

# COLLECTIVE ACTION AND COMMON PROPERTY RESOURCES REJUVENATION: The case of peoples artificial reefs in Kerala State, India

BY

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## INTRODUCTION

Issues concerning the degradation of our planet's environment and the implications this has for the future of life on earth are matters of widespread concern today. Together with this environmental consciousness there is a growing recognition that the most affected environmental resources are those over which control by individuals, firms or the state is difficult to establish and maintain. Such resources are often qualified using the adjectives "open access", "common property" or "common pool" implying that in general they are open to use by all and owned by none.<sup>2</sup> Important examples of such resources include: the earth's atmosphere, seas and oceans, ground water, forests and village grazing grounds.

Contemporaneous with this welcome environmental consciousness is the resurgence of influential opinions that in the case of resources that are in the realm of the "commons", precious little can be done to save them from ecological ruin.

The most influential of these opinions is that of Garrett Hardin whose expression "tragedy of the commons" (Hardin, 1968) is today gaining currency in symbolising the degradation of the environment that is to be expected *whenever* many individuals freely use a resource in common.

There is a less known formulation of Hardin's opinion which contrasts the difficulty of getting individuals to pursue their joint welfare, as opposed to their individual welfare. This was developed by Mancur Olson in his well known book "The Logic of Collective Action" (Olson, 1965). Olson was of the opinion that the mere presence of a perceived benefit for a group was *not* sufficient to create collective action possibilities to achieve that benefit. He argued emphatically that ".....unless the number of individuals is quite small, or unless there is coercion or some other special device to make individuals act in their common interest, *rational, self-interested, individuals will not act to achieve their common or group interests*"(ibid pg.2 emphasis in the original)

These opinions have been formalised as a Prisoners' Dilemma Game (Luce and Raiffa, 1957) which has long held sway among scholars who have studied questions of cooperation and non-cooperation. The game illustrates the paradox that rational strategies of individuals can lead to collectively irrational outcomes. This seems to challenge a fundamental tenet that rational human beings can achieve rational results.

The net result of this growing environmental awareness and the concomitant sway of "tragedy and dilemma" models tend to make policy makers and concerned observers pessimistic about the possibilities of collective action to protect, manage or nurture common environmental resources. The spectre of helpless individuals inextricably caught in the process of destroying their own resources is constantly evoked in the public mind.

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<sup>2</sup> Common property as an institution must be distinguished from free and open access resources. In the case of common property there exist non-market institutions to manage it. Common property resources are accessible to a wider community though no individual has exclusive property rights. It is therefore the absence of management rules that distinguish free and open access resources. (See Runge 1986; Jodha, 1986 and Ciriacy-Wantrup & Bishop, 1975)

The consequences of such a line of analysis are best reflected in the policy prescriptions that emanate from influential quarters at national and international levels as regards the *modus operandi* in creating institutions and institutional change for regulating common environmental resource usage. These prescriptions either emphasise the 'market solution' where "sovereignty of the individual, the sanctity of private property and the domination of the present" (Perrings, 1987) are highlighted or propose the 'state solution' where a centralised controlling authority be granted the powers – coercive if necessary – to allocate and protect common resources.

Two strong assumptions are implicit in these market and 'state' prescriptions.

Firstly they imply that institutional change *must* come from outside. This they take as inevitable for the simple reason that individuals affected by a deteriorating common property resource situation would refrain from investing their own resources and time for collective action to solve their dilemma.

Secondly they emphasise only the issue of safeguarding or modulating the "flow" aspect of common resources – its regulation and management – with little understanding or appreciation of its "stock" aspect – particularly the dimension of nurturing and the long term sustainability of the total resource system.

There are numerous examples from different parts of the world both from developed and developing regions which call to question the first assumption: The successful anti-soil erosion and reforestation measures by the farmers of Sukhomajri in the lower Shivalik range of the Himalayas (Chopra et al, 1990); the peasants of Torbel, Switzerland, who have for over seven centuries managed their communally owned grazing land (Netting, 1981); the communally managed irrigation systems of Ilocos Norte, Philippines (Siy, 1982); the innovative self-regulation of the coastal waters by the fishermen of Alanya in Turkey (Berkes, 1986) and those in Lofoten, Norway (Jentoff, 1989).

In this paper we shall examine once again if these influential opinions are always valid. To achieve this we shall examine a marine fishery situation in the lower south-west coast of India where fishermen confronted with a declining harvest from their coastal waters have undertaken macro measures to regulate and safeguard, as well as micro measures to restore and rejuvenate, their common property resource. Our focus will be on the latter, the micro-level measures, with particular reference to the village level attempts to erect artificial reefs in the bottom of the sea. (For details of the macro-level measures see Kurien 1989a and Kurien and Achari 1989b)

We will investigate the origins, the reasons for the decline and the subsequent resurgence of artificial reef construction. Taking the period of the resurgence – the decade of the eighties – we shall examine two aspects more closely. First, the incremental changes in the materials and designs of artificial reefs. Secondly, the evolution of the forms of collective action which the fishermen have adopted in constructing these reefs and the factors which facilitated it. In conclusion we will reflect on the future directions which these initiatives will take and the lessons that we can learn from it.

## THE FISHERY AND THE FISHING COMMUNITY

The coastal waters of the 650 km coastline of the lower southwest of India (comprising Kerala and Kanyakumari Districts of Tamilnadu) are the most productive waters in the country. It is also one of the world's most important sources of marine prawns. (See Map 1)

It is estimated that the annual sustainable fish yield from one square kilometre of these coastal commons is 35 tonnes compared to the all-India average of 13 tonnes. On this basis the maximum sustainable yield for this region was estimated at 380,000 tonnes per annum. This resource plenitude probably accounts for the greater concentration of traditional fishing communities along this coast. Though this region accounts for only a little over one-tenth of the country's coastline, it is the home of over a third of the active marine fishing population of India.

Marine fishing communities in India live on the geographic, economic and social fringes of society. Their conditions in the lower south-west coast of India are no different. However, fishermen of this region are a brave and daring lot. They also have a strong conservationist ethic towards the fishery resource. This is the combined result of several factors. The most important among them include: the particular features of the tropical water living resources which have been the basis for the diversity of their fishing gear design; their keen awareness and knowledge of the totality of the aquatic ecosystem; and their view of "mother ocean" as a life-giving system rather than a hunting ground. Marine resources appeared to them as "limitless." Bringing ruin to it – individually or collectively – was something they could not quite comprehend.

## ORIGINS OF THE ARTIFICIAL REEF IDEA

"Artificial reefs are man-made or natural objects specifically placed to attract fish, provide or improve fish or shellfish habitat, and increase fish biomass locally. Extremes range from traditional designs frequently made from local scrap materials to modern Japanese-style artificial reefs that are highly sophisticated modules built of concrete, fiberglass, or steel.

