SUPPLY CHAIN ANALYSIS OF MARINE FISHES IN KARNATAKA, INDIA

Thesis submitted in part fulfillment of the requirements for the degree of Doctor of Philosophy in Fisheries Economics to the Tamil Nadu Fisheries University, Nagapattinam

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2015

CERTIFICATE

This is to certify that the thesis entitled, "**SUPPLY CHAIN ANALYSIS OF MARINE FISHES IN KARNATAKA, INDIA**", submitted in part fulfillment of the requirements for the award of the degree of **Doctor of Philosophy** in Fisheries Economics to the Tamil Nadu Fisheries University, Nagapattinam is a record of bonafide research work carried out by **Mr. Viswanatha, B. S.** under my supervision and guidance and that no part of this thesis has been submitted for the award of any other degree, diploma, fellowship or other similar titles or prizes and that the work has not been published in part or full in any scientific or popular journal or magazine.

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To my beloved

Parents
Sister Vanitha Family
&
Friend Spoorthi, T.

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INTRODUCTION

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ABSTRACT

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ABSTRACT

Title	**:**	**Supply Chain Analysis of Marine Fishes in Karnataka, India**
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Degree	**:**	**Ph.D. (Fisheries Economics)**
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University	**:**	**Tamil Nadu Fisheries University**

The present study was undertaken to study the supply chain system for the marine fishes in Karnataka state. The objectives include identifying the emerging marine fish supply chains and its marketing efficiency, analysis of the seasonal price fluctuations of marine fishes, assessment of the existing market and marketing infrastructure of the selected fish markets, compare the consumer preferences for marine fishes across the selected coastal and non-coastal cities, and quantifying the constraints and recommend policy interventions for improving the marine fish supply chains. The sample size of the present study was fixed as 550 covering 201 consumers from the coastal cities and 199 consumers from the non-coastal cities, about 41 fishermen, 16 auctioneers, 16 wholesalers, 19 retailers, 46 vendors and 12 supermarkets from the coastal cities. Pre-tested comprehensive survey schedules were used for primary data collection from the fishermen, supply chain intermediaries, and the consumers. The simple random sampling method and the personal interview technique were used for primary data collection from the respondents. The marine

fish supply chains of commercially important marine fishes such as Anchovy, Black Pomfret, White Pomfret, Cat fish, Crab, Mackerel, Pink Perch, Sardine, Seer fish and Shrimp were considered for assessing the marketing efficiency. The seasonal price fluctuations of marine fishes in the selected fish markets were also studied during the period 2012-2013 and 2013-2014. The marketing infrastructure of the fish markets was studied by collecting the responses from the supply chain intermediaries. The consumer preferences for marine fish were compared across the coastal and non-coastal cities and also the identification of constraints along the marine fish supply chains were reported.

The overall average price spread was the lowest for the marine fish supply chain 1: Fishermen - Auctioneers - Wholesalers - Retailers - Consumers in Mangaluru (32.59 ₹/kg), supply chain 2: Fishermen - Auctioneers - Retailers - Consumers in Malpe (27.92 ₹/kg) and supply chain 4: Fishermen - Auctioneers - Vendors - Consumers in Karwar (27.53 ₹/kg). The overall average fishermen's share in consumer rupee was the highest for the supply chain 1: Fishermen - Auctioneers - Wholesalers - Retailers - Consumers in Mangaluru (80.40%), supply chain 2: Fishermen - Auctioneers - Retailers - Consumers in Malpe (84.45%) and Karwar (83.82%). The overall average marketing efficiency of supply chain 2: Fishermen - Auctioneers - Retailers - Consumers was the highest in Mangaluru (6.11), Malpe (7.42) and Karwar (9.36).

The seasonal price fluctuations of high value marine fishes was at its peak during August-January and the lowest during February-July for the medium value

fishes, more price fluctuations during June-September and the lowest during October-May. The maximum price fluctuations were occurred during June-September and minimum during February -May during the period 2012-13 for the low value fishes. The highest Coefficient of Variation (CV) for marine fishes was observed during the months of April-June 2014 in Mangaluru and Malpe while during October 2013 in Karwar fish landing centre. The maximum CV was found for the marine fishes in January 2014 (178.97%), July 2014 (74.91%), August 2013 (75.96%) and May 2014 (67.15%) in the retail fish markets of Mangaluru, Malpe, Karwar and Bengaluru fish markets. However the highest CV was observed in December 2013 (168.26%), June 2014 (88.22%) and October 2014 (79.05%) in the terminal fish markets of Mangaluru, Malpe and Karwar respectively.

The auctioneers had given the highest infrastructure availability index for ice plants availability in Mangaluru and Malpe, cold storage facilities in Karwar the wholesalers had given the infrastructure index for insulated vehicles in Mangaluru, cold storages facilities in Malpe and ice plants availability in Karwar. The retailers were responded for ice plants availability in Mangaluru while in the case of Malpe and Udupi, market infrastructure availability was not satisfactory. The fish vendors had given poor status for market infrastructure availability in Karwar fish market. The adoption of hygienic practices among the stakeholders of marine fish supply chains revealed that the fish vendors were less adopted the hygienic practices in all the fish markets of study.

The consumer preferences for marine fishes revealed that quality, freshness and the taste of fish was the important factors influenced the purchasing decision of the consumer in the coastal cities while the quality, taste and health aspects were the deciding factors for fish purchase in the non-coastal cities. The variety of fish was a key attribute as per the responses of consumers in Mangaluru, Udupi, Bengaluru and Dharwad cities while the place of purchase was the important attribute for marine fish marketing in Karwar and Mysuru.

The major constraints faced by the fishermen in Mangaluru was the declining fish catch, while high operational costs and declining fish catch in case of Malpe and Karwar fishing harbours. The wholesalers expressed the constraint of high transportation costs while the market information of the fish prices on daily basis in the coastal cities was the major constraint as expressed by the retailers, fish vendors and owners of supermarkets. The non-availability of fresh fish was the major problem in the non-coastal cities like Bengaluru.

The study recommended further research for assessing the efficiency of inter-state and export supply chains for marine fish and the value added fishery products for exploring the better opportunities and enhancing the competitiveness among the stakeholders of marine fish supply chains.

CHAPTER 1

INTRODUCTION

1.1. An overview of Indian marine fisheries

The marine fisheries is one of the important common property resources generate wide variety of economic benefits to the society. In India, fishing has been a commercial occupation and the basis of fishermen communities and is considered as an important component of the country's agricultural sector. Fisheries is one of the fastest growing food production sectors in India and also world over. India ranks third in total fish production and second in inland fish production with total production of 9.58 mt in which 3.44 mt contributed from marine fisheries and remaining 6.14 mt from the inland fisheries during 2013-14. The contribution of the fisheries sector to the country Gross Domestic Product (GDP) at current prices rose to ₹ 78,053 crores which is 0.83% of the total GDP and 4.65% of the total agriculture GDP during 2013-14 (GOI, 2014). Fisheries sector has witnessed an impressive growth from a subsistence traditional activity to a well-developed commercial and diversified enterprise. It has been playing a pivotal role in the economic development by virtue of its potential contribution to employment generation, income augmentation, addressing food and nutritional security concerns and foreign exchange earnings (Sabat, 2008).

The markets that function efficiently are necessary to drive growth, employment and economic prosperity in the rural areas where fisheries and aquaculture activities are concentrated. Ideally the production and market needs should match but this is not the case in fisheries and aquaculture (Chatson, 1987).

The price of fish fluctuates far higher than any other agricultural commodity. The price changes due to the changes in supply besides due to the prices of other marine fish varieties in the market and uncertain nature of fish production and perishability. The price of fish is determined by the interaction of demand and supply at both the producing centres and the consuming markets (Sathiadhas and Narayanakumar, 1994).

The fish production and the income generated from marine capture fisheries increased substantially over the years, but the coastal rural fisherfolk could not get much of the benefits of the economic development taken place in India since independence. Effective distribution and efficient marketing of perishable fish is inevitably essential to ensure remunerative price and enable the fishermen to earn higher income. There is no proper grading, weighing, and quality control at any level of domestic fish marketing. Marine fish marketing in India is characterized by monopsony and oligopsony conditions and hence the fishermen are unable to get maximum advantage of high price prevalent in the consumer markets (Sathiadhas, 1998).

Fisheries sector has emerged as an important commercial activity during 1980's from its subsistence, supplementary status and the economic importance of the sector would be realized in terms of animal protein for human consumption, income and employment, and foreign exchange earnings (Bhatta, 2000). The existing fishery infrastructure for marine fish marketing was classified into physical infrastructural facilities in primary markets and infrastructural facilities in the distribution system. The fishery infrastructure for handling and processing

in India includes freezing plants, canning plants, ice plants, fishmeal plants, pre-processing centers and cold storage (Sathiadhas *et al.*, 2000).

The fish marketing plays a pivotal role not only in making available the produce to the consumer but also stimulating further production and consumption leading ultimately to the overall economic development of the sector (Rao, 2000). However, the domestic fish markets in India are highly unorganized and marketing system is inefficient. Market access to the producers as well as the consumers by creating a value chain and organizing trade in fish and fishery products with emphasis on quality, hygiene and public health is very much important (Ravindranath, 2008).

The enhanced fish production leads to the problems related to marketing, processing and hence there is need to do supply chain analysis for sustainable growth of the sector. The supply chain includes all the links both physical and financial flows from the point of production to the end-user or final consumer. The number of intermediaries and fish supply chains of distribution varies from region to region, district to district and state to state. Depending on the distance of the markets and type of consumers, i.e. individual or institutional, the number of intermediaries varies (Viswanatha, 2009).

Thus the domestic fish marketing system in India is neither efficient nor modern and it is mainly carried out by the private traders with a large number of intermediaries between producer and consumer, thereby reducing the producer's share in consumer's rupee. Physical facilities and infrastructure in all types of fish markets are far from satisfactory (FAO, 2008).

1.2. An overview of Karnataka marine fisheries

The marine fishery is one of the major occupations of the coastal Karnataka. Out of the total 30 districts in Karnataka, it has only three coastal districts viz. Dakshina Kannada, Udupi and Uttara Kannada. The total length of coastline is 300 km out of which 42 km in Dakshina Kannada, 98 km in Udupi and 160 km in Uttara Kannada districts. The standard of living was found with the low levels of income, inadequacy of infrastructural facilities and basic amenities and high risk nature of occupation itself (Munireddy and Mohan, 2008b).

The total fish production in the state was 5.46 lakh mt in which 1.99 lakh metric tonnes from inland sector and 5.26 lakh metric tonnes contributed by marine sector during 2012-13. Traditionally, Karnataka coast is known as "mackerel coast". The state has 300 km of coastline and 27,000 sq. km of continental shelf area which has rich pelagic fisheries resources. The state has Exclusive Economic Zone (EEZ) of 87,000 sq. km. The marine fisheries resource potential of the state is estimated at 4.25 lakh metric tonnes of which 2.25 lakh metric tonnes are from inshore zone up to a depth of 70 m and the remaining 2.0 lakh metric tonnes are from the offshore/deep sea zone (Gowda, 2013).

In Karnataka, there are five major fishing harbours and 25 fish landing centers and 198 fish markets. Mangaluru is the main fishing and marketing centre which contributes about 30-40% of the state's marine fish landings. Fish from Mangaluru goes to Kochi, Chennai, Bengaluru and Mumbai. Mackerel and oil sardine occupy the major share of the catch among the different fish species landed and distributed in the domestic market accounting for 70% of the total marine fish production of the state. The major fish landing centers of the state are

Mangaluru, Malpe and Karwar. The major retail fish markets are Mangaluru, Udupi, Karwar and Russel fish market in Bengaluru. Among the fisherfolk in the state, 45,699 are engaged in fishery allied activities, 1,927 males and 12,400 females are involved in fish marketing in Karnataka. Another 3,342 persons are engaged in curing/processing and 581 persons in peeling activities (Sathiadhas *et al*., 2012).

Fish is highly perishable commodity hence it has to be marketed as quickly as possible without losing its quality and marketing efficiency. The unique features of fish and fishery products are that landing centers are located in remote areas and scattered all along the coastline. Fishermen themselves cannot perform fishing, processing, marketing and hence they are mainly depending upon different supply chains to sell their fish catch at the landing centers. If supply chains are inefficient and wanted higher margins that would reflect in higher price of fish, which eventually fall on the end-user or consumer (Munireddy and Mohan, 2008b).

Considering the above research problems and the research gaps such as lack of studies on emerging fish supply chains and its efficiency in the state, inadequate research on prices of marine fishes in the different emerging supply chains, the scanty information about market and marketing infrastructure of fish markets, lack of market research on consumer preferences for fish and the constraints in the different emerging fish supply chains are to be thoroughly studied. The information pertaining to supply chain analysis of marine fishes in Karnataka state is rather vague and scanty. Therefore, a detailed study of supply

chain analysis of marine fishes has been attempted considering its vast potential and high revenue sharing among the stakeholders of marine fish supply chains.

1.3. Objectives of the Study

The present study on "Supply Chain Analysis of Marine Fishes in Karnataka, India" has been carried out with the following objectives.

i) to identify the emerging supply chains and marketing efficiency and its impact on fishermen and consumers

ii) to analyze the seasonal price fluctuations of the most preferred marine fishes in the selected fish markets

iii) to assess the existing market and marketing infrastructure of selected fish markets

iv) to compare the consumer preferences for marine fishes across the coastal and non-coastal cities and

v) to identify the constraints and recommend policy interventions for improving the marine fish supply chains

1.4. Scope of the Study

This research provides a comprehensive supply chain analysis of marine fishes with special reference to Karnataka state. The thesis starts with the conceptual framework of the supply chain system for fish focusing on coastal fisheries in Karnataka state. The results of the study would provide useful information on the efficiency of emerging marine fish supply chains in terms of fishermen share in the consumer's rupee, price spread, marketing costs and gross marketing margins. The study would also cover seasonal price fluctuations of commercially important marine fish varieties of the major fish landing centers,

wholesale markets, retail markets and terminal markets in the state. The availability of market and marketing infrastructure and the upgradation requirements was also elaborately reported. The market research on consumer preferences for fish was carried out across the major coastal and non-coastal cities of the state. In addition, the constraints encountered at the various stakeholders of marine fish supply chains were also documented. The results of the study would be of immense help in analyzing the marine fish supply chains, existing marketing practices and suggesting measures for efficient supply chain system for marine fish. The study is expected to generate voluminous data of marine fish supply chains, a host of publications, institutional and technical capacity building and set of policies for improving the efficiency of marine fish supply chains.

1.5. Limitations of the study

The sample of the study was confined to the selected major fishing harbours, coastal cities (Mangaluru, Udupi and Karwar) and non-coastal cities (Bengaluru, Mysuru and Dharwad) of Karnataka due to lack of time and logistical constraints. Further, the studies covering a larger geographic area with more sample size are necessary. The respondents of the survey such as fishermen, supply chain intermediaries and consumers usually do not maintain records of their harvest, price, income and expenditure etc. Hence the primary data collected for the study was based on the memory of the respondents through personnel interview method, and cross checking of information provided by the respondents was done to minimize bias.

1.6. Organization of the study

Chapter 1: Introduction-Overview, objectives, scope and limitations

Chapter 2: Concepts and Review-Concepts used in the study and review of earlier studies.

Chapter 3: Design of the study-Methodology and tools of analysis used

Chapter 4: Description of the study area-A profile of the study area

Chapter 5: Results and Discussions-Presentation of the results followed by a brief discussion

Chapter 6: Summary and Conclusion: Summary of the study along with conclusion and policy implications

Chapter 7: References: List of references of the study

CHAPTER 2

CONCEPTS AND REVIEW OF LITERATURE

The concepts used in the present study are described first along with a short review of earlier studies.

2.1. Concepts

2.1.1. Supply chain

Christopher (1992) explained that supply chain is a network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate customer.

Zigiaris (2000) defined that supply chain encompasses all of those activities associated with moving goods from the raw-materials stage through to the end users.

According to Thorpe and Elizabeth (2004), fish supply chain is a set of inter dependent agents (fishers, processors, and distributors) that work together, consciously or unconsciously, to deliver the fish to the eventual consumer.

A supply chain has three key parts which includes supplying raw materials to manufacturing units, manufacturing raw materials into semi-finished or finished products and distribution to ensure products reach consumers (Desilva, 2011).

A supply chain is a network of product-related business enterprises through which products move from the point of production to consumption, including pre-production and post-consumption activities. Supply chains are mostly concerned with costs and how long it takes to present the product for sale (NORAD, 2013).

In the present study, fish supply chain is defined as the flow of marine fish from the point of production to the ultimate consumer or end user through various market intermediaries such as auctioneer, wholesaler, retailer, vendors, department stores and supermarkets. Supply chain includes the various accrued costs and margins during the process of supply of fish.

2.1.2. Fish market

Reddy *et al*., (2004) defined the market as a place where goods and services are exchanged. Fish market consists of buyers and sellers with facilities to communicate each other for transactions of goods and services.

In the present study, fish market is defined as a place where fish is exchanged among the buyers and sellers with some basic facilities to communicate to each other for smooth functioning of fish marketing.

2.1.3. Supply chain intermediaries

Fish passes through several intermediaries from the marine fish landing center or fish pond to the consumer. The intermediaries are involved in providing services of headloading, processing, preservation, packing and transporting and these activities result in cost addition at every stage of marketing (Bishnoi and Kumar, 2005).

In the present study, supply chain intermediaries are defined as the stakeholders of marine fish supply chain who carried out all the activities in the fish market for the successful deliver of marine fish from the point of harvest to the end user.

2.1.4. Fish marketing

Ruckes (1980) defined fish marketing as the combination of activity by which fresh or processed fish was made available for the ultimate use. The activities included technical marketing functions like assembling, sorting, cleaning, packing, storing, transporting, icing and curing and commercial marketing functions like buying, selling, auctioning, pricing and financing.

Fish marketing was defined by Narayanan (1981) as a continuous process whereby the needs and the satisfactions of consumers are matched with the objectives of the firm which may, in the process, involve handling (of the product by intermediaries), storage and processing so that, it reaches the consumers with the services of a very few intermediaries (retailers alone in most cases) are utilized, while for foreign consumers, services of the processors were also utilized.

Reddy *et al*., (2004) defined the marketing as an economic process by which the goods and the services are exchanged between the producers and the consumers and their values determined in terms of prices.

Fish marketing was explained by Senthilathiban and Rajakumar (2004) as all those functions performed by auctioneer, commission agent, wholesaler, retailer etc in directing the flow of fishes from fishermen to the ultimate consumers. Functions like fish sale to the wholesalers through commission agents by the fishermen, transport and purchase by the retailers and finally purchase by the ultimate consumers constitute the entire fish marketing process.

In the present study, fish marketing is defined as an economic process in which all the marketing activities accomplished by the intermediaries of supply chain for successful delivery of fish and fishery products from the point of harvest

to the end user and their values are determined in terms of prices. The marketing costs and margins would be charged for the services rendered by the supply chain intermediaries.

2.1.5. Auctioneer

Rajakumar (2006) defined auctioneer as the first intermediary who performs the auctioning of fishes at landing centre on behalf of fishermen and for that they charge some percentage as auction fee from the fishermen.

In the present study, auctioneer is defined as the first intermediary of marine fish supply chain who facilitates the trade of fish by conducting open auction and impose auction fee in terms of percentage of auction amount on fishermen for his services.

2.1.6. Wholesaler

Velayudhan (1999) explained that wholesalers directly procure fish from fishermen or through commission agents from different landing centres and sell them to retailers / vendors at distant consuming centres.

Khobragade and Sonawane (2003) considered wholesaler as the link between the producer and the retailer, responsible for bulk sales to the latter.

Senthilathiban and Rajakumar (2004) highlighted the wholesalers as those who buy the commodities in bulk from the producers and sell them either to secondary wholesalers or to retailers. They buy and resell to the retailers and other wholesalers but do not sell a significant amount to ultimate consumers.

In the present study, the wholesaler is defined as the key supply chain intermediary who facilitates the large quantity movement of fish from the lower

end of supply chain to the next level of supply chain intermediary located in the near or distant places.

2.1.7. Retailer

Khobragade and Sonawane (2003) defined retailer as usually the final intermediary and the last link in the marketing distribution chain. Retailers buy fish from any of the wholesalers according to their convenience and requirements.

According to Kalidas (2003) retailers procure fish from the wholesalers and supply fish to the consumers. They buy immediately on credit and pay for it the next day.

Yadav (2006) defined retailer as one who sells fish directly to the consumers located in the different places of city through his/her retail outlet.

In the present study, the retailer is defined as the supply chain intermediary who involves in the movement of fish in small quantities either to the consumer or hotels/restaurants through his/her established kiosks/shops.

2.1.8. Vendor

Velayudhan (1999) classified vendors into head load vendors and cycle vendors. They carry fish to consumption centers for retail sales. Vendors buy fish from commission agents, wholesalers or fishermen.

Senthilathiban and Rajakumar (2004) defined vendors as they sell fish directly to the consumers located in different places. They purchase fish from the producers or wholesalers or from commission agents sometimes and resell them to the consumers.

Yadav (2006) defined vendor as a merchant middleman who performs the selling function of marine fishes directly to the consumers at the door steps or residences of the consumers.

In the present study, vendor is defined as a supply chain intermediary who purchases small quantities of fish from the lower end of supply chain and selling them to the consumers. Vendors are classified as head load vendors, street vendors and cycle vendors based on the mode of supply of fish.

2.1.9. Super market

In the present study, super market is defined as the warehouse of all the varieties of fish and fishery products with organised modern marketing infrastructure and sanitation facilities established mostly at the dense populated places of large cities/towns for sale of high quality fish and fishery products with some market offerings.

2.1.10. Departmental store

In the present study, the departmental store is defined as the kiosk/shop for sale of fish and fishery products at fair prices to the consumers/hotels/restaurants which is fully undertaken by the department of fisheries of concerned state/central government.

2.1.11. Marketing efficiency

According to Chidambaram and Natarajan (2002), the marketing was said to be efficient if the total marketing margin was reduced for a given marketing cost. To put in other words, only the alternative channel with the lowest marketing margin would be efficient.

Viswanatha *et al.* (2011) explained that the marketing efficiency of fish markets can be studied using three parameters namely cost of marketing services and producer share in consumer rupee in price spread.

In the present study, the marketing efficiency of fish supply chains is said to be better if the fishermen's share in consumer rupee is maximum, minimum marketing costs, marketing margins and price spread.

2.1.12. Marketing costs

Jayaraman (1996) defined the marketing costs as the actual expenses incurred in bringing goods and services from the producer to the consumers. It may be incurred by the producer, market intermediaries and other marketing agencies involved in the movement of a commodity while marketing.

According to Yadav (2006), marketing cost is defined as the actual expenses incurred in bringing fishes from fishermen to the consumers. It may be incurred by the fishermen, auctioneer, wholesaler, retailer and vendor in the marketing of fishes.

In the present study, the marketing costs were defined as the costs incurred by the fishermen, supply chain intermediaries and other marketing agencies for the physical flow of marine fish from the point of harvest till the end user.

2.1.13. Marketing margins

Jayaraman (1996) defined the term marketing margin as the income earned by the market intermediaries and marketing agencies involved in marketing a commodity and as a reward for their management and risk bearing responsibility.

Bhatta (1996) explained marketing margins as the difference between the prices at primary and secondary markets for a particular fish species.

In the present study, marketing margin is the profit accrues to the supply chain intermediary in the process of supply of fish and it is the difference between the prices of two consecutive supply chain intermediaries.

2.1.14. Marketing loss

In the present study, the marketing loss is defined as the quantity of fish damaged/spoiled during the flow fish in the supply chain from the point of harvest to till it reaches the end user. The marketing losses are encountered at various stages of fish supply chain such as while handling, transportation, storage, packaging, and icing etc.

2.1.15. Fisherman's share in consumer's rupee

In the present study, it is the actual price received by the fisherman for particular variety of fish and expressed as a percentage of the consumer price. It is used as one of the indicator of measuring efficiency of marine fish supply chains.

2.1.16. Price spread

Gopal *et al*. (2001) pointed out that the price spread, measured as the difference between the price paid by the consumer and the price received by the fishermen, was an important index of marketing efficiency as well as the fairness with which the market treats the consumer and the producer.

The price spread refers to the difference between the price paid by the ultimate consumer and the price received by the producer-seller. It includes the cost of performing various marketing functions and the margins of different agencies involved in marketing (Sundaravaradarajan & Jahanmohan, 2002).

Salam (2005) explained the price spread as the difference between the price paid by consumer and the price received by the producer for an equivalent

quantity of product. It included the cost incurred and the margins earned by the market intermediaries in the process of marketing a commodity.

In the present study, price spread is used for estimating the marketing efficiency of supply chains and it is estimated as the difference between the price paid by the consumer and the price received by the fishermen. Thus price spread includes the marketing costs and the marketing margins of supply chain intermediaries.

2.1.17. Price behaviour

According to Sathiadhas (1997), the price behaviour of fish is mainly characterized by wide fluctuations at all the stages of transactions in the marketing chain. This is mainly due to perishable nature of fish, species variation and its short run supply and determinants of price.

Yadav (2006) explained the price behaviour as the monthly price fluctuations of fishes at the selected fish landing centers.

In the present study, the price behaviour is defined as the price variations of fish among the fish supply chains at the landing centre, wholesale markets, retail markets and terminal markets.

2.1.18. Fisherman's price

Singh and Toppo, (2010) defined the fisherman's price as the net price received by the fisherman at the time of first sale. This is equal to the wholesale price at the primary assembly centre minus the charges borne by the producer in selling the fish.

In the present study, fisherman's price is defined as the net price received during the point of sale in the fish landing centre.

2.1.19. Landing price

Yadav (2006), defined landing price as the value of fish catch offered by the bidders for a known quantity of particular marine fish variety usually one kilogram at the time of sale at a particular landing centre.

In the present study, the landing price is the value of fish catch offered by the traders for a known quantity of particular marine fish variety at the time of sale and particular landing centre.

2.1.20. Wholesale price

Yadav (2006) defined wholesale price as the value offered by wholesaler to retailer and consumer for a known quantity of particular fish variety usually one kilogram at the wholesaler's outlet.

In the present study, the wholesale price is the value offered by wholesaler to the next supply chain intermediaries for a known quantity of particular fish variety at the wholesaler's outlet.

2.1.21. Retail price

Yadav (2006) defined retail price as the value of fish offered by the retailers to consumers for a known quantity of particular variety of marine fish usually one kilogram at the retail outlet.

In the present study, the retail price is the value of fish offered by the retailers to the end users for a known quantity of particular variety of marine fish at the retail outlet.

2.1.22. Seasonal price variation

Manasa (2009) opined that the seasonal price variation for fish varieties occurs within a year. The main reasons of seasonal price variations were fish production cycles, customs, climatic conditions etc.

Tveteras (2005) was of the view that the volatility in price and fish production within a year was caused by the external forces such as weather conditions, regulated fishing seasons, and fish consumption pattern.

In the present study, the seasonal price variation of marine fish that occurs within a month and the main reasons were the variations in fish production, weather conditions, fishing regulations, customs and the fish consumption patterns.

2.1.23. Price instability

Sathiadhas (2012) explained that the prices of marine fish varieties fluctuate very widely and they fluctuate across the seasons, within the season varies across the months, within the month across the days and within the days across the hours of business.

In the present study, price instability refers to the instability of marine fish prices caused across the fishing seasons, within the seasons, across the months, within the months, across the days and within the hours of a day and fish, across the different markets. The price instability helps the market intermediaries to plan for the purchase of fish and suitability of fish markets.

2.1.24. Price index

Tveteras (2005) defined the price index as a comparative or relative measure over time. Usually, it is the two periods compared with each other. The

two main uses of a price index were either as a deflator or as a price level measurement.

In the present study, the price index is defined as a comparative measure of marine fish prices of a particular quantity over the time period. The price index of marine fish would help in understanding the price volatility over the time period.

2.1.25. Fish landing centre

Bindhu (2003) considered the fish landing centre as the landing site in the seashore with some shore facilities such as guide lights, workshops, fuel station, ice plant and a boat jetty.

Yadav (2006) defined the fish landing centre as a place where the exchange of marine fishes takes place between fishermen and the buyers immediately after fish landing.

In the present study, fish landing centre is referred as a place near to the seashore where the marine fishes are merchandised between the fishermen soon after the fish landed from the fishing vessels. Fish landing centre is offers some basic infrastructure facilities such as jetty, ice plants, fuel stations, transportation, workshops, auction halls etc. for the fishermen and the traders.

2.1.26. Wholesale market

When large quantities of commodity brought and sold in the market among the traders such markets are called as wholesale markets (Reddy *et al*., 2004).

In the present study, the wholesale market is defined as a market where large quantities of fish are brought by the wholesalers and sold to the next level of supply chain intermediaries.

2.1.27. Retail market

These are the markets in which retailers sell commodities to the consumers in very small quantities as per their requirements. Producers, retailers and consumers are seen in the markets (Reddy *et al*., 2004).

In the present study, retail market is defined as a market where small quantities of fish are brought by the retailers and sold to the end users of fish supply chain.

2.1.28. Terminal markets

These are located in big cities/state capitals/sea ports. These are well-organized markets and controlled by the Government to see that all the modern methods of marketing operations take place (Reddy *et al*., 2004).

In the present study, fish sold through super markets, stalls and vendors to the consumers are considered as terminal markets.

2.1.29. Regulated fish markets

The statutory market committees govern regulated markets and the Government makes marketing acts from time to time. The marketing costs, margins etc. are standardized. Marketing practices are regulated and facilities created for the smooth conduct and marketing (Reddy *et al*., 2004).

In the present study, the regulated fish market is a market in which the marketing practices are regulated through the marketing acts enforced by the concerned governing body for protecting the interests of fishermen and consumers from exploitation by the supply chain intermediaries.

2.1.30. Unregulated fish markets

In unregulated fish markets, business is conducted without any supervision. There is absence of rules and regulations. The middlemen exploit the farmers and consumers to the maximum extent (Reddy *et al*., 2004).

In the present study, the unregulated fish market is a market in which the marketing practices are not regulated through any of the marketing acts. The fishermen and consumers are exploited by the intermediaries of fish supply chain by charging more marketing costs and margins.

2.1.31. Market information

Market information is broadly defined as the communication or reception of knowledge or intelligence. It includes all the facts, estimates, opinions and other informations which affect the marketing of goods and services (Tousely *et al*., 1968).

Market information is the data collected on the prices of commodities, and on marketing costs and margins of the commodity, analyzing and disseminating the required through various mass media (Reddy *et al*., 2004).

In the present study, market information is defined as the information on fish landings, prices, marketing costs and margins etc. would be maintained by concerned governing institution, analyzing and disseminating it through various mass media. This would benefit both the fishermen and the consumers in planning selling and buying of fish respectively.

2.1.32. Consumer

According to Ghosh *et al*. (1990) a consumer may be referred to strictly, the ultimate consumer for a product, the ultimate user of a product or service, the person who derived the satisfaction or the benefits offered.

Stanton *et al*. (1994) defined consumers as individuals or an organization unit that uses or consume a product.

In the present study, the consumers are referred to as the individuals or a group who consume different varieties of fish and fishery products and derive for derive satisfaction or benefits.

2.1.33. Coastal consumers

In the present study, coastal consumers are the individuals or a group who consume different varieties of fish and fishery products and residing in the coastal cities/places.

2.1.34. Non-coastal consumers

In the present study, non-coastal consumers are the individuals or a group who consume different varieties of fish and fishery products and residing in the non-coastal cities/places.

2.1.35. Consumer behaviour

Reddy *et al.* (2004) explained that the theory of demand begins with the analysis of the behavior of consumer, since the market demand is the summation of the individual consumers. Consumption decisions are made by individual or household group based on income and the market prices of various goods and services, he plans spending income with the aim of attaining maximum possible utility or satisfaction.

In the present study, consumer behaviour is explained as the rational thinking of consumer to arrive at fish consumption decisions based on income and the market prices of fish varieties with the aim of attaining maximum possible utility or satisfaction.

2.1.36. Consumer preferences

In the present study, consumer preferences are defined as the psychological belief of consumer for the various attributes of specific/general fish and fishery products. Understanding consumer preferences would assist marketers for formulation of marketing strategies in fish marketing.

2.1.37. Substitutes

Two goods are substitutes if an increase (decrease) in the price of one of the goods causes consumers to demand more (less) of the other good, holding all other factors constant. In general, goods are substitutes if one good can be used in the place of the other (Thomas, 2012).

In the present study, a substitute can be defined as the food commodity which could be demanded more in the place of the other when the price of other food commodity is more.

2.1.38. Complements

Two goods are complements if an increase (decrease) in the price of one of the goods causes consumers to demand less (more) of the other good, holding all other things constant. In general, goods are complements if they are used in conjunction with each other (Thomas, 2012).

In the present study, a complement can be defined as the food commodity which could be demanded less in the place of the other when the price of other food commodity is high.

2.1.39. Willingness To Pay (WTP)

In the present study, willingness to pay is defined as the more and more quantities of fish would be purchased though its unit price is high because of strong willingness of the consumer towards the particular variety of fish.

2.1.40. Conjoint Analysis

Manalo (1990) described the use of conjoint analysis to estimate the importance of attributes and the attribute levels through decomposition of the consumers ranking of alternative attribute combinations. The approach suggests that the consumers derive utility not from the goods themselves, but rather from the attributes or characteristics that the goods possess.

Louviere (1991) stated that the conjoint analysis will be done to quantify and predict the consumers overall quality evaluation of marine fishes based on their rankings given for the profiles of the selected attributes.

Kuzmanovic (2011) defined the conjoint analysis as a research technique for measuring the customers preferences, and it is a method for stimulating how customers might react to changes in current products or to new products introduced into an existing competitive market. The analysis bridge the information gap between the company and its customers, by confronting the value the company intends to offer with the value desired by its customers.

In the present study, conjoint analysis is defined as a market research technique used for the assessment of consumer preferences for different marine

fish varieties by specifying selected attributes based on their rankings given by the consumers.

2.2. Review of earlier studies

Review of literature is an eventful facet of any scientific endeavour as it helps the researcher to develop good understanding of the subject and to formulate appropriate research methodology. It helps the researcher to identify the problems and relate the empirical findings to those done in the past (Kothari, 2006). This section deals with the review of related past studies. Keeping in the view of the various objectives of the study, the literature review is presented under the following headings:

Gupta (1983) had observed that the fish consumption was substantially high among fish producers compared to non-producer consumers. In general, the fish consumption level (both the percentage of fish consuming population and the per capita fish consumption) was much higher in the coastal areas than the inland areas (Babji 1985).

Gupta *et al*. (1984) reported that the retail markets in most of the consuming centers in India did not have the necessary infrastructure facilities and the sanitation conditions were very poor.

The KFDC limited resulted in a huge revolutionary change in fish marketing by establishing cold chain system to supply fresh and iced fish to interior rural markets, and through refrigerated trucks and cold storages to the farther and interior urban markets. The system, which covered four districts of the state was a landmark development in freezing technology (Moorjani, 1984).

Kalavathy (1985) given a description of the marketing organization of a large fish landing centre (Madras), outlining in particular the role of women in the marketing business. Findings indicate that while modernization of fishing technology and fish transport has benefited some women by way of higher earnings or new earning opportunities, it has aggravated income disparities among fisherwomen.

Panikar and Sathiadas (1985) estimated the fisherman's share in consumer‘s rupee at Sathikulangara district of Kerala. The price spread analysis indicated that the fisherman received a share ranged from 31 to 68 % in consumer‘s rupee where as the retailers and the wholesalers earned a margin ranged from 11 to 25 % and 15 to 37 % respectively. The marketing cost ranged from 6 to 7 % of the consumer‘s rupee. Further, the study suggested that a fast and efficient transportation system need to be developed to avoid fish spoilage and also for the quick distribution to the consumers.

Shrinivasan (1985) had studied the marine fish marketing in Tamil Nadu and opined that the market intermediaries such as commission agents, retailers, vendors, and wholesalers were dominating the fish marketing. The fish catch was disposed off by women auctioneer, who took a share of fish as commission from the owner as well as the purchaser. The analysis of price spread showed that fisherman share in consumer‘s rupee varied from 30-95% both in fresh and dry fish trade. Further the study reported that there were some weakness in fishermen's co-operative societies, such as inadequate funds, poor management and the lack of marketing strategies due to which the traders were dominating the

fishermen. The study suggested for strengthening and revamping the co-operatives through state Government to benefit the active fishermen.

