



# Assessment of Fish Demand and Consumption Behaviour in Manipur, India

N.K. Sonanla<sup>1</sup>, M. Rajakumar<sup>2</sup>, T. Umamaheswari<sup>3\*</sup>, N.V. Sujathkumar<sup>3</sup>, S. Athithan<sup>4</sup> and Wanglar Chimwar<sup>5</sup>

<sup>1</sup>Fisheries College and Research Institute, Thoothukudi 628008, India

<sup>2</sup> Directorate of Extension Education, Tamil Nadu Dr. J. Jayalalitha Fisheries University, Nagapattinam, India

<sup>3</sup>Department of Fisheries Extension, Economics and Statistics, Fisheries College and Research Institute, Thoothukudi-628008, India

<sup>4</sup>Department of Aquaculture, Fisheries College and Research Institute, Thoothukudi-628008, India

<sup>5</sup>Women Scientist Scheme, Central Agricultural University, Imphal, 795004, India

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## Authors' Contribution

NKS: Production of the first draft of the manuscript and gathering of source data. MR: Provides technical support and critical examination of research work. TU: Verified the findings and edited the manuscript. NVS, SA, and WC examined the paper and made helpful edits to the manuscript.

## Key words

Manipur, Fish demand and supply, Fish consumption behaviour, ARIMA Model, Conjoint analysis

## ABSTRACT

The current study was undertaken with the purpose of assessing the various criteria towards fish purchase and consumption behaviour, besides estimating the fish demand and supply of Manipur during the year 2022–2023. The study was conducted in six districts, including Churachandpur, Imphal East, Imphal West, Senapati, Thoubal, and Ukhrul, where the consumption of fish predominates. A pre-tested interview schedule was used to conduct in-person interviews with 450 fish consumers, who provided the first-hand data. The outcome showed that product and promotion were the key elements in fish purchase decisions. It is observed that total fish demand in Manipur will increase in the upcoming 10 years with the total fish requirement of 99,367.74 metric tonnes. The important factors affecting decisions to purchase fish and fishery products were product, followed by promotion, fish type, and the lowest importance to fish price.

## INTRODUCTION

Fish consumption in the state of Manipur has been increasing gradually among the different ethnic communities for different reasons. With the passage of time, behavioral patterns and preferences for food choice have changed drastically, and consumption of fish is growing at a considerable scale, especially in the hills and traditionally high in the valleys, whereas, the overall fish consumption per capita in the valley is relatively much higher than in the hills. For the people of Manipuri's, fish marks the most special and integral part of their cuisine, which comprises rice, fish, vegetables, etc. Not only for consumption, Manipuri's, widely used fish while performing rituals and other cultural practices. Demand for fish has been

traditionally high as it is the staple food that is loved by all. Fish delicacies are always served as the main course of all community feasts and social functions. All sizes and varieties of fish are found in the market in the form of live, dry, processed, fermented, etc., all over the corner within the length and breadth of Manipur. Of all the varieties of fish, rohu, common carp, snakehead murrels, loaches, gourami, and freshwater sharks are the main features in the state of Manipur. The people cook in different styles and patterns, which give them different tastes and fragrances. Fish cooking features like Atoiba (smash curry), Ataoba (fried), Arouba (roasted), Ametba, Kangshoi (vegetables boiled with dry fish as an add-on), etc. are popularly known as Manipuri's delicacies liked by all. Rice Hotel in and around Polo Ground and Luxmi Kitchen in Imphal are the most popular food corners serving different fish items and are frequented by all groups of people living in the state of Manipur. Tourists and visitors coming from abroad, including eminent national political leaders, people from different walks of life, leading national journalists, and the anchor of India, enjoy the fish delicacies of Imphal. Fermentation of fish Ngari (local name), which is the produce of Manipuris is one of the popular aromas of Manipur and is widely used in every household within and beyond Manipur.

