

CHAPTER - 5

A STUDY OF DEMAND AND SUPPLY CONSTRAINTS:

- 1. DEMAND, SUPPLY AND DEFICIT OF FISH; THEIR
RELATIONSHIP WITH PRICE, INCOME AND SAVINGS.**
- 11. PRICE AND ELASTICITY OF DEMAND FOR FISH.**
- 111. SUPPLY RESPONSE OF PRICE, SUPPLY ELASTICITY.**

5.1. DEMAND, SUPPLY AND DEFICIT OF FISH; THEIR RELATIONSHIP WITH PRICE, INCOME AND SAVINGS:

The study of demand and supply is to examine whether demand is a prime factor to the production and cultivation of fish or it is the supply, whether the market is a sellers' market or it is a buyers' one, how market behave in case of any gap existed between demand and supply of fish, whether fish cultivation is in need of any protection, whether there is need for market promotion of fish.

The above elements are discussed in details in the following paragraphs. For a meaningful and systematic study the following hypotheses have been considered -

- i) Demand is not a constraint to the production of fish.
- ii) No need for market promotion.
- iii) Market is neither for sellers nor for buyers.
- iv) Needs supply regulation.

The above hypotheses may be tested whether they may be either accepted or rejected.

For analysing the position of demand, supply and deficit in supply of fish in the district of West Dinajpur this study considers the population of the district (as in 1981 census) and considers the proportionate growth of population in the nine years i.e., from 1980-81 to 1988-89 also considering the fact that 20% of the population in the district are vegetarian⁽¹⁾.

The Table 5.I shows the total demand (including potential demand) for fish of the 'fish consuming population', supply and the deficit in supply of fish in the district of West Dinajpur for the period 1980-81 to 1988-89.

