

## Spiny Lobsters and Their Fishing Techniques

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Scores of publications on spiny lobsters and their fishing techniques are available from various parts of the world. A variety of fishing gears which vary in design and operation are employed for exploiting lobsters. A review of the work carried out on spiny lobsters with special reference to their distribution, fishing gear, fishing methods, baits and crafts in India, Sri Lanka, United States, Australia, South Africa, United Kingdom, Ireland and Portugal based on selected literature are considered and discussed.

The present knowledge on various aspects of spiny lobster fishery is mainly from Australia, United Kingdom, United States of America, South Africa, Japan, France, New Zealand and India. Scores of research publications are available, out of which an exhaustive and indexed bibliography on the spiny lobsters (Palinuridae) edited by Kanciruk & Herrkind (1976) and annotated bibliographies on spiny lobsters by Sims (1966) and Smolowitz (1978) deserve special mention. Mc Koy (1979) has published an annotated bibliography exclusively on the New Zealand rock lobster *Jasus edwardsii*. However literature pertaining to different fishing gears and methods employed in Indian waters are few.

### Distribution

Spiny lobsters are found in warmer seas throughout the world. They are variously known as rock lobster, spiny lobster, sea craw fish, langouste and langosta (Smith, 1958). In India, there are about six species occurring in the submerged rocky patches along the coast. The species in the order of commercial importance are *Panulirus homarus* (Linnaeus), *Panulirus polyphagus* (Herbst), *Panulirus ornatus* (Fabricus), *Panulirus versicolor* (Latrielle), *Panulirus penicillatus* (Olivier) and *Panulirus longipes* (Milne Edwards). *Puerulus sewelli* (Ramdan) and *Palinustus mossambicus* (Barnard) are two deep sea lobsters recorded from India (George, 1967; 1973; George & George, 1967).

Six species of *Panulirus* are found in seas around Sri Lanka namely *Panulirus dasypus*,

*P. versicolor*, *Panulirus japonicus*, *P. penicillatus*, *P. ornatus* and *P. polyphagus*. All except *P. polyphagus* are uniformly distributed in reefs and rocky areas around the island, with *P. dasypus* dominant on the west coast, *P. ornatus* in the north and *P. versicolor* in the east (De Bruin, 1962).

Nine species are found in Australia (George, 1966). They are *P. versicolor* (Latrielle), *P. homarus* (Linnaeus), *Jasus verreauxi* (Milne Edwards), *Panulirus cygnus* (George), *P. longipes* (Milne Edwards), *P. penicillatus* (Olivier), *P. ornatus* (Fabricus), *P. polyphagus* (Herbst), and *Jasus lalandei* (Milne Edwards). Four of them *P. cygnus* (western rock lobster) *Jasus lalandei* (southern rock lobster) *Jasus verreauxi* (eastern rock lobster) and *P. ornatus* (tropical rock lobster) are fished commercially. Western lobsters are confined to Western Australia, where they are caught over an area of about 20,720 sq. km within the 45 fathom line extending from Bunbury to Shark Bay and further along the reefs fringing the Houtman Abrolhos Islands, off Geraldton. The tropical rock lobsters of Australia are found in North Australia and in Papua New Guinea and are commercially fished by divers from Thursday Island in Torres Strait. As it will not enter the conventional baited pots, it is speared and caught by hands (Hughes, 1971).

The major catch of lobsters in New Zealand is constituted by *Jasus edwardsii* (Hutton) and *J. verreauxi* (Milne Edwards). From Phillipines three species of *Puerulus*, namely, *Puerulus sewelli*, *Puerulus ortman* and *Puerulus angulatus* are recorded. *P.*

*sewelli* is also reported from Gulf of Aden, Arabian sea off Travancore, North West of Colombo and Gulf of Mannar (Holthuis, 1965). *Linuparus trigonus* (Von Seibold) is now reported from Philippines (Holthuis, 1965) and another species *Linuparus white* from South China Seas (Bruce, 1965). The important species occurring in Japan is *P. japonicus* (Von Seibold). The South Californian market lobsters are *Panulirus interruptus* (Randall) and *Panulirus inflatus* (Bouvier) and are also present to a limited extent on the west coast of Mexico and around Hawaiian Island. The form usually found in the Hawaiian market however is *P. japonicus*. The other species of Pacific lobsters include *Panulirus gracilis* caught in Gulf of Panama (Smith, 1958).