The extent to which artificial reefs increase fish biomass or redistribute existing stocks of fish is not clear. However, even if they do not substantially increase fish production, they can be used as effective fisheries management tools. The increased standing fish crop around artificial reefs reduces fishing effort and, therefore, saves time and fuel. Fishermen in developing countries often must limit their efforts because of high fuel costs. Furthermore, artificial reefs can be used to create fishing grounds for artisanal fishermen who use traps and hook and line gear. (BOSTID, 1988)

The idea that certain types of external objects in the sea tend to attract fish to them has undergone considerable evolution among the fishermen of the region. Since these fishing communities have only an oral tradition, we can reconstruct history only from the reminiscences of old fishermen.

There was an age-old practice, among the artisanal fishermen of the region who operated the shore-seine, of dumping rocks fastened with coconut fronds into the near shore sea within depths of 5 to 10 metres. Fish tended to aggregate over and around these rocks and were more easily netted by the shore-seines.

It was known that a ship had sunk off the village of Anjengo during the Second World War because it was the local fishermen who rescued some of its crew. In 1949 a hook fisherman discovered the wreck at the 50 meters depth contour and was amazed by the high hooking rate over the limited area.<sup>3</sup> News of this new fishing spot spread quickly by word of mouth and the expert hook fishermen from the more densely populated southern villages of the region swamped the area and made a greater success of fishing over the wreck by using artificial bait. Use of artificial bait was new to the fishermen of Anjengo and they initially opposed it.<sup>4</sup> But in a brief period the southerners settled into Anjengo by marrying into the community.<sup>5</sup> Soon the use of artificial bait to fish over the 'kappal paar' (Kappal=ship; paar=reef) gradually gained widespread acceptance in the village.

<sup>3</sup> Using their depth gauging plumbines the fishermen have estimated the wreck to measure 50 metres in length and 45 metres in width. The top of the wreck was just 15 metres below the surface. This spot was until recently (until 1985) considered to be one of the major fishing grounds of the region. Fishermen say that too many drift and gillnets which got entangled to it have wrapped around the top of the wreck and reduced its productivity.

<sup>4</sup> In the oral tradition of the village there is a couplet which alludes to this discovery and the use of artificial bait:  
Sukkurappan kandupidicha kappal paar  
Irayillathe meen pidichu thekken maar  
(Translation: Sukkurappan discovered the shipwreck; (But the) Southerners fished over it without (live) bait)

<sup>5</sup> Fishing communities of this region follow a matrilineal tradition.

During the early forties, due to a storm, a ship which was berthed at the Valiathura Pier near Trivandrum City lost its anchors. Only one was immediately recovered from the sea bottom. A decade later a hook fisherman located the spot where the other anchor had been buried when his line got entangled in it. His loss was temporary because it was compensated by his simultaneous discovery of a rich fishing spot around the '*nanguram paar*' (nanguram—anchor).

It is this early practice of dumping rocks with coconut fronds in the shore-seine fishing grounds and the discovery of the rich fishing spots atop sunken structures in deeper waters which provided the basis for conscious attempts to erect artificial reefs in deeper waters.

The first artificial reefs were erected in the early 1950's in the villages where natural reefs existed and where there was a tradition of fishing using the hook and line. The best example of that is the reef in Puthiyathura erected in 1955.

The hook and line fishermen of Puthiyathura had been fishing over the natural reefs found close to the shore (2.5 kms away) at a depth of 40 metres. Over time they observed that fishermen from the neighbouring village of Karimkulam – also fishing off a natural reef at about the same depth – got better harvests. The only difference that they observed between the reefs was that the one off Karimkulam was higher than theirs. This led them to try ways and means of raising the height of their reef. This was achieved by taking granite stones piled on the beach sands as anti-erosion sea-walls and dumping them on the existing natural reef thus raising its height by about a metre. The fishermen observed that in six months their efforts paid off in the form of higher hooking rates. This was the first known attempt in this region to create an artificial reef.

Another early attempt was in Eraviputhenthura in 1957. Hook fishermen of this village had a favourite fishing spot about 1.5 km off the coast at a depth of 22 metres. The sea bottom at this depth had a clay substratum which they attributed as the main reason for the larger concentration of fish there. In their village the local *panchayat* authorities had used large concrete rings (3 metre in diameter and 0.5 metre high) to build a community well. One of the concrete rings remained unused and was left on the beach. The fishermen got together, transported this ring on their *kattumarams* (local raft-like fishing craft) to their favourite fishing spot and dropped it there. This was the first known example of an external pre-fabricated structure being used in a known fishing spot as an artificial reef. The new reef was christened "*Vatta paar*" (Vatta-ring).

## DECLINE OF ARTIFICIAL REEF CONSTRUCTION

For almost a quarter of a century after the late 1950's we do not hear of any more attempts to create reefs. However during this period several accidentally formed reefs continued to provide occasional fishing spots.<sup>6</sup> These generally remained lucrative fishing grounds for a time and then ceased to be productive after a while.

The sudden loss of interest in reefs can be largely attributed to the new fishery development strategies of the 1960's which resulted in an initial spurt in fish harvests. The introduction of nylon nets can certainly be cited as one important factor in achieving these increased yields from the sea.

The importance given to the fishery sector changed rather dramatically. The country was facing an acute foreign exchange crisis and every effort had to be made to increase exports. In the early 1980's there was a dramatic increase in prawn prices in the international markets. To cash in on the prawn

<sup>6</sup> The most interesting examples are that of the spent rocket heads (fired from the equatorial rocket launching station, Trivandrum) that dropped into the sea. Initially the authorities provided a compensation to fishermen who "discovered" these heads – when their nets got entangled on them and partially destroyed in the process. Soon the fishermen observed that the rocket heads became good fish aggregating devices.

boom, new harvesting technologies like bottom trawling were promoted in a big way by the government. The marine fish harvesting sector – once the exclusive preserve of traditional fishing communities who viewed the sea as their community asset – became a virtually open access resource to anyone who could afford to make the necessary investments in craft and gear. Fishing effort increased substantially in the 1960's.

