skipjack and yellowfin are the two dominant species in the tuna catches in both coastal and offshore fisheries. The relative distribution of skipjack and yellowfin in the offshore range was found to be similar to what has already been established for the coastal zone — i.e. a decrease in concentrations of skipjack northwards and southwards of South-West and an inverse pattern for yellowfin (Joseph, 1989a). A considerable proportion of the tuna resources earlier exploited by the 3 1/2 ton day boat fishery within the coastal zone is now being taken by the multiday boats in the offshore. Falling catches and income, added to high operational costs have made the 3 1/2 ton boat uneconomical in large pelagic fisheries within the range it has been dominating since its introduction. Virtually no 3 1/2 ton boats are now built for coastal large pelagic fisheries.

6.2 TECHNOLOGICAL IMPACT

The success of the Abu Dhabi boat led to a spurt of boat building activity in the late 1980's. A large number of 3 1/2 ton a day boats were modified for multiday fishing by the provision of insulated fish holds or insulated ice boxes on board. Eight boatyards have developed new designs of multiday boats which are more cost effective and economically viable than the Abu Dhabi boat.

During this time, the Government policy on fishery development also changed, with greater priority for the development of offshore fisheries compared to the traditional coastal fishery. More subsidy and bank credit was made available for multi-day boats. Bank of Ceylon, in its now defunct Self Employment Schemes I and II, has made credit facilities available for 199 multiday boats during 1986 - 88 period. Since 1991, it is operating a non- subsidised Self Employment Loan Scheme and another credit scheme for the newly established fisheries co-operatives, with a 25% subsidy by the Ministry of Fisheries, since 1991. A total of 92 and 51 boats have been issued through these schemes respectively. Another 30 multiday boats have been issued by the People's Bank through its SMI (Small and Medium Term Industrial) Credit Project with refinance from the National Development Bank.

In addition to the 80 Abu Dhabi boats, the Ministry of Fisheries has estimated the total number of multiday boats in 1990 as 362. Dayaratne (1990) has estimated a total of over 600 boats in the offshore fishery. A few larger boats of 38 - 40 ft. and 45 ft. are also engaged in offshore fishing. The offshore fishery seems to have reached a level of sustained development without need for further technical inputs from outside.

6.3 SOCIO — ECONOMIC IMPACT

The Abu Dhabi boat and the offshore fishery development it helped trigger off have raised the income levels of the fishermen engaged in this fishery. The monthly income of an offshore fisherman has ranged from Rs. 3,600 to 6,500 during 1987 to 1988 period. (Table 12). The monthly income of a 3 1/2 ton day boat fisherman in 1984 was estimated at Rs. 1734 (Table 6). Fishermen are reported to have changed their lifestyle and work habits because of higher incomes. Some of them walk off the boat as soon as it lands and go home, and return only when the boat is ready for the next trip. The boat owner has to engage hired labour to unload the catch, load fuel and provisions for the next trip, clean the boat etc. Some would even want to know the amount of fishing gear on board and the benefits offered free by the boatowner before joining as crew since these will determine their share of the nett income.

In the case of the Abu Dhabi boat, Gulbrandsen (1991) claims that the economic non-viability of the boat is partly due to the high crew share, being 50% of the net return. This is the same percentage used on smaller boats with far less investment and is now applied to all multiday boats as well.

Besides increasing fish production, another important objective in developing an offshore multiday fishing fleet was to reduce the increased fuel costs of fishing experienced by the 3 1/2 ton coastal boats. Fuel costs in producing one kilogram of fish in a 3 1/2 ton boat was Rs. 4 (from Table 6). It is also high in the Abu Dhabi boat, but is nearly half in other small multiday boats.

6.4 MANAGEMENT ISSUES

There have been no reported conflicts between the coastal and offshore fishermen although they exploit the same resources in different ocean regimes. The Abu Dhabi boats since their introduction have kept well away from the smaller coastal boats, despite the absence of laws or regulations banning their entry into the coastal zone as a protective measure towards the coastal fishermen. Fear of losing their fishing gear may have influenced the operators to keep their boats well outside the coastal range. There is also mutual understanding between the crews of coastal and offshore boats since it is the experienced fishermen and skippers from the coastal fishery who have gone on to man the offshore boats. The fact that the Abu Dhabi boats with their radio communication facilities have always assisted the smaller coastal boats in distress situations may also have helped matters considerably.

