



Exploratory drilling for hydrocarbon resources in the Cauvery basin: Potential impacts on artisanal fishery and fishing grounds of Sri Lanka

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Abstract

Fisheries sector contribute around 1.7 to the GDP and provide 65% of the animal protein requirement of the communities in Sri Lanka. Present per capita fish availability of Sri Lanka is 16.1 kg, and is expected to increase to 21 kg. The sector provides employment to around 6,50,000 people. Marine fish production contributes around 85% to the total fish production and is the most important sub sector in the fisheries industry of the country. The government of Sri Lanka has identified five blocks in the Cauvery basin off the west coast of Sri Lanka for exploratory drilling for hydrocarbon resources and production upon successful discovery. These blocks are in artisanal fishing grounds where fishers from 200 bordering villages are engaged in fishing and fishery related activities. Main activities associated with hydrocarbon exploration include seismic exploration, structural emplacement, well drilling, decommissioning or well abandonment. Hydrocarbon exploration activities will restrict the areas available for fishing and obstruct the navigational paths of the fishing vessels. Leakages from drilling equipments, ballast water discharges from dredging vessels, mud and dredging material discharges, accidental oil spills and oil leakages from ships are other concerns. There will be movement restrictions to fish and disturbances to fish due to sound waves. Socio-economic impacts on fishermen due to exploratory activities include loss of opportunities for fishing, restrictions on fishing grounds, reduced fishing time, reduced fish catches and health hazards. Chemical pollution due to discharge of drill mud, drill cutting, bilge water and sewage and accidental spills and blowouts can affect the general health of fishers. Mitigation

of impacts due to seismic exploration, structural emplacement, well drilling, decommissioning or well abandonment and compensation for artisanal fishermen in the event of reduced fishery activities are suggested to minimize social and environmental impacts of the exploration activities.

Keywords: *Marine fisheries, hydrocarbon exploration, artisanal fishing, environmental impacts.*

Introduction

Government of Sri Lanka has identified commercially exploitable oil and gas reserves in the Cauvery basin area within the territory of Sri Lanka which is an extension of sedimentary rocks offshore from South India. The Petroleum Resources Act, No. 26 of 2003 of Sri Lanka makes provision for the establishment of a Petroleum Resources Development Committee (PRDC) and a Petroleum Resources Development Secretariat (PRDS). The PRDS is the government agency entrusted to administer all petroleum operations in Sri Lanka. The Act makes provisions to PRDS for the regulation of petroleum operations and grant of licenses for exploration, development and production of petroleum in Sri Lanka. There

are no existing exploration licenses issued for the Cauvery basin area. Past exploration activities in this area was more than 25 years ago and consisted of three exploratory wells and a number of 2D seismic programs.

The Sri Lanka government has identified five blocks (C1 to C5) varying from 4710 sq.km to 2146 sq.km in size in the Cauvery Basin (northwest coast of Sri Lanka; Fig. 1) for exploratory drilling for hydrocarbon resources and production upon successful discovery. These blocks are located in shallow areas (Table 1) in the continental shelf and in artisanal fishing grounds. The coastal area that may be affected from the dredging activities includes four fishing districts with rich demersal fishing grounds in Sri Lanka. The fisheries sector contributes around 1.7% to the GDP and significantly to the animal protein requirement of the communities. Sixty five percent of animal protein consumed in Sri Lanka is from fish and fishery products. The present per capita fish availability is 16.1 kg, and is expected to increase to 21kg.

Table 1. Blocks identified for hydrocarbon exploration in Cauvery basin and their extent.

Block	Area (sq km)	Remarks
C-1	2,539.12	Shallow water
C-2	2,146.96	Shallow water
C-3	2,424.02	Shallow water
C-4	4,700.15	Shallow water
C-5	3,915.68	Shallow water



Fig. 1. Areas earmarked for the hydrocarbon exploration in the Cauvery Basin.