In Kerala State, from a level of 75 percent of the maximum sustainable yield (MSY) in 1961 the fish harvests in 1971 crossed the MSY level. Since prawns were mainly found in the nearshore coastal waters there was virtually no increase in the fishing area following the introduction of the new technologies. A greater and more powerful fishing fleet was continuously harvesting the same stock of fish in a small area of the coastal sea. However, from 1975 onwards despite rising investments (or rather because of it) the harvests begin to fall below the MSY indicating that the resource *system* as a whole was at the verge of an ecological crisis. The substantial drop in yields per fishermen (both in physical and value terms) resulted in lower income levels despite rising fish prices. A socio-economic crisis was also in the making. (See Table 1)

The year 1979 witnessed the beginning of a socio-ecological movement among the artisanal fishermen of the region. They made three major demands to the state authorities: (a) a ban of trawl fishing during the monsoon months of June, July and August which was the breeding season for many species of fish (b) the creation of an exclusive fishing zone for artisanal fishermen in which fishing by trawlers would be totally prohibited all year (c) a greater share in the fishery development budget of the state. (See Kurien and Achari, 1989b)

By the mid-1980's this movement had attained the dimensions of a major political force in the region. In a parliamentary democracy with numerous coastal constituencies, a restive fishing community is no solace for politicians irrespective of their political colour. Leaders of every political party began to take the fishermen's demands seriously irrespective of whether they were in or out of power.

The second and third demands of the fishermen were conceded by the government by 1984. Legislation to zone and regulate the coastal commons and a police force to enforce it was set up. The emphasis on promoting prawn exports using state finances was relegated and funds were earmarked for investments which would directly benefit the artisanal fishermen. A big push was given to upgrade their harvesting technology by supplying outboard engines, beach landing craft and new fishing gear. Welfare measures for artisanal fishermen and their families were also increased significantly. The demand for a total monsoon trawl ban was conceded only in 1989 after three scientific commissions had studied the matter following the fishermen's refusal to compromise on this issue.

The socio-ecological movement was their first collective macro-initiative to re-establish their historical rights of exclusive access to the in-shore coastal commons. This was largely a political process emanating from their long term concern for themselves and for fish.<sup>7</sup> Its very organisational form – an independent trade union – and organisational processes – grassroots level mobilisation using a wide variety of militant but non-violent forms of protest – gave the initiative a special synergic effect which was an important factor in providing an ethos and enthusiasm which alone helped to sustain their struggles for over a decade.

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<sup>7</sup> This is best illustrated in the words of the artisanal fisherman who was on his sixth day of an indefinite fast before the government secretariate demanding greater regulation of the coastal waters: "Our struggle is to ensure a future – for us and fish" (See Kurien 1989a)

## RESURGENCE OF ARTIFICIAL REEFS

It is against this background of a depleted coastal commons and the fishermen's ability to extract from the state a commitment to providing the legal enforcement apparatus for zoning and regulating the use of the commons that we must situate the renewed initiatives among fishermen to erect artificial reefs.

These new reefs were developed primarily as a result of the initiative of the hook fishermen who were convinced that they had to help *Kadalamma* (Mother Sea) to rejuvenate herself after the onslaught of trawlers. Though they were victims of a tragedy of the coastal commons, they did not become strait-jacketed prisoners in this dilemma. Several groups of these fishermen from as many as 22 villages decided to take creative, collective action to erect reefs in the coastal waters off their villages fully aware that the benefits would accrue to the group/community as a whole. These actions also need to be viewed as the micro-level expressions of their larger socio-ecological movement.

Reefs erected in this manner we have termed people's artificial reef or PAR's.

In the first decade of the fishermen movement (1979-89) the pace at which PAR's were erected increased substantially. These efforts were however restricted primarily to the 130 km coastline off the Trivandrum and Kanyakumari Districts.<sup>8</sup> (See Table 2)

The stretch of coastline where PAR's have been erected can be further divided into three zones with the city of Trivandrum as the reference point: Zone 1: The villages of the south of Trivandrum which have a predominance of hook fishermen who use the *kattumaram* as the main craft. This region had a greater number of natural reefs. It is perhaps one of the most densely populated set of fishing villages in the whole country. Zone 2: The villages around Trivandrum where hook fishermen (using *Kattumarams*) are in the minority and shore-seining is an important gear. The plank canoe is the predominant craft which is used for other forms of coastal fishing. Zone 3: The villages north of Trivandrum city where the presence of hook fishermen (using *kattumarams*) vary from village to village. In general they are not the "original settlers," having migrated to this zone from the southern villages (recall the village of Anjengo). A significant number of the original settlers among the fishermen in this zone depend on shore-seine fishing, which coincides with the best hook fishing season – November to March. (See Table 3)

## INCREMENTAL CHANGES IN PAR DESIGN

The "first generation" reefs erected before 1960 used the materials available at the village which the fishermen could obtain free (no money cost for them). This 'whatever-you-can-get' approach to collecting materials to erect reefs continued. The fishermen of Eraviputhenthura who were the first to use a pre-fabricated structure (cement well ring) in 1957 made their first PAR in 1980 with the large unused iron wheel of a damaged road roller that was abandoned in the village ! In Valiyathura an unused telephone post was used in 1983.

However with the more organised and widespread efforts to build PAR's it was unlikely that such an approach could continue for long. We notice that in the "second generation" PAR's erected between 1984–86, while granite stones wrapped in coconut fronds remained the main component, three more important additional items were widely used. Large rocks packed in monofilament net bags; the screw-pine plant and cement well rings. All these items had to be specially ordered or collected for the purpose and paid for also.

<sup>8</sup> There are 80 villages on this stretch of coastline. In 1980 the number of active fishermen numbered around 50,000 and the total fishing community was 226,400 strong.

After 1986 there was a further spurt of changes. The use of old automobile tyres tied to the cement rings was tried out by the fishermen in Valiyathura. In Thoothoor, the granite stones were painted red before they were transported to the sea.

Along with this came the measures taken to protect the PAR's from getting covered by fishing nets. Rings with built-in hooks, anchors and concrete pillars placed at the four corners of the PAR structure were examples of the measures taken by the fishermen. (See Figure 1, 2 and 3)

The incremental changes in the materials and in the designs used for the erection of PAR's are primarily the result of two factors: (a) the process by which artisanal fishermen acquire knowledge – essentially learning by doing and (b) the process of sharing this knowledge among themselves.

### **Fishermen's Knowledge**

“Coastal fishermen live at a particular spot on the coast for generations, and thus have thoroughly mastered the topography of the in-shore waters, the profile of the sea current and other hydrological fluctuations and the related fisheries, so that they constitute an “eco-society” that has ecologically tuned itself to the coastal ecosystem that they have been living in. They have learned to live in perfect harmony with their coastal environment, to conserve their natural resources and even to manage them so judiciously as to be reckoned as the self-appointed custodians of their coastal ecosystem. It is this intimate relations with their immediate environment and its resources that has enabled them to be masters of their profession of fishing also. (Sanjeeva Raj, 1990)

Any fishing operation is a simultaneous integration of a large number of discrete thought processes of past experiences enmeshed with the immediate observations of the current operation which is aided by all the human senses. It is a progression of learning which fishermen can hardly make explicit in the form of any “theory” of their fishing. We may infer that their “theory” is constructed from observation and tested by further observation. They add or subtract from “theory” by producing new explanations or dropping existing ones. It is this process of learning about their micro-reality which then permits them to generalise from it.