In Indian Ocean, commercial fishery is dependent on *P. ornatus* and *P. polyphagus*. The South African genera are *Jasus*, *Palinurus* and *Panulirus* (Silas, 1967). *Jasus lalandei* forms the bulk of South African fishery, where it is known as Keef or Cape craw fish. Another species of spiny lobster from South Africa is *Palinurus delagoae* (Berry, 1973). From Mozambique *Panulirus gilchristi*, *P. ornatus*, *P. longipes* and *P. versicolor* are reported. What is probably a subspecies of *J. lalandei* supports an important fishery off the coast of Chile (Smith, 1958). There is a seasonal fishery for *J. lalandei* in St. Pauls and New Amsterdam Islands where at present the catch is limited to 200 tonnes of lobster per year. *Jasus* is the only genera of Palinuridae known so far to occur around St. Pauls and New Amsterdam Islands (Silas, 1967).

*Palinurus rissonni* (Desmarst) is caught on the west coast of Africa and sold in France as the "Royal Langouste." A Mediterranean species *Palinurus elephas* (Fabricus) is caught from the French coast, whose distribution extends north to Great Britain (Smith, 1958), but the important one in British and Irish waters is *Palinurus vulgaris* (Forsyth, 1946). The common Caribbean species *Panulirus argus* (Latrielle) is found in the Western Atlantic from Rio-de-Janeiro, Brazil to Beaufort, North Carolina and Bermuda. Within these geographical limits, the Caribbean spiny lobster is caught in sufficient quantity only in Florida, Bahamas, Cuba and British Honduras. Along the coast of Brazil the

common form of spiny lobster is *Panulirus laevicauda* (Latrielle). Small numbers of related species are occasionally found in commercial catches of Western Atlantic and Bermuda. They are *Panulirus guttatus*, *Palinustus truncatus*, *Justitia longimana* and *Palinurellus gundlachi* (Smith, 1958).

#### Fishing gear and methods

A wide variety of fishing gears are employed for catching lobsters. They vary in design, fabrication and mode of operation from place to place. Hand picking to trawling are employed in various parts of the world. Lobster traps however seem to be the well known and conventional fishing tackle extensively employed.

#### Traps

The terms 'traps and pots' are used interchangeably. Some of the primitive traps, invented by the ancient men can still be seen in many parts of the world (Job & Pantulu, 1953). Trap is a highly versatile fishing gear; its dexterous operation enables several scattered areas to be worked simultaneously. Even today wicker-work baskets used for fish, crustaceans and even snails (whelks) are spread all over the world especially for fisheries in river or off the seashore (von Brandt, 1972).

Hornell (1950) considers traps as the earliest form of fishing gear used in the Orient, which have been later introduced to several other parts of world. The findings of Arocha (1964) support this assumption. Dow (1964) is of opinion that the probable forerunner of traps is the creels of Northern Europe and British Islands. In Canada lobster trap is supposed to have come into operation by about 1870 (Levett, 1965).

#### India

The indigenous traps used in south west coast of India for catching lobsters are generally termed as "Colachal type", the shape of which is described as 'heart shaped' or as 'arrow heads' by different authors. It is collapsible and consists of three parts—floor, top and sides with a removable entry funnel in front. The different parts are normally laced together with vegetable fibres. Miyamoto & Shariff (1961)

described these traps and their operation. Presently the operation of traps in India is mostly confined to 8–12 m in depth. Similar traps are also used in other parts of the world. In Panama, the woven reed trap similar to the Indian lobster trap is in use (Pease, 1965).

#### *Sri Lanka*

Methods employed by Sri Lankan fishermen are described by De Bruin (1960). Gear efficiency tests were conducted in Ceylon, with 'Scottish creel', the 'Canadian parlour and bedroom' and 'Cornish inkwell' traps. A collapsible Canadian type made of steel and hemp netting was developed later, and found to be efficient and convenient.

