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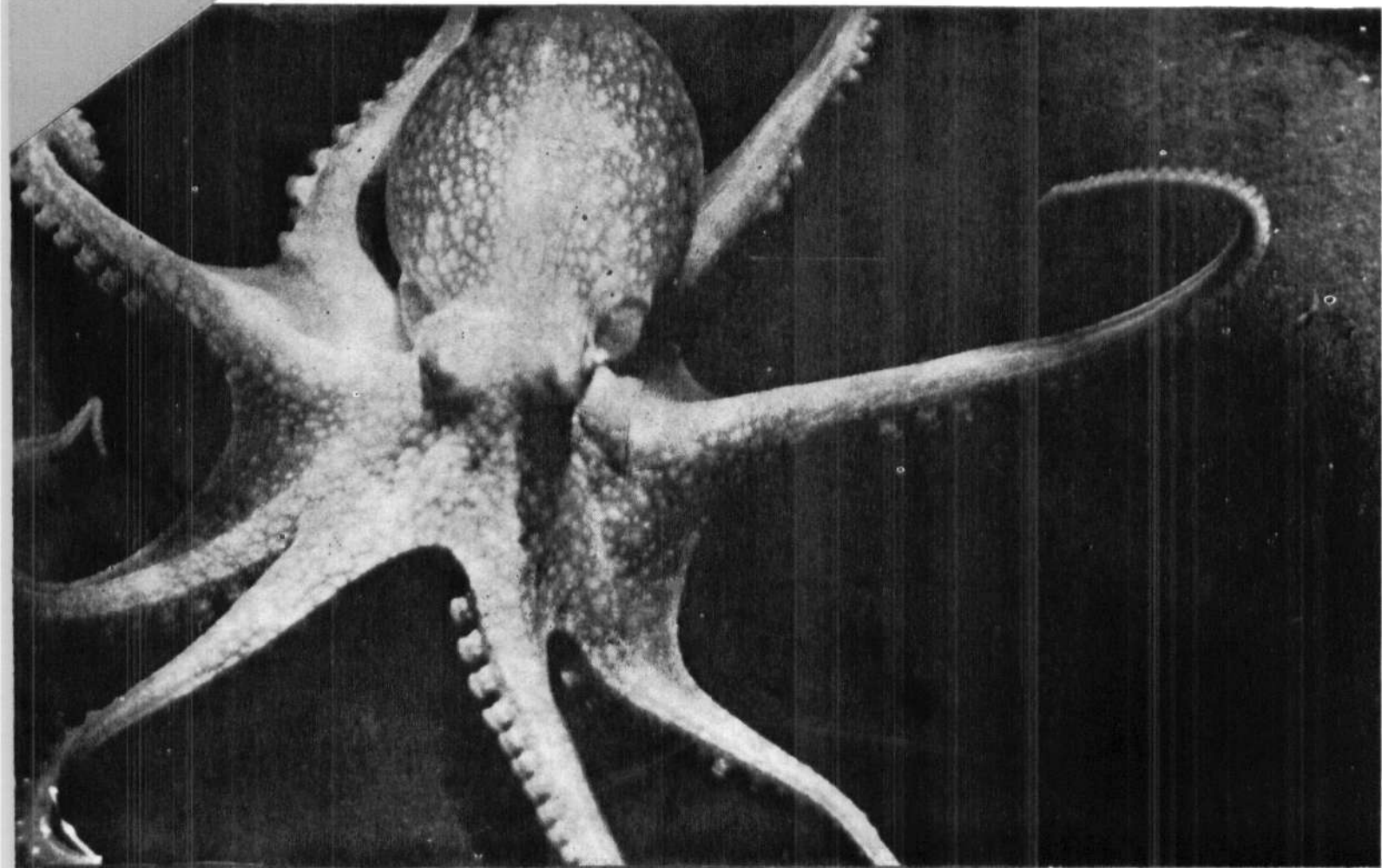
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CEPHALOPOD BIONOMICS, FISHERIES AND RESOURCES OF THE EXCLUSIVE ECONOMIC ZONE OF INDIA

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UTILISATION AND EXPORT OF CEPHALOPODS

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ABSTRACT

A major portion of the cephalopod catch in India is used as food in the coastal areas and a small portion as bait in the long-line fishing. Other uses such as poultry feed, manure, abrasives etc. are also indicated. About one-third of the catch is exported as frozen cuttlefish, frozen cuttlefish fillets, frozen squids and cuttlebone. The trends in the export of cephalopod products in recent years are indicated.