The basis of PAR's as an important initiative for coastal ecosystem rejuvenation stems from the understanding of the fishermen that PAR's cater to the basic needs of fish: their need to feed; their strong desire for protection, rest and shade; and their urge to breed.

For a PAR to be a source of food the kind of materials used to build the PAR gain importance. Materials on which benthic vegetation will quickly aggregate is crucial to ensure adequate food supplies. The PAR needs to be erected in areas where the sea bottom is naturally productive. To serve needs of overall protection, the structure and the position of the PAR are determining factors. Only a PAR of sufficient height will provide shade. Structures which are solid are not conducive for rest and shade and do not provide hiding places from predators. If fish are to make PAR's their breeding grounds, then the requisites of food and protection become imperative.

If fishermen are to catch the fish which make use of the PAR's in such a wide variety of ways, then the PAR's should be aligned on the seabed in the East-West direction. Given the North-South direction of the currents in the region this is the best alignment to ensure that the maximum number of fishermen can fish over a PAR at the same time without getting their hooks entangled.

They have learnt that ideally PAR's should be located in the “fish channel” – a path which fishermen of the region have identified between 25 and 50 metres depth.

Referring to the way this total understanding of fish behaviour helped to induce fish into the PAR's one fishermen remarked: “The fish teaches us and then we teach the fish.”

## Sharing Knowledge

The process of sharing the knowledge which they had accumulated over the years was achieved by the unique possibilities for inter-village discussions on these matters.

The forum to achieve this was provided by the Programme for Community Organisation (PCO) a non-governmental organisation – initiated by this author and a few other social activists – which had been in close contact with these fishing communities for over two decades. The exchange of information regarding the materials and design for PAR's was achieved as part of systematic attempts by the PCO to encourage fishermen to articulate more clearly the slowly disappearing oral traditions of their knowledge systems so that it could be documented and where possible refined and complemented with the knowledge of modern science. The process revealed the possibilities of undertaking what Norgaard referred to as a "coevolutionary development process" of the two knowledge systems. (See Norgaard, 1984, Kurien, 1987)

The need for a better understanding of the nature processes that takes place underwater around a PAR has highlighted the scope for a far greater degree of collaboration between coastal fishermen, marine biologists, oceanographers and other scientific personnel.

These discussions gave a big impetus to the learning process and provided occasions for collective thinking on micro-level options. It widened their horizons and gave them the possibilities of knowing what went on around them and also in other parts of the world vis-a-vis artificial reefs.

## EVOLUTION OF INSTITUTIONAL FORMS IN PAR DESIGN

Along with the discussions about materials and designs also came the concerns about the micro-level institutional processes and forms adopted in erecting and maintaining reefs.

The details which we have of the pre-1960 reefs indicate that though the erection was the result of a small group initiative, the use of the reef was open to the whole community. There were no perceived "private costs" to the group since the materials used were obtained free of cost by the fishermen and the labour involved in erecting the reef was considered as *shramadan* (voluntary labour). As a result the initiators did not think in terms of private returns or property rights.

In the post-1980 PAR's, materials had to be specially ordered and transported to the village before they could be taken out to sea. Since hooks and line are the most effective fishing gear to fish over the PAR's, the initiative to erect them came from the fishermen who were accustomed to hook fishing.<sup>9</sup> The distribution of post-1980 PAR's indicates that the first initiatives came mainly from the villages around and to the south of Trivandrum. (Zone 1 & 2)

What we observe in this period is an evolution of institutional initiatives in erecting and fishing over reefs. It may be useful to consider the activity of erecting reefs as the initiative to rejuvenate the *stocks* of the coastal commons and the activity of fishing over the reef as the use of the *flows* from the coastal commons.

We can distinctly identify initiatives for erecting reefs from four sources: individuals, groups, whole communities and external agencies. It is not that these four types are mutually exclusive. For example, certain leading individuals may play a crucial role in the initiatives of a group. Alternatively, an external agency – eg. an NGO, the church/temple, – may financially or otherwise assist a community or a group in erecting a reef.

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<sup>9</sup> Other gears may also be used. However a lot depends on the structure of the reef. In the Bay of Bengal off the coast of Tamilnadu, fishermen use lift nets over reefs.

It is also pertinent to note that there are certain combinations between those who take the initiative to erect reefs and those who finally fish over them which are incompatible. For example, it is unlikely that an individual would take the initiative to erect a reef and the same or another individual alone fish over it. Similarly, it is highly improbable that a whole community would invest in a reef and reserve the right to fish over it to an individual.

We shall enumerate below five "initiative/use" combinations which have been observed in the post-1980 period (A to E) and one which is likely to emerge soon (F). At the present juncture, some combinations co-exist. Some of them are likely to emerge as dominant forms.

#### **A. Individual Initiative/Group Use**

One of the first post-1980 reefs was erected by the initiative of an ex-serviceman from the fishing community who resided in the village of Valiyathura. (Zone 2) This was in 1983. He organised the erection of the reef partly using material freely available on the beach (stumps of coconuts etc) and arranged for the purchase of granite, cement rings etc. This reef came to be known after him as "Ouseph Paar." The total cash investment was estimated to be about Rs. 1000/- which Ouseph claims to have made by pledging his wife's gold ornaments. He hoped to recover this investment by collecting a rent from the fishermen who used the reef. The reef became productive in about three months and became known as a good fishing spot. Due to the difficulty of monitoring and preventing free access to the reef, Ouseph's hopes of profit were only partially realised.

#### **B. Group Initiative/Group Use**

"Ouseph Paar" became the inspiration for fishermen to consider taking their own collective initiatives to erect reefs as the means of rejuvenating the coastal commons and enhancing their fish harvests. They joined together, formed a coherent group, collected equal shares and erected a people's artificial reef.

Interestingly these small group initiatives were restricted to the villages around Trivandrum City where hook fishermen are in a minority. (Zone 2) In 1984 the fishermen of Kochuthope, a village just north of Valiyathura erected a PAR which cost them Rs.6000. Initially only 100 fishermen had access rights to it. Subsequently when the PAR was built-up again the membership was raised to 300. Their collective experience of restricting the use of the PAR to the members was fairly successful.

We notice that there was a spurt of group initiative/group use PAR's erected in these villages during the years 1984-85. These were located just outside the range of the shore-seine operations (about 15 metre depth) which is about 1.5 to 2.0 kms from the shore and just within keen eye-shot.