\* Corresponding author: [umamaheshwari@tnfu.ac.in](mailto:umamaheshwari@tnfu.ac.in)  
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As such, Manipuri's are also rich in traditional knowledge about fish in all aspects. In one of their myths, there was a popular saying that is still prevailing in society: Rirah rirahga phajabasi Nga khakdani, meaning "the older the prettier the fish. This myth clearly indicates that they have an in-depth social and economic association with fish. Age-old practices like community fishing are one inherent cultural event of Manipuri's community that has been practiced till today with pomp and gaiety by young and old, and they also boost the social, economic, and food security of the society. In short, it may be mentioned that the preparation of Manipuri cuisine starts and ends with fish. Fish items are one of the common preferences of the various communities living in the Imphal capital of the state of Manipur. Thus, the consumption and corresponding demand for fish are ever increasing. In the wake of growing demand, hygienic fish stalls and checking of fish quality in the market have become indispensable to ensure safety and healthy consumption of fish for the denizens of the state. With the passage of time, along with the development of communications, education also played a significant role in determining food choices and preferences. As such, the fish-eating population has considerably increased. Apart from live fish, fermented, smoked, frozen, refrigerated and dry fish were consumed by the people of Manipur. In Manipur, Ching-ngah (fish from the hills) is also largely regarded as one of the most organic and nutritive fish in the state. A dry fish, especially from Chatric village, Ukhrul District, Manipur, popularly called "Chatric Khai" (Chatric fish), is widely recognized and demanded in Ukhrul district, Imphal capital, and beyond. Ironically, Chatric village is also one of the hotspots for cold-water fish in the state of Manipur. Moreover, it is noteworthy that hills stations are hotspots of biodiversity and a hub of organic fish, having a huge potential to supply the entire state and can contribute significantly to the food security of the state if attention is given by the state authorities. As a matter of fact, the advancement of medical sciences that gives awareness and realization on the nutritive values and health benefits of fish vis-à-vis a modern culture of health consciousness has a significant impact on household consumption, resulting in boosting fish consumption in today's society. Likewise, the demand and supply of fish in the state is escalating at a good pace, and the installation of a proper fish market may be earmarked along with different types of awareness programs in the towns and cities of Manipur.

## MATERIALS AND METHODS

### *Percentage analysis and frequency distribution*

Percentage analysis and frequency distribution were attempted to analyse the month-wise preference, place

of preference, day of preference, seasonal preference, knowledge level on the nutritive value of fish, fish consumption practices, fish spoilage, criteria of regular fish consumption, decisions for purchase of fish, purchase of fish and consumers preference.

### *ARIMA model of forecasting*

The ARIMA models combine Autoregressive (AR), Integrated (I) and Moving Average (MA) models. When it comes to forecasting relatively steady time series data, ARIMA models are very accurate. It predicts future trends by integrating the past data and giving them an autoregressive component. This is done by taking the previous value of a measure and multiplying it with certain parameters to calculate how much it should move from its current value. It is important to remember that seasonal trends are varied and difficult to analyse. The aim of analysis based on ARIMA is to develop a model which properly explains the patterns existing in past and future and are that of a time series, which implies that the methods used to estimate the ARIMA model are designed to deduce the suitable metrics. Time series analysis benefits from decomposition and fish requirement data of the last 10 years (2012-13 to 2021-22) was taken for series decomposition.

### *Conjoint analysis- model specification*

Conjoint analysis was employed based on main effects analysis of variance model used for identifying the factors influencing product-wise fish purchase decisions. Subject provides data about their preference by hypothetical products defined by attribute combinations. Conjoint analysis decomposes judgement data into components, based on qualitative attributes of the products. Each degree of each attribute has a part-worth-utility value determined for it. The most desired levels are designated for large part utilities, while the least preferred levels are designated for tiny part utilities. The most significant factor in predicting preference is thought to be the characteristic with the widest part-worth utility range. When all the attributes are nominal, the metric conjoint analysis has simple main effect ANOVA with some specialized output. The attributes are the important variables, the judgement comprise the dependent variable, and the part worth utilities are the  $\beta$ 's, the parameter estimates from the ANOVA model.