INTRODUCTION

Cephalopods have many uses, and by far the most important among them is the use as human food. Apart from having been mentioned in folklore, and some of them, especially octopus, depicted as among the monsters of the sea, the cephalopods were used by man as food from time immemorial. There are references to the Greeks, Egyptians and many other people such as those of Polynesia as eating octopus since very ancient times. Today the world catch of cephalopods has gone up to 1,304,154 t in 1981 (FAO Yearbook of Fishery Statistics, 1983) and almost the entire catch is being used for culinary purposes.

UTILISATION

The meat of cephalopods is clean with good flavour, nourishing and delicious. The nutritive value is high and comparable to some of the good-quality fishes. The squid meat is a good source of protein which forms about 20% wet weight. The biochemical constituents of the Japanese squid are crude protein 17.3%; fat 1.8% and carbohydrates 7.1% wet weight; the caloric value is 117 cal/100 g (Tanikawa and Suno, 1952; Dracowich and Kelly, 1963). The Tasmanian squid is high in protein and phosphorus, and contain traces of calcium, thiamine and riboflavin (Australian Fisheries, May 1979). According to Howard (1981) the composition of *Loligo vulgaris* is protein 15-19%, and fat 1.1-1.5%. The edible portion of cephalopods consisting of the mantle, arms, tentacles and fins forms 60-80% of the body weight, and this is much higher

than in finfish or other shellfish. The high protein and low fat content of the meat of cephalopods make them suitable for human consumption (Roper *et al.*, 1984).

Most of the cephalopods are consumed fresh and in the cooked form. The Japanese eat cuttlefish meat and sometimes squid meat raw ('sashimi') with sauce. The overseas exports from cephalopod producing countries are mostly in frozen form, and a small portion as dried or canned products.

The Japanese have mastered a large variety of culinary preparations out of squids, cuttlefishes and octopods. They range from raw dishes to various fried, roasted and boiled preparations. Some of them include squid pickled in yeast, rice or wheat, pickled with red pepper and soy sauce, roasted squid, boiled squid, salt-fermented squid with ground pepper, uncooked squid with herring or seaurchin roe, diced and boiled squid with kelp, smoked squid, lemon-flavoured and soy sauce-flavoured squid, and various other products (Court, 1980). Dried squid ('surume-ika') is a highly esteemed item used on ceremonial occasions like weddings and festivals. In 1977 about 400,000 t of squid were converted into a variety of dried and seasoned products (Sheehy and Vik, 1980). Sun-drying is still practised but most of the drying is now automated which is faster and more economical. Among 'surume-ika', there are many varieties: 'Surume' (sun-dried or unseasoned dried squid), 'daruma' (slightly seasoned, semi-dried squid with skinless mantle and fins), 'noshi-ika' (dried mantle with fins that have been flattened,

stretched and softened by rollers) and 'saki-ika' (seasoned and shredded mantle).

In India cephalopods were considered as poor man's food for a long time and even today the stigma continues. In spite of the increased production and great demand as a commodity for export, their inclusion in our diet is still a far cry. This may be due to the conventional food habits and preference for fish and prawns to any other marine products.

Consumption of cephalopods has been restricted to some localised coastal areas mainly by fishermen and other poor sections of people. Rao (1954) recorded that in Mandapam and nearby areas on the southeast coast of India where there was a good fishery for the Palk Bay squid, the squids were sold mainly in fresh condition in the local markets, and at times of good catches a portion was cured with salt and dried in the sun. According to Sarvesan (1974) the large quantities of squids (*Loligo duvaucelii*) caught in trawl net at Mandapam were taken in baskets with crushed ice to Ramanathapuram and Kilakarai markets where they are sold in small lots; when the catch is very good a portion is cured.