Fishermen enumerate five distinct advantages to this location: (a) it prevents conflict with shore-seine operators (b) it allows for easier monitoring of the PAR for poachers - mainly from the neighbouring villages (c) it is within rowing distance thus ruling out the need for mechanical propulsion to reach the PAR hence reducing the costs of fishing (d) proximity also makes the PAR accessible to the older and the very young fishermen (e) since the reef fish are fresh and brought quicker to the shore they fetch a higher price.<sup>10</sup>

<sup>10</sup> Achari, 1988 in a study of these PAR's has reported that in the village of Vettucaud there was a strong conflict between the minority group of hook fishermen who erected the PAR and the shore-seine fishermen who with the backing of the church authorities were able to ensure that the PAR was destroyed. Achari also reports that the catch and the net returns per fishermen from these PAR's is marginally higher than what is obtained by hook fishermen of the region as a whole.

### C. Group and External Agency Initiative/Group Use

In early 1988 the fishermen of Valiyathura, who were members of a village-level cooperative which was part of the apex organisation called the South Indian Federation of Fishermen Societies (SIFFS), decided to erect a reef. They formed a group of 100 members with each one contributing Rs.100 towards the cost of the reef materials. They approached SIFFS for a grant of Rs.10,000. The amount was granted and the SIFFS took the initiative to arrange for fishery scientists to be associated with the erection and monitoring of the biological aspects of this PAR.

Access rights did not in anyway materially affect the activities of the scientists who were monitoring the biological changes that were taking place underwater on the PAR. However if one was to assess the PAR's economic viability – a task which SIFFS intended to do – restricted use rights would make the task much easier. The concept of group initiative and group use was therefore supported by SIFFS.

### D. Group Initiative/Community Use

Our enquiries reveal that at about the same time as the fishermen in the villages around Trivandrum City were erecting their "group initiative-group use" PAR's, fishermen in the villages south of Trivandrum (Zone 1) where hook fishing predominated and where natural reefs were once in abundance, were erecting PAR's in what was termed by them as the *utsava shylee* or festival approach.

This form of erecting PAR's is analogous to the funding and celebration of a village festival.

For village festivals the funds are collected from all the households in the village on the basis of "whatever each one can give happily" in cash or kind. The actual initiative and hard work of organising the festival is taken on by a core group (a festival committee) whose primary gain is social recognition. Any number of volunteers are accommodated. While the grandeur of the festival is proportionate to the total funds raised, access to the fun of festival day is open to all irrespective of their contribution.

The analogy can be fully extended to the PAR's erected by these fishermen. These PAR's are assets created with a large group initiative with access open to the whole community.

### E. Community Initiative/Community Use

It was during discussions at the PCO that fishermen from the southern villages heard authentically about the "privatisation" of reefs by small groups in the villages around Trivandrum. They were astonished and remarked: "You don't show your narrowness at a village festival or at sea. Both are for all." A very animated discussion followed in which the implications of the philosophy of stewardship of natural resources was raised. They were of the opinion that as children of the sea and as those who know the secrets of the sea, such a narrow and partisan approach was not warranted *between themselves*.

The southerners suggested that while access to the PAR's should be open to all, certain community agreements need to be evolved to restrict fishing effort by individuals. For example: there should be a limit placed on the number and size of hooks used; the use of lights to fish over the reef at night should be prohibited. This would ensure a more equitable distribution of the catch. Community sanctions for those who violated these norms were appropriate.

These inter-village discussions about the need for more "community initiative/community use". PAR's has resulted in a self-critical review of the other approaches.

The most recent initiative to create a PAR by the fishermen of the village of Thumba in the north of Trivandrum (Zone 3) bears witness to this. In true festival style the whole community is involved in the fund raising efforts to erect a PAR which they claim will help to rejuvenate a natural reef which was recently destroyed by the indiscriminate fishing of a large fleet of trawlers. They have formed a "sahodara samajam" – brotherhood fraternity – with the whole village actively participating in the venture.

The changes in materials, designs and institutional forms – the hard and software – have resulted in PAR's attaining a wide range of "meanings" to the artisanal fishermen. They are no more just the collective effort of "throwing granite into the sea".

PAR's are symbolic of the creative efforts for "greening the sea." PAR's provide the avenue for the creative use of their accumulated, transgenerational knowledge about the aquatic milieu and the behaviour of fish.

PAR's are seen as the appropriate physical structures for fencing of their exclusive fishing zone against the incursion of trawlers.

PAR's are the rallying point for collective action in evolving institutional processes and institutional forms for coastal resource rejuvenation.

#### **F. External Agency (State) Initiative/Community Use**

Interestingly, among the policy makers, government bureaucrats and scientists there was not even an awareness about PAR's and their growing numbers until it was brought to their notice by the Programme for Community Organisation in 1987.

When they were first appraised of the matter they viewed these initiatives to be quaint. It did not fit into the usual patterns of development and management strategies which they had initiated following the recognition that the coastal commons was facing an overfishing crisis.

Given their preoccupation with ways and means of getting the maximum amount of fish out of the sea with a minimum of social conflict and law and order problems, it is not surprising that they initially considered this "throwing of granite into the sea" to be a waste of time, materials and money. Providing outboard engines or better craft to artisanal fishermen to fish in deeper waters or putting into action a marine police force to regulate fishing was more in line with their concerns.

However, with the spreading of the idea of PAR's among the fishermen and the scientists, the policy makers have begun to take cognizance of the matter. Initiatives of the fishermen along the lower east coast of India (Tamilnadu) to build reefs and the role of NGO's specialising on rural technology in assisting their efforts has prompted the Department of Science and Technology of the Government of India to initiate a national programme on artificial reefs. On hearing about the initiatives along the lower south-west coast the pervue of the programme has been extended to include this area. It will now only be a short while before the funding of artificial reefs becomes an accepted programme of the state's fishery budget.

At the present level of investment (on average about Rs. 10,000 per PAR) the scale is too small for a state sponsored programme. However, the growing appreciation among the fishermen of the need for bigger and better designed physical structures for PAR's – e.g: specially designed concrete structures or the use of old bus bodies etc. – is creating a latent demand for a greater level of financial investment in artificial reefs. The larger the level of investment the more "viable" it becomes for governments and financial institutions to invest in reefs.

## THE FUTURE OF PAR's

We need to examine if there has been any direction in the evolution of institutional initiatives taken by fishermen in erecting and using PAR's. A matrix illustrating the "initiative/use" combinations which we have enumerated above indicates that while there is a convergence towards community *use* of reefs, the initiatives to *erect* them are likely in the future, to come from both the community and external agencies. (See Table 4)

The convergence towards community *use* of PAR's is a resolution of a dilemma and a reaffirmation of a choice (made by fishermen) that the coastal waters are their social asset and should not be privatised by individuals or small groups. The divergence in the initiatives in *erecting* PAR's – between the community and possibly the state – point to "higher order" dilemmas and choices.

