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CONTENTS

Sr. No.	TITLE & NAME OF THE AUTHOR (S)	Page No.
1.	DIRECTION AND TRENDS OF INDIA'S PINEAPPLE EXPORTS: A STUDY IN THE FREE TRADE REGIME <i>JOMY M THOMAS & DR. MARY JOSEPH</i>	1
2.	A STUDY ON HOUSEHOLDS' CONSUMPTION PATTERN OF AAVIN MILK IN ERODE DISTRICT <i>SARAVANAN. R., YOGANANDAN. G., RUBY. N & KARTHI.C</i>	6
3.	A JOURNEY FROM FERA TO FEMA & ITS IMPACT ON FOREX <i>DHEERAJ GANDHI & DR. I.C.KASHYAP</i>	10
4.	EMERGENCE OF MORAL PRINCIPLES AND ETHICS IN MANAGEMENT EDUCATION <i>U. PADMAVATHI</i>	15
5.	EMPOWERMENT OF WOMEN THROUGH MICROFINANCE: A STUDY IN CHITTOOR DISTRICT <i>K. RAMANAMMA & P. MOHAN REDDY</i>	18
6.	THE IMPACT OF MACROECONOMIC VARIABLES ON STOCK MARKET INDEX: AN EMPIRICAL STUDY <i>PRADEEP K & DR. Y. NAGARAJU</i>	22
7.	IMPACT OF COALMINE INDUSTRIAL EFFLUENTS ON PRODUCTIVITY OF PULSE CROP <i>DR. S. RADHA KRISHNA</i>	29
8.	IMPACT OF MERGER ON THE PROFITABILITY PERFORMANCE OF REGIONAL RURAL BANKS (RRBs) IN BIHAR STATE OF INDIA: AN EMPIRICAL STUDY <i>DR. MANAS CHAKRABARTI</i>	32
9.	PERFORMANCE OF MGNREGA IN MANIPUR: A CROSS DISTRICT ANALYSIS <i>JIYAU RAHMAN & ZEBA SHEEREN</i>	37
10.	A STUDY ON PROSPECTS AND FINANCE PROBLEMS OF FOOD BASED SMALL SCALE INDUSTRIES WITH SPECIAL REFERENCE TO MADURAI <i>DR. S.FATIMA ROSALINE MARY & D.ANUSANKARI</i>	42
11.	PROGRESS AND PERFORMANCE OF PRIMARY AGRICULTURE CO-OPERATIVE SOCIETIES IN INDIA <i>PARDEEP KUMAR CHAUHAN</i>	48
12.	SUSTAINABLE GROWTH: UTILIZATION OF NATURAL RESOURCES <i>V. VANEENDRA SASTRY</i>	51
13.	HEALTH INFRASTRUCTURE IN HARYANA: AN ANALYSIS <i>ISHU GARG</i>	54
14.	CHALLENGES AND OPPORTUNITIES FOR RURAL WOMEN ENTREPRENEURS <i>JAINENDRA KUMAR VERMA</i>	58
15.	A STUDY ON PERFORMANCE OF STATE CONSUMER DISPUTES REDRESSAL COMMISSIONS IN INDIA <i>GURLEEN KAUR</i>	60
16.	STUDY OF SENSITIVITY TOWARDS IMPORTANCE OF GEOGRAPHICAL INDICATION REGISTRY IN UTTARAKHAND <i>DEEPAK JOSHI</i>	63
17.	MARKET MIX STRATEGIES FOR DESTINATION AS A RURAL TOURISM PRODUCT <i>AJAZ AHMAD DAR, HAMID ABDULLAH & PRIYA SINGH</i>	70
18.	SPECIES-WISE MAJOR MARINE FISH PRODUCTION: TRENDS AND GROWTH PERFORMANCE IN SINDH <i>DR. MOHAMMAD PERVEZ WASIM</i>	74
19.	GOVERNMENT EXPENDITURE AND ECONOMIC GROWTH IN ASEAN-5: LONG-RUN TENDENCIES AND SHORT-TERM ADJUSTMENT <i>EHSAN RAJABI & JUNAINA MUHAMMAD</i>	85
20.	AN ASSESSMENT OF COMPETITIVE STRATEGIES ADOPTED BY COMMERCIAL COLLEGES IN NAIROBI, KENYA IN IMPROVING THEIR ENROLMENT CAPACITY <i>ALICE WAIRIMU KANDE</i>	90
21.	ORGANIZATIONAL ANALYSIS OF PANCHAYATI RAJ INSTITUTIONS IN INDIA <i>PARDEP KUMAR CHAUHAN</i>	95
22.	RELATIONSHIP BETWEEN EXCHANGE RATE AND TRADE BALANCE OF SOUTH ASIA: THE J-CURVE PATTERN <i>ADNAN ALI SHAHZAD</i>	99
23.	VOLATILITY IN GOLD PRICE IN INDIA: AN UPDATE <i>MADHUSMITA BHUYAN</i>	106
24.	A STUDY ON PERFORMANCE OF CONSUMER DISPUTES REDRESSAL AGENCIES IN STATE OF KARNATAKA <i>GURLEEN KAUR</i>	111
25.	THE LONG RUN RELATIONSHIP BETWEEN STOCK MARKET RETURNS AND INVESTMENT GROWTH IN NIGERIA: (1960 - 2010) <i>DR. FREDRICK ONYEBUCHI ASOGWA</i>	113
26.	THE EFFECT OF PENSION FUNDS ON THE GROWTH OF NIGERIAN ECONOMY <i>SAMUEL, KEHINDE OLUWATOYIN & OKE, MARGARET ADEBIMPE</i>	117
27.	AGRICULTURE AND WOMEN ENTREPRENEURSHIP IN INDIA <i>HRIDESHWER GUPTA</i>	123
28.	WOMEN ENTREPRENEURSHIP: AN EMERGING WORKFORCE IN 21st CENTURY <i>JAINENDRA KUMAR VERMA</i>	126
29.	AN EMPIRICAL STUDY ON THE DYNAMICS OF COMMODITY DERIVATIVE MARKET'S IMPACT ON INDIAN INVESTMENT <i>PRASAD R.A</i>	128
30.	AGRICULTURAL GROWTH AND FOOD SECURITY: PROBLEMS AND CHALLENGES <i>KUMARI MARY MATHE</i>	131
	REQUEST FOR FEEDBACK	138