Table - 5.I

Demand, supply and Deficit of fish

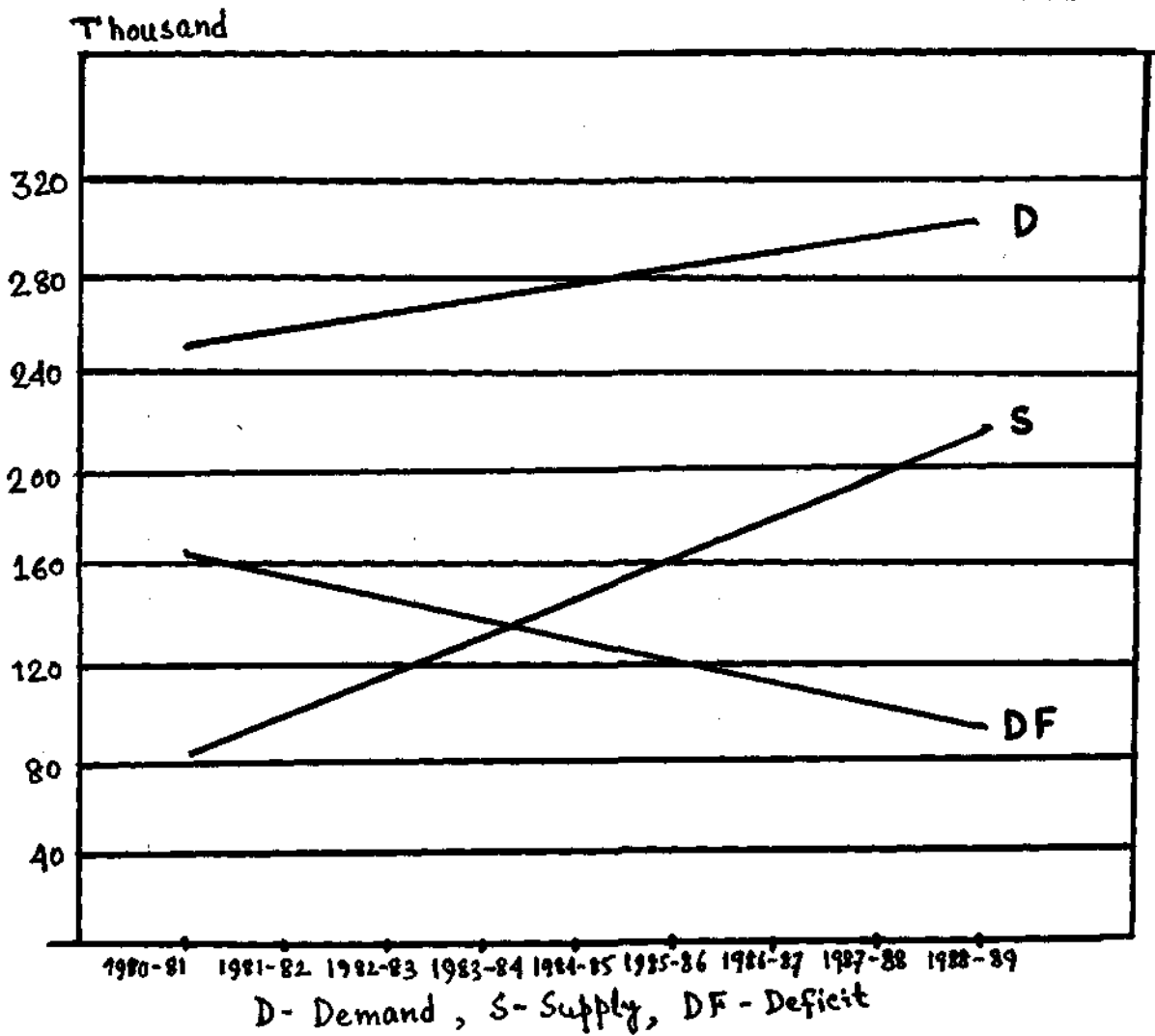
Year	Total demand (Quintals)	Total supply (Quintals)	Deficit (Quintals)	% of increase or decrease of deficit
1980-81	2,51,760	88,966.30	1,62,793.70	
1981-82	2,59,225	95,450.44	1,63,774.56	(+) 0.60
1982-83	2,66,604	1,07,802.86	1,58,801.14	(-) 3.04
1983-84	2,73,893	1,35,560.80	1,38,422.20	(-)12.83
1984-85	2,81,362	1,47,691.94	1,33,670.06	(-) 3.43
1985-86	2,88,742	1,67,346.00	1,21,396.00	(-) 9.18
1986-87	2,96,121	1,69,723.00	1,26,398.00	(+) 4.12
1987-88	3,03,500	1,94,356.42	1,09,143.58	(-)13.65
1988-89	3,12,900	2,27,485.00	85,415	(-)21.74

Source: FFDA, Balurghat, W.D.

From the Table 3.1 it is observed that in 1981-82 and 1986-87 only the deficit increased and in the other years the deficit decreased with the corresponding increase in demand and supply of fish. The rate of increase in demand and supply were different; causing different patterns (increase or decrease) of the deficit. Deficit increased in 1981-82 and 1986-87 only, where the rate of increase in demand for fish was more than the rate of increase in supply of fish.

Graph 3.1

Demand, Supply and Deficit Trend of fish



Graph 5.1 shows the demand, supply and deficit trend ($Y = A + BT$) of fish for the period 1980-81 to 1988-89 made by the least square method of time series; where it is found that the annual average rate of growth (8000 Qtl) of demand was less than the annual average rate of growth (17000 Qtl) of supply of fish in the district of W.D. resulting in a negative growth trend (-9000 Qtl) of the deficit.

Again by considering growth of population and supply of fish, the annual per capita availability of fish of the district in 1987-88 (the last year of the proposed study) was 7.77 kg and the annual per capita demand for fish was 12.14 kg. which indicate that 64% of the per capita supply of fish was available against the per capita demand in 1987-88 leaving a deficit of 36% (2).

From the above analysis it is found that the total supply of fish did not match with the total demand for fish of the increased population in the district.

This analysis has been made after considering the following assumptions:

- i) Being perishable in nature the total production of fish in the district had been supplied in the market for sell.
- ii) Majority of the fish eating population of the district were financially able to take off the fish for their consumption at various prices settled in the market.
- iii) The total demand for fish is made of actual and potential demand both combinedly.

