

## ECONOMIC EFFICIENCY OF DIFFERENT SYSTEMS OF 'DOL' (BAG NET) OPERATION IN NORTHWEST COAST\*

D. B. S. SEHARA AND J. P. KARBHARI

*Central Marine Fisheries Research Institute, Cochin 682 031*

### ABSTRACT

There are three systems of 'dol' (bag net) operation, locally known as 'Khamba', 'Khunt-sus' (both in Maharashtra) and 'Kaba-sus' (in Gujarat). 'Kaba-sus' is a permanent stone anchor consisting of a heap of stones with a rope tied to float (Kaba) for net operation. In Maharashtra, 'Khunt-sus' consists of anchor pole or spike (of about 8-10 feet in length) driven in mud at the bottom of the sea. Another system of 'dol' operation is 'Khamba' which consists of very long wooden poles or pylons fixed to the bottom.

For the three 'dol' operating system, the cost and earning data from 20 sample units were collected on 5 systematically selected sample days each month for a period of one year starting from September 1984 and analysed. This paper deals with the different components of variable and fixed costs and monthwise distribution of catch, fishing days and income for the three systems.

Comparative economic analysis of these systems showed that annual net income per unit was maximum for 'Kaba-Sus' (Rs. 22,085) and minimum for 'Khamba' (Rs. 18,416). Giving due weightage to the initial investment and net income, it is concluded that 'Sus' systems is more economical than 'Khamba' in northwest coast.

### INTRODUCTION

MAHARASHTRA and Gujarat are two important maritime States of India in respect of marine fish landing. The two states contribute about 1/3rd of total marine catch of the country. Among different nets operated in northwest coast, 'dol' (bag net) has its own importance. It contributes about 50% catch of mechanised sector in Maharashtra and 25% in Gujarat. The 'dol' is used to capture surface fish at a depth of a few metres and set in the water so as to face the incoming current. It is capable of being employed in three different methods. The main characteristics of these

methods are the techniques used to anchor the net and to keep the mouth open. Two systems of 'dol' operation are called 'Khamba' and 'Khunt-sus' in Maharashtra and third is known as 'Kaba-sus' in Gujarat. Initial investment, operational cost and method of putting anchor differ among the three systems. The economic efficiency of the three systems of 'dol' operation in the northwest coast of India is compared in the present study.

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### DATA BASE

Based on preliminary information collected from 'dol' operating centres in northwest

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coast two centres in Maharashtra namely, Naveder-Nawgaon in Raigad District for 'Khamba', Madh in Greater Bombay District for 'Khunt-sus' and one centre in Gujarat namely Navabunder in Junagadh District for 'Kaba-sus' were selected for indepth study. At each centre data regarding catch, price, operating expenditure, employment and investment on boat, engine, net and 'Khamba'/'Sus' were collected from 20 'dol' operating units on 5 systematic selected sample days each month starting from September 1984 for a period of one year through a schedule specially designed for this study. The enumerators were engaged locally from fishermen community and trained for data collection. The enumeration work was supervised and the data were cross checked periodically.

#### THE SYSTEMS OF EMPLOYING 'DOL'

##### 'Khamba' or 'Medha'

'Khamba' system is a peculiarity of about 10 fishing centres in Raigad District (Maharashtra) from Rewas to Revdanda. Though, this system was also prevailing in a few centres in Greater Bombay District (from Gordi to Worli) during 1940's, it has been totally replaced by comparatively cheaper and easier system locally called 'Sus' or 'Khunt'. 'Khamba' or 'Medha' (wooden pylon and spike) is cylindrical in shape and varying from 50' to 120' in length. It is made up of 5-6 joints of two kinds of wood namely teak wood (locally called 'Sag') and wild wood (locally called 'Haid'). Its life span is about 5 fishing seasons. The fishing season lasts for about 9 months starting from September every year. It has to be laid down into sea floor every year during September in neap tide period (locally called Bhang). Similarly, it has to be dismantled (unearthed from sea floor every year during the fog end of May when 'dol' fishing comes to a close. It is protected from rain water and preserved from decaying by embedding it in the mud near creek during monsoon period. Each 'dol'

netter requires about 10 'Khamba' for laying them at varying depth from 12 m to 30 m. The small sized 'Khamba' are made up of locally available wood such as casurina, coconut and palm.

