

Economics of Traditional Gill Net Fishing Using Wind Energy Along Tamil Nadu Coast

R.Sathiadhas, K.K.P.Panikkar and K.P.Salini
Central Marine Fisheries Research Institute Cochin-682 031

The paper highlights the economics of plank built boats and catamarans using sails operating gill nets at selected centres representing different regions of Tamil Nadu coast. Data on daily operational costs and earnings of catamarans and plank built boats operating various types of resource specific gill nets for different seasons have been collected for a period of one year.

The average initial investment of a plank built boat with sails operating different types of gill nets varies from Rs.27,000 to 60,000 realising annual gross returns of Rs.55,000 to 66,000/-. The average capital investment of a catamaran operating gill net ranges from Rs.6,500/- to Rs.45,000/- depending upon the number of gear used for different seasons realising annual earnings of Rs.21,000/- to Rs.1.15 lakhs. The key economic indicators such as initial investment, rate of return, cost of production, net returns etc. have been worked out which indicate that utilisation of wind energy is most suitable and economically viable for the traditional fishermen operating gill nets along Tamil Nadu coast.

The process of mechanisation of fishing fleet in Tamil Nadu coast dates back to the year 1955 and still the non-mechanised sector of the State dominates in the capture fishery. Surveys conducted earlier (Anon, 1981) revealed that about 31 per cent of the non-mechanised units available in our country were operating only in 1000 kms coastal belt of Tamil Nadu. As per the latest statistics available (Anon) 1986, there are about 28788 catamarans and 9200 other country craft engaged in marine fishing in the State. About 61 per cent of the gear possessed by the marine fishermen were various types of gill nets. Utilization of wind energy through sails with the combination of human power is the significant feature of the diversified gill net fishery. The pace of motorization of country craft in Tamil Nadu coast is comparatively slow (Sathiadhas & Benjamin, 1990). Although motorization is considered as technically superior its economic efficiency has not been well established to attract more and more fishermen to adopt it. The continuous hike in price of kerosene as well as its non availability in sufficient quantity also con-

tributed to its slow pace. In view of the large scale utilisation of wind energy in Tamil Nadu as against the high tempo of motorization in the neighbouring states of Kerala and Karnataka and the excessive manpower available along the coastal regions of the State it is essential to study the economics of such indigenous units for further planning and development of the artisanal sector. Hence, the present study on the economics of diversified gill net fishing by traditional craft was carried out.

Materials and Methods

On the basis of the information obtained from the National Marine Living Resources Data Centre of CMFRI, representative landing centres namely, Thiruvottiyurkuppam, Akkaraipet, Alanthalai and Kadiapattinam have been selected for collection of data with regard to catamaran units and Malpattanam and Tuticorin for plank built boats.

Sample units of catamarans operating sardine gill net, combination gill nets and drift nets have been observed from different centres (Table 1). Data have been collected

from plank built boats with sardine gill net units at Tuticorin and *Koivalai* units at Mallipattinam. At each centre a sample of 20 units was randomly selected and data on initial investment, seasonwise operational costs, species-wise catch and earnings have been collected for one year during 1987-90.

Result and Discussion

Craft and gear

About 40 per cent of fishermen households in Tamil have ownership of fishing craft and 50 per cent that of fishing gear.

About 90 per cent of the traditional fishing craft operating along Tamil Nadu coast use wind energy for their mobility and more than 80 per cent of the gear used by them are different types of gill nets. The sardine gill net is operated through out the year. The prawn net operation is mostly restricted to the period from June to September. Operation of bottom set gill nets like *thiruk-*

kai valai, *thattuvalai* and a *sinkiral valai* varies from region to region but mostly confined to July to February.

Initial investment

The average initial investment on catamaran and plank built boat along with sails and gear at selected centres is given in Table 1.

The capital requirement of a catamaran with gear at Kadiappattinam and Akkaraipet is wide due to the high price of *thadichivalai*. For plank built boats operating gill nets the initial investment ranges from Rs.27,000/- at Tuticorin to Rs.60,000/- at Mallipattinam. For *koivala* operations at Mallipattinam the ownership of the net costing around Rs.45,000/- is equally shared by 6 crew members.