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SPECIES-WISE MAJOR MARINE FISH PRODUCTION: TRENDS AND GROWTH PERFORMANCE IN SINDH

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ABSTRACT

Fish being the biggest source of food to mankind, many of the countries have capitalized on this potential of these deep seas. Fishing industry of Pakistan employs more than 1% of the labor force. It is also a major source of employment, especially for those people living along the coastal belts of Sindh province and Balochistan. Pakistan is ranked as protein deficient country, as per capita fish consumption in Pakistan is very low, whereas in the rest of East Asia and South the domestic consumption is fifty percent of the total production. Domestically Pakistan consumes only 25 percent with 20 percent being exported and a big 55 percent going for fishmeal. This study analyzed the trends and growth performance of species-wise marine fish production for two different periods of Sindh coastal areas to clearly bring out the more recent trends. Period I (1985 to 1996) and Period II (1997 to 2008). The study confirms that in Period I, out of fourteen species eight species (Sole, mangra, pitton, tarli, palla, aal, dawan, hira, poplet, and khagga) showed significant positive growth mainly due to proper stock assessment of marine resources, research and development programmes, control fishing and completely ban on illegal nets. The study also concluded that in Period II out of fourteen species five species namely mushka, surmai, dhotar, poplet and hira growth significantly increased while that of sole, mangra, pittan, khagga and aal growth rate significantly declined. The declining growth rate indicates the problem of over fishing.

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KEYWORDS

Cold storage, coastal belts, compound growth rates, fish harbours, marine fish species.

INTRODUCTION

Fish being the biggest source of food to mankind, many of the countries have capitalized on this potential of these deep seas. Those countries which are situated along the coastal belts have emerged as major exporters of seafood besides providing to the nutritional needs of their own people. The fishing sector of Pakistan makes a contribution of \$237 million per annum to the national economy (Pakistan Economic Survey, 2008 09). Fishing industry of Pakistan employs more than 1% of the labor force. It is also a major source of employment, especially for those people living along the coastal belts of Balochistan and Sindh province. Fishing sector in Pakistan employs around 35,000 sail and row boats, gillnetters, and trawlers including many other manually-operable fishing tools and fishing apparatus.

Pakistan has vast marine and inland resources, which are rich for fishing purposes. The Arabian sea at the coast of Sindh and Balochistan has rich fish deposits of commercial importance. Pakistan has a coastal line of about 1120 kilometers, with a number of bays and broad continental shelf lying in front of the Indus deltas, which are ideal for the growth of marine life. On the basis of topography and productivity, the coast is divided into the following two zones.

- Southeastern Region or Sindh Coastal Zone
- Northwestern Region or Makran Coastal Zone

Sindh coastal zone is extended between Pakistan-Indian border and the Hub River. The bottom is generally sandy or sandy cum muddy. The region unlike Makran is characterized by a network of creeks having mangroves catering nursery for a number of marine inhabitants and is also suitable for trawling. The bays are Karachi port and Ibrahim Hyderi.

Makran coastal zone extends from Hub River to Iranian border. This region is characterized by a number of bays like, Sonmiani, Ormara, Pasni, Gwadar and Giwani. Due to narrow shelf, rough bottom and rocky areas, this region is not permissible for trawling.

The Indian Ocean on the Sindh coastal zone of Pakistan remains the main source of marine fish production in our country. Therefore the study is concentrated on Sindh coastal zone.

Though Pakistan fisheries share in total GDP declined to 0.4 percent in 2008 as compared to 0.78 in 1985, the potential is far greater. The per capita fish consumption of Sindh province is more as compared to Pakistan. It was 3.00 kgs per capita annually for Sindh as compared to 1.97 kgs per capita annually for Pakistan in 2008 (Table 1). Pakistan is ranked as a protein deficient country as per capita fish consumption in Pakistan is very low. Whereas in the rest of East Asia and South the domestic consumption is fifty percent of the total production. Domestically Pakistan consumes only 25 percent with 20 percent being exported and a big 55 percent going for fishmeal. There are many basic reasons behind this bleak scenario in the fishing sector of the country e.g. lack of technical expertise, and insufficient infrastructure with less facilities offered to fishermen.

TABLE – 1: PER CAPITA FISH CONSUMPTION IN PAKISTAN AND SINDH (Kg. per capita)

Years	Pakistan	Sindh
1985	1.80	4.10
1990	1.70	3.71
1995	1.80	2.66
2000	1.76	2.90
2005	1.95	3.00
2006	1.95	3.00
2007	1.96	3.07
2008	1.97	3.00

Source: Agricultural Statistics of Pakistan, Government of Pakistan.

The share of Sindh in total and marine fish production showed more or less a decreasing trend (Table 2). It declined to 67.0 percent of the total in 2008 compared to 67.5 percent in 1985. The share of marine fish production also decreased to 49.5 percent in 2008 as compared to 56.1 percent in 1985. As far as the share of marine fish production in Pakistan's marine fish production is concerned, it is showing a fluctuating trend. It was 68.8 percent in 1985, increased to its maximum (96.3%) in 2000 and then decreased to 71.1 percent in 2008. Poor handling of fish stock leads into massive post-harvest losses where almost 70 percent of the seafood becomes totally putrefied even before reaching the end consumers.

TABLE – 2: MARINE AND INLAND FISH PRODUCTION SHARE OF SINDH IN PAKISTAN'S TOTAL FISH PRODUCTION

Years	Pakistan (000 Tonnes)			Sindh (000 Tonnes)			Sindh's Share (%)			Share of Sindh Marine Fish Production . in Pakistan's Marine Fish Production
	Total	Marine Prod.	Inland Prod.	Total	Marine Prod.	Inland Prod.	Total	Marine Prod.	Inland Prod.	
1985	408.4	333.3	75.1	275.8	229.2	46.6	67.5	56.1	11.4	68.8
1990	481.0	367.8	113.2	320.9	260.6	60.3	66.7	54.2	12.5	70.8
1995	541.9	405.5	136.4	358.4	358.4	75.4	66.1	52.2	13.9	88.4
2000	614.8	438.4	176.4	422.3	422.3	113.6	68.7	50.2	18.5	96.3
2005	580.6	406.0	174.6	383.0	276.0	107.0	66.0	47.5	18.4	68.0
2006	604.9	425.0	179.9	394.0	285.0	109.0	65.1	47.1	18.0	67.1
2007	640.0	390.0	250.0	385.0	250.0	135.0	60.1	39.1	21.1	64.1
2008	685.0	477.0	208.0	459.0	339.0	120.0	67.0	49.5	17.5	71.1

Source: Agricultural Statistics of Pakistan, Government of Pakistan.