The fixing of 'Khamba' is done with the help of two boats which are tied together by means of two logs of wood fixed horizontally across the beam in each boat. The upper end of wooden pylon is connected by a rope to a pulley arrangement at the mast head of two boats. The wooden pylon is raised vertically and carefully lowered towards the sea floor by crew in two boats. The rise and fall of sea level acts as a powerful force to drive the spike (lower most pointed end of pylon) into sea bed. The rope tied to pylon is loosened when water level comes up and tightened when the level goes down. This process is continued for about 2-3 hours till pylon is firmly laid into the sea bed. The distance between two pylons is about 150 feet. A peculiar contrivance locally called 'Khora' is fixed with each pylon which is useful in the operation of 'dol' net with great ease. Generally, 4 'Khamba' are used for operating 3 'dol'.

##### 'Khunt-sus'

This method is prevalent in the fishing villages from Dahanu to Mora-Karanja, covering Thane, Greater Bombay and Raigad Districts and from Salav (Raigad District) to Dabhol (Ratnagiri District). The deep waters and the resultant weak currents beyond Dabhol (Southern most fishing village in Maharashtra) are not favourable for 'dol' operation. 'Khunt' (wooden anchor) about 6-7 feet in length and 1-2 feet in breadth, is made up of locally available wood of palm or coconut. The laying of 'Khunt' is more or less on the same way as described for 'Khamba'. The nylon is replaced by garfil rope in this system. The 'Khunt' pointed at one end is embedded in the muddy sea floor. For hammering 'Khunt' a log resembling 'Khamba', which

TABLE 1. Details of catch (kg), earning (Rs.) and operating cost (per unit) in different systems of 'dol' operation in northwest coast (1984-85)

Months	'Khamba' System				'Khunt-sus' System				'Kaba-sus' system			
	Percentage of annual				Percentage of annual				Percentage of annual			
	Catch	Gross earning	Operating cost	No. of fishing days	Catch	Gross earning	Operating cost	No. of fishing days	Catch	Gross earning	Operating cost	No. of fishing days
September	.. 13.2	13.1	10.7	9.0	16.1	14.0	13.2	11.1	13.1	12.7	12.1	9.6
October	.. 17.9	16.9	12.1	11.8	18.0	15.6	11.8	11.8	20.0	18.3	11.7	12.0
November	.. 14.3	14.5	12.4	11.8	14.7	13.2	11.1	11.5	12.9	13.9	11.4	11.2
December	.. 8.4	8.7	10.2	12.3	7.6	8.6	9.9	11.5	9.2	10.2	10.6	11.6
January	.. 6.4	7.1	10.3	11.8	7.4	8.0	10.3	11.1	6.1	7.4	10.5	12.0
February	.. 6.7	7.6	9.4	10.2	6.3	7.7	9.8	10.3	6.2	6.9	9.8	10.4
March	.. 10.5	10.9	12.2	11.9	9.1	10.5	11.8	11.8	11.2	10.8	12.4	12.0
April	.. 12.0	11.1	12.6	11.5	11.0	12.0	11.6	11.1	12.6	11.2	11.5	11.2
May	.. 10.6	10.1	10.1	9.8	9.8	10.4	10.5	9.8	8.7	8.6	10.0	10.0
Total	(73,172)	(1,60,241)	(79,275)	(245)	(87,013)	(1,66,479)	(1,05,605)	(253)	(82,854)	(1,80,623)	(1,12,500)	(250)

TABLE 2. Cost and return (Rs.) of 'dol' units in the northwest coast (1984-85)