#### *United States*

The earliest recorded instance of fishermen operating a string of lobster pots commercially was in 1870 (Levett, 1965). In United States, the fishermen have gradually settled to two types of pots, semicylindrical and the rectangular. Seasoned wood of oak, spruce and hem-lock are favoured for the construction.

Semicylindrical lobster pot is still the most popular in State of Maine. It measures 80 x 68 x 45 cm and has a short chamber and a longer 'parlour'. The completed traps are weighted with 2 to 4 building bricks. The buoy line is attached at the corner of the chamber end (Firth, 1944).

The rectangular pot is of more recent origin than the half round type. The absence of curved surfaces makes the rectangular trap more rugged and easy to repair. The traps thus made stack better. A typical pot measures 80 x 65 x 40 cm at the base with 55 cm width at top (all outside measurements). Originally these traps had only one opening at the side, but the present practice is to have one opening each at both the sides (Firth, 1944). In addition, the traps called 'parlour trap' and 'double headed trap' with six different versions of each are in vogue. The parlour trap is generally preferred from Kittery East Waters to Cape Split while the 'double header' is in use from Cape Split to State's eastern extremities.

'Igloo'—a new type of dome shaped plastic trap with a vertical entry has an effective life of 8 to 10 years. The trap is very stable. 'Igloo' traps comes in 4 sections, the base has a mild-steel ring with a tow eye. Each pot can be nested separately during transport and can be baited and assembled in seconds. The trap weighs 9 to 9.5 kg in water and 11 kg in air (Anon 1965).

#### *Australia*

Lobster pots of Australia are described by Hughes (1971). There are 4 types in commercial use with the same catching techniques. Pot dimensions differ from area to area with the species. Beehive pots are extensively used. The frame may be woven with cane, ti-tree or similar sticks and covered with wire netting. It has a basal diameter of 90 to 105 cm, height 62 to 72 cm, diameter of the neck 18–30 cm, depth of the neck 15–21 cm and width of the cane apron 8–12 cm.

The stick pot construction is popular in Western Australia. The frame consists of 19–25 heavy, galvanised wire of 5 mm diameter and is closely woven with 10 mm diameter cane. Ballast is placed inside to sink the pots and to hold them to the sea bed.

Wire pots are more popular in Southern Australia, whose frames are fabricated out of 10 mm mild steel rod with horizontal stiffening with metal rings welded to 8 — 12 vertical frames. A covering of heavy galvanised wire netting is used round the circumference of the pot. It is also a common practice to use moulded plastic neck and apron. Ballast is seldom used, as the trap itself is heavy.

Wooden batten pots are used in shallow waters of Western Australia. These pots are constructed with wood or have a welded strap steel bottom with wooden sides and top. The neck is made of either wood or plastic. One end of the pot can be removed for baiting and removal of catch. Ballast is necessary for all wooden pots. It has a length of 80 to 85 cm, width (base) 70 to 80 cm, height 38 cm, width (top) 30 to 52 cm, neck 18 x 18 cm, depth of neck 15 to 20 cm. Winstanley (1979) indicates that dual purpose traps for crab-lobster fishing would be more rewarding.

Alec White of Aden while studying the Western Australian cray fish industry, obtained a pot from the Western Australian Fisheries Department. The pot is of wicker work construction and weighs only few kg. The top section is laced to the sides, but only loosely along the edge opposite the entrance (Anon, 1963).

#### *Japan*

Besides the conventional traps the latest one used in Japan is a collapsible one made with flexible polythene tubing and synthetic fibre netting. The diameter of its circular base is 97.5 cm, mesh size of plastic covered wire netting 2.5 cm, diameter of frame tubes 1.8 cm, and netting of 5 cm Kuralon. There are two opposite entrances with an outer diameter of 23 cm and inner diameter of 15 cm. The length of entrance is 16.5 cm. Size in collapsible state is 12 cm high and in rigged state 67.5 cm high (Temple, 1964).