Table 5.IIDemand, Supply and Price relationship

Year	Total Demand (Quintal)	Total supply (Quintal)	Price per (Quintal) Rs.
1980-81	2,51,760	88,966.30	1,000
1981-82	2,59,225	95,450.44	1,200
1982-83	2,66,604	1,07,802.86	1,200
1983-84	2,73,893	1,35,560.80	1,400
1984-85	2,81,362	1,47,691.94	1,400
1985-86	2,88,742	1,67,346.00	1,600
1986-87	2,96,121	1,69,723.00	1,800
1987-88	3,03,500	1,94,356.42	1,800

Source: PFDA, Balurghat, W.D.

It is observed from the Table 5.II that even if the annual average rate of increase in the supply of fish was more than the rate of increase in the demand for fish of the people of the district of W.D., the prices of two successive years in three cases (i.e., 1981-82 and 1982-83; 1983-84 and 1984-85; 1986-87 and 1987-88) were the same.

It was because of this reason that a portion of the fish had gone out of the district for marketing to be sold at a higher price, the presence of 'middlemen' in the distribution channel of marketing and the rate of increase in fish eating population, where a major portion of fish had gone out of the district for marketing along with the steady growth of population and for the presence of middlemen and wholesalers.

ring, the price of fish is found to have increased (i.e. in 1981-82, 1983-84, 1985-86 and 1986-87) in spite of 118% increase in supply of fish during the period 1980-81 to 1987-88; assuming the price of fish settled on an average of sales at site.

Demand forecasting and demand function:

Keeping in view for planning of cultivation and catching of fish the following regression equation is worked out by the least square method of time series for forecasting and estimating the future demand of fish for a particular year in W.D. district -

$$y = 2,82,000 + 8000 T \text{ (Figures shown in Quintals and } T \text{ stands for period or year)}$$

From the Table 5, II the estimated demand parameter can be calculated with the help of the following normal equations:

$$(a) \sum y = b \sum x + na$$

$$(b) \sum xy = b \sum x^2 + a \sum x$$

Substituting the figures of total demand (y) and Price (x) of fish (as is shown in Table 5, II) and by solving the above normal equations the values of the parameters 'a' and 'b' are found.

Therefore the Demand function will be $y = a + bx$

$$\therefore y = 1,91,000 + 61 x \text{ (where, } y = \text{Quantity of demand and } x = \text{price)}$$

The following assumptions have been made in the calculation of parameters:

- (1) Parameters are constant.
- (2) The errors are randomly and independently distributed.

A demand function states the dependence relationship between the demand for a commodity (fish) or service and the factors or variables affecting it. Thus the demand function for commodity x can, symbolically, be stated as follows:

$$D_x = f(I, P_x, P_s, P_c, T, u)$$

Where, D_x = demand for x

I = consumers' income

P_x = price of x

P_s = prices of substitutes of x

P_c = prices of complements of x
(P_s and P_c are vectors)

T = measures of consumers' tastes and preferences

u = "other" determinants of demand for x

f = unspecified function, to be read as
"function of" or "depends on".

In the above demand function demand determinants such as population and its distribution, and consumers' expectations are included in variable ' u ', for their individual effect on demand may be insignificant. Advertisement is included in T , for it affects demand through consumers' tastes and preference.

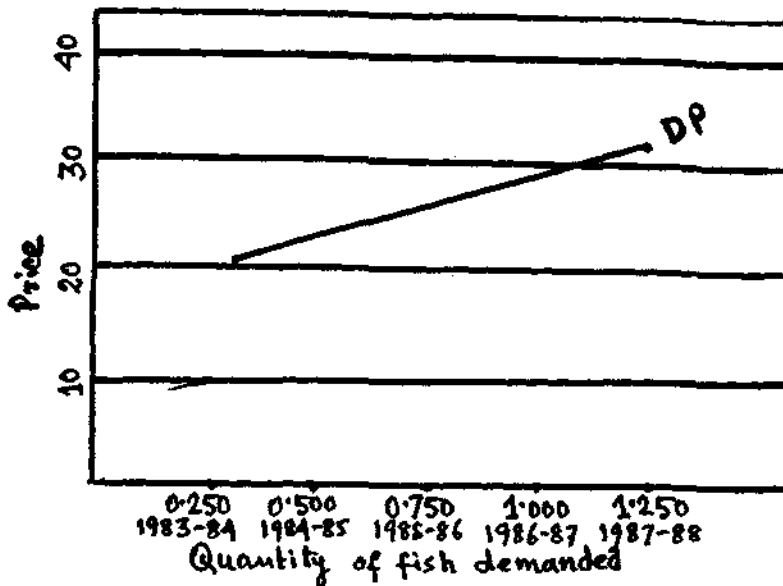
Table 5.III**Average Demand and Price relationship**