Large scale state investment – even if the reef thus created will be open to use for the whole community of active fishermen – will tend to "standardise" artificial reef construction taking out of it the "people's science" element as well as the popular, decentralised, participation in creating this social asset. People loose their autonomy and become passive recipients of the benevolence of a central authority. The values associated with PAR's as concrete expressions of the people's will and resolve to nurture a damaged ecosystem will tend to get lost in the euphoria of reefs as a source of fish and quick profits.<sup>11</sup>

## LESSONS IN COLLECTIVE ACTION

The evolution of the actions of the fishermen of the region in erecting PAR's questions the prediction that people confronted with a Hardinian tragedy will in accordance to Olsonian predictions not join hands for collective action unless coerced to do so. It also raises the issue about the assumption of the prisoner's dilemma game: that there cannot be any change in the structure of the game.

Examining the brief history of PAR's we see that once those caught in a dilemma meet together, discuss, exchange views and learn from each other it is unlikely that they will retain the status quo structures. They evolve new learning, new institutions and new trust among themselves – attributes which contemporary theories of collective action do not address.

We have observed how the resurgence of reef building, in the wake of the marine resource crisis, has also brought with it the reaffirmation of the community's responsibility to nurture the resource-system which is the basis of their survival. It has also provided a new, collective motivation for them to articulate, sharpen and expand their knowledge base and provide fresh foundations for the growth of community leadership and widespread participation in the process.

As Chopra et al (1990) rightly suggest: "when conventional methods of development fail ..... there is a need for some rethinking about the socio-economic institutions that link resources, people and governments."

However, we have seen how people's initiatives at creating institutions very quickly interface with market and/or state. This can in turn lead back to "conventional methods of development".

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<sup>11</sup> This is likely to be an imminent possibility given the keen observation by fishermen that cuttle fish (*Sepia pharonis*) which has a big export demand, spawn in the PAR's. Whether fish other than specific "reef fishes" breed on artificial reefs still seems an unsettled issue among American and Japanese scientists. The former continue to debate whether artificial reefs actually increase productivity or merely attract and concentrate organisms from surrounding areas. Japanese scientists generally have *People's* artificial reefs (PAR's) will become just artificial reefs (AR's) !

<sup>12</sup> little doubt that artificial reefs, *when properly designed, sited and placed* can be used to increase the productivity of desired species. (Sheeby, 1982)

The future of these small- scale fishing communities in the lower south-west coast of India and the common property resource which they consider their inheritance does not depend overwhelmingly on the success or failure of PAR's as technological artifacts. It however hinges crucially on the cultural, socio-economic and political empowerment which results from the processes and institutions evolved in the collective action while erecting and maintaining them.

**Table 1. Select data on Kerala State's marine fishery sector.**

	1961	1965	1971	1975	1981
Fish Harvest (000 tonnes)	286	339	445	420	274
Harvest as % of MSY (MSY= 380,000 t)	75	89	117	110	72
Price of Fish (Rs/tn)	120	200	660	1760	2000
Value of Harvest (Rs.mn)					
Current Prices	35	68	293	740	548
Constant Prices (60-61)	35	48	138	197	144
Active Fisherman (000)	80.7	88.6	101.9	111.6	127.9
Fishing Craft					
Non-mechanised	20667	20900	21718	25100	26271
Mechanised	152	501	1780	2105	3038
Productivity per annum					
Physical (Kg/worker)	3540	3820	4370	3760	2140
Value (Rs/wkr-current)	430	770	2900	6600	4300
(Rs/wkr-const)	430	550	1370	1760	1134

**Table 2. People's artificial reefs erected in Trivandrum and Kanyakumari.**

Period	Before 1960	1979 - 1983	1984 - 1989
No. of PAR's Erected	2	9	21

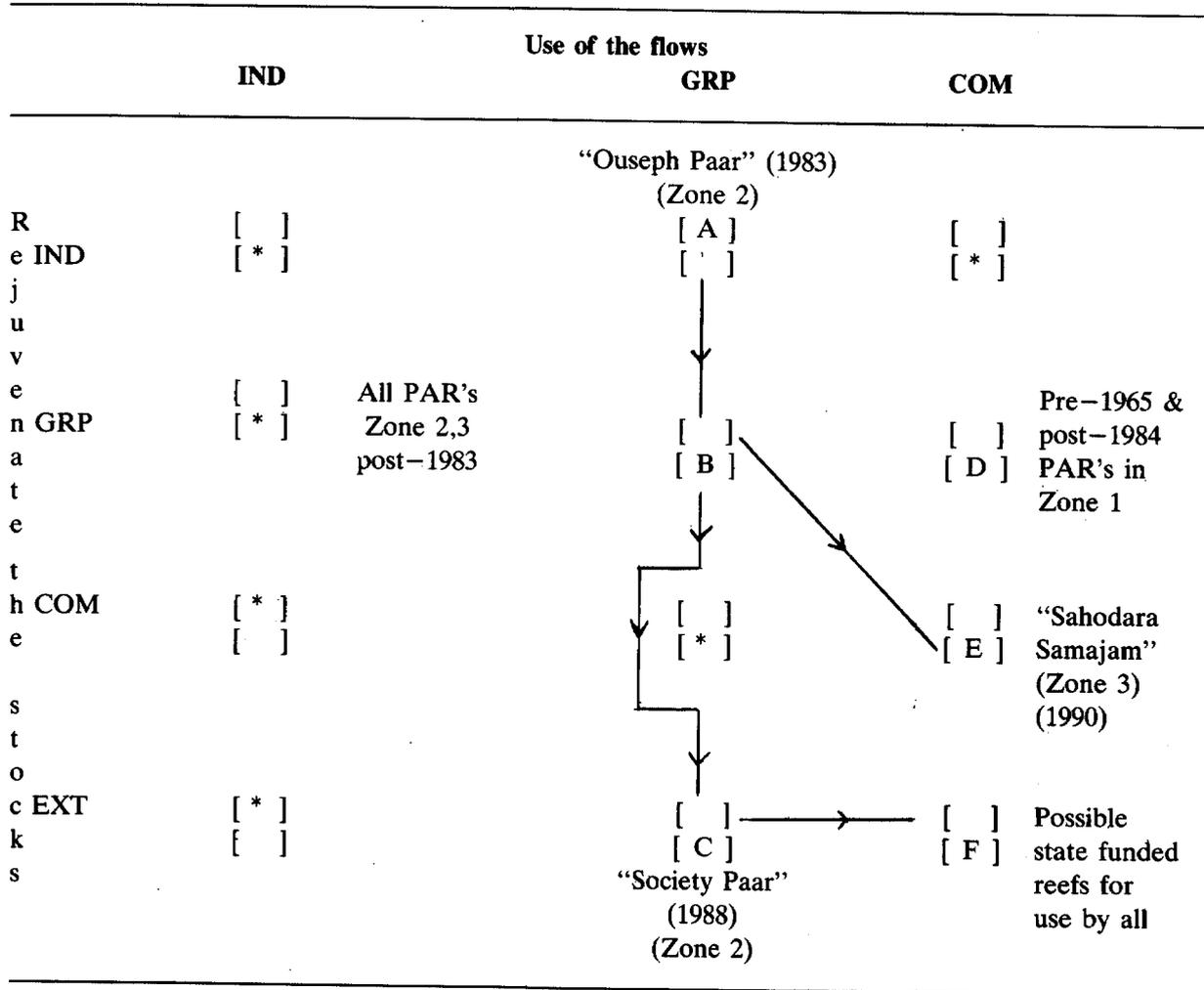
Source: Adapted from Kadappuram, 1989a.