#### *South Africa*

South African lobster traps are identical to the American parlour pots and are constructed with a metal frame work of truncated pyramid shape with hexagonal base. The trap measures 105 cm across the base and is 22.5 cm in height and weighs less than 4.5 kg and collapses to a thickness of 2.5 cm enabling boats to carry large numbers (Anon 1960).

Angot (1951) gives a brief description of the traps used which is closely akin to the type used along the French coast and Gulf of Maine. It is semicylindrical, with a rectangular basal plate and with two openings along the upper median line. The flat bottom enables the trap to rest properly on irregular bottom. It is also reported that 50–70 kg of lobsters are caught per day, and each boat uses about 20 to 50 traps (Silas, 1967).

#### *England*

The pots used in England are the 'cornish pot' and the 'creel' or 'creeve.' Cornish pots are bulky, 60 cm or more in diameter, beautifully woven in willow with a top entrance or spout varying from 12.5 to 20 cm.

Cornish spherical traps made of tougher wood dates back to the early 17th century. Stones or bricks were used as ballast. Such types are rare in Scotland (Forsyth, 1946). There are several designs of parlour pots but the one most favoured is a fore bowed east coast pot with opposing spouts in two of the divisions. One entrance is at one side and woven to the central bow is another funnel leading to a chamber at the opposite end (Forsyth, 1946).

In single eyed creels, the base measure 50 x 37.5 cm, the roof is slatted and the netting is cut from otter trawl and stitched to the frame. The height is roughly 30 cm (Forsyth, 1946).

The frame work of metal pots consists of 3 mm rod covered by 3 mm wire of meshes 1.6 cm. There are oval, top and side spouts, scaling 25 x 20 cm with a door at one end. The spouts are reduced to about 5 cm at the inner ends and are fitted with pigeon traps and counter balanced with a piece of lead to keep them in down position (O' Farrel, 1966). Pots of French pattern are seen on the south coast of England. It is a cylinder of wooden laths, closed at each end by netting or laths, with a single opening half way long. A pot made of rabbit wire supported on iron frames and triangular in section is found at Babbacombe. On the Cornish coast, modifications of Cornish pot made of wire are often used (Davis, 1958).

An ingenious type of French pot is reported from Beaumaris. It is cylindrical and the outer supporting hoops are the rims of bicycle wheels joined longitudinally with broom sticks and opening of the funnels are supported by the rim of small perambulator wheels (Davis, 1958). There are more types of lobster pots used on Welsh coast than in any coast in British Isles. There are three types, (a) Cornish ink-well type with eye at the top (b) Scottish creel, cottage shaped, with an entrance on either side and (c) barrel pots. (Simpson, 1959). Folding pots are being used in Broad Stair and this helps in saving deck space (Anon 1962).

Norwegian 'Venor pot' has also been tried here. It consists of upper and lower halves which are readily assembled or taken apart by a twist of the upper half. During fishing

operations this can be facilitated by the use of two pins fixed in the boat to steady the lower half. The funnel of the pot is of polished plastic and is moulded integral with the frame. Pot is 39 cm high and has a diameter of 50 cm at the centre (Burgess, 1963).

#### *Ireland*

The Irish craw fish industry centers mainly on the use of French barrel pots introduced into Ireland in 1947 (Culley & Driver 1972). Recently lobster pot industry is developed in Ireland based on a new North American type. The difference between the new and the traditional type off Irish coast is that it has a double trap—a kitchen and a parlour (Anon 1966).

The ideal design of lobster pot in Ireland is the 'round turret lobster pot' designed by an Irish fisherman, Thomas G. Pyne. This has the entrance at the top and is made of heavy gauge galvanised steel wire on treated steel frame. Pot weights 3.2 kg and is 140 cm in circumference, 42 cm high with 22 cm diameter plastic entrance with 'V' cuts at the bottom to ensure that lobsters do not escape. It combines light weight, low cost, escape proofness, compactness and strength (Anon 1970).

#### *France*

Plastic moulded lobster pot of France is called 'Kavel lobster pot.' Designed along the lines of hexagonal French 'Casier', the pots are made in six separate parts which can be quickly and easily assembled or dismantled with the aid of simple tool. The pot is 76 cm long, 58 cm wide and 45 cm deep with an inlet neck of 25 cm diameter at its widest part. When assembled, the pot weighs 4 kg and about 9 kg of ballast must be provided to it (Smith, 1969).