IMPORTANCE OF THE STUDY

Keeping in mind the above discussion there is a need to examine the trends and growth performance of marine fish production in Sindh Coastal areas. Not a single study of species-wise marine fish production in Pakistan or Sindh is available, this study is a maiden attempt in this direction. Results of this kind of study would be helpful for exporters, extension staff and policy makers.

The present study has, therefore been undertaken to examine the trends and growth performance of major species-wise marine fish production in Sindh. The following are the specific objectives:

1. to discuss major marine fish production share of Sindh in Pakistan’s major marine fish production.
2. to discuss average production and percentage change in species-wise marine fish production
3. to discuss species-wise marine fish production trends
4. to estimate period-wise and species-wise compound growth rates of marine fish production.
5. conclusion and measures to promote marine fisheries

DATA SOURCE

The analysis is based on secondary data of species-wise marine fish production of Sindh, collected from various issues of Hand Book of Fisheries Statistics of Pakistan and Agricultural Statistics of Pakistan, published by Marine Fisheries Department, Government of Pakistan and Ministry of Food and Agriculture, government of Pakistan respectively. The analysis of species-wise marine fish production growth is done for two different periods. Period I from 1985 to 1996 and Period II from 1997 to 2008. In order to bring out more recent trends in growth, the data is distributed in two different periods. GDP share of fisheries in the last decade either remained the same or declined.

RESEARCH METHODOLOGY

A widely accepted growth model i.e. $y = ab^t e^{\mu}$ has been fitted to the time series data for estimating growth rates, whose log linear equation of the fitted model is given by,

$$\ln(y) = \ln(a) + t \ln(b) + \mu$$

where,

- y = production (metric tonnes) of major marine fish
- t = time variable in years (1, 2,n)
- μ = disturbance or error term

a and b are the parameters to be estimated from the sample observations. The regression coefficient, b was computed by ordinary least squares (OLS) techniques.

The Compound Growth Rates (CGR) was estimated as:

$$\text{CGR (percent per annum)} = (\text{antilog } b - 1) \times 100$$

RESULTS AND DISCUSSION

Table 3 shows major marine fish production share of Sindh in Pakistan’s major marine fish production from 1985 to 2008. The table shows that the share of species like dawan, mangra, pittan, tarli, khagga, aal, mushka, surmai, dhotar, paplet, hira and palla fish increased, while that of sole and shrimps/prawn decreased in 2008 as compared to 1985. In 2008 the highest share in descending order is, dawan (100 percent), hira (100 percent), shrimps/prawn (87.18 percent), aal (85.97 percent), dhotar (82.73 percent, tarli (81.86 percent), surmai (73.49 percent) mangra (70.20 percent), palla (69.70 percent) mushka (60.41 percent), sole (51.20 percent), pittan (46.20 percent), poplet (33.50 percent, and khagga (20.00 percent).

TABLE – 3: MAJOR MARINE FISH PRODUCTION SHARE OF SINDH IN PAKISTAN'S MAJOR MARINE FISH PRODUCTION

Years	Dawan	Sole	Mangra	Pitton	Tarli	Khagga	Aal	Mushka	Surmai	Shrimps/Prawn	Dhotar	Poplet	Hira	Palla
1985	89.34	65.47	33.13	27.85	42.04	3.76	6.54	37.33	26.92	97.10	48.62	12.43	91.11	44.66
1990	100.00	57.14	25.55	42.47	70.92	16.26	8.01	52.81	31.12	96.86	61.54	1.28	98.02	46.67
1995	100.00	65.89	30.97	47.13	75.55	15.37	12.73	59.00	17.72	95.11	75.60	15.60	95.54	50.42
2000	100.00	55.55	32.32	48.22	54.80	14.85	15.71	41.77	47.95	91.83	84.61	17.75	98.33	52.63
2005	100.00	48.30	67.22	48.10	56.04	18.18	82.93	58.02	63.23	96.17	91.20	36.11	100.00	70.97
2006	100.00	52.80	75.17	47.04	61.25	20.71	82.92	58.68	58.19	92.93	86.09	33.37	100.00	75.00
2007	100.00	51.95	71.12	47.60	82.29	17.48	79.34	59.04	59.84	88.42	83.77	34.31	100.00	74.19
2008	100.00	51.20	70.20	46.20	81.86	20.00	85.97	60.41	73.49	87.18	82.73	33.50	100.00	69.70

Period-wise mean production of major marine fishes and percentage change in Period II over Period I are presented in Table 4. During Period I, the average annual dawan production in Sindh was 72.443 metric tonnes, sole 12137 metric tonnes, mangra 78181 metric tonnes, pittan 69351 metric tonnes, tarli 142185 metric tonnes, khagga 20296 metric tonnes, aal 13341 metric tonnes, mushka 70381 metric tonnes, surmai 30128 metric tonnes, shrimps/prawn 321865 metric tonnes, dhotar 34701 metric tonnes, poplet 6530 metric tonnes, hira 11392 metric tonnes and palla 5866 metric tonnes. In Period II, the production of dawan increased by 15.08 percent, pittan by 27.56 percent, tarli by 4.97 percent, khagga by 18.43 percent, aal by 73.82 percent, mushka by 9.30 percent, surmai by 144.54 percent, dhotar by 49.81 percent, and poplet by 175.36 percent. The highest increase in production was recorded by poplet (175.36%) while lowest in tarli (4.97%). Similarly the production of sole, mangra, shrimps/prawn, hira and palla decreased by 13.54 percent, 17.00 percent, 67.82 percent and 56.61 percent respectively in Period II compared to Period I. As an ecological problem, the problem of over fishing is indicated when total catch size of any specie decreases. For better understanding of species-wise marine fish production trends we have presented Table 5 and Figure 1. The species like dawan, khagga, aal, tarli, mushka, surmai, dhotar, pittan and poplet production increased at the end of the study period (2008) but with a fluctuating trend, similarly the production of sole, mangra, shrimps/prawn, hira and palla decreased at the end of the study period but with a fluctuating trend.