Exploratory activities for hydrocarbons include activities that can affect the fishing environment, fishery resources, fish breeding grounds, fish migration and recruitment. There is a possibility of reduction in fish production affecting the livelihood and income of the fishing community living in the bordering fishing villages. There is a need to assess the present

status of fisheries and potential impacts of the exploratory activities with a view of identifying possible interventions to minimize adverse impacts.

Material and methods

The present paper is a consolidation of the available information, literature surveys of the coastal fisheries of Sri Lanka and personal interviews. Due to civil conflict in Sri Lanka, recent publications on different aspects of fisheries are limited. Information available are mainly with the Department of Fisheries and Ocean Resources. Only a few studies have been initiated by Universities in these areas (e.g., Piratheepa and Edirisinghe, 2011). For the present study, data on catch, seasonal variations and species composition were collected from the Ministry of Fisheries and Aquatic Resources (MOFAR), from published statistics, and from interviews with officers in head office and regional offices of assistant directors in the Mannar and Jaffna districts in the northwest coast of Sri Lanka. Published information and reports available at NARA (National Aquatic Resources Research and Development Agency), BOBP-IGO and Bay of Bengal Large Marine Ecosystem (BOBLME) program were also used as a source. Fisheries inspectors/office bearers/members of fisheries societies, and community leaders were consulted. A few selected landing sites were also visited.

Results and discussion

The coastal districts that would be affected to a greater extent by the dredging activities include Mannar, Jaffna, Kilinochchi, and Mullaithivu to a lesser extent. The total length of the coastline bordering the five blocks is approximately 480 km and there are around 200 fishing villages located in these coastal districts. Mannar and Jaffna are the major contributors to fish catches in the Northern Province and to the coastal fish production in Sri Lanka.

In 1983, prior to the internal conflict, the fisheries sub-sector in the Northern Province played an important role in the regional economy and also contributed substantially by means of providing employment, income and nutrition to the communities. Contribution from three districts (Mullaithivu, Jaffna and Mannar) of the Northern Province to the total marine fish production of the country was 40%, of which, 26% was from Jaffna District alone (MOFAR, 2012).

Fishing has been identified as the primary livelihood of the coastal communities in Mannar, Jaffna, Kilinochchi and Mullaithivu. Communities are engaged in preparation of dry fish, seaweed and holothuroid collection, and ornamental fish farming. Palk Bay and Gulf of Mannar are very rich in fishery resources due to wide continental shelf (Berg, 1971;

BOBP, 1989). Majority of the fishermen are engaged in artisanal fishery and there is a trend to increase fishing with mechanized crafts.

According to MOFAR (2009) the highest number of active fishermen (15,195) is recorded in Jaffna, followed by Mannar district (7,900). There are 750 fishermen in Kilinochchi and 1200 in Mullaitivu, where majority are engaged in lagoon fishery. There is a significant reduction in the number of fishermen in 2009 when compared to the year 1982 except in Mannar (Table 2). However, in Kilinochchi, the total number of active fishermen increased to 912 by the year 2012 (Raveenthira, personal communication) and a similar trend is expected in other districts as well in the near future.

Table 2. Number of active fishermen before and after the civil conflict

Year	Killinochchi	Mullaitivu	Jaffna	Mannar
1982	1,103	3,183	24,839	5,684
2009	750	1,200	15,195	7,900

Source: Fisheries Statistics MOFAR (2010)

With the targeted development activities of the Sri Lankan government, it is expected that the number of fishermen will increase, indicating greater dependence on the fishery resources from the area which is now earmarked for dredging.

When compared to the year 2009, contribution by the districts of Mannar (32.7%) and Jaffna (59.7%) were high in 2012 (Table 3). These two districts are responsible for increase in the overall coastal fish production of the country. Relaxation of fishing limitations after the conflict, and supply of fishing

boats and gear to fishers are the main contributory factors identified for this increase (MOFAR, 2011). Ninety percent of fishermen are engaged in artisanal fishery and the majority (72%) of them use non-mechanized traditional boats. Cast nets, drift nets, gill nets, set nets (for crabs), bottom nets, long line, hooks (for cuttlefish) and beach seine are the common fishing gears used. Details of crafts and gears used during the two periods are compared in Table 4.