#### *Portugal*

Portuguese traps for spiny lobsters are made of wood and wire and is almost drum shaped, wire netting mounted on both the ends and the wooden or bamboo slats lengthwise (von Brandt, 1972).

#### *Pot tippers*

For the efficient and easy handling of lobster traps under operation, mechanised

pot tippers are used as standard equipment in most West Australian cray boats, even though fishermen of eastern states are slow to adopt them. This equipment in its modified version has become part of a lobster fishermen's gear in Japan, America, Canada, South Africa and Norway. It is known as Fremantle cray pot tipper (Hughes, 1966).

Though simple in mechanism, these devices are great labour savers. Used to set and retrieve pots, pot tipper is a hinged platform or a see-saw with a roller across the inboard or upper end. Lobster pot haulers are almost invariably constructed from rear axle assembly of car or a light truck. When the pots are being retrieved, the bouy line is picked up first and brought about. It is lead to the hauling winch over a roller, situated between the two vertical guides on the tipper. The bouy line is hauled, until the pot reaches the roller, the tipper swings upwards and the pot slides inboard and comes to rest on the guide rails. The hinge position can be varied to change the angle of the tipper to the side of the hull. The roller position regulates the length of the leverage from the pivot point (Anon 1973).

Other than the conventional traps, there are innumerable methods by which lobsters can be caught successfully.

#### *Anchor hook*

The method of fishing with anchor hooks for lobsters in south west coast of India has been described by Miyamoto & Shariff (1961). Anchor hook consists of 3 parts—the hook, brass wire and cotton line. The hook proper is shaped like that of a small grapnel anchor with 6 sharp arms of 10 to 12 cm made of cast iron. The brass wire used for the snood part is 3 fathoms long and 16 gauge in thickness. Cotton line used for lowering the hooks to the required depth is 20 counts, 36 threads, 3 ply, or 10 counts, 21 threads, 3 ply. Mussel (*Perna* sp.) is used as bait and fishing is generally done during night. The baited lures are lowered on reaching the fishing ground and when the bite of the lobster is felt, the hook is pulled fiercely, when the lobster gets hooked. The lobsters thus caught are necessarily wounded or mutilated.

### *Scoop net*

In India fishing for lobsters with scoop net was successful and prevalent when the lobster population was very dense. Here, a lure line either baited or unbaited is lowered to the area populated by lobsters and slowly pulled up until the lobsters follow the line and reach very close to the fishing craft. Once they are near the surface they are scooped up by a scoop net (Miyamoto & Shariff, 1961). The gear used in some parts of Sri Lanka such as Galle Harbour is very similar to the device employed for the capture of crab, *Scylla serrata* and consists of a heavy iron ring about 75 cm in diameter carrying a conical net. A rope is stretched across the diameter of the ring, to which at the middle the bait is fixed. Three strands of the rope are attached to the ring at three points on the circumference. The free ends of these strands are joined to a single rope which is pulled up for hauling the gear (De Bruin 1960).

### *Bottom set-net*

Bottom set nets generally used for catching lobsters in some parts of India, are usually made from old webbing re-rigged as bottom set gill nets. Each piece is 18 m in length and 3 m in breadth. Mesh size varies from 8 to 15 cm. Each unit consists of 6 to 12 such pieces. 5 to 9 floats of wood or plastic are attached to each piece on the head rope. The nets are lowered and set at the bottom with a marker float and long buoy line at the beginning of the first piece and at the end of last piece. The nets are so laid, that they encircle an entire rocky patch and the lobsters generally get entangled in the webbing (Balasubramanyan *et al.*, 1960).

Experimental rock lobster fishing operations were conducted during 1958–59 along the south west coast of India with newly designed bottom set gill nets. This was repeated with a slightly modified design during 1959–60. As the fishing operations proved successful, the design became popular among the fishermen thereafter (Balasubramanyan *et al.*, 1961). In the coast of Spanish Sahara also fishermen use bottom set nets for lobsters (Anon 1967). De Bruin (1960) has also reported the use of old webbings as bottom set nets for catching spiny lobsters in Sri Lanka.