However, ther have been a number of occasions when Sri Lankan offshore boats have strayed into the EEZs of neighbouring countries. These incidents have often occurred during the lean season when boats try to extend their range of operations and stay longer to ensure viability of the operations. The Sri Lankan offshore fishery is small scale and the boats need to fish throughout the year to provide income and employment to boat operators and crew. The fleet need to be very mobile to take advantage of seasonal availability of the resource in different parts of the seas around the country. With the closure of the east coast, these boats cannot migrate there for fishing. The catch rates are reported to be very low, particularly during the lean season and only the prevailing high prices of fish offer some economic viability to the operations. Careful planning in the expansion of the offshore fleet is therefore imperative, until the resources around the whole country are available for exploitation.

Another point to note is that the resources exploited by the offshore fleet (tuna, billfish, sharks) are highly migratory and form part of a larger Indian Ocean stock. As such, it is important to understand the dynamics of fisheris based on such resources in a regional context when national development strategies are planned and implemented.

7.0 CONCLUSION

When compared with the previous attempts at developing an offshore fishing fleet in Sri Lanka, the objectives of the North West Coast Fishery, Development Project, through which the Abu Dhabi boat was introduced, seems to have been adequately achieved. The Abu Dhabi fleet is still very much active and makes a considerable contribution to the overall fish catch from the offshore. The offshore fishery which the scheme helped establish is now the fastest growing sector in the country's fishing industry.

The success of the scheme owes much to the manner in which it was implemented as well as to the boat itself. It has been suggested that most of the original lessees were not suitable boat operators fishermen. In this respect, the PMU was handicapped as operators of the earlier ADB boats and most co-operatives were ineligible to acquire the Abu Dhabi boats due to defaults in payment of bank loans. Others could not provide the required guarantee/collateral. The boat operators fishermen were also venturing into an unknown area, with high financial responsibility and risks.

The CFC played a key role in the implementation of the scheme in many vital areas as mentioned previously. It also operated 10 boats during 1982 to 1985. The performance of the CFC in operating the 10 boats as well as in fulfilling its other obligations has not been very

impressive. It is claimed that the tasks of collecting lease rentals and insurance premium on a commission basis was entrusted to CFC solely for the purpose of generating some income to the ailing enterprise. It was the PMU staff who were heavily involved in the reocvery of lease rentals. With the mobility of the PMU staff in monitoring the progress and co-ordinating other activities of the scheme, these tasks delegated to CFC could have been more efficiently performed by the PMU.

It is suspected that the seizure of boats due to non-payment of lease rentals was done in a very arbitrary manner. Non repayment or long delays in payment became the rule rather than the exception. With the income from Abu Dhabi boats, some of the boat operators have even acquired other smaller and less costly multi-day boats, neglecting payment of loans and maintenance of the boats.

The collection of fishing operational data from the Abu Dhabi fleet seems to have been abandoned very early in the life of the project. No pressure has been brought to bear on the operators to provide fishing operations data regularly and accurately. Such information would have been very valuable to the Ministry of Fisheries not only in assessing the economic viability of the Abu Dhabi fleet but also in evolving a sound strategy of offshore fishery development.

Lack of reliable data from the offshore fihsery also makes it difficult to assess the extent to which this development has affected the coasta day boat fishery of the 3 1/2 ton fleet directed on the same resource. Tuna production in the coastal fishery has declined in recent years, from 34,600 t in 1982 to 21,700 t in 1990. Average annual production of a 3 1/2 ton boat has also declined from 20 t in 1983 to 16 t in 1990. Whether such changes were in response to the developing offshore fishery or disruptions to fishing due to continued civil unrest is difficult to determine. However, there is no evidence that such an interaction was even envisaged between the existing coastal fishery and the offshore fishery the Abu Dhabi boat was excepted to promote.

Although the Abu Dhabi boat was soon found to be expensive to acquire and operate, the heavy beamy hull provided a very stable fishing platform which enabled the fishermen on these boats to conduct and demonstrate successful offshore multiday fishing. The confidence thus gained enabled them to venture offshore in smaller, less equipped boats subsequently. When the North West Coast Fishery Development Project was developed, the same hull had to be suitable for use as a trawler, with a large diameter propeller. 1f designed only for a gillnetter, the draft could have been reduced from 1.35 m. to 1.0 m, enabling the boat entry into smaller and shallower harbours.

