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A STUDY ON 'DOL' NET FISHERY AT SELECTED CENTRES IN NORTHWEST COAST WITH SPECIAL REFERENCE TO COSTS AND RETURNS

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Introduction

Along the west coast of India, Maharashtra and Gujarat are two important states in respect of marine fish landing. About one-third of the total catch of the country is produced in nine coastal districts of Gujarat and five coastal districts of Maharashtra. More than 25 per cent of pelagic catch in the country comes from these two states. About 90 per cent of total catch in Maharashtra and 70 per cent in Gujarat are contributed by mechanised sector. 'Dol' netters (bagnetters) contributed 48 per cent of catch of mechanised sector in Maharashtra and 23 per cent in Gujarat during 1983-'84. Among pelagic fishes, dominating species of 'dol' catch along the northwest coast include Bombay duck, ribbon fish, pomfret, seerfish, penaeid prawn, 'jawla' (*Acetes* spp.) and sciaenids.

Keeping in view the importance of 'dol' fishery in northwest coast, the Central Marine Fisheries Research Institute, Cochin has undertaken a study on the 'dol' operation. The main objectives of the study were (i) to estimate returns to capital and net income to owners; (ii) to compare income levels of owners and wage earners on 'dol' units.

Methodology

For selection of 'dol' operating landing centres, ten centres covering Raigadh, Greater Bombay and Thane districts in Maharashtra and eight centres covering Valsad, Amreli and Junagadh districts in south and Saurashtra region of Gujarat were visited during 1984. Preliminary information regarding availability of infrastructure facilities, number and type of crafts and gears and the system of 'dol' operation were collected from fishing villages/landing centres through a schedule.

Three types of base systems attached with 'dol' operations were observed in northwest coast. In

Raigadh District, big wooden pylons (*Khambas* or *Medhas*) fixed in sea bed serve as stands for 'dol' net operation. In Greater Bombay District wooden spikes (*Khunt*) laid in muddy sea floor attached with strong nylon ropes to them serve as bases for 'dol' net operation. Heavy stones (*Kaba*) are laid in the sea floor and the accessory nylon ropes are attached to them to make base for 'dol' net operation in Junagadh District of Gujarat. The method of 'dol' operation in Greater Bombay and Junagadh districts is popularly known as 'Sus'.

Based on peculiar characteristics of the three 'dol' operating systems, two villages in Maharashtra namely Navedar-Navgaon (*Khamba* system) and Mudh (*Khunt-sus* system) and one in Saurashtra namely Navabunder (*Kaba-sus* system) were selected for costs and returns study. At each centre, details of boat, engine and net, availability of credit facilities and other relevant information were collected from 20 randomly selected units. Operating expenditure and catch particulars (including price) from sample units were recorded on five systematically selected sample days each month for a period of one year, starting from September, 1984 through a schedule designed for this study. The enumerators were engaged locally from fishermen community and trained for data collection. The enumeration work was supervised periodically by the officers associated with the project.

Fishing season of 'dol' operation limited to nine months in a year was divided into three quarters based on good (post-monsoon), lean (winter) and moderate (summer/pre-monsoon) catch and the data was analysed quarterwise; mentioned here as quarters I (September-November), II (December-February) and III (March-May). Important constituents of catch categorised for analysis, included Bombay duck, prawns, pomfret, seer fish, ribbon fish, croakers, Indian cod, *Coilia*, other fishes and 'kuta' (trash fish). The value of the catch was taken as the gross income of a unit.

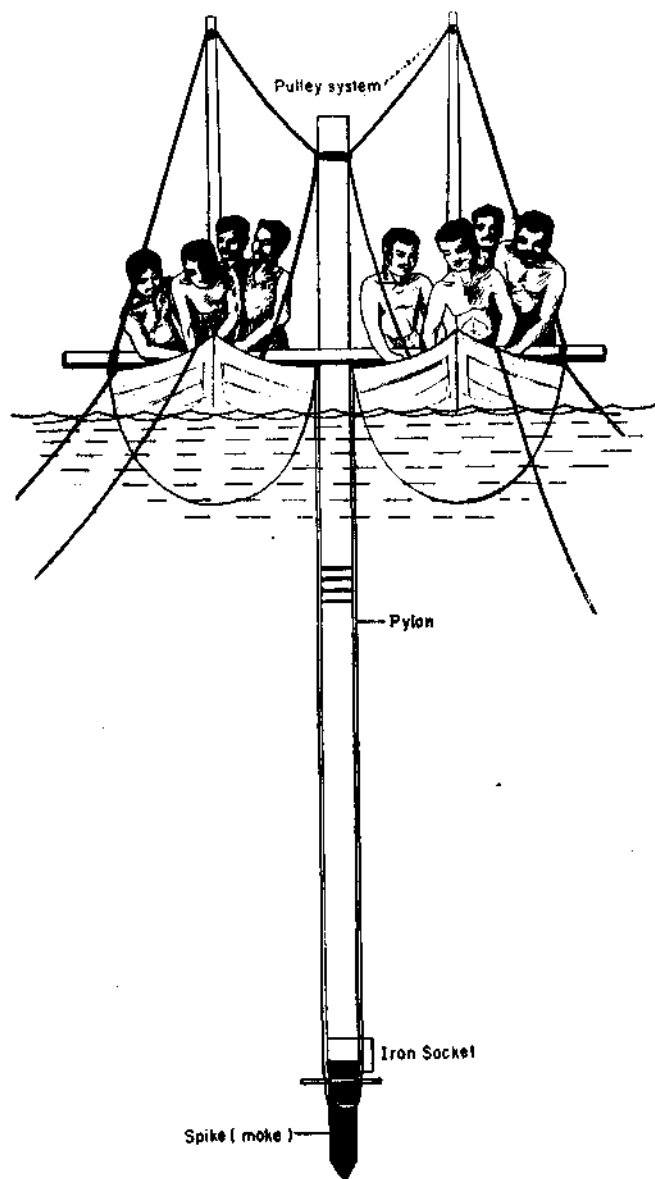


Fig. 1. Fixation of *khamba* at Navedar - Navgaon.

General information about the selected centres

Navedar-Navgaon is about 7 km from Alibag, the district headquarters of Raigadh in Maharashtra. There are about 500 fishermen families belonging to *Koli (Vaiti)* community. About 70 mechanised boats operate 'dol' at this centre. The centre lacks jetty facility. Boat building yard, engine repair workshop, electricity and drinking water facilities are available in the village. The Fishermen Co-operative Society provides fishing implements, diesel/oil, kerosene, household items and canteen facilities to the fishermen. It also provides transport facilities and help the fishermen

in procuring loan and subsidy from state fisheries department.

In Madh, out of 620 fishermen families, about 300 are Christians (Catholics) and the rest Hindus (*Kolis*). About 350 boats (80% mechanised and 20% non-mechanised) operate at this centre. Madh, better known as Madh Island comes under Greater Bombay District of Maharashtra. It has got *pukka* road, electricity and drinking water facilities but lacks jetty facility. Two fishermen co-operative societies are functioning. One of the societies provides fishing implements, diesel/oil and other fishery requisites to its 350 members and the other fish transport facility. The society also acts as a commission agent between fishermen and traders. One ice factory and cold storage are run by the society.

Navabunder, about 10 km from Una Taluk headquarters is one of the important landing centres for Bombay duck in Saurashtra, Gujarat. Besides about 300 fishermen of the village, a good number of fishermen, migrate to this centre every year in September-October from south Gujarat for fishing. Fifteen boats procured recently through National Co-operative Development Corporation in Nandan village also land their catch at this centre. In the village, two fishermen co-operative societies are defunct at present. During post-monsoon quarter more than 500 boats operate at this centre.