Operational cost

Operational cost of non-mechanised fishing units comprises mainly maintenance, wages and auction charges. The major component of operational expenses for sail craft is wages. In catamaran units the gross income after deducting the auction charges and other expenses is divided into three shares in which two shares are equally divided among the crew members as their wages. For the operation of sardine gill net by plank-built boats at Tuticorin, 50 per cent of the net income is paid as crew wages. At Mallipattinam the *Koivala* operation by PB boats are carried out as a joint venture in which 10 per cent of the gross revenue is given to the craft owner as his share. However, the opportunity cost of labour is taken into consideration for working out the operating cost. The maintenance cost of the units are entirely borne by the owners of fishing units.

The annual operational cost for different units are given in Table 2. The average operational expenses per trip of catamaran ranges from Rs.77/- to Rs. 358/- for various

Table 1. *Sail craft and gear combinations and average initial investment per unit at different centres, Tamil Nadu*

| Name of centre | Combination of craft and gear | Average investment (Rs.) | Total Rs. | No. of crew |
|-------------------------------|-------------------------------|--------------------------|-----------|-------------|
| 1. Akkaraipet (Naga-pattinam) | Catamaran | 10,000 | 45,000 | 3-6 |
| | <i>Thudichi valai</i> | 25,000 | | |
| | <i>Vuluvulai</i> | 5,000 | | |
| | <i>Kavalai valai</i> | 5,000 | | |
| 2. Thiruvottiyur-kuppam | Catamaran | 7,500 | 15,500 | 2-3 |
| | <i>Kavala valai</i> | 3,500 | | |
| | <i>Irukai valai</i> | 3,000 | | |
| | <i>Kaul valai</i> | 1,500 | | |
| 3. Alanthalai | Catamaran | 6,500 | 13,500 | 2-3 |
| | <i>Chula valai</i> | 3,000 | | |
| | <i>Thirukkai Valai</i> | 2,500 | | |
| | <i>Sinkiral valai</i> | 1,500 | | |
| 4. Kadiappattinam | Catamaran | 3,500 | 6,500 | 2-3 |
| | <i>Chula valai</i> | 3,000 | | |
| 5. Mallipattinam | Plank built boat | 15,000 | 60,000 | 5-7 |
| | <i>Koivalai</i> | 45,000 | | |
| 6. Tuticorin | Plank built boat | 18,000 | 27,000 | 6 |
| | <i>Chala valai</i> | 9,000 | | |

Table 2. Operational costs and earnings of gill net units using wind energy at different centres