Day boats (1 day), outboard motor boats (OFRP), motorized traditional boats (MTRB) and non-mechanized traditional boats (NTRB) are the main types of fishing crafts engaged in harvesting the fishery resources. In addition, beach seines are also operational. There is a significant increase in OFRP and MTRB in recent years when compared to the number of fishing boats operating before the conflict in 1982 and hence, it is expected that the number of different types of boats will increase in the coming years.

Accurate information on species composition and seasonal variation of different species in the catch are not available. No attempt has been made to assess the fishery resource in a scientific manner in the recent past due to the conflict. Information on fishing effort are not available.

Reasonable amount of information on finfish and shellfish resources in Gulf of Mannar and Palk Bay of Indian side are available (George, 1973a,b; Hussain *et al.*, 1985; Sivalingam, 2005). The Gulf of Mannar and Palk Bay support a large number of fisher population along the coasts of India and Sri Lanka. Fisheries of this region are typical of tropical

Table 3. Fish production in fisheries districts bordering the areas earmarked for hydrocarbon exploration in 2012 (Source: MOFAR 2012)

Fish landings (t)	1983	1990	1995	2000	2005	2007	2008	2009	2012
Northern province	75,740	24,150	4,500	8,100	24,410	15,250	13,840	21,210	59,340
Coastal fish landings of Sri Lanka	184,740	145,790	217,500	263,680	130,400	252,670	274,630	293,170	477,220
% contribution to national fish production	40	16	2	3	18	6	5	7	14.2

Table 4. Number of fishing boats before (1982) and after (2009) the conflict

Boat types	Killinochchi		Mullaitivu		Jaffna		Mannar	
	1982	2009	1982	2009	1982	2009	1982	2009
Multi-dayboats (IMUL)	-	-	-	-	-	-	-	-
Dayboats (1 DAY)	-	-	-	-	60	20	24	60
Outboard motor boats(OFRP)(OFRP)	82	100	196	200	298	1,000	86	1,200
Motorized traditional boats (MTRB)(MTRB)	24	100	138	100	192	270	81	130
Non mechanized traditional boats (NTRB)	221	100	221	120	3,562	1,000	607	500
Total	327	300	555	420	4112	2290	798	1890
Beach seines (NBSB)	5	3	70	15	110	83	115	95

Source: Fisheries Statistics (MOFAR 2011)

fisheries. Main fish stocks tend to be concentrated along the continental shelf (BOBP, 1986) with high biodiversity leading to multi species fisheries. Around 450 species of fish belonging to 107 families have been recorded (BOBP, 1986). Of these, 122 species inhabit the reef areas and about 32 species in the seagrass beds and about 40 species in the near-shore as well as mangrove areas.

According to the information available, the daily average fish production in Mannar district during 1940s was around 29.3 tonnes. Vankalai, Mannar, Talaimannar and Pesalai were the main fish landing centres then. Stock assessment carried out by the vessel *Dr. Fridtjof Nansen* during 1978 to 1980 (Blindheim *et al.*, 1979) showed that fish biomass of the northwestern coastal waters was around 71,600 t, contributing about 16% to the total biomass estimated for the entire country. The results of deep sea trawl fishing trials carried out by the above vessel revealed the presence of lobsters, shrimps and finfish in considerable quantities in Gulf of Mannar.

The exploratory fishing surveys conducted under the BOBP program of Palk Bay, Palk Strait and Point Pedro showed maximum sustainable yield (MSY) as 30,000 t (BOBP/REP/23).

Activities associated with petroleum exploration may include conduct of seismic and other geophysical surveys and exploratory drilling of wells. If exploratory drilling indicates petroleum accumulations with commercial potential, production activities may follow. Production activities may involve drilling of development wells, installation and operation of rigs and associated equipments, installation and operation of production facilities and restriction or abandonment of fishing activities. However, the nature and scale of potential production activities could not be assumed at this stage.