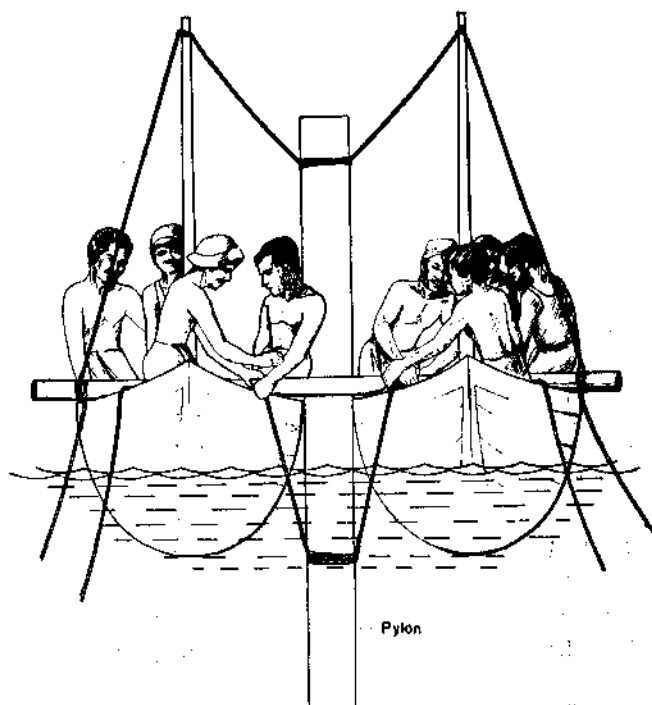


Fig. 2. Fixation of *khamba*.

Amenities like electricity, *pukka* road and jetty are available but drinking water facility is yet to be provided.

Khamba/Medha

Operating 'dol' with *khamba/medha* (wooden pylon) is the peculiarity of about 10 fishing centres from Rewas to Revdanda in Raigadh District (Maharashtra). The *khamba* varies from 15 to 36 m (8 to 20 wam; 1 wam is about 1.8 m) in length and 0.2–0.3 m in diameter in Navedar–Navgaon. It is made up of two kinds of wood namely teak wood (locally called 'sag') and wild wood (locally called 'haid'). A small *khamba* costs Rs. 7–8 thousand whereas big one Rs. 15–18 thousand. In addition, a few cheaper and small sized *khambas* made from locally available wood such as casuarina, coconut and palm trees are laid in inshore waters. A *khamba* has 5–6 joints and needs repairs and replacement of damaged joints especially during monsoon.

After the cessation of monsoon *khambas* are laid during neap tide (*Bhang*) in the water in different depths depending upon the availability of fish. The *khambas* are taken out from sea in the end of May of the following year. These are protected from rain water and preserved from decaying by covering with mud in creek during monsoon. Generally, 4 *khambas* are laid, for operating 3 'dols', in 4–8 fathoms in post-monsoon, 8–10 fathoms in winter and 10–15 fathoms in summer season.

Fixation of *khambas* is done with the help of two boats tied together by means of two logs put horizontally (Fig. 1). The upper end of the *khamba* is connected

with a rope to a pulley-arrangement at mast head of two boats. The wooden-pylon is raised vertically and carefully lowered towards the sea floor by 15–20 persons in the boats. The rise and fall of sea level through waves act as a powerful force to drive the spike (lowermost end of pylon fitted with iron socket) into the sea bed. The rope tied to pylon is loosened when water level comes up and tightened when the level goes down. Thus powerful downward thrust of wave is exerted on pylon driving it deeper and deeper till it is fixed firmly. The pylon is driven about 4.5 to 6.0 m deep into the sea floor and projected 3.0 to 4.5 m above surface of water. A peculiar contrivance, locally called 'khuda' is fixed with each pylon at the bottom which is useful in 'dol' net operation with ease (Fig. 3).

Khunt-sus system

This method is prevalent in Ratnagiri, Greater Bombay, Thane and partly Raigadh districts of Maharashtra. The *sus* system at Madh contains wooden anchor (*Khunt*), garfil rope and float (*buoys*). The *khunt*, 1.8 to 2.1 m length and 0.3–0.6 m in breadth is made up of palm or coconut tree. As shown in Fig. 4, *khunt* is pointed at one end and embeded in the muddy sea floor in the same way as pylon is fixed. *Khunt* laying into sea floor is done mainly in the month of September during neap tide (*Bhang*). The *khunt* is fixed by hammering through *khamba* tied with the two boats and helped by up and down movement of the water. This takes 3–4 hours and involves 12–15 crew members. The *khunt* so fixed into the sea floor remains fixed for about three years. Two garfil ropes depending on the depth of the 'dol' operation are fastened to *khunt*. The base

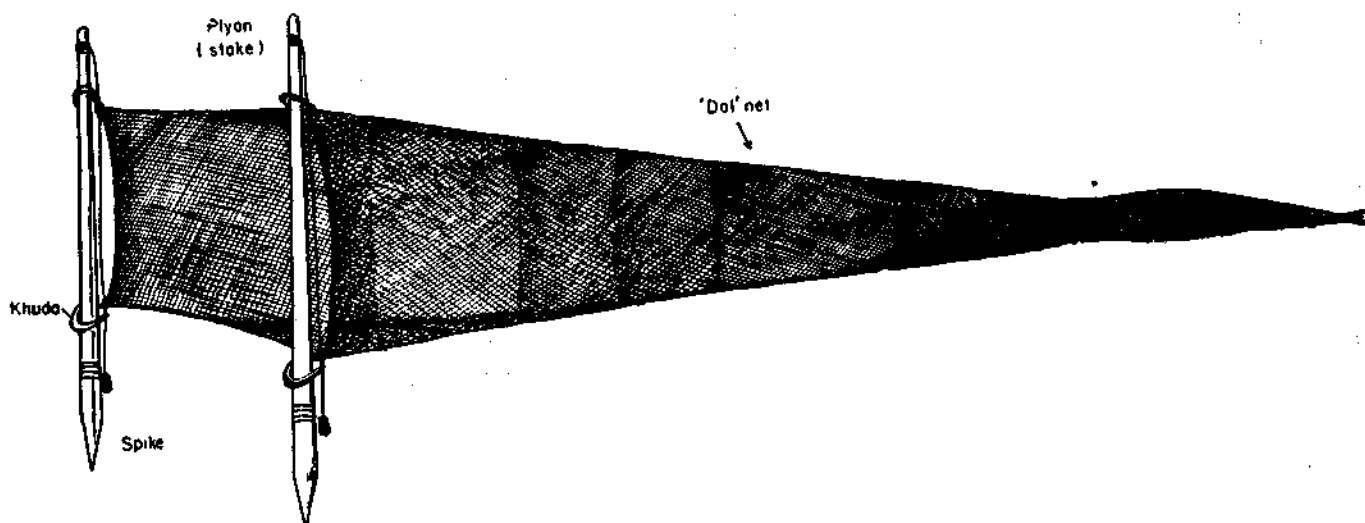


Fig. 3. 'Dol' operation of Navedar-Navgaon.

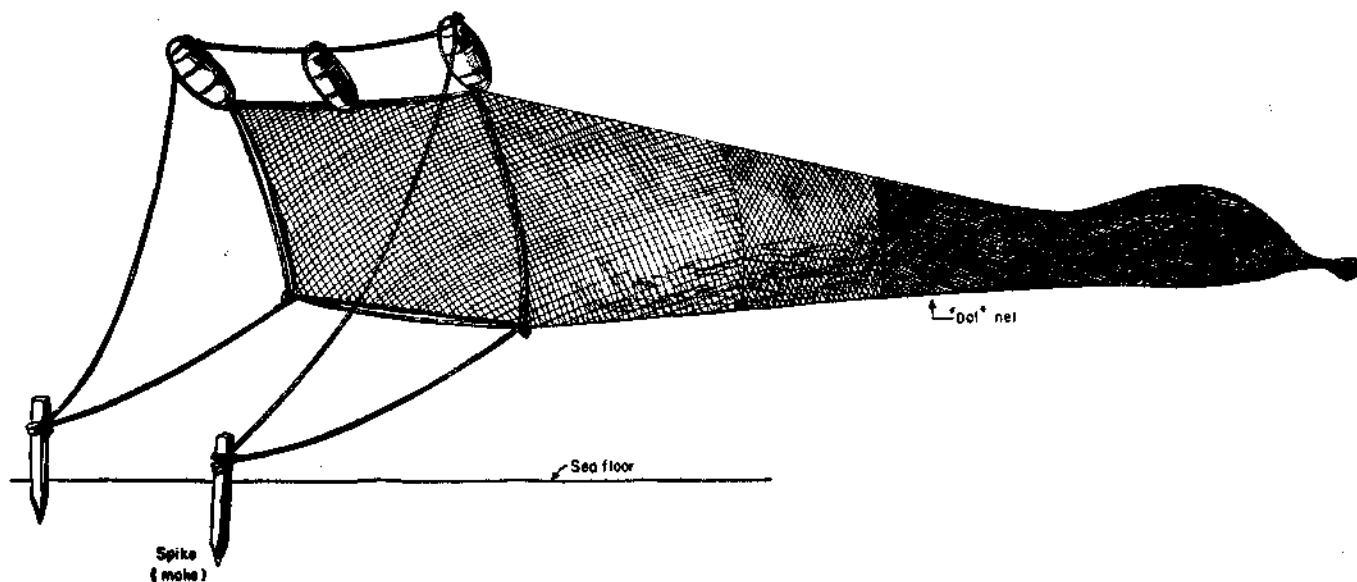


Fig. 4. 'Dol' operation in Sus at Madh.

ropes suspended in the water are supported with the help of floats made up of wood or plastic (known as *pimp* or *buoya*). 'Dol' net is tied with the help of base ropes and operated.

