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FISHERIES IN ATOLLS- TRADEOFFS BETWEEN HARVEST AND CONSERVATION

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Introduction

Atolls are ring shaped coral reefs including a coral rim that encircles a lagoon partially or completely and with or without a coral island/cays on the rim. Most of the world's atolls are in the Pacific Ocean and Indian Ocean. Lakshadweep islands, Maldives and the Chagos Archipelago are the atolls in the Indian Ocean. Lakshadweep are the only atoll islands in India. They lie scattered in the Arabian Sea between Latitude 8.26° to 12.4° N and Longitude 71.7°-73.75° E, comprising of 36 islands, 3 reefs and 5 submerged banks. These islands consist of coral formations built upon the Laccadive-Chagos submarine ridge rising steeply from a depth of about 1500 m to 4000 m off the west coast of India. While the total land area is 30 sq.km, the length of the coastline is 132 km and lagoon area of 4200 sq.km. Its territorial water spread is 20000 sq.km and it constitutes 0.4 million sq.km to the EEZ of Indian Union. Out of the 36 islands, 11 are inhabited with a population of 64,473 (2011 census). The atolls have 4 distinct biomes comprising of the islands, lagoons, reefs and the Open Ocean. Few threats to the atoll systems are sea level rise, salt water intrusion, reduced availability of fresh water, coral bleaching, disturbances to reef ecosystem, shrinking of livelihood and excessive dependence on external resources, excessive harvest of reef resources *etc*.

Marine Biodiversity of Lakshadweep: Corals are represented by 148 species; fish-126 families and 601 species; crustaceans-68 species; mollusks-227 species; sponges-91 species; mangroves-2 species; seaweeds-114 species; echinoderms-78 species, sea grass-6 species; sea turtles-4 species; 101 species of birds and 12 species of cetaceans. Pitti, a tiny sand bank situated nearly 24km northwest of Kavaratti with an area of only 1.21 ha is an Island of Birds. This is a breeding ground for 4 species of terns and therefore the island has great significance since such breeding colonies are very rare in the Indias territorial areas.

Fishes: The fishes that occur in the coralline niches of the lagoon exhibit the characteristic variety of colours and mainly consist of perches, gar-fishes, half-beaks, scarids, goat-fishes, carangids, grey mullets, antherinids, spyraenids, polynemids, balistids, blennids and globe-fishes (Balan, 1958; Kumaran *et al.,* 1989). Jones and Kumaran (1980) recorded 603 species of fish from the Laccadive archipelago. The offshore fishery is constituted by fishes *viz*., tunnies, wahoo, sharks, rays, sail fish, flying fish, carangids *etc*. Fishes such as *Crenimugil crenilabis, Polynemus sexfilis, Naso tuberosus, Naso unicornis, Gomphousus varius,*

Novacutichthys taeniurus and *Anampses diadematus* are common in the waters of Lakshadweep (James *et al.*, 1989). Of the 603 species of marine fishes belonging to 126 families that are reported from the islands, at least 300 species are of ornamental value. The ornamental fish such as *Abudefdus, Amphiprion, Apogon, Coris, Balistes, Platax* are common in Lakshadweep lagoons (Murthy *et al.*, 1989).

Fisheries in the islands

Present day fisheries in Lakshadweep are built on the traditional fishing and trade practices prevalent ever since settlement in the islands. Fishing here range from hand picking, cloth fishing, spear fishing, cast netting *etc.* in the lagoons to pole and line, troll line, handline, harpooning *etc.* in the deeper areas of the sea around the islands. Plank built country canoes or modified country canoes with or without outboard motors are the basic craft. Open decked Pablo type boats, motorized using inboard engines are the major fishing crafts in all the islands. Principal fishing method- Pole & Line is presently practiced in such boats. Of late, a modified version of these boats, which are larger and with wheel house on the stem are gaining popularity in the islands.

The fisheries in the islands can be broadly divided into Tuna Fishery and Non Tuna fisheries. Tuna fisheries comprise mainly of capture of oceanic tunas- skipjack (*Katsuwonus pelamis*) and Yellwofin tuna (*Thunnus albacores*). Other tunas like the Little tunny (*Euthynus affinis*), Bullet tunas (*Auxis spp*) and the Dog tooth tuna (*Gymnosarda unicolor*) also form catch at varying rates in different seasons. Non-tuna fisheries comprises of fishing for other large pelagic resources like rainbow runner, Mahi mahi, Wahoo, sharks rays *etc*. and Reef associated fishes like snappers, groupers, carangids, full beaks, half beaks *etc*. The fishing grounds for these resources are the deep sea in the vicinity of all the islands, reef areas and submerged banks. It may be noted that the principal fishing methods in the islands are hook and line based, which are considered to be the most ideal fishing tackle in view of its selectivity and harvest limitations. Use of gillnet, the only major net used for fishing are limited to reef and lagoon areas for reef associated resources like the fullbeaks and halfbeaks.

