# Practical and Economic Aspects of Commercial Tuna Longline Operations in Indian Seas

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About three decades ago, the most exploited fisheries of Indian seas were finfish based. This character of the fisheries later gave way to diversification of fishing effort mainly focusing on shrimp trawling. However, owing to the depletion of the shrimp stocks mostly for reasons of over fishing, there has been quest for identification of alternate resources with export potential other than shrimp in the open sea zones of EEZ as well as in the coastal zones. In the year 2002, MPEDA in their pilot project at Visakhapatnam converted two 23 m $L_{OA}$ shrimp vessels for tuna long lining with imported gear and equipment. This has paved way in identification of appropriate deck design and the equipments needed for tuna long line. The first successful conversion of six shrimp trawlers of 23 m $L_{OA}$ into tuna longliners in the year 2005 equipped with RSW (refrigerated seawater) system, resulted in the export of 250 tonnes of chilled *sashimi* tuna in the first year (2005-2006) and 500 tonnes in the second year (2006-2007). The tuna catches from the Bay of Bengal by these six Chennai-based vessels were air-lifted mostly to Japan. The conversion of the vessels for tuna long line operations was made possible due to scheme by the Ministry of Agriculture (Animal husbandry, Dairying and Fisheries), New Delhi which offers 50 % subsidy towards the cost of the equipment and its installation, subject to a maximum of Rs 1.5 million.

The six vessels equipped with long lining have been continuing tuna operations successfully. This encouraging development has motivated not only owners of several other 23 m $L_{OA}$ vessels to apply for subsidy for similar installation on their vessels but also those who own more than 15 m $L_{OA}$ for open sea tuna fishing. The timely financial assistance for all type of vessels for tuna long lining by MPEDA constitute a major step forward towards augmentation of the tuna fleet strength for harvesting the estimated annual potential yield of 2,47,000 tonnes of tuna in Indian EEZ.

## Harvest management

### *Fishing season*

Past fishing experience has indicated that fishing season for tunas along east coast ranges from the middle of October to the end of March. However, there is likelihood for a change in the onset of the season by a fortnight or a month, depending on the onset of monsoon and other factors. The peak fishing season is during and just after the north east monsoon.

### *Bait*

Mackerels, milkfish, sardines and scad were found to be efficient baits for tuna longlining. The optimum size of bait should be 18-22 cm (total length). It should be fresh and of good quality, not crushed/ beheaded, with high level of shine. If live baits are used, the results are better.

### *Gear*

Experience has shown that imported long line gear are generally more durable and give better service life than indigenous gear.

### *Harvest operations*

Normally, the fishing season for large vessels based at the east coast starts from the beginning of October and continues up to the end of March. Sometimes it may end up by middle of February or extended up to middle of April. Once fishing season starts, all the group vessels (minimum of 5 vessels) will be fishing continuously. In regular turn one of the vessel or any vessel, which needs immediate repairs or maintenance will act as mother vessel i.e., collect materials from the other vessels and unload the materials either at Chennai or Visakhapatnam

depending upon the fishing ground. The tuna catch is not kept for more than seven days. In Chennai, the materials will be unloaded on the same day of export. At Visakhapatnam, the materials will be unloaded in the late evening (after sunset) to the insulated 1000 litre capacity special tubs with sufficient ice and lid closed airtight. The fish are unloaded at Chennai packing facility one day later early in the morning. During the peak season, the fishing is done twice by splitting the fishing operation both early in the morning and in the evening. If the catches are less between the lunar cycles, only one or two vessels of the group will do the fishing with reduced hooks, while the other vessels are allowed to drift.

## Post-harvest management

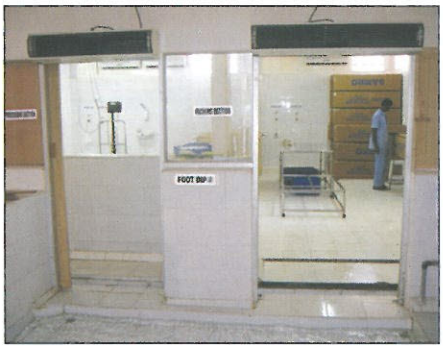
Vessel-wise catch details are communicated to the shore on a daily basis. At least, two or three days in advance to the day of export the space bookings are to be confirmed. Management need to be in constant touch with the air logistics for the confirmed space booking. The knowledge of market trends, auction market holidays and the days in a week where it will fetch a better price is a must. Normally late night flights with proper transit connection so as to reach the desired destination early in the morning are preferred. Hence, Chennai and Mumbai are the best places in India where frequent international flights with appropriate connection to Japan, Europe and USA are available. Views of production and packing of *sashimi* grade tuna and tuna loins are shown in Fig. 1a to 2 b.