The local consumption of cephalopods has increased in recent times, with the result that only about one-third of India's cephalopod landings is being exported, the rest consumed internally. The large and medium sized squids and cuttlefishes are exported; the small-sized ones, the octopods and those landed during the off seasons are used as food. These are sold at the landing centres or taken to local markets near the coastal areas.

At Vizhinjam, on the southwest of India, the squid and cuttlefish catches are auctioned to agents of exporters or to private individuals who make the preliminary processing and sell the products to the exporters. Only the large and the medium-sized squids and cuttlefishes are taken for processing. After removing the skin, viscera, head and the cuttlebone or pen (of squid), the mantles are washed, kept in ice water and then taken to the processing shed for further processing and transporting in refrigerated vans to the freezing plant. In recent years, the price of cuttlefish meat ranged from Rs. 12 to 18 per kg at the landing centre and that of squids Rs. 8-10 per kg. At times of great demand, cuttlefishes at Vizhinjam are sold at higher prices and large-sized ones of 300-340 mm size fetch Rs. 25 to 35 each. The head and arms are sold to local people, the price ranging from 50 paise to 1 Rupee depending on the size. The nidamental glands of the female cuttlefish are also sold at 25-50 paise per each pair.

The small sized squids and cuttlefishes are taken to local markets and sold by number or by small lots. At times of good landings, a portion of the squid catch is sun-dried as also the head and arms of cuttlefish, after removing the mantle for export. The cuttlebone is sold for export at the rate of Rs. 6-10 per 100.

At Madras the cuttlefish meat (mantle) fetches a price of Rs. 10-14 and squids (whole) Rs. 6-7. At Cochin the price of whole cuttlefishes is Rs. 7-10 and squids Rs. 5-7. At Mandapam and Rameswaram areas the squid *Sepioteuthis lessoniana* is sold at a higher price than the cuttlefish; the whole squid costs Rs. 10-12 per kg. The cuttlefishes *Sepia aculeata*, and the squid *Loligo duvaucelii* are sold at Rs. 5-7 per kg.

Use as bait

Cephalopods are a favourite bait for long-line fishermen engaged in catching tunas, billfishes and other pelagic fishes. In the hooks and line fishery at various places along the Indian coast, cephalopods have been used as an effective bait (Jones, 1968; Sarvesan, 1974; Rajagopal *et al.*, 1977; Silas and Pillai, 1982). According to Silas and Pillai (1982) squids are the most important bait in the tuna long-line fishery for the southern bluefin, albacore, bigeye and yellowfin.

Other uses

Apart from being a good source of human food and an effective bait in long-line fisheries, cephalopods have many other uses. Byproducts such as oil and liver extracts are made from squids in Japan. Squid liver extracts are used for human consumption and in the dehydrated form they are used as food for livestock (Takahashi, 1965). The viscera of squids is a good poultry feed (Kawata *et al.*, 1955). Ambergris, obtained from sperm whales and used as a fixative in perfumery, is formed around beaks of squids consumed as food (Lane, 1962). Squids are also used as manure, and the waste from squids and other cephalopods are converted into fish meal.

The cuttlebones are commercially used in preparing fine abrasives and dentifrices (Dees, 1961). The powdered cuttlebone is a good source of food for poultry and cage birds. It is also provided to cage birds as a grinding stone for their beaks. Pulverised cuttlebones are used for cleaning the surface of woodwork and motor vehicles before they are painted (Sarvesan, 1974). Powdered cuttlebone is a good cleansing agent for glass and other smooth surfaces. Medicinal value is attributed to cuttlebone and *Sepia* ink (Boycott, 1957). The ink of cuttlefish has been used by artists