Year	Average price per kg. of fish Rs.	Average purchase per day Kg.
1983-84	20	0.500
1984-85	24	0.500
1985-86	26	0.700
1986-87	30	1.000
1987-88	32	1.200

Source : Field Survey (20 families)

From the Table 5.III it is observed that the actual demand increased continuously in spite of rise in price of fish in the district.

If the statistical data relating to the price and demand of fish are plotted on a graph by means of a linear trend ($y = A + Bx$) through the least square method of time series the demand-price linear relationship shows an upward trend; which shifted to the right like the graph 5.2 .

Graph 3.2Demand-Price linear relationship

The families (under survey) got their economic condition uplifted from what it was earlier. They took loan and other assistance from different departments of the Government and financial institutions to cultivate their land and a few members engaged themselves in weaving and handloom activities since 1984-85 and raised their demand for fish with their increased income even if the prices of fish increased. The reason for increase in demand in spite of rise in price of fish was also caused by hoarding and manipulative stocking, increased number of middlemen in the marketing-distribution channel and fish going out of the local market. These created crisis for fish and excess demand for fish in the markets of the district of W.D. sometimes. On the other side the rise in price of fish was due to excess demand and increased cost of modern fishery schemes. That is price rise was caused by the demand pull and cost push elements.



The demand for fish also depended upon the income of the people. The greater the income of the people, the greater would be their demand for fish. When as a result of the rise in the income, the demand increased, the whole of the demand curve shifted upward. The greater income means the greater purchasing power and the people can afford to buy more. It is because of this reason that the increase in income had a positive effect on the demand for fish.

During the planning period the income of the people of the rural area like the district of W.D. has increased owing to the large investment expenditure on the development schemes by the Government and the Private Sector. The income-demand curve (D_x) or Engel curve for fish will be like as shown below.

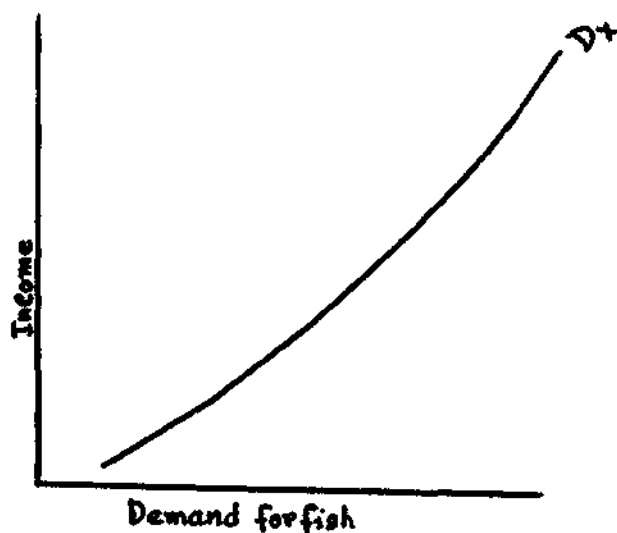


Table 5.IV**Average Income and Savings relationship**

Year	Average Income P. a. Rs.	Average Savings P. a. Rs.	% of savings against income
1984-85	12,000	1,000	8.33
1985-86	16,000	1,200	7.50
1986-87	18,000	1,250	6.94
1987-88	20,000	1,300	6.50

Source : Field Survey (of 20 families)

From the Table 5.IV it is also observed that the propensity of the people (under survey) for saving money was decreasing every year and they were able to spend more of their income on the food stuff like fish with the result that the demand for fish increased.