By evaluating the respondent's rating for the combined attributes for the product, the individual preference scores for each attribute can be deduced that would have provided the overall evaluation. The attributes and their levels are selected based on the pilot survey conducted. A total of six attributes with 16 levels for factors affecting decisions to purchase fish and fishery products were derived. The

required combination would be 324 (4 attributes with 3 levels X 2 attributes with 2 levels) for factors affecting the decisions to purchase fish and fishery products.

$$U(X) = \sum_{i=1}^m \sum_{j=1}^{k_i} \alpha_{ij} x_{ij}$$

Where  $U(X)$  is Overall utility of fish/fishery product,  $k_i$  is number levels of attribute  $I$ ,  $m$  is number of attributes,  $\alpha_{ij}$  is part-worth or utility of level of attribute,  $x_{ij}$  is level of attribute or feature.

The conjoint method employs a fractional factorial design, which uses only a suitable subset of all possible product profiles in the rating experiment. The subset is called as orthogonal array and was worked out using IBM SPSS version 29.0.1 to reduce that number of combinations to 16 excluding 5 hold-outs for factors affecting decisions to purchase fish and fishery products.

## RESULTS AND DISCUSSION

The data gathered from the fish consumers in Manipur were tabulated and analysed as per the envisaged objectives of the study and the findings are as follows:

The demand and supply of fish from both internal and external sources for the period from 2012–2022 was collected from the respective departments of Manipur state. The results showed that fish production increases annually, but the 2017–18 fiscal year indicated a drop (505 metric tonnes) in fish production. Comparing 2013–14 to previous years, there was a notable rise in fish production (4039 metric tonnes) and during the year 2021–22, the highest production with 33,123 metric tonnes has been recorded. Likewise, the requirement also increases every year. In the year 2019–20, the requirement for fish was recorded highest with 59,410 metric tonnes. It is observed that the demand for fish is rising rapidly when compared to the slow increase of fish production over the years (Fig. 1). This indicated that the respective department authorities should make a special effort to raise production to satisfy consumer demand and eliminate the state's reliance on other states. The estimated demand and supply of fish in Manipur over the last ten years accounted for 4.66 lakh metric tonnes and 3.10 lakh metric tonnes, respectively.

Using Auto Regressive Integrated Moving Average (ARIMA) ( $p, d, q$ ) model, the demand forecast for fish was estimated for the next ten years with the collected annual fish demand data. The curve of the histogram indicates that the data fits the model very well (Fig. 2). The coefficient of the autoregressive term was found statistically significant ( $p < 0.05$ ) and the model parameter ranged from 0–2. Among the nine combinations, model 1,1,0 had less BIC values (15.512) with an R-square of 0.784 which shows

that the ARIMA (1,1,0) model fits the best for demand forecasting of fish.

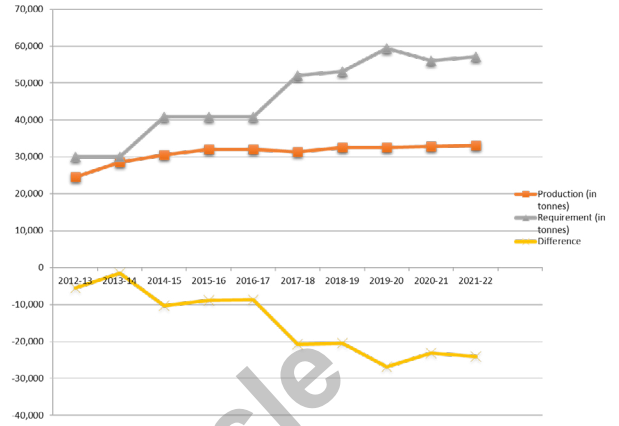


Fig. 1. Status of demand and supply of fish in Manipur State (2012–2022).