Kaba-sus system

This system of 'dol' fishery is prevalent in Valsad, Amreli and Junagadh districts of Gujarat. This *sus* has a striking difference from the *sus* adopted in Maharashtra, particularly in making use of stones for anchor instead of wooden *khunt*. The *sus* at Navabunder, locally called as *kaba* (Fig. 5) can be divided into three components - stone anchor, anchor ropes and floats (buoys). The stones are excavated from nearby quarries and supplied to fishermen through co-operative societies of stone cutters. One 'dol' needs two heaps of stones, each containing 50-60 stones. After the fishing season is over these heaps cannot be used for next year. In this region the use of wooden anchor (*khunt*) or pylon (*khamba*) is not possible due to very strong water currents. In a *kaba-sus*, there are 7 sets of anchor ropes, locally known as *Jotha*, *Lambudu*, *Hendoro*, *Sher*, *Uthab Sethu* and *Karcha*. Barrel buoys which are tied to the basal rope give support to keep it in upward position.

To put *Kaba*, first the anchor rope is lowered to the bottom from the boat with the help of heavy stone tied at one end of the rope (*sher*) till it touches the sea

floor. The remaining stones tied with thin coir ropes are deposited along the *sher* one after another so as to get stones distributed evenly around the basal end of *sher*. In this way anchor rope is securely fixed and other end of the rope is tied with the barrel buoys touching surface of the water. Generally six *kabas* are required to operate three 'dol' nets. After the closing of 'dol' fishery in May part of the anchor ropes is salvaged but the stones-anchor is a total loss.

Details of 'dol' (bagnet)

'Dol' is conical in shape with wide rectangular opening (mouth) and tapering cod end. The net varies from 45 to 73 m in length with a circumference of mouth ranging from 45 to 70 m. It is made up of 'polyethylene monofilament plastic twine'. 'Dol' resembles trawl net but being stationary it is used to capture column fish. In Maharashtra, six segments of 'dol' starting from opening to cod end, are known as *Mohar* (8.5-10.7 m), *Chirate* (6.7-11.0 m), *Katra* (11.0-15.0 m), *Manjuwala* (9.8-13.7 m), *Munj* (4.8-8.5 m) and *Khola* (4.8-7.6 m). In Saurashtra, eight sections of 'dol' are named as *Bochi* (1.2-1.5 m), *Mathadu* (12.0-13.7 m), *Malkhadu* (2.4-3.6 m), *Oar* (16.7-20.0 m), *Trijo* (9.0-12.0 m), *Bangu* (3.0-4.6 m), *Chothi* (2.4-4.6 m) and *Jalo* (3.0-5.5 m). A nylon 'dol' net costs Rs. 7-9 thousand. The mesh size differs in each section and is reduced from mouth to cod end. The cod end is made up of double layers to give additional strength as the entire catch is

collected in the cod end with the force of current. The net is set to face the incoming current and when the tide starts receding the position of the net is reversed.

Fishing craft

Bagnetters, varied from 9-14 m in length, 2-3.6 m in breadth and 1-1.8 m in height in Navedar-Navgaon. Most of them are fitted with 2-4 cylinder diesel engine. The cost of a mechanised craft varied from Rs. 1.1 lakhs to Rs. 2.0 lakhs. A wide variation of 5 to 14 tonnes was found in carrying capacity of boats. About 50% of the boats are more than 10 years old.

The boats at Madh centre varied from 8.5-12.8 m in length, 1.5-3.6 m in breadth and 0.8-1.2 m in height with the tonnage varying from 2 to 10. The boats are fitted with 2-4 cylinder diesel engine. Most of the boats and engines were purchased during the period from 1970 to 1980 and were with single family ownership.

At Navabunder the bagnetters are 10-12.8 m in length, 2.4-3.6 m in breadth and 1-1.8 m in height with tonnage varying from 4 to 12. The boats were fitted with 3-4 cylinder engines. The cost of engine and boat varied from Rs. 1.3 lakhs to Rs. 2.2 lakhs.

Share system and crew payment

Catch sharing system prevails on majority of units at Navgaon. If eight crew members are engaged in a unit, the catch (after deducting the operating cost) is divided into 13 parts. Of these, five shares go for boat, engine, *khamba* and net and the rest are divided equally among the crew members (*Khapnara*). All repair charges including that of boat, engine, net and *khamba* are borne by the owners. Women labourers charge Re. 1 per basket for transporting and loading/unloading of catch. Some women labourers are paid in kind (about $\frac{1}{4}$ of owner's share) for sorting and drying of catch and making platforms.

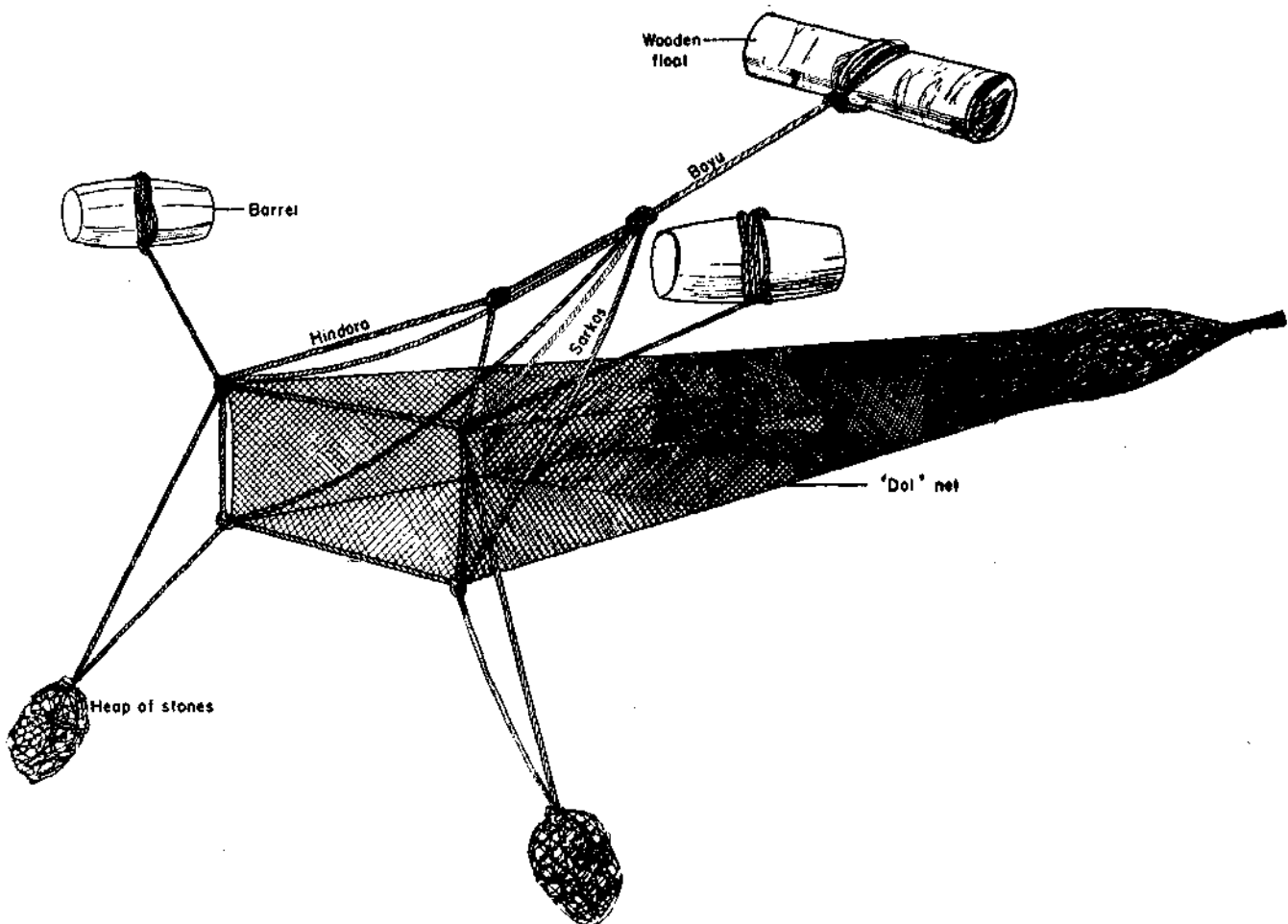


Fig. 5. 'Dol' operation in *sus* at Navabunder.