In order to preserve the freshness of fish, the Government had encouraged investments through its policy of providing infrastructure loan at concessional interest rates and subsidies since 1980s. The commissioning of Mangaluru ice-cum-freezing plant, with a capacity of 5 tons/day, one cold storage of 68 tons and a frozen storage of 80 tons at Mangaluru in the early fifties, increased the level of consumption of fish in the fresh form. However, the increased landings of shrimps, fin fishes, cuttle fishes, and squids enabled their freezing mainly for export to the European Union. This gave a spurt to processing activity which resulted in the establishment of about 31 freezing units in Karnataka (Ramalingam, 1986).

Canning enterprises were started in Karnataka during the late 1960s. During the following decade, 1970-72, there were 13 canning companies with varying production capacity of 500 to 25,000 cans per day, in the undivided Dakshina Kannada district of Karnataka state (Sripathy, 1986).

Sathiadhas and Panikar (1988) worked out the fishermen's share in consumer's rupee that ranged from 32 to 72 % and it was more than 60 % for Pomfrets. Further they reported that the wholesaler's margin (12.50 %), retailer's margin (69.50 %) and the marketing cost (18.00 %) were involved in Pomfret marketing. The price behaviour analysis revealed that the difference of wholesale price from the landing centre ranged from Rs.0.5 to 5/ per kg and the retail price ranged from Rs. 2.50 to 7.10 per kg for different fish varieties. The study suggested that to protect the interest of both the producers and consumers, it was

essential to reduce the magnitude of marketing margins through co-operative system.

Pannikar and Sathiadas (1989) reported the marine fish marketing system prevailing in Kerala (India), the price structure, seasonal and spatial price variations, marketing margins of commercially important varieties of fish and the share of fishermen as well as middlemen in consumers' money. The study showed that due to lack of infrastructure facilities, the supply of fish at the landing centre is highly inelastic, often resulting in the disposal of fish at throw-away prices at the time of heavy landings. The involvement of a number of middlemen in the marketing chain adversely affects the interests of both fishermen and consumer. Fishermen's share in the consumers' money varied from an average of about 40% for cheaper varieties of fish to about 65% for high priced fish varieties. The study outlined the considerable increase in the marketing expenditure over the recent years.

Sathiarajan (1989) opined that the fisheries development of any country should have a close link with the domestic fish consumption. The infrastructure facilities needed for domestic fish marketing in India is inadequate. The successive five-year-plans did not give emphasis on this aspect. Instead, importance was given only to marine fish export, and that to only one item i.e. shrimp. This has resulted in the lopsided development of Indian fisheries and the capital invested in the fishing craft mechanization, research and development did not bring the desired results. This paper dealt with the aspect of giving importance to the domestic fish marketing for the real development of fisheries. The study suggested that a strong domestic market is a guarantee for a healthy export trade.

Chidambaram and Rajan (1990) studied the marine fish marketing in the Tiruchendur town of Tamil Nadu state. The study found that the fish marketing system was invariably under the control of middlemen and suggested that Government must strengthen the co-operatives societies financially and adequate infrastructure facilities must be provided to increase the efficiency of fish marketing system.

Prasad *et al.* (1990) studied the marketing costs and margins and the constraints faced by the market intermediaries in fish marketing in Andhra Pradesh. The producer's share in the consumer price was found to be 61% which indicates that the market intermediaries were exploited major share of consumer price.

Taliat (1991) studied the domestic marketing of fish and fishery products as support to export industry in India. Auctioneer, commission agent (purchase), wholesaler, commission agent (sale), retailer and vendor were the major market intermediaries involved in different marketing functions. The study reported that the fisherman's share in the consumers' price was maximum (95%) in one member channel and the lowest (27.9%) in sales where the more numbers of middlemen were involved. The study also reported that the fisherman received a better share for quality fishes and comparatively less for low priced fishes. Formation of fish marketing organizations and the support of Governmental agencies with infrastructure facilities were the important measures suggested for the development and the establishment of domestic market for fishery items in India.

Sathiadhas and Panikkar (1992) estimated the share of fishermen and middlemen in consumer price in Madras region of Tamil Nadu. The fisherman's share varied from 32 to 72 % and was higher for quality fishes like seer fish, pomfret etc. because of comparatively high consumer preference. Further the analysis revealed that the retailers margin ranged from 19 to 45% and the wholesaler‘s margin 4 to 27% of the consumer rupee for pomfrets and silver bellies respectively. Finally, the study suggested for establishing basic infrastructural facilities and introduction of regulated marketing system, support price policy and co-operative marketing.

Senthilathiban and Selvaraj (1992) studied the price spread analysis of important marine fish varieties in the four randomly selected fish landing centers of Chidambarnar district, Tamil Nadu. The price spread analysis revealed that the fisherman share for all fish varieties was more than 60% and the retailers earned a profit margin of 14 to 23 % of the consumer rupee. Development of fast and efficient transportation system and the formulation of price support policy would have been proved the best to eliminate the importance of market intermediaries.

Senthilatiban and Selvraj (1992) had done a comprehensive study on price spread of important varieties of marine fish landed at selected fish landing centers, their marketing costs, margins and the share of producers in consumer's rupee was carried out from four landing centers in Chidambaranagar district of Tamil Nadu, India. The data on important species-wise landings, auction price, marketing costs and margins were collected at weekly intervals. A healthy trend of 60% share for the fishermen in consumer retail price is noticed, whereas the share of marketing margins accruing to the retailers varies from 14 to 23%. A positive correlation

between the retail price and the net amount realized by the fishermen for almost all the fish varieties was noticed.

Sathiadhas and Narayanakumar (1994) opined that the high fluctuations in fish prices were due to the uncertain nature of the fish harvest, perishable nature and variations in short run supply. Besides fish supply being highly inelastic, a bumper catch on any one day will slash down the prices and a small fish catch boost the prices to very high level.

Shadur and Bamber (1994) reported that the supply chain management practice involves improved value delivery to the customers, rely on just-in-time system, eliminate wastes, get the involvement of all the stakeholders in the value creation process, develop close collaborations, work closely with the suppliers, reduce the number of suppliers, and develop efficient suppliers.

Sathiadhas and Narayanakumar (1994) were of the opinion that the fish marketing in India is gradually transforming from primitive to modern stage. The basic amenities are not present in many of the markets to carry out the marketing activities. No proper grading or weighing was done for fresh fish and no proper sheds for auctioning or facilities for preservation at the fish marketing centers. Inefficient collection and distribution of fish results in concomitance of surplus and deficit in internal marketing system. Lack of marketing infrastructure was another factor responsible for low returns to fishermen.

In a traditional supply chain, the buyers and supplier operate in an arm's length environment, meaning that each of them is responsible for its own inventory control and production or distribution activities. The only information

exchanged between the parties consists of purchase orders and this behavior leads to distortion of demand along supply chain members (Lee *et al*., 1997).

The fish marketing has characteristic features such as greater uncertainties in fish production, high perishability of fish, assembling of fish from numerous landing centers, too many fish species and as many demand pattern, wide seasonal and regional variations in price, difficulties in adjusting the supply to the variations in demand (Sathiadhas, 1997).

Devaraj *et al.* (1998) studied the new economic policy and the perspectives for marine fisheries research and development in India. The analysis revealed that the fisherman share in the consumer‘s rupee ranged from 30 to 68 % for different fish species/group. Further, the analysis revealed that the wholesaler received 5 to 32 % and retailers received 14 to 47 % of the consumer‘s rupee. The fisherman’s share for pomfrets was worked out with the percentages of 64, 68, 46, 45, 51 and 53 % in Gujarat, Maharashtra, Karnataka, Kerala, Tamil Nadu, and Andhra Pradesh respectively. The study suggested that there was enormous scope for improving the marketing process of marine fishes in the internal marketing system under the liberalized economic policy.

In order to survive in this challenging scenario, it was considered to focus on reducing the cost with improving customer satisfaction besides revenue increasing methods by effective supply chain management (Sahay and Ramneesh, 1999).

Velayudhan (1999) studied the issues in fish marketing and the scope for intervention by the local bodies in Kerala. The study reported that fishermen were forced to sell their catches at very low price, because the market was controlled by

middlemen. High perishability of fish, markedly seasonal nature of fish, scattered fish landing centers, helplessness of fishermen in the disposal of fish catches, control of fish market by middlemen, unhygienic market conditions, wide fluctuations in price, dearth of cold storage facilities in the market etc., were the major problems identified during the study. In addition to these, auctioneer charged 4 to 6 percent commission from the fishermen for their services. The study suggested to intervene by the local bodies and implement the developmental programmes to improve the facilities of fish marketing.

The most important factor that influences the web of relationships that makes up the marketing structure is the mode of sale or the organisation of transaction between fishermen and buyers (Bhatta, 2000).

Bhatta *et al.* (2000) estimated the annual per capita fish consumption at 8.2 kg for the lowest income groups which increased to 14.16 kg, 11.43 kg, and 14.89 kg for the middle, rich and very rich income groups respectively.

Sathiadhas and Kangam (2000) analysed the price spread in marine fisheries which revealed that fisherman share ranged between 30 to 60 percent, wholesaler‘s share 5 to 32 % and the retailers share 14 to 47%, whereas marketing cost for all the marine fish varieties in consumer‘s price was 6 to 13%. The auctioneers were charging 5 to 10 % of commission for total the fish auctioned by them.

Sathiadhas and Kangam (2000) had identified greater uncertainties in fish marketing such as high perish ability of fish, disequilibrium of demand and supply, lack of information on fish price which were making the market inefficient hence to increase the efficiency of fish marketing system, it was

suggested to avoid the involvement of too many marketing intermediaries by introducing co-operative marketing system.

Bhatta (2001) reported that in Andhra Pradesh 10% of total market arrivals were wasted due to quality deterioration in the absence of proper cold storage. Major cost categories involve input costs and transport, while purchasing costs represent only 5-10 % of the total supply chain costs. He also indicated that retail markets were not maintaining hygienic conditions in Andhra Pradesh.

Gopal *et al.* (2001) studied the marketing efficiency of fresh fish trade at Cochin and Veraval. The primary data on wholesale and the retail markets were collected from landing centre twice in a week for major species of fish. The major portion of fish was passing through landing centre-wholesaler-retailer-consumer channel. The results revealed a very high price spread in wholesale and retail market ranging from 1.11% to 46.00% and 4.71% to 14.10% respectively. The study concluded that every variety of fish showed a very high range of price fluctuations meaning large share of benefits, depriving fair price for both the consumers and producers.

The supply chain management involves the management of flows of products, information, and funds upstream and downstream in the supply chain. In addition, it also entails making decisions about the locations of the production facilities, which products to produce, how to produce them and finally, how to distribute these products (Chopra *et al*., 2001).

Guillotreau (2001) found that the seasonal price variations are regular and periodic lasting for a period of one year. Seasonal price variations of marine fishes originates due to their shorter shelf life. However their supply depends on

biological availability and the price goes down as the supply increases. Fish price fluctuations are related to a series of seasonal variables such as fish landings and increased demand due to specific reasons. Evaluation of fish price should be on the basis of the grade of fish and not on the basis of fish species. But price is actually varied by fish species and grades of fish such as species, size, body defects, and muscle quality. The reasons for the variability of fresh fish prices attributes to the rigidity of fish supply with regard to prices.

Thomas (2002) reported that the food supply chain has been a linear relationship involving the primary producers, or farmers, the manufacturers or processors who fabricate the food for the table, and the retailers who gather a range of such products and sell them to the consumers

Rao (2003) proposed that a 'retail revolution' in domestic fish marketing was very essential so that fish was demanded like any other agricultural product. What is produced must be marketed and market is the 'manthra' for bringing remarkable changes in the consumption pattern of fish. To improve fish marketing on scientific methods, effective strategies were to be adopted with regard to the changing food habits of consumption, improving transport network, conversion of raw fish into processed fish, increased investments etc.

In India, marine fish landings from about 1896 landing centers were marketed at three levels namely landing centre (Primary market) wholesale market (secondary market) and retail market (tertiary and ultimate consumer point). About 85-90% of the fish catch is channelized through domestic marketing system of which 5% of fish is marketed by fishery cooperatives and the rest was through private marketing agencies and the traders (Sathiadhas *et al.*, 2003).

Zynudheen *et al.* (2003) studied the marketing channels and the market intermediaries in the fish trade in Veraval, Gujarat state. They found a number of intermediaries like commission agents, suppliers, merchants, and vendors involved in fish marketing. They concluded that retailers and the wholesalers exploited large share of margins in consumer‘s rupee. Further, they recommended that fixing a price at the primary level will play a significant role in ensuring a fair price to the fishers and the consumers.

The stakeholders of supply chain with reference to inland fisheries in Cambodia were fishing lot owner, fisher, fish collector, wholesaler/trader/middleperson and retailer (Rab *et al.*, 2004).

Chandrasekharaiah (2004) reported the marketing of marine fisheries in Karnataka state. The South Kanara Fish Marketing Federation, North Kanara Fish Marketing Federation, Fisheries Development Corporation and a number of primary Fishermen Co-operatives were engaged in fish marketing. The fresh fish was marketed by the fisherwomen in all the 198 coastal fish markets constructed by the village panchayats and town municipalities. Fisheries Corporation organizes freezing of fresh fish and arranges marketing of the frozen fish through its cold chain consisting of about 50 retail outlets.

Khobragade and Sonawane (2004) evaluated the marketing margins in the marine fish trade in Mumbai, Maharashtra. The information on prices was collected over a period of two years from June 2000 to July 2002. Price spread analysis stated that the fishermen received a share of 30.16 % to 91.40 % in consumer‘s rupee where as the wholesalers and the retailers margin ranged between 4 % to 38% and 5% to 60 % respectively in consumer‘s rupee. They

estimated the marketing margin in the marketing channel for physical flow of fresh marine fish. They worked out the average wholesale marketing cost at Rs. 1.55 per kg and the retail cost Rs. 2.60 per kg for all fish varieties. The study concluded that the extent of marketing margin for many fish varieties was high mainly due to higher share received by the intermediaries and not due to the marketing cost. Further they suggested that for increasing the efficiency of marketing system, the involvement of too many middlemen has to be avoided by establishing a co-operative fish marketing system.

Sahar and Mandal (2004) analyzed the status of fish market in Jammu city. The information regarding market activities was collected from one wholesale market and 30 retailers. The study found three types of channels: wholesaler-retailer-consumer, fisherman- wholesaler-consumer, and fisherman- retailers-consumers and observed that the fish marketing in Jammu city was handled largely by wholesalers and retailers.

Jung (2004) surveyed the consumer's fish purchasing behaviour and found that the consumers are willing to pay more in buying safe and sanitized fish.

The knowledge of consumer preference, food habits, family income and the nature of the produce are necessary to develop a food chain in any area. In India, most of the studies on fish markets and marketing have been related to the unorganized retail markets, particularly with reference to gender, age and credit (Tietze, 2004).

Sahar and Mandal (2004) studied the constraints in fish marketing in Jammu city and identified the non-existence of organized markets, lack of hygiene and sanitation and inadequate storage facilities as some of the problems in fish

marketing process. The study concluded that the fish market in Jammu city had not been developed properly so co-operative fish marketing would be the remedy and the solution to the marketing problems. They suggested that market research programmes should be oriented towards the development of an orderly and efficient marketing system.

Arora (2005) mentioned that there was a wide variations in the consumer's behaviour as far as food is concerned. Demography plays an important role and in urban areas consumers have different buying habits as compared to the consumers in the rural areas. Similarly, high income groups buying pattern is quite different from the low or middle-income groups.

Suraparaju (2005) studied variations in the methods of exploitation in fish marketing of Krishna district in Andhra Pradesh. The study revealed that the merchants exploited fishermen by way of lending money without charging any interest on the condition that they had to surrender their entire catch to them until they clear their loans. The study also reported that the agents of the fish marketing company and the fish vendors exploited the fisherman by lending them money in order to purchase their catch regularly at a very low price. They also grade the catch wrongly and cheat them in weighing the fish. The study suggested that Government should not only supply credit through institutional agencies with less interest but also provide proper infrastructural facilities like refrigerators, storage facilities, processing units etc. to weaken the present system of credit market linkages and to get better remunerative prices for fish catches.

A supply chain is a system of organizations, people, activities, information, and resources involved in moving a product or service from supplier to customer (Nagurney, 2006).

Yadav *et al*., (2006) reported that the marketing efficiency of the marketing channel Fishermen-Auctioneer-Vendor-Consumer was higher comparatively with other marketing channels in the fish landing centres of Thoothukudi. The major constraints reported in the existing marine fish marketing channels were of the high degree of dependency on middlemen for financial support followed by high marketing cost and low landing prices.

Hassan and Veerabhadran (2006) had identified the marketing constraints encountered by the market intermediaries in the coastal districts of Tamilnadu. The unhygienic conditions of fish market complex was ranked first followed by the more number of market intermediaries, lack of developmental schemes for intermediaries, poor market infrastructure, fluctuations in consumer prices, change in consumer preferences and limited availability of marine fish varieties.

Changing life styles, higher income levels, and increase in the number of working women have altered the buying habits and increased the demand for high value processed food products (Soundararajan, 2007).

Managing fish supply chain is one of the most crucial factors in reducing cost and improving the efficiency. The single most important problem facing the Indian fisheries sector is of highly inefficient fish supply chain which is evident as about 25-30 % of all the fish produced in India is wasted (Sharma, 2007).

Ruben (2007) had reported that transport and quality control costs could be decreased when the number of suppliers is reduced. Afroz (2007) was of the view

that the prices were usually fluctuating seasonally due to the variations in supply and demand of fish. The study of seasonal price variations has greater importance for fishers and stakeholders of fish supply chains to plan the production schedule in an efficient way so as to enable them to supply to the public demands according to the seasons.

Kumar *et al.* (2008) found that the marketing efficiency was found to be more in the case of marine fish species than the freshwater fish species, since the latter travel longer distances from the point of production to consumption center, passing many intermediaries as compared to the former. The infrastructural facilities at most of the landing centers, fishing harbours and wholesale and retail markets have found grossly inadequate and poorly maintained. The study recommended the need for formulating a uniform market policy for fishes for easy operation and regulation for efficient management of country fish production.

The study of price spread assumes importance due to the reason that large portion of price paid by the consumer goes to the middlemen in the fish marketing chain. The primary producer gets only 32.5% of the consumer rupee and middlemen were getting lion share in consumer rupee (Munireddy and Mohan, 2008a).

Socio-economic profile has been evolved to understand the basic amenities such as demographic features, housing, health, assets, income and consumption pattern of coastal fishermen of Karnataka (Munireddy and Mohan, 2008b).

An efficient marketing system is characterized by the perfect market integration and full price transmission and such system enables the producers, middlemen and consumers in the fish supply chain to derive maximum gains. The

price movements in different fish markets depend on the cross market movement of the available fish catch which in turn is governed by the demand and supply factors (NCAP, 2008).

The problems related to the fisheries sector include fisheries and aquaculture products were highly perishable, bulking raw materials, cost of storage and transport is high, quality and quantity are not assured, availability is in small quantities spread over a wide area and the market intermediaries are many with low demand elasticity and price spread (Ravindranath and Reddy, 2008).

Sabat *et al.,* (2008) identified the socio economic variables affecting the consumption of value-added fish and fish products. The major problems in fish consumption found were irregular supply, followed by the lack of fresh fish, high price and the presence of bones in fish and the lack of awareness, unavailability, no preference and the unacceptable taste were the major problems for consumption of value-added fish and fishery products.

Joshi *et al.,* (2010) studied the awareness, behaviour and the practices among the Indian consumers regarding the maintenance of cold chain from the retailer's place to home and at homes within the framework of food safety. The study revealed that the consumers do not have adequate awareness about refrigeration practices or the consumers themselves are responsible for maintaining cold chain and food safety.

Alam *et al.* (2010) reported that the market structure, species quality, size and weight have an influence on the price of fish and it was obtained that the price of fish increases per kilogram with size and species wise. A great amount of profit is made by all the traders in the market in a successful manner. The productivity

of fishers and their livelihood security would be increased through efficient fish marketing system. The study recommended that Government intervention and public-private partnership is necessary for commercial implementation and improvement of the existing fish marketing system in Bangaladesh.

The lack of market information, poor market structure which leads to price instability, poor road network, high cost of transportation and low income of the producers can affect the marketing efficiency. The increased marketing costs in freshwater fish supply chains was due to institutional inefficiencies in terms of number of intermediaries, risks, absence of insurance, seasonality, absence of marketing finance and storage facilities (Viswanatha, 2011).

Fish marketers face the problem of responding to the developments by offering products which are consistent with changing consumer preferences. It is therefore increasingly important for marketers to understand the nature of consumer preferences towards the new value added fishery products. Conjoint analysis technique was employed to identify the consumer preference segments in the market. The analysis revealed that the preferences of the consumers are very heterogeneous, but it is possible to identify segments with distinct preferences for particular fish attributes. The price of the fish was found to be the most important attribute that explained the consumers preference followed by fat content, texture and size of the fish (Munireddy *et al*., 2012).

In Karnataka, the landings increased from 1.83 tonnes to 3.86 tonnes during 2000-2010. The gross earnings at landing centre level increased from Rs 467 crores to Rs 1987 crores and the retail level from Rs 857 crores to 3463 crores during 2000-10. The average fish price at the landing centre level gradually

increased from Rs 25.53/kg to Rs 51.51/kg and from 46.85/kg to Rs 89.76/kg at retail level during the same period (Sathiadhas *et al*., 2012).

The study of price spread in the value chain enables us to understand the marketing efficiency and help the fishermen to choose the channel which gives him maximum profit at less marketing costs. The price spread was high for pomfrets (168 Rs/kg) and seer fish (163 Rs/kg) in Karnataka. It was found that 37-47% of the consumer rupee was received by the supply chain intermediaries. The study also found that the middlemen were getting very high share of consumer rupee in the fish supply chains (Viswanatha *et al*., 2012).

Fish is a highly perishable commodity and its inelastic supply leads to soaring fish prices with low catch and plunging prices with bumper catch. Further, the increase in demand in both domestic and export sectors resulted in the augmentation of seafood prices. The marine fish prices showed incessant increase over the years with the growing demand, falling supply and urbanization. Analysis of wholesale price index values for different food commodities in India during the past decade indicated that the inland and marine fishes recorded the maximum price rise among all the non-vegetarian items in India (Ministry of Commerce and Industry, 2012).

Rahaman (2013) reported the major constraints faced in production and the marketing of fishes are theft and pilferages, non availability of quality fish seeds, lack of government support both technically and financially, quarrel and litigations among the owners of the pond, poor adaptability of fish seed in new environment, non availability of quality fish seeds, lack of government support,

labour crisis, high degree of perishability of the product, cut throat competition, inconsistent supply of fish, lack of storage facility.

The economic efficiency and success of supply chain is largely depends on the cost effective management of operations like production, procurement, processing, distribution and sale of crops and its value added products in the supply chain. Efficient supply chain leads to boost the profits of various market intermediaries (Rangasamy, 2013).

Aktar (2013) was reported that the prices of fish mostly depend on the supply and demand factors. The price of the same variety of fish has been quite similar in all the markets of Bangladesh.

The risks involved in transporting the perishable commodity and involvement of large number of intermediaries resulted in the rise in marketing costs and margins and low marketing efficiency. Hence the analysis of price behaviour and the efficiency of marine fish marketing is very essential for the development of policies in protecting the interests of domestic producers and consumers. The average price of seer fish have rose from ₹ 4 per kg to ₹ 223 per kg at the primary fish markets of India during 1970-2010. However the prices of low value fishes like oil sardines, lizard fishes and cat fishes also increased during last five decades both at the landing centers and at retail levels with a prominent increase during 2000-2010 (Aswathy, 2013).

Omar (2014) found that the availability of substitute products of fish like chicken, meat etc. is also responsible for the price fluctuation of fish. In addition, many religious festivals such as Ramadan, Eid-ul-Azha decreases the demand for fish resulting in price fluctuation of the same in Bangladesh.

At the higher ends of the income distribution, the consumption of milk, eggs, meat and processed food rises. Fish is India's most popular non-vegetarian product; the average Indian household consumes 1.14 kg of fish in a month with Kerala being India's fish capital (www.thehindu.com).

Presently, major market channels in Bengaluru city are conventional retail shops and local open markets hence a majority of the consumers buy food products in these markets. Despite this trend, the higher strata of consumers prefer to purchase in supermarkets/hypermarkets. The constraints like high prices and difficulties in accessing these shops are the reasons for buying food products from local open markets and conventional retail shops. Regional differences in consumer preferences should be considered in order to improve the marketing channels (Nandi, 2014).

The dominance of multiple retail stores, supermarkets are increasing and also the purchasing behaviour of the consumers. Hence, it is important to understand the consumer behaviour for better offering a product and service. The socio-economic profile of the consumers plays a crucial role in determining the choice for fish. The constraints pertaining to hygiene and foul odour of fish shops and markets in Bengaluru which needs to be addressed immediately by the concerned Governing bodies. (Viswanatha *et al*., 2014).

CHAPTER 3

DESIGN OF THE STUDY

This chapter describes the rationale of the design of the study. Design of the research includes the methodology, methods of data collection and analysis of data in a manner that aims to combine relevance to the research purpose. This chapter describes the choice of the study area, selection of respondents, sampling procedure, sampling period and tools used for analysis of data.

3.1. Choice of the study area

Karnataka state has 300 km of coastline and 27,000 sq km continental shelf area, rich in pelagic fishery resources. The marine fisheries resource potential of the state has been estimated at 4.25 lakh metric tons, of which 2.25 lakh metric tons come from inshore areas up to a depth of 70 m and the remaining 2.0 lakh metric tons hail from off shore/deep sea zone. The state has three coastal districts with 6 major fishing harbours such as Mangaluru fishing harbour in Dakshina Kannada (D.K.), Malpe and Gangolli fishing harbours in Udupi and Honnavar, Tadri, and Karwar in Uttara Kannada (U.K.) districts. About 90% of the marine fish production in Karnataka state comes from these major fishing harbours (DOF, 2009). Karnataka state was purposively selected to undertake the study on supply chain analysis of marine fishes. The reasons that favoured the selection of the state were: (i) lack of studies on the traditional and emerging marine fish supply chains (ii) lack of studies regarding seasonal price fluctuations of marine fish iii) lack of information on market and marketing infrastructure in the fish markets iv) lack of studies on consumer preferences for marine fish, and v) lack of market research on constraints faced by the fish consumers in the state.

3.2. Selection of the respondents for the study

3.2.1. Collection of primary data

3.2.2. Sampling design

The major fishing harbours in the Karnataka state such as Mangaluru, Malpe and Karwar were selected for the study because of their significance contribution to the total marine fish production of the state. The objectives include estimation of marketing efficiency of emerging supply chains for marine fishes, to analyze the seasonal price fluctuations of the marine fishes, to assess the market and marketing infrastructure in the fish markets, to compare the consumer preferences for marine fishes of coastal and non-coastal cities and to identify the existing constraints in existing marine fish supply chains in Karnataka. From Mangaluru fishing harbour, about 18 fishermen, 7 auctioneers, 9 wholesalers, 9 retailers, 19 vendors and 5 supermarkets were selected on the basis of proportionate sampling method. From Malpe fishing harbour, about 15 fishermen, 5 auctioneers, 3 wholesalers, 6 retailers and 15 vendors and 4 supermarkets were selected. From Karwar fishing harbour, about 8 fishermen, 4 auctioneers, 3 wholesalers, 4 retailers and 12 vendors and 3 supermarkets were selected. The secondary data on the number of supply chain intermediaries in the major fishing harbours is not available and hence the sample size was determined after visiting the fishing harbours. (Table 1)

3.2.3. Sample size determination for selection of consumer respondents

The following sampling formula (Churchill, 1995) was used in order to determine the adequate sample size for the study. Since, the householder ratio of fish consumers was not known definitely, P and Q values were taken into

consideration as 0.50 in order to reach the maximum sample size. According to this formula, sample household size is 400 at 95% significance level and 5% of margin of error.

$$n = \left(Z_{x/2} \div d\right)^2 P.Q$$

Where,

n= Sample size that will be applied for all the cities

P= The possibility of realization of the verified unit inside the main population (the ratio of fish-buyer consumers is 50%)

Q= 1-P (the ratio of non-buying consumers is 50%)

$Z_{x/2}$= Level of significance (95%, table value 1.96)

d= 5% error term

Table 1. Selection of the supply chain intermediaries

Particulars	**Mangaluru**	**Udupi**	**Karwar**	**Total**
Fishermen	18	15	08	41
Auctioneers	07	05	04	16
Wholesalers	09	03	03	16
Retailers	09	06	04	19
Vendors	19	15	12	46
Supermarkets	05	04	03	12
Total	68	48	34	**150**

The coastal cities of Karnataka state such as Mangaluru, Udupi and Karwar and the non-coastal cities such as Bengaluru, Mysuru and Dharwad were selected for comparing the consumer preferences for marine fishes. The cities representing the headquarters of each coastal and non-coastal districts were selected based on their total population and geographic zones across. Since the

collection of information from the consumers requires extensive travel and the access to the consumers was difficult, the sample size for fish consumers survey was fixed at n=400 using the formula method already described. The proportionate to population size method was employed for distribution of sample size (n) for each city of coastal and non-coastal cities. For the selection of consumers, major fish markets in the selected coastal and non-coastal cities were considered. (Table 2.)

Table 2. Selection of the fish consumers

Coastal cities	**Sample size (n)**
Mangaluru	152
Udupi	29
Karwar	20
Sub total (a)	201
Non-coastal cities	
Bengaluru	162
Dharwad	17
Mysuru	20
Sub total (b)	199
Grand total (a+b)	400

3.2.4. Collection of secondary data

The secondary data was collected from both the published and unpublished records. Published information on district profiles was collected from the website **www.ka.nic.in.** Secondary data on commercially important varieties of marine fish prices were collected from KFDC limited, Mangaluru. The information pertaining to the fish production, profile of major fishing harbours and the infrastructure facilities available at major fishing harbours and landing centers was

collected from the annual reports of the Department of Fisheries, Government of Karnataka.

3.3. Sampling procedure

For collection of primary data, four sets of comprehensive survey schedules were designed and pre-tested to overcome any ambiguities and deficiency. On the basis of information obtained from pre-testing, necessary modifications were made in the interview schedules. The survey schedule for each individual is presented in Appendix. The first schedule was meant for the fisherman, second was for the supply chain intermediary, third schedule for fish consumer, and the fourth one was for the marine fish prices. Necessary care was taken to collect the most reliable information from the respondents involved in the study.

The simple random sampling technique was used to collect the primary data from fisherman and the supply chain intermediaries such as auctioneers, wholesalers, retailers, vendors, department stores and the supermarkets. The fortnightly data was collected on the prices of commercially important marine fish varieties from the major fishing harbours and Russell fish market in Bengaluru. The price information was collected at the fish landing centers, wholesale markets, retail markets and terminal markets to analyze the price fluctuations. The simple random sampling method was followed for the collection of primary data from fish consumers. The respondents answered all the questions by personal interview.

3.4. Sampling period

The sampling period for the study was planned from August 2013 to July 2014. The primary data was collected from the fishermen and the supply chain intermediaries during January 2014 to March 2014. The fortnightly data on commercially important marine fish varieties was collected during August 2013 to July 2014. The prices of marine fish landings from the traditional crafts during fishing ban were considered in the major fishing harbours. The fish consumer's survey was undertaken during April 2014 to July 2014 for both the selected coastal and non-coastal cities of the state. The information was recorded on interview schedule and the collected data were tabulated for statistical analysis.

3.5. Tools of analysis

3.5.1. Marketing efficiency analysis

Marketing efficiency of different marine fish supply chains in the study area has been calculated by using Shepherd Index (1972) which is as follows:

Shepherd Index (1972)

$$\text{Marketing Efficiency (ME)} = \frac{V}{I}$$

Where,

V = Value of goods sold or price paid by the consumer's

I = Total marketing costs and margins

Marketing efficiency was estimated as the ratio of consumer's price to total marketing costs and margins.

Marketing costs (Singh and Toppo, 2010)

The total cost incurred on marketing, in cash or in kind, by the fisherman and various intermediaries involved in the sale and purchase of the fish till the commodity reaches the ultimate consumer was calculated as follows:

$C = C_f + C_{m1} + C_{m2} + \ldots\ldots\ldots\ldots + C_{mn}$

Where,

C = Total cost of marketing of fish

C_f = Cost paid by the fisherman in marketing his produce

C_{mn}= Cost incurred by the n^{th} middleman in the process of buying and selling

Fisherman's Price (Singh and Toppo, 2010)

It is net price received by the fisherman at the time of first sale. This is equal to the wholesale price at the primary assembly centre, minus the charges borne by the producer in selling the fish. If P_n is the wholesale price in the primary assembling market and C_f is the marketing cost incurred by the producer, the producer's price (P_f) is given as follows:

$P_f = P_n - C_f$

Marketing margins of the Middleman (Balaji *et al*., 2010)

It is the difference between the total payments and receipts (sale price) of the middleman (the agency). The following measures were used.

Absolute margin of the middleman (A_{mi}) = $P_{ri} - (P_{pi} + C_{mi})$

$$\text{Percentage margin of the middleman } (P_{mi}) = \frac{P_{ri} - (P_{pi} + C_{mi})}{P_{ri}} \text{ X } 100$$

Where,

P_{ri} = Total value of receipts per unit of produce (sale price)

P_{pi} = Total purchase value of goods per unit of produce (Purchase price)

C_{mi} = Cost incurred in marketing per unit. The margin thus calculated includes the profit of the middleman and the returns

Fisherman's share in consumer's rupee (FSCR)

Fisherman's share in consumer's rupee (F_s) was calculated by using the following formula (Acharya and Agarwal, 2005):

$$F_s = \frac{P_f}{P_c} \text{ X } 100$$

Where,

F_s = Fisherman's share in consumer's rupee

P_f = Price of the produce received by the fisherman

P_c = Price of the produce paid by the consumer

Price Spread or Gross Marketing Margin (GMM)

Price Spread or Gross Marketing Margin is the difference between the net price received by the fishermen at landing centre (Price at first sales) and price paid by the consumer (Retail price or Price at last sales) for any given commodity at a particular point of time in a market (Aswathy, 2011) which is given below:

GMM = Retail Price (RP) - Landing centre Price (LP)

Fisherman's share in the consumer's rupee and the gross marketing margin were used for analyzing the trends in fish landings and studying the price behavior of fishes.

3.5.2. Coefficient of variation (Sathiadhas; 2012, Omar; 2014)

The prices of marine fish varieties fluctuate widely. They fluctuate across the seasons, within the season varies across the months, within the month across the days and within the days across the hours of business. Hence the stability of

fish prices was estimated by working out the Coefficient of Variation (CV) of the prices. CV is used to measure the seasonal variability of marine fish price fluctuations. CV is computed for monthly average fish prices of the year using the formula:

$$CV = \frac{\text{Standard deviation}}{\text{Mean}} \text{ X } 100$$

Range (Omar, 2014)

Range is the difference between the highest and the lowest average monthly price index values of marine fish.

Correlation (Blyn, 1973, Naik & Arora, 1986)

The degree of correlation between the prices of selected fish varieties at the points of first sales and the last sales is measured using correlation coefficient. Correlation coefficient is the commonly used measure of pricing efficiency and market integration in developing countries.

$$r = \frac{(P_{xi} - \overline{P}_x)(P_{yi} - \overline{P}_y)}{\sqrt{[\sum(P_{xi} - \overline{P}_x)^2][\sum(P_{yi} - \overline{P}_y)^2]}}$$

Where 'r' is the correlation coefficient, P_{xi} and P_{yi} are the monthly average prices of species 'i' at point of the first sales and point of the last sales respectively in each market.

3.5.3. Adoption index

Adoption index of each improved hygiene practices by the supply chain intermediaries was measured on a three-point scale viz., 'adopted', 'partially adopted' and 'not adopted' with the scoring pattern of 3, 2 and 1 respectively. From the response score, each index was computed by the ratio of actual score obtained to the maximum score possible and expressed in percentage for each

respondent (Balasubramaniam *et al*., 2004, Brajmohan *et al*., 2003, Ponnusamy *et al*., 2004).