		'Khamba' System		'Khunt-sus' System		'Kaba-sus' System	
		Annual	Per operating day	Annual	Per operating day	Annual	Per Operating day
Catch (Kg)	..	73,172	300.0	87,013	344.0	82,854	331.4
Gross income (Rs.)	..	1,60,241	657.0	1,66,479	658.1	1,80,623	722.5
Cost (Rs.)							
<i>A. Operating</i>							
(a) Fuel	..	28,175	115.0	32,890	130.0	33,750	135.0
(b) Labour	..	36,740	150.0	47,186	186.5	54,000	216.0
(c) Repairs & maintenance	..	6,560	26.8	14,650	57.9	16,750	67.0
(d) Preservation & marketing	..	5,080	20.7	7,400	29.2	5,050	20.2
(e) Others	..	2,720	11.1	3,479	13.8	2,950	11.8
Total	..	79,275	323.6	1,05,605	417.4	1,12,500	450.0
<i>B. Fixed</i>							
(a) Depreciation on boat, engine, net & Khamba	..	36,000	146.9	22,000	87.0	25,000	100.0
(b) Interest on Capital	..	26,550	108.4	18,450	72.9	21,038	84.2
Total	..	62,550	256.4	40,450	159.9	46,038	184.2
Total cost (A+B)		1,41,825	581.5	1,46,055	577.4	1,58,538	634.2
Net income (Rs.)	..	18,416	75.5	20,424	80.7	22,085	88.3

is available on hire, is used. The 'Khunt' and 'Khamba' are adjusted and lowered vertically into sea water through horizontally tied logs. The force generated by the rise and fall of high tides is made use of to drive the 'Khunt' firmly into the sea floor. This process takes about 3 hours. Two garfil ropes depending upon the depth of 'dol' operation are also fastened to 'Khunt'. The loose ends of both the garfil ropes are tied to a 'barrel buoy' (locally known as Pimp) which is made up of wood or plastic. This sort of 'Sus' is also known as 'Kau'.

#### 'Kaba-sus'

This method of 'dol' fishing is prevalent in Gujarat from Unbergam to Wansiborsi (in Valsad District) and from Diu to Siyalbet (in Junagadh and Amreli Districts). It has a striking difference from the method adopted in Maharashtra, particularly in making use of stones for anchor instead of wood. The 'Sus' locally called 'Kaba' can be divided into three components viz. stone anchors, anchor ropes and barrel buoy. The stones are excavated from nearby quarries and supplied to fisherman through cooperative societies of stone cutters. One 'dol' net needs two heaps of stones and each heap contains 30-40 stones, the weight of each stone varying from 30-40 kg. After the close of fishing season the fisherman cannot bring back or reuse these stones. Due to very strong currents in the Gulf of Cambay, stone anchor alone can withstand the current in making 'dol' operation possible. There are about 7 sets of anchor ropes of varying length and thickness used for different purposes in this system. Empty wooden barrels of 2-3 feet in length and 1-2 feet in diameter are used as barrel buoy. These buoy (2-3 in numbers) are kept on the surface of the sea and since the barrel ropes or 'Karcha' are comparatively shorter, the raising of anchor head rope (*heyer/sher*) is done to a great extent by these barrel ropes. Further, the barrel head rope is linked with the upper corners of the mouth of

'dol' which facilitates in keeping the mouth of the net open to a great extent.

For laying of a stone anchor two boats, loaded with anchor ropes and stones (locally called Malia) reach at pre-selected point during ebb tide (locally called Oarti). A rope of about 240 feet in length is held in between two boats making right angle to the direction of the current. First, anchor ropes are lowered in the water from each boat with a heavy stone tied to its end by 'heyer' or 'sher' and the rope is paid out till it touches the sea floor. The remaining stones tied with coir ropes having loops are slid or deposited along the 'sher' one after another so as to get distributed evenly around the basal end of anchor rope. This makes anchor rope securely fixed without directly coming into contact with the stones. Anchor ropes facilitate the operation of 'dol' net. After the close of fishing season part of anchor rope can be salvaged while the stones are left out.

#### 'Dol' (Bag net)

'Dol' varies from 150' to 220' in length with a circumference of mouth ranging from 160' to 250'. It is conical in shape with rectangular opening (mouth) and tapering closed end. The net is made up of polyethylene monofilament plastic twine and resembles trawl net, but stationary while operating. The net is operated entirely by the force of tide. It is set in the water so as to face incoming current and the position is reversed when tide starts receding. The object is propulsion of fish into net by force of current.