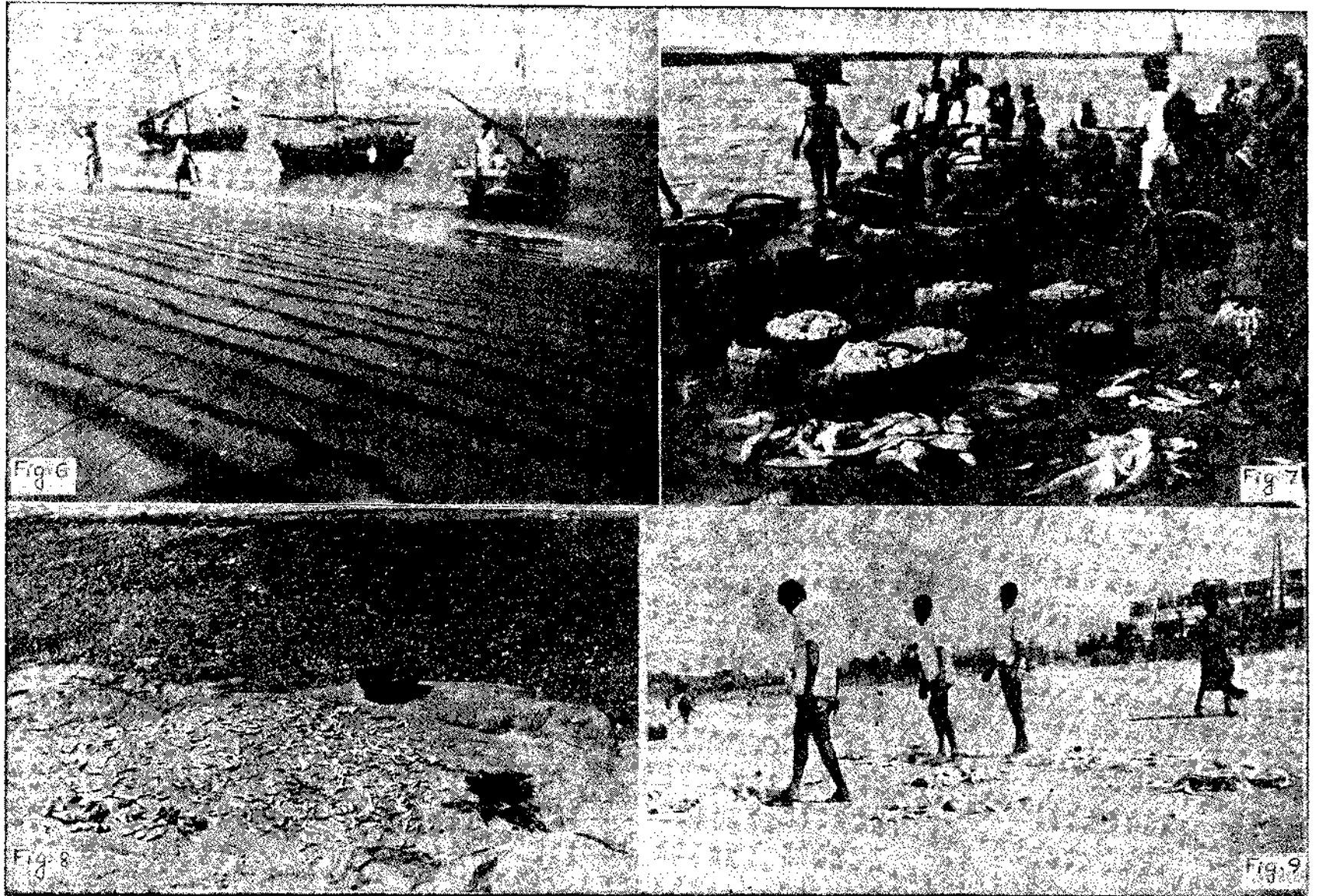


Fig. 6. Mechanised 'dol' netters at Navabunder (Gujarat). Fig. 7. A view of fish landed by 'dol' netters at Madh (Greater Bombay). Fig. 8. Non-penaeid prawns (at back ground) and miscellaneous fishes (in the fore-front) caught in the 'dol' net are being sun-dried on beach in Madh. Fig. 9. Fisherman are collecting their shares as their wages, a typical system prevailing on Maharashtra coast.

In Madh (Maharashtra) and Navabunder (Saurashtra, Gujarat) the crew (known as *Khavnara* at Madh and *Khalasi* at Navabunder) are paid in cash varying from Rs. 5,000 to Rs. 7,000 each for a fishing season of nine months starting from September. Labourers are contracted for one fishing season and paid advances. Besides this they are provided with food, *pan*, *bidi* etc. on the boat. For sorting, drying, loading/unloading and transportation of catch, women labourers are paid both in cash and kind.

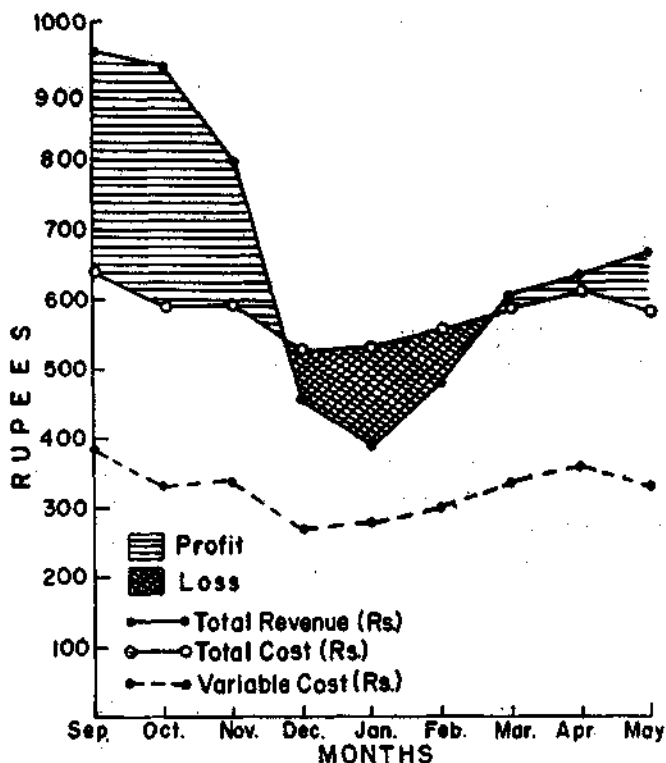


Fig. 10. Monthwise profit/loss (Rs./day) at Navgaon centre during 1984-85.

Preservation and marketing of catch

In Navedar-Navgaon, non-penaeid prawn (*Jawla*), Indian-cod and ribbon fish are dried and sold in *Mandla* (get-together held on 7th lunar day) to fish traders coming from Mahad, Poona, Sholapur and Satara. The non-penaeid prawns are graded as *Diswill* (best quality), *Safed* (medium quality), *Lal* (low quality) and *Kuta* (mixed) and priced accordingly. Ice is used for storing the quality fishes which are sold by lady vendors locally.

Fresh catch at Madh is transported in society's trucks to wholesale fish market at Malad (14 km), by

charging Rs. 3/- per basket and sold to fish traders through Fishermen Co-operative Society. Commission of 6 % from fishermen and 2 % from traders is charged on the value of catch sold. Quality fishes are sold in Shivaji wholesale fish market. Sundried catch including non-penaeid prawn, Bombay-duck and ribbon fish is sold in the village itself to private traders. An amount of Rs. 150-200 is paid as rent of plot used for fish drying.