3.5.4. Conjoint analysis (Louviere, 1991)

The important requirement of conjoint analysis for its application is the identification of appropriate attributes to describe the product and the specific and feasible levels of these attributes (Gerhardy and Ness, 1995). On the basis of the objective attributes, representative indicators for a given quality attribute are chosen. Further, the overall judgement of consumer's is broken down into the contributions of each level. The contribution of the various attribute levels to the overall judgement is called part-worths or relative utilities. In the present study, an additive type of conjoint model was used as it gives comparatively a better fit to the data than the other types of models. This model assumes that the overall evaluations are formed by the sum of separate part-worths or utilities of the attribute levels. The model is formulated as

$$Y = \sum_{i=1}^{n} \sum_{j=1}^{m} V_{ij} X_{ij}$$

Where,

Y denotes the consumer's overall evaluation of the product alternative,

V_{ij} is the part worth associated with level j (j=1, 2, 3,...m) of the attributes i (i=1,2,3……n) and

X_{ij} is a dummy variable representing the presence (=1) or absence (= 0) of the j^{th} level of i^{th} attribute.

The Ordinary Least Squares (OLS) regression analysis is the most commonly used procedure to estimate the part-worths. The goodness of fit of the model to the data is revealed by the Spearman's rank correlation coefficient between input and estimated values of the dependent variable. The attributes and its levels of fish were identified based on the interaction with experts with related field from the various fisheries institutions in India. The profiles describing features of fish were constructed by combining levels of the four attributes. Each combination of attribute levels represents a specific marine fish alternative to the consumer. For example, a fish variety, with bright appearance, available from fish market, and high priced represents a fish alternative. Similarly, other attribute levels and their combination can set up for all the four attributes with their levels resulting in 54 profile solution or combinations (3*3*3*2). However, the number of all possible combinations of these four attributes was too large for the consumers to evaluate. Hence, using IBM SPSS (20 version) package, a subset of 11 fish profiles was selected. Each profile was described on a separate card called plan card. The plan cards were explained to the selected consumer respondents and asked them to rank as per their preferences.

Table 3. Fish attributes selected for conjoint analysis

Attributes	**Level 1**	**Level 2**	**Level 3**
Price (₹/kg)	Less than 200	200-400	More than 400
Place of purchase	Fish market	Vendor	Supermarket
Variety of fish	Marine fish	Freshwater fish	Marine fish + Freshwater fish
Appearance	Bright	Dull	-

Table 4. Plan cards for conjoint analysis

Card ID	Price (₹/kg)	Place of purchase	Variety of fish	Appearance
1	More than 400	Vendor	Marine fish	Dull
2	200-400	Vendor	Marine and Freshwater fish	Bright
3	More than 400	Fish Market	Marine and Freshwater fish	Bright
4	Less than 200	Supermarket	Marine and Freshwater fish	Dull
5	200-400	Supermarket	Marine fish	Bright
6	Less than 200	Fish Market	Marine fish	Bright
7	Less than 200	Vendor	Freshwater fish	Bright
8	More than 400	Supermarket	Freshwater fish	Bright
9	200-400	Fish Market	Freshwater fish	Dull
10[a]	More than 400	Supermarket	Marine fish	Bright
11[b]	200-400	Fish Market	Marine and Freshwater fish	Dull

Note: a, b holdouts

3.5.5. Engel's coefficient

To study the standard of living of the consumer respondents, the ratio of expenditure on the food to total expenditure known as the Engel's coefficient was used. It is hypothesised that the higher the Engel's coefficient, the lower is the rate of saving consequently, the lower is a household's standard of living (Ramegowda, 2008).

$$\text{Engel's coefficient} = \frac{\text{Expenditure on Food}}{\text{Total expenditure}}$$

3.5.6. Rank Based Quotient (RBQ)

The constraints in fish purchase were studied using Rank Based Quotient. The Preferential ranking technique was used to identify the constraints faced by the respondents/fish consumers. The quantification of data was done by ranking the constraints from calculated RBQ as given by Sabarathnam (2002).

$$RBQ = \frac{\Sigma n\,(Fi)\,(n + 1 - i)}{i = 1 \quad (Nxn)} \; X \; 100$$

Where,

Fi = Number of consumers reporting a particular constraint under i^{th} rank

N= Number of consumers/sample size

n= Number of constraints identified

Chapter 4

DESCRIPTION OF THE STUDY AREA

This chapter briefly describes the geographical features of fishery resources potential, profile of fishing harbour facilities and marine fisheries and fish processing infrastructure facilities in the study area.

4.1. Location

The major fishing harbours from Mangaluru, Udupi and Karwar were selected for studying the efficiency of emerging fish supply chains. The marine fish landing centers, wholesale markets, retail markets and terminal markets adjacent/nearby the major fishing harbours were considered to analyze the seasonal price fluctuations of the most preferred marine fish varieties and also for the assessment of the existing fish market and marketing infrastructure. The wholesalers and the retailers from the oldest and the largest fish market known as "Russel market" from Bengaluru city was also considered for the assessment of seasonal price fluctuations of the most preferred marine fish varieties study. For comparing the consumer preferences for marine fishes across the coastal and non-coastal cities, the consumer respondents were selected from the major fish markets of coastal cities like Mangaluru, Udupi and Karwar and the non-coastal cities such as Bengaluru, Mysuru and Dharwad. The constraints were identified along the marine fish supply chains and also on the part of fish consumers in the study area.

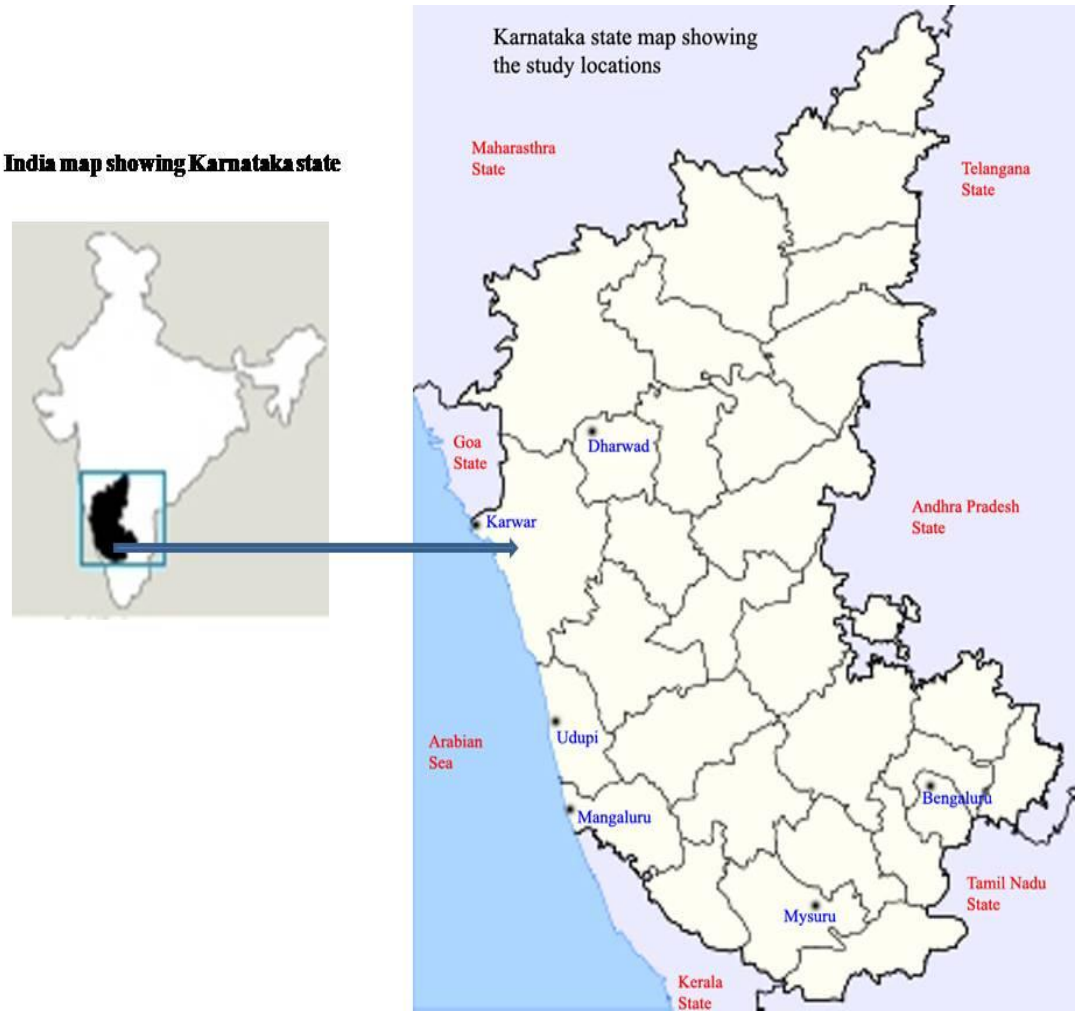

Fig. 1. Map showing study locations in Karnataka state, India.

4.2. Geographical features

4.2.1. Mangaluru

Mangaluru is located at 12.87°N 74.88°E in the Dakshina Kannada district of Karnataka. It has an average elevation of 22 metres above the mean sea level. It is the administrative headquarters of the Dakshina Kannada district, the largest urban coastal center of Karnataka, and the fourth largest city in the state. Mangaluru is situated on the west coast of India, and is bounded by the Arabian Sea to its west and the Western Ghats to its east. Mangaluru has a population of 484,785 as per the 2011 census of India. Mangaluru literacy rate is

94.03% significantly higher than the national average of 59.5%. Mangaluru has a tropical monsoon climate and is under the direct influence of the Arabian sea branch of the southwest monsoon. It receives about 95% of its total annual rainfall within a period of about six months from May to October, while the remaining extremely dry from December to March. The average annual precipitation in Mangaluru is 3,796.9 millimetres (149 in). Humidity is approximately 75% on average, and peaks during May, June and July. The maximum average humidity is 93% in July and the average minimum humidity is 56% in January.

4.2.2. Udupi

Udupi is a city in the southwest Indian State of Karnataka. It is the headquarters of Udupi District and is situated about 58 km north of Mangaluru and about 422 km northwest of Bengaluru. People in Udupi have the highest average per-capita income in Karnataka state. The poverty rate in Udupi is fairly low when compared to the Bengaluru and the other districts of Karnataka. Udupi's economy depends mainly on agriculture and fishing. As of the 2011 India census, Udupi had a population of 165,401. The climate in Udupi is hot in summer and pretty good in winter. During summers (from March to May) the temperature reaches up to 40 °C and in winters (from December to February) it is usually between 32 °C and 20 °C. The monsoon period is from June to September with the rainfall averaging more than 4000 mm every year with heavy winds.

4.2.3. Karwar

Karwar is a city in Uttara Kannada district of Karnataka state, India, and the administrative headquarters of Uttara Kannada district. Karwar lies on the west coast of southern India on the banks of the Kali river. Its geography creates a

natural harbour with protection against monsoon weather. The 2001 census recorded Karwar's population at 75,038. Karwar lies on a coastal strip known as the Monsoon Coast. Karwar has hot summers from March to May, where the temperature may reach 37 °C. Winters from December to February are very mild (24 °C and 32 °C). The windy monsoon period from June to September has an average rainfall of over 400 centimetres.

4.2.4. Bengaluru

Bengaluru, officially known as Bengaluru is the capital of the Indian state of Karnataka. It has a population of about 8.42 million and a metropolitan population of about 8.49 million, making it the third most populous city and fifth most populous urban agglomeration in India. Bengaluru is known as the "Silicon Valley of India" because of its role as the nation's leading information technology exporter. The cosmopolitan nature of the city has resulted in the migration of people from other states to Bengaluru. Bengaluru suffers from the major urbanisation problems as has been seen in many fast-growing cities in developing countries: rapidly escalating social inequality, mass displacement and dispossession, proliferation of slum settlements, and epidemic public health crisis due to severe water shortage and sewage problems in poor and working-class neighbourhoods. Due to its high elevation, Bengaluru usually enjoys a more moderate climate throughout the year, although occasional heat waves can make summer somewhat uncomfortable. Bengaluru receives rainfall from both the northeast and the southwest monsoons and the wettest months are September, October and August in that order.

4.2.5. Mysuru

Mysuru is the third largest city in the state of Karnataka, India, which served as the capital city of Mysuru Princely Kingdom (Kingdom of Mysuru) located at the base of the Chamundi Hills about 146 km southwest of the state capital Bengaluru. Mysuru is located at 12.30°N 74.65°E and has an average altitude of 770 metres. According to the provisional results of the 2011 census, Mysuru had a population of 8,87,000 with the literacy rate of 86.84%, which is higher than the state's average of 75.60%. The main seasons are summer from March to June, the monsoon season from July to November and winter from December to February.

4.2.6. Dharwad

Dharwad is the district headquarters of Dharwad district in the state of Karnataka, India. Dharwad is situated on the edge of the Western Ghats and hence is a hilly town spread over seven small hills at an average altitude of 750 meters above the sea level, the city enjoys a salubrious climate amidst thick vegetation. The climate is mildly hot during the summer (April-May), and pleasant during the rest of the year, as it is at an altitude of about 750 m, plus still has a lot of greenery round. The average yearly rainfall is 838 mm. Temperatures are fairly moderate from late October to early February with virtually no rainfall.

4.3. Marine Fisheries

The total length of the state’s coastline is 300 km out of which 42 km in Dakshina Kannada, 98 km in Udupi and 160 km in Uttara Kannada districts. Karnataka state has 27,000 km^2 area of continental shelf which represents 5% of the total continental shelf area. The EEZ area of the state is 87000 km^2 which is

4.30% of India's total EEZ. Similarly, Karnataka coast has 191 number of fishing villages. The total number of fish landing centers in the state is 26 (Table 5). However, the state fish production/mechanized fishing unit was 16.70 tons which is well above the national average of 12 tons. Fish production in India was observed a significant increase since independence and it has soared to 30.24 lakh tons in 2006-07 from a subsistence level of 5.34 tons in 1950-51 (GOI., 2008).

Table 5. Marine fisheries resources of Karnataka

Sl. No.	Particulars	Coastal line (km)	EEZ (million km^2)	Continental shelf (million km^2)	Number of fish landing centers	Number of fishing villages
1	Dakshina Kannada	42	N.A	N.A	3	21
2	Udupi	98	N.A	N.A	10	64
3	Uttara Kannada	160	N.A	10-11000	13	106
4	Karnataka	300	87000	27000	26	191
5	India	8811 (3.40)	2.02 (4.30)	0.53 (5)	2251 (1.15)	3202 (5.97)

Source: GOK (2009) and GOI (2008) Note: N.A= Not available

(Figures within the parentheses represent state percent share in India's marine fisheries resources)

The decadal growth of the state's average marine fish production per km of coastline was almost double of the nation's average production since 1950s and the rate of increase was steep during 70s and 80s, mainly due to the highly efficient exploitation of the pelagic resources by the purse seine fleets. During 1970-80 and 1980-90s, the rate of growth of production increased at decreasing rate although overall decadal growth was 40%. However from 1990-00 to 2000-09, the total marine fish production declined from 1,84,419 tons to 1,59,833

tons (Table 6). However at country level there was no decline in total marine fish production but in the state it could be observed a stagnation and marginal decline in the marine fish production which is an indicator of overfishing and unsustainability.

Table 6. Marine fish production Karnataka and India (in metric tons)

Decades	Karnataka		India	
	Average annual Production	**Average production/km of coastline**	**Average annual production**	**Average production/km of coastline**
1980-1990	151401.4	504.67	1697300 (8.92)	213.8
1990-2000	184419.3	614.73	2252300 (8.19)	299.6
2000-2009	159833.0	532.78	2924000 (5.47)	360.19

Source: GOK (2009) and CMFRI (2011)

(Figures within the parentheses represent percentage share of the Karnataka state in India's average annual production)

The share of non-mechanised/traditional sector declined from 59% in 1979-80 to 6% in 2008-09 in Karnataka state. The average catch rate per non-mechanised unit has declined from 1.03 metric tons in 1984-85 to 0.35 metric tons in 2008-09. The catch rate of mechanised units has declined from 80 metric tons in 1979-80 to 12 metric tons in 2008-09. The year wise review of Karnataka marine fish production shows a declining trend with year to year fluctuations (Table 7). The marine fisheries resource potential of the state is estimated at 4.25 \lakh metric tons, of which about 50% falls within the inshore region of 50 m depth and remaining within the off shore/deep zone (Jayaraj, 1983)**.** Compared to the estimated resource potential of the state of 4,25,000 tons, the actual catch is around 1,50,000 tons, which is only 35% of the potential (CMFRI, 2005). On the other hand, there are already signs of unsustainability as indicated by stagnating

total fish catch, declining size of fish and declining catch per unit of fishing effort (Nandakumar & Nayak, 2010). Thus, the resource potential and actual landings of Karnataka depict a disturbed picture.

Table 7. Sector-wise marine fish production in Karnataka (in metric tons)

Year	Total marine fish production	Marine fish production per fishing unit /year	
		Share of mechanised sector	Share of non-mechanised sector
1976-77	62785	17.70 (40.53)	NA (59.47)
1979-80	191026	80.14 (81.68)	NA (18.32)
1984-85	168046	51.11 (92.73)	1.03 (7.27)
1989-90	186132	45.96 (92.11)	1.26 (7.89)
1994-95	172500	31.87 (89.49)	1.52 (10.51)
1999-00	165653	24.91 (95.00)	0.43 (5.00)
2004-05	171227	20.88 (96.44)	0.32 (3.56)
2005-06	176897	19.63 (96.10)	0.33 (3.90)
2006-07	168881	44.44 (97.15)	0.23 (2.85)
2007-08	123956	12.34 (92.98)	0.41 (7.02)
2008-09	123978.6	12.43 (93.58)	0.35 (6.42)
Average	166612.55	32.85 (87.98)	0.53 (12.02)

Source: GOK (2005) and GOK (2009) Note: N.A= Not available

(Figures within the parentheses are percent share of mechanized and non mechanized boats)

4.3.1. Profile of fishing harbours in Karnataka

The profile of six major fishing harbours includes length, berthing capacity and availability of public utility services within the port. In addition, availability of allied services such as workshop, ice plants and cold storage, marketing yards were also documented. Based on the available information, we can conclude that Malpe has the more facilities and the largest in size followed by Mangaluru and Tadri. However, in terms of production, Mangaluru is the highest indicating the

preference of fishing units to land their catches at Mangaluru port as attracted by higher auction prices and the appropriate marketing arrangements. Fish processing infrastructure facilities such as ice plants, cold storages, canning plants, fish meal plants has been installed with proper approach roads, transport trucks, insulated vans and marketing facilities. In order to preserve the freshness of fish, the Government has encouraged investments through its policy of providing infrastructure loan at concessional interest rates and subsidies since 1980s. The commissioning of Mangaluru ice-cum-freezing plant, with a capacity of 5 tons/day, one cold storage of 68 tons and a frozen storage of 80 tons at Mangaluru in the early fifties, increased the level of consumption of fish in the fresh form (Table 8). However, the increased landings of shrimp, fin fish, cuttle fish, and squid enabled their freezing mainly for export to the European Union. This gave a spurt to processing activity which resulted in the establishment of about 31 freezing units in Karnataka (Ramalingam, 1986).

Table 8. Profile of major fishing harbours of Karnataka

Particulars	Major fishing harbours					
	Mangaluru	**Malpe**	**Honnavar**	**Tadri**	**Karwar**	**Gangolli**
Year of commencement						
i. First stage	1984-85	1975-76	1973-74	1982-83	1966-63	2001-02
ii. Second stage	2000-01	1996-97	-	1993-94	-	-
Length of quay	183 m	658 m	200 m	250 m	160 m	54 m
Berthing capacity(no. of boats)	230	279	40	50	33	40
Marine fisheries infrastructure						
No. of auction halls	2	3	2	1.	2	2
Length of auction halls (sq.m)	675	4500	2760	1400	260.	1680
Jetties	A	A	A	A	A	A
Roads	A	A	A	A	A	A
Freshwater supply	A	A	A	A	A	NA
Drainages	A	NA	A	A	A	NA
Electricity	A	A	A	A	A	A
Toilets	A	A	A	A	A	A
Parking facility	A	A	A	A	A	A
Boat building yard (no.)	11	11	4	2	5	12
Mechanical workshop	A	A	NA	A	A	A
Slipway	NA	A	NA	NA	A	NA
Community hall	NA	NA	NA	A	NA	NA
Diesel bunk(no.)	5	6	2	3	2	3
Ice plants(no.)	5	7	2	2	1	1
Cold storage and freezing plant	NA	NA	NA	1	1	NA
Satellite communication	A	A	A	A	A	NA
Fish markets and handling sheds	NA	NA	A	NA	NA	NA
Fish gear shed	NA	A	NA	A	NA	A
Dry fishing yard	NA	A	A	A	A	A
Fish marketing co-operatives (nos.)	5	6	2	2	2	3
Cumulative public investments (₹ in lakh)	290.14	2725.34	120.98	1505.68	162.10	902.36

Source: GOK; 1977, GOK; 1987, Mohamed; 1998, Moorjani; 1984 Note: A = Available, NA = Not available

Canning enterprises were started in Karnataka during the late 1960s. During the following decade, 1970-72, there were 13 fish canning companies with varying production capacity of 500 to 25,000 cans per day, in the undivided D.K. district (Sripathy, 1986). The demand for canned fish arises mostly from the defence services and from North eastern states. The main importers of fish canned products are countries of Europe and America. Tuna, mackerel and oil sardine are the three major fish species, used for canning in Karnataka. Due to the growing demand for frozen products coupled with high cost of tin containers, the canning sector suffered a setback in the export field by the middle of 1970. During the period 1990-98, though the number of canning units in coastal Karnataka decreased from 10 to 8 units, the annual capacity increased from 320 tons to 528 tons (GOK, 2009). The number of ice plants increased from 50 to 187 during 1970-2009 and the ton capacity per day has increased over 6 times during the same period. During the corresponding period, the installed capacity of cold storages increased from 874 metric ton per day to 2055 metric ton per day. The number of fish meal factories increased from 4 to 20 during 1977-2009. (Table 9&10)

With the objective of an integrated marine fisheries development, the Government of Karnataka established Karnataka Fisheries Development Corporation (KFDC) during 1971. The corporation resulted in a huge revolutionary change in fish marketing by establishing cold chain system to supply fresh and iced fish to interior rural markets, and through refrigerated trucks and cold storages to the farther and interior urban markets. The system, which

covered four districts of the state was a landmark development in freezing technology (Moorjani, 1984).

Table 9. Marine fisheries infrastructure in Karnataka

Particulars	1977		1988-89		1996-97		2008-09	
	No.	Capacity (metric tons/day)	No.	Capacity (metric tons/day)	No.	Capacity (metric tons/day)	No.	Capacity (metric tons/day)
Ice Plants								
Dakshina Kannada	NA	-	-	-	38	475	63	933
Udupi	-	-	-	-	53	731	69	1152
Uttarakannada	NA	-	-	-	34	616	55	721.5
Total	90	781	93	1191	125	1822	187	2806.5
Cold Storage								
Dakshina Kannada	-	-	-	-	20	653	10	357
Udupi	-	-	-	-	9	886	8	1056
Uttarakannada	-	-	-	-	10	1028	9	642.50
Total	20	797	29	1183	39	2567	27	2055.5
Freezing Plants								
Dakshina Kannada	-	-	-	-	11	58	3	19
Udupi	-	-	-	-	5	39	5	28
Uttarakannada	-	-	-	-	6	39	5	32.5
Total	25	117.5	20	123	22	136	13	79.5
Frozen Storage								
Dakshina Kannada	-	-	-	-	10	1090	2	178
Udupi	-	-	-	-	4	625	4	725
Uttarakannada	-	-	-	-	6	1025	5	750
Total	25	236.1	17	2054	20	2740	11	1653
Canning Plants								
Dakshina Kannada	12	NA	7	24.5	-	-	-	-
Udupi	-	-	-	-	6	524	7	526
Uttarakannada	-	-	-	-	1	2	1	1.5
Total	12		7	245	7	526	8	527.5
Fish meal Plant								
Dakshina Kannada	-	-	-	-	10	71	14	291.5
Udupi	-	-	-	-	6	73	5	83
Uttarakannada	-	-	-	-	2	40	1	40
Total	4		1	129.5	18	184	20	414.5

Source: GOK; 1977, GOK; 1995, GOK; 2009, GOK; 2010 Note: NA =Not available

Table 10. Fish processing infrastructure in Karnataka

Details	1970		1977		1987		1997		2008-09	
	No.	Capacity	No.	Capacity	No.	Capacity	No.	Capacity	No.	Capacity
Ice plants	50	418	90	781	136	1518	125	1822	187	2806.5
Cold storage	NA	874	20	797	46	1630	39	2567	27	2055.5
Freezing plants	15	70	25	117.5	25	116.5	22	136	13	79.5
Frozen storage	NA	NA	25	236.1	25	2900	20	2740	11	1653
Canning plants	13	NA	12	NA	7	24.5	7	526	8	527.5
Fish meal plant	NA	NA	4	NA	10	129.5	18	184	20	414.5
No. of fish markets	NA	-	NA	-	NA	-	158	-	218	-

Source: Bhatta and Sagarad; 1999, GOK; 1977 GOK; 2009, GOK; 2010, NA=Not available, (Capacity is given in tons/day)

CHAPTER 5

RESULTS AND DISCUSSION

5.1. Price spread, Fishermen's share in consumer rupee and Marketing efficiency of marine fish supply chains in Mangaluru fishing harbour

The network of auctioneers, wholesalers, retailers and vendors participate in the disposal of marine fish from fishermen to the consumers. The emerging fish supply chains operating in the fishing harbours of Karnataka state for disposal of marine fish are identified and presented in subsequent sections. The emerging marine fish supply chains observed in the marketing of marine fish in Mangaluru, Udupi and Karwar major fishing harbours are as follows:

1. Fishermen - Auctioneers - Wholesalers - Retailers - Consumers
2. Fishermen - Auctioneers - Retailers - Consumers
3. Fishermen - Agents of Supermarket - Supermarkets - Consumers
4. Fishermen - Auctioneers - Vendors - Consumers

The marketing efficiency aspects of marine fish supply chains in Mangaluru fishing harbour are discussed in the Table 11. The marketing efficiency of marine fish supply chains for the commercially important marine fish varieties in Mangaluru fishing harbour was varied across the marine supply chains and fish varieties due to the added marketing costs and margins by the different supply chain intermediaries. The price spread is the actual difference of the price paid by the consumer and received by the fishermen for specific amount of quantity along the marine fish supply chain. The fishermen and the consumers are less benefitted as the price spread

increases and vice versa. The Fishermen's Share in Consumer Rupee (FSCR) refers to the actual share or percentage of fishermen in the final price paid by the consumer. As the percentage of FSCR increases, the fishermen would receive more percentage of consumer's rupee. The marketing efficiency gives an idea about the total marketing costs and marketing margins added by the different market intermediaries of marine fish supply chains during the process of fish marketing. As the marketing costs and the margins increases, the marketing efficiency would get reduced and vice versa which implies that there is an inverse relationship exists between the marketing efficiency and the marketing costs and marketing margins. The fishermen and the consumers are more benefitted with higher the marketing efficiency.

The FSCR and the marketing efficiency for the White Pomfrets was found to be the highest among the commercially important marine fish varieties such as 90.73% and 10.79 respectively with a price spread of 48.01 ₹/kg whereas, the fishermen's share was 31 to 68 % (Panikar and Sathiadas, 1985). The auctioneers were incurred marketing cost of 0.50 ₹/kg and a marketing margin of 5 ₹/kg while the wholesalers were added the marketing cost of 2.45 ₹/kg and the marketing margin of 9 ₹/kg and the retailers incurred marketing cost of 6.50 ₹/kg and margin of 24.56 ₹/kg for White Pomfret under the supply chain 1. The FSCR and the marketing efficiency for Black Pomfret was maximum with 89.19% and 9.25 respectively with a price spread of 37.59₹/kg. The high consumer preference is the main reason for higher fishermen share in consumer rupee for high value fishes. The price spread was the highest for Seer fish (50.30₹/kg) with the FSCR of 87.43% and the marketing

efficiency of 7.96. The marketing costs and the margin of 2.45 ₹/kg and 12 ₹/kg was added for the wholesalers and the marketing costs and the margin of 6.50 ₹/kg and 22.45₹/kg was added for the retailers for Seer fish under the supply chain 1. The price spread, FSCR and marketing efficiency for Shrimp was 40.15 ₹/kg, 85.14% and 6.73 respectively with the marketing costs and the margin of 2.45 ₹/kg and 8.45 ₹/kg was incurred for the wholesalers and marketing costs and margin of 6.50 ₹/kg and 18.20 ₹/kg was incurred for the retailers under the supply chain 1. The FSCR was 83.09% for Pink Perch followed by the 81.66% for Cat fish, 79.33% for Anchovy and 77.80% for Crab. The FSCR was the lowest for Sardine (63.12%) and Mackerel (66.53%) with a price spread of 20.45 ₹/kg and 31.85 ₹/kg respectively under the supply chain 1.

The FSCR was the highest for White Pomfret (89.75%), Black Pomfret (87.30%) and Seer fish (86.76%) under the marine fish supply chain 2 whereas it was 30-95% for fresh fish marketing in Tamil Nadu (Shrinivasan, 1985). The FSCR and the marketing efficiency for White Pomfret were the highest accounting for 89.75% and 11.46 respectively with a price spread of 53.70 ₹/kg whereas Sathiadhas and Panikar (1988) reported only 60% for Pomfrets. The marketing cost and the margin of 0.60 ₹/kg and 4.35 ₹/kg was added for the auctioneer and 10.20 ₹/kg and 27.50 ₹/kg for the retailer under the marine fish supply chain 2. The FSCR and the marketing efficiency for Black Pomfret was 87.30% and 8.84 respectively with a price spread of 45.10 ₹/kg. The marketing margin of 4.35 ₹/kg was added for the auctioneer and 25₹ /kg for the retailer. The FSCR and the marketing efficiency for Seer fish was worked

out to 86.76% and 8.95 respectively with a price spread of 53.41 ₹/kg. The marketing margin of 7.73 ₹/kg was incurred for the auctioneer and 26.55 ₹/kg for the retailer. The FSCR and the marketing efficiency for the Shrimps came to 84.34% and 7.46 respectively with a price spread of 42.70 ₹/kg. The marketing margin of 5.55 ₹/kg was added for the auctioneer and 20.20 ₹/kg for the retailer. The FSCR and the marketing efficiency for Pink Perch was 80.13% and 5.71 respectively with a price spread of 32.24 ₹/kg. The marketing margin of 3.22 ₹/kg was added by the auctioneer and 14.40 ₹/kg by the retailer. The FSCR and marketing efficiency was the lowest for Sardine accounting for 60.40% and 2.71 respectively with a price spread of 22.95 ₹/kg. The marketing margin of 1 ₹/kg was incurred the auctioneer and 9.55 ₹/kg by the retailer for Sardines under the marine fish supply chain 2.

The FSCR and marketing efficiency for Black Pomfret was the highest accounting for 86.50% and 8.26 respectively with a price spread of 48.37 ₹/kg. The marketing cost and the margin of 1.75 ₹/kg and 3.21 ₹/kg was incurred by the agents of supermarket and 18.45 ₹/kg and 20 ₹/kg by the supermarket under the marine fish supply chain 3. The FSCR and the marketing efficiency for White Pomfret was calculated as 84.12% and 7.11 respectively with a price spread of 88.75 ₹/kg whereas, Prasad *et al.* (1990) was reported only 61% in fish marketing in Andhra Pradesh. The marketing cost and marketing margin of 1.75 ₹/kg and 8.40 ₹/kg added by the agents of supermarket and 18.45 ₹/kg and 50 ₹/kg by the supermarket. The price spread for Seer fish calculated as 78.39 ₹/kg with the FSCR and the marketing efficiency of 81.70% and 6.40 respectively. The price spread for Shrimp was 73.95

₹/kg with the FSCR and the marketing efficiency of 75.67% and 4.77 respectively. The FSCR was the lowest for Mackerel (54.71%) and Crab (63.91%) with a price spread of 52.41 ₹/kg and 48.95 ₹/kg respectively under the marine fish supply chain 3.

The price spread for White Pomfret was 63.12 ₹/kg with the FSCR and the marketing efficiency of 87.70% and 8.80 respectively. The auctioneers incurred marketing cost of 0.75 ₹/kg with a marketing margin of 4.05 ₹/kg for White Pomfret. The fish vendors incurred a marketing cost of 13.40 ₹/kg for 40.12 ₹/kg. The FSCR and marketing efficiency for Seer fish was 86.78% and 8.42 respectively with a GMM of 60.91 ₹/kg while the share of accrued marketing margin by the auctioneers was 5.40 and 35.21 ₹/kg by the fish vendors. The FSCR and marketing efficiency for Black Pomfret was 81.60% and 6.05 respectively with GMM of 60.90 ₹/kg with the accrued marketing margin of 5.50 ₹/kg by the auctioneer and 35 ₹/kg by the fish vendors. The FSCR and marketing efficiency for Shrimp was 78.55% and 5.04 with a GMM of 54.60 ₹/kg however the marketing cost added by the auctioneers was of 3.35 ₹/kg and 33 ₹/kg from the fish vendors. The price spread was less for the Sardines (27 ₹/kg) and Crab (28.05 ₹/kg) with FSCR of 47.26% and 74.21% respectively. The marketing margin of 2.5 ₹/kg added from the auctioneers and 8 ₹/kg from the fish vendors for Sardine under the marine fish supply chain 4. Munireddy and Mohan (2008a) reported that the primary fishermen gets only 32.5% of the consumer rupee and middlemen were getting lion share in consumer rupee for

marketing of mackerel and sardine in Karnataka but the present study revealed that fishermen share of consumer rupee was improved.