### *Trawling*

Commercial trawling for lobsters is employed in Norway, Sweden and France. Stray catches of lobsters are obtained during trawling for bottom fishes in Indian waters especially along the east coast of India. De Bruin (1960) has reported catches in Granton trawl at a depth of 20 fathoms in Sri Lanka.

Fishermen of United States have dragged for lobsters since mid 1950's especially on the banks of north eastern United States. The boats and crew are larger than in inshore fishery and they exploit different stocks under different conditions. The U. S. offshore fleet is switching from trawl to trap fishery, which indicate that as stock is exploited near to maximum sustainable yield, trapping is more efficient than trawling (De Wolf, 1974). Offshore lobsters are harvested either by otter trawls that are specifically rigged for catching lobsters or to catch lobsters incidentally while fishing for ground fish (Doliber, 1973). Trawling is done on aggregation of migratory lobsters, in the middle of Gulf of Papua during October and November as reported by Moore & Mac Farlane (1980)—the first trawl catch being in 1973.

### *Hoop net*

Introduction of hoop nets marked the beginning of today's systematic fishery of lobsters in Maine, America's northern most Atlantic state. Hoop net consists of a circular piece of fish net, supported by an iron hoop up to 1.8 m in diameter in such a way that the net sags in centre. The bait is tied to the centre of the net which is then lowered to the sea bottom by means of a rope line and bridle attached to the hoop. The hoop is hauled at a fast steady pace so that the craw fish attached to the bait will be held in the sagging centre of the net. This method of fishing is not widely used in western Atlantic, but is occasionally carried out from anchored boats off Florida Keys. South African industry however relies entirely upon this method. The nets are set out in rows upto 25 fathom deep and are buoyed in a manner similar to traps (Smith, 1958).

During experiments conducted in England using 'Scoop' (hoop traps) and creels (wooden traps) it was found that 'scoops' were

more efficient than creels when the population of lobsters was dense and that the efficiency increased with increasing concentration of lobsters (Thomas, 1953).

#### *Bulley net*

Bulley net is a small hoop net of about 45 cm in diameter and depth with 3 cm mesh. The hoop is fastened at right angles to a long pole. A pole carrying a stiff wire probe is used to force the lobsters from the hiding and then caught by the hoop net (Smith, 1958). In India too bulley nets called 'Gadas' and wall seine nets are used in Bombay coast for catching spiny lobsters (Jones, 1967).

#### *Trammel net*

Trammel nets made of nylon have caught considerable number of lobsters in Haiti. They were set at the bottom primarily for experimental scale fishing (Smith, 1958). A similar experience with tangled nets is reported from west Africa (Smith, 1958). Trammel nets are used in Bombay coast also for catching lobsters (Jones, 1967). In Mediterranean, spiny lobsters are mainly caught in trammels and bottom set gill nets (O'Farrel, 1966).

#### *Grains, spears and grabs*

Grains, spears and grabs are seldom used in commercial fishing but are fairly common in Caribbean waters. Lobsters pierced with spears or two pronged grains are necessarily damaged. Grabs are long paired poles hinged near the bottom so as to act as tongs but they are not used very frequently (Smith, 1958). The use of gaff hooks by divers for spearing the spiny lobsters has become prevalent in some parts of India. In the grounds where the lobster stock is highly scattered and sparse, fishermen wearing diving masks resort to naked diving and with the help of gaff hooks, some times attached to long poles pierce the lobsters even while they are in the burrows. While referring to the lobster industry in Clark's Harbour, Nickerson (1937) deals with some of the early catching methods of lobsters in America. "One way of catching lobsters in very shallow water was to throw bait over and as it lay on the bottom they would come up for it and be hooked up with long gaffs".

Ice can and gasoline drum traps are made of discarded metal ice moulds and consists of light steel rectangular tank about 120 cm deep and 23/75 cm in section. The trap is prepared by crushing in the rim of the opening in such a way as to have two openings of sufficient size to admit the spiny lobsters. Small holes are punched on the sides in order to allow ready egress of water. The can trap does not need a bait, since the lobsters enter it in much the same way as they enter the rocky crevices in search of shelter (Smith, 1958).