The changes in prices of factors or resources of the recent fishery schemes also cause a change in cost of production and consequently bring about a change in supply. Sometimes with a higher unit cost of production, less were supplied than before at various given prices and the supply curve shifted to the left. But with the adoption of new technology through the "World Bank Assisted Inland Fisheries Project" there occurs an improvement in production and the unit cost of production of fish in the district came down and the supply of fish increased at various given prices. But since it is subjected to diminishing returns which is generally the rule, the supply curve shifted ultimately to the right.

In practice the demand for fish in the district of West Dinajpur is closely related with the factors like income of the people, changes in propensity of the consumer to consume and save, tastes and preference of the consumers and the number of consumers in the market.

It is also seen that the supply of fish is short in comparison with the minimum requirement of fish in the district due to the following constraints:

1. Lack of technological know how of the farmers and fishermen.
2. Poverty, illiteracy of the farmers and fishermen.
3. Lack of capital for improved technology
4. Lack of research and development activities in the fisheries sector.

5.II PRICE AND ELASTICITY OF DEMAND FOR FISH:

A change in price of fish is always followed by a change in the quantity demanded. For a small change of price, the change of demand may be small or large according to perishable nature of the fish and the consumption pattern of the demanders. The rate at which the demand changes in response to change of price of fish is called the elasticity of demand for fish. The greater the responsiveness of quantity of fish demanded to the changes in its price, the greater its elasticity of demand.

The concept of elasticity of demand plays a crucial role in the pricing decisions of the fish seller. This is because change in price of fish will bring about a change in the quantity demanded depending upon the co-efficient of

elasticity. This change in quantity demanded as a result of changes in price will affect the total consumers expenditure and will therefore affect the earning of the fish seller.

In order to understand this, it is necessary to explain the relationship between marginal revenue and price elasticity of demand. Let TR denote total revenue, MR the marginal revenue, P the price, X the quantity of fish demanded and e the price elasticity of demand for fish. Then-

$$TR = PX$$

$$\begin{aligned} MR &= P + X \frac{dP}{dX} \\ &= P \left(1 + \frac{X}{P} \frac{dP}{dX} \right) \end{aligned}$$

$$\text{or} \quad MR = P \left(1 + \frac{1}{e} \right)$$

The equation indicates that

$$(a) \text{ if } e = -1, MR = 0$$

$$(b) \text{ if } e > 1, MR > 0$$

$$(c) \text{ if } e < 1, MR < 0$$

[NB: It should be remembered that price elasticity of demand (e) is negative while price (P) is non-negative].

Therefore, for fixing an optimum or profit maximising price, the fish seller cannot ignore the elasticity of demand for fish. The sellers often fail to take elasticity into account while taking decisions regarding prices. The main reason for this is that they don't have the means to calculate elasticity for fish, since sufficient data regarding past prices and quantity demanded of those prices are seldom available to them. Even if such data are available there are difficulties of interpretation of it because it is not easy

to isolate the price effect on the quantity demanded from the effects of other factors determining the demand.

The concept of elasticity of demand for fish refers to the degree of responsiveness of quantity demanded of fish to a change in its price and income of the consumers mainly.

The price elasticity of demand for fish and the total outlay (expenditure) made on the fish are greatly related of each other. Considering the changes in the total outlay or expenditure made on the fish as a result of changes in its price, the price elasticity of demand for fish can be found.

Table 5.V
Price, Demand, Total outlay and Elasticity relationship

Year	Price per kg. Rs.	Fish purchased (kg)	Total outlay Rs.
1980-81	12	0.250	3
1981-82	15	0.300	4.50
1982-83	18	0.400	7.20
1983-84	22	0.400	8.80
1984-85	24	0.500	12.00
1985-86	26	0.700	18.20
1986-87	30	1.000	30.00
1987-88	32	1.200	38.40

Source: Field Survey (of 20 families)

It is observed from the Table 5.V that with the rise in price of fish in different years of the district of W.D. the quantity of fish purchased also increased resulting in a corresponding increase in the total outlay. Therefore the demand for fish was inelastic and the demand curve shifted upward to the right. That is, the price elasticity of demand for fish was less than unity ($e_d < 1$). This indicates an extraordinary attraction for fish as one of the main food stuff of the people of the district of W.D.