| Item | Catamarans | | | Plank built boats | | | |
|--|----------------|-------------------------------|-----------------|-------------------------|-------------------------|----------------|-------|
| | Akka- aipet | Thiruvo- tتيyur- kuppam | Alantha- lai | Kadia- patti- nam | Malli- patti- nam | Tuti- corin | |
| I. Operational costs | | | | | | | |
| 1. Repair and maintenance | 6240 | 778 | 800 | 1396 | 4510 | 3848 | |
| 2. Wages to labourer | 72658 | 15437 | 13576 | 12714 | 30870 | 27364 | |
| 3. Auction charges | 1628 | 1260 | 820 | 712 | 3305 | 3406 | |
| 4. Salt/ice etc | 350 | - | - | - | - | - | |
| 5. Other expenses | 2880 | 1940 | 750 | 736 | 1060 | 825 | |
| Total | 83756 | 19415 | 15946 | 15558 | 39745 | 35443 | |
| II. Species-wise catch (Q) Revenue (V) (Q-kg & V-Rs.) | | | | | | | |
| 1. Elasmobranchs | Q | 3687 | 1450 | 778 | - | - | - |
| | V | 10468 | 5950 | 1556 | - | - | - |
| 2. Other Sardine/ clupeids | Q | 3569 | 3900 | 5760 | 3654 | 1127 | 18882 |
| | V | 10720 | 15600 | 17600 | 14616 | 2918 | 52857 |
| 3. Perches | Q | 6982 | - | - | - | 563 | - |
| | V | 21562 | - | - | - | 2815 | - |
| 4. Mackerel | Q | 2531 | - | - | - | 2112 | - |
| | V | 13973 | - | - | - | 10560 | - |
| 5. Croakers | Q | 1226 | - | - | - | - | - |
| | V | 2927 | - | - | - | - | - |
| 6. Carangids | Q | 1060 | 314 | - | - | 1125 | - |
| | V | 5261 | 2512 | - | - | 7875 | - |
| 7. Seer fish | Q | 1053 | - | 10 | - | 986 | - |
| | V | 9341 | - | 100 | - | 9860 | - |
| 8. Cat fish | Q | 1016 | - | - | - | 289 | - |
| | V | 3035 | - | - | - | 1445 | - |
| 9. Goat fish | Q | - | 150 | - | 524 | - | - |
| | V | - | 448 | 255 | 2000 | - | - |
| 10. Ribbon fish | Q | - | - | 765 | - | 845 | - |
| | V | - | - | - | - | 3380 | - |
| 11. Hilsa | Q | - | - | - | - | 6619 | - |
| | V | - | - | - | - | 23146 | - |
| 12. Others | Q | 7567 | 256 | 218 | 1000 | 417 | 1113 |
| | V | 37659 | 2080 | 2440 | 4096 | 4107 | 2415 |
| Total | Q | 28691 | 6070 | 7021 | 5178 | 14083 | 19995 |
| | V | 114946 | 26590 | 22141 | 20712 | 66106 | 55272 |

centres. Labour cost alone constituted 80 to 86 per cent of the operational expenses. For plank built boats, the operational cost per trip worked out at Rs.128 at Tuticorin

and Rs.196 at Mallipattinam. The maintenance expenses constituted 4 to 9% of the operational expenses for catamaran units at various centres and 11% for plank built

boats both at Tuticorin and Mallipattinam. The annual fishing days for sail craft ranged from 202 to 248 for catamarans and 203 to 277 for plank built boats.

Catch composition

The clupeids/other sardine is a common variety available at all centres. For catamaran units other sardines come about 82% at Alanthalai, 71% at Kadiapattinam and 64% at Thiruvottiyurkuppam. For the plank-built boats, other sardines (69%) and *H.kelee* (47%) are the major components of catch at Tuticorin and Mallipattinam respectively.

Gross earnings

The gross income is the total value received for different species of fish caught in the units (Table 2). About 71% of revenue at Kadiapattinam, 78% at Alanthalai and 59% at Thiruvottiyurkuppam were realised from the catches of other sardines/clupeids. But in Akkaraipet perches contributed max-

imum revenue (19%) followed by mackerel (12%) elasmobranchs (9%) and clupeids (9%).

Almost the entire gross revenue of plank built boats at Tuticorin was contributed by different species of clupeids. But at Mallipattinam *Hilsa kelee* contributed maximum revenue (39%) followed by mackerel (16%), seer fish (15%) and carangids (12%).

Annual income and expenditure

The annual fixed cost includes the depreciation of the unit and the interest for initial investment. Depreciation is worked out under linear method by allocating equal values every year on the basis of expected life. The interest for initial investment is @ 15% per annum. The annual fixed cost for catamaran units varies from Rs.2315/- at Kadiapattinam to Rs.19,300/- at Akkaraipet and for plank built boats the same works out at Rs.8,820/- at Tuticorin and Rs. 19,500/- at Mallipattinam (Table 3). Net operating income is obtained by subtracting operating costs from gross income. The