CEPHALOPODS: EXPORTS

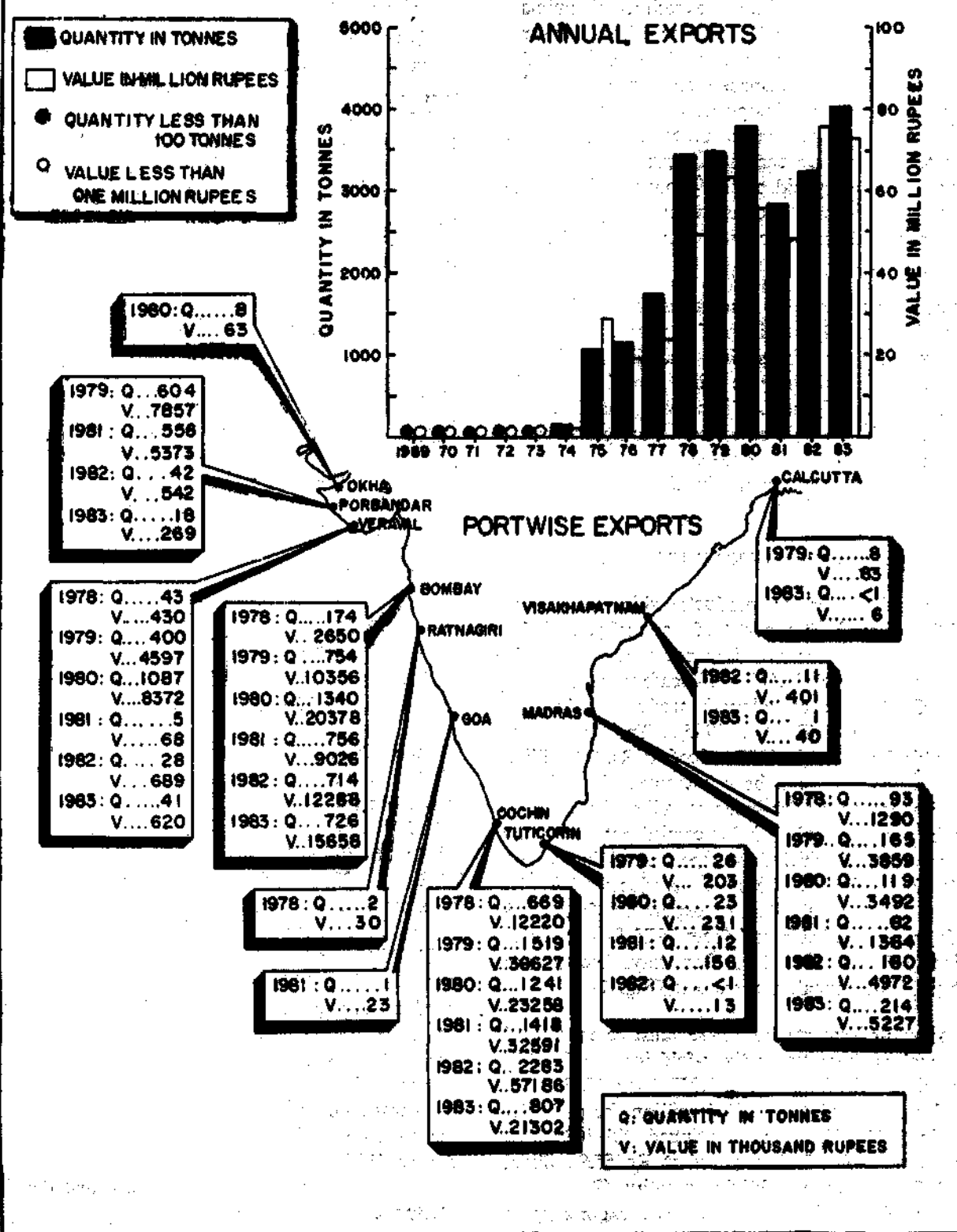


FIG. 1. Quantity and value of annual (1969-'83) and portwise (1978-83) exports of cephalopod products (portwise export figures for 1983 include only frozen cuttlefish and cuttlefish fillets).

as a natural *Septa* pigment. The Romans have been using finely ground cuttlebone as a cosmetic. In the Japanese cuttlebone craft, a variety of fancy articles are made from cuttlebone. The shell of *Nautlius* is a shell collector's delight.