TABLE – 4: PERIOD-WISE MEAN PRODUCTION OF MAJOR MARINE FISHES IN SINDH

Specie	Local Name	Scientific Name	Average Production (metric tonnes)		Percentage Change %
			Period-I (1985-1996)	Period-II (1997-2008)	
Dawan	Dawan	Thunnus tonggol	72443	83371	15.08
Sole	Sole	Pleuronectiformes	12137	10494	-13.54
Mangra	Mangra	Corcharhinidae	78181	64886	-17.00
Piton	Piton	Rajiformes spp.	69351	88464	27.56
Tarli	Tarli	Sardinella longiceps	142185	149250	4.97
Khagga	Khagga	Arius spp.	20296	24036	18.43
Aal	Aal	Scomberoides spp.	13341	23190	73.82
Mushka	Mushka	Scianidae	70381	76927	9.30
Surmai	Surmai	Scomberomorus spp.	30128	73676	144.54
Shrimps/ Prawn	Jaira+Kalri+Kiddi	Penaeus spp. Metapenaeus spp. Parapenaeopsis Seylifera	321865	315613	-1.94
Dhotar	Dhotar	Pomadasya spp.	34701	51985	49.81
Poplet	Poplet	Parastromateus niger	6530	17981	175.36
Hira	Hira	utjanus spp.	11392	3666	-67.82
Palla	Palla	Tenualosa illisha	5866	2545	-56.61

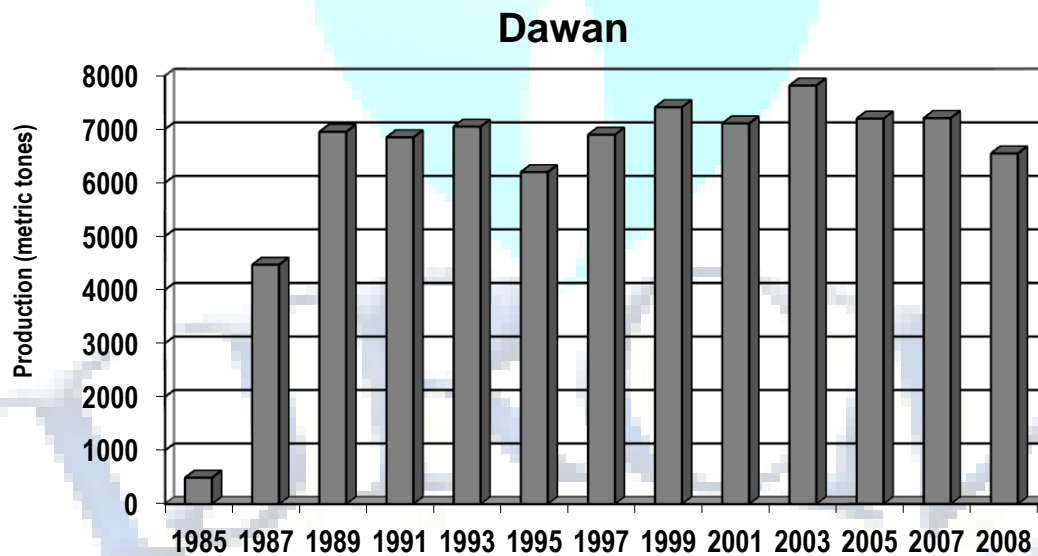
Source: Handbook of Fisheries Statistics of Pakistan Agricultural Statistics of Pakistan

Note: Period-I refers to marine fish production years 1985-1996 and Period-II 1997-2008

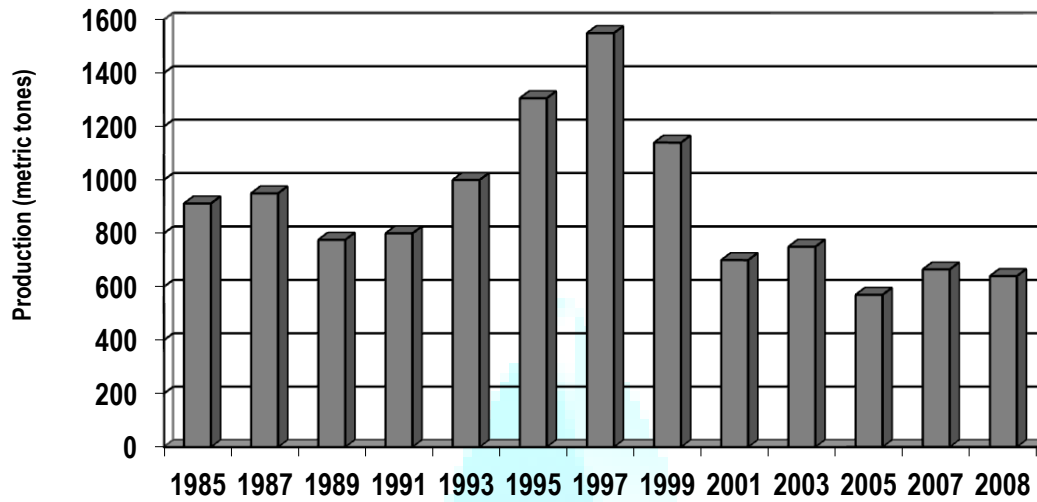
TABLE – 5: SPECIES-WISE MARINE FISH PRODUCTION TRENDS IN SINDH 1985-2008 (Production in metric tonnes)

Years	Dawan	Sole	Mangra	Pitton	Tarli	Khagga	Aal	Mushka	Surmai	Shrimps/Prawn	Dhotar	Poplet	Hira	Palla
1985	492	912	4520	4000	4566	344	455	5907	2041	25911	2509	430	1107	928
1987	4469	950	4650	5600	9319	1851	850	5120	2694	29000	3307	510	990	707
1989	6953	776	4300	4600	13107	1775	775	5000	2652	22955	2800	470	825	403
1991	6850	800	4380	4310	14450	1740	850	7500	3000	26916	2630	550	955	600
1993	7050	1000	9120	7110	11250	1770	1000	3370	3250	28281	2880	550	800	350
1995	6200	1306	10000	7750	14609	1780	2100	7110	1650	26100	3100	500	300	240
1997	6898	1550	10120	7314	13900	1770	3350	7660	2400	27760	3760	580	230	270
1999	7414	1140	10550	9990	12100	1900	2505	5048	4470	21460	3500	569	300	260
2001	7110	700	5560	7750	10000	1830	2100	5900	5440	24160	4460	1350	266	100
2003	7818	750	3200	6000	11200	1950	1980	6660	7360	29160	4540	010	260	190
2005	7200	570	1620	6980	10390	2036	1020	7740	8350	29100	4560	2275	350	220
2007	7210	665	1682	3595	18310	2100	420	8000	7540	25200	4775	2230	320	230
2008	6550	640	1620	3560	18500	2500	450	7600	10200	23260	4550	2010	350	230