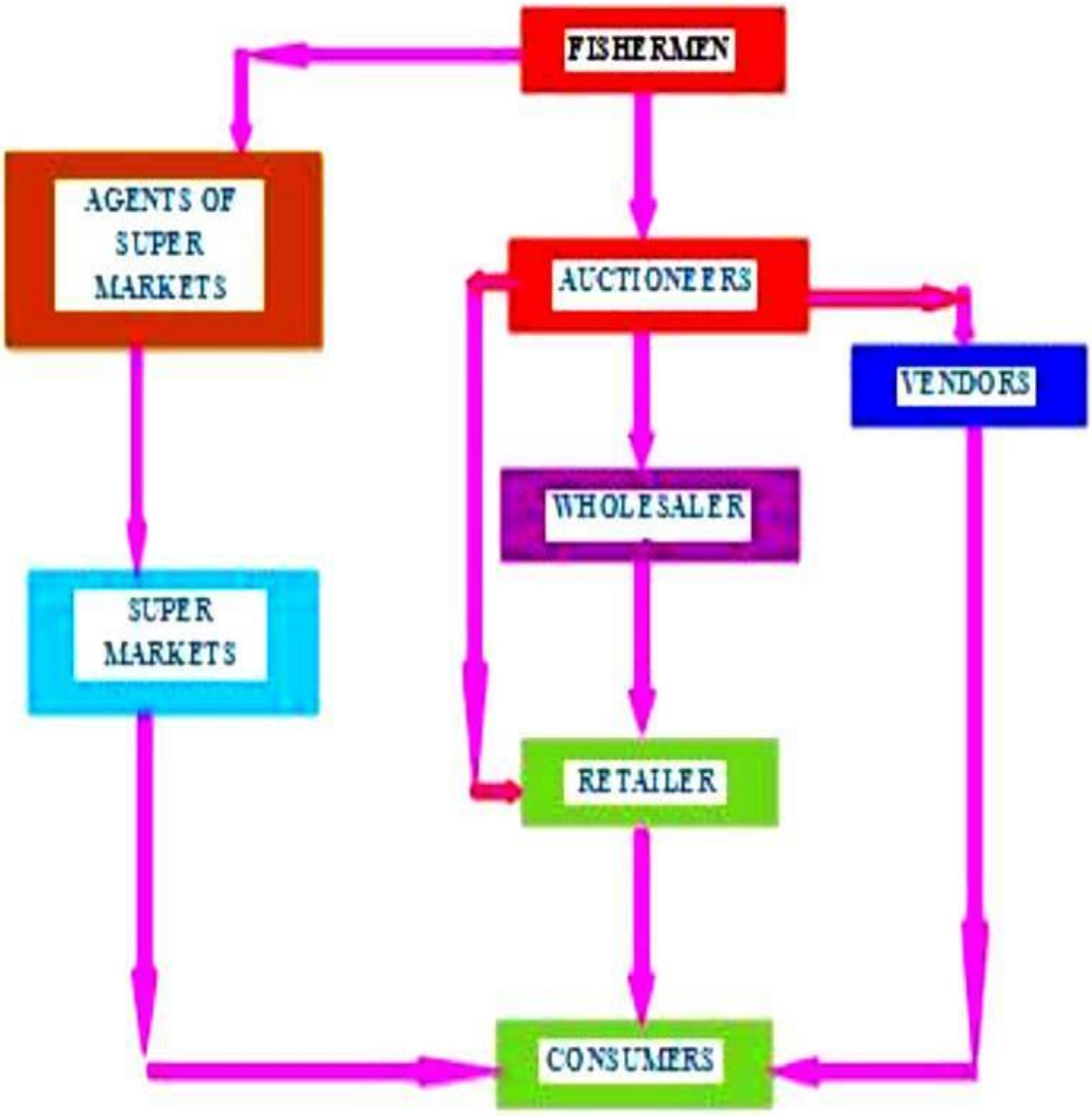

Fig. 2. The network of marine fish supply chains in Karnataka

Table.11. Price spread, Fishermen's share in consumer rupee and Marketing efficiency of marine fish supply chains in Mangaluru fishing harbour (₹/kg)

SC 1: Fishermen - Auctioneers - Wholesalers - Retailers – Consumers											**Overall Average**
Particulars	**A**	**BP**	**WP**	**CF**	**C**	**M**	**PP**	**S**	**SF**	**SH**	
Auctioneer purchase price	85.00	310.00	470.00	108.00	86.70	63.30	130.00	35.00	350.00	230.00	186.80
Marketing cost	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Marketing margin	1.05	3.35	5.00	1.80	2.45	3.30	1.25	1.50	6.40	4.05	3.02
Auctioneer sold price	86.55	313.85	475.50	110.30	89.65	67.10	131.75	37.00	356.90	234.55	190.32
Wholesaler purchase price	86.55	313.85	475.50	110.30	89.65	67.10	131.75	37.00	356.90	234.55	190.32
Marketing cost	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45
Marketing margin	3.25	7.40	9.00	2.80	3.50	5.60	4.25	2.00	12.00	8.45	5.83
Wholesaler sold price	92.25	323.70	486.95	115.55	95.60	75.15	138.45	41.45	371.35	245.45	198.59
Retailer purchase price	92.25	323.70	486.95	115.55	95.60	75.15	138.45	41.45	371.35	245.45	198.59
Marketing cost	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50
Marketing margin	8.40	17.39	24.56	10.20	9.34	13.50	11.50	7.50	22.45	18.20	14.30
Retailer sold price	107.15	347.59	518.01	132.25	111.44	95.15	156.45	55.45	400.30	270.15	219.39
Price spread or GMM (₹/kg)	**22.15**	**37.59**	**48.01**	**24.25**	**24.74**	**31.85**	**26.45**	**20.45**	**50.30**	**40.15**	**32.59**
Fishermen's share in consumer rupee (%)	**79.33**	**89.19**	**90.73**	**81.66**	**77.80**	**66.53**	**83.09**	**63.12**	**87.43**	**85.14**	**80.40**
Marketing efficiency	**4.84**	**9.25**	**10.79**	**5.45**	**4.50**	**2.99**	**5.91**	**2.71**	**7.96**	**6.73**	**6.11**
Note: A:Anchovy, BP:Black Pomfret, WP:White Pomfret, CF:Cat Fish,C: Crab, M:Mackerel, PP:Pink Perch, S:Sardine, SF:Seer Fish, SH:Shrimp. GMM:Gross Marketing Margin											

SC 2: Fishermen - Auctioneers - Retailers - Consumers											Overall Average
Particulars	**A**	**BP**	**WP**	**CF**	**C**	**M**	**PP**	**S**	**SF**	**SH**	
Auctioneer purchase price	85.00	310.00	470.00	108.00	86.70	63.30	130.00	35.00	350.00	230.00	186.80
Marketing cost	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60	0.60
Marketing margin	1.65	4.35	7.40	2.00	3.50	4.20	3.22	1.00	7.73	5.55	4.06
Auctioneer sold price	87.25	314.95	478	110.6	90.8	68.1	133.82	36.6	358.33	236.15	191.46
Retailer purchase price	89.5	319.9	486	113.2	94.9	72.9	137.64	38.2	366.66	242.3	196.12
Marketing cost	10.20	10.20	10.20	10.20	10.20	10.20	10.20	10.20	10.20	10.20	10.20
Marketing margin	15.00	25.00	27.50	15.00	12.34	15.55	14.40	9.55	26.55	20.20	18.11
Retailer sold price	114.7	355.1	523.7	138.4	117.44	98.65	162.24	57.95	403.41	272.7	224.43
Price spread or GMM (₹/kg)	**29.70**	**45.10**	**53.70**	**30.40**	**30.74**	**35.35**	**32.24**	**22.95**	**53.41**	**42.70**	**37.63**
Fishermen's share in consumer rupee (%)	**74.11**	**87.30**	**89.75**	**78.03**	**73.82**	**64.17**	**80.13**	**60.40**	**86.76**	**84.34**	**77.88**
Marketing efficiency	**4.18**	**8.84**	**11.46**	**4.98**	**4.41**	**3.23**	**5.71**	**2.71**	**8.95**	**7.46**	**6.19**
Note: A:Anchovy, BP:Black Pomfret, WP:White Pomfret, CF:Cat Fish,C: Crab, M:Mackerel, PP:Pink Perch, S:Sardine, SF:Seer Fish, SH:Shrimp. GMM:Gross Marketing Margin											

SC 3: Fishermen - Agents of supermarket- Supermarkets - Consumers											Overall Average
Particulars	**A**	**BP**	**WP**	**CF**	**C**	**M**	**PP**	**S**	**SF**	**SH**	
Agents purchase price	-	310.00	470.00	-	86.70	63.30	130.00	-	350.00	230.00	234.29
Marketing cost	-	1.75	1.75	-	1.75	1.75	1.75	-	1.75	1.75	1.75
Marketing margin	-	3.21	8.40	-	5.50	6.23	4.35	-	9.72	8.50	6.56
Agents sold price	-	314.96	480.15	-	93.95	71.28	136.10	-	361.47	240.25	242.59
Supermarket purchase price	-	319.92	490.30	-	101.20	79.26	142.20	-	372.94	250.50	250.90
Marketing cost	-	18.45	18.45	-	18.45	18.45	18.45	-	18.45	18.45	18.45
Marketing margin	-	20.00	50.00	-	16.00	18.00	16.00	-	37.00	35.00	27.43
Supermarket sold price	-	358.37	558.75	-	135.65	115.71	176.65	-	428.39	303.95	296.78
Price spread or GMM (₹/kg)	**-**	**48.37**	**88.75**	**-**	**48.95**	**52.41**	**46.65**	**-**	**78.39**	**73.95**	**62.50**
Fishermen's share in consumer rupee (%)	**-**	**86.50**	**84.12**	**-**	**63.91**	**54.71**	**73.59**	**-**	**81.70**	**75.67**	**74.31**
Marketing efficiency	**-**	**8.26**	**7.11**	**-**	**3.25**	**2.60**	**4.36**	**-**	**6.40**	**4.77**	**5.25**

Note: A:Anchovy, BP:Black Pomfret, WP:White Pomfret, CF:Cat Fish,C: Crab, M:Mackerel, PP:Pink Perch, S:Sardine, SF:Seer Fish, SH:Shrimp. GMM:Gross Marketing Margin

SC 4: Fishermen - Auctioneers - Vendors - Consumers											Overall Average
Particulars	**A**	**BP**	**WP**	**CF**	**C**	**M**	**PP**	**S**	**SF**	**SH**	
Auctioneer purchase price	80.00	270.00	450.00	88.00	80.70	63.30	80.00	25.00	400.00	200.00	173.70
Marketing cost	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Marketing margin	3.40	5.50	4.05	2.89	1.35	4.20	2.65	2.50	5.40	3.35	3.53
Auctioneer sold price	84.15	276.25	454.80	91.64	82.80	68.25	83.40	28.25	406.15	204.10	177.98
Vendor purchase price	88.30	282.50	459.60	95.28	84.90	73.20	86.80	31.50	412.30	208.20	182.26
Marketing cost	13.40	13.40	13.40	13.40	13.40	13.40	13.40	13.40	13.40	13.40	13.40
Marketing margin	12.32	35.00	40.12	13.00	10.45	12.00	11.34	8.00	35.21	33.00	21.04
Vendor sold price	114.02	330.90	513.12	121.68	108.75	98.60	111.54	52.90	460.91	254.60	216.70
Price spread or GMM (₹/kg)	**34.02**	**60.90**	**63.12**	**33.68**	**28.05**	**35.30**	**31.54**	**27.90**	**60.91**	**54.60**	**43.00**
Fishermen's share in consumer rupee (%)	**70.16**	**81.60**	**87.70**	**72.32**	**74.21**	**64.20**	**71.72**	**47.26**	**86.78**	**78.55**	**73.45**
Marketing efficiency	**3.82**	**6.05**	**8.80**	**4.05**	**4.19**	**3.25**	**3.96**	**2.15**	**8.42**	**5.04**	**4.97**
Note: A:Anchovy, BP:Black Pomfret, WP:White Pomfret, CF:Cat Fish,C: Crab, M:Mackerel, PP:Pink Perch, S:Sardine, SF:Seer Fish, SH:Shrimp. GMM:Gross Marketing Margin											

5.2. Price spread, Fishermen's share in consumer rupee and Marketing efficiency of marine fish supply chains in Malpe fishing harbour, Udupi

The marketing efficiency of marine fish supply chains for the commercially important marine fish varieties in Malpe fishing harbour was discussed across the marine supply chains and fish varieties given in the Table 12. The price spread is the actual difference of the price paid by the consumer and received by the fishermen for specific amount of quantity along the marine fish supply chain. The fishermen and consumers are less benefitted as the price spread increases and vice verse. Fishermen's Share in Consumer Rupee (FSCR) refers to the actual share or percentage of fishermen in the final price paid by the consumer. The marketing efficiency is gives an idea about the total marketing costs and marketing margins added by the different intermediaries of marine fish supply chain during the process of fish marketing. As the added costs increases the marketing efficiency would reduces and vice verse. Thus an inverse relationship lies between the marketing efficiency and marketing costs and marketing margins. The fishermen and consumers are less benefitted are more benefitted if the marketing efficiency is good.

The FSCR was maximum for White Pomfret (90.07%) and Black Pomfret (88.39%) with a price spread of 51.82 ₹/kg and 40.70 ₹/kg respectively. The marketing cost of 0.40 ₹/kg was accrued for the auctioneer, 1.95 ₹/kg was added by the wholesalers and 8.67 ₹/kg was added for the retailers for each selected marine fish variety under the marine fish supply chain 1 in Malpe. The marketing margin fixed by the auctioneers was 7.5 ₹/kg, wholesalers (10.30 ₹/kg), retailers (23 ₹/kg) for White

Pomfret under the marine fish supply chain 1 whereas, a marketing margin of 5.23 ₹/kg was fixed by the auctioneers, 9.45 ₹/kg fixed by the wholesalers and 15 ₹/kg was fixed by the retailers for Black Pomfret under the marine fish supply chain 1. The FSCR for Seer fish and Shrimp was 86.25% and 85.02% with a price spread of 55.82 ₹/kg and 40.52 ₹/kg respectively. Viswanatha *et al*., (2012) reported very high price spread for pomfrets (168 Rs/kg) and seer fish (163 Rs/kg) in Karnataka while the present study reported less price spread. The marketing margin of 7 ₹/kg added by the auctioneers, 10.50 ₹/kg was added by the wholesalers and the retailers were added 27.30 ₹/kg for Seer fish while, the auctioneers were fixed 3.5 ₹/kg, 9 ₹/kg was added by the wholesalers and the retailers were added 17 ₹/kg for Shrimp. The FSCR was significantly better for Pink Perch (83.64%) and Cat fish (82.05%) with a price spread of 25.42 ₹/kg and 23.62 ₹/kg respectively. Sathiadhas and Panikkar (1992) estimated the fisherman's share varied from 32 to 72 % higher for quality fishes. The price spread was the lowest for Sardine (17.79 ₹/kg) with a FSCR and the marketing efficiency of 66.30% and 2.97 respectively under the marine fish supply chain 1 in Malpe fishing harbour.

The FSCR was the maximum for White Pomfret (91.53%) and Black Pomfret (90.68%) with a GMM of 46.24 ₹/kg and 35.99 ₹/kg respectively. The marketing cost of 0.50 ₹/kg was accrued by the auctioneer, 7.24 ₹/kg was added by the retailers for each selected marine fish variety. The FSCR for Seer fish was 90.45% and 88.59% for Shrimp with GMM of 47.53 ₹/kg and 32.19 ₹/kg respectively. The marketing margin of 9.45 ₹/kg was added by the auctioneers and 30.34 ₹/kg was added by the

retailers for Seer fish under the marine fish supply chain 2. The price spread was minimum for Sardine (12.74 ₹/kg), Cat fish (16.78 ₹/kg) and Anchovy (16.74 ₹/kg) with FSCR of 75.84%, 86.55% and 82.70% respectively. The marketing margin of 1.5 ₹/kg added by the auctioneers and 3.5 ₹/kg was incurred by the retailers for Sardine under the marine fish supply chain 2.

The FSCR and the marketing efficiency for White Pomfret was 89.31% with a price spread and marketing efficiency of 65.85 ₹/kg and 9.35 respectively. The marketing efficiency was the maximum for Seer fish (11.91) with FSCR and a price spread of 91.60% and 45.85 ₹/kg. The marketing cost of 1.4 ₹/kg was borne by the agents of supermarket and 13.45 ₹/kg was added by the supermarkets for all the selected commercially important varieties of marine fish. The FSCR was also considerably better for shrimps (84.03%), Crabs (79.89%) and Cat fish (78.75%). The agents of supermarkets were fixed highest marketing margin for White Pomfret (16 ₹/kg), Seer fish (12 ₹/kg) and Black Pomfret (11 ₹/kg) whereas, the marketing margin was fixed highest by the supermarkets for White Pomfret (35.00 ₹/kg), Black Pomfret (30.78 ₹/kg) and Shrimps (25.87 ₹/kg). The FSCR was minimum for Sardine (63.41%) and Anchovy (68.22%) with a price spread of 25.97 ₹/kg and 32.61 ₹/kg respectively under the marine fish supply chain 3.

The price spread was maximum for Seer fish (66.98 ₹/kg) and FSCR was the highest for White Pomfret (86.71%) with a price spread of 58.25 ₹/kg. The marketing cost of 0.80 ₹/kg was borne by the auctioneers and 8.45 ₹/kg incurred by the fish vendors for all the selected marine fish under the marine fish supply chain 4. The

FSCR for Black Pomfret was 84.22% with a price spread and marketing efficiency of 48.70 ₹/kg and 6.34 respectively. The marketing margin of 9.20 ₹/kg was added by the auctioneers and 30.25 ₹/kg was added by the fish vendors. The FSCR for Shrimp and Pink Perch was 81.50% and 79.11 with the marketing efficiency of 5.41 and 4.79 respectively. The marketing efficiency was least for Sardine (2.85) and Anchovy (3.49) with price spread of 18.95 ₹/kg and 26.14 ₹/kg respectively. The lowest marketing margin of 7.20 ₹/kg and 8.34 ₹/kg was fixed by the fish vendors for Sardine and Mackerel respectively under the marine fish supply chain 4.

Table.12. Price spread, Fishermen's share in consumer rupee and Marketing efficiency of marine fish supply chains in Malpe fishing harbour (₹/kg)

SC 1: Fishermen - Auctioneers - Wholesalers - Retailers - Consumers											**Overall Average**
Particulars	**A**	**BP**	**WP**	**CF**	**C**	**M**	**PP**	**S**	**SF**	**SH**	
Auctioneer purchase price	70.00	310.00	470.00	108.00	86.70	63.30	130.00	35.00	350.00	230.00	185.30
Marketing cost	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Marketing margin	2.00	5.23	7.50	1.00	3.00	2.45	2.00	0.82	7.00	3.50	3.45
Auctioneer sold price	72.40	315.63	477.90	109.40	90.10	66.15	132.40	36.22	357.40	233.90	189.15
Wholesaler purchase price	72.40	315.63	477.90	109.40	90.10	66.15	132.40	36.22	357.40	233.90	189.15
Marketing cost	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
Marketing margin	4.50	9.45	10.30	3.00	2.85	5.00	3.50	1.45	10.50	9.00	5.96
Wholesaler sold price	78.85	327.03	490.15	114.35	94.90	73.10	137.85	39.62	369.85	244.85	197.06
Retailer purchase price	78.85	327.03	490.15	114.35	94.90	73.10	137.85	39.62	369.85	244.85	197.06
Marketing cost	8.67	8.67	8.67	8.67	8.67	8.67	8.67	8.67	8.67	8.67	8.67
Marketing margin	7.45	15.00	23.00	8.60	9.10	10.00	8.90	4.50	27.30	17.00	13.09
Retailer sold price	94.97	350.70	521.82	131.62	112.67	91.77	155.42	52.79	405.82	270.52	218.81
Price spread or GMM (₹/kg)	**24.97**	**40.70**	**51.82**	**23.62**	**25.97**	**28.47**	**25.42**	**17.79**	**55.82**	**40.52**	**33.51**
Fishermen's share in consumer rupee (%)	**73.71**	**88.39**	**90.07**	**82.05**	**76.95**	**68.98**	**83.64**	**66.30**	**86.25**	**85.02**	**80.14**
Marketing efficiency	**3.80**	**8.62**	**10.07**	**5.57**	**4.34**	**3.22**	**6.11**	**2.97**	**7.27**	**6.68**	**5.87**

Note: A:Anchovy, BP:Black Pomfret, WP:White Pomfret, CF:Cat Fish,C: Crab, M:Mackerel, PP:Pink Perch, S:Sardine, SF:Seer Fish, SH:Shrimp. GMM:Gross Marketing Margin

SC 2: Fishermen - Auctioneers - Retailers - Consumers											**Overall Average**
Particulars	**A**	**BP**	**WP**	**CF**	**C**	**M**	**PP**	**S**	**SF**	**SH**	
Auctioneer purchase price	80.00	350.00	500.00	108.00	95.00	75.00	110.00	40.00	450.00	250.00	205.80
Marketing cost	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Marketing margin	2.50	7.00	10.50	1.59	4.50	5.20	3.40	1.50	9.45	5.00	5.06
Auctioneer sold price	83.00	357.50	511.00	110.09	100.00	80.70	113.90	42.00	459.95	255.50	211.36
Retailer purchase price	83.00	357.50	511.00	110.09	100.00	80.70	113.90	42.00	459.95	255.50	211.36
Marketing cost	7.24	7.24	7.24	7.24	7.24	7.24	7.24	7.24	7.24	7.24	7.24
Marketing margin	6.50	21.25	28.00	7.45	10.00	13.35	11.30	3.50	30.34	19.45	15.11
Retailer sold price	96.74	385.99	546.24	124.78	117.24	101.29	132.44	52.74	497.53	282.19	233.72
Price spread or GMM (₹/kg)	**16.74**	**35.99**	**46.24**	**16.78**	**22.24**	**26.29**	**22.44**	**12.74**	**47.53**	**32.19**	**27.92**
Fishermen's share in consumer rupee (%)	**82.70**	**90.68**	**91.53**	**86.55**	**81.03**	**74.04**	**83.06**	**75.84**	**90.45**	**88.59**	**84.45**
Marketing efficiency	**5.78**	**10.72**	**11.81**	**7.44**	**5.27**	**3.85**	**5.90**	**4.14**	**10.47**	**8.77**	**7.42**

Note: A:Anchovy, BP:Black Pomfret, WP:White Pomfret, CF:Cat Fish,C: Crab, M:Mackerel, PP:Pink Perch, S:Sardine, SF:Seer Fish, SH:Shrimp. GMM:Gross Marketing Margin

SC 3: Fishermen - Agents of supermarket - Supermarkets - Consumers											Overall Average
Particulars	**A**	**BP**	**WP**	**CF**	**C**	**M**	**PP**	**S**	**SF**	**SH**	
Agents purchase price	70	400.00	550.00	120.00	130.00	80.00	125.00	45.00	500.00	250.00	227.00
Marketing cost	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.40
Marketing margin	5.00	11.00	16.00	4.00	6.45	6.00	5.00	2.00	12.00	6.80	7.43
Agents sold price	76.4	412.40	567.40	125.40	137.85	87.40	131.40	48.40	513.40	258.20	235.83
Supermarket purchase price	76.4	412.40	567.40	125.40	137.85	87.40	131.40	48.40	513.40	258.20	235.83
Marketing cost	13.45	13.45	13.45	13.45	13.45	13.45	13.45	13.45	13.45	13.45	13.45
Marketing margin	12.76	30.78	35.00	13.54	11.43	12.00	14.32	9.12	19.00	25.87	18.38
Supermarket sold price	102.61	456.63	615.85	152.39	162.73	112.85	159.17	70.97	545.85	297.52	267.66
Price spread or GMM (₹/kg)	**32.61**	**56.63**	**65.85**	**32.39**	**32.73**	**32.85**	**34.17**	**25.97**	**45.85**	**47.52**	**40.66**
Fishermen's share in consumer rupee (%)	**68.22**	**87.60**	**89.31**	**78.75**	**79.89**	**70.89**	**78.53**	**63.41**	**91.60**	**84.03**	**79.22**
Marketing efficiency	**3.15**	**8.06**	**9.35**	**4.70**	**4.97**	**3.44**	**4.66**	**2.73**	**11.91**	**6.26**	**5.92**

Note: A:Anchovy, BP:Black Pomfret, WP:White Pomfret, CF:Cat Fish,C: Crab, M:Mackerel, PP:Pink Perch, S:Sardine, SF:Seer Fish, SH:Shrimp. GMM:Gross Marketing Margin

SC 4: Fishermen - Auctioneers - Vendors - Consumers											Overall Average
Particulars	**A**	**BP**	**WP**	**CF**	**C**	**M**	**PP**	**S**	**SF**	**SH**	
Auctioneer purchase price	65.00	260.00	380.00	78.00	95.00	60.00	95.00	35.00	350.00	180.00	159.80
Marketing cost	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Marketing margin	4.50	9.20	14.00	3.24	2.50	5.50	4.50	2.50	12.50	11.30	6.97
Auctioneer sold price	70.30	270.00	394.80	82.04	98.30	66.30	100.30	38.30	363.30	192.10	167.57
Vendor purchase price	70.30	270.00	394.80	82.04	98.30	66.30	100.30	38.30	363.30	192.10	167.57
Marketing cost	8.45	8.45	8.45	8.45	8.45	8.45	8.45	8.45	8.45	8.45	8.45
Marketing margin	12.39	30.25	35.00	14.00	10.30	8.34	11.34	7.20	45.23	20.30	19.44
Vendor sold price	91.14	308.70	438.25	104.49	117.05	83.09	120.09	53.95	416.98	220.85	195.46
Price spread or GMM (₹/kg)	**26.14**	**48.70**	**58.25**	**26.49**	**22.05**	**23.09**	**25.09**	**18.95**	**66.98**	**40.85**	**35.66**
Fishermen's share in consumer rupee (%)	**71.32**	**84.22**	**86.71**	**74.65**	**81.16**	**72.21**	**79.11**	**64.87**	**83.94**	**81.50**	**77.97**
Marketing efficiency	**3.49**	**6.34**	**7.52**	**3.94**	**5.31**	**3.60**	**4.79**	**2.85**	**6.23**	**5.41**	**4.95**
Note: A:Anchovy, BP:Black Pomfret, WP:White Pomfret, CF:Cat Fish, C: Crab, M:Mackerel, PP:Pink Perch, S:Sardine, SF:Seer Fish, SH:Shrimp. GMM:Gross Marketing Margin											

5.3. Price spread, Fishermen's share in consumer rupee and Marketing efficiency of marine fish supply chains in Karwar fishing harbour

The price spread, fishermen's share in consumer rupee and marketing efficiency of marine fish supply chains in Karwar fishing harbour is given in the Table 13. The price spread is the actual difference of the price paid by the consumer and received by the fishermen for specific amount of quantity along the marine fish supply chain. The fishermen and consumers are less benefitted as the price spread increases and vice verse. Fishermen's Share in Consumer Rupee (FSCR) refers to the actual share or percentage of fishermen in the final price paid by the consumer. The marketing efficiency is gives an idea about the total marketing costs and marketing margins added by the different intermediaries of marine fish supply chain during the process of fish marketing. As the added costs increase the marketing efficiency would reduce and vice verse. Thus an inverse relationship lies between the marketing efficiency and marketing costs and marketing margins. The fishermen and consumers are more benefitted if the marketing efficiency is good. Viswanatha *et al*., (2012) found about 37 to 47% of the consumer rupee was received by the supply chain intermediaries which is very high as compared with the present study for pomfrets and seer fish in Karnataka. The study also found that the middlemen were getting very high share of consumer rupee in the fish supply chains.

The FSCR and marketing efficiency for White Pomfret was 85.33% with a price spread and marketing efficiency of 80.83 ₹/kg and 9.45 respectively. The marketing cost of 0.45 ₹/kg was borne by the auctioneers, about 2.45 ₹/kg was added

by the wholesalers and the retailers were added 7.45 ₹/kg for all the selected commercially important varieties of marine fish under the marine fish supply chain 1. The FSCR for Black Pomfret and Seer fish was 83.92% and 81.81% with a price spread of 59.42 ₹/kg and 77.80 ₹/kg respectively. The FSCR was considerably better for Shrimps (80.62%) with a price spread and marketing efficiency of 55.30 ₹/kg and 7.01 respectively. The FSCR for Pink Perch and Cat fish was 76.43% and 74.91% with the marketing efficiency of 5.53 and 5.41 respectively. The FSCR was the lowest for Sardine (56.52%) and Mackerel (60.27%) with a price spread of 26.93 ₹/kg and 41.73 ₹/kg respectively. The retailers had fixed the lowest marketing margin of 5.76 ₹/kg for Sardine under the marine fish supply chain 1 in Karwar fishing harbour. Senthilatiban and Selvraj (1992) reported a positive correlation between the retail price and net amount realized by the fishermen in Tamilnadu which is equally holds true as in case of fish marketing in Karnataka.

The FSCR and marketing efficiency for White Pomfret was 92.32% with price spread and the marketing efficiency of 39.93 ₹/kg and 16.72 respectively. The marketing efficiency was maximum for Black Pomfret (17.58) with FSCR and the price spread of 91.86% and 27.47 ₹/kg. The marketing cost of 0.84 ₹/kg was borne by the auctioneers and 3.50 ₹/kg was added by the retailers for all the selected commercially important varieties of marine fish under the marine fish supply chain 2. The FSCR was significantly better for Seer fish (89.81%), Crabs (86.53%), Shrimps (84.28%) and Pink Perch (83.94%) with a price spread of 53.34 ₹/kg, 17.13 ₹/kg, 42.91 ₹/kg, and 22.01 ₹/kg respectively. The auctioneers were fixed the highest

marketing margin for Seer fish (8.75 ₹/kg), followed by White Pomfret (8 ₹/kg) and Black Pomfret (7.43 ₹/kg) while the marketing margin was fixed highest by the retailers for Seer fish (30.66 ₹/kg) and White Pomfret (18.75 ₹/kg). The FSCR was minimum for Sardine (68.47%) and Mackerel (75.35%) with a price spread of 16.12 ₹/kg and 22.90 ₹/kg respectively under the marine fish supply chain 2. Chidambaram and Rajan (1990) were stated that the fish marketing system is invariably under the control of middlemen in Tamilnadu whereas in case of Karnataka the middlemen exploitation of consumer rupee is considerably less.

The FSCR and the marketing efficiency for the White Pomfret was the highest accounting for 88.72% and 8.87 respectively with a price spread of 59.73 ₹/kg whereas the fisherman's share for pomfrets was only 46% in Karnataka as reported by Devaraj *et al.* (1998) in Karnataka. The marketing cost and margin of 1.2 ₹/kg and 14.70 ₹/kg was added by the agents of supermarket and 8.83 ₹/kg and 35.00 ₹/kg added by the supermarket under the marine fish supply chain 3. The FSCR and marketing efficiency for Black Pomfret was 86.65% and 7.49 respectively with a price spread of 49.31 ₹/kg. The marketing margin of 8.50 ₹/kg was added by the agents of supermarket and 30.78 ₹/kg by the the supermarket. The price spread for Seer fish was 42.30 ₹/kg with the FSCR and the marketing efficiency of 91.41% and 11.64 respectively. The price spread for Shrimp was 44.18 ₹/kg with the FSCR and marketing efficiency of 83.89% and 6.21 respectively. The FSCR was the lowest for Sardine (62.34%) and Mackerel (71.19%) with a price spread of 21.14 ₹/kg and 26.31 ₹/kg respectively under the marine fish supply chain 3 in Karwar fishing harbour.

Sahay and Ramneesh, (1999) stressed on reducing the marketing costs with improving customer satisfaction besides revenue increasing methods by effective supply chain management which is equally required as in case of supermarkets and retail shops in Karnataka.

The price spread for White Pomfret was 52.04 ₹/kg with the FSCR and marketing efficiency of 88.98 and 9.07 respectively. The auctioneers incurred the marketing cost of 0.65 ₹/kg for each selected marine fish with a marketing margin of 11.94 ₹/kg for White Pomfret. The fish vendors incurred a marketing cost of 6.58 ₹/kg the marketing margin of 32.87 ₹/kg for White Pomfret. The FSCR and the marketing efficiency for Seer fish was 89.63% and 9.64 respectively with a GMM of 43.97 ₹/kg while the share of accrued marketing margin by the auctioneers was 11.87 ₹/kg and 24.87 ₹/kg by the fish vendors. The FSCR and the marketing efficiency for Black Pomfret was 88.65% and 8.81 respectively with a GMM of 40.95 ₹/kg with the accrued marketing margin of 6.85 ₹/kg by the auctioneers and 26.87 ₹/kg by the fish vendors. The FSCR and the marketing efficiency for Shrimp was 84.49% and 6.45 with a GMM of 35.81 ₹/kg and however the marketing cost added by the auctioneers was of 0.65 ₹/kg and 18.93 ₹/kg from the fish vendors. The price spread was less for Sardine (12.74 ₹/kg) and Mackerel (15.37 ₹/kg) with FSCR of 70.19% and 82% respectively. The marketing margin of 1.75 ₹/kg was added for the auctioneers and 3.76 ₹/kg by the fish vendors for Sardine under the marine fish supply chain 4.

Table.13. Price spread, Fishermen's share in consumer rupee and Marketing efficiency of marine fish supply chains in Karwar fishing harbour (₹/kg)

SC 1: Fishermen - Auctioneers - Wholesalers - Retailers - Consumers											**Overall Average**
Particulars	**A**	**BP**	**WP**	**CF**	**C**	**M**	**PP**	**S**	**SF**	**SH**	
Auctioneer purchase price	70.00	310.00	470.00	108.00	86.70	63.30	130.00	35.00	350.00	230.00	185.30
Marketing cost	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
Marketing margin	2.50	6.50	8.39	1.30	1.75	2.86	1.45	1.10	6.50	2.75	3.51
Auctioneer sold price	72.95	316.95	478.84	109.75	88.90	66.61	131.90	36.55	356.95	233.20	189.26
Wholesaler purchase price	75.90	323.90	487.68	111.50	91.10	69.92	133.80	38.10	363.90	236.40	193.22
Marketing cost	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45	2.45
Marketing margin	3.45	7.36	11.23	5.34	2.76	3.89	4.98	2.86	10.45	8.95	6.13
Wholesaler sold price	81.80	333.71	501.36	119.29	96.31	76.26	141.23	43.41	376.80	247.80	201.80
Retailer purchase price	87.70	343.52	515.04	127.08	101.52	82.60	148.66	48.72	389.70	259.20	210.37
Marketing cost	7.45	7.45	7.45	7.45	7.45	7.45	7.45	7.45	7.45	7.45	7.45
Marketing margin	10.50	18.45	28.34	9.65	12.76	14.98	13.98	5.76	30.65	18.65	16.37
Retailer sold price	105.65	369.42	550.83	144.18	121.73	105.03	170.09	61.93	427.80	285.30	234.20
Price spread or GMM (₹/kg)	**35.65**	**59.42**	**80.83**	**36.18**	**35.03**	**41.73**	**40.09**	**26.93**	**77.80**	**55.30**	**48.90**
Fishermen's share in consumer rupee (%)	**66.26**	**83.92**	**85.33**	**74.91**	**71.22**	**60.27**	**76.43**	**56.52**	**81.81**	**80.62**	**73.73**
Marketing efficiency	**3.94**	**8.66**	**9.45**	**5.41**	**4.41**	**3.27**	**5.53**	**3.09**	**7.38**	**7.01**	**5.81**

SC 2: Fishermen - Auctioneers - Retailers - Consumers											**Overall Average**
Particulars	**A**	**BP**	**WP**	**CF**	**C**	**M**	**PP**	**S**	**SF**	**SH**	
Auctioneer purchase price	76	310	480	110	110	70	115	35	470	230	201
Marketing cost	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Marketing margin	3.26	7.43	8.00	2.54	1.65	3.98	2.98	2.98	8.75	4.32	4.59
Auctioneer sold price	80.10	318.27	488.84	113.38	112.49	74.82	118.82	38.82	479.59	235.16	206.03
Retailer purchase price	84.20	326.54	497.68	116.76	114.98	79.64	122.64	42.64	489.18	240.32	211.46
Marketing cost	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
Marketing margin	5.23	7.43	18.75	10.87	8.65	9.76	10.87	4.98	30.66	29.09	13.63
Retailer sold price	92.93	337.47	519.93	131.13	127.13	92.90	137.01	51.12	523.34	272.91	228.59
Price spread or GMM (₹/kg)	**16.93**	**27.47**	**39.93**	**21.13**	**17.13**	**22.90**	**22.01**	**16.12**	**53.34**	**42.91**	**27.99**
Fishermen's share in consumer rupee (%)	**81.78**	**91.86**	**92.32**	**83.89**	**86.53**	**75.35**	**83.94**	**68.47**	**89.81**	**84.28**	**83.82**
Marketing efficiency	**7.24**	**17.58**	**16.72**	**7.39**	**8.68**	**5.14**	**7.53**	**4.16**	**11.96**	**7.23**	**9.36**
Note: A:Anchovy, BP:Black Pomfret, WP:White Pomfret, CF:Cat Fish,C: Crab, M:Mackerel, PP:Pink Perch, S:Sardine, SF:Seer Fish, SH:Shrimp. GMM:Gross Marketing Margin											

SC 3: Fishermen - Agents of supermarket - Supermarkets - Consumers											Overall Average
Particulars	**A**	**BP**	**WP**	**CF**	**C**	**M**	**PP**	**S**	**SF**	**SH**	
Agents purchase price	70	320	470	100	115	65	120	35	450	230	198
Marketing cost	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.20
Marketing margin	3.50	8.50	14.70	2.80	3.98	4.28	2.87	1.99	13.27	8.28	6.42
Agents sold price	74.7	329.70	485.90	104.00	120.18	70.48	124.07	38.19	464.47	239.48	205.12
Supermarket purchase price	74.7	329.70	485.90	104.00	120.18	70.48	124.07	38.19	464.47	239.48	205.12
Marketing cost	8.83	8.83	8.83	8.83	8.83	8.83	8.83	8.83	8.83	8.83	8.83
Marketing margin	12.76	30.78	35.00	13.54	11.43	12.00	14.32	9.12	19.00	25.87	18.38
Supermarket sold price	96.29	369.31	529.73	126.37	140.44	91.31	147.22	56.14	492.30	274.18	232.33
Price spread or GMM (₹/kg)	**26.29**	**49.31**	**59.73**	**26.37**	**25.44**	**26.31**	**27.22**	**21.14**	**42.3**	**44.18**	**34.83**
Fishermen's share in consumer rupee (%)	**72.70**	**86.65**	**88.72**	**79.13**	**81.89**	**71.19**	**81.51**	**62.34**	**91.41**	**83.89**	**79.94**
Marketing efficiency	**3.66**	**7.49**	**8.87**	**4.79**	**5.52**	**3.47**	**5.41**	**2.66**	**11.64**	**6.21**	**5.97**

Note: A:Anchovy, BP:Black Pomfret, WP:White Pomfret, CF:Cat Fish,C: Crab, M:Mackerel, PP:Pink Perch, S:Sardine, SF:Seer Fish, SH:Shrimp. GMM:Gross Marketing Margin

SC 4: Fishermen - Auctioneers - Vendors - Consumers											Overall Average
Particulars	**A**	**BP**	**WP**	**CF**	**C**	**M**	**PP**	**S**	**SF**	**SH**	
Auctioneer purchase price	70	320	420	84	110	70	110	30	380	195	178.90
Marketing cost	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Marketing margin	2.38	6.85	11.94	2.45	1.83	3.27	2.87	1.75	11.87	9.65	5.49
Auctioneer sold price	73.03	327.50	432.59	87.10	112.48	73.92	113.52	32.40	392.52	205.30	185.04
Vendor purchase price	73.03	327.50	432.59	87.10	112.48	73.92	113.52	32.40	392.52	205.30	185.04
Marketing cost	6.58	6.58	6.58	6.58	6.58	6.58	6.58	6.58	6.58	6.58	6.58
Marketing margin	8.45	26.87	32.87	8.76	12.98	4.87	5.78	3.76	24.87	18.93	14.81
Vendor sold price	88.06	360.95	472.04	102.44	132.04	85.37	125.88	42.74	423.97	230.81	206.43
Price spread or GMM (₹/kg)	**18.06**	**40.95**	**52.04**	**18.44**	**22.04**	**15.37**	**15.88**	**12.74**	**43.97**	**35.81**	**27.53**
Fishermen's share in consumer rupee (%)	**79.49**	**88.65**	**88.98**	**82.00**	**83.31**	**82.00**	**87.38**	**70.19**	**89.63**	**84.49**	**83.61**
Marketing efficiency	**4.88**	**8.81**	**9.07**	**5.56**	**5.99**	**5.55**	**7.93**	**3.35**	**9.64**	**6.45**	**6.72**

Note: A:Anchovy, BP:Black Pomfret, WP:White Pomfret, CF:Cat Fish,C: Crab, M:Mackerel, PP:Pink Perch, S:Sardine, SF:Seer Fish, SH:Shrimp. GMM:Gross Marketing Margin

The marketing efficiency of different marine fish supply chains in the Mangaluru fishing harbour, is given in the figure 1. The marketing efficiency was better for high value fishes such as White Pomfret (10.79), Black Pomfret (9.25) and Seer fish (7.96) and least for Sardine (2.71) and Mackerel (2.99) under the supply chain 1. The marketing efficiency was better for high value fishes such as White Pomfret (11.46), Black Pomfret (8.84) and Seer fish (8.42) and least for Sardine (2.71) and Mackerel (3.23) under the supply chain 2. The marketing efficiency was better for high value fishes such as White Pomfret (8.26), Black Pomfret (7.11) and Seer fish (6.40) and least for Mackerel (2.60) under the supply chain 3. The marketing efficiency was highest for White Pomfret (8.80), Black Pomfret (6.05) and Seer fish (8.42) and least for Sardine (2.15) and Anchovy (3.82) under the supply chain 4. The overall average marketing efficiency for all the selected marine fishes was maximum under the supply chain 2 (6.19) followed by supply chain 1 (6.11) supply chain 3 (5.25) and supply chain 4 (4.97) in Mangaluru fishing harbour.