Live cephalopods are good experimental animals in the field of research and education. The discovery of the giant nerve fibres or axons of the squid by Dr. J. Z. Young in 1936 has opened up great avenues for research in electrophysiology and cellular neurophysiology which have great practical applications. The researches that are currently being carried out on the giant nerves of squid at the Woods Hole Marine Biological Laboratory and elsewhere may help in developing new drugs which will work on the human nervous system.

Jacques Cousteau in his fascinating book 'Octopus and Squid, the Soft Intelligence' points out how an octopus was used to salvage the coal that was lost in the sea by a ship during the First World War. To quote Cousteau, 'Chinese, Vietnamese and Japanese salvage workers have used octopuses to bring up objects from sunken ships. The octopus in other words, took over the role of a human diver.'

CEPHALOPOD EXPORTS FROM INDIA

Among India's marine products which earn over Rs. 3,500 million from export trade annually, cephalopods have emerged as an important component in recent years. Out of 86,169 t of seafood exported in 1983, 4,050 t were cephalopod products valued at Rs. 72.7 million (MPEDA, 1985). The growth of export trade from 46 t in 1973 valued at Rs. 0.4 million to the present level has been phenomenal, and this gives an impetus to the fishermen as well as the industry. Today the overseas trade is being carried out with many countries some of which have been providing steady markets for Indian cephalopod products. Initially, cuttlebone was the only item of export but from 1973 onwards frozen cuttlefish and from 1975 frozen squids were included and since then they have become the mainstay of the cephalopod exports (Fig. 1).

The growth of exports from 1973 must be considered phenomenal as there was a three-fold increase in 1974 and an eight fold increase to 1,072 t by 1975. The value also increased to Rs. 29.4 million from Rs. 1.9 million in 1974. The spurt continued till 1980 with the quantity reaching 3,818 t valued at Rs. 55.8 million, but in 1981 there was a fall in quantity (2,830 t) as well as value (Rs. 48.6 million). The exports again

picked up when the quantity reached 3,260 t in 1982 and the all-time high of 4,050 t in 1983. However, this trend was not reflected in the value which came down from Rs. 76.1 million to Rs. 72.7 million.

Products of Export

Though the cephalopod fishery in India consists of cuttlefish, squids and octopods to a very small extent, only the first two are being exported at present. The cuttlefish products include frozen cuttlefish, frozen cuttlefish fillets and cuttlebone, and in 1983 these together formed 45% of the total cephalopod exports. Squids are exported in frozen form, and the quantity exported in 1983 was 55% of the total exports. The trends of the export of all the four items, and also their major foreign markets are shown in Fig. 2.

1. Frozen Cuttlefish

The beginning of the export of cuttlefish products other than cuttlebone was made in 1973 with the shipment of 13.8 t of frozen cuttle fish worth Rs. 0.2 million to Japan. Since then there was a marked increase in exports and in 1980 a record quantity of 926 t worth Rs. 18 million was exported and this record export (quantitywise) has not been surpassed in the subsequent years. In 1981 the quantity came down to 243 t valued at Rs. 4.6 million. In the following years, however, the quantity picked up to 639 t and the value to Rs. 15.2 million in 1982, and 886 t and Rs. 21.6 million in 1983; in the latter year this item formed 21.9% of the total export of cephalopod products accounting for 29.8% of the value.

Japan is the top buyer of Indian frozen cuttlefish all through the years. In 1983 the export to Japan was 609 t which amounted to 69% of the total export of this product and earned foreign exchange equivalent of Rs. 16 million (74.6%). After a good performance (202 t to 339 t) during 1975-77, the exports dropped to a mere 30 t but picked up again in 1977 (300 t) and continued through 1983, except for another drop in 1981 (95 t). France is another regular buyer of frozen cuttlefish since 1975, taking 16% of the export of this product during 1983. A quantity of 143 t valued at Rs. 3 million was exported to France during that year. The export to that country started in 1975 and it increased till 1978 but showed ups and downs during the subsequent years. Other than Japan and France, the countries which imported the product from India during 1983 were Bahrain, Kuwait, Belgium, Spain, Saudi Arabia, the Netherlands, U.S.A. and the Federal Republic of Germany.