At Navabunder centre, the catch is sold to fish traders directly. Ribbon fish, Bombay duck, *Collia* and '*dhoma*' are sundried and sold to the traders of Shivri (Bombay) and Navabunder itself. The traders provide advances to fishermen and pay less price for the catch. *Mandla* is arranged for selling dry fish on 11th lunar day and the price is fixed for 15 days to one month period. The ice is used in summer for preservation of quality fishes.

Credit facilities

Fishermen in Navgaon availed loan from banks and Government for procuring boat, engine and net. Unlike in other villages, taking loan from private agencies was not popular in this village. In Mudh, Indian Bank, Central Bank, Bank of India and Dena Bank provided finance to fishermen. Few units have been provided on loan from N. C. D. C. and State Fisheries Department at lower interest rates through Fishermen Co-operative Society. At Navabunder, fishermen have availed loan from commercial banks, District Co-operative Bank and N.C.D.C. Majority of fishermen avail loan from fish traders and hypothecate their catch against loans. Rate of interest on the loan availed from institutional agencies varied from 9 to 13 % per annum. The loan was availed for purchasing craft/gear or operating expenditure.

Discussion

Number of fishing days

'Dol' operating is confined to 9 months in a year, starting from September, and throughout the northwest coast it remains suspended during the monsoon. Number of annual 'dol' operating days ranged from 245 in Navedar-Navgaon to 253 in Madh. The number of fishing days was more in the villages where crew members were contracted by boat owners compared to those where they shared catch and operating expenditure with

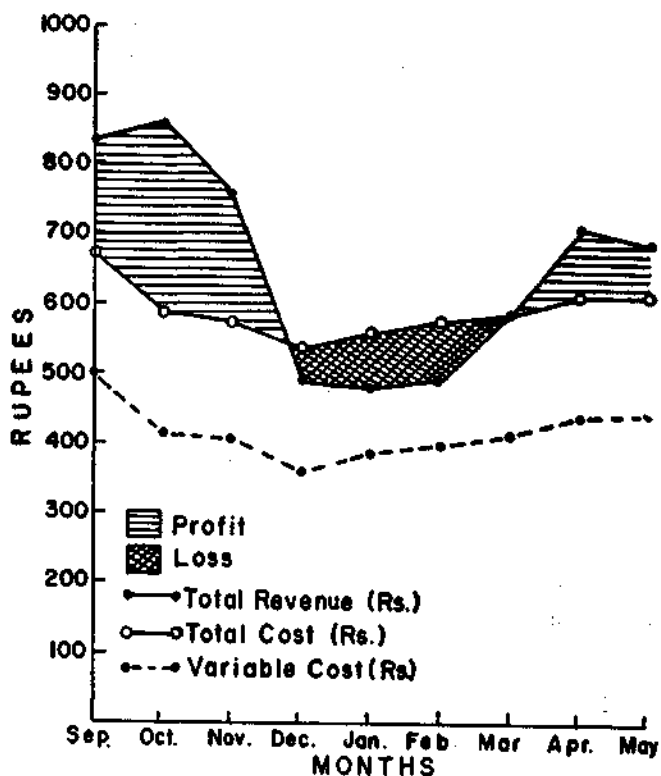


Fig. 11. Monthwise profit/loss (Rs./day) at Madh centre during 1984-85.

the boat owners. No significant difference was observed in the number of fishing days between post-monsoon (80-87 days), winter (83-85 days) and pre-monsoon (81-83 days) quarters. 'Dol' was operated 2-4 times a day (24 hours).

Catch particulars

Bombay duck, prawns, seer fish, pomfret, croakers and ribbon fish were common fishes available at the selected centres. The catch composition varied from centre to centre and season to season. At Navedar-Navgaon percentage of prawns in total catch increased from 19 in post-monsoon to 36 in pre-monsoon quarter (following year). Bombay duck accounted for 24.8% of total catch in I quarter whereas contribution in subsequent quarters was very low (1-2%). The share of ribbon fish in catch was highest in I quarter (31.1%) and lowest in II quarter (13.9%). There was a good catch of Indian cod in II and III quarter forming 24.5 and 13.6% of total catch respectively. Of the total catch, about 5% belonged to other species (eels, cat fish, clupeoids, sharks etc.) throughout the year. Kuta (unsorted small size fish/trash fish) formed about 11-18% of total catch in different quarters at this centre. The catch consisted of 6-9% commercially important fishes

like seer fish, pomfret and croakers. There was a wide variation in per day catch of I (415 kg), II (187 kg) and III (300 kg) quarter. For the whole fishing season, the average per day catch of a unit was calculated at 298.7 kg. Bombay duck, prawns, ribbon fish and Indian cod formed majority of catch (about 75%). Monthwise analysis showed a maximum catch of 452 kg per operating day landed in October and minimum of 162 kg per day in January. Sometimes 'dol' net operation becomes difficult in winter due to strong wind, affecting the catch adversely.

At Madh centre, penaeid and non-penaeid prawns formed about 53% of annual catch. Maximum contribution of Bombay duck was noted in I quarter (11.5%) and minimum in II quarter (1.1%). Second important species at the centre was ribbon fish contributing the highest of 19.7% of catch in III quarter and the lowest of 7.6% in II quarter. Seer fish and pomfret formed 2-3% and croakers 8-10% of total catch. Average catch of a unit was calculated at 344 kg per operating day. The share of I, II and III quarter in total catch was about 48, 22 and 30% respectively. Prawns and ribbon fish together contributed about 68% towards the catch. Monthwise analysis showed maximum per day catch in October (523 kg). The catch declined in subsequent months upto 210 kg but again increased in last quarter upto 342 kg. Average catch of a unit was worked out to 87,013 kg during the study year.

Bombay duck and ribbon fish together formed about 54% of total catch at Navabunder centre. The contribution of Bombay duck was highest in I quarter (47.7%) and lowest in III quarter (9.5%) whereas ribbon fish trend was just reverse, contributing highest in III quarter (51.3%) and lowest in I quarter (11.3%). There was a good catch of croakers and *Coilla*, in winter, contributing 12.7 and 20.8% respectively. The catch on an average amounted to 465.3 kg/day in I quarter, 210.6 kg/day in II quarter and 322.8 kg/day in III quarter. Croakers, *Coilla*, prawns and seer fish/pomfret accounted for 10.2, 8.6, 4.0 and 2.4% of annual catch respectively. Total catch of a unit was noted as 82,854 kg during 1984-'85.

Coefficient of variation in per day catch at Navgaon, Madh and Navabunder was 22, 18 and 24% respectively within the units and 35, 35 and 37% respectively within the months. Higher variations within the months reflected seasonal fluctuation in catch availability at all the centres.

Cost of production

a) *Fixed cost:* At Navedar-Navgaon, the capital investment (Rs. 2,36,000) included the cost of boat and engine (Rs. 1,40,000), nets (Rs. 21,000) and *khamba* (Rs. 75,000). The annual depreciation of craft (10%), gear (33.3%) and *khamba* (20%) was worked out to Rs. 14,000, Rs. 7,000 and Rs. 15,000 respectively (Table 1). Taking 11.25% rate of interest on capital, the amount of interest was calculated at Rs. 26,550 per annum. The total annual fixed cost was worked out to Rs. 62,550 per unit. At Madh and Navabunder, the total annual fixed cost was Rs. 40,450 and Rs. 46,038 respectively.

b) *Variable cost or operating expenditure:* As given in Table 1, the annual variable cost of a 'dol' unit in *khamba* system at Navgaon was worked out to Rs. 79,275 which formed about 56% of total cost (Rs. 1,41,825). About 46% of the operating expenditure was incurred on labour - crew and those employed for loading/unloading, sorting and drying of the catch. Fuel, the second major cost item accounted for 35.5% of the expenditure. An average amount of Rs. 3,700 was spent on boat, engine and net repairs. Transportation, preservation and marketing charges accounted for 5.5% of the variable cost.