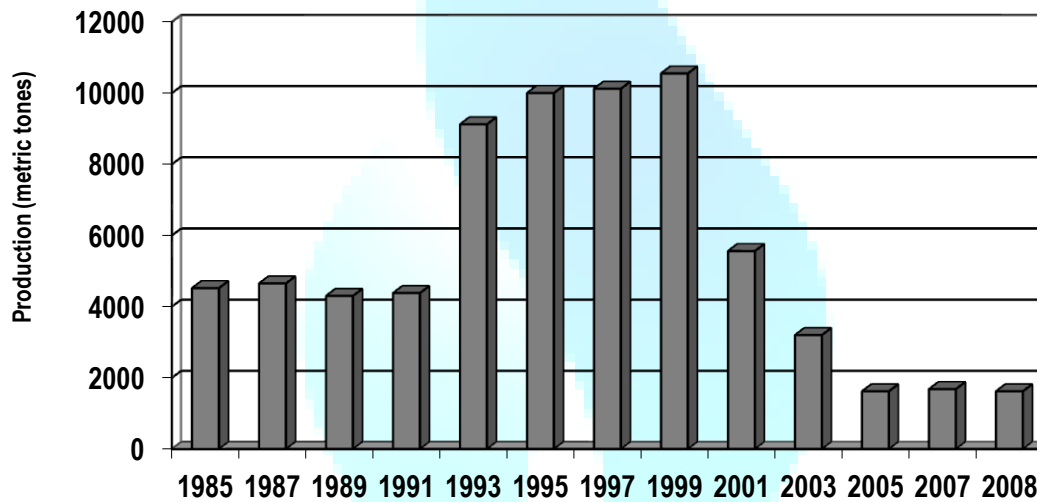
FIGURE – 1: FLUCTUATIONS IN SPECIES-WISE MARINE FISH PRODUCTION IN SINDH



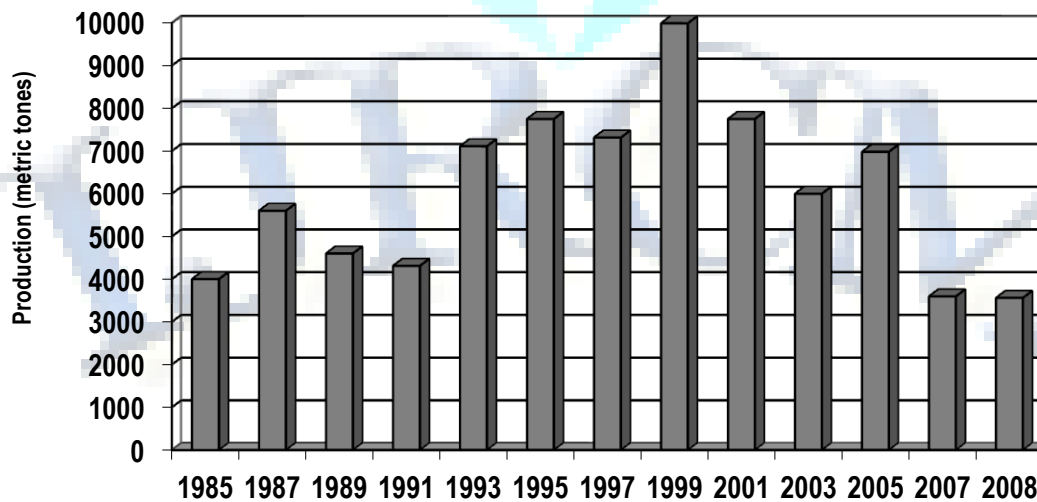
Sole



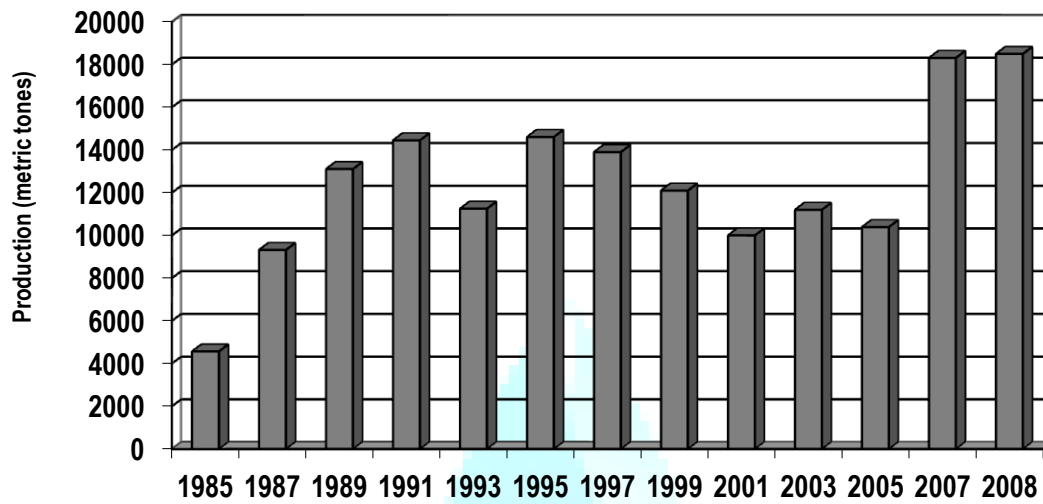
Mangra



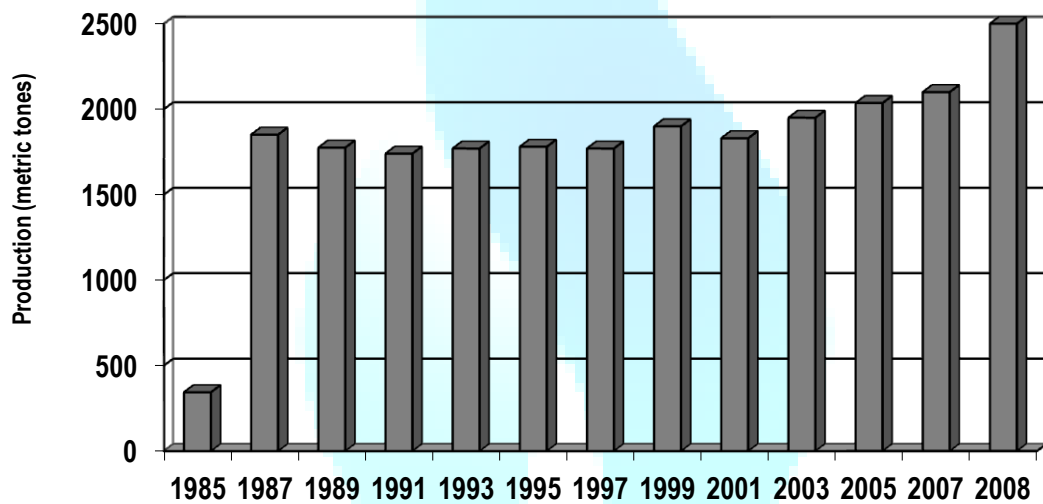