## Onshore catch handling

The vessels arrive early on the day of export at Chennai fishing harbour. The fishes are unloaded in batches of 35-40 fishes to the insulated trucks with sufficient ice. On reaching the chilled tuna packing facility centre, fishes are unloaded quickly, and then graded, cleaned, weighed, mopped dry with a cloth and packed according to sizes in a seven ply carton with dry ice of around 2% of body weight. After packing, it is immediately loaded in the refrigerated truck which is maintained at -4°C. The refrigerated truck should reach at least six hours before the flight in the international cargo complex. After completing the Customs formalities, the consignment is unloaded, screened for security and paletted for easy handling, three hours before flight departure, and air-lifted. Proper care is to be taken at all points of loading and unloading. In case of missing connection at transit places like Singapore, Bangkok

Tuna being removed from RSW tank of the vessel

Loading to refrigerated truck



Processing area with foot dip before entry

Fish entry chute

Tuna kept for grading

Checking for quality

Fig. 1a Views of *sashimi* grade tuna processing

Grading

Graded tuna kept for cleaning

Removing unwanted parts

Cleaning with chilled water jet

Weighing prior to packing

On insulated table prior to packing

Fig. 1b Views of *sashimi* grade tuna processing

Preparation of packing box

Tuna placed in box

Placing dry ice

Sealing the box for export

Transfer to the cold storage

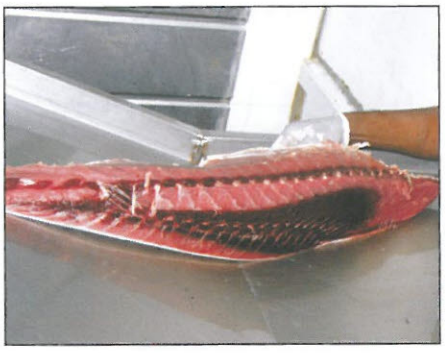
Transfer to the refrigerated truck

Fig. 1c Views of *sashimi* grade tuna processing

Removing of head

Tuna after removal of head

Removal of belly portion



Tuna loin

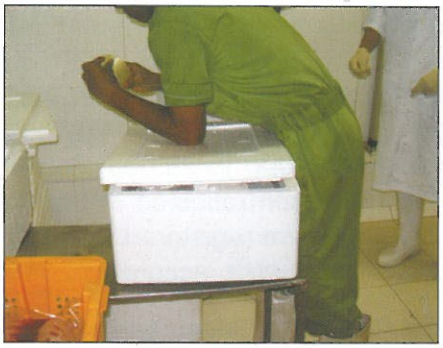
Removal of skin from tuna loin

Tuna loins ready for packing

Fig. 2a Views of production of tuna loins

Vacuum packing machine

Vacuum packed tuna in chilled water



Tuna loins being packed for export

**Fig. 2b Views of production of tuna loins**

or Hong Kong the goods are kept at -4°C refrigerated stores. In the event of late arrival at Japan or on a market holiday, the goods are stored in a cold room at -4°C. This process (in case of delay) will fetch 100 to 200 yen less on an average per kilogram in the sale. The *sashimi* whole tunas are sold in the auction markets of Japan mainly in Osaka, Tokyo and Nagoya. The chilled packing facility charges will be Rs. 30/ - to Rs. 35/- depending upon the quantity, for the services rendered from unloading of the fishes from the vessel to delivery of packed goods at the cargo complex including handling, grading and packing (material cost included). At present the normal air flight charges works out to be US$ 1.8-2.0 per kg. Buyer/agent normally deducts 15% as commission on the value of sale. This sales commission includes the import duty and transport from airport clearance to the auction market.

The chilled packing facility will hold the loins and canning grade materials separately during the process and dispatch the same to processors for further value addition after export consignment of *sashimi* tunas leaves the premises.

Due to lack of experience, the tuna industry could not gauge the early start of the season last year. Most of the vessels were under conversion stage and hence started late by end of November. In addition, the season ended very early. We were able to sustain the operation because of better quality management from the harvesting point to the auction centre, thereby realizing a better average price.

## Future prospects

It is noted that while Indian vessels either starts tuna operation late or stops operation early, the Taiwan, Srilankan and Indonesian tuna liners operating under the Letters of Permissions (LOP) from the Ministry of Agriculture operate for more than six months in the east coast both in the international waters and the Indian EEZ. The quantity of fish caught by these vessels is roughly 15,000 to 20,000 tonnes in a period of six months and the same is not seen reflected in the landings from Indian EEZ, as some of these vessels are registered with IOTC under a different flag and the catches are accounted accordingly.

The Indian National Centre for Ocean Information Service (INCOIS), an autonomous body under the Ministry of Earth Science (MoES), is known to have initiated steps to identify potential tuna fishing zones round the year, which will facilitate tuna fishing operation at the appropriate time. Focused research in this area will improve the efficiency of fishing efforts to a greater extent, by reducing the search time and also improving the hooking rate.

The MPEDA is known to have taken steps with Andaman and Nicobar administration to permit Indian vessels from mainland for tuna fishing beyond six nautical miles and relax other restrictions to boost the exports. Similar exercise is expected for the Lakshadweep also very shortly. It is high time MPEDA formulated new guidelines for *sashimi* whole or loins for EU markets and also gives a special status for tuna in the export incentives, at least on par with the shrimp exports. Ministry of Agriculture should also encourage Indian industry by issuing letter of registration (LOR), similar to LOP for the imported tuna vessels, which is pending for the past two years. It should also simplify procedures for the import of baits.