**Table 3. Percentage distribution of PAR's along the coast.**

Area	Pre-1960	Post-1979
Zone 1 Villages south of Trivandrum City	100	40
Zone 2 Villages around Trivandrum City	-	50
Zone 3 Villages north of Trivandrum City	-	10

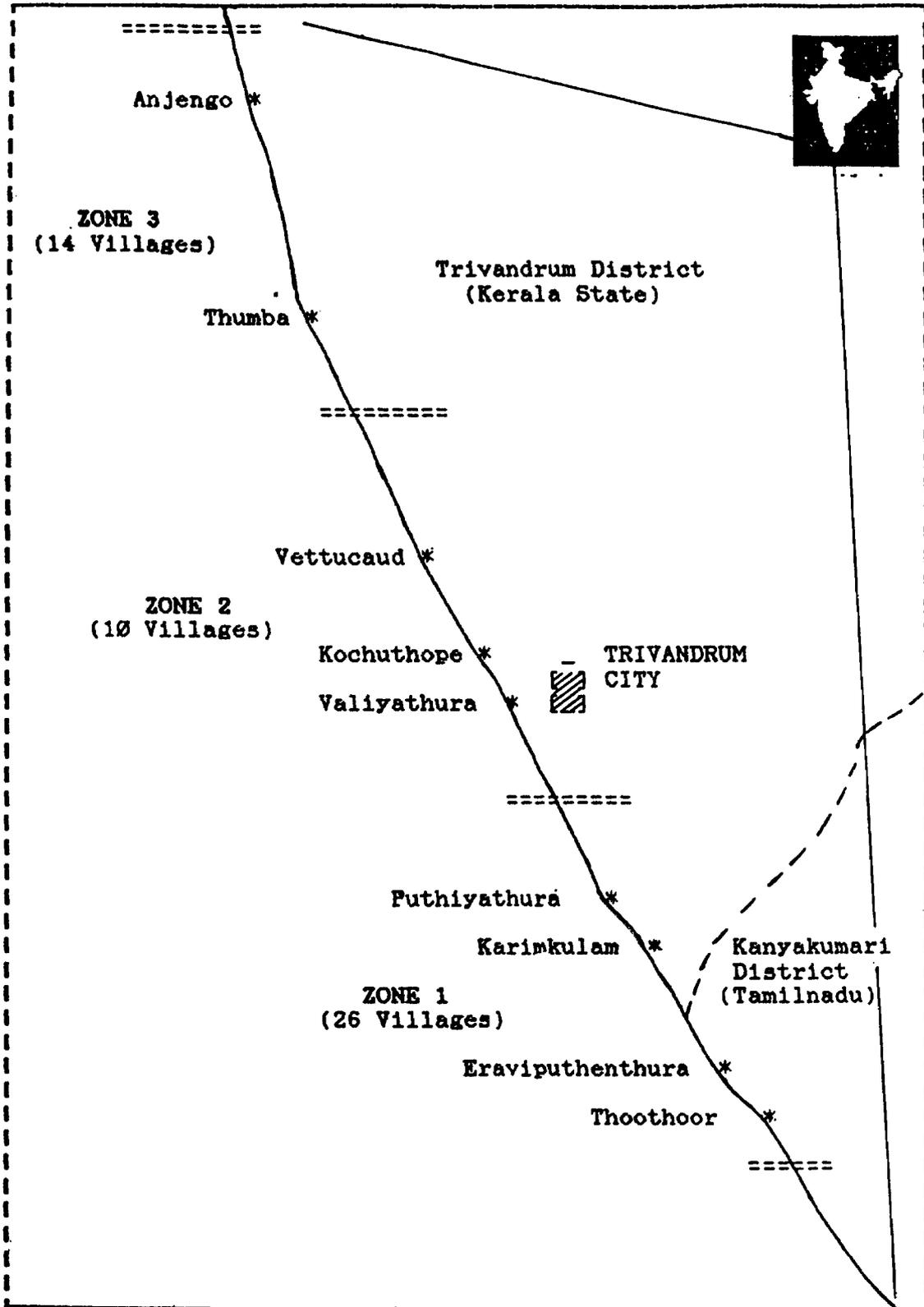
Source: Adapted from Kadappuram, 1989a

**Table 4. Matrix of initiatives to rejuvenate the stocks and use the flows of the coastal commons.**



Note: [\*] indicates improbable combination  
 IND = Individual  
 GRP = Group  
 COMM = Community

EXT = External Agency  
 (A,B,C,D,E & F refer to the "initiative/use" types)