Table 3. Annual average costs and earnings of non-mechanised gill net units at different centres, Tamil Nadu

| Item | Catamaran | | | | Plank built boat | |
|-------------------------------------|------------|--------------------------|------------|--------------------|--------------------|-----------|
| | Akkaraipet | Thiruvotti- yurkuppam | Alanthalai | Kadiapat- tinam | Mallipat- tinam | Tuticorin |
| A. Initial investment (Rs.) | | | | | | |
| i) Craft | 10,000 | 7,500 | 6,500 | 3,500 | 15,000 | 18,000 |
| i) Gear | 35,000 | 8,000 | 7,000 | 3,000 | 45,000 | 9,000 |
| Total | 45,000 | 15,500 | 13,500 | 6,500 | 60,000 | 27,000 |
| B. Fixed cost (Rs.) | | | | | | |
| i) Depreciation | | | | | | |
| 1. Craft (20%) | 1,000 | 750 | 650 | 350 | 1,500 | 1,800 |
| 2. Gear (20-33%) | 11,550 | 2,640 | 2,310 | 990 | 9,000 | 2,970 |
| ii) Interest (15%) | 6,750 | 2,325 | 2,025 | 975 | 9,000 | 4,050 |
| Total | 19,300 | 5,715 | 4,985 | 2,315 | 19,500 | 8,820 |
| C. Operating cost (Rs.) | 83,756 | 19,414 | 15,946 | 15,558 | 39,745 | 35,443 |
| D. Total cost (Rs.) (B+C) | 1,03,056 | 25,130 | 20,931 | 17,873 | 59,245 | 44,263 |
| E. Catch (tonnes) | 28.7 | 6.1 | 7.0 | 5.2 | 14.1 | 20.0 |
| F. Gross revenue (RS) | 1,14,946 | 26,590 | 22,141 | 20,712 | 66,106 | 55,272 |
| G. Net operating income (Rs.) (F-C) | 31,190 | 7,175 | 6,195 | 5,154 | 26,361 | 19,829 |
| H. Profit (Rs.) (F-D) | 11,890 | 1,460 | 1,210 | 2,839 | 6,861 | 11,009 |

Table 4. Key economic indicators of catamarans and plank boats operating gill nets at different centres, Tamil Nadu

| Item | Catamaran | | | Plank built boat | | |
|---|------------|----------------------|------------|------------------|----------------|-----------|
| | Akkaraipet | Thiruvotti-yurkuppam | Alanthalai | Kadia-pattinam | Malli-pattinam | Tuticorin |
| 1. Initial investment (Rs.) | 45,000 | 15,500 | 13,500 | 6,500 | 60,000 | 27,000 |
| 2. Average catch per day of operation (kg) | 123 | 25 | 33 | 26 | 69 | 72 |
| 3. Average revenue per day (Rs.) | 491 | 107 | 103 | 103 | 326 | 200 |
| 4. Average number of days fished in a year | 234 | 248 | 216 | 202 | 203 | 277 |
| 5. Number of crew required for operation | 5 | 2 | 2 | 2 | 6 | 6 |
| 6. Average operating cost for day of operation (Rs.) | 358 | 78 | 74 | 77 | 196 | 128 |
| 7. Average total cost per day of operation (Rs.) | 440 | 101 | 97 | 89 | 292 | 160 |
| 8. Operating cost per kg of fish (Rs.) | 2.9 | 3.1 | 2.2 | 3.0 | 2.8 | 1.8 |
| 9. Total cost per kg of fish (Rs.) | 3.6 | 4.0 | 2.9 | 3.4 | 4.2 | 2.2 |
| 10. Average value realised per kg of fish (Rs.) | 4.0 | 4.3 | 3.1 | 4.0 | 4.7 | 2.8 |
| 11. Quantity of fish produced per manday (kg) | 25 | 13 | 17 | 13 | 12 | 12 |
| 12. Value of production per manday (Rs.) | 100 | 56 | 53 | 52 | 56 | 34 |
| 13. Average wages per manday (Rs.) | 62 | 31 | 31 | 32 | 25 | 17 |
| 14. Net operating income per day (Rs.) | 133 | 29 | 29 | 26 | 130 | 72 |
| 15. Net profit per day of operation (Rs.) | 51 | 6 | 6 | 14 | 34 | 40 |
| 16. Net income per day of the owner including family labour (Rs.) | 195 | 60 | 60 | 58 | 155 | 89 |
| 17. Rate of return to capital (%) | 41 | 24 | 24 | 59 | 26 | 56 |
| 18. Capital turn over ratio (%) | 155 | 172 | 164 | 318 | 110 | 205 |
| 19. Pay back period (years) | 1.8 | 3.2 | 3.2 | 1.6 | 3.5 | 1.7 |

units can work even during lean season as long as they could cover the operational expenses.