## Economics of operation of tuna longliners

Tuna fishing with longliner is the one of the deep sea fishing activity which involves high investment and effort. Information on economics of operation of tuna longliners is significant in the context of its emergence as a thrust area for development in India in recent years. It is expected that in the near future, oceanic tuna will contribute in a significant way in the seafood export earnings of India. Against this background, a case study on comparative economics of operation of small, medium and large tuna liners in operation in Indian waters was carried out based on the information related to fishing operations and cost and returns. Data on small and medium longliners were collected from operators in the west coast and that for large longliners from Chennai based vessels.

The general particulars about the tuna longliners are given in Table 1. The fish landed per crew member were worked out to be 313, 500 and 560 kg for small (42 ft $L_{OA}$), medium (65 ft $L_{OA}$) and large (76 ft $L_{OA}$) vessels. The catch rate was found to increase from small to large vessel depending upon the catch and number of fishermen involved.

**Table 1: General particulars of tuna longline operations**

| Particulars | Small | Medium | Large |
|---|---|---|---|
| Size of the vessel ($L_{OA}$, ft) | 42 | 65 | 76 |
| Engine horsepower | 110 | 120 | 402 |
| Speed (kn) | 6 | 7 | 9 |
| Fish holding capacity (t) | 8 | 30 | 20 |
| Fuel capacity (litre) | 2000 | 4000 | 40000 |
| Freshwater capacity (litre) | 5000 | 8000 | 15000 |
| Fishing days/trip | 10 | 23 | 12 |
| Crew (nos.) | 8 | 12 | 15 |
| Fish catch per trip (t) | 2.5 | 6.0 | 8.4 |
| Catch per crew member (kg) | 313 | 500 | 560 |

Results of analysis of economics of operation of small, medium and large tuna longliners are presented in Table 2. Tuna fishing is a capital intensive operation which needs high initial investment especially for purchase of craft and gear. The fixed cost for the fishing unit in three categories were Rs. 1.9 million, 3 million and 9.44 million respectively

**Table 2. Economics of operation of tuna longliners (Rs. million)**

| Particulars | Small vessel | Medium vessel | Large vessel |
|---|---|---|---|
| **Fixed capital** | | | |
| Craft and engine | 1.60 | 2.50 | 8.50 |
| Gear | 0.30 | 0.50 | 0.80 |
| Insurance | 0.00 | 0.00 | 0.14 |
| **Sub total** | **1.90** | **3.00** | **9.44** |
| **Variable cost** | | | |
| Fuel and lubricants | 0.86 | 0.77 | 4.10 |
| Wages, *bata* and crew incentives | 0.13 | 0.15 | 0.60 |
| Ration | 0.22 | 0.22 | 0.24 |
| Maintenance | 0.27 | 0.40 | 1.23 |
| Miscellaneous (including ice and water) | 0.28 | 0.52 | 1.01 |
| **Sub total** | **1.76** | **2.06** | **7.18** |
| **Total cost** | | | |
| Variable cost | 1.76 | 2.06 | 7.18 |
| Interest on fixed capital | 0.29 | 0.45 | 1.42 |
| Interest on variable cost | 0.14 | 0.15 | 0.54 |
| Depreciation | 0.38 | 0.60 | 0.75 |
| **Sub total** | **2.57** | **3.26** | **9.89** |
| **Gross Income** | **3.31** | **4.18** | **11.51** |
| **Net income** | **0.74** | **0.92** | **1.62** |

for small, medium and large longliners. Fuel cost was the major component in the variable cost. Expenditure on fuel was 47%, 35% and 58% of the total variable cost respectively for small, medium and large tuna longliners.

The break-even point is the indicator to evaluate the worth of an enterprise. It is the point where there is no loss or no profit. The break-even point for small, medium and large vessels were 52.18 t, 63.12 t and 65.54 t, respectively which was less than the actual catch per year (Table 3) indicating the profitability of the three category of tuna longliners. In any of the enterprise, the real profit is realized when the investment is recovered from the revenue generated. The pay-back

period determined for small, medium and large longliners were 2.5 years, 3.7 years and 5.8 years, respectively.

**Table 3. Break-even analysis**

| Type of vessel | Price per kg (Rs.) | Actual catch per year (t) | Break-even point (t) |
|---|---|---|---|
| Small vessel | 70 | 55 | 52.18 |
| Medium vessel | 70 | 66 | 63.12 |
| Large vessel | 160 | 84 | 65.54 |

## Conclusion

It was strongly evident that the marine resources available within 50 m depth are almost fully exploited. At this stage, tuna fishing is one of the potential options to meet the seafood export demand. Already effort has been put forth towards introducing new tuna longliners or conversion of the existing vessels into tuna longliner for operation in Indian waters. During XI Plan period, at least 800 fishing vessels are to be converted into tuna longliners and increase tuna exports to $500 million in diversifying India's marine export basket. The profitability of tuna longliner is clearly evident from this case study. As India has potential to become a major exporter of *sashimi* grade tuna and other value added product forms in the global market, technological facilitation for sustainable harvesting, processing, value addition and quality control of tuna and export promotion are required.