TREND OF CEPHALOPOD EXPORTS (1969-83)

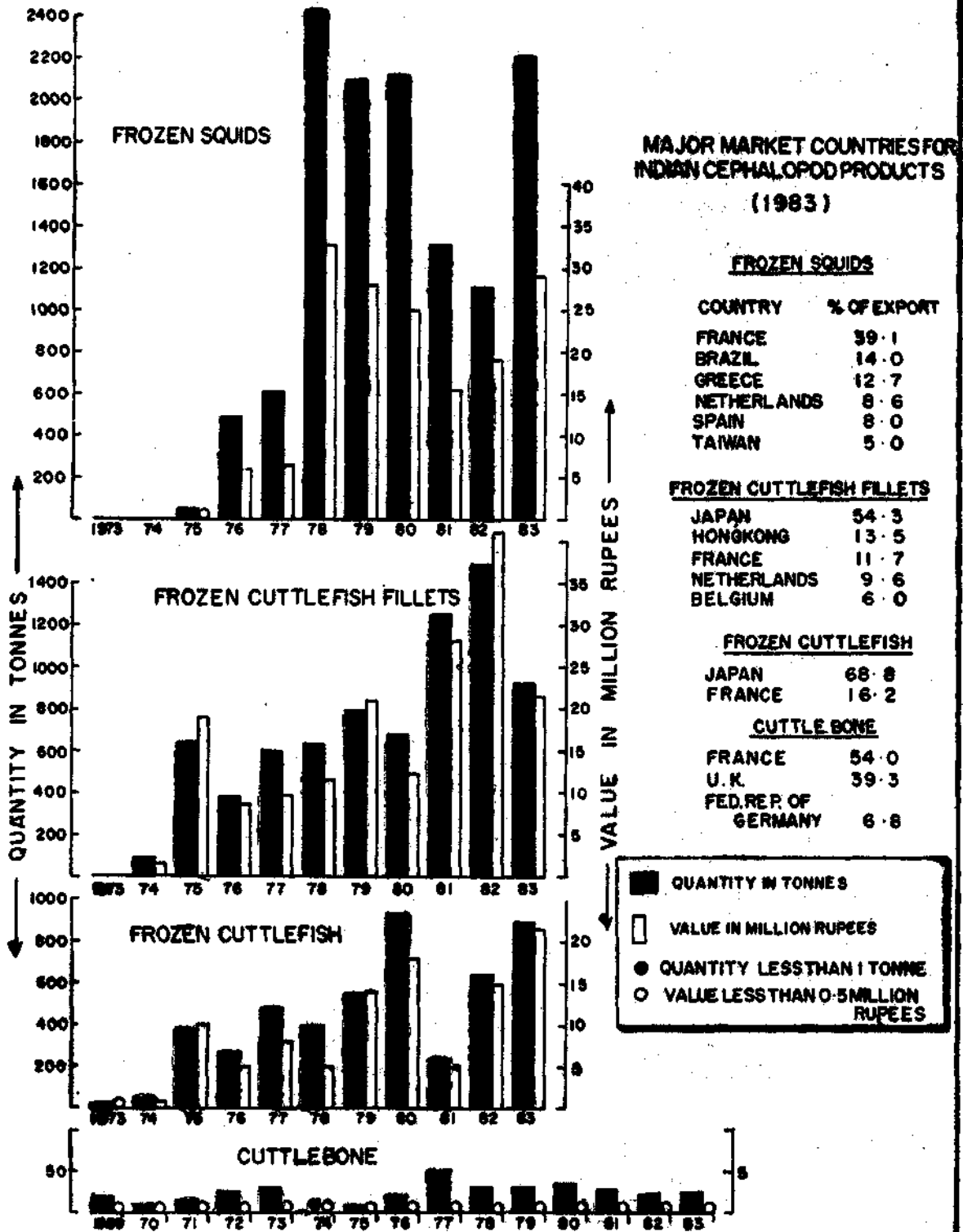


Fig. 2. Trend of itemwise exports of cephalopod products during 1969-'83 and major market countries in 1983.