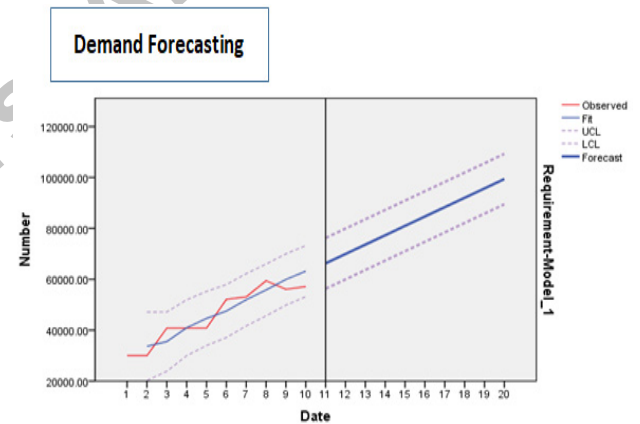


Fig. 2. Forecast of fish demand for Manipur State.

The fish demand forecasting has become a crucial problem that needs efficient and supportive tools. Forecasting the demand for fish requirements will help in assessing and increasing fish production. The ARIMA model fits the data points comparatively better. Table I shows the forecast values of fish demand in the upcoming ten years in Manipur state. The forecast values are observed within 80,000 to 1,00,000 confidence limits. Moreover, the trends of fish demand using the ARIMA (1,1,0) model for the data set are shown in Figure 2. It is observed that total fish demand in Manipur will increase in the upcoming 10 years. The fish requirement for the year 2033 will be 99367.74 metric tonnes. Since the population of Manipur is still expanding, more sophisticated techniques for producing fish must be concentrated to fulfill future demand.

**Table I. Fish demand forecast value for the next ten years (2023-2033).**

Year	Requirement (Metric Tonnes)
2023-24	66,257.83
2024-25	69,936.71
2025-26	73,615.59
2026-27	77,294.47
2027-28	80,973.34
2028-29	84,652.22
2029-30	88,331.10
2030-31	92,999.98
2031-32	95,688.86
2032-33	99,367.74

#### *Factors affecting fish purchase decisions–Conjoint analysis*

The part-worth utilities of all the levels of attributes of factors affecting decisions to purchase fish and fishery products are given in the Table II. It is seen that the levels for prawn and crab had lesser utility than the other two levels of attribute fish type and the level fin fish has higher utility than the other two levels of attribute of fish type.

**Table II. Part worth utilities of attribute of factors affecting decisions to purchase fish and fishery products.**

S. No.	Attributes	Levels	Utilities	Std. error
1	Fish type	Fin fish	0.251	0.618
2		Prawn and Crab	-0.475	0.725
3		Other shellfish	0.223	0.725
4	Product	Taste	0.273	0.618
5		Freshness	-0.893	0.725
6		Quality	0.620	0.725
7	Price	Perceive price	0.531	0.464
8		cheap	-0.531	0.464
9	Market	Cleanliness	0.063	0.618
10		Convenience	-0.391	0.725
11		Parking space	0.328	0.725
12	Promotion	Discount	0.612	0.618
13		Introductory	-0.007	0.725
14		Nutrition	-0.605	0.725
15	Others	Health concern	0.066	0.464
16		Festival	-0.066	0.464

The quality level of the attribute product has higher utility than the other two levels of the attribute product and the level of freshness has lesser utility than the other two attribute products. The perceived price level of the attribute price had positive utility and hence it had higher utility in the attribute. Convenience had negative utility and the highest utility was found to be the parking space of the attribute market. Discount had positive utility and the other two levels had negative utility in the attribute promotion. While health conditions had a positive utility, the festival had negative utility in the attribute others which mean that there exists a high preference due to health concerns.