The marketing efficiency of different marine fish supply chains in the Malpe fishing harbour, Udupi is given in the figure 2. The marketing efficiency was better for high value fishes such as White Pomfret (10.07), Black Pomfret (8.62) and Seer fish (7.27) and least for Sardine (2.97) and Mackerel (3.22) under the supply chain 1. The marketing efficiency was the highest for White Pomfret (11.81) followed by Black Pomfret (10.72) and Seer fish (10.47) and least for Mackerel (3.85) under the supply chain 2. The marketing efficiency was the highest for Seer fish (11.91) followed by White Pomfret (9.35) and Black Pomfret (8.06) and less for Sardine

(2.73) and Anchovy (3.15) under the supply chain 3. The marketing efficiency was highest for White Pomfret (87.52), Black Pomfret (6.34) and Seer fish (6.23) and less for Sardine (2.85) under the supply chain 4. The overall average marketing efficiency for all the selected marine fishes was maximum under the supply chain 2 (7.42) followed by supply chain 3 (5.92) supply chain 1 (5.87) and supply chain 4 (4.95) in Malpe fishing harbour.

The marketing efficiency of different marine fish supply chains in the major fishing harbour, Karwar is given in the figure 3. The marketing efficiency was better for high value fishes such as White Pomfret (9.45), Black Pomfret (8.66), Seer fish (7.38) and Shrimp (7.01) and less for Sardine (3.09) and Mackerel (3.27) under the supply chain 1. The marketing efficiency was the highest for Black Pomfret (17.58), White Pomfret (16.72) and Seer fish (11.96) and less for Sardine (4.16) under the supply chain 2. The marketing efficiency was maximum for Seer fish (11.64), White Pomfret (8.87) and Black Pomfret (7.49) and minimum for Sardine (2.66) under the supply chain 3. The marketing efficiency was highest for Seer fish (9.64), White Pomfret (9.07), Black Pomfret (8.81) and minimum for Sardine (3.35) under the supply chain 4. The overall average marketing efficiency for all the selected marine fishes was maximum under the supply chain 2 (9.36) followed by supply chain 4 (6.72) supply chain 3 (5.97) and supply chain 1 (5.81) in Karwar fishing harbour.

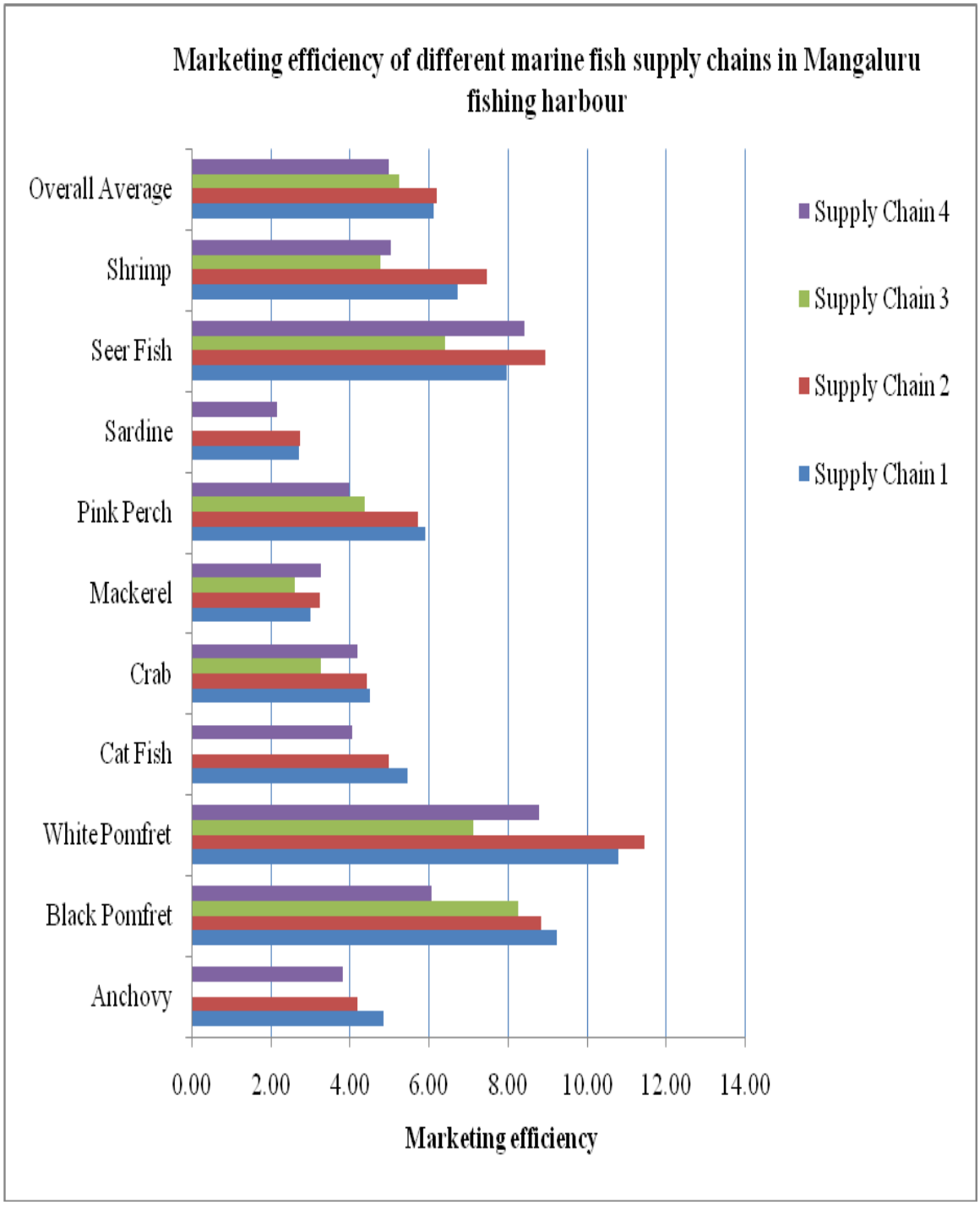
Marketing efficiency of different marine fish supply chains in Mangaluru fishing harbour
Overall Average
Shrimp
Seer Fish
Sardine
Pink Perch
Mackerel
Crab
Cat Fish
White Pomfret
Black Pomfret
Anchovy
Supply Chain 4
Supply Chain 3
Supply Chain 2
Supply Chain 1
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
Marketing efficiency

Fig.3.

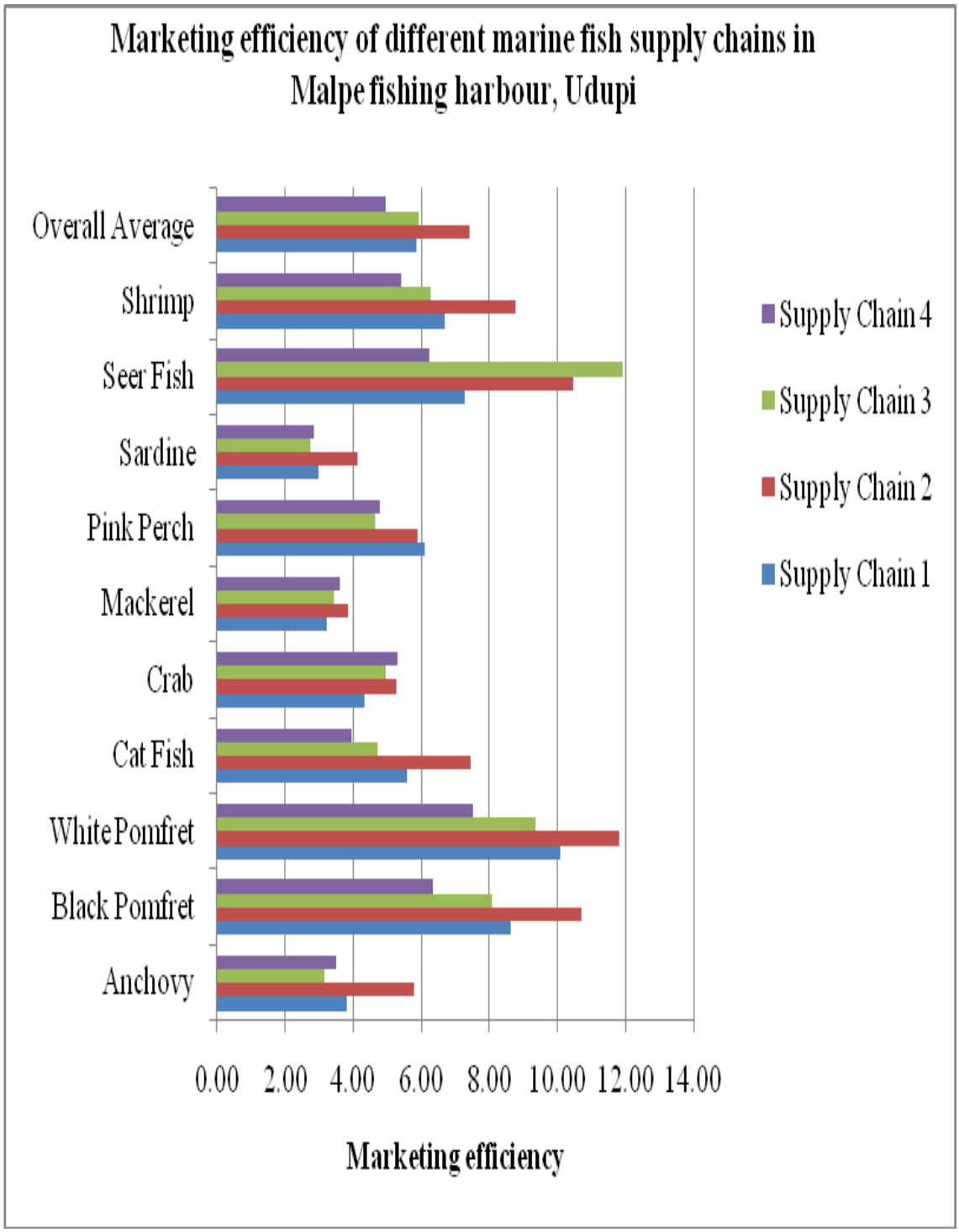
Marketing efficiency of different marine fish supply chains in Malpe fishing harbour, Udupi
Overall Average
Shrimp
Seer Fish
Sardine
Pink Perch
Mackerel
Crab
Cat Fish
White Pomfret
Black Pomfret
Anchovy
Supply Chain 4
Supply Chain 3
Supply Chain 2
Supply Chain 1
0.00 2.00 4.00 6.00 8.00 10.00 12.00 14.00
Marketing efficiency

Fig. 4.

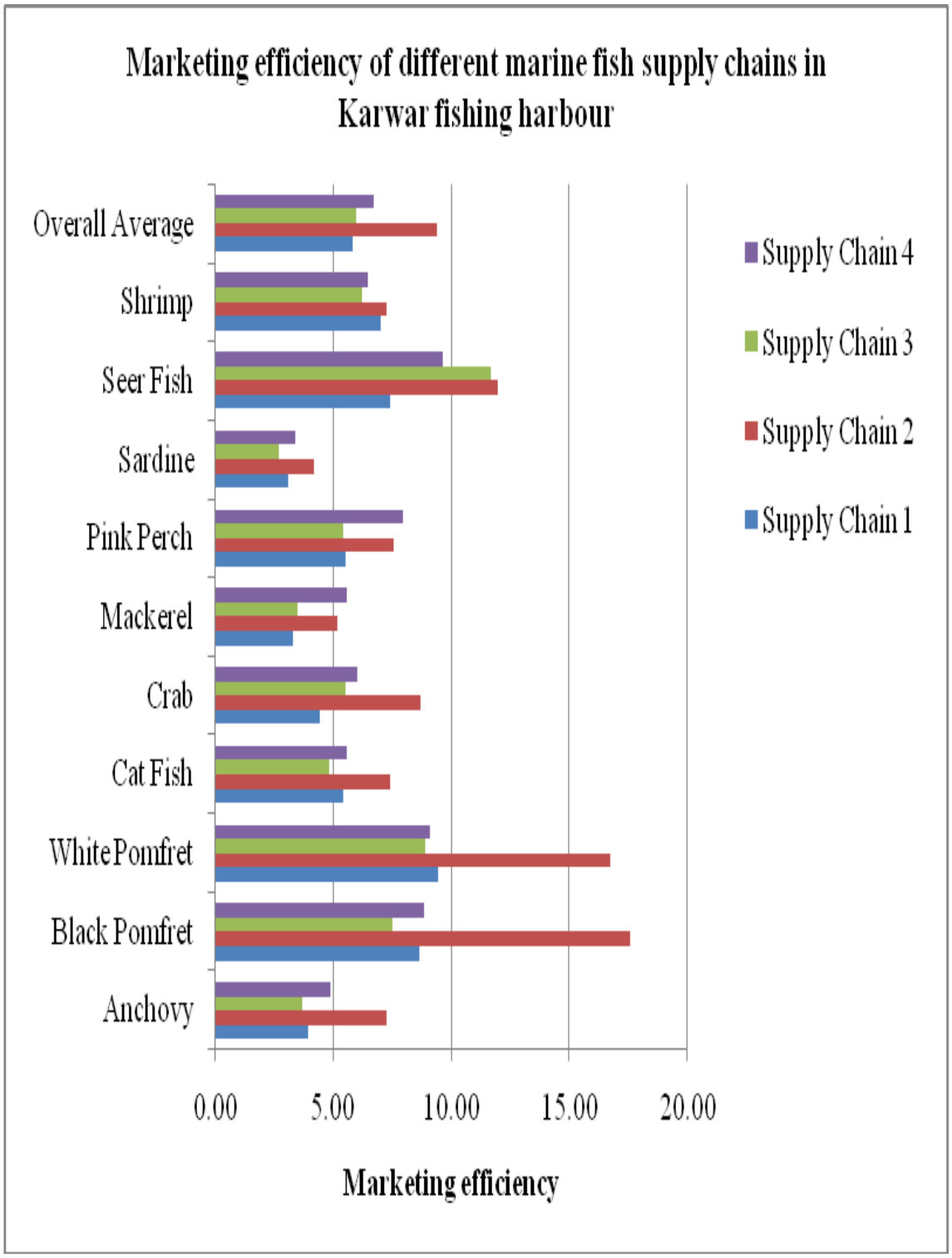
Marketing efficiency of different marine fish supply chains in Karwar fishing harbour
Overall Average
Shrimp
Seer Fish
Sardine
Pink Perch
Mackerel
Crab
Cat Fish
White Pomfret
Black Pomfret
Anchovy
Supply Chain 4
Supply Chain 3
Supply Chain 2
Supply Chain 1
0.00
5.00
10.00
15.00
20.00
Marketing efficiency

Fig.5.

5.4. Seasonal price fluctuations of marine fishes in the selected fish markets of Karnataka

The monthly landing centre price indices of high value marine fish such as black pomfret, white pomfret and seer fish varied more during June - July and less during October - November months. However, the monthly price index for white prawn was the highest in November and least in July. The price index of lady fish swung up in January and recorded least in may while the maximum range was observed in pomfret, lady fish and seer fish, the minimum range was found for white prawns and black pomfret. The CV was used to measure the variability of marine fish prices and as the CV increases the marine fish prices are more volatile. The range is the actual difference of maximum and minimum prices of particular quantity of marine fish and as the range increases the prices would be fluctuating more. The high price fluctuations responsible for large share of benefits among the intermediaries of marine fish supply chain by depriving fair price for both the consumers and fishermen. The CV was found highest for white pomfret (22.51%) and lady fish (16.48%) and the least for white prawn (7.38%). The prices of black pomfret were highly volatile during June - July because of their irregular supply due to fishing ban and the subsequent excess demand was observed in the cities of Karnataka. Though the price of white prawn was more, the CV was less because of regular uninterrupted availability in the market (Table 14).

The majority of medium value marine fish price indices were found to be at its peak during June - July and minimum during September - October. While, for pink

perch and tuna, maximum price index was found in March; the minimum price index was seen observed for mackerel and lactarius fish during the month of December. The maximum and minimum price index for soles was observed in August and April respectively. The maximum range of price index was seen for crocker (68) followed by lactarius (66) and pink perch (64). The minimum range of price index was observed for soles (36) and crabs (42). The fishing ban was responsible for the major raise of price indices during June - July.

The highest CV was found for crocker (21.77%) followed by pink perch (20.75%), squid (19.97%), lactarius (18.76%), tuna (17.20%), barracuda (16.43%) and mackerel (15.80%). However, minimum CV was observed for soles (11.53%) and crabs (13.20%). The CV of medium value marine fish was comparatively higher in comparison to high value fishes which showed more price fluctuations which were attributed to instability and decreasing rate of harvest. Inverse relationship was found between the price indices and the quantity of marine fish traded through KFDC (Table 15).

The monthly landing centre price indices for low value fishes were recorded highest during July - September. This may be due to the inadequate supply of marine fish (Aktar, 2013). The quantity of cat fish traded was low during June - July. The least price indices for cat fish were recorded during December - February months (Table 16). The maximum CV was found for cat fish (20.89%) followed by sardine (18.57%) and clams (12.06%). The quantity of clams and sardine traded was low

during April - May. The maximum range price index was found for cat fish (78) and minimum for clam (37).

The primary data was collected fortnightly for about 33 commercially important marine fish varieties in Mangaluru fishing harbour during August 2013 to July 2014. The monthly CV and Range for marine fish prices across landing center, wholesale fish market, retail fish market and terminal fish market were calculated for studying the seasonal price fluctuations. The maximum CV was recorded in fish landing center, Mangaluru during June, 2014 (159.80%) and September months (147.19%) in 2013 and June (159.80%) and March (158.21%) in 2014 respectively. The minimum CV was found in landing center, Mangaluru during August (128.82%) and October months (129.28%) in 2013. The maximum price range was found in May, 2014 (₹ 565/kg) and least during August, 2013 (₹ 305/kg) in fish landing center, Mangaluru. However, the CV was high during December, 2013 (161.28%) to January 2014 (160.84%) and the maximum price range of ₹ 595/kg in July 2014 in the wholesale fish market, Mangaluru. The maximum CV was recorded during December, 2013 (170.10%) and January 2014 (178.97%) and the maximum price range of ₹ 625/kg and ₹ 605/kg in retail fish market, Mangaluru during May and June respectively in 2014. The maximum CV was recorded during December, 2013 (168.26%) and June 2014 (164.01%) and maximum range of ₹ 612.5/kg during May, 2014 in terminal fish market, Mangaluru (Table 17). Sathiadhas and Narayanakumar (1994) opined that the high fluctuations in fish prices were due to the uncertain nature

of the fish harvest, perishable nature and variations in short run supply which is also true as in case of marine fish price fluctuations in Karnataka.

The CV was used to measure the variability of marine fish prices and as the CV increases the marine fish prices are more volatile. The range is the actual difference of maximum and minimum prices of particular quantity of marine fish and as the range increases the prices would be fluctuating more. The primary data was collected fortnightly for about 27 commercially important marine fish varieties in Malpe fishing harbour, Udupi during August 2013 to July 2014. The maximum CV was recorded in fish landing center, Malpe during March (78.30%) in 2014 and minimum CV of 69.36% in December, 2013. The minimum price range was found in August, 2013 (₹ 273/kg) and the maximum during April, 2014 (₹ 478/kg) in fish landing center, Malpe. However, the CV was more during July, 2014 (76.32%) and the minimum of 58.81% during December, 2013 with a maximum price range of ₹ 523/kg in April, 2014 in the wholesale fish market, Malpe. The maximum CV (74.91%) was recorded and a maximum price range of ₹ 585/kg during July, 2014 in retail fish market, Malpe. The highest CV was recorded during June, 2014 (88.22%) with a maximum price range of ₹ 978/kg during June, 2014 in terminal fish market, Malpe, Udupi (Table 18). Gopal *et al.* (2001) reported that each variety of marine fish showed a very high range of price fluctuations which was also observed in case of the present study.

The primary data was collected fortnightly for about 23 commercially important marine fish varieties in Karwar fishing harbour during August 2013 to July

2014. The maximum CV was recorded in fish landing center, Karwar during October (85.69%) during 2013 and the minimum CV of 60.90% in April 2013. The minimum price range was found during September, 2013 (₹ 275/kg) and the maximum during July, 2014 (₹ 538/kg) in fish landing center, Karwar. However, the CV was more during October, 2013 (83.60%) and the minimum of 60.90% during April, 2014 with a maximum price range of ₹ 538/kg in July, 2014 in the wholesale fish market, Karwar. The maximum CV (78.12%) was recorded in October, 2013 and a maximum price range of ₹ 580/kg during June, 2014 in retail fish market, Karwar. The highest CV was recorded during October, 2014 (79.05%) with a maximum price range of ₹ 605/kg during May, 2014 in terminal fish market Karwar (Table 19).

The primary data was collected fortnightly for about 19 commercially important marine fish varieties in Russel fish market, Bengaluru during August 2013 to July 2014. The maximum CV was recorded in wholesale fish market, Bengaluru during May (69.82%) in 2014 and the minimum CV was found during January 2104 (46.00%). The maximum price range was found July, 2014 (₹ 570/kg) and the least during August (₹ 375/kg) and November (₹ 375/kg) in 2013. However, the CV was high during May, 2014 (67.15%) and the minimum during January month, 2014 (45.09%) in the retail fish market, Bengaluru with a maximum price range of ₹ 685/kg during January and May months, 2014 in retail fish market (Table 20).

Table 14. Seasonal price fluctuations of high value marine fishes in Mangaluru

Months	Black Pomfret	White Pomfret	Seer Fish	White Prawn	Lady Fish
April ’12	107 (460)	116 (132)	113(1099)	96 (1179)	879(187)
May ’12	113 (469)	111 (179)	110(2423)	100 (659)	77 (293)
June ’12	118 (664)	128 (149)	130 (995)	92 (795)	119 (595)
July ’12	119 (379)	135 (186)	115 (869)	91 (793)	105 (295)
Aug ’12	93 (881)	82 (348)	100 (1382)	102 (915)	103 (617)
Sept’12	85 (775)	80 (570)	91 (1346)	95 (699)	87 (437)
Oct ’12	76 (1269)	74 (1487)	78 (2981)	100 (753)	102 (351)
Nov’12	83 (1030)	67 (1202)	81 (2318)	117 (454)	95 (270)
Dec ’12	90 (959)	80 (723)	83 (3335)	108 (566)	94 (429)
Jan ’13	96 (984)	99 (467)	98 (3458)	105 (671)	138 (338)
Febr ’13	112 (838)	109 (168)	100 (2175)	100 (549)	108 (406)
March ’13	110 (703)	117 (442)	101 (2339)	95 (771)	85 (385)
Highest	119 (1269)	135 (1487)	130 (3458)	117 (1179)	138 (617)
Lowest	76 (379)	67 (132)	78 (869)	91 (454)	77 (187)
Range	43 (890)	68 (1355)	53 (2589)	27 (725)	61 (430)
CV (%)	14.64 (33.69)	22.51 (87.02)	15.65 (44)	7.38 (25.71)	16.48 (32.91)

Source: KFDC (2012)

(Figures in the parentheses give the total quantity (in kg) of marine fishes traded through KFDC)

Table 15. Seasonal price fluctuations of medium value marine fishes in Mangaluru

Months/ Marine fishes	Crab	Crocker	Lactarius	Mackerel	Pink Perch	Barracuda	Soles	Squid	Tuna
April '12	91 (578)	92(665)	92 (527)	86 (4306)	121 (488)	98 (557)	78 (87)	110 (71)	73 (01)
May '12	93 (794)	118 (510)	100 (553)	93 (5668)	120 (546)	109 (621)	88 (45)	120 (83)	104 (20)
June '12	99 (510)	145 (276)	99 (210)	109 (4858)	100 (290)	113 (309)	103 (257)	113 (10)	105 (194)
July '12	118 (202)	121 (175)	146 (24)	138 (2664)	105 (228)	132 (80)	113 (288)	135 (99)	105 (105)
Aug '12	111 (753)	112 (772)	108 (37)	97 (5028)	77 (861)	105 (269)	114 (163)	125 (115)	89 (251)
Sept'12	76 (472)	116 (273)	124 (110)	105 (5934)	85 (645)	88 (199)	110 (993)	102 (47)	98 (126)
Oct '12	117 (569)	77 (826)	89 (473)	85 (7281)	65 (1096)	72 (638)	111 (130)	86 (157)	71 (348)
Nov'12	117 (242)	78 (655)	96 (445)	87 (5742)	NA (NA)	87 (545)	90 (250)	79 (104)	100 (85)
Dec '12	100 (441)	81 (847)	79 (619)	81 (7958)	89 (606)	78 (415)	88 (280)	81 (144)	93 (246)
Jan '13	88 (684)	84 (1101)	92 (715)	108 (9369)	108 (1063)	105 (463)	100 (445)	85 (104)	111 (92)
Febr '13	99 (508)	89 (757)	95 (556)	112 (5526)	NA (NA)	110 (838)	101 (249)	84 (129)	122 (139)
March '13	90 (526)	86 (826)	80 (452)	98 (5900)	130 (659)	103 (741)	103 (302)	79 (127)	129 (302)
Highest	118 (794)	145 (1101)	146 (715)	138 (9369)	130 (1096)	132 (838)	114 (993)	135 (157)	129 (348)
Lowest	76 (202)	77 (175)	79 (24)	81 (2664)	65 (228)	72 (80)	78 (45)	79 (10)	71 (01)
Range	42 (592)	68 (926)	66 (691)	57 (6705)	64 (868)	59 (758)	36 (948)	56 (147)	58 (347)
CV (%)	13.20 (34.05)	21.77 (43.59)	18.76 (60.05)	15.80 (29.70)	20.75 (44.85)	16.43 (48.05)	11.53 (84.62)	19.97 (41.96)	17.20 (68.88)

Source: KFDC (2012), Note: NA-Not Available

(Figures in the parentheses give the total quantity (in kg) of marine fishes traded through KFDC)

Table 16. Seasonal price fluctuations of low value marine fishes in Mangaluru

Months	**Cat Fish**	**Clam**	**Sardine**
April ’12	95 (93)	97 (30)	95 (2315)
May ’12	99 (62)	100 (44)	97 (2765)
June ’12	114 (05)	99 (104)	106 (4096)
July ’12	134 (05)	109 (121)	131 (3732)
Aug ’12	88 (108)	113 (61)	116 (4748)
Sept’12	111 (304)	109 (98)	133 (3090)
Oct ’12	82 (52)	110 (175)	96 (5038)
Nov’12	100 (121)	109 (103)	78 (3901)
Dec ’12	96 (136)	106 (191)	74 (5758)
Jan ’13	129 (69)	76 (335)	90 (5614)
Febr ’13	56 (102)	94 (195)	91 (3518)
March ’13	94 (117)	79 (164)	93 (3174)
Highest	134 (304)	113 (335)	133 (5758)
Lowest	56 (05)	76 (30)	74 (2315)
Range	78 (299)	37 (305)	59 (3443)
CV (%)	20.89 (79.45)	12.06 (62.14)	18.57 (27.87)

Source: KFDC (2012)

(Figures in the parentheses give the total quantity of marine fish traded through KFDC)

Table 17. Seasonal price fluctuations of marine fishes in Mangaluru fishing harbour (Amount in ₹)

Marine fish		Aug 2013	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	March 2014	April 2014	May 2014	June 2014	July 2014
Landing center	CV (%)	128.82	147.19	129.28	141.67	159.75	156.43	144.39	158.21	127.56	140.51	159.80	137.24
	Range	305	320	422.5	370	385	505	497.5	455	410	565	482.5	490
Wholesale fish market	CV (%)	130.33	150.87	134.67	144.80	161.28	160.84	146.35	150.38	132.13	149.43	158.96	139.91
	Range	335	335	437.5	395	432.5	535	547.5	497.5	422.5	587.5	525	595
Retail fish market	CV (%)	139.83	156.21	136.03	149.36	170.10	178.97	163.04	160.48	157.16	165.84	160.58	149.15
	Range	347.5	390	555	460	485	550	575	565	580	625	605	575
Terminal fish market	CV (%)	139.83	148.83	125.88	142.47	168.26	162.07	161.48	158.79	151.78	162.20	164.01	139.91
	Range	347.5	400	595	438.5	460	550	550	520	570	612.5	585	595

Source: Primary data

Table 18. Seasonal price fluctuations of marine fishes in Malpe fishing harbour, Udupi (Amount in ₹)

Marine fish		Aug 2013	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	March 2014	April 2014	May 2014	June 2014	July 2014
Landing center	CV (%)	70.29	72.10	73.60	76.06	69.36	69.49	72.15	78.30	75.50	77.87	69.90	76.66
	Range	273	325	383	333	383	405	430	428	478	460	393	465
Wholesale fish market	CV (%)	69.64	69.61	71.72	71.83	58.81	69.48	70.29	73.52	73.93	75.81	70.33	76.32
	Range	295	365	398	348	305	450	470	453	523	500	435	505
Retail fish market	CV (%)	64.52	65.14	66.56	67.79	64.99	66.30	64.61	70.20	69.20	74.38	69.14	74.91
	Range	320	395	415	405	450	493	500	498	558	565	520	585
Terminal fish market	CV (%)	68.87	68.41	67.46	67.17	67.46	67.17	65.83	68.99	69.34	71.10	88.22	77.58
	Range	353	373	420	505	420	505	505	475	545	518	978	625

Source: Primary data

Table 19. Seasonal price fluctuations of marine fishes in Karwar fishing harbour (Amount in ₹)

Marine fish		Aug 2013	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	March 2014	April 2014	May 2014	June 2014	July 2014
Landing center	CV (%)	82.57	73.82	85.69	73.79	69.51	70.57	70.08	75.83	60.90	73.95	76.41	75.73
	Range	300	275	360	280	278	283	350	350	315	445	463	538
Wholesale fish market	CV (%)	80.02	72.66	83.60	74.57	69.34	70.57	68.56	72.90	60.90	72.33	76.49	75.73
	Range	320	295	400	320	310	283	375	390	315	485	505	538
Retail fish market	CV (%)	75.96	67.69	78.12	67.48	65.36	66.33	65.85	69.13	63.31	72.76	73.51	75.26
	Range	340	315	443	350	355	355	405	445	450	565	580	560
Terminal fish market	CV (%)	75.92	70.99	79.05	69.48	66.58	67.61	65.34	71.50	61.09	73.83	74.43	75.73
	Range	343	335	440	350	360	355	415	430	390	605	555	538

Source: Primary data

Table 20. Seasonal price fluctuations of marine fishes in Russel fish market, Bengaluru (Amount in ₹)

Marine fish		Aug 2013	Sept 2013	Oct 2013	Nov 2013	Dec 2013	Jan 2014	Feb 2014	March 2014	April 2014	May 2014	June 2014	July 2014
Wholesale fish market	CV (%)	46.17	48.22	51.90	52.28	48.84	46.00	50.61	61.34	46.69	69.82	58.35	65.23
	Range	375	405	385	375	398	528	425	448	513	523	520	570
Retail fish market	CV (%)	45.37	47.12	55.33	49.67	47.14	45.09	50.84	59.94	47.80	67.15	57.63	64.26
	Range	493	475	405	473	515	685	543	577.5	667.5	685	640	650

Source: Primary data

5.5. Assessment of the availability of market infrastructure facilities of selected fish markets

The extent of available marketing infrastructural facilities in major fishing harbour in the fishing harbour and nearby fish market in Mangaluru as per the responses received by the different supply chain intermediaries is given in Table 21. The Mean and Standard Deviation (SD) are used for knowing the present status of market and marketing infrastructure in the study areas and it is generally presented as Mean±SD in this entire section. As the mean score improves the infrastructure availability would be good. Among the infrastructural facilities, auctioneers were given the highest availability index for ice plants (100±0) followed by spare parts supply shops (83.33±0.55), road accessibility (77.78±0.52), transportation facilities (77.78±0.52), fuel supply (72.22±0.98) and cement flooring (72.22±0.41) in the fishing harbour. The wholesalers responded with the highest availability index for insulated vehicles availability (92.59±0.67), ice plants (92.59±0.44), spare parts supply (88.89±1), fuel supply (88.89±1), hall/shed for marketing accessories (88.89±0.71), cleaning, packing and filleting units supply (85.19±073), road accessibility (81.48±1.01) and cement flooring (81.48±0.73) in the Mangaluru fishing harbour.

The retailers were given the highest availability index for ice plants (93.33±0.45), insulated vehicles (86.67±0.55), road accessibility (86.67±0.55), parking area/shed (73.33±0.45), berthing/jetty (73.33±0.45), and auction hall (73.33±0.45) in the fishing harbour. The fish vendors expressed their concurrence

about available infrastructure in the fishing harbour and fish market of Mangaluru with the highest availability index for the fuel supply (82.22±1.13) followed by spare parts supply shop availability (80±0.91), road accessibility (77.78±0.49), transportation facilities (75.56±0.59), power supply (71.11±0.52) and parking area/shed (71.11±0.35). This reveals that the fishing harbour and the nearby markets were significantly equipped with reference to marketing infrastructure in the fishing harbour, Mangaluru. Sathiarajan (1989) opined that the infrastructure facilities needed for domestic fish marketing in India is inadequate but in case of Karnataka there is significant improvement of fisheries infrastructure over the years. Das (2013) reported that among the various infrastructural facilities, icing (70.28%) and waste disposal facilities (71.66%) were reported to be scarce than other facilities in fish markets of Tripura and the same facilities were also lacking in some fish markets of Karnataka.