At present the major commercial activities in the area is fishing. According to the MOFAR there are 1990 fisher households and 22,500 dependents directly or indirectly for their livelihoods in the project area. For the people of the Mannar area, fishing is the main source to sustain their livelihoods. Due to the location of Gulf of Mannar close to pearl banks, seaweed beds, coral and lime stone reef areas, the area is environmentally very sensitive, biologically productive and rich in biodiversity. The proposed project area includes most productive shallow trawling grounds of Sri Lanka although now trawling has been banned since the late 1970s (Sivasubramaniam and Maldeniya, 1985).

Fishers are also involved in shrimp fishery, lobster fishery, collection of holothurians, collection of oysters, and other

edible bivalves and seaweed collection which are the other marine resource based activities. About 90% of the fishers are artisanal and the rest work in single day mechanized boat operations. The planned fisheries development activities of the government include distribution of fishing gear and boats and expansion of fishery related infrastructure in the area aiming at increased fish harvests to provide more livelihood opportunities to coastal communities.

The proposed project activities can pose a threat to sensitive coastal ecosystems and habitats in the coastal area including estuaries, mangroves, salt marshes, coral reefs, lime stone reefs, seaweed beds, pearl banks, sea grass beds, shrimp and finfish fishing grounds and the shallow continental shelf with high biodiversity.

Identified impacts of oil exploration activities on fishery resources and fishing include, movement restrictions of fish, discharge of pollutants, disturbances to fish due to sound waves, movement of offshore supply and crew change vessels, helicopter sounds and sound waves (NEERI, 2004).

Creating a navigational zone with a radius of 500 to 1,000 m around seismic vessels and oil platforms, abandoned platforms and their fragments on the sea bed, suspended well heads for a period of time, and abandoned debris on the sea bed can cause problems to fish populations and fishing activities. Mortality of fish during sound wave generations, disturbances to spawning and fish egg and larval developments have the potential to reduce the fishery resources. Only positive impact identified is that the abandoned structures after drilling operations may act as fish aggregation devices.

Chemical pollution due to discharge of drill mud, drill cutting, treated bilge water and treated sewage and accidental spills and blowouts (pH, Mn, Cr, Ni, Cu, Zn, Cd, Hg, Pb, CN, oil & grease, TPH omit and toxicity) are likely to affect the health of fishes and the ecosystem.

Increased sedimentation and turbidity could affect fish production in several ways. Reduced light penetration could lead to reduced photosynthesis which could lower the primary productivity and density of plankton available for fish and crustaceans. Oil spills, ballast water and oil and chemical pollution could affect the coral reefs that act as an important ecosystem, around which most of the current fisheries activities are concentrated. Other fishing activities for oysters and other shells, echinoderms and sea weeds are likely to be affected due to dredging and subsequent siltation. Increased sedimentation could lead to high levels of egg mortality due to adherence of particles to eggs. There can be some physical impacts on the present fish landing sites.

Conclusion

Oil exploration activities can significantly affect fishery resources off the northern province of Sri Lanka and the livelihood of the fishing communities in the bordering districts. The waste generated from the drilling operations has to be dealt with in a manner, in compliance to applicable MARPOL standards to reduce hazards and environmental impacts, and direct and indirect impacts on fishery resources. Preventive measures (e.g., avoidance of dredging during the breeding season of commercially important fish and crustaceans) have to be investigated. Any possible physical impacts on the fish landing sites need to be assessed. Plans need to be developed for obtaining compensation to the local communities in the event of reduced fishery activities, oil spills etc. and institutions for preparation of plans have to be identified.

There is no recent assessment of fishery resources and breeding seasons of commercially important fishes and crustaceans. Long term impacts of siltation and pollution on key species at different stages of their life cycle, assessment of livelihood status of communities and impacts on biodiversity are some of the areas to be investigated.

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