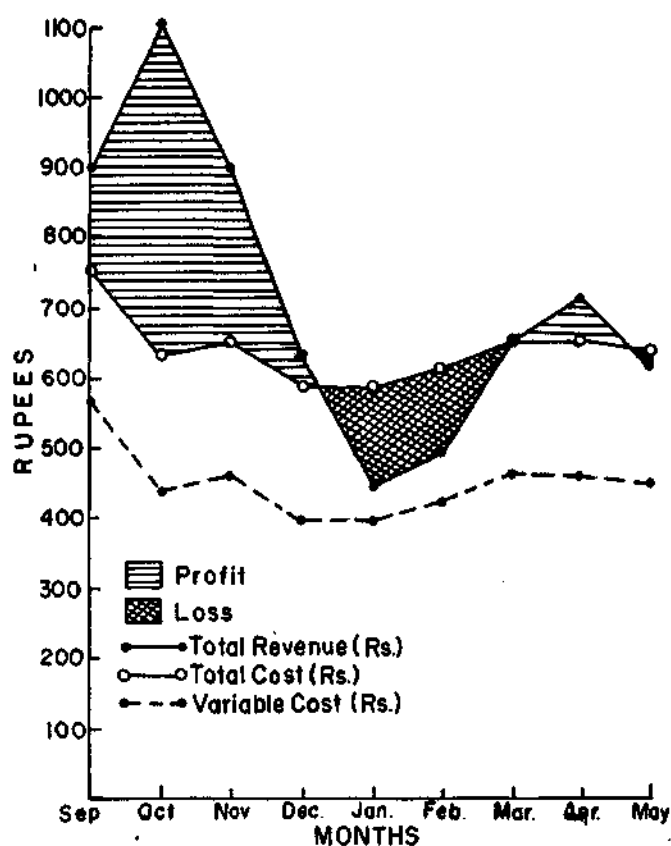


Fig. 12. Monthwise profit/loss (Rs./day) at Navabunder centre during 1984-85.

Table 1. Details of annual fixed and variable cost of 'dol' operation

Annual expenditure/Centres	Navedar-Navgaon (<i>Khamba</i> system)	Madh (<i>Sus</i> system)	Navabunder (<i>Sus</i> system)
a) Fixed cost (Rs)			
i) Depreciation on boat and engine	14,000	14,000	16,000
ii) Depreciation on 'dol'	7,000	8,000	9,000
iii) Depreciation on <i>Khamba</i>	15,000	—	—
iv) Interest on initial investment	26,550	18,450	21,038
Total	62,550	40,450	46,038
b) Variable cost (Rs)			
i) Fuel (diesel & oil) charges	28,175 (35.5)	32,890 (31.1)	33,750 (30.0)
ii) Labour (a) active fishermen	34,290 (43.3)	42,126 (39.9)	41,500 (36.9)
(b) fishery allied activities	2,450 (3.1)	5,060 (4.8)	12,500 (11.1)
iii) <i>Khamba/Sus</i> maintenance	760 (1.0)	7,000 (6.6)	9,000 (8.0)
iv) Boat, engine & net repairs	3,700 (4.7)	4,100 (3.9)	3,950 (3.5)
v) Construction & maintenance of hut/shed/ drying stands and rent of plot	2,100 (2.6)	3,550 (3.4)	3,800 (3.4)
vi) Transportation, marketing and preservation	5,080 (6.4)	7,400 (7.0)	5,050 (4.5)
vii) Miscellaneous items (ropes, basket, bucket, mat, fare, donations etc.)	2,720 (3.4)	3,479 (3.3)	2,950 (2.6)
Total	79,275 (100)	1,05,605 (100)	1,12,500 (100)
Total annual expenditure (a + b)	1,41,825	1,46,055	1,58,538

Note: Figures in parentheses show the percentages of variable cost.

Table 2. Quarterwise details of operating expenditure (Rs.) of 'dol'

Items/Centres	Navedar-Navgaon Quarters				Madh Quarters				Navabunder Quarters			
	I	II	III	Annual	I	II	III	Annual	I	II	III	Annual
a) Cost of fuel (diesel & oil)	8,734 (31.4)	9,016 (38.0)	10,425 (37.7)	28,175 (35.5)	9,867 (25.9)	10,854 (34.3)	12,169 (33.9)	32,890 (31.1)	10,125 (25.5)	11,475 (33.0)	12,150 (31.9)	33,750 (30.0)
b) Labour charges:												
i) Active fishing	12,036 (43.2)	10,580 (44.5)	11,674 (42.2)	34,290 (43.2)	14,323 (37.6)	13,801 (43.7)	14,002 (39.0)	42,126 (39.9)	14,203 (35.8)	13,412 (38.6)	13,885 (36.5)	41,500 (36.9)
ii) Engaged in fishery allied activities	990 (3.6)	660 (2.8)	800 (2.9)	2,450 (3.2)	2,024 (5.3)	1,316 (4.2)	1,720 (4.8)	5,060 (4.8)	4,875 (12.3)	3,125 (8.9)	4,500 (11.8)	12,500 (11.1)
c) Maintenance cost of <i>khamba/sus</i>	300 (1.1)	205 (0.9)	255 (0.9)	760 (1.0)	2,800 (7.3)	1,750 (5.5)	2,450 (6.8)	7,000 (6.6)	3,150 (7.9)	2,880 (8.3)	2,970 (7.8)	9,000 (8.0)
d) Maintenance & repair cost of boat, engine and net	1,850 (6.6)	740 (3.1)	1,110 (4.0)	3,700 (4.7)	2,050 (5.4)	820 (2.6)	1,230 (3.4)	4,100 (3.9)	1,778 (4.5)	1,185 (3.4)	987 (2.6)	3,950 (3.5)
e) Cost of construction & maintenance of hut/shed, drying stands & rent of plots	840 (3.0)	580 (2.4)	680 (2.5)	2,100 (2.6)	2,485 (6.5)	355 (1.1)	710 (2.0)	3,550 (3.4)	2,280 (5.7)	684 (2.0)	836 (2.2)	3,800 (3.4)
f) Expenditure on transportation, marketing & preservation	2,032 (7.3)	1,270 (5.3)	1,778 (6.4)	5,080 (6.4)	3,108 (8.2)	1,850 (5.8)	2,442 (6.8)	7,400 (7.0)	2,020 (5.1)	1,262 (3.6)	1,768 (4.7)	5,050 (4.5)
g) Miscellaneous expenditure	1,061 (3.8)	707 (3.0)	952 (3.4)	2,720 (3.4)	1,461 (3.8)	870 (2.8)	1,148 (3.3)	3,479 (3.3)	1,239 (3.2)	767 (2.2)	944 (2.5)	2,950 (2.6)
Total	27,843 (100)	23,758 (100)	27,674 (100)	79,275 (100)	38,118 (100)	31,616 (100)	35,871 (100)	1,05,605 (100)	39,670 (100)	34,790 (100)	38,040 (100)	1,12,500 (100)

Note: Figures given in parentheses show the percentages.

Table 3. Measures of economic efficiency of 'dol' units

Economic parameters/Centres	Navedar-Navgaon	Madh	Navabunder
a) Gross income (Rs)	1,60,241 (654.1)	1,66,479 (658.0)	1,80,623 (722.5)
b) Net cash flow (Rs)	80,965 (330.5)	60,874 (240.6)	68,123 (272.5)
c) Net unit income (Rs)	44,966 (183.6)	38,874 (153.6)	43,123 (172.5)
d) Unit earnings (Rs)	47,416 (193.6)	41,404 (163.6)	45,623 (182.5)
e) Family labour earnings (Rs)	20,866 (85.2)	22,954 (90.7)	24,585 (98.3)
f) Net profit of the owner (Rs)	18,416 (75.2)	20,424 (80.7)	22,085 (88.3)
g) Operating cost-cash flow ratio	0.98	1.73	1.65
h) Fixed cost-cash flow ratio	0.39	0.24	0.26
i) Total cost-cash flow ratio	1.8	2.4	2.3
j) Rate of capital turnover (%)	67.9	101.5	96.6
k) Pay back period (years)	4.3	3.9	4.0
l) Profit % of investment	7.8	12.4	11.8

Note: Figures in parentheses show the income/earnings per fishing day.

Quarterly analysis showed that 35% of annual operating expenditure was incurred in I, 30% in II and 35% in III quarter (Table 2). Maximum operating expenditure of Rs. 385 per day was worked out for September and minimum of Rs. 270 per day for December.