Demand tends to be inelastic also because of the want of substitution of fish and the consumers preferred to purchase more fish with their additional income which they earned during the period 1980-81 to 1987-88 in spite of rise in price of fish.

(Assumptions : The figures of prices and purchase of fish were obtained from ten selected retail markets on an average).

In the short period a different picture was observed sometimes, where with the fall in price of fish the total outlay decreased. The quantity demanded increased very little with a considerable fall in price of fish which ultimately reduced the total outlay.

Most consumers were sticky in their consumption habits for a short period.

Hence the demand for fish was inelastic (i.e., $e_d < 1$) as is shown in Table 5.VI.

Table - 5.VI**Price, Demand, Total outlay and Elasticity relationship**

Month	Average price per kg. (Rs.)		Average purchase kg		Total outlay Rs.	
	1986	1987	1986	1987	1986	1987
January	32	35	1	1	32	35
March	25	28	1,200	1,10	30	30.80

Elasticity (e_d) 1986 - Inelastic $e < 1$

Elasticity (e_d) 1987 - Inelastic $e < 1$

Source: Field Survey (of 20 families)

Income elasticity of demand refers to the sensitiveness of quantity demanded to the change in income.

Table 5.VII**Income, Demand and Elasticity relationship**

Year	Average Income per day	Average purchase per day
	Rs.	Kg
1986	50	0.500
1987	58	0.600

Elasticity (e_y) - Elastic $e > 1$

Source: Field Survey (of 20 families)

Foot Note: The above type of seasonal variation in price, income and quantity of fish demanded (shown in Table 5.VI and 5.VII) is almost a regular phenomena in every year.

From the Table 5.VII it is observed that proportionate change in quantity of fish demanded was more than the proportionate change in income. The maximum number of the consumers spent more on the fish than they did in earlier period from their additional income. Hence, the income elasticity of demand was greater than unity (i.e., $e_y > 1$).

From the above discussion it is seen that in the long period of fish market in the district of West Dinajpur the price of fish and the demand for fish increased simultaneously. The proportionate increase in quantity of fish demanded was more than the proportionate change (i.e., rise) in the price. As a result of which the total outlay increased. Therefore the demand for fish was inelastic.

On the other side in the short period, a different picture was found as fish production in a particular period (as in January) of a year was poor causing a higher price. From the period of increase in price of fish upto the period when price fallen (say in March) the demand was inelastic. The reason was that the customers did not like to increase much their consumption of fish with the fall in price of fish and total outlay reduced. Therefore the demand was inelastic. On the other side i.e., from the period when price of fish had fallen and upto the period when price increased, the demand for fish generally disclosed inelastic because the proportionate rise in price of fish was more than the proportionate change (i.e., fall) in the quantity demanded. As a result total outlay also increased. Price rise did not prompt the consumers much to purchase a considerably lesser quantity of fish.

It is also found that in case income of the people increased they did like to purchase fish proportionately more than the proportionate change in income. Therefore the demand was elastic.

5. III SUPPLY RESPONSE OF PRICE, SUPPLY ELASTICITY:

Supply of fish refers to a schedule of quantity of fish that are offered for sale at different prices. It depicts sellers' quantity reactions to various prices. Supply of fish is functionally related to its price. The law of supply relates to this functional relationship between price of fish and its supply. The quantity supplied generally varies directly with price. That is the higher the price, the greater the incentive for the producers to produce and supply fish in the market.

To produce more fish the producers have to mobilise more resources to its production. When production of fish is expanded by using more resources, diminishing returns occur. Due to diminishing returns average and marginal cost of production increase. This implies that a greater quantity of fish would be produced and supplied in the market only at a higher price so as to cover higher cost of production.