2. Frozen Cuttlefish Fillets

The export of frozen cuttlefish fillets during 1983 was 921 t valued at Rs. 21.6 million. This was 22.7% of the total cephalopod export and 29.7% of its value. As in the case of frozen cuttlefish, the frozen cuttlefish fillets also was first exported to Japan in 1974 with a quantity of 93 t valued at Rs. 1.5 million. In the next year there was a seven fold increase in the quantity and a thirteen fold increase in the value. After a fall in 1976, the export again improved in 1977 and increased till 1979 but dropped slightly in 1980. The exports were very good in 1981 (1,245 t, Rs. 27.9 million) and 1982 (1,488 t, Rs. 41.3 million). The year 1983 witnessed a big drop by 38% in quantity and 47% in value.

Japan is a regular buyer of Indian frozen cuttlefish fillets since 1974 and has been importing 92 t to 835 t annually. The maximum quantity was exported to Japan in 1982, and the value also was the highest, Rs. 28.8 millions that year. In 1983, export to Japan was 500 t which formed 54.3% of the total export of this product and the value realised was Rs. 13.2 million forming 61.3% of the total value. Apart from Japan, there are 14 other countries which have imported or continue to import cuttlefish fillets from India. Among them Hong Kong and France took 125 t (13.5%) and 108 t (11.7%) respectively in 1983; the Netherlands, Belgium, Singapore, U.A.E. and Nepal together shared 20.5%. The monetary realisation from exports to Hong Kong and France were Rs. 2.4 million (11%) and Rs. 1.9 million (8.8%) respectively.

3. Frozen Squids

Frozen squids is the largest single item of export among all the cephalopod products. In 1983 a quantity of 2,217 t worth Rs. 29.2 millions was exported. The export of this item was started in 1974 with a trial shipment of 454 kg valued at Rs. 6,823 to Australia. The regular exports commenced in 1975 and Australia, Belgium, France, Spain and U.S.A. together took 46 t. There was tremendous increase in exports since then, and in 1978 it has reached the highest peak of 2,429 t valued at Rs. 32.8 millions. But from 1979 to 1982 there was a decline in the exports to 1,108 t. However, the export of this product showed a healthy trend by doubling the quantity in 1983.

Twenty four countries have been buying frozen squids from India during the last ten years. Among these, France offers a steady market all through the years with the import into that country varying from the initial 9 t in 1975 to the maximum, 2,101 t in 1978. In all the years the quantity was over 400 t except in

1977 (279 t). Australia imported Indian squids regularly from 1975 to 1982 but in 1983, she did not import this product. Among the major importers Belgium, the Netherlands and Spain still continue to buy this product. Japan which provides the largest market for Indian frozen cuttlefish and cuttlefish fillets has taken frozen squids only in 1976 (13 t), 1978 (4 t) and 1979 (30 t). In 1983 France took 868 t of the product worth Rs. 12.3 million which formed 14% of the total export by quantity and 42.2% by value respectively. A significant aspect of the export performance in 1983 was the finding of a new market in Brazil. A quantity of 307 t (14%) valued at Rs. 3.5 million (12%) was exported to Brazil, Greece took 12.7%, followed by the Netherlands (8.6%) and Spain (8%). Taiwan, Switzerland, Belgium, U.S.A., the Federal Republic of Germany, Saudi Arabia, Italy, and Kuwait together imported 17.7% of this product.

4. Cuttlebones

Of all the cephalopod products, cuttlebone was the first item to be exported from India. The available data show that 17.3 t of cuttlebone valued at Rs. 50,348 were exported in 1966. From 1967 the exports showed marked fluctuations from less than a tonne to 49 t in 1977; though there was decline in the quantity exported during 1978-83, the value increased from Rs. 0.2 million to Rs. 0.5 million. In 1983, a total quantity of 26 t of cuttlebones worth Rs. 0.3 million were exported. This product was being exported to about 14 countries but in 1983 their number came down to three viz., U.K., France and the Federal Republic of Germany. U.S.A. was a regular buyer from 1975 to 1981, and New Zealand from 1975 to 1980. From 1974 onwards U. K. continues to import cuttlebone from India, and in 1983 the quantity taken was 10 t worth Rs. 0.2 million. Though France has taken more quantity (14 t), the return was comparatively less (Rs. 68,000). The Federal Republic of Germany which is in the market since 1977 has taken only 1.8 t in 1983.