Fuel (diesel & oil) cost varied from Rs. 8,734 in I quarter to Rs. 10,425 in III quarter. Labour charges were maximum in I quarter (Rs. 13,026) and minimum in II quarter (Rs. 11,240). Reduction in labour engagement in winter was due to decline in fish landings and fishery allied activities. Similarly, expenditure on repairs of craft and gear, construction of shed and fish drying stands, transportation and marketing was maximum in I quarter and minimum in II quarter. Monthly analysis of expenditure showed maximum fuel consumption in March (Rs. 4,010) and minimum in September (Rs. 2,293). About 30% of expenditure on repairs of craft and gear and 17% on maintenance of shed and fish drying stands was incurred in September though number of fishing days were minimum (22 days) in this month. Labour, transportation, marketing and fuel charges were positively correlated with number of fishing days in a month within the quarters. Expenditure on the maintenance of *khamba* and miscellaneous items (baskets, mat, rope etc.) had mixed trend over the months. Average monthly operating expenditure was minimum in February (Rs. 7,489) and maximum in April (Rs. 10,035).

Annual operating expenditure of a 'dol' unit at Madh was about 72% of the total cost (Rs. 1,46,055).

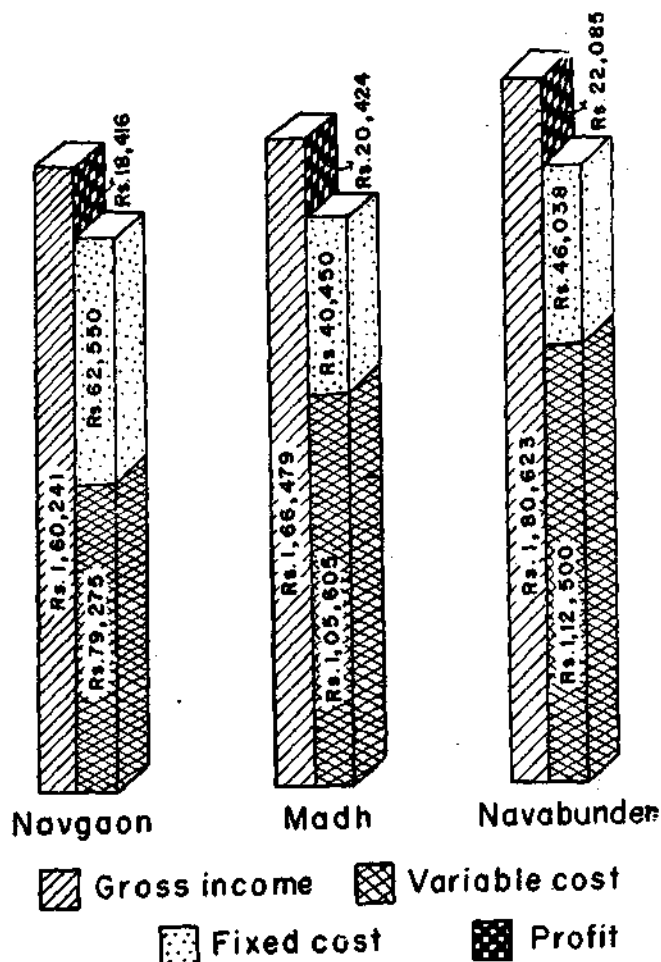


Fig. 13. Annual income, cost and profit during 1984-85.

Of variable cost, labour charges formed about 44%. An amount of Rs. 31,500 was paid as wages for nine months fishing season and an amount of Rs. 10,626 was spent on food and other personal expenditure of the crew. For those employed in fishery allied activities (generally women) the annual payment totalled Rs. 5,060. *Sus* installation and maintenance cost amounted to Rs. 7,000. Of variable cost boat, engine and net repair formed about 4%. Annual cost of marketing, transportation and preservation of catch was Rs. 7,400. Amount spent on purchase of basket, rope, mat and other miscellaneous items accounted for 3.3% of operating cost.

Quarterly operating expenditure varied from a minimum of Rs. 31,616 in winter to a maximum of Rs. 38,118 in summer. Since *sus* was installed in deeper water in summer, the fuel expenditure was highest in this quarter (37%). There was not much change in labour charges over the seasons (Rs. 15-16 thousand) as the crew members were contracted for nine months period. Of annual expenditure on *sus* about 40% was incurred in I quarter. Similarly 50% of annual amount spent on repairs of craft and gear and 70% on construction of shed and fish drying stands was recorded for I quarter. Expenditure on transportation, marketing and preservation was maximum in I quarter (Rs. 3,108) and minimum in II quarter (Rs. 1,850).

Monthwise break-up showed a minimum fuel expenditure of Rs. 2,948 in September and a maximum of Rs. 4,308 in March. No significant difference was observed in the crew wages over months. *Sus* expenditure was maximum in September (Rs. 1,500) forming 21.4% of the annual amount. Similarly amount spent on repairs of crafts and gear, maintenance and construction of hut/shed and fish drying stands and marketing was maximum in September as compared to following months. No significant difference was noted in monthly expenditure within the quarters. On the whole, the variable cost of a unit was calculated at Rs. 417.4 per day.

At Navabunder, the annual operating expenditure of a 'dol' unit was Rs. 1,12,500 (71% of total cost). Of the operating cost, 30% was spent on fuel in 250 fishing days. Crew wages formed about 37% of the annual expenditure. Loading/unloading, sorting and drying charges totalled to Rs. 12,500 per annum. Each unit engaged 4-6 women labourers for this job. Expenditure on installation of *sus* amounted to Rs. 9,000 per unit. An amount of Rs. 3,950 was spent on boat, engine and net repairs. Maintenance of shed and drying stands

costed Rs. 3,800 per annum. Transportation, marketing and preservation of catch accounted for 4.5% of variable cost. Miscellaneous expenditure aggregated to about Rs. 3,000.

Quarterly break-up of expenditure showed that among three quarters maximum expenditure was noted in I quarter (Rs. 39,670) and minimum in II (Rs. 34,790). About one-third of the annual variable cost was recorded for III quarter. Fuel expenditure varied from Rs. 10,125 in I quarter to Rs. 12,150 in III quarter. Crew wages had no significant change over quarters (Rs. 13-14 thousand). Women labourers were paid a maximum amount of about Rs. 4,800 in post-monsoon quarter and a minimum of about Rs. 3,000 in winter. Reduction of labour was due to the low catch in winter. There was not much variation in maintenance cost of *sus* over the quarters. Amount spent on repairs of craft and gear was maximum in I quarter (Rs. 1,778) and minimum in III quarter (Rs. 987). About 60% of the expenditure on the construction of shed and stand was incurred in I quarter. The highest percentage of transportation, marketing and preservation cost was observed in I quarter (40%) and lowest in II quarter (25%). Miscellaneous expenditure maintained almost the same trend.

Cost-comparison between months revealed minimum fuel consumption in September (Rs. 2,964) and maximum in March (Rs. 4,392). There was no difference worth mentioning in crew wages over the months. Payment for labour engaged in fishery allied activities accounted lowest in February (Rs. 956) and highest in October (Rs. 1,784). Amount spent on *sus* maintenance was maximum in September (Rs. 1,550) and minimum in November (Rs. 740). Charges on repairs of craft and gear varied from Rs. 220 in October to Rs. 1,105 in September. Maintenance cost of shed and drying yards ranged from Rs. 200 in January to Rs. 1,550 in September. Preservation and marketing expenditure was minimum in February (Rs. 200) and maximum in October (Rs. 740). Miscellaneous expenditure was comparatively high in September (Rs. 440). Variable cost per operating day was worked out to Rs. 450 which ranged from Rs. 395 in December and January to Rs. 463 in March.

c) *Total cost*: Sum of variable and fixed cost was worked out to Rs. 1,41,825 per unit at Navgaon. For *sus* system, total cost was Rs. 1,46,055 at Madh and Rs. 1,58,538 at Navabunder. Though fixed cost was more in Navgaon in comparison of other two

villages, the total annual cost was less owing to substantially low variable cost at this centre. The annual cost per operating day was Rs. 634 at Navabunder. At Navgaon and Madh per day operating cost was almost the same (Rs. 577 & 579).