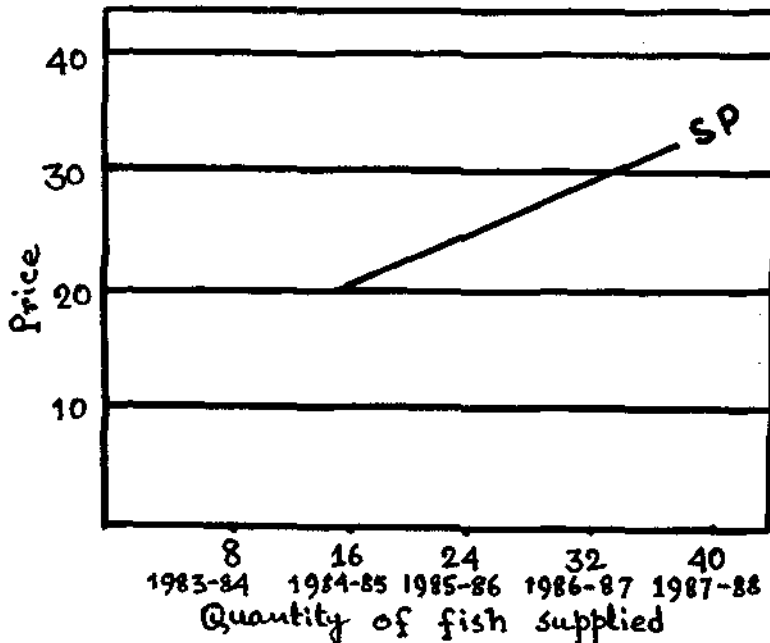
With the technological advancement in the fisheries, expansion of output of the fish lowered the unit cost of production of fish in the district of M.D. This implies that the supply of fish increased at any given prices. But since it is subjected to diminishing returns, the supply curve shifted upward to the right.

Table - 5.VIII**Average Supply and Price relationship**

Year	Average price per quintal Rs. "00"	Average supply per market in quintal "00" %
1983-84	20	16
1984-85	25	22
1985-86	28	28
1986-87	30	32
1987-88	32	38

Source: Field Survey (of 10 markets)

The Table 5.VIII indicates that as the price of fish rose in the district, quantity of fish supplied also increased and vice versa. If the above supply-price relationship are shown by means of linear trend ($y = A + BT$) it shows an upward trend; which shifted to the right like the Graph 5.3.

Graph 5.1Supply-Price linear relationship

It may also be noted that in case of price of fish fallen too much (specially during a few particular days of a year) supply also 'dries up'. The seller buys his own stock as it were at the reserve price (i.e., the price below which the seller refused to sell). The reserve price was very low (say, Rs. 600 per quintal of fish for a few days in 1984) considering the perishability of the fish. The reserve price of fish also depended on the future costs, carrying costs, period of holding the stock of fish in the cold storage and sellers liquidity-preference. But above the reserve price, supply curve rose upward showing that, at higher prices of fish more were supplied. This was because as production of fish in the district expanded to increase its supply in the market, unit cost of production

rose due to the operation of diminishing returns. Since cost per unit of fish raised, when its production was expanded, only at a higher price more were produced and supplied. But since the production of fish is subjected to diminishing returns, the supply curve shifted upward to the right ultimately. It is true that the quantity of fish supplied varies directly with price of fish. The supply of fish is function of its price. However, the supply of fish in the district of West Dinajpur depended not only on the price of fish but also on several other factors like the modern production technology, price of factors or resources (e.g., labour, fertilisers etc.), number of producers, future price expectations, period of holding the stocks.

The elasticity of supply of fish is the degree of responsiveness of supply of fish to the changes in its price. It is a relative change in quantity of fish supplied in response to a relative change in price of fish. It also occupies an important place in price theory. The greater the responsiveness of quantity of fish supplied to the changes in its price, the greater its elasticity of supply.

Table - 5.IX
Price, Supply and Elasticity relationship

Year	Average price per quintal Rs. '00'	Average supply per market in quintal '00'
1980-81	12	4
1981-82	15	7
1982-83	16	10
1983-84	18	12
1984-85	22	17
1985-86	25	22
1986-87	28	26
1987-88	30	30

Source: Field Survey (of 10 markets)

From the Table 5.IX it is observed that supply of fish rises considerably with a comparatively small rise in price of fish in the district. Hence, the supply of fish was elastic and the elasticity was greater than unity (i.e. $e_s > 1$). This was because the consumers spent their additional income on the fish and also for want of suitable substitution of fish. Therefore the supply of fish got an acceleration in spite of rise in price of fish.