Pitton



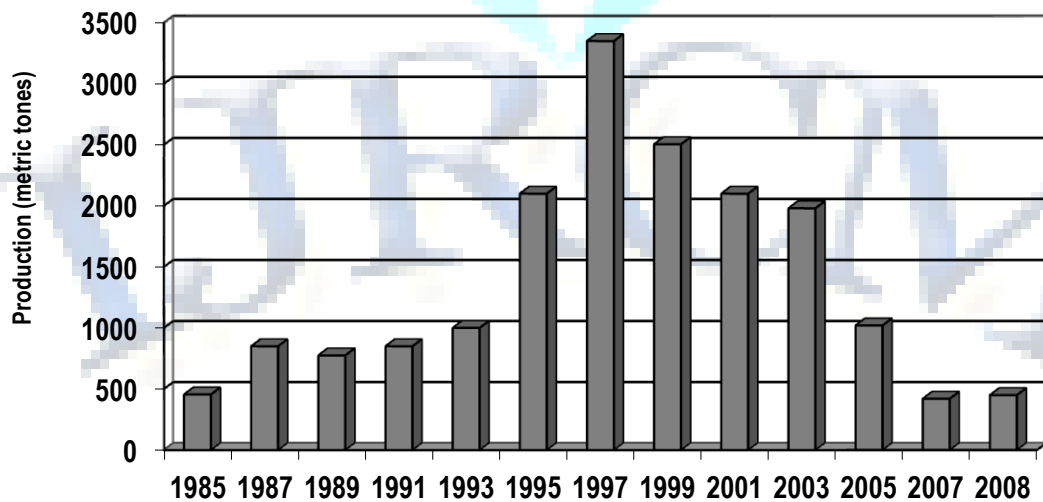
Tarli



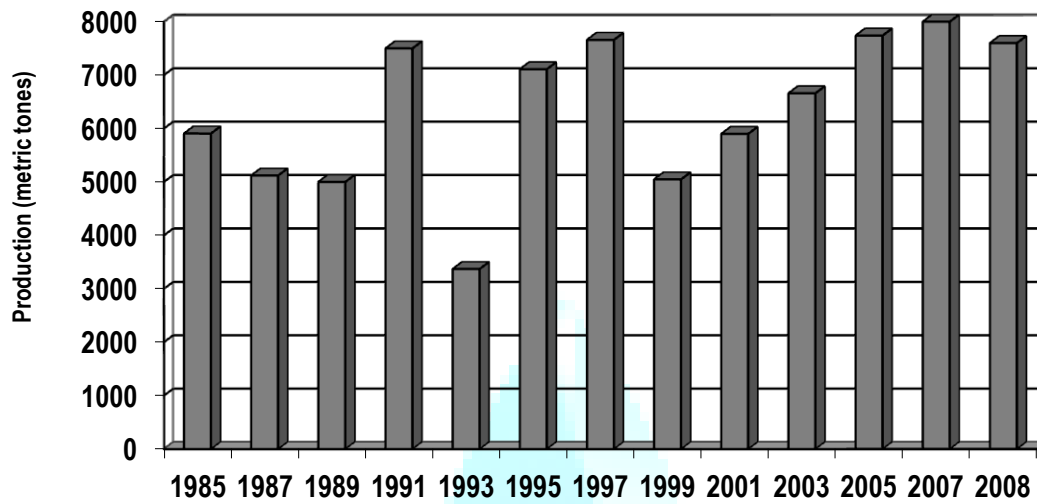
Khagga



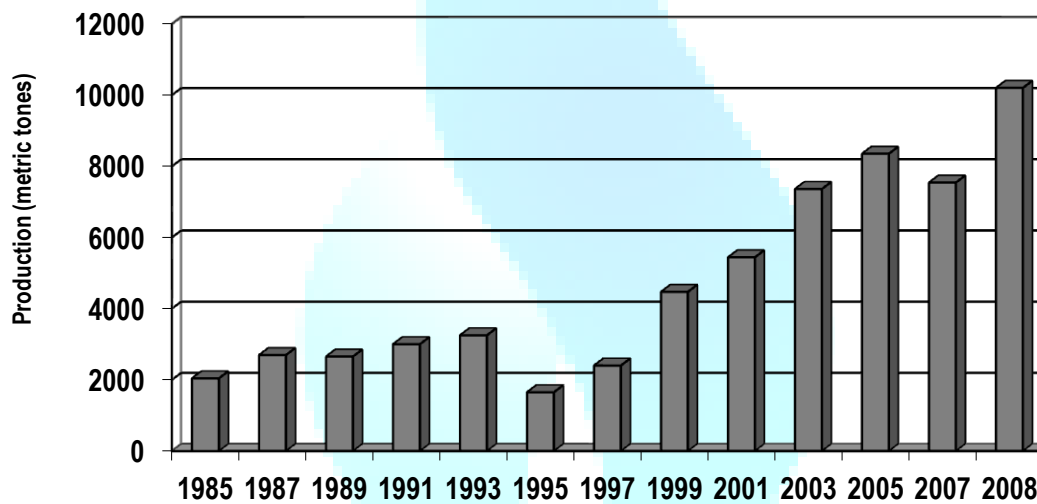
Aal



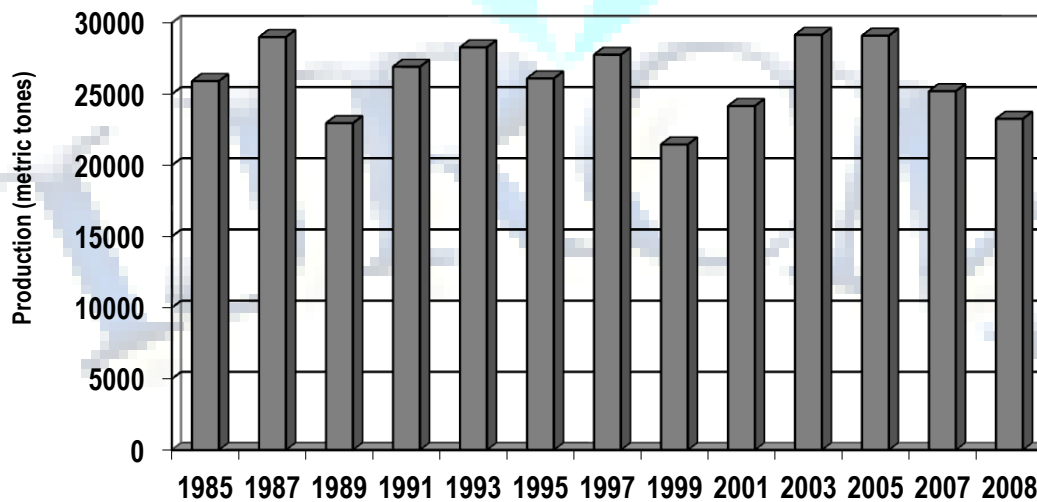
Mushka



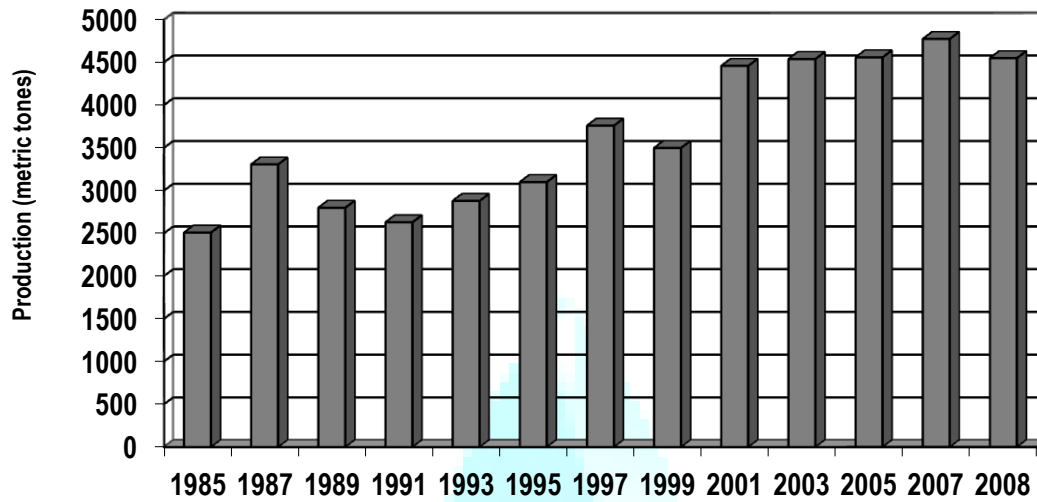
Surmai