**MAP 1: MAP OF TRIVANDRUM AND KANYAKUMARI DISTRICTS**  
(Not to Scale)

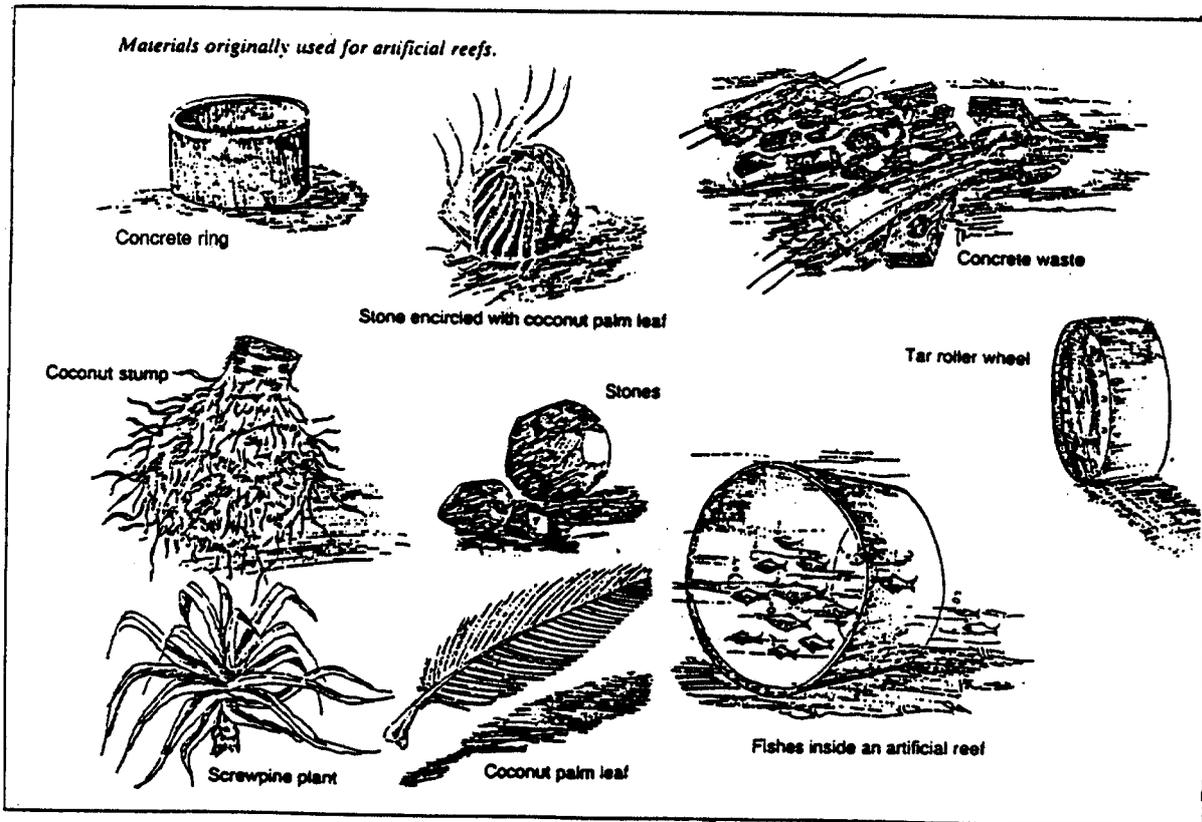


Figure 1.

Source: Kadappuram 19896b.

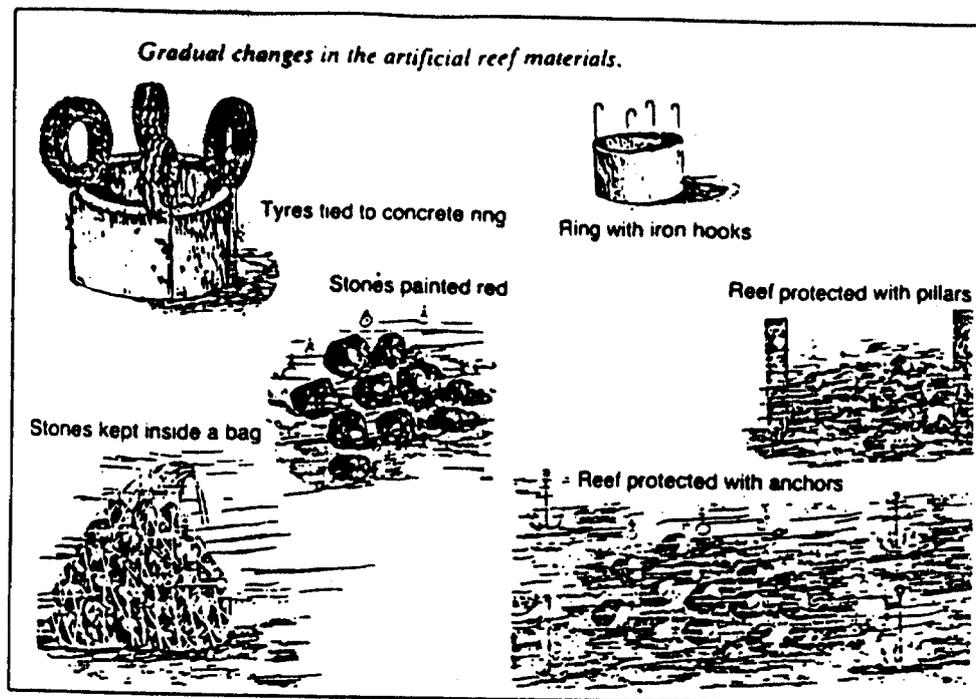
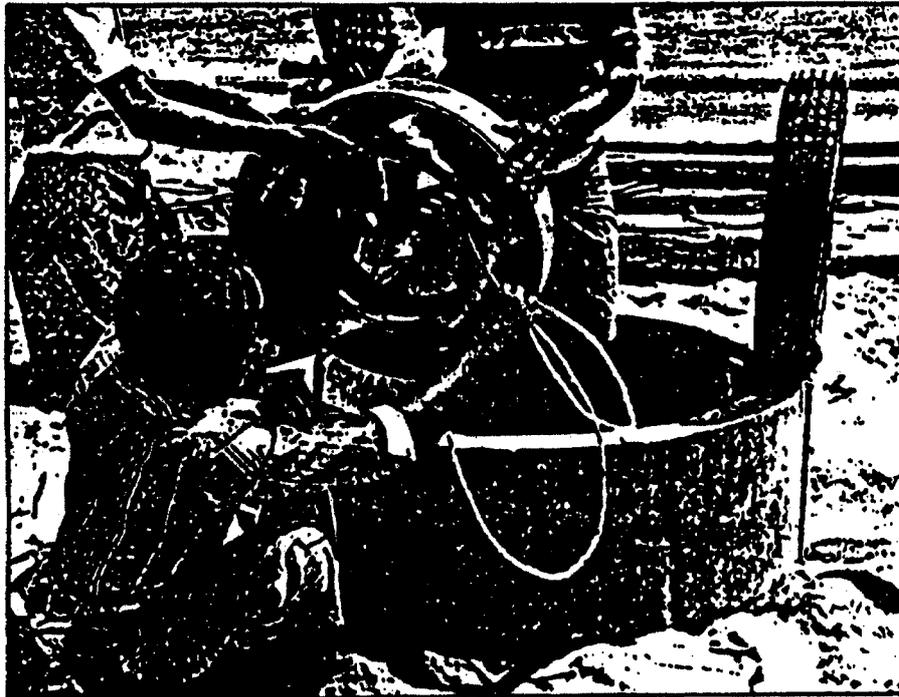


Figure 2.

source: Kadappuram 1989b.



*Material for artificial reef being readied on shore.*

**Figure 3.**

Source: Aravindakshan 1990

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