The average importance of attributes is given in the Figure 3. The most important factors affecting decisions to purchase fish and fishery products were product (21.00%), followed by promotion (19.00%), fish type (18.00%), and the lowest importance to fish price (12.00%).

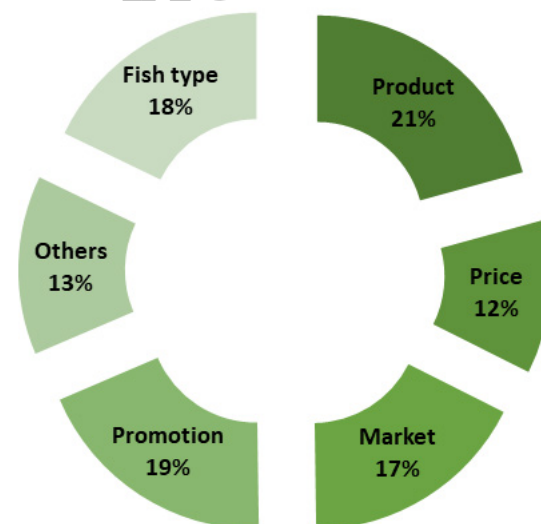


Fig. 3. Average importance of factors (Attributes).

#### *Consumer preference and usage pattern of fish consumption*

The results revealed that the consumers preferred to consume fish regularly in January since about 73.56% of the fish consumers had chosen followed by July as about 68.67% of the consumers had chosen and 67.78% preferred to consume fish regularly in April. It is recorded that 51.78% consume occasionally in September followed by December (50.22%) and August (48.89%). In May and November, 4.00% of each never consumed fish followed by September (3.78%) and June (3.56%). It is noted that a maximum of them consume fish regularly.

The average share of fish consumers who had their food at home was 99.33% across the study area (Table III). The mean percentage of the respondents who ate fish

at a restaurant was 0.67%. It is stated that none of them desire to eat fish at mobile stalls or elsewhere. Fish is most frequently consumed on Sunday (29.33%), followed by Saturday (27.33%), Tuesday (10.45%), Wednesday (10.00%), Friday (9.78%), Thursday (6.89%) and Monday (6.22%). According to the preferences for eating fish, 71.56% of fish consumers had no preference, 15.33% wanted to eat fish in the summer, 7.78% preferred to eat fish in the winter, and the remaining 5.33% chose to eat fish in the rainy season. It was observed that the nutritional value of fish was known to 74.89% of the consumers, while it was unknown to 25.11% of the consumers. The report of Ergonul (2011) conveys that while 71.00% of the respondents opined fish as healthier than poultry meat and red meat, about 19.00% of the people preferred poultry meat as healthy and 10.00% as red meat. It was also stated that 86.00% of the respondents knew the health benefits of fish consumption and 14.00% didn't know the fish health benefits.

**Table III. Fish consumption practices.**

Particulars	Categories	Overall (n=450)
Place of preference to consume fish the most	Home	447 (99.33)
	Restaurants	3 (0.67)
	Mobile stalls	0 (0)
	Others	0 (0)
Day of preference	Sunday	132 (29.33)
	Monday	28 (6.22)
	Tuesday	47 (10.45)
	Wednesday	45 (10.00)
	Thursday	31 (6.89)
	Friday	44 (9.78)
	Saturday	123 (27.33)
Preference of season	Rainy	24 (5.33)
	Winter	35 (7.78)
	Summer	69 (15.33)
	No preference	322 (71.56)
Knowledge about the nutritive value of fish	Yes	337 (74.89)
	No	113 (25.11)
Regular consumption of fish	Good for health	318 (70.67)
	Not good for health	0 (0)
	Can't say	132 (29.33)

Note: Figures in parentheses indicate percentage.