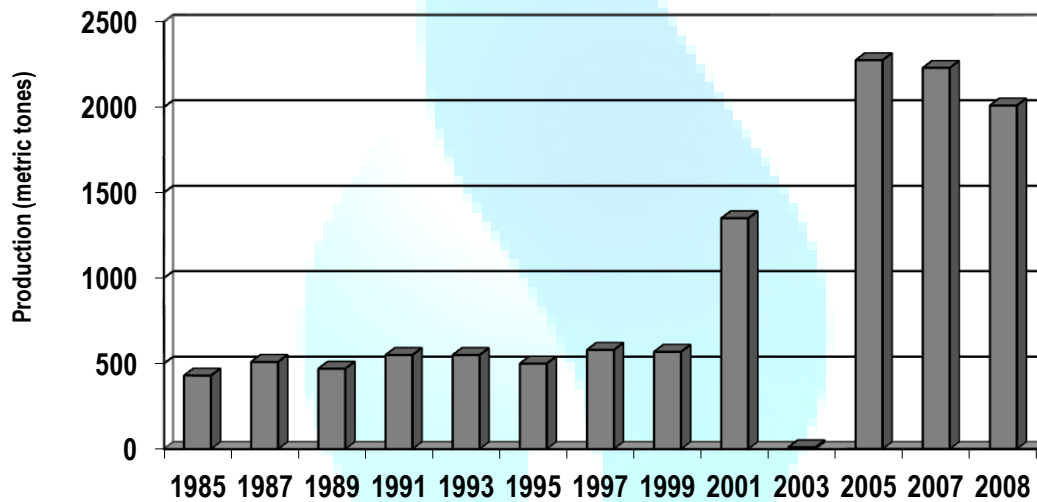
Shrimps/Prawn



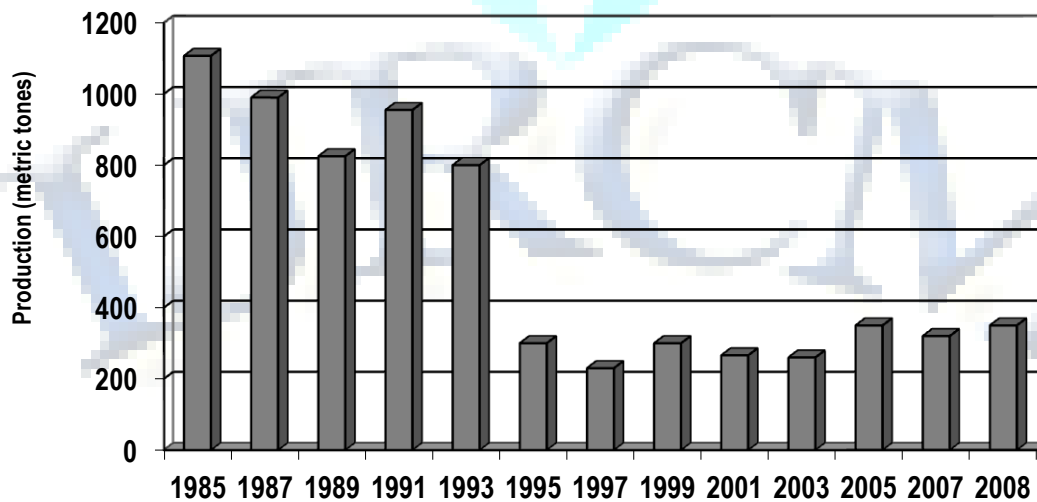
Dhotar



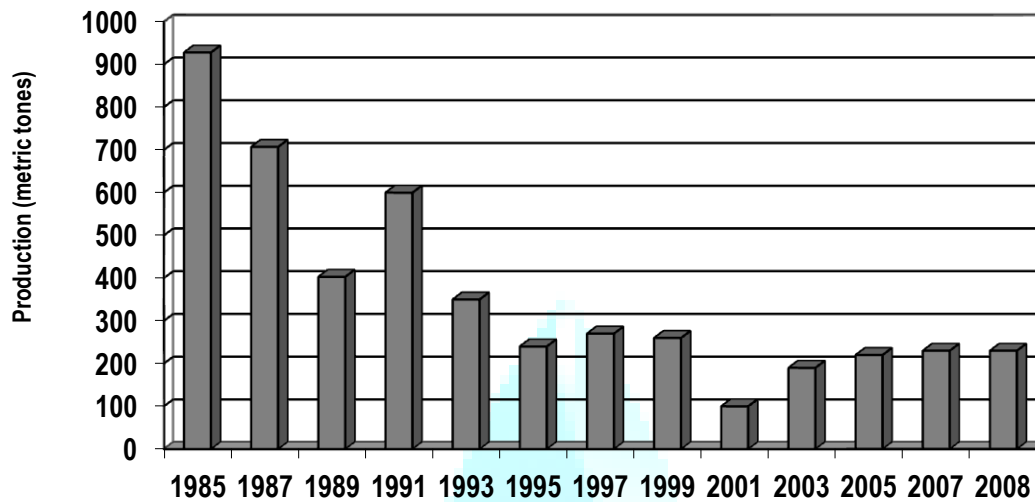
Poplet



Hira



Palla



GROWTH RATES ANALYSIS

Using growth model equation, we have estimated the annual