It is of interest to note that all the cuttlefish products (frozen cuttlefish, frozen cuttlefish fillets and cuttlebone) put together, quantitywise form 45% of the total cephalopod exports, the rest (55%) being frozen squids, but in value the cuttlefish products account for 60%. It is also pertinent to mention that Japan and France provide the largest overseas markets for Indian cephalopod products. In 1983, Japan lifted 609 t of frozen cuttlefish and 500 t of frozen cuttlefish fillets, together forming 27% of the overall total exports. The value realised for both the products was Rs. 29 million which formed 40% of the total export value. Rs. 18 million (25%) came from France for 1,133 t (28%)

of all the cuttlefish and squid products. Thus Japan and France together account for 55% of the export by quantity and 65% by value. As it stands today, our success in the export trade in regard to cephalopod products depend on their market demands in these two countries.

Portwise Export of Cephalopods

The Indian cephalopod products are exported from many ports, viz., Calcutta, Visakhapatnam, Madras, Tuticorin, Cochin, Mangalore, Ratnagiri, Bombay, Veraval, Porbunder and Okha (Fig. 1). Of these Cochin, Bombay, Madras, Veraval and also Porbunder and Tuticorin to a great extent, are the ports for the regular exports during almost all the years. At other centres the export is only occasional and on a small scale, from less than 1 t to 11 t annually. The annual export from Cochin port varied from 669 t in 1978 to 2,283 t in 1982 within a range of 33-50% of the country's cephalopod exports. In foreign exchange inflow also Cochin port was topping the list, with Rs. 12 million to Rs. 57 million annually (42-75%). The annual exports from Bombay ranged from 714 t to 1,340 t with the value of the products varying from Rs. 9 million to Rs. 20.4 million. The export from Veraval was 5 t to 1,087 t, from Porbunder 18 t to 604 t, from Madras 81 t to 214 t, and from Tuticorin 0.5 t to 26 t. The high positions of Kerala, Maharashtra, Gujarat and Tamil Nadu in the all India cephalopod production are reflected in the export performance at the ports of Cochin (Kerala), Bombay (Maharashtra), Veraval and Porbunder (Gujarat) and Madras and Tuticorin (Tamil Nadu). The proximity to landing places, better transportation networks and location of the processing plants facilitate quick and more efficient exports from these ports.

Among 159 firms engaged in processing and exporting marine products from India, listed by MPEDA, 139 firms deal with squids and cuttlefishes as one of the major items. Of these, 43 are in Cochin (72 in Kerala), 31 in Madras (35 in Tamil Nadu), 21 in Bombay (23 in Maharashtra) and the rest in other maritime states (9 in Gujarat, 3 in Goa, 9 in Karnataka, 3 in Andhra Pradesh, 1 in Orissa and 4 in West Bengal).

Consumer acceptability of any product depends upon the quality of the product and therefore the quality of cephalopod raw material and finished products is to be ensured before they are processed and exported. In the case of frozen products, the external appearance, colour, texture, flavour, thickness of mantle and degree of freshness are very important. There are detailed guidelines and methods for processing frozen cuttlefish and squids under strict quality control requirements (MPEDA, 1976). In 1976, the MPEDA had arranged a training programme in processing squids and cuttlefishes, and a team of Japanese experts imparted practical training at Calcutta, Paradeep, Madras, Quilon, Cochin, Mangalore and Bombay. Shenoy (1985) has given the method for processing dried squids according to quality requirements in the Japanese market. According to the Market Study Team sponsored by MPEDA, which visited Japan, there is immense scope for exporting Indian dried squid to Japan as the demand there for this commodity is about 12,000 t a year. The price is very attractive, which is about Rs. 65 per kg, and according to the committee's estimation, India can export 2000 t of dried squid a year.

With the increased production of cephalopods, improved handling and processing techniques under strict quality control measures, India has bright prospects in the overseas trade in cephalopod products.

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