Mallappa *et al.* (2023) attempted to assess the knowledge gap of fish eaters regarding the health and

nutritional benefits, along with identifying the factors that directly and indirectly influence the knowledge level of fish consumers in Gujarat. The results revealed that fish consumers were found to have insufficient knowledge about health and nutritional benefits, which stalled the growth of fish consumption in the region. The significant factors influencing the knowledge level of fish consumers were educational qualification, fish quality evaluation criteria, number of children in a family, years of fish consumption and family size. The consumers were found to place greater emphasis on the fish quality evaluation parameters such as smell, appearance, nutritional value, product price and freshness. The study's outcome suggested that mass awareness programs should be planned to achieve higher levels of fish consumption in the region and the country.

It was found that all the consumers (100%) preferred to eat fish as an adjunct in any form at lunch or dinner and both lunch and dinner. They also opted for fish curry and fish fries the next day after keeping them in the refrigerator. Additionally, it has been shown that 10.22% of fish consumers favoured to eat fish even if it had been stored in the refrigerator for longer than two days, 3.11% of fish consumers prefer to eat fish cutlet, 2.44% prefer to eat just on the day of preparation. None of them would not cook fish at home but like to eat outside. Devadawson *et al.* (2015) studied the socio-demographic factors and fish-eating trends in eastern community, Sri Lanka and stated that 19.1% of the people had consumed fish daily, while 80.9% of people had consumed fish weekly or monthly. Also stated that, 64% of the studied respondents had fish at both lunch and dinner time, while 25% had three times and the rest 11% consumed only at lunch.

According to the information provided by the consumers about the assessment of fish spoilage, 40.89% of the respondents determined that the fish had spoiled based on colour, followed by smell (26.89%), taste (4.89%), and other factors (27.33%) such as the softness of the muscles and overall freshness. Fish is recommended for frequent eating for health reasons, according to the majority of the consumers (70.67%), and 29.33% of the respondents didn't respond. Nobody among the consumers stated that it was bad for their health. The husband was the one who decided to buy the fish (54.89%), followed by the children (25.55%) and the wife (19.56%). The majority of fish purchases were made by the husband (65.11%), followed by the wife (21.78%), and others (13.11%), according to the consumers. Das *et al.* (2013) conducted a research on fish consumers' behaviour at selected fish markets of Tripura, India. Purchasing of fish was done mainly by the male members of the family (86.87%) which is similar to the fish purchase of Manipur. The majority of consumers (98.67%) chose to buy fish, and the remaining consumers

(1.33%) liked to buy prawns to some degree. Mugaonkar *et al.* (2011) reported that about 84% of the respondents bought fish munch followed by prawn masala (78%), fish keema (72%) and prawn pickle (64%) by the respondents.

## CONCLUSIONS AND RECOMMENDATIONS

Fishery products particularly fish cutlets shall be introduced as a measure of promotion activity since this product is not well known and popular among the people, particularly in Churachandpur, Ukhrul, and Senapati districts.

Demand and supply of fish in the state are escalating at a good pace, and the installation of a proper fish market may be earmarked, coupled with different types of awareness programs.

The fish demand in the state is increasing more rapidly than the supply every year, which clearly indicates that special intervention by the respective department is highly required to meet the demand of the people. Also, the state shall eliminate its reliance on other states.

Hill stations are hotspots of biodiversity and a hub of organic fish with a huge potential for supplying the entire state, which can contribute significantly to the food security of the state if attention is given by the state authorities.

In the wake of growing demand, hygienic fish stalls and checking of fish quality in the market have become indispensable to ensuring the safety and healthy consumption of fish for the denizens of the state.

All stakeholders (including the government, processors, and traders) should strive to put in place mechanisms to improve transport and distribution systems that will provide consumers with the best quality fish and encourage policy reforms to help reduce fish price volatility.

Improper fish marketing and delivery systems, and huge compromises in terms of setting the norms for the health and hygiene of the wet markets, the quality of water to be used, the disposal of fish waste, and the health of fish handlers.

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### Ethical statement

The authors declared that no live specimens have been used in this study.

### Statement of conflict of interest

The authors have declared no conflict of interest.

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