compound growth rates of marine fish production for two different periods (Table 6 and Figure 2).

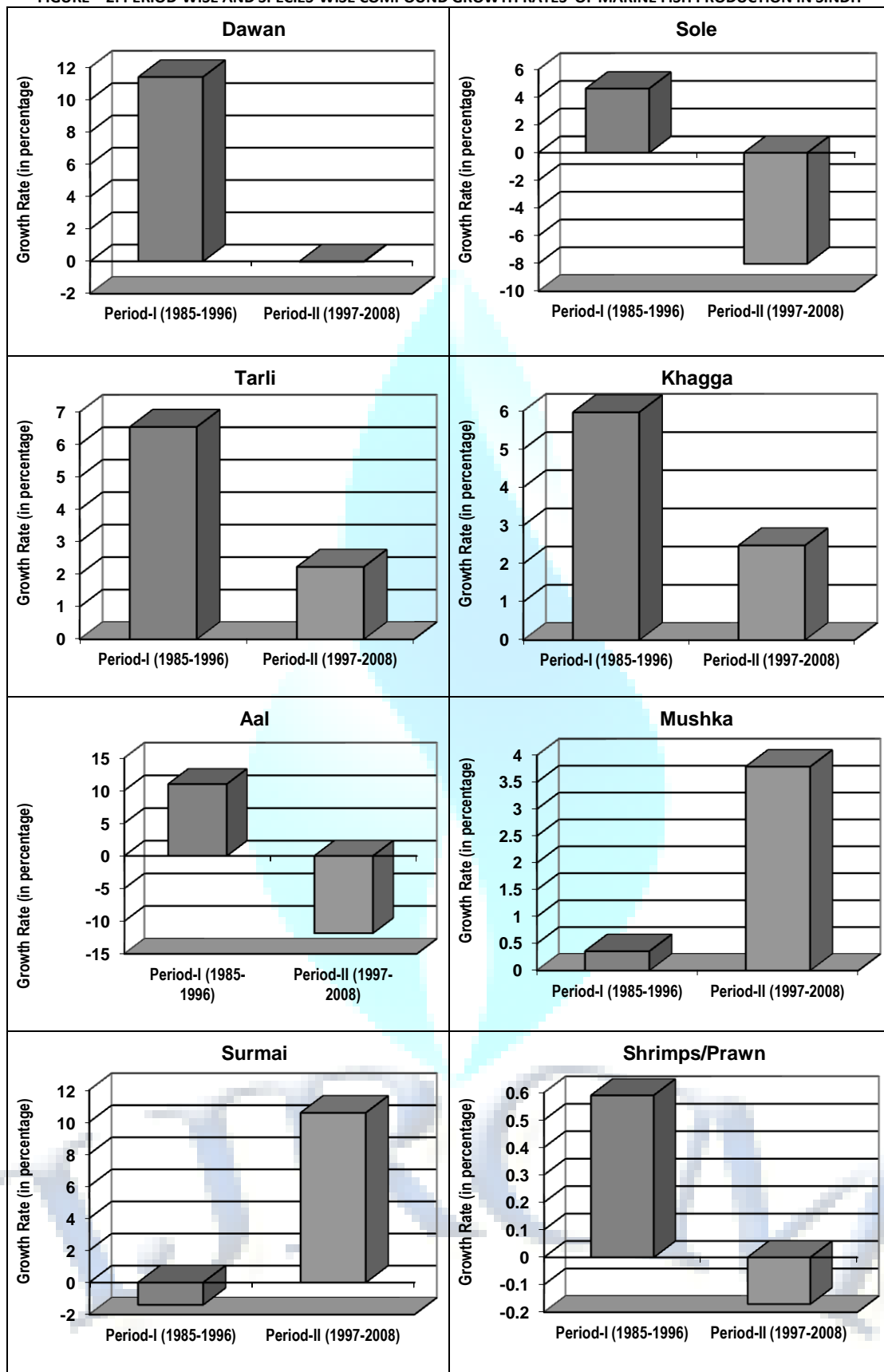
TABLE – 6: PERIOD-WISE AND SPECIES-WISE COMPOUND GROWTH RATES OF MARINE FISH PRODUCTION IN SINDH (Percent per annum)