Income and economic efficiency measurers (Table 3)

a) *Gross income*: At Navgaon, annual gross income of a unit was Rs. 1,60,241 for 245 fishing days. Of gross income about 45% was earned in I quarter, 23% in II quarter and 32% in III quarter. Seer fish/pomfret, ribbon fish, prawn, Indian cod and Bombay duck were the important fishes contributing 24.8, 21.1, 18.0, 11.3 and 9.0% respectively towards gross income. Of total catch value in I quarter (Rs. 71,405) highest contribution was made by seer fish/pomfret (32.6%), followed by ribbon fish (25.3%) and Bombay duck (16.7%). In winter, highest contributor was Indian cod (26.8%) followed by non-penaeid prawn (22.7%). About 81% of the income in III quarter was obtained from non-penaeid prawns (24.5%), ribbon fish (23.0%), seer fish/pomfret (18.6%) and Indian cod (15.3%). During nine months fishing season, gross earning per day (Fig. 6) was highest in October (Rs. 936) and lowest in January (Rs. 392). No significant difference was observed in income between the months during III quarter. Value of catch per operating day averaged Rs. 654. The gross income per operating day was maximum in I quarter (Rs. 892) and minimum in II quarter (Rs. 446).

With the *sus* system of 'dol' net operation, annual gross earning of a unit in Madh was Rs. 1,66,479. About 43% of income was obtained in I quarter, 24% in II quarter and 33% in III quarter. Of the annual income, about 36% was obtained from non-penaeid prawns, 19% from seer fish/pomfret, 16.2% from croakers, 11% from ribbon fish and 8.2% from Bombay duck. Percentage contribution of prawns to the gross income was highest in winter (43.4%) and lowest in post-monsoon quarter (32.5%). Share of Bombay duck in gross income varied from 2.3% in winter to 13.7% in post-monsoon quarter. About 15% of gross income in III quarter was obtained from ribbon fish. Significant difference in per day income was observed between I (Rs. 818), II (Rs. 487.9) and III quarter (Rs. 660.4). Monthwise analysis showed a maximum income of Rs. 863 per day in October and a minimum of Rs. 479 per day in January (Fig. 7). Per day earning from prawns was maximum in November (Rs. 325), Bombay duck in September (Rs. 172), and croakers and

ribbon fish in May (Rs. 184 & Rs. 119 respectively). Gross income of a unit was worked out to Rs. 658 per day.

At Navabunder, annual gross income of a unit was Rs. 1,80,623. Of the earnings, about 45% was recorded in I quarter, 25% in II quarter and 30% in III quarter. The value of per day catch in I, II and III quarter was Rs. 989.6, Rs. 522.5 and Rs. 663.4 respectively. In total income, share of prawns was 22.5%, Bombay duck 18.8%, seer fish/pomfret 15.8%, croakers 14.4% and ribbon fish 11.6%. In I quarter, highest contribution towards income was made by Bombay duck (27.6%) followed by prawns (19.8%). In II quarter percentage contribution of prawns (27.9%) was more than any other fish. In III quarter, ribbon fish was the highest contributor (23.8%) to the gross income. There was a decline in the percentage income obtained from Bombay duck from I to II quarter and then a marginal increase from II to III quarter. In winter *Collia* added 12.5% to the quarterly revenue. The percentage of income obtained from croakers was highest in III quarter (16.8%) and lowest in I quarter (12.2%). The analysis further revealed that per day income of a unit (Fig. 8) was maximum in October (Rs. 1,103) and minimum in January (Rs. 446) averaging Rs. 722.5 for fishing season.

b) *Net cash flow*: For *khamba* system at Navgaon the net cash flow of a unit during the study year amounted to Rs. 80,966, averaging Rs. 330.5 per operating day. For *sus* system, the net cash flow over operating cost was about Rs. 61,000 at Madh and Rs. 68,000 at Navabunder. The income per operating day for *sus* system (Rs. 241-272) was less than that of *khamba* system (Rs. 330).

c) *Net unit income*: Net unit income was calculated by deducting depreciation from net cash flow. For *khamba* system the income was about Rs. 45,000 in Navgaon. Net unit income at Madh and Navabunder, for *sus* system, was found to be Rs. 38,874 and Rs. 43,123 respectively. The income of a unit ranged from Rs. 154 to 184 per operating day at these centres.

d) *Unit earning*: The sum of value of the produce (fish) used in the house during study year and the net unit income formed the unit earning. It was estimated that fish worth Rs. 10 was consumed per day and accordingly, unit annual earning was calculated at Rs. 47,416 at Navgaon, Rs. 41,404 at Madh and Rs. 45,623 at Navabunder.

e) *Family labour earning*: It was derived by deducting the interest on capital from the unit earning. For *sus* system, family labour earning per operating day ranged from Rs. 91 at Madh to Rs. 98 at Navabunder. At Navgaon, on *khamba* system, the annual family income was about Rs. 21,000 averaging Rs. 85.2 per operating day.

f) *Net profit of the owner*: Net profit of the owner was derived by deducting the value of produce consumed in the house from the family earning. As shown in Fig. 9 net profit was maximum at Navabunder (Rs. 22,085 per annum) and minimum at Navgaon (Rs. 18,416 per annum). The net profit (income) per operating day ranged from Rs. 75 to Rs. 88.

g) *Operating cost ratio*: Operating cost ratio is a measure to compare the quantum of operating cost against gross profit. For Navgaon the ratio was worked out to 0.98. The ratio of operating expenses to the gross profit (cash flow) was higher for Madh (1.73) and Navabunder (1.65). Comparatively low operating cost and higher net cash flow at Navgaon resulted in lower operating cost ratio.

h) *Fixed cost ratio*: Fixed cost ratio or overhead charges ratio was minimum for Madh (0.24) and maximum for Navgaon (0.39). Additional amount of depreciation on *khamba* resulted in higher fixed cost at Navgaon as compared to other centres which accounted for higher fixed cost ratio at this centre.

Gross cost ratio was almost the same on *sus* system (2.3 to 2.4) for Madh and Navabunder. For Navgaon the ratio was 1.8 on *khamba* system.

i) *Rate of capital turnover*: The rate of capital turnover was about 68 % in Navgaon. For *sus* it ranged from 96.6% at Navabunder to 101.5% at Madh. Reverse to this, capital per 100 gross profit was lowest for Madh (98.5%) and highest for Navgaon (147.3%).

j) *Payback period*: Payback period was calculated on dividing the initial investment by the sum of net profit and depreciation. Results revealed that the period required to recover capital investment was about four years both for *sus* and *khamba* systems.

k) *Profit investment ratio*: Annual net profit accounted for is about 12% of total investment for *sus* system and about 8% for *khamba* system. Net

profit being comparatively less and investment high for *khamba*, the profit investment ratio was low for *khamba* at Navgaon. If annual interest is added to the profit, the returns on investment comes to about 19% for *khamba* and 24% for *sus*.

Highlights of the study

1. Main constituents of 'dol' catch were non-penaeid prawns, ribbon fish and Bombay duck at Navgaon (about 65%), non-penaeid prawns and ribbon fish at Madh (68%) and Bombay-duck, prawns, croakers and ribbon fish at Navabunder (about 67%).
2. Post-monsoon quarter contributed 45-49% towards the annual catch and 43-45% towards the gross income at the selected centres.
3. In winter, the catch of all species declined drastically but Indian cod at Navgaon and *Coilia* at Navabunder registered increase in catch, contributing 24.5 and 20.8 % towards the catch of the quarter respectively.
4. The number of annual operating days ranged from 245 to 253.
5. Initial investment was more for *khamba* system as compared to *sus*.
6. The variable cost per operating day ranged from Rs. 324 for *khamba* system at Navgaon to Rs. 450 for *sus* at Navabunder.
7. For a fishing season of nine months a labourer was paid about Rs. 6,000. Labour charges formed 37-43% of the variable cost.
8. Fuel, the second major operating expenditure, constituted 30-36%.
9. Net profit per operating day was more for *sus* system (Rs. 81-88) than *khamba* (Rs. 75).
10. Rate of capital turnover was lowest at Navgaon (68%) and highest at Madh (102%).
11. Payback period was found about 4 years for both *sus* and *khamba* systems.

12. Based on net profit and initial capital investment the *sus* system of 'dol' operation was found more economical. In Madh, *khamba* system, which prevailed in '50s and early '60s, has been completely replaced by *sus*.

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