#### *Raft fishing*

Crude rafts are prepared of drift wood and sunk to the bottom where spiny lobsters accumulate. Then the raft is surrounded by old pieces of netting and the lobsters are caught by hand or with bully nets, or become entangled in the net when they rush to escape. Since this method takes advantage of the lobsters' habit of retiring to shelters during day, bait is unnecessary (Smith, 1958).

George (1967 a) has reported on the use of cast nets by some fishermen from canoes in north Malabar coast for catching spiny lobsters.

#### *Baits*

The role of bait in a method of fishing where the principle involved is that of luring the organism, is of utmost importance. It looks as though, exclusive study on baits used in lobster fishing in India has not been made in detail. Miyamoto & Shariff (1961) have referred to only one type of bait used by the Indian lobster fishermen, namely the sea-mussel (*Perna* sp.). About 100 to 200 mussels are put as bait in the traps in live condition. Occasionally sea-urchins are also used as bait. This is also available in the rocky bottoms and is picked up by divers. After the spines are scrapped off, the shell and the internal organs are beaten to pulp and then spread inside the trap. There are about 30 variety of baits available to the fishermen in Australia such as sheep-head, fish heads whole fish and the like. Sometimes fish heads are imported from overseas and Eastern States. Bait is the biggest single item of expenditure to the fishermen in Western Australia (Hughes, 1971). A canned product with fish offal as base has

been developed in Australia, the use of which appears to be satisfactory (Gates, 1961).

In United States bait consists of low priced fish or salted fish, trimmings from nearby canneries, spoiled fish or fish frames from which the fillets have been removed. Here again the cost of the bait is an important operating expenditure as an average of 700 g is required each time. Oily fish, either fresh or salted or partially decomposed seems to possess the greatest attraction for lobsters. When the bait materials are soft or decomposed, they are chopped up and placed in bait bags treated with coal tar (Firth, 1944). It is reported that during exploratory fishing conducted for spiny lobsters, sand lobsters and scallops in Panama, experiments were also made to determine whether or not lobsters showed any significant preference to the variety of locally caught baits. According to Pease (1965) all species were of equal efficiency as long as they were fresh, but putrid bait appeared to be less attractive. Davis (1958) records that lobsters are dirty feeders and are usually caught with any fish remains and are particularly fond of stale wrasse.

According to Forsyth (1946) 'stale bait for lobsters and fresh bait for crabs' is the advice of fishermen. Fish heads of wrasse, pollack, flounder, eels and other fish of low market value also may be obtained. If the fish used are salted lightly and kept in barrels for a few months a strong smell of fish oil is emitted and this forms a most attractive lure for lobster. Offal usually thrown away by local fish mongers may also be utilised. Skinned and salted sea birds are used in some places. The bait or bait bag is placed on the top of a stone. Some fishermen place the bait in a small box of 18x13x10cm, the sides of which are profusely perforated. In Sri Lanka, baits used are the cheapest available, mainly fish heads of *Lutianus rivulatus*, *Lethrinus rostratum*, *Epinepheles tauvina* and *Drepane punctata* (De Bruin, 1960). During some experiments in Maldivian Island baits like chunks of *Caranx stellatus* and mantles and muscles of *Tridacna* were tried without much success (Jonklass 1967). The fishermen of New Amsterdam Islands have found that the flesh of the 'Blue fish' (*Chirodactylus macropterus*) attracts more lobsters to the traps than any other bait (Silas, 1967).

### Fishing crafts

The type of craft used in operating lobster traps from south west coast of India is the 4 logged boat catamaran. It is about 6.3 m in length and 0.6 m in width and is usually constructed of very light buoyant wood (*Albizia* sp). The propulsion is by sails usually and at times by oars. Bottom set nets used for lobster fishing are operated from catamaran as well as from small dug out canoes called 'Vallams.' However trawl nets in which lobsters some times form the incidental catch are operated from mechanised trawlers.