Table - 5.XPrice, Supply and Elasticity relationship

Month	Price Rs. (00)		Supply Quintal (00)	
	1986	1987	1986	1987
March	22	25	15	18
April	28	30	18	20

Elasticity (e_s) - Inelastic $e < 1$

Source: Field Survey (of 10 selected markets)

Foot Note: The above type of seasonal variation in price and quantity of fish supplied (shown in Table 5.X) is almost a regular phenomena in every year.

From the Table 5.X it is observed that with a considerable increase in price of fish in the short period the supply of fish got a rather small extension. Hence, the supply of fish in the short period was inelastic in the district. The elasticity was less than unity (i.e. $e_s < 1$). This was because the consumers were generally sticky in their consumption habits for a short period. Their income also did not rise within a short period. Therefore the supply of fish got no acceleration with the rise in price of fish.

Supply elasticity (e_s) of fish can also be measured for the period from 1980-81 to 1988-89 in the district of West Dinajpur as follows -

$$e_s = \frac{\Delta Q}{Q} \div \frac{\Delta P}{P}$$

Where ΔQ = change in the quantity demanded

ΔP = change in the price of fish

P = price of fish before change of price

Q = Demand before change of price

$$\Delta Q = 2,27,485 \text{ Quintal} - 88,966.30 \text{ Quintal} = 1,38,518.7 \text{ Quintal}$$

$$Q = 88,966.30 \text{ Quintal}$$

$$\Delta P = \text{Rs. } 2000 - \text{Rs. } 1000 = \text{Rs. } 1,000$$

$$P = \text{Rs. } 1000$$

$$\text{Therefore } e_s = \frac{1,38,518.7}{88,966.30} \div \frac{1000}{1000} = 1.56$$

It follows from the above analysis that supply is not so responsive with a hike in price of fish in the short period. But in the long period as it appears from the above (where co-efficient of supply elasticity is 1.56) supply of fish increase more proportionately than the increase in price which indicate its responsiveness.

To conclude the present analysis it could be said that in West Dinajpur district deficit in supply of fish was decreasing. This indicates that the production of fish was continuously increasing. The price of fish sometimes remained constant and sometimes increased in spite of increase in supply of fish by more than a hundred percent during the period 1960-61 to 1967-68. This was due to the manipulative stocking by the businessmen, the presence of middlemen in the marketing distribution channel, the outgoing of fish from the district for marketing at a higher price.

The demand for fish in the long period was also continuously increasing with the corresponding increase in price of fish. This 'increased demand' was caused mainly by the increased income owing to the large investment expenditure on different development schemes during the planning period and also for want of suitable substitution of fish.

The elasticity of demand for fish in the long period was also less than unity as the demand increased with the increase in price of fish resulting in an increase in the total outlay made on fish.

The demand for fish in the short period was also seen inelastic as the demand increased less than proportionately with the fall in price of fish; which resulted in a decrease in total outlay. Therefore the elasticity of demand for fish in the short period was less than unity.

It is also seen that as the people saved 'less', they spent more on fish from their income. The proportionate change in quantity demanded was more than the proportionate change in their income. Hence, the income elasticity of demand was greater than unity.

On the other side it is observed that in the long period, the supply of fish increased considerably with a small increase in price. Hence, the supply of fish was elastic.

In the short period the supply of fish got a small extension with a considerable increase in price of fish. Hence, the supply was inelastic.

In the long period it is seen that the consumers spent their additional income on fish for want of suitable substitution. In the short period the consumers were sticky in their consumption of fish and their income did not also rise within a short period.

It is also observed that in the pricing of fish in the district of West Dinajpur sellers had more control over the market in the long period than in the short period. The consumers in the long period were developing a habit of purchasing more fish from their increased income in spite of rise in price of fish, whereas the consumers in the short period could not do so.

After all the demand for fish in the district of West Dinajpur is closely related with the factors like income of the people, changes in propensity of the consumers to consume and save, tastes and preferences of the consumers and the number of consumers in the market. And the supply of fish depended not only on the price of fish but on several other factors like the modern production technology, price of factors or resources (e.g. labour, fertilisers etc), number of producers, future price expectations and period of holding the stocks.

R E F E R E N C E S

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