Based on the performance of NW-4, where the average catch per trip rarely exceeded 2 t, Gulbrandsen (1991) observed the possibility of a 30% reduction in the volume of the fish hold and a considerable reduction in the consumption and expenditure on ice with better insulation. With such changes, an engine of about 45 hp. would then have been sufficient and would have contributed to a significant reduction in the capital and operational costs of the boat. With the anticipated target of 100 t. not being realised, it seems that too much has been compromised in the designing of the boat for it to be economically viable as a gillnetter.

However, the offshore fishery development in Sri Lanka has reached a stage where it may not be necessary to have any more Abu Dhabi boats. There is a large body of knowledge and expenditure gained through the operations of the Abu Dhabi boat as well as a number of different types of small multiday boats that could be harnessed to develop a better, economically viable and safe offshore boat.

ANNEXURE I

RETURN ON INVESTMENT OF MODIFIED ABU DHABI BOAT

			Rs.
I.	**Investment**		
	(a) Hull		950,000
	(b) Engine		530,000
	(c) Equipment		370,000
	(d) Sub total		1,850,000
	(e) Fishing gear 60 driftnets (120 MDx500 ML) 40 bundles of longline		280,000
	(f) Total investment		2,130,000
II.	**Annual Fixed Cost**		
	(a) Depreciation of hull — 16 years		59,000
	(b) Depreciation of engine — 8 years		66,000
	(c) Depreciation of equipment, 12 years		31,000
	(d) Depreciation of fishing gear, 4 years		70,000
	(e) Insurance 1.8% on boat, 5% on fishing gear		47,000
	(f) Total fixed cost		273,000
III.	**Annual Variable Cost**		
	(a) Fuel and oil		203,000
	(b) Ice		97,000
	(c) Bait		2,000
	(d) Food for Crew		61,000
	(e) Repairs hull, engine and fishing gear		45,000
	(f) Crew share		
	Gross Income	1,248,000	
	—Expenses III (a) (b) (c) (d)	363,000	
	Net Income	885,000	
	Crew share, 50% of net income		443,000
	(g) Tax 5% of gross income		62,000
	(h) Total variable cost		913,000
IV.	**Total annual cost II (f) + III (h)**		1,186,000
V.	**Annual revenue 64 tonne at Rs 19 50 kg**		1,248,000
VI.	**Net Profit V — IV**		62,000
VII.	**Rate of return (VI/I (f) x 100%**		3%

Source : Gulbrandsen (1991)

ANNEXURE II

RETURN ON INVESTMENT OF MODIFIED ABU DHABI BOAT

			Rs.
I.	**Investment**		
	(a) Hull		950,000
	(b) Engine		539,000
	(c) Net hauler		90,000
	(d) S. S. B. Radio		100,000
	(e) Electrical system		80,000
	(f) Equipment		120,000
	Sub total		1,920,000
	Fishing gear 60 nets, 50 — 60 baskets longline		300,000
	Total investment		2,220,000
II.	**Annual Fixed Cost**		
	(a) Depreciation of Hull — 16 years		59,375
	(b) Depreciation of engine — 8 years		66,250
	(c) Depreciation of equipment — 12 years		30,833
	(d) Depreciation of fishing gear — 4 years		75,000
	(e) Insurance 1.8% on boat and 5% on engine		49,560
	Total fixed cost		281,018
	TOTAL NUMBER OF SEA DAYS	240	
	TOTAL NUMBER OF FISHING DAYS	190	
III.	**Annuaal variable cost**		
	(a) Fuel		2,50,000
	(b) Ice		1,25,000
	(c) Water		25,000
	(d) Bait		25,000
	(e) Food		60,000
	(f) Repairs		75,000
	(g) Crew share 40%		3,62,200
	Total expenses		8,99,700
IV.	**Total annual cost (II, III)**		11,80,718
V.	**Annual revenue 72 ton x 19.00 per kg,**		13,68,000
VI.	**Nett profit**		1,87,281
VII.	**Rate of return to Investment**		15.8%

Source : Suraweera (1990)

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