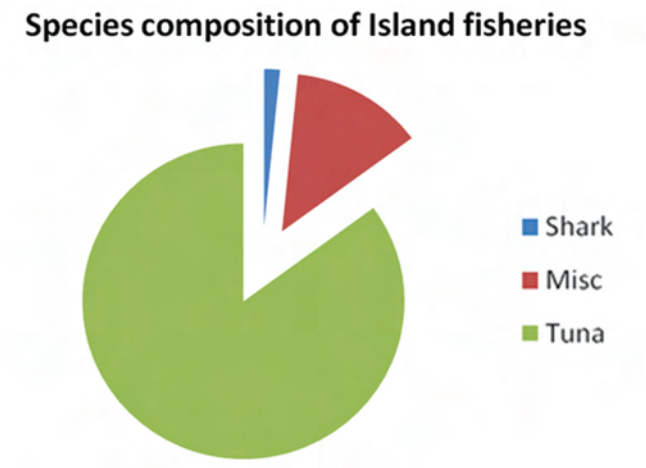

Fig. 1. Gross catch composition of island fisheries

Tuna fisheries

Lakshadweep islands have situational advantage of being located in the migratory paths of the oceanic tunas like the skipjack and yellowfin. Tunas constitute nearly 78% of the total catch with skipjack alone forming nearly 50% of the fish landing in the islands followed by Yellowfin (nearly 25%). Tunas are principally caught by the Pole & Line method contributing nearly 80% of the tuna catch followed by troll lines and handlines. Skipjack tuna is almost entirely caught by the Pole and Line method and Yellowfin by Handline and Pole & Line. Troll line fishing is used mainly for catching neritic tunas like the Little tunny and Bullet tunas though skipjack and yellowfin are also occasionally caught in this gear. The Dog tooth tuna is almost entirely caught by handlines.

Pole and Line: A sustainable fishing method

The traditional system of pole and line fishing for capturing tunas is widely employed in all the islands. Minicoy, Agatti and Kavaratti are the islands leading in pole and line fishing. This ifhsing method has been Minicoy's asset from time immemorial which was later extended to all other islands in the 1960s. Nationwide mechanization drive in the 1970s added impetus to adopting pole and line fishing by fishers of all the islands. An important mechanization in this fishing method was the replacement of hand splashing of water with mechanical water spraying system, using a pump connected to an auxiliary engine introduced by the fisheries department in 1984. This modification, besides saving labor costs improved the efficiency of the fishing method considerably.

The hook and line fishing methods are targeted fishing gears and have very less or no bycatch. All these gears catch one fish at a time, popularly known as 'one-by-one' fishing. Such fishing gears are selective as they fish from identified shoals of fishes. Bycatch, especially sensitive bycatch like turtles, mammals, birds, juveniles *etc.* don't form catch in most often. Pole & Line is an efficient fishing method catching more fishes in short time. Live-baits are essential for the pole & line fishing and hence this method of fishing has a subsidiary fishing activity for collection of live baits. Live baits are collected from the lagoons and near reef areas using boat seines and stored in the live bat tank on board. Live-bait collection is done during the early morning hours. After collecting sufficient baits, the boats set out to the deep sea beyond the lagoons scout for tuna shoals often in the vicinity of the islands. Once, a shoal is located, the boats steer close to the shoal and move in the direction of the fish shoal, splashing water continuously with occasional broadcasting of live baits. The pole & line fishermen will now swing into action and hooking of fishes will continue until the boat is filled up or till the shoal disappear.

Fig. 2. Pole & line boat

Fig. 3. Bait fishing

Fishery for Other resources

The major non-tuna species or groups that form considerable fishery in the islands are that for full beak and half beak using gillnets fished inside or outside the lagoons, especially during the monsoons months. Wahoo fishing using spear and troll lines are good fishery during post monsoon months. Mahimahi, rainbowrunner, carangids, barracudas *etc.* form minor catch in troll lines all through the year. The reef associated fishes that are caught using handlines in the near reef areas and seamounts are the groupers, snappers, grunts, sweet lips, parrotfishes, wrasses, trigger fishes *etc.*

Shark fishery: Shark fisheries are one the ancient fishery still continued though at a very low scale following traditional single or multi-hook long lines in most of the islands.

Large mesh drift gillnetting done during monsoon months also catch sharks along with other large pelagics. The most common species of sharks that occur in Lakshadweep are the Spade-nose shark/Yellow dog shark, *Scoliodon laticaudus* and the Milk shark, *Rhizopriodon acutus* (Devdoss *et al.,* 1985). The Blacktip Shark, *Carcharhinus limbatus* and Hammerhead shark, *Sphyrna mokarran* are also commonly found in the waters around Lakshadweep (Hanfee, 1997; Basudev Tripathy, *Pers. Obs.*).