The net profit varied from Rs. 1,210/- at Alanthalai to Rs. 31,190/- at Akkaraipet for catamaran units and Rs.6,861/- at Mal-

lipattinam to Rs.11,009/- at Tuticorin for plank built boats.

Comparative economic efficiency

Some of the key economic indicators worked out on the basis of costs and earnings data for catamarans and plank built

boats to highlight the comparative economic efficiency are given in Table 4.

Both types of sail craft are showing encouraging results with regard to economic efficiency. Considering all the key economic indicators, catamarans possessing 3 types of gill nets such as *thadichi valai*, *kavala valai* and *valavali* operating at Akkaraipet is superior, with the highest average initial investment of Rs.45,000/-. These units provide higher employment, better wages, catch rates and profitability. For catamarans with lesser investment of Rs.5,600/- to Rs.15,500/- at Kadiapattiam, Alanthalai and Thiruvottiyurkuppam, units operating sardine gill nets with least investment appears to be better than other choices.

Plank built boats require about 6 crew per unit as compared to 2 to 5 in catamaran units. But the returns to labour is more in the latter. The catamaran labourers earn per capita wages ranging from Rs.31/- to Rs.62/- per day whereas the labourers of plank units earn Rs.17/- to Rs.25/- per day.

The average catch per unit per day of operation was estimated at 69 and 72 kg for plank built units in Mallipattinam and in Tuticorin and the corresponding revenue worked out at Rs.326/- and Rs.200/- respectively. The higher revenue in the former is due to the existence of high priced varieties in its catch composition. However the cost of production per kg of fish was lower with Rs.2.2 per kg at Tuticorin. The rate of return to capital, capital turn-over ratio, pay-back period and net profit per day of operation also were found to be better for the plank built boats at Tuticorin. But in terms of returns to labour and net income per day, the boats at Mallipattinam performed well.

Conclusion

The study indicates gill net fishing using wind energy by country craft is economically viable even for the lower income group. The choice of gill net units with sails having varied investment levels is so wide as it ranged from Rs.6,500/- to 45,000/- for catamaran units and Rs.27,000/- to 60,000/- for plank built units. The sardine gill net appears to be suitable for all seasons and all regions. The combination of gill net units by catamaran units such as *thadichivalai*, *valavulai* and *kavalavulai* at Akkaraipet is far better than the combinations of *kavalavulai*, *iruckaivaluai* and *ralvalai* at Thiruvottiyurkuppam and *chalavulai*, *thirukkaivalai* and *sinkiralvalai* at Alanthalai.

The catch rates of the non-mechanised fishing units declined with the advent of mechanisation and motorization of fishing boats. The continued increase in fuel prices also enhanced the cost of production of motorized and mechanised units. If the wind is favourable, the sail craft gets equal speed as that of motorized units.

As a fuel saving measure, even the motorised units can utilise the sails whenever the wind is favourable. Hence the motorization of sail crafts should be carried out only as a supplement to the sails and not to supplant it.

The joint ownership of gill nets by traditional fishermen at Mallipattinam works successfully. The fisheries co-operatives can play an important role in promoting joint ownership of indigenous crafts and gear by providing fishing equipments to the fishermen on easy terms and conditions.

Authors are thankful to Dr.P.S.B.R. James, Director, Central marine Fisheries Research Institute, Cochin and Dr.A. Regunathan, Head, Fisheries Economics & Extension Division for their encouragement. The services rendered by S/Shri R. Guruswamy, N. Ramesh, V. Thanapathi, J. P. Ebenezer, V. Sivarajam,

S.Chandrasekhar, A.Kanakkan and R.C.Shenoy are gratefully acknowledged.

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