Table.21. Availability of infrastructural facilities in the fishing harbour, Mangaluru

Infrastructural facilities	Availability index (Mean±SD)			
	A	W	R	V
Ice plant	100±0	92.59±0.67	93.33±0.45	-
Cold storage facilities	61.11±0.75	74.07±0.67	66.67±0.71	55.56±0.82
Modern wholesale market	44.44±0.52	62.96±0.33	40±0.45	42.22±0.80
Drying yard	33.33±0	37.04±0.33	33.33±0	35.56±0.26
Insulated vehicles	66.67±0	81.48±1.01	86.67±0.55	62.22±0.64
Road accessibility	77.78±0.52	92.59±0.44	86.67±0.55	77.78±0.49
Market information centres	33.33±0	62.96±0.93	33.33±0	42.22±0.59
Cleaning, packing & filleting units	50±0.55	85.19±073	46.67±0.55	55.56±0.72
Parking area/Shed	66.67±0	48.15±0.53	73.33±0.45	71.11±0.35

Berthing/jetty	55.56±0.52	44.44±0.71	73.33±0.45	60±0.77
Auction hall	66.67±0	51.85±0.53	73.33±0.45	68.89±0.46
Net repairing hall	72.22±0.41	59.26±1.09	46.67±1.34	62.22±0.74
Spare parts supply	83.33±055	88.89±1	46.67±1.34	80±0.91
Fuel supply	72.22±0.98	88.89±1	60±1.64	82.22±1.13
Bicycles/Tricycles with ice boxes for traders	38.89±0.41	40.74±0.44	33.33±0	55.56±0.72
Availability of drinking water	66.67±0	77.78±0.71	66.67±0	68.89±0.46
Cement flooring	72.22±0.41	81.48±0.73	66.67±0	66.67±0.53
Clean water availability	66.67±0	48.15±0.53	60±0.45	57.78±0.70
Drainage channel	44.44±0.52	44.44±0.50	40±0.45	62.22±2.59
Waste disposal facility	44.44±0.52	33.33±0	46.67±0.55	44.44±0.62
Clean ground conditions	33.33±0	40.74±0.44	40±0.45	48.89±0.64
Transportation facilities	77.78±0.52	55.76±0.50	66.67±0.71	75.56±0.59
Hygienic toilet	44.44±0.52	48.15±0.53	46.67±0.55	62.22±0.74
Power supply	61.11±0.75	62.96±0.93	73.33±0.45	71.11±0.52
Hall/Shed for marketing accessories	-	88.89±0.71	66.67±0.71	68.89±0.59

Note: A**:** Auctioneer W: Wholesaler R: Retailer V: Vendor

The extent of available marketing infrastructural facilities in the fishing harbour, Malpe as per the responses received by the different supply chain intermediaries are given in Table 22. The availability index for marketing infrastructure as per the responses of the auctioneers was found to be the highest for ice plants (88.8±0.58) followed by the spare parts supply shop availability (77.78±1.15) and fuel supply (77.78±1.15). The wholesaler respondents were given the highest availability index for the cold storage facilities followed by (100±0), ice plants (100±0), spare parts supply shop (100±0), fuel supply (100±0), hygienic toilets (100±0), power supply (100±0), hall/shed for locating marketing accessories shops

(100±0), bicycles/tricycles with ice boxes for traders (88.89±0.58), parking area/shed (88.89±0.58), transportation facilities (88.89±0.58). The fish vendors in fish market of Malpe responded with the highest marketing infrastructure availability index for the road accessibility (86.67±0.51) followed by transportation facilities (77.78±0.62) and parking area/shed (75.56±0.70) in Malpe fishing harbour. Sathiadhas and Narayanakumar (1994) stated that the lack of marketing infrastructure was important factor responsible for low returns to fishermen in India which is true in case of fishermen and fish vendors in Karnataka.

Table.22. Availability of marketing infrastructural facilities in the fishing harbour, Malpe, Udupi

Infrastructural facilities	Availability index (Mean±SD)			
	A	W	R	V
Ice plant	88.8±0.58	100±0	60±0.45	73.33±0.94
Cold storage facilities	66.67±0	100±0	53.33±0.55	64.44±0.96
Modern wholesale market	33.33±0	66.67±0	53.33±0.55	37.78±0.35
Drying yard	33.33±0	55.56±1.15	33.33±0	37.78±0.64
Insulated vehicles	66.67±0	77.78±0.58	73.33±1.10	53.33±0.91
Road accessibility	66.67±0	100±0	86.67±0.55	86.67±0.51
Market information centers	33.33±0	77.78±1.15	33.33±0	33.33±0
Cleaning, packing & filleting units	66.67±0	77.78±1.15	60±0.84	64.44±0.80
Parking area/Shed	66.67±0	88.89±0.58	80±0.55	75.56±0.70
Berthing/jetty	66.67±0	100±0	86.67±0.55	57.78±1.22
Auction hall	66.67±0	77.78±0.58	80±0.55	48.89±0.83
Net repairing hall	66.67±1	77.58±1.15	93.33±0.55	60±1.37
Spare parts supply	77.78±1.15	100±0	100±0	71.11±1.36
Fuel supply	77.78±1.15	100±0	100±0	71.11±1.36
Bicycles/Tricycles with ice boxes for traders	55.56±0.58	88.89±0.58	66.67±0	60±0.86
Availability of drinking water	66.67±0	66.67±1	73.33±0.45	62.22±0.83
Cement flooring	66.67±0	77.78±0.58	66.67±0	62.22±0.74

Clean water availability	66.67±0	44.44±0.58	66.67±0	62.22±0.35
Drainage channel	55.56±0.58	66.67±1	53.33±0.55	40±0.41
Waste disposal facility	55.56±0.58	66.67±1	46.67±0.55	42.22±0.46
Clean ground conditions	44.44±0.58	77.78±0.58	75±2.0	51.11±0.52
Transportation facilities	66.67±0	88.89±0.58	66.67±0	77.78±0.62
Hygienic toilet	33.33±0	100±0	80±0.89	53.33±0.74
Power supply	55.56±0.58	100±0	86.67±0.55	71.11±0.92
Hall/shed for marketing accessories	33.33±0	100±0	86.67±0.55	71.11±0.92

Note: A**:** Auctioneer W: Wholesaler R: Retailer V: Vendor

The extent of available infrastructural facilities as per the responses received by the different supply chain stakeholders in the fishing harbour, Karwar is given in Table 23. The infrastructure availability index as per the auctioneers were found to be the highest for cold storage facilities (100±0) followed by fuel supply (100±0), ice plants (100±0), road accessibility (100±0), berthing/jetty (88.89±0.58), power supply (88.89±0.58) and hall/shed for locating the marketing accessories shops (88.89±0.58). However, the wholesaler respondents had given the highest availability index for the presence of ice plants (100±0) followed by cold storage (90±5.51), drying yards (88.89±0.58), cement flooring (88.89±0.58), availability of drinking water (88.89±0.58) and the road accessibility (88.89±0.58) in the fishing harbour. Bhatta (2001) stated that the major cost categories involved in supply chains of fish in Andhra Pradesh are input costs and transport costs but in case of present study transportation costs are the major portion of total costs in the distribution of marine fish.

The retailer respondents had given the highest availability index for ice plants (100±0), cold storage (100±0), road accessibility (100±0), berthing/jetty (100±0),

spare parts supply shops (100±0), fuel supply (100±0), availability of drinking water (100±0), hall/shed for locating the shops for marketing accessories (100±0), power supply (100±0), modern wholesale market (83±0.71), parking area/shed (83±0.71), net repairing hall (83±0.71), cement flooring (83±0.71), clean ground conditions (83±0.71), transportation facilities (83±0.71) in the fishing harbour. The fish vendors were ranked highest infrastructure availability index for hall/shed for marketing accessories shops (90.48±0.73), power supply (90.48±0.73), road accessibility (90.48±0.61), spare parts availability (85.71±1.09), fuel supply (85.71±1.09), net repairing hall (80.95±1.09), berthing/jetty (80.95±1.09), transportation facilities (78.57±0.84) and availability of drinking water (78.57±0.63) in the fish market.

Table.23. Availability of marketing infrastructural facilities in the fishing harbour, Karwar

Infrastructural facilities	Availability index (Mean±SD)			
	A	W	R	V
Ice plant	100±0	100±0	100±0	69.05±1.21
Cold storage facilities	100±0	90±5.51	100±0	71.43±1.10
Modern wholesale market	55.56±0	33.33±0	83±0.71	54.76±0.50
Drying yard	66.67±0	88.89±0.58	67±1.41	71.43±1.03
Insulated vehicles	66.67±0	66.67±1.73	67±0	76.19±0.91
Road accessibility	100±0	88.89±0.58	100±0	90.48±0.61
Market information centers	33.33±0	44.44±0.58	33±0	38.10±0.53
Cleaning, packing & filleting units	33.33±0	33.33±0	50±0.71	66.67±0.68
Parking area/shed	77.78±0.58	33.33±0	83±0.71	76.19±0.91
Berthing/jetty	88.89±0.58	44.44±1.15	100±0	80.95±1.09
Auction hall	55.56±0.58	33.33±0	67±0	66.67±0.39
Net repairing hall	66.67±0	22.22±0.58	83±0.71	80.95±1.09
Spare parts supply	77.78±1.15	66.67±1.73	100±0	85.71±1.09

Fuel supply	100±0	66.67±1.73	100±0	85.71±1.09
Bicycles/Tricycles with ice boxes for traders	66.67±1	33.33±0	50±0.71	57.14±0.47
Availability of drinking water	77.78±0.58	88.89±0.58	100±0	78.57±0.63
Cement flooring	77.78±0.58	88.89±0.58	83±0.71	66.67±0.39
Clean water availability	66.67±0	33.33±0	67±1.41	59.52±0.58
Drainage channel	33.33±0	33.33±0	33±0	50±0.52
Waste disposal facility	44.44±0.58	44.44±0.58	50±0.71	35.71±0.27
Clean ground conditions	55.56±0.58	33.33±0	83±0.71	50±0.52
Transportation facilities	66.67±0	66.67±0	83±0.71	78.57±0.84
Hygienic toilet	55.56±0.58	44.44±0.58	67±0	66.67±0.55
Power supply	88.89±0.58	55.56±1.15	100±0	90.48±0.73
Hall/Shed for marketing accessories	88.89±0.58	55.56±1.15	100±0	90.48±0.73

Note: A**:** Auctioneer W: Wholesaler R: Retailer V: Vendor

The Mean and Standard Deviation (SD) are used for knowing the adoption level of hygienic practices in the selected fish markets and it is generally presented as Mean±SD in this entire section. As the mean score increases the adoption level of hygienic practices would be good. Extent of adoption of hygienic practices among the different fish supply chain stakeholders across the major fishing harbours of the study are presented in Table 24. Auctioneers, wholesalers and fish vendors were mostly adopted the hygienic practices such as the use of good quality water for washing (72.22±0.41, 88.89±0.71 and 77.78±0.72). The retailers followed the practices of the use of good quality water for washing (100±0), maintaining personal cleanliness (100±0), adequate quality ice to prevent spoilage of fish (100±0), using good quality container and packaging material (100±0) and hygienic sorting of fish (93.33±0.45) in Mangaluru. The hygienic adoption index for the auctioneers in fishing harbour,

Malpe was very poor. The hygienic adoption index for the wholesalers in Malpe for the practices such as sanitation of market/shops, using good quality container and packaging material, maintaining personal cleanliness and use of clean water for washing was 77.78±0.58. Velayudhan (1999) was reported the major problems in marine fish supply chains of Kerala state such as improper disposal of fish catches by the fishermen, control of fish market by middlemen, unhygienic market conditions, wide fluctuations in price, dearth of cold storage facilities in the market etc. which were moderately observed as in case of fish markets in Karnataka state.

The retailer hygienic adoption index for the practices such as use of good quality water for washing, maintaining personal cleanliness, hygienic sorting of fish, using the practice container and packaging material and sanitation of market/shops was 80.00±18.26. Whereas, in case of fish vendors the hygienic adoption index was poor except the use of good quality water for washing which was moderately better (75.56±0.70). The auctioneer hygienic adoption index in Karwar was moderately better for the use of good quality water for washing (88.89±0.58) followed by maintaining personal cleanliness (77.78±0.58) and adequate quality ice to prevent spoilage of fish (77.78±0.58). All the wholesaler respondents were adopted the hygienic practices such as maintaining personal cleanliness, use of good quality water for washing, adequate quality ice to prevent spoilage of fish and using good quality container and packaging material (100±0). All the hygienic practices adopted by the retailer respondents except the waste disposal practice (83±0.70) in Karwar. However, the fish vendors were moderately adopted the practice of using good

quality water for washing the fish (73.81±0.70). The adoption of hygienic practices was significantly poor by the fish vendor in Karwar. Das (2013) reported that the adoption of good hygienic practices was determined in maintaining personal cleanliness (90.04%), sorting of fish hygienically (85.28%), using clean container and polythene sheet (79.22%), using prompt method of waste disposal (79.22%), use of clean water for washing (78.35%) and use of ice to prevent fish spoilage (77.48%) in fish markets of Tripura whereas the same practices are equally adopted by the intermediaries of marine supply chains except the fish vendors in some fish markets of Karnataka state.

Table.24. Extent of adoption of hygienic practices among the different marine fish supply chain intermediaries

Type of hygienic practices	Adoption index (Mean±SD)											
	Mangaluru				Malpe				Karwar			
	A	W	R	V	A	W	R	V	A	W	R	V
Use of good quality water for washing	72.22± 0.41	88.89± 0.71	100± 0	77.78± 0.72	55.56± 0.58	77.78± 0.58	80.00± 18.26	75.56± 0.70	88.89± 0.58	100± 0	100± 0	73.81± 0.70
Maintaining personal cleanliness	66.67± 0.89	81.48± 0.73	100± 0	71.11± 0.64	44.44± 0.58	77.78± 0.58	80.00± 18.26	73.33± 0.56	77.78± 0.58	100± 0	100± 0	69.05± 0.83
Waste disposal	55.56± 0.52	77.78± 0.87	80.00± 0.55	44.44± 0.49	55.56± 0.58	55.56± 1.16	60.00± 27.89	44.44± 0.49	55.56± 0.58	77.78 ± 1.15	83± 0.70	52.38± 0.51
Adequate quality ice to prevent spoilage of fish	50.00± 0.55	81.48± 0.73	100± 0	66.67± 0.38	44.44± 0.58	66.67± 1.00	66.67± 33.33	51.11± 0.64	77.78± 0.58	100± 0	100± 0	57.14± 0.61
Hygiene sorting of fish	55.56± 0.52	66.67± 0	93.33± 0.45	68.89± 0.26	44.44± 0.58	55.56± 0.58	80.00± 29.81	55.56± 0.49	55.56± 0.58	55.56 ± 0.58	100± 0	50.00± 0.65
Using good quality container and packaging material	55.56± 0.52	85.19± 0.73	100± 0	68.89± 0.46	33.33± 0	77.78± 0.58	80.00± 18.26	62.22± 0.35	55.56± 0.58	100± 0	100± 0	54.76± 0.50
Sanitation of market/shops	61.11± 0.75	59.26± 0.44	86.67± 0.55	42.22± 0.59	0	77.78± 0.58	80.00± 18.26	44.44± 0.49	44.44± 0.58	33.33 ± 0	100± 0	57.14± 0.61
Cleanliness of fish baskets	61.11± 0.75	85.19± 0.73	86.67± 0.55	53.33± 0.63	44.44± 0.58	55.56± 1.16	66.67± 23.57	57.78± 0.59	55.56± 0.58	66.67 ± 1.00	100± 0	52.38± 0.65

Note: A**:** Auctioneer W: Wholesaler R: Retailer V: Vendor

5.6. The consumer preferences for marine fishes across the coastal and non-coastal cities

Among the coastal cities of Karnataka, the percentage of male fish consumer respondents was more in Mangaluru (75%) followed by Udupi (62%) and Karwar (48%) whereas, the percentage of female consumers was more in Udupi (38%) followed by Mangaluru (25%) and Karwar (20%). In the non-coastal cities, Mysuru had comparatively larger male consumers (60%) and female consumers were more in Bengaluru (46.3%) in comparison with other cities. About 63.8% and 51.7% of the fish consumer respondents belongs to urban locality in Mangaluru and Karwar respectively but about 65.5% respondents belonged to rural locality in Udupi city. Among the non-coastal cities, about 55% and 51.5% of the consumers belong to urban locality in Mysuru and Bengaluru respectively and about 41.7% consumers had rural locality in Dharwad city.

The mean age of the fish consumers were 33.66 years in Udupi 36.65 years in Bengaluru across the coastal and non-coastal cities respectively in Karnataka. The percentages of married consumer respondents were 87% in Bengaluru and 83% in Udupi. Alternatively, the unmarried consumers were more in Mangaluru accounting for 51.3% and 25% in Mysuru. All the selected consumers were literate in the cities except Mangaluru (94%). About 40% of the consumers in Mangaluru were graduates and post graduation qualification. Among the non-coastal cities, Bengaluru (51%) and Mysuru (55%) consumer respondents were graduates. The percentage of consumers belonging to hindu religion were more in all the coastal and non-coastal cities

followed by muslims and christian religions. Among the hindu community, II (A) and III (A) which are listed under the Backward Communities (BC) were more in all the coastal and non-coastal cities. The majority of the consumer respondents had nuclear family type in all the selected cities. The majority of the consumer respondents belong to Above Poverty Line (APL) families in Mangaluru (67%), Bengaluru (62%) and Mysuru (65%) whereas, Below Poverty Line (BPL) consumer families were accounted for 55% in Udupi, 45% in Karwar and 62.5% in Dharwad. The average family size of the consumer respondents was maximum in Udupi (5.03) and minimum in Dharwad city (3.47). As far as the occupational status of the consumer respondents, majority of the consumers were employed in private sector followed by government sector and engaged in self employment. The mean monthly income of the consumer respondents was found to be the maximum in Udupi (₹ 28650) followed by Bengaluru (₹ 28604), Karwar (₹ 13823) and Dharwad (₹ 15600) in that order.

The average provision and vegetable consumption was maximum in Bengaluru such as 33 kg/month and 11 kg/month respectively whereas, milk and dairy products consumption was more in Mangaluru (16.70 litre/month). The average marine fish consumption was maximum in Udupi (13.34 kg) among coastal cities and Bengaluru (2.53 kg) among non-coastal cities. The average freshwater fish consumption was maximum in Mangaluru (3.63 kg) among coastal cities and Dharwad (2.44 kg) in non-coastal cities. The monthly average non-vegetarian items consumption was maximum in Mangaluru (7.75 kg) followed by Mysuru (5.21 kg), Udupi (4.96 kg) and minimum in Bengaluru (2.80 kg).

The Engel's coefficient was estimated for all the selected coastal and non-coastal cities to study the standard of living of the consumer respondents. The higher the Engel's coefficient, the lower is the rate of saving consequently, the lower is a household's standard of living. The Engel's coefficient was found highest in Mangaluru (0.21), Udupi (0.18), Bengaluru (0.11) and Mysuru (0.11) and least in Karwar (0.06) and Dharwad (0.08).

The consumer respondents purchase marine fish mainly from the retailers (21.7%) followed by the fish vendors (20.4%) and fish market (16.4%) in Mangaluru whereas in Udupi city consumers preferred the marine fish purchase mostly from fish market (24.1%), supermarket (24.1%) and vendors (20.7%). In Karwar, the consumers purchased marine fish mostly from vendors (55%) followed by fish landing center (30%). The consumers preference of marine fish purchase was mostly from vendors (36.4%) followed by supermarket (34.6%) in Bengaluru city. In Mysuru, the fish was mostly purchased from supermarket (40%) and retailers (35%). All the consumer respondents purchased marine fish from the retailers (100%) in Dharwad city. The purchase frequency of marine fish in Mangaluru was more than twice/week (31.6%) followed by twice per week (27.6%) and once per week (19.7%). However, the purchase frequency of marine fish by the consumer respondents was more than twice per week in Udupi (65.5%) and Karwar (50%). The purchase frequency of marine fish was mainly on fortnightly basis in Bengaluru (51.9%), Mysuru (55%) and Dharwad (52.9%).

The quantity of marine fish purchased at a time was mostly 1-2 kg in Mangaluru, less than one kg in Udupi (65.5%) and Karwar (70%) whereas, the 1-2 kg at a time was more in Bengaluru (82%) and less than one kg at a time was more in Mysuru (95%) and Dharwad cities (94%). The average distance to the fish shop or market was mostly less than 5 km in Mangaluru (61.8%), Udupi (96.6%) and Karwar (70%). Whereas, the location of the fish shop/market was mostly 5-10 km in Bengaluru (56.2%), Mysuru (50%) and more than 10 km in case of Dharwad city. Mostly the society and festivals influenced the fish consumption in all the coastal and non-coastal cities except in Dharwad city where 76.5% of the consumer respondents were not influenced by the society and festivals for the consumption of marine fish. Most of the consumer respondents were aware of the health benefits of consuming fish among the selected coastal and non-coastal cities of Karnataka. The storage of the cooked fish item in refrigerator was found mostly less in Mangaluru (65%) and Dharwad (76.5%) cities. All the consumers from both the selected coastal and non-coastal cities showed the preference for specific marine fish variety and for the whole form of fish. The preference for processed marine fish products was exhibited less by the consumer respondents in Udupi (58.6%) and Mysuru (60%). All the consumers from both the selected coastal and non-coastal cities were ready for Willingness To Pay (WTP) more prices for marine fish except in Dharwad city where the most of the consumer respondents were not WTP more price for marine fish (95%).

The ten independent factors which influence the marine fish purchase decision of consumer respondents in the selected cities were tested for their significance using

t test. In Mangaluru, all the selected independent factors were found to be significant with quality (158.349), freshness (112.410) and taste (108.615) showed better significance whereas in Udupi and Karwar about 6 factors were significantly influencing the purchase decisions of marine fish and out of which taste factor had more t value of 74.610 and 59.206 respectively. Among the non-coastal cities, all the selected independent factors were found significant in Bengaluru and Dharwad. The quality (129.766), taste (113.631) and health aspects of marine fish (92.593) were showed higher t value as far as Bengaluru city is concerned. In case of Dharwad city, quality, taste and price of the fish were equally found significant with the t value of 84.00 for making the purchasing decisions by the consumer respondents. In Mysuru, about eight factors were found significant and out of which price (t=99.000) and taste (71.195) were the guiding factors in making the purchasing decisions of consumers.

Table.25. Socio-economic profile of consumers across coastal and non-coastal cities

Socio-economic variables	Category	Coastal cities			Non-coastal cities		
		Mangaluru (n=152)	Udupi (n=29)	Karwar (n=20)	Bengaluru (n=162)	Mysuru (n=20)	Dharwad (n=17)
Gender	Male	114 (75)	18 (62.1)	14 (48.3)	87 (53.7)	12 (60)	12 (50)
	Female	38 (25)	11 (37.9)	6 (20.7)	75 (46.3)	8 (40)	5 (20.8)
Locality	Urban	97 (63.8)	10 (34.5)	15 (51.7)	88 (51.5)	11 (55)	7 (29.2)
	Rural	28 (18.4)	19 (65.5)	1 (3.4)	6 (3.5)	2 (10)	10 (41.7)
	Semi-urban	27 (17.8)	0	4 (13.8)	68 (39.8)	7 (35)	0
Age (years) (mean ±SE)		30.43±0.82	33.66±0.96	29.95 ±1.45	36.65±0.56	32.40±1.32	33.35±1.45
Marital status	Single	78 (51.3)	5(17.2)	5 (17.2)	13 (7.6)	5 (25)	2 (8.3)
	Married	73 (48)	24 (82.8)	15 (51.7)	149 (87.1)	15 (75)	15 (62.5)
	Widow	1 (0.7)	0	0	0	0	0
Literacy status	Illiterate	9 (5.9)	0	0	0	0	0
	Literate	143 (94.1)	29 (100)	20 (100)	162 (100)	20 (100)	17 (100)
Education status	Up to S.S.L.C.	13 (8.6)	0	2 (6.9)	10 (5.8)	0	0
	Up to PUC	11 (7.2)	5 (17.2)	5 (17.2)	30 (17.5)	3 (15)	5 (20.8)
	Graduate	63 (41.4)	15 (51.7)	11 (37.9)	87 (50.9)	11 (55)	8 (33.3)
	Post Graduation	60 (39.5)	9 (31)	2 (6.9)	35 (20.50	5 (25)	4 (16.7)
	Others:	5 (3.3)	0	0	0	1 (5)	0

Socio-economic variables	Category	Coastal cities			Non-coastal cities		
		Mangaluru (n=152)	Udupi (n=29)	Karwar (n=20)	Bengaluru (n=162)	Mysuru (n=20)	Dharwad (n=17)
Religion	Hindu	132 (86.8)	20 (69)	15 (51.7)	121 (70.8)	15 (75)	12 (50)
	Muslim	11 (7.2)	6 (20.7)	3 (10.3)	24 (14)	3 (15)	4 (16.7)
	Christian	9 (5.9)	3 (10.3)	2 (6.9)	17 (9.9)	2 (10)	1 (4.2)
Community	SC	18 (11.8)	3 (10.3)	3 (10.3)	15 (8.8)	3 (15)	2 (8.3)
	ST	11 (7.2)	1 (3.4)	1 (3.4)	11 (6.4)	1 (5)	3 (12.5)
	Cat-I	21 (13.8)	4(13.8)	3 (10.3)	9 (5.3)	1 (5)	1 (4.2)
	II (A)	33 (21.7)	5 (17.2)	2 (6.9)	25 (14.6)	4 (20)	2 (8.3)
	II (B)	10 (6.6)	6 (20.7)	3 (103)	20 (11.7)	3 (15)	5 (20.8)
	III (A)	25 (15.8)	5 (17.2)	6 (20.7)	49 (28.7)	4 (20)	3 (12.5)
	III(B)	10 (6.6)	2 (6.9)	0	8 (4.7)	1 (5)	0
	General	25 (16.4)	3 (10.3)	2 (6.9)	25 (14.6)	3 (15)	1 (4.2)
Family type	Nuclear	124 (81.6)	25 (86.2)	17 (58.6)	131 (76.6)	18 (90)	17 (100)
	Joint	28 (18.4)	4 (13.8)	3 (10.3)	30 (17.5)	2 (10)	0
Poverty	BPL	50 (32.9)	16 (55.2)	13 (44.8)	56 (32.7)	7 (35)	15 (62.5)
	APL	102 (67.1)	13 (44.8)	7 (24.1)	106 (62)	13 (65)	2 (8.3)
Occupation	Government	32 (21.1)	4 (13.8)	3 (10.3)	29 (17)	2 (10)	2 (8.3)
	Private	30 (19.7)	16 (55.2)	14 (48.3)	83 (48.5)	15 (75)	10 (41.7)
	Self employee	22 (14.5)	9 (31)	3 (10.3)	45 (26.3)	3 (15)	5 (20.8)
Monthly income in ₹ (mean ±SE)		24448±1122	28650±4033	13823.52±2376	28604±2275	21414±2258	15600±1190
Family size (mean ±SE)		4.05±0.193	5.03±0.90	4.05±0.21	4.04±0.07	3.90±0.25	3.47±1.25

Table.26. Monthly average expenditure pattern of consumers across coastal and non-coastal cities

Sl. No.	Category	Coastal cities						Non-coastal cities					
		Mangaluru		Udupi		Karwar		Bengaluru		Mysuru		Dharwad	
		Q	E	Q	E	Q	E	Q	E	Q	E	Q	E
1	Provisions	32.03	1526	31.55	1311	30.25	1172	33.09	1753	30.75	1637	28	1064
2	Vegetables	11.33	546	10	509	8.75	313	10.44	540	9.65	613	7	273
3	Milk and dairy products	16.70	562	9.48	322	11.75	411	14.48	469	14.30	496	9	315
4	Marine fish	9.05	1193	13.34	1583	8.6	847	2.53	804	2.4	685	2	286
5	Freshwater fish	3.63	439	2.08	215	0	0	2.11	277	2.44	328	3	351
6	Non-vegetarian items	7.75	471.60	4.96	252.40	3.61	189.00	2.80	45.80	5.21	363.40	4.30	343.80
7	Education	0	14989	0	16636	0	50818	0	23650	0	24615	0	24615
8	Health expenses	0	1631	0	396	0	979	0	1037	0	690	0	690
9	Housing	0	3646	0	3340	0	3500	0	5515	0	13350	0	13350
10	Mobile recharge	0	811	0	635	0	1085	0	667	0	630	0	630
11	Others*	0	3525	0	3345	0	2215	0	3675	0	4350	0	4350
	Expenditure on food		6624		5201	5201	3632		4072		5577		4008
	Total expenditure		31226		29553		62285		38616		49213		47643
	Engel's coefficient	**0.21**		**0.18**		**0.06**		**0.11**		**0.11**		**0.08**	

Note: Q: Quantity in kg's, E: Expenditure in ₹ .* Entertainment, transportation, clothing, life style expenses etc.

Table. 27. Consumer behaviour for marine fish and fishery products across coastal and non-coastal cities

Sl. No.	Particulars	Category	Coastal cities			Non-coastal cities		
			Mangaluru (n=152)	Udupi (n=29)	Karwar (n=20)	Bengaluru (n=162)	Mysuru (n=17)	Dharwad (n=20)
1	Source of purchase	Retailer	33 (21.7)	5 (17.2)	3 (15)	1 (0.6)	7 (35)	17 (100)
		Vendor	31 (20.4)	6 (20.7)	11 (55)	59 (36.4)	0	0
		Fish landing center	38 (25)	4 (13.8)	6 (30)	0	0	0
		Supermarket	16 (10.5)	7 (24.1)	0	56 (34.6)	8 (40)	0
		APMC	2 (1.3)	0	0	9 (5.5)	5 (25)	0
		Department store	7 (4.6)	0	0	11 (6.8)	0	0
		Fish market	25 (16.4)	7 (24.1)	0	27 (16.7)	0	0
2	Purchase frequency of marine fish	Once per week	30 (19.7)	2 (6.9)	1 (5)	39 (24.1)	4 (20)	0
		Twice per week	42 (27.6)	7 (24.1)	2 (10)	3 (1.9)	0	0
		More than twice/week	48 (31.6)	19 (65.5)	10 (50)	7 (4.3)	0	0
		Fortnightly	15 (9.9)	0	0	84 (51.9)	11 (55)	9 (52.9)
		Once in a month	9 (5.9)	0	0	29 (17.9)	5 (25)	8 (47.1)
		Daily	8 (5.3)	1 (3.4)	7 (35)	0	0	0
3	Quantity of marine fish purchased per visit (kg)	Less than one	46 (30.3)	19 (65.5)	14 (70)	18 (11.1)	19 (95)	16 (94.1)
		1-2	96 (73.2)	8 (27.6)	6 (30)	133 (82.1)	1 (5)	1 (5.9)
		More than two	10 (6.4)	2 (6.9)	0	11 (6.7)	0	0
4	Distance to the fish shop or market (km)	Less than 5	94 (61.8)	28 (96.6)	14 (70)	52 (32.1)	8 (40)	0
		5-10	53 (34.9)	1 (3.4)	6 (30)	91 (56.2)	10 (50)	5 (29.4)
		More than 10	5 (3.3)	0	0	19 (11.7)	2 (10)	12 (70.6)
5	Do society/festivals influence the fish consumption?	Yes	120 (78.9)	28 (96.6)	18 (90)	162 (100)	20 (100)	4 (23.5)
		No	32 (21.2)	1 (3.4)	2 (10)	0	0	13 (76.5)

Sl. No.	Particulars	Category	Coastal cities			Non-coastal cities		
			Mangaluru (n=152)	Udupi (n=29)	Karwar (n=20)	Bengaluru (n=162)	Mysuru (n=17)	Dharwad (n=20)
6	Are you aware about health benefits of consuming fish?	Yes	143 (94.1)	29 (100)	20 (100)	161 (99.4)	20 (100)	17 (100)
		No	9 (5.9)	0	0	1 (0.6)	0	0
7	Are you store the cooked fish item in refrigerator?	Yes	52 (34.2)	15 (51.7)	16 (80)	136 (84)	12 (60)	4 (23.5)
		No	99 (65.1)	14 (48.3)	4 (20)	26 (16.1)	8 (40)	13 (76.5)
8	Preference for specific marine fish variety	Yes	129 (84.9)	29 (100)	20 (100)	156 (96.3)	20 (100)	17 (100)
		No	21 (13.8)	0	0	6 (3.7)	0	0
9	Form of marine fish	Whole fish	136 (89.5)	21 (72.4)	18 (90)	152 (93.8)	20 (100)	17 (100)
		Cut pieces	16 (10.5)	8 (27.6)	2 (10)	8 (6.2)	0	0
10	Do you prefer processed marine fish products?	Yes	79 (52)	12 (41.4)	15 (75)	122 (75.3)	8 (40)	17 (100)
		No	73 (48)	17 (58.6)	5 (25)	40 (24.7)	12 (60)	0
11	WTP more price for marine fish	Yes	130 (85.5)	29 (100)	16 (80)	140 (86.4)	19 (95)	1 (5.9)
		No	13 (8.6)	0	4 (20)	22 (13.6)	1 (5)	16 (95)

Table.28. Factors influencing the purchase decisions of the fish consumer respondents

Factors	Coastal cities						Non-coastal cities					
	Mangaluru		Udupi		Karwar		Bengaluru		Mysuru		Dharwad	
	SE	t value	SE	t value	SE	t value	SE	t value	SE	t value	SE	t value
Quality of fish	0.378	158.349*	0.000	-	0.000	-	0.036	129.766*	0.000	-	0.059	84.000*
Taste	0.529	108.615*	0.065	74.610*	0.082	59.206*	0.039	113.631*	0.069	71.195*	0.059	84.000*
Appearance of fish	0.604	89.025*	0.124	34.946*	0.185	21.939*	0.049	82.614*	0.112	39.149*	0.123	37.291*
Size of fish	0.676	72.625*	0.099	40.299*	0.274	11.492*	0.064	57.164*	0.099	47.816*	0.254	12.976*
Species of fish	0.798	66.501*	0.000	-	0.082	59.206*	0.069	55.001*	0.105	44.706*	0.193	23.790*
Price of fish	0.743	72.483*	0.000	-	0.000	-	0.073	54.597*	0.050	99.000*	0.059	84.000*
Freshness of fish	0.515	112.410*	0.000	-	0.000	-	0.063	73.208*	0.000	-	0.235	20.250*
Availability of fish	0.796	61.315*	0.126	31.928*	0.272	13.582*	0.073	58.306*	0.169	27.286*	0.286	15.842*
Form of fish	1.271	31.005*	0.164	11.769*	0.164	7.935*	0.114	29.880*	0.150	14.333*	0.146	14.546*
Health aspects	0.797	69.481*	0.000	-	0.000	-	0.051	92.593*	0.250	19.000*	0.235	20.250*

Note: t' value cannot be computed because the standard deviation is 0. *Significant at 1% level

The conjoint analysis is an advanced market research technique used for quantifying the fish attributes and its levels which helps marketers for planning the effective marine fish marketing strategies. The consumer preferences for fishes in Mangaluru city revealed that variety of fish (31.301) was an important fish attribute as per order of preference given by the consumer respondents followed by place of purchase (29.765), price of fish (24.159) and appearance of fish (14.776). The attribute level both marine and freshwater fish was received greater utility score (0.861) under the attribute of variety of fish whereas, supermarkets had gained better utility score (0.606) for attracting the consumer respondents under the place of purchase attribute. The consumer respondents were given better utility score for more than 400 /kg attribute level under the price of fish attribute and bright appearance attribute level had positive utility (0.124) under the appearance attribute of fish. The correlation between observed and estimated preferences was estimated for the study (0.994). The strong correlation was showed between attributes and their levels in Mangaluru city. Munireddy *et al*., (2012) found that the preferences of the consumers are very heterogeneous, but it is possible to identify segments with distinct preferences for particular fish attributes. The price of the fish was found to be the most important attribute for as per the consumer preference in Mangaluru whereas price was received least importance as per the present study.

Table.29. Consumer preferences for marine fishes in Mangaluru city

Fish attributes	Attribute levels	Utility Estimate	Standard Error	Averaged Importance Score
Price of fish (₹ /kg)	Less than 200	-0.366	0.136	24.159
	200-400	-0.235	0.136	
	More than 400	0.601	0.136	
Place of purchase	Fish market	-0.211	0.136	29.765
	Vendor	-0.394	0.136	
	Supermarket	0.606	0.136	
Variety of fish	Marine fish	-0.277	0.136	31.301
	Freshwater fish	-0.584	0.136	
	Both marine and freshwater fish	0.861	0.136	
Appearance of fish	Bright	0.124	0.102	14.776
	Dull	-0.124	0.102	
(Constant)		4.959	0.102	
Pearson's R*		0.994		
* Correlations between observed and estimated preferences				

The consumer preferences for fishes in Udupi city indicated that the variety of fish (28.825) was the fish attribute preferred and with the better utility scored attribute level of both marine and freshwater fish (.632). The second important fish attribute score given by the consumers was for the place of purchase (27.955) with the better utility score given to supermarket (0.184). The third important fish attribute rank was given to the price of fish with the better utility score for more than 400 ₹ /kg attribute level (0.782). The least important score was given to the appearance of fish (16.784)

and its attribute level for bright appearance (0.819). A strong correlation was evident between the attributes and their levels in Udupi city (r = 0.980).