Boats used in Australia are fully mechanised and vary in size and design, according to the area in which they operate. Their length can be from less than 7.6 to 24.4 m and some of these boats are even fitted with echosounders. Some have a dual role in catching such as shark/lobster and lobster/prawns, depending on the prevailing season. In west Australia high powered boat with planing hulls are popular and are capable of developing more than 20 knots speed. These scooter boats with planing hulls are designed to operate among reefs. Dual purpose boats are mostly larger vessels with displacement type of hulls. They operate in south Australia, Victoria and Tasmania (Hughes, 1971).

Steel prawn trawlers of 30 m size have operated with increasing efficiency during the period of lobster migration across the Gulf of Papua in Australia. Daru lobster fishermen on the western side of Gulf of Papua still commonly dive from traditional sailing dug out canoes (Moore & Mac Farlane, 1980). In England creels are worked from small boats upto about 15 m length with a wheel house well forward to allow plenty of space aft for handling the creels. Small boats 6 to 12 m in length are usually used to work 8 to 10 creels. A motorised catamaran with a speed of 20 knots or more has been built on English south coast for lobster fishing from island of Islay, western Scotland. This 11.1 m catamaran can carry 300 pots aboard (Anon 1977). A London firm which specialises in small GRP trihedral hulled boats has released a popular fast creeling/potting boat. This is proving to be particularly suitable for catching 'scampi' which inhabits the



muddy bottoms (Anon 1980). Gasoline powered boats 4.2 to 7.5 m long are also used in this fishery. Sometimes they are tended in dories and if required they are towed by power boats (Firth, 1944).

In Sri Lanka out rigger canoe is the craft commonly used by lobster fishermen (De Bruin, 1960). In some European and American countries specially designed vessels are built, capable of spending upto 6 months away, storing the catch all the while. Even vessels of 250 tonnage is considered small in this context. While fishing for lobsters off Spanish Sahara, mother ships are used which anchors at a safe distance and men go out to set their net using two 7.5 m sea going launches (Anon 1967). Spiny lobster fleet that fish out of Cape Town, South Africa is composed of 15 m to 18.5 m long wooden vessels that resemble New England dragger in profile. Each vessel carries 4 to 6 wooden dinghies and a crew of 16 men (Anon, 1963a).

In United States fast sampan-keeled boat of 8 m OAL with a beam of 2.7 and a draught of 0.68 m built of 1.5 cm ply wood panels are used. Propulsion is by 150 hp petrol engine (Burgess, 1966).

Thus it is clear that spiny lobsters are caught in most of the countries by diversified methods consequent to its ever increasing demand in the world markets. Location of new grounds, and adoption of newer techniques for their commercial exploitation are likely to boost the present trend of the lobster fisheries. Canada, Australia and Chile rank first in lobster catch. Others are United States, Cuba, France and South Africa. Australia is the world's largest exporter of spiny lobsters. The annual catch is between 11 to 12.5 million kg worth more than 30 million dollars per year. Today rock lobster fishing is Australia's most important fishing operation (Hughes, 1971).

In India rock lobster fishing and its trade are no more a subsistence business. After the realisation of its potential as a very lucrative export commodity, there has been a sudden spurt of activity on all fronts like fishing, processing and export, since the last 20 years. Balasubramanian (1967) has assessed the status of the spiny lobster fishery

in India and has indicated scope of further development. Despite rapid gains, lobster tails contribute only 0.82% of total quantity and 2.04% of total value of marine products exported from India in 1979 and the figures pertaining to the last five years are shown in Table 1 (Anon 1980a).

Table 1. Landings and export of lobster tails from 1975 to 1979

Year	Landings Tonnes	Export Tonnes	Value Rs.
1975	2991	402	15,76,000
1976	2532	513	3,18,02,000
1977	1217	596	3,88,04,000
1978	1307	691	4,56,68,000
1979	1136	752	5,34,65,000

With further exploration, development, conservation and judicious fishing, the export trade for spiny lobsters has a bright future. The Central Institute of Fisheries Technology, Cochin has comprehensive research plans for the development of improved lobster fishing gear and methods for exploiting lobsters of India in the coming years.

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