### RESULTS AND DISCUSSION

#### Catch and income

During 1984-85, 'dol' net operation at selected centres was confined to 9 months starting in September. The important constituents of catch included Bombay-duck, penaeid and non-penaeid prawns, pomfret, seerfish, ribbonfish, croaker, Indian cod and *coilia*.

The number of fishing days (Table 1) ranged from 245 for 'Khamba' system to 253 for 'Khunt-sus'. Except the starting (September) and closing (May) months of 'dol' fishing there was no significant difference in the number of fishing days between the months. In 'Khamba' system annual catch of a unit was about 73 thousand kg. During the year maximum catch was landed in October (17.9%) and minimum in January (6.4%). For 'Khunt-sus' highest catch share of 18% was noted in October and lowest of 6.3% in February. Total annual catch of a 'dol' unit worked out at 87,013 kg. For 'Kaba-sus' of total annual catch of 82,854 kg. monthly contribution ranged from 6.1% in January to 20.0% in October. For all the three systems post-monsoon quarter was the best fishing period while the winter was lean period. Gross income showed almost the same trend for all the three systems. During the lean fishing period the fish prices were higher than the period of fish abundance. The gross income was maximum for 'Kaba-sus' system (Rs. 1,80,623) and minimum for 'Khamba' system (Rs. 1,60,241). Depending on the fish landings the gross income was low in winter and high in post-monsoon.

#### *Variable and fixed cost*

Table 1 further shows the percentage of total variable cost incurred in different fishing months for different systems. Of total operating expenditure of Rs. 79,275 for 'Khamba' system lowest percentage incurred in February (9.4%) when fishing activity was at low ebb. In 'Khunt-sus' system the annual operating expenditure was found to be Rs. 1,05,605 for 253 fishing days and the highest and the lowest percentage of the expenditure incurred in September (13.2%) and February (9.8%) respectively. The annual operating cost for 'Kaba-sus' system was calculated at Rs. 1,12,500. The percentage expenditure was comparatively higher in the months of March (12.4%) and September (12.1%) and less in

February (9.8%). Overall, the expenditure per day was maximum for 'Kaba-sus' (Rs. 450) and minimum for 'Khamba' (Rs. 234).

The expenditure (Table 2) on labour was one of the major cost items ranging from Rs. 152 per day for 'Khamba' to Rs. 216 for 'Kaba-sus'. An amount of Rs. 115-135 was spent on fuel per day. Repairs, replacement and maintenance cost was Rs. 58-67 per day for 'sus' systems and Rs. 27 per day for 'Khamba'. The expenditure incurred on preservation, marketing and other miscellaneous items did not vary much between the three systems.

Since there was heavy initial investment on wooden pylon, the annual fixed cost was more for 'Khamba' system (Rs. 62,550) as compared to 'Khunt-sus' (Rs. 40,450) or 'Khaba-sus' (Rs. 46,038). The initial investment on 'Khamba' comes about Rs. 75,000. In other two systems of 'sus' the cost of material used for putting 'sus' was included in operating cost since most of the items stood for one fishing season.

Total annual cost (variable and fixed) was about Rs. 1.42 lakh for 'Khamba', Rs. 1.46 lakh for 'Khunt-sus' and Rs. 1.58 lakh for 'Kaba-sus'. The fixed cost per day of operation was maximum for 'Khaba-sus' (Rs. 634) and minimum for 'Khunt-sus' (Rs. 577).

#### *Net income*

Net income of a unit was obtained by deducting the total cost from the gross revenue (Table 2). The annual net income was maximum for 'Kaba-sus' (Rs. 22,085) and minimum for 'Khamba' (Rs. 18,416). The income per fishing day was calculated at Rs. 75.5 for 'Khamba', Rs. 80.7 for 'Khunt-sus' and Rs. 88.3 for 'Kaba-sus'.

Comparing the initial investment and net income, both the 'sus' systems were found to be more economical than 'Khamba' and recommended to be adopted by fishermen at north west coast.