Table.30. Consumer preferences for marine fishes in Udupi city

Fish Attributes	**Attribute levels**	**Utility Estimate**	**Standard Error**	**Averaged Importance Score**
Price of fish (₹ /kg)	Less than 200	-0.241	0.312	26.346
	200-400	-0.540	0.312	
	More than 400	0.782	0.312	
Place of purchase	Fish market	0.149	0.312	27.955
	Vendor	-0.333	0.312	
	Supermarket	0.184	0.312	
Variety of fish	Marine fish	-0.322	0.312	28.825
	Freshwater fish	-0.310	0.312	
	Both marine and freshwater fish	0.632	0.312	
Appearance of fish	Bright	0.819	0.234	16.874
	Dull	-0.819	0.234	
(Constant)		4.727	0.234	
Pearson's R*		0.980		
* Correlations between observed and estimated preferences				

The consumer respondents had given the highest importance score for the place of purchase attribute (37.415) with its attribute level for supermarket (1.483) in Karwar city. The second preferred fish attribute was the variety of fish (27.835) with its attribute level for both the marine and freshwater fish (0.367). The price of fish was the third preferred importance score (26.711) with its price attribute level for less than 200 ₹ /kg. The appearance of fish was preferred as the last fish attribute (8.039)

with its attribute level for bright appearance (0.037). A strong correlation was found between the attributes and their levels in Karwar city (r = 0.996).

Table.31. Consumer preferences for marine fishes in Karwar city

Fish attributes	**Attribute levels**	**Utility Estimate**	**Standard Error**	**Averaged Importance Score**
Price of fish (₹ /kg)	Less than 200	0.500	0.164	26.711
	200-400	0.233	0.164	
	More than 400	-0.733	0.164	
Place of purchase	Fish market	-1.400	0.164	37.415
	Vendor	-0.083	0.164	
	Supermarket	1.483	0.164	
Variety of fish	Marine fish	0.217	0.164	27.835
	Freshwater fish	-0.583	0.164	
	Both marine and freshwater fish	0.367	0.164	
Appearance of fish	Bright	0.037	0.123	8.039
	Dull	-0.037	0.123	
(Constant)		4.987	0.123	
Pearson's R*		0.996		
* Correlations between observed and estimated preferences				

The consumer respondents had indicated first rank for the variety of fish attribute (31.401) with its attribute level for both marine and freshwater fish (0.848) in Bengaluru city. The second preferred fish attribute was the place of purchase (29.610) with its attribute level for supermarket (0.592). The price of fish was the third preferred importance score (24.273) with its attribute level for the price of more than 400 ₹ /kg (0.581). The appearance of fish was preferred as the last fish attribute

(14.716) with its attribute level for bright appearance (0.109). Strong correlation was evident between the attributes and their levels in Bengaluru city (r = 0.995). Nandi (20114) reported that regional differences in consumer preferences should be considered in order to improve the marketing channels in Bengaluru was coincide with the results of the present study.

Table.32. Consumer preferences for marine fishes in Bengaluru city

Fish attributes	**Attribute levels**	**Utility Estimate**	**Standard Error**	**Averaged Importance Score**
Price of fish (₹ /kg)	Less than 200	-0.378	0.126	24.273
	200-400	-0.203	0.126	
	More than 400	0.581	0.126	
Place of purchase	Fish market	-0.194	0.126	29.610
	Vendor	-0.397	0.126	
	Supermarket	0.592	0.126	
Variety of fish	Marine fish	-0.269	0.126	31.401
	Freshwater fish	-0.579	0.126	
	Both marine and freshwater fish	0.848	0.126	
Appearance of fish	Bright	0.109	0.094	14.716
	Dull	-0.109	0.094	
(Constant)		4.964	0.094	
Pearson's R*		0.995		
* Correlations between observed and estimated preferences				

The consumer preferences for the fishes in Mysuru city indicated that the place of purchase (30.340) was the first preferred fish attribute with the better utility

attribute level for supermarket (0.783). The second important fish attribute score given by the consumers was for the variety of fish (28.121) with the better utility score given to both the marine and freshwater fish (0.883). The third important fish attribute was given to the price of fish with the better utility score for the price more than 400 ₹ /kg attribute level (0.433). The fourth important score was given to the appearance of fish (14.273) and its attribute level for bright appearance (0.213). A strong correlation was found between the attributes and their levels in Mysuru city (r = 0.999).

Table.33. Consumer preferences for marine fishes in Mysuru city

Fish attributes	**Attribute levels**	**Utility Estimate**	**Standard Error**	**Averaged Importance Score**
Price of fish (₹ /kg)	Less than 200	-0.133	0.048	27.266
	200-400	-0.300	0.048	
	More than 400	0.433	0.048	
Place of purchase	Fish market	-0.300	0.048	30.340
	Vendor	-0.483	0.048	
	Supermarket	0.783	0.048	
Variety of fish	Marine fish	-0.567	0.048	28.121
	Freshwater fish	-0.317	0.048	
	Both marine and freshwater fish	0.883	0.048	
Appearance of fish	Bright	0.213	0.036	14.273
	Dull	-0.213	0.036	
(Constant)		4.929	0.036	
Pearson's R*		0.999		
* Correlations between observed and estimated preferences				

Table.34. Consumer preferences for marine fishes in Dharwad city

Fish attributes	Attribute levels	Utility Estimate	Standard Error	Averaged Importance Score
Price of fish (₹ /kg)	Less than 200	-0.125	0.553	25.179
	200-400	0.521	0.553	
	More than 400	-0.396	0.553	
Place of purchase	Fish market	-0.438	0.553	27.409
	Vendor	0.062	0.553	
	Supermarket	0.375	0.553	
Variety of fish	Marine fish	-0.187	0.553	32.186
	Freshwater fish	-1.292	0.553	
	Both marine and freshwater fish	1.479	0.553	
Appearance of fish	Bright	0.313	0.415	15.226
	Dull	-0.313	0.415	
(Constant)		4.896	0.415	
Pearson's R*		0.956		
* Correlations between observed and estimated preferences				

The consumer preferences for fishes in Dharwad city indicated that the variety of fish (32.186) was considered as an important fish attribute as per the order of preference given by the consumer respondents followed by the place of purchase (27.409), price of fish (25.179) and the appearance of fish (15.226). The attribute level for both marine and freshwater fish was received greater utility score (1.479) under the attribute of variety of fish whereas, supermarkets had gained better utility score (0.375) for attracting the consumer respondents under the place of purchase

attribute. The consumer respondents had given the better utility score for the price range of 200-400 ₹ /kg attribute level (0.521) under the price of fish attribute and bright appearance attribute level had positive utility (0.313) under the attribute of fish appearance. A correlation between observed and estimated preferences was estimated for the study. A strong correlation was found between the attributes and their levels in Dharwad city (0.956).

5.7. The constraints analysis in marine fish supply chains of Karnataka

The constraints faced by the fishermen in the fishing harbours of coastal cities in Karnataka such as Mangaluru, Malpe and Karwar are discussed in the following Table 35. The Rank Based Quotient (RBQ) technique was used for the study to quantify and rank the various constraints. The major constraints faced by the fishermen in Mangaluru were declining fish catch (I), high operational costs (II) and insufficient space for boat and net repairing (IV) whereas, high operational costs and declining fish catch were the important constraints faced by the fishermen in Malpe and Karwar fishing harbours. The scarcity of boat crew was common constraint (III) in all the selected major fishing harbours and the more number of the middlemen per boat was the fifth ranked constraint in Mangaluru and Malpe. The lack of basic facilities like drinking water was the fourth ranked constraint and the lack of adequate institutional credit support was the sixth ranked constraint by the fishermen of Malpe and Karwar whereas the ice cost was the six ranked constraint as expressed by the fishermen of Karwar fishing harbour.

Table.35. Constraints faced by the fishermen in the fishing harbours of the study area

Sl. No.	Fishermen's constraints	RBQ score		
		Mangaluru (n=18)	**Malpe (n=15)**	**Karwar (n=08)**
1	High operational costs	II (88.33)	I (93.89)	I (83.75)
2	Declining fish catch	I (92.22)	II (86.67)	II (82.50)
3	Insufficient space for boat and net repairing	IV (50.00)	VIII (43.33)	V (53.75)
4	Absence of cooperative marketing	-	XII (5.56)	-
5	Un remunerative price and underbidding	VIII (10.00)	IX (32.78)	X (15.00)
6	More number of middlemen/boat	V (46.11)	V (52.22)	VIII (38.75)
7	Lack of market information on price	VII (15.56)	VII (48.33)	-
8	Delay in settlement of sale proceeds	VII (15.56)	X (13.33)	IX (16.25)
9	Lack of basic facilities like drinking water	VI (42.78)	IV (62.22)	IV (60.00)
10	Lack of adequate institutional credit support	VI (42.78)	VI (51.11)	VII (46.25)
11	Scarcity of boat crew	III (81.11)	III (72.22)	III (63.75)
12	Ice cost	-	XI (12.78)	VI (50.00)

Note: Figures in the parentheses indicates RBQ score for the respective constraint

The various constraints expressed by the wholesaler respondents in the major fishing harbours of the study area such as Mangaluru, Malpe and Karwar are discussed in the following table. The wholesaler respondents in Mangaluru and Karwar were commonly reported the high transportation cost and the lack of hygiene and sanitation in the landing centers/markets/shops as the first and the second ranked constraints. High cost of labour and market price discrimination for the fishes were the III and IV ranked constraints as expressed by the wholesaler respondents in Mangaluru whereas the higher number of middlemen and low market arrival ranked as the third important constraint in Malpe. The poor cold storage facilities and the

lack of basic facilities like drinking water in the landing center were reported as the third and the fourth constraints in Karwar fishing harbour. The fifth important constraint ranked by the wholesalers was the higher number of middlemen, high cost of labour and delay in settlement of sale proceeds in Mangaluru, Malpe and Karwar respectively. The sixth constraint was the lack of basic facilities like drinking water in Mangaluru, Malpe and the lack of market information on fish prices in Karwar. The seventh constraint was the stiff competition among the traders, high marketing cost and the low market arrival of fish catch in Mangaluru, Malpe and Karwar respectively.

The constraints faced by the retailer respondents in major fishing harbours of the study are given below the Table 27. The lack of market information on fish prices was the first constraint faced by the retailers in Mangaluru and Karwar while the lesser number of buyers for the purchase of fish at the retail shops was the first constraint in Malpe. The lack of hygiene and sanitation aspects in the landing centers/markets/shops was the second ranked constraint in Malpe and Karwar while the high cost of labour was ranked second in case of retailers in Mangalore. The stiff competition among the traders was the third constraint faced by the retailers in Malpe and Karwar while the lack of cold storage facilities in case of Mangaluru. Some of the other constraints faced by the retailers in Mangaluru were the lesser number of buyers (IV), lack of basic facilities like drinking water (V), delay in the settlement of sale proceeds (VI), high transportation cost (VII), low market arrival of fish catch (VIII), High marketing cost and Higher number of middlemen (X). The fourth, fifth, sixth

and seventh constraints ranked by the retailers in Malpe were high marketing cost, lack of market information on fish prices, lack of basic facilities like drinking water and high transportation cost respectively. In case of the retailers of Karwar, some of the other constraints include lack of basic facilities like drinking water (IV), high degree of dependency on middlemen for financial support (V), higher number of middlemen in the landing center (VI) and the lack of cold storage facilities (VII).

Table.36. Constraints at wholesalers level in the fishing harbours of study area

Sl. No.	Wholesaler constraints	RBQ score		
		Mangaluru (n=09)	Malpe (n=03)	Karwar (n=03)
1	High cost of labour	III (76.98)	V (55.66)	II (80.56)
2	High marketing cost	XI (18.25)	VII (50.00)	VIII (16.67)
3	High transportation cost	I (89.68)	II (80.56)	I (94.44)
4	Higher number of middlemen	V (60.32)	III (61.11)	IX (11.11)
5	Lack of cold storage facilities	VIII (57.14)	VIII (44.44)	III (75.00)
6	Lack of market information on fish prices	IX (56.35)	IX (33.33)	VI (58.33)
7	Delay in settlement of sale proceeds	-	XI (11.11)	V (66.67)
8	Lack of basic facilities like drinking water	VII (59.52)	VI (52.78)	IV (69.44)
9	High degree of dependency on middlemen for financial support	XIII (7.94)	X (22.22)	-
10	Stiff competition among traders	VII (59.52)	I (86.11)	IX (11.11)
11	Low market arrivals	X (44.44)	III (61.11)	VII (27.78)
12	Lack of hygiene and sanitation of the landing centers/markets/shops	II (81.75)	IV (58.33)	II(80.56)
13	Un remunerative price	XIV (4.76)	-	VII(27.78)
14	Price discrimination	IV (65.87)	-	-

Note: Figures in the parentheses indicates RBQ score for the respective constraint

Table.37. Constraints at retailers level in major fishing harbours of study area

Sl. No.	Retailer constraints	RBQ score		
		Mangaluru (n=09)	Malpe (n=06)	Karwar (n=04)
1	High cost of labour	II (75.38)	XI (13.33)	V (22.73)
2	High marketing cost	IX (32.31)	IV (73.33)	III (63.64)
3	High transportation cost	VII (55.38)	VII (46.67)	III (63.64)
4	Higher number of middlemen	X (20.00)	IX (30.00)	VI (18.18)
5	Lack of cold storage facilities	III (69.23)	VIII (38.33)	VII (13.64)
6	Lack of market information on fish prices	I (83.08)	V (63.33)	I (77.27)
7	Delay in settlement of sale proceeds	VI (56.92)	-	-
8	Lack of basic facilities like drinking water	V (63.08)	VI (50.00)	IV (54.55)
9	High degree of dependency on middlemen for financial support	-	X (16.67)	V (22.73)
10	Stiff competition among traders	XII (10.77)	III (75.00)	III (63.64)
11	Low market arrival of fish catch	VIII (50.77)	III (75.00)	VI (18.18)
12	Lack of hygiene and sanitation of the landing centers/markets/shops	V (63.08)	II (83.33)	II (72.73)
13	Lesser number of buyers	IV (64.62)	I (91.67)	-
14	Absence of cooperative fish marketing	XI (18.46)	-	-

Note: Figures in the parentheses indicates RBQ score for the respective constraint

The constraints expressed by the vendors in the fishing harbours of the study area are discussed in the following Table 38. The first constraint as ranked by the fish vendors was the lack of market information on fish prices in Mangaluru and Karwar while the lesser number of buyers from the vendors in the fish market of Udupi. Fish vendors at Malpe and Karwar had ranked the lack of hygiene and sanitation of the landing centers/markets/shops as the second constraint while the lack of market information on fish prices in the case of fish vendors at Mangaluru. The third

constraint as perceived by the vendor respondent was the higher number of middlemen, lack of basic facilities like drinking water and lack of hygiene and sanitation of the landing centers/markets/shops at Mangaluru, Udupi and Karwar respectively.

High transportation cost was ranked as the fourth constraint in Udupi and Karwar whereas high degree of dependency on middlemen for financial support in the case of vendors in Mangaluru. The high marketing cost was the fifth constraint in Karwar, high degree of dependency on middlemen for financial support in Udupi and lack of basic facilities like drinking water in the case of vendors in Mangaluru. Some of the constraints felt by the vendors in Mangaluru were the high transportation cost (VI), low market arrival of fish catch (VII), high marketing cost (VIII), poor cold storage facilities (IX) and the lesser number of buyers (X). However, in the case of fish vendors in Udupi, the high marketing cost, lack of market information on fish prices, lesser number of buyers were ranked as the sixth, seventh and eight ranked constraints respectively. The poor cold storage facilities was ranked as the sixth, higher number of middlemen as the seventh, high degree of dependency on middlemen for financial support as the eight and stiff competition among the traders as the ninth ranked constraint in the case of fish vendors Karwar.

The constraints found in case of supermarkets are explained in the following Table 39. The lack of market information on fish prices was the first ranked constraint in the supermarkets of Udupi and Karwar whereas it got second rank in the case of supermarkets in Mangaluru. The second ranked constraint being the lack of

market information on fish prices in Mangaluru, high marketing cost in Udupi and the competition among the traders in Karwar. However, competition among the traders was the common constraint (III) in Mangaluru and Udupi while high marketing cost was the third ranked constraint in Karwar. Some of the other constraints faced by the supermarkets in Mangaluru were the low arrival of fish catch at the landing centers (IV), high transportation cost (V) and the lack of hygiene and sanitation in the landing centers (VI). The supermarkets in Udupi were facing the constraints of high transportation cost (IV), low arrival of fish catch at the landing centers (V) and lesser number of buyers for purchase of fish from supermarkets (VI).

The constraints faced by the consumer respondents for the purchase of marine fish across coastal and non-coastal cities were studied using Rank Based Quotient (RBQ) technique is given in the Table 40. The first constraint reported by the consumer respondents was wide fluctuations in prices of marine fish in all the coastal cities and non-coastal cities except Bengaluru city. The second rank was given to the lack of fresh fish followed by irregular supply (III), Lack of hygienic conditions in the fish markets (IV), non availability of preferable fishes (V), highly perishable nature of fish (VI), distance to the place of purchase (VII), religious aspects (VIII) in the Mangaluru fish markets. The second rank was given for Irregular supply followed by Lack of hygienic conditions in the fish markets (III), non availability of preferable fishes (IV) and lack of fresh fish (V) for purchase of marine fish in fish markets of Udupi. The second rank was given to the lack of hygienic conditions followed by distance to the place of purchase (III), irregular supply of fish (IV) and lack of fresh

fish (V) in the fish markets of Karwar city. Nandi (2014) found that the constraints like high prices and difficulties in accessing these shops are the reasons for buying food products from local open markets and conventional retail shops in Bengaluru was coincides with the results of the study.

Table. 38. Constraints at vendors level in the fishing harbours of study area

Sl. No.	Vendor constraints	RBQ score		
		Mangaluru (n=19)	Malpe (n=15)	Karwar (n=12)
1	High cost of labour	XI (8.89)	XII (9.23)	-
2	High marketing cost	VIII (46.22)	VI (53.85)	V (62.43)
3	High transportation cost	VI (64.89)	IV (58.97)	IV (65.68)
4	Higher number of middlemen	III (75.56)	XI (24.62)	VII (44.25)
5	Lack of cold storage facilities	IX (45.78)	X (33.85)	VI (57.14)
6	Lack of market information on fish prices	I (85.78)	VII (52.31)	II (74.30)
7	Delay in settlement of sale proceeds	XV (3.56)	-	-
8	Lack of basic facilities like drinking water	V (66.22)	III (62.05)	I (86.83)
9	High degree of dependency on middlemen for financial support	IV (66.67)	V (56.41)	VIII (44.81)
10	Cut-throat competition among traders	-	I (78.46)	IX (34.51)
11	Low market arrival of fish catch	VII (49.78)	IX (50.26)	X (23.56)
12	Lack of hygiene and sanitation of the landing centers/markets/shops	II (79.11)	II (68.21)	III (74.30)
13	Un remunerative price	VX (4.00)	-	-
14	Price discrimination	XIII (4.44)	XIII (5.64)	-
15	More ice cost	XII (4.89)	-	-
16	Lesser number of buyers	X (29.33)	VIII (51.28)	X (23.36)

Note: Figures in the parentheses indicates RBQ score for the respective constraint

Table.39. Constraints at supermarket level in coastal cities of Karnataka

Sl. No.	Constraints	RBQ score		
		Mangaluru (n=05)	**Malpe (n=04)**	**Karwar (n=03)**
1	High marketing costs	I (88.72)	II (81.92)	III (78.38)
2	High transportation costs	V (45.98)	IV (76.23)	VI (42.09)
3	Lack of market information on fish prices	II (82.89)	I (92.30)	I (87.30)
4	Low arrivals of fish at the landing centers	IV (63.98)	V (73.98)	IV (74.89)
5	Lack of hygiene and sanitation of the landing centers	VI (25.34)	VII (53.09)	V (62.98)
6	Lesser number of buyers	V (45.98)	VI (70.29)	VII (19.34)
7	Competition among the traders	III (74.79)	III (79.10)	II (81.00)

Note: Figures in the parentheses indicates RBQ score for the respective constraint

The lack of fresh fish was given first rank constraint by the consumer respondents followed by wide fluctuations in price (II), irregular supply of fish (III), non availability of preferable fishes (IV), lack of hygienic conditions (V) in the fish markets of Bengaluru city. The least rank was given to distance to the place of purchase (VII) and religious aspects (VIII). The second rank was given to non availability of preferable fishes followed by lack of fresh fish (III) and irregular supply of fish (IV) in the fish markets of Mysuru city. The least rank was given to highly perishable nature (VII) and religious aspects (VIII). The irregular supply of fish was given second rank followed by lack of fresh fish (III) and non availability of preferable fishes (IV) and the least ranked constraint was lack of hygienic conditions in the fish markets (VI), highly perishable (VI) and religious aspects (VII) in the Dharwad city. Velayudhan (1999) stated that the problem of high perishability nature of fish, markedly seasonal nature of fish, scattered fish landing centers in Kerala

which have also observed as in case of marine fish supply chains in Karnataka state. The constraints pertaining to hygiene and foul odour of fish shops and markets in Bengaluru were reported by Viswanatha *et al*., (2014) coincides with the present study.

Table.40. Constraints faced by the consumer's for purchase of marine fishes across coastal and non-coastal cities

Sl. No.	Consumer constraints	Coastal cities			Non-coastal cities		
		Mangaluru (n=152)	Udupi (n=29)	Karwar (n=20)	Bengaluru (n=162)	Mysuru (n=17)	Dharwad (n=20)
1	Irregular supply	III (62.75)	II (83.19)	IV (46.25)	III (65.35)	IV (69.38)	II (75.74)
2	Lack of fresh fish	II (66.53)	V (53.88)	V (49.38)	I (89.89)	III (81.88)	III (71.32)
3	Wide fluctuations in price	I (75.00)	I (94.40)	I (62.50)	II (80.79)	I (86.88)	I (92.65)
4	Non availability of preferable fishes	V (58.31)	IV (65.52)	VI (41.88)	IV (63.89)	II (86.25)	IV (53.68)
5	Religious aspects	VIII (29.03)	VIII (20.26)	VIII (28.13)	VIII (22.84)	VIII (13.75)	VII (13.97)
6	Highly perishable	VI (45.23)	VI (40.95)	VII (37.50)	VI (36.65)	VII (31.25)	VI (35.29)
7	Lack of hygienic conditions in the fish markets	IV (60.44)	III (68.53)	II (71.88)	V (45.45)	V (45.63)	VI (35.29)
8	Distance to the place of purchase	VII (34.70)	VII (29.31)	III (61.25)	VII (33.18)	VI (35.00)	V (44.12)

Note: Figures in the parentheses indicates RBQ score for the respective constraint

CHAPTER 6

SUMMARY AND CONCLUSION

The supply chain analysis for marine fishes in Karnataka seems to be significantly improved in terms of marketing efficiency, fishermen share in consumer rupee and reduction of price spread among the different marine fish supply chains in the selected fishing harbours of Karnataka. However, marine fish supply chain intermediaries were facing the problems of inadequate marketing infrastructure and market information on the fish prices. With this background, the present study was conducted to understand the present supply chain system of marine fishes in Karnataka state.

6.1. Summary

The specific objectives of the study includes assessing the marketing efficiency of emerging marine fish supply chains, to analyse the seasonal price fluctuations of the most preferred marine fishes in the selected fish markets, assessment of the existing market and marketing infrastructure of the selected fish markets, to compare the consumer preferences for marine fishes across the selected coastal and non-coastal cities, and identify the constraints and recommend policy interventions for improving the marine fish supply chains in Karnataka.

In Karnataka state, there are five major fishing harbours out of which the x fishing harbours located in Mangaluru, Malpe and Karwar were purposively selected for the present study. The sample size of the study was fixed at 550 covering 201 consumers from the coastal cities and 199 consumers from the non-coastal cities.

About 41 fishermen, 16 auctioneers, 16 wholesalers, 19 retailers, 46 vendor and 12 supermarkets were selected from the fishing harbours. Pre-tested comprehensive survey schedules were used for primary data collection from the fishermen, supply chain intermediaries and the consumers. The simple random sampling method was employed for collecting the primary data from fishermen, supply chain intermediaries and the consumers and the personal interview technique was followed for collecting the responses. About ten commercially important marine fish varieties were considered for studying the marketing efficiency of marine fish supply chains namely Anchovy, Black Pomfret, White Pomfret, Cat fish, Crab, Mackerel, Pink Perch, Sardine, Seer fish and Shrimp. The seasonal price fluctuations of the most preferred marine fish varieties in the selected fish markets of the state was also studied using both secondary data and primary data. The market and the marketing infrastructure of the selected fish markets were studied by collecting the responses from the different market intermediaries of the different marine fish supply chains. The consumer preferences for marine fish were studied across the coastal and non-coastal cities using conjoint analysis technique.

The emerging marine fish supply chains identified for the present study in Mangaluru, Udupi and Karwar fishing harbours are as follows:

Supply chain 1: Fishermen - Auctioneers - Wholesalers - Retailers - Consumers

Supply chain 2: Fishermen - Auctioneers - Retailers - Consumers

Supply chain 3: Fishermen - Agents of supermarket - Supermarkets – Consumers

Supply chain 4: Fishermen - Auctioneers - Vendors - Consumers

The Fishermen's Share in Consumer Rupee and marketing efficiency for White Pomfret was 90.73% and 10.79 respectively with a price spread of 48.01₹/kg. The price spread was the highest for Seer fish (50.30₹/kg) with FSCR of 87.43% and the marketing efficiency of 7.96. The FSCR was the lowest for Sardine (63.12%) and Mackerel (66.53%) with a price spread of 20.45 ₹/kg and 31.85 ₹/kg respectively under the marine fish supply chain 1 in Mangaluru. The FSCR and the marketing efficiency for White Pomfret was the highest with 89.75% and 11.46 respectively with a price spread of 53.70 ₹/kg. The FSCR and marketing efficiency was the lowest for Sardine such as 60.40% and 2.71 respectively with a price spread of 22.95 ₹/kg under the supply chain 2 in Mangaluru. The FSCR and marketing efficiency for Black Pomfret was highest such as 86.50% and 8.26 respectively with a price spread of 48.37 ₹/kg. The FSCR was the lowest for Mackerel (54.71%) and Crab (63.91%) with a price spread of 52.41 ₹/kg and 48.95 ₹/kg respectively under the marine fish supply chain 3 in Mangaluru. The price spread for White Pomfret was 63.12 ₹/kg with the FSCR and the marketing efficiency of 87.70% and 8.80 respectively. The fish vendors incurred a marketing cost of 13.40 ₹/kg for each selected marine fish and marketing margin of 40.12 ₹/kg. The price spread was least for Sardine (27 ₹/kg) and Crab (28.05 ₹/kg) with the FSCR of 47.26% and 74.21% respectively.

The FSCR was maximum for White Pomfret (90.07%) and Black Pomfret (88.39%) with a price spread of 51.82 ₹/kg and 40.70 ₹/kg respectively. The price spread was the lowest for Sardine (17.79 ₹/kg) with a FSCR and marketing efficiency of 66.30% and 2.97 respectively under the marine fish supply chain 1 in Malpe

fishing harbour. The FSCR was maximum for White Pomfret (91.53%) and Black Pomfret (90.68%) with a price spread of 46.24 ₹/kg and 35.99 ₹/kg respectively. The price spread was minimum for Sardine (12.74 ₹/kg), Cat fish (16.78 ₹/kg) and Anchovy (16.74 ₹/kg) with the FSCR of 75.84%, 86.55% and 82.70% respectively. The FSCR and the marketing efficiency for White Pomfret was 89.31% with a price spread and marketing efficiency of 65.85 ₹/kg and 9.35 respectively. The marketing efficiency was maximum for Seer fish (11.91) with the FSCR and price spread of 91.60% and 45.85 ₹/kg. The FSCR was also considerably better for shrimps (84.03%), Crabs (79.89%) and Cat fish (78.75%). The price spread was maximum for Seer fish (66.98 ₹/kg) and the FSCR was the highest for White Pomfret (86.71%) with a price spread of 58.25 ₹/kg. The marketing efficiency was the least for Sardine (2.85) and Anchovy (3.49) with the FSCR of 18.95% and 26.14% respectively. The lowest marketing margin of 7.20 ₹/kg and 8.34 ₹/kg was fixed by the fish vendors for Sardine and Mackerel respectively under the marine fish supply chain 4 in Malpe fishing harbour.

The FSCR and the marketing efficiency for White Pomfret was 85.33% with a price spread and the marketing efficiency of 80.83 ₹/kg and 9.45 respectively. The FSCR was the lowest for Sardine (56.52%) and Mackerel (60.27%) with a price spread of 26.93 ₹/kg and 41.73 ₹/kg respectively in the marine fish supply chain 1 in Karwar fishing harbour. The FSCR was the least for Sardine (68.47%) and Mackerel (73.35%) with a price spread of 16.12 ₹/kg and 22.90 ₹/kg respectively under the marine fish supply chain 2 in Karwar fishing harbour. The FSCR was the lowest for

Sardine (62.34%) and Mackerel (71.19%) with a price spread of 21.14 ₹/kg and 26.31 ₹/kg respectively under the marine fish supply chain 3 in Karwar fishing harbour. The price spread was the least for Sardine (12.74 ₹/kg) and Mackerel (15.37 ₹/kg) with the FSCR of 70.19% and 82% respectively under the marine fish supply chain 4 in Karwar fishing harbour.

The secondary data on the commercially important marine fish varieties during the period April 2012-March 2013 was considered for studying the seasonal price fluctuations in Karnataka. The monthly landing centre price indices of high value marine fishes such as black pomfret, white pomfret and seer fish varied more during June - July and less during October - November months. However, the monthly price index for white prawn was the highest in November and the least in July.

The CV was used to measure the variability of marine fish prices and it was found highest for white pomfret (22.51%) and lady fish (16.48%) and the least for white prawn (7.38%). The medium value marine fish price indices were found to be at its peak during June - July and minimum during September - October. The maximum range of price index was seen for crockers (68.00) followed by lactarius spp. (66.00) and pink perch (64.00). The minimum range of price index was observed for soles (36.00) and crabs (42.00). The highest CV was found for crockers (21.77%) followed by pink perches (20.75%), squids (19.97%), lactarius spp (18.76%), tuna (17.20%), barracuda (16.43%) and mackerel (15.80%). However, minimum CV was observed for soles (11.53%) and crabs (13.20%). The monthly landing centre price

indices for the low value fishes were recorded highest during July - September. The maximum CV was found for cat fish (20.89%) followed by sardines (18.57%) and clams (12.06%). The quantity of clams and sardine traded was low during April – May months.

The primary data was collected fortnightly for about 33 commercially important marine fish varieties in Mangaluru fishing harbour during August 2013 to July 2014. The monthly CV and Range for marine fish prices across landing center, wholesale fish markets, retail fish markets and terminal fish markets were calculated for studying the seasonal price fluctuations of marine fishes. The maximum CV was recorded in the fish landing centers of Mangaluru during June, 2014 (159.80%) and September months (147.19%) in 2013 and June (159.80%) and March (158.21%) in 2014 respectively. The minimum CV was found in landing center, Mangaluru during August (128.82%) and October months (129.28) in 2013. The maximum price range was found in May, 2014 (₹ 565/kg) and the least during August, 2013 (₹ 305/kg) in the fish landing center, Mangaluru. The maximum CV was recorded during December, 2013 (168.26%) and June 2014 (164.01%) and maximum range of ₹ 612.5/kg during May, 2014 in terminal fish market, Mangaluru.

The primary data was collected fortnightly for about 27 commercially important marine fish varieties in Malpe fishing harbour, Udupi during August 2013 to July 2014. The highest CV was recorded during June, 2014 (88.22%) with a maximum price range of 978 ₹/kg during June, 2014 in terminal fish market, Malpe, Udupi. The primary data was collected fortnightly for about 23 commercially

important marine fish varieties in Karwar fishing harbour during August 2013 to July 2014. The maximum CV was recorded in fish landing center, Malpe during October 2013 (85.69) and the minimum CV of 60.90% in April 2013. The minimum price range was found during September, 2013 (₹ 275/kg) and the maximum during July, 2014 (₹ 538/kg) in fish landing center, Karwar. The primary data was collected fortnightly for about 19 commercially important marine fish varieties in Russel fish market, Bengaluru during August 2013 to July 2014. The maximum CV was recorded in wholesale fish market, Bengaluru during May 2014 (69.82%) and the minimum CV was found during January 2104 (46.00%). The maximum price range was found in July, 2014 (₹ 570/kg) and the least during August (₹ 375/kg) and November, 2013 (₹ 375/kg).

Among the infrastructural facilities, auctioneers had given the highest availability index for ice plants (100±0), the wholesalers for insulated vehicles availability in the fish market (92.59±0.67). The retailers had given the highest availability index for ice plants (93.33±0.45) while the fish vendors for the fuel supply (82.22±1.13) in the Mangaluru fishing harbour. Auctioneers had given the highest availability index for ice plants (88.8±0.58), the wholesalers for the cold storage facility (100±0), ice plants (100±0), spare parts availability (100±0), fuel supply (100±0), hygienic toilets (100±0), power supply (100±0), hall/shed for locating marketing accessories (100±0). The fish vendors had given the highest infrastructure availability index for the road accessibility (86.67±0.51) to the fish market of Malpe. The auctioneers had given the highest infrastructure index for cold

storage facility (100±0), fuel supply (100±0), ice plants (100±0) and road accessibility (100±0) in Karwar fishing harbour. However, the wholesalers quoted the highest availability index for ice plants (100±0) while the retailers for ice plants (100±0), cold storage facility (100±0), road accessibility (100±0), berthing/jetty (100±0), spare parts availability (100±0), fuel supply (100±0), availability of drinking water (100±0), hall/shed for locating the marketing accessories (100±0) and power supply (100±0). The fish vendors had indicated the highest infrastructure availability index for hall or shed for marketing accessories shops (90.48±0.73) in the fish market of Karwar.

The extent of adoption of hygienic practices among the different fish supply chain intermediaries in the fishing harbours reveals that the auctioneers, wholesalers and the fish vendors were mostly adopted the hygienic practices such as the use of clean water for washing (72.22±0.41, 88.89±0.71 and 77.78±0.72 respectively). All the retailers had adopted the hygienic practices of using clean water for washing (100±0), maintaining personal cleanliness (100±0), adequate quality ice to prevent spoilage of fish (100±0), using good quality container and packaging material (100±0) in Mangaluru fish market. The wholesaler hygienic adoption index was 77.78±0.58 for the hygienic practices such as sanitation of market or shops, using good quality container and packaging materials, maintaining personal cleanliness and using clean water for washing in Malpe fishing harbour. The retailer hygienic adoption index was 80.00±18.26 for the hygienic practices such as the use of good quality water for washing, maintaining personal cleanliness, hygiene sorting of fish,

using good quality container and packaging material and sanitation of market or shops. However in case of fish vendors the hygienic adoption index was poor except the practice use of clean water for washing which was moderately better (75.56±0.70). All the wholesalers followed the hygienic practices such as maintaining personal cleanliness, use of good quality water for washing, adequate quality ice to prevent spoilage of fish and using clean container and packaging materials (100±0) in Karwar. All hygienic practices adopted by the retailer respondents except waste disposal practice (83±0.70) in Karwar. However, the fish vendors moderately adopted using clean water for washing the fish (73.81±0.70).