Other Traditional Fishing practices in the islands

Owing to the typical geographical features of an atoll and its natural isolation from mainland, the people of the islands have used varieties of indigenous methods for catching fishes and other marine creatures from lagoon and the adjoining sea for food. Some of the important fishing activities/gears used in lagoons given in table 1.

Table 1: fishing activities/gears used in lagoons

Local Name	Description	Target Resource
Appal kuthal	Octopus hunting using sharp iron spears	Octopus
Chilla	Fishing using wooden spike	Flying fishes, Garfishes, half beaks
Chadal	Harpooning for catching fish	Wahoo
Bala adiyal	Shore seine, used mainly in the western lagoon	Juvenile and sub-adults of reef associated fishes
Bala attal	Long, small meshed nets used inside the lagoons around the island	Juvenile and sub-adults of reef associated fishes
Bala fadal	Large drag net involving 15-30 people, operated in both eastern and western lagoons together with scare lines	Juvenile and sub-adults of reef associated fishes
Bala idal	Set gillnets in the lagoon	Reef associated fishes, sharks, rays *etc.*
Cast net	Small mesh cast net operated in the lagoon from shore during low tide	Juvenile of carangids, surgeons, damsels *etc.*
Nool bikel	Baited hook and line set from shore or from a boat	Snappers, carangids *etc.*
Kalmoodal	"Boulder trap" – a net set around a coral boulder which is then agitated using rods to drive out fish.	Juvenile of reef associated fishes
Kurakkal	Light and spear or sword. Not commonly used, only practised in shallow water	Juvenile of reef associated fishes
Rod and line	Baited hook and line, used opportunistically around the island and mainly from the shore	Sub adults of Reef associated fishes
Shal kakal	Gillnet set in reef channels, used mainly during the monsoon and at spring tide.	Reef associated fishes like snappers, carangids, *etc.*

Coral reefs and their importance to island fisheries

Islands are formed inside the lagoon of atoll through continuous accumulation of coral sand due to wave action driven mainly by the South-west monsoon. Shore of these islands are protected from the hazards of the waves by the reef crest as all the waves surf on the reef crest before proceeding to the shore as low energy waves. The lagoons are doing an excellent service by way of being the nursery grounds for the fishes and other organisms besides being home to a plethora of flora and fauna, especially the corals. It is estimated that the coral lagoon of Lakshadweep is the habitat for about 75 species of marine ornamental fishes belonging to 13 families. Similarly, the lagoon is the source of live-bait fishes, which is the most essential component of the Pole & Line fishery of Tuna. The rich bio-diversity of the coral lagoon is also the base for the development of tourism in the Lakshadweep for events like coral reef diving and snorkeling. Therefore, the survival of these islands fully depends on the survival of the coral reefs and the lagoon ecosystem. Scientific management of resources within the coral reefs therefore is of paramount importance.

Conservation of the Atoll Ecosystem

Extraction of marine resources is the major anthropogenic threat to the ecosystem. Harvest of the natural resources therefore should be at levels that can be regained with natural recruitment and rebuilding. Every organism in the lagoon performs an ecological service and therefore the harvest should be balanced not affect the ecosystem functioning. Many fishes inhabiting the lagoons like the parrot fishes do the service of cleaning the coral boulders of algae and other foulers to create space suitable for attachment by the coral larvae leading replenishment of corals. Similarly, many herbivore fishes like the surgeon fishes, butterfly fishes *etc.* do such services. Dependence of lagoon for fish supply is much limited in Lakshadweep as the major commercial fishing activity is tuna based. This makes the fishing in the islands more sustainable. Besides, there are quite a lot of conservations measures adopted by the Govt in tandem with the international obligations.

Compliance to National and International Obligations

The point number 11 of the Aichi biodiversity targets, says that "By 2020, at least 17 percent of terrestrial and Inland water, and 10 percent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected area and other effective area based conservation measures, and integrated into the wider landscape and seascapes", which is integrated in India's National Biodiversity Targets, 2012-2020. The Environment Protection Act (1986) provides for identification of ecologically sensitive areas based on the sensitivity and conservation value of a spatial unit. In case of Lakshadweep islands, the Integrated Island Management Plans, prepared as per

the Island Protection Zone Notification (2011), demarcate the preservation and conservation zones for spatial conservation of the coral reef areas. The Pitti Island, because of being a bird nesting area has been declared as an MPA. The report of the Planning Commission of India (2008) proposed to declare one or two reefs among the Suheli par, Baliyapani par, Cheriyapani par and Perumal par as Marine National Park to protect and preserve the marine biodiversity. The Bombay Natural History Society, based on a detailed study on the giant clam resources in the Islands proposed declaring the reefs of Agatti Island to be a conservation reserve. International Union for Conservation of Nature (IUCN) and oceanographer Sylvia Earle of Mission Blue named 31 new hope spots, among them Andaman & Nicobar and Lakshadweep islands have been named as the new "hope spots" from India. A Hope Spot is an area of ocean that merits special protection because of its wildlife and significant underwater habitats. Some are already formally protected, while others still need protection.