Among the coastal cities of Karnataka, the percentage of male fish consumer respondents was more in Mangaluru (75%) whereas the female consumers was more in Udupi (38%). In the non-coastal cities, Mysuru had comparatively larger male consumers (60%), while the female consumers were more in Bengaluru (46.3%). The mean age of the fish consumers was 33.66 years in Udupi and 36.65 years in Bengaluru. Among the non-coastal cities, about 51% of Bengaluru and 55% of Mysuru consumer respondents were graduates. The majority of the consumer respondents belong to the Above Poverty Line (APL) families in Mangaluru (67%), followed by Bengaluru (62%) and Mysuru (65%) whereas, the Below Poverty Line (BPL) consumer families accounted for 55% in Udupi followed by 45% in Karwar and 62.5% in Dharwad. The average family size of the consumer respondents was maximum in Udupi (5.03) and minimum in Dharwad city (3.47). The mean monthly

income of the consumer respondents was found to be the maximum in Udupi (₹ 28650) and Bengaluru (₹ 28604).

The monthly average quantity of provisions and vegetable consumption in Bengaluru was 33 kg and 11 kg respectively whereas, milk and dairy products consumption was more in Mangaluru (16.70 litre). The monthly average marine fish consumption was maximum in Udupi (13.34 kg) and Bengaluru (2.53 kg). The monthly average freshwater fish consumption was 3.63 kg in Mangaluru and 2.44 kg in Dharwad. The monthly average non-vegetarian food items consumption was maximum in Mangaluru (7.75 kg) and Mysuru (5.21 kg). The Engel's coefficient was estimated for all the selected coastal and non-coastal cities and the Engel's coefficient was found to be highest in the Mangaluru (0.21) followed by Udupi (0.18).

The consumer respondents purchased marine fish mainly from the retailers (21.7%) in Mangaluru whereas the consumers purchased from fish market (24.1%) followed by supermarket (24.1%) and vendors (20.7%) the Udupi. In Karwar, the consumers purchased marine fish mostly from the fish vendors (55%). The consumer preferences of marine fish purchase were mostly from the fish vendors (36.4%) followed by supermarket (34.6%) in Bengaluru city whereas the fish was mostly purchased from supermarket (40%) in Mysuru. All the consumer respondents preferred purchasing marine fish from the retailers (100%) in Dharwad city. About 31.6% of the consumers purchase frequency of marine fish in Mangaluru was more than twice/week while, 65.5% in Udupi and 50% in Karwar. About 51.9% of the consumers purchase frequency of marine fish was mainly on fortnightly basis, 55% in

Mysuru and 52.9% in Dharwad. The average distance to the fish shop or fish market was mostly less than 5 km in Mangaluru (61.8%), Udupi (96.6%) and Karwar (70%) whereas, the average distance of the fish shop or fish market was mostly 5-10 km in Bengaluru (56.2%) and Mysuru (50%). The society and the festivals were not influenced the fish consumption in Dharwad city (76.5%) and most of the consumer respondents were well aware of the health benefits of consuming fish coastal and non-coastal cities in Karnataka. All the consumers from both the selected coastal and non-coastal cities showed the preference for specific marine fish variety and also for the whole form of fish. The preference for processed marine fish products was exhibited less by the consumer respondents in Udupi (58.6%) and Mysuru (60%). All the consumers of the coastal and non-coastal cities were ready for Willingness To Pay (WTP) more price for marine fish except in Dharwad city wherein the most of the consumer respondents were not WTP more price for marine fish (95%).

The ten independent factors which influences the marine fish purchase decision of the consumers in the selected cities were tested for their significance using t test. In Mangaluru, all the selected independent factors were found to be significant whereas taste factor had more t value of 74.610 and 59.206 in Udupi and Karwar respectively. Among the non-coastal cities, the quality (129.766), taste (113.631) and health aspects of marine fish (92.593) were showed higher t value in Bengaluru city. In case of Dharwad city, quality, taste and price of the fish were equally found significant with the t value of 84.00. The price (t=99.000) and taste (t=71.195) were found significant in Mysuru.

The conjoint analysis revealed that the variety of fish (31.301) and the place of purchase (29.765) were preferred by the consumers in Mangaluru city. The attribute level of both marine and freshwater fish was received greater utility score (0.861) whereas the supermarkets had gained better utility score (0.606) for attracting the consumer respondents. A strong correlation was found between the attributes and their levels in Mangaluru city($r = 0.994$). The consumer preferences for fishes in Udupi city indicated that the variety of fish (28.825) was the important attribute with better utility score for attribute level of both marine and freshwater fish (0.632). The second important fish attribute score given by the consumers was for the place of purchase (27.955) with the better utility score given to supermarket (0.184). A strong correlation was evident between the attributes and their levels in Udupi city ($r = 0.980$). The consumer respondents had given the highest importance score for the place of purchase attribute (37.415) with its attribute level for supermarket (1.483) in Karwar city. The second preferred fish attribute was the variety of fish (27.835) with its attribute level for both the marine and freshwater fish (0.367). A strong correlation was found between the attributes and their levels in Karwar city ($r= 0.996$).

The consumer respondents had indicated the first rank for the variety of fish attribute (31.401) with its attribute level for both marine and freshwater fish (0.848) in Bengaluru city. The second preferred fish attribute was the place of purchase (29.610) with its attribute level for supermarket (0.592). A strong correlation was evident between the attributes and their levels in Bengaluru city ($r=0.995$). The consumer preferences for the fishes in Mysuru city indicated that the place of

purchase (30.340) was the first preferred fish attribute with the better utility attribute level for supermarket (0.783). The second important fish attribute score given by the consumers was for the variety of fish (28.121) with the better utility score given to both the marine and freshwater fish (0.883). A strong correlation was found between the attributes and their levels in Mysuru city (r=0.999). The consumer preferences for fishes in Dharwad city indicated that the variety of fish (32.186) was considered as an important fish attribute followed by the place of purchase (27.409) and price of fish (25.179). A strong correlation was found between the attributes and their levels in Dharwad city (r=0.956).

The constraints faced by the fishermen in the fishing harbours of coastal cities in Karnataka were calculated using Rank Based Quotient (RBQ) technique. The major constraints faced by the fishermen in Mangaluru was the declining fish catch, while high operational costs and declining fish catch in Malpe and Karwar fishing harbours respectively. The constraints expressed by the wholesalers in Mangaluru and Karwar were the high transportation cost and the lack of hygiene and sanitation in the fish landing centers as the first and the second ranked constraints. The lack of market information on fish prices was the first constraint faced by the retailers in Mangaluru and Karwar while the lesser number of buyers for the purchase of fish at retail shops was the first constraint in Malpe. The important constraint expressed by the fish vendors was the lack of market information on fish prices in Mangaluru and Karwar while the lesser number of buyers at the vendors in the fish market of Udupi. The major constraint found in case of supermarkets was the lack of market information on

fish prices in Udupi and Karwar whereas second rank in case of supermarkets in Mangaluru. The first constraint reported by the consumer respondents was the wide fluctuations in prices of marine fish in all the coastal cities and non-coastal cities except Bengaluru city. The second and third rank was given to the lack of hygienic conditions and the place of purchase in the fish markets of Karwar city. The lack of fresh fish and wide fluctuations in price were given first and second rank with reference to constraints expressed by the consumers in Bengaluru city.

6.2. Conclusion

The following conclusions could be drawn based on the results of the study.

1. The overall average price spread was the highest for the marine fish supply chain 3: Fishermen - Agents of supermarket - Supermarkets - Consumers (in Mangaluru, Malpe) and supply chain 1 (in Karwar) : Fishermen - Auctioneers - Wholesalers - Retailers - Consumers indicated that the marine fish supply chain intermediaries have taken major share of the consumer rupee whereas the fishermen and the consumers were less benefitted.
2. The overall average fishermen's share in consumer rupee was the highest for the supply chain 1 (in Mangaluru): Fishermen - Auctioneers - Wholesalers - Retailers - Consumers, supply chain 2: Fishermen - Auctioneers - Retailers - Consumers in Malpe and Karwar indicated that the fishermen have realized better returns from the consumer rupee.
3. The overall average marketing efficiency of supply chain 2: Fishermen - Auctioneers - Retailers - Consumers was better as compared with the other marine fish supply

chains of the study in the Mangaluru, Malpe and Karwar fishing harbour pointing out that the added marketing costs and the marketing margins were minimum and hence all the market intermediaries of the marine fish supply chain 2 would be equally benefitted.

4. The monthly landing centre price indices of high value marine fishes varied more during June - July and less during October - November, 2012 in Mangaluru with the possible reasons of wide fluctuations in the landings of high value marine fishes and more consumer demand.
5. The Coefficient of Variation was used to measure the fluctuations of marine fish prices and it was found highest for the high value marine fishes and the least for white prawns during April 2012 to March 2013 which indicated that low fish landings and greater consumer demand for high value marine fishes were responsible for more price fluctuations.
6. The medium value marine fish price indices were found maximum during June - July due to the fishing ban of mechanized vessels in June in Karnataka which leads to the low fish landings and the least price indices were observed during September - October, 2012 indicating that after the fishing ban the fish landings would be more and hence the price fall occurred during September - October, 2012.
7. The monthly landing centre price indices for low value fishes recorded the highest during February-May, 2012 indicating that the price rise occurred due to less quantity of low value fish landings.

8. The highest CV was estimated for all the 33 commercially important marine fish varieties indicating that, more price fluctuations of marine fishes were due to the fishing ban and the variations in the quantity of fish landings in fish landing center, Mangaluru during June, 2014.
9. The maximum CV was recorded in the fish landing centre during March 2014 for all 27 commercially important marine fish varieties in Malpe fishing harbour which indicated high consumer demand for those varieties.
10. The maximum CV was estimated in the fish landing center during October, 2013 for all the 23 commercially important marine fish varieties selected for the study from Karwar fishing harbour pointed out that more price fluctuations were observed due to the variability in fish landings and consumer demand.
11. The maximum CV was found in the wholesale Russel fish market, Bengaluru during May, 2014 for all the 19 commercially important marine fish varieties which revealed that more price fluctuations were observed due to the variability in fish supply to the high variations in fish supply to the market in view of the fishing ban.
12. Among the market infrastructural facilities, auctioneers had given the highest availability index for ice plants, wholesalers for the availability of insulated vehicles, and the retailers for ice plants which indicated that over the years, the infrastructure facilities were improved in Mangaluru fishing harbour.
13. The auctioneers responded with the highest availability infrastructure index for ice plants while the wholesalers for the cold storages, ice plants, spare parts supply availability, fuel supply, hygienic toilets, power supply, hall or shed for marketing

accessories shops and fish vendors had given for the road accessibility to the fishing harbours and market which revealed that the physical infrastructure facilities were significantly developed in Malpe fishing harbour.

14. The auctioneers were responded with the highest availability infrastructure index for cold storages, fuel supply, ice plants, road accessibility while the wholesalers for ice plants, the retailers for ice plants, cold storage, road accessibility, berthing or jetty, spare parts supply availability, fuel supply, availability of drinking water, hall or shed for marketing accessories, power supply and the fish vendors had given the highest infrastructure availability index for the availability of hall or shed for marketing accessories in Karwar fishing harbour.

15. All the auctioneers, wholesalers, retailers and fish vendors had adopted the hygienic practices of using hygienic water for washing while the retailers were also adopted the hygienic practices such as personal cleanliness, adequate quality ice to prevent spoilage of fish, using hygienic container and packaging materials in Mangaluru fishing harbour.

16. The wholesalers had adopted the hygienic practices of maintaining sanitation in markets using hygienic container and packaging materials, maintaining personal cleanliness and use of hygienic water for washing wherea the hygienic adoption index in the case of other supply chain intermediaries in the fish market of Malpe was not satisfactory.

17. The auctioneer hygienic adoption index was moderately better in the case of using hygienic water for washing, all the hygienic practices were adopted by the retailers

except the practice of fish waste disposal in Karwar. The fish vendors were less moderately adopted the practice of using good quality water for washing fish and the overall hygienic practices adoption was significantly poor by the fish vendors in Karwar.

18. The mean age of the fish consumers was 33.66 years in Udupi and 36.65 years in Bengaluru. The percentage of consumers belonging to hindu religion were more in all the coastal and non-coastal cities followed by muslims and christian religions. The majority of the consumers belongs to APL families in Mangaluru whereas 55% of the consumer families living in below poverty line were found in Udupi.
19. Majority of the consumers were employed in private sector followed by government sector and also engaged in self employment in the study areas. The mean monthly income of the consumers was found to be the highest in Udupi and Bengaluru.
20. The expenditure on household provisions and vegetable was the highest in Bengaluru whereas, milk and dairy products consumption was more in Mangaluru. The monthly average non-vegetarian food items consumption was maximum in Mangaluru which indicated that the consumers in Mangaluru consume more of animal protein compared to other cities.
21. The average marine fish consumption was the highest in Udupi and Bengaluru compared with other cities whereas the average freshwater fish consumption was the highest in Mangaluru and Dharwad which indicated the freshwater fish consumption was in the coastal cities owing to its lesser price. The standard of living of the consumers was also studied by using Engel's coefficient and it was found highest in

Mangaluru and Udupi which indicates the high living status and the families spend low expenditure on food.

22. The consumers purchased marine fish mainly from the retailers in Mangaluru, fish market and supermarket in Udupi and fish vendors in Karwar fish market. The quantity of marine fish purchased was 1-2 kg per visit in Mangaluru and Bengaluru, less than one kg per visit in Udupi and Karwar.
23. All the consumers from both the selected coastal and non-coastal cities showed the preference for specific marine fish variety. The consumers were ready for Willingness To Pay (WTP) more prices for marine fish except in Dharwad city where in most of the consumer respondents were not willingness to pay more price because of availability of freshwater fish.
24. The taste of fish was the important factor which influenced the purchase decision of marine fish in Udupi and Karwar while, the quality, taste and health aspects of marine fish were the key factors in Bengaluru city which revealed that deciding factors for purchase of marine fish were not uniform across the coastal and non-coastal cities .
25. The conjoint analysis revealed that the variety of fish was an important attribute for the consumers in Mangaluru, Udupi, Bengaluru and Dharwad cities while the place of purchase was an important attribute in Karwar and Mysuru indicated that the people should give the importance for variety of fish and location of establishing the fish retail outlets while marketing the marine fish.
26. The major constraints faced by the fishermen in Mangaluru was the declining fish catch, while high operational costs and declining fish catch in Malpe and Karwar

fishing harbours. The wholesalers expressed concern over high transportation cost and lack of hygiene and sanitation in the landing centers in Mangaluru and Karwar.

27. The market information of the fish prices on daily basis was the major constraint in the coastal cities as expressed by the retailers, fish vendors and supermarkets however, the lack of availability of fresh fish was another major problem in the non-coastal city like Bengaluru since the city is located far from the coastal area.

6.3. Policy interventions for improving the marine fish supply chains

The present study revealed that marine fish supply chain system in Karnataka has considerably improved in terms of marketing efficiency, marketing infrastructure but still the information on seasonal marine fish price fluctuations and consumer preferences for marine fishes are scanty and subjected to variations. Hence some of the policy interventions to be undertaken are proposed below:

1. The marine fish supply chains of low value fishes was comparatively inefficient in terms of FSCR, price spread and hence the market intermediaries would be provided with proper infrastructure to maintain the quality and price rise of fish.
2. The increasing gross marketing margins and low fishermen's share in consumer rupee of certain marine fishes would be improved by enacting effective market laws which would regulate the actions of fish marketing intermediaries.
3. The institutional arrangement should be made for encouraging the transparency in marine fish trade and display of fish market information on supply chain regular basis which would benefit the all stakeholders of marine fish supply chain for improving marketing efficiency.

4. The government shall take initiatives to increase the number of cold storages of fish among the major fishing harbours for maintain the fish buffer stock which would help the market intermediaries to realise high returns during the marketing process and also help to stabiles market prices during fishing ban periods.
5. The Government may establish an initiative for effective enforcement of Minimum Support Price (MSP) for low value marine fishes and Ceiling Price (CP) for medium and high value marine fishes through establishing the centralized price commission which is followed in the field of agriculture.
6. The effective market acts and regulations should be framed for monitoring the market conduct and the market activities of marine fish supply chain intermediaries there is free entry for all the market intermediaries in the fishing harbours.
7. The market infrastructure status of the Karwar fishing harbour and fish market needs to be improved for improving the efficiency of marine fish supply chains.
8. The adoption of hygienic practices among the fish vendors was not satisfactory in the Karwar fish market and hence they should be provided with the training programmes on hygienic handling of fishes.
9. The sanitation and the hygienic conditions of fishing harbours and fish markets should be strictly monitored by the concerned governing body.
10. The market research for the consumer preferences revealed that the fish marketers have to give the importance for the variety of fish and place of selling in the city areas.

11. The fishermen should be given the training by the state fisheries department for the effective adoption of fishing technologies in order to minimise their operational costs and sustainable harvesting of fish.
12. The retailers of the fish markets are facing the stiff market competition from supermarkets and hence the modernisation of retailer shops is recommended for attracting the buyers.
13. The fish vendors should be provided with better market infrastructure for selling the marine fish in the study areas. The government should improve the cold chain infrastructure for regular supply of the marine fresh fishes in the non-coastal cities.

The study recommended further research to be undertaken for assessing the efficiency of inter-state and export supply chain analysis of marine fish and value added products separately for exploring the better opportunities and enhancing the competitiveness among the stakeholders of marine fish supply chains. The dry fish supply chain analysis was another key area that needs to be explored in Karnataka.

CHAPTER 7

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Ph.D. Dissertation: ***Supply Chain Analysis of Marine Fishes in Karnataka, India***

Tamil Nadu Fisheries University, Fisheries College & Research Institute (FC&RI)

Tuticorin-8, Tamil Nadu, India

Fisherman

I. General information:

Name & Address :				Community :		Fisherman/Others:						
Family size (no.) :	M		F		C		Family members involved in fishing :		Experience (years) :		Age (years):	
Education :		Monthly income (₹):			Inherited Profession:		Yes/No					
No. of crew:		No. of boats owned :			Type of craft:		Motorized/ Mechanized					
Ownership :		Owned/Leased in			Lease /Investment amount (₹) :							
Fishing season:		June-August/Sept-May			Fishing ground:		Inshore/Offshore/Deep-sea					
Fish harvested (kg trip^{-1}) :		Avg. no. of fishing (trips/year):			Type of gear :		Trawl/Gillnet/Purse seine/Others:		Fish consumed: (kg day^{-1})			

*M-Male, F-Female, C-Children

II. Fish marketing details (₹/kg) :

Marine fish varieties		**S-1**	**S-2**	**S-3**	**S-4**	**S-5**	**S-6**	**S-7**	**S-8**	**S-9**	**S-10**
Marketing costs incurred by Fisherman	Labour										
	Icing										
	Transportation cost										
	Market fee										
	Commission charges										

	Any other:										
Market losses	Loss due to handling										
	Transportation delays										
	Storage										
	Packaging										
	Icing										
	Marketing										
	Others:										

Note: Q-Quantity, P-Price

1. **What are the sources of disposal?**

Commission agent/ Auctioneer/

Wholesaler/Vendor/Retailer/Others:_____

III. Items of operational costs per fishing trip: (_____hours)

Operational costs	Quantity	Cost (₹)
Diesel		
Ice cost		
Freshwater		
Crewmen		
Food expenses		
Kerosene		
LPG		
Others:		

1. **What are the fishing equipments used on boat? (Tick)**

RADAR / GPS/Life jackets / Sonar / LED light / Radio / Compass / First aid box / Watch / Mobile phone

2. Tick the following credit sources for investment?

Credit Sources	Bank	Co-operatives	SHGs	Chit funds	DCC Bank	Money lenders	Federations	Friends	Others:
Tick									
Amount (₹)									
Interest rate (%)									

IV. What are the reasons for taking loans?

S. No.	**Reasons**	**Tick**
1	Fish business	
2	Boat purchase	
3	Boat maintenance and repair	
4	House construction/repair	
5	Festivals	
6	Domestic consumption	
7	Purchase boat accessories	
8	Education and health	
9	Debt repayment	
10	Others:	

V. Constraints in fishing activity/fish marketing:

S. No.	Constraints	Ranks (Most important=1)
1	High operational costs	
2	Declining fish catch	
3	Insufficient space for boat and net repairing	
4	Absence of cooperative marketing	
5	Un remunerative price and underbidding	
6	Exploitation by commission agents	
7	More number of middlemen/boats	
8	Lack of market information on price	
9	Delay in settlement of sale proceeds	
10	Lack of basic facilities like drinking water etc.	
11	Lack of institutional credit support	
12	Others:	

VI. Suggestions for improving the marine fish supply chains:

Signature of Enumerator

Ph.D. Dissertation: ***Supply Chain Analysis of Marine Fishes in Karnataka, India***

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Tuticorin- 8, Tamil Nadu, India

Supply Chain Intermediaries

A. General information

Name of the market :		Year of establishment:		Name of the intermediary :	
Status of intermediary:	Auctioneer/ Commission agent/Wholesaler /Retailer/Vendor/ Processing plant/Supermarket/KFDC/Others:_____				
Age (years):		Community:	Fishermen/Others:	Ancillary occupation:	
Location:	Urban/Rural/Semi-Urban		Investment (₹):	Marital status:	S/M/W/D*
Education:		Monthly income (₹):		Experience (years):	
No. of working days/ year:		Family size (no.):	Male:	Female:	Children:
Market Structure and Conduct					
Area coverage:	Local/Regional/ National/Export		Volume of transaction:		Wholesale/Retail/Both
Time span:	Short/long period	Nature of transaction:	Cash/ Forward/ Both	No. of commodities:	General/Specialized markets
Extent of public intervention:	Regulated/ Unregulated		Weighing process:	Physical balance/Electronic balance/ Platform balance/Spring balance/Others:	

*S= Single, M=Married, W=Widow, D= Divorcee

B. Marketing details (₹/kg)

Marine fish varieties			**S-1**	**S-2**	**S-3**	**S-4**	**S-5**	**S-6**	**S-7**	**S-8**	**S-9**	**S-10**
Source of arrival (Purchase price)	Commission agent	Q										
		P										
	Auctioneer	Q										
		P										
	Wholesaler	Q										
		P										
	Others:	Q										

		P										
Marketing costs	Labour											
	Ice											
	Transport											
	Sorting											
	Wastage											
	Cleaning											
	Packing											
	Marketing charges											
	Establishment charges											
	Rent											
	Electricity											
	Others:											
Marketing margin												
Market losses (kg)	Loss due to handling											
	Transportation delays											
	Storage											
	Packaging											
	Icing											
	Marketing											
	Others:											

Note: Q-Quantity, P-Price

1. **What are the sources of disposal?**

   Commission agent/

   Auctioneer/Wholesaler/Vendor/Retailer/Others:_____

2. **How do you negotiate the price of marine fish? (Tick)**

Pre-determined/Market price/Auction price/others (specify):_____

Total quantity (kg) =_____ and Price (₹) =_____

3. **How do you fix the price while buying fish? (Tick)**

Mutual consultation/ Size of fish/ Availability of fish in landing centre/ others:

_____

4. **What is the source of market news/intelligence? Yes/No. If yes specify:_____**
5. **What is the proportion of fish and ice used? :_____**
6. **Which type of the box used for handling and capacity?:** corrugated/thermo coal/plastic/wooden & ___kg

C. What are the factors used to determine the price of marine fish? (Tick)

Factors	Appearance of the body	Fat content	Gill color	Meat portion	Shape of the eyes	Size	Odour	Taste	Texture	Credit linkage	Business relationship	Others:
SA												
A												
UD												
DA												
SDA												

SA = Strongly Agree, A = Agree, UD =Undecidedness, DA = Disagree, SDA = Strongly Disagree

D. Adoption of hygienic practices among different supply chain intermediaries (Tick):

S. No.	**Hygienic Practices**	**A**	**PA**	**NA**	**Managing agency***
1	Use of clean water for washing				
2	Maintaining personal cleanliness				

3	Waste disposal				
4	Adequate quality ice to prevent spoilage of fish				
5	Hygiene sorting of fish				
6	Using clean container and packaging material				
7	Sanitation of market/shops				
8	Cleanliness of fish baskets				
9	Cleanliness of deck				
10	Others:				

* Govt. agency (1), Producers associations (2), SHGs (3), Private agencies (4), PPP arrangement (5) (A: Adequate, PA: Partially Adequate, NA: Not Adequate)

E. Market and marketing infrastructure of details:

1. Availability of infrastructural facilities in the landing center/market (Tick):

S. No.	Infrastructural facilities	A	PA	NA	Managing agency*
1	Ice plant				
2	Cold storage				
3	Modern wholesale market				
4	Drying yard				
5	Insulated vehicles				
6	Road accessibility				
7	Market information centres				
8	Telephone facilities				
9	Cleaning, packing & filleting units				
10	Parking area/Shed				
11	Berthing/jetty				
12	Auction hall				
13	Net repairing hall				

14	Spare parts supply				
15	Fuel supply				
16	Bicycles/Tricycles with ice boxes for traders				
17	Availability of drinking water				
18	Cement flooring				
19	Clean water availability				
20	Drainage channel				
21	Waste disposal facility				
22	Clean ground conditions				
23	Transportation facilities				
24	Hygienic toilet				
25	Power supply				
26	Hall/Shed for marketing accessories				
27	Others:				

* Govt. agency (1), Fishermen's associations (2), SHGs (3), Private agencies (4), PPP arrangement (5)

(A: Adequate, PA: Partially Adequate, NA: Not Adequate)

2. Upgradation of existing market infrastructure (Tick):

S. No.	**Infrastructure facilities**	**Yes**	**No**	**Managing Agency***
1.	**Wholesale market**			
i.	Area expansion & Civil works			
ii.	Power supply			
iii.	Electrical fittings			
iv.	Modern weighing machines			
v.	Fly repellants/destroyer			
vi.	Modern drainage system			
vii.	Water supply			
viii.	Platforms for sellers			

ix.	Toilet and sanitation facilities			
2.	**Auction hall**			
i.	Area expansion & Civil works			
ii.	Power supply			
iii.	Electrical fittings			
iv.	Modern weighing machines			
v.	Fly repellants / destroyer			
vi.	Modern drainage system			
vii.	Water supply			
viii.	Platforms for auctioneers			
ix.	Toilet and sanitation facilities			
3.	**Landing centres**			
i.	Area expansion & Civil works			
ii.	Repair & Spare parts supply			
iii.	Fuel Supply			

* Govt. agency (1), Fishermen associations (2), SHGs (3), Private agencies (4), PPP arrangement (5)

F. Constraints in the marine fish supply chains

S. No.	**Constraints**	**Ranks (Most important=1)**
1	High cost of labour	
2	High marketing cost	
3	High transportation cost	
4	Absence of cooperative marketing	
5	Un remunerative price	
6	Exploitation by commission agents	
7	Price discrimination	
8	Higher number of middlemen	
9	Poor storage facilities	

10	Lack of market information on fish prices	
11	Delay in settlement of sale proceeds	
12	Lack of basic facilities like drinking water etc.	
13	High degree of dependency on middlemen for financial support	
14	Cut-throat competition among traders	
15	Low market arrivals	
16	Lesser number of buyers	
17	Lack of hygiene and sanitation of the landing centers/markets/shops	
18	Others:	

L. Suggestions for improving the marine fish supply chains:

Signature of Enumerator

Ph.D. Dissertation: ***Supply Chain Analysis of Marine Fishes in Karnataka, India***

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Tuticorin-8, Tamil Nadu, India

Marine fish prices (Fortnightly)

Place :		Market:		Date:	

S. No.	Marine fishes (₹/kg)	Vernacular name	Landing centre	Wholesale markets	Retail markets	Terminal markets*
1	Anchovies	Kollatharu				
2	Barracuda	Kaandya				
3	Bulls Eye	Disco meenu				
4	Carangids	Kodabatti				
5	Catfish	Thede				
6	Crabs	Yedi				
7	Croakers	Kooddayi				
8	Cuttle Fish	Kappu Bondas				
9	Eels	Haavu meenu				
10	Flat fish	Balchut				
11	Lactarius	Aadavu				
12	Lady Fish	Kaane				
13	Lizard Fish	Odathi meenu				
14	Lobsters	Perangayi				
15	Mackerel	Bangude				
16	Mullets	Maala				
17	Perches	Kemberi				
18	Pomfrets	Manjee				
19	Rays	Thorke				
20	Ribbon fish	Baale meenu				
21	Milk Fish	Hu meenu				
22	Sardine	Boothayi				
23	Seer fish	Anjal				
24	Sharks	Thaate				
25	Shrimps	Sigadi				
26	Silver bellies	kurchi				
27	Silver Fish	Bolinger				
28	Soles	Sanna Nangu				
29	Squids	Bondas				
30	Tuna	Sura meenu				

***Terminal markets:** Super market/Stall/Vendors

Signature of Enumerator

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Consumer

1. Socio-economic profile of consumers

Name :		Locality:	Urban/Rural/Semi-Urban	*Sex:	M/F	Age (years):	
Marital Status*:	S/M/W/D	Literacy level:	Illiterate/Literate			Family size:	
Education:	Up to S.S.L.C/Up to PUC/ Graduate/Post-graduate/ Others:						
Religion:	Hindu/Muslim /Christian/Others:	Community	SC/ST/Cat-I/II (A)/II (B)/III (A)/III (B)/Gen				
Sub caste:		Family type:	Nuclear/Joint/Extended	Nativity:	Coastal/Non-coastal		
Poverty level:	BPL/APL**	Perceived economic situation:	Difficult/ Intermediate/Well-off				
Occupation:	Government/Private/Self employee/Others:			Monthly income(₹) :			
Personal health:	Sound health/Heart patient/Diabetic/Cancer/BP/Others:						

**BPL: Blow Poverty Line, APL: Above Poverty Line, * M: Male, F: Female

1.1 Family Details:

S. No	Relation to the household head	Sex	Age	Marital Status*	Educational status	Occupation		Monthly income (₹)
						Primary	Secondary	

*S= Single, M=Married, W=Widow, D= Divorcee

2. Expenditure pattern of consumers

Particulars	Provisions	Vegetables	Milk and dairy products	Marine fish	Freshwater fish	Chicken	Mutton	Pork	Beef	Eggs (no.)	Education	Health expenses	Housing	Mobile recharge	Others*:
Quantity /month															
Price (₹/unit)															

*Others: Entertainment, transportation, clothing, life style expenses etc.

3. Factors influencing your purchasing decision for marine fish (Tick)

Factors	Quality	Taste	Appearance	Size	Species	Price	Freshness	Fish availability	Form of fish	Health aspects	Others:
SA											
A											
UD											
DA											
SDA											

(SA= Strongly agree, A = Agree, UD =Undecidedness, DA=Disagree, SDA = Strongly disagree)

3. Rank the following marine fishes as per your order of preference?

S. No.	Marine fishes	Vernacular name	Rank (Most important=1)	Quantity/week	Price (₹ /kg)	Source of purchase*
1	Cuttle Fish	Kappu Bondas				
2	Crabs	Yedi				
3	Croakers	Kooddayi				
4	Mackerel	Bangude				
5	Perches	Kemberi				
6	Pomfrets	Manjee				

7	Sardines	Boothayi				
8	Seer fish	Anjal				
9	Shrimps	Sigadi				
10	Others:					

*1.Retailer 2.Vendor 3. Landing center 4. Super market 5. Departmental Stores 6. Others:

4.1 What is the purchase frequency of marine fish?

Once per week/twice per week/more than twice/fortnightly/once in a month

4.2 Quantity of marine fish purchase (kg/visit):_____ and Distance to the fish shop/market:____km

4.3 Do society/festivals influence the fish consumption? Yes/No

4.4 Do you aware about health benefits of consuming marine fish? Yes/No

4.5 Do you store the cooked fish item in refrigerator? Yes/No If yes how long?____

4.6 Do you prepare fish by products? Yes/No If yes please specify:_____

4.7 Do you have any preference for specific marine fish variety? Yes/No

4.8 Which form of marine fish you prefer to buy? Yes/No

Whole fish/ Cut pieces

4.9 Do you prefer processed marine fish products? Yes/No

Frozen fish/Chilled ready to cook/ Frozen ready to cook/Smoked products/Salted products/Others:_____

4.10 What are the closest substitutes to marine fish? Give reasons:

4.11 What are the closest complementary to marine fish? Give reasons:

5. Do you have Willingness To Pay (WTP) more price for marine fish? Yes/No

S. No.	Determinants	Maximum WTP price (₹/kg)				Reason for selecting as first choice (tick)			
		M	S	P	Sh	M	S	P	Sh
1	Taste & Preferences								

2	Less bones in fish								
3	Nutrition (low fat)								
4	Convenience to cook								
5	Accessibility of shop								
6	Others:								

(M-Mackerel, S-Seer fish, P-Pomfret, Sh-Shrimp)

6. What are the constraints you faced for purchasing marine fish?

S. No.	Constraints	Rank (Most important=1)
1	Irregular supply	
2	Lack of fresh fish	
3	Wide fluctuations in price	
4	Non availability of preferable fishes	
5	Health aspects	
6	Religious aspects	
7	Highly perishable	
8	Lack of hygienic conditions in the fish markets	
9	Distance to the place of purchase	
10	Others:	

7. Give the preference for the following marine fish attributes

S. No.	Attributes	Attribute levels
1	Price	<200, 200-400, >400 ₹/kg
2	Place of purchase	Fish market, Vendor, Supermarket
3	Variety of fish	Marine, Freshwater fish, Marine and Freshwater fish
4	Appearance	Bright, dull

Card ID	**Price (₹/kg)**	**Place of purchase**	**Variety of fish**	**Appearance**	**Preference for cards (Most important=1)**
1	More than 400	Vendor	Marine fish	Dull	
2	200-400	Vendor	Marine and Freshwater fish	Bright	
3	More than 400	Fish Market	Marine and Freshwater fish	Bright	
4	Less than 200	Supermarket	Marine and Freshwater fish	Dull	
5	200-400	Supermarket	Marine fish	Bright	
6	Less than 200	Fish Market	Marine fish	Bright	
7	Less than 200	Vendor	Freshwater fish	Bright	
8	More than 400	Supermarket	Freshwater fish	Bright	
9	200-400	Fish Market	Freshwater fish	Dull	
10[a]	More than 400	Supermarket	Marine fish	Bright	
11[b]	200-400	Fish Market	Marine and Freshwater fish	Dull	

Note: a, b holdouts

7. Any other comments:

Signature of Enumerator

TAMILNADU FISHERIES UNIVERSITY
FISHERIES COLLEGE AND RESEARCH INSTITUTE
THOOTHUKUDI – 628 008

Dr. R. Senthiladeban,
Professor
Department of Fisheries Economics
Fisheries College and Research Institute (FC&RI)
Thoothukudi – 628 008.

No. FC&RI/D.F.ECON/PhD./DPF 12004(FEC)/2013
Date:

Sir,

Sub: Education – Ph.D (Fisheries Economics) Research work - Selection of attributes and levels requested – regarding.

I wish to state that my student Mr. Viswanatha.B.S., DPF 12004(FEC) has taken up the research work entitled *"Supply Chain Analysis of Marine Fishes in Karnataka, India"* for Ph.D (Fisheries Economics) under my guidance with the following objectives.

i. To identify the emerging supply chains and marketing efficiency and its impact on fishermen and consumers.
ii. To analyze the seasonal price fluctuations of the most preferred marine fishes in the selected fish markets
iii. To assess the existing market and marketing infrastructure of selected fish markets
iv. To compare the consumer preferences for marine fishes across the coastal and non-coastal cities.
v. To identify the constraints and recommend policy interventions for improving the marine fish supply chains.

I also state that he is studying the consumer preferences for marine fishes across the coastal and non-coastal cities using conjoint analysis method. In this connection, I am sending herewith a list of attributes ans its levels which could be performed in the study. Therefore, I request you to kindly indicate the suitable attributes in a five point continuum by putting a tick mark **(✓)** under each item. If you find any other attributes and levels suitable for the study may also be incorporated.

Thanking you

To

Yours faithfully

(R. Senthiladeban)

ANNEXURE – I

List of attributes selected for studying consumer preferences for marine fresh fish

Sl.No	Attributes	Levels	Most relevant	More relevant	Relevant	Less relevant	Least relevant
1.	Price	High (>Rs. 300)					
		Medium (Rs. 100-300)					
		Low (< Rs.100)					
2	Quality of fish	High					
		Medium					
		Low					
3	Source of purchase	Fish market					
		Fish vendor					
		Supermarket					
4	Willingness to buy fish	Health aspects					
		Price advantage					
		Taste of fish					
5	Size of fish	Large					
		Medium					
		Small					
6	Form of fish	Whole					
		Dressed					
7	Variety preference	Most preferred					
		Least preferred					
8	Fish availability	Year round					
		Seasonal					
9	Quantity of Purchase	More (> 1 kg)					
		Less (< 1 kg)					

Signature :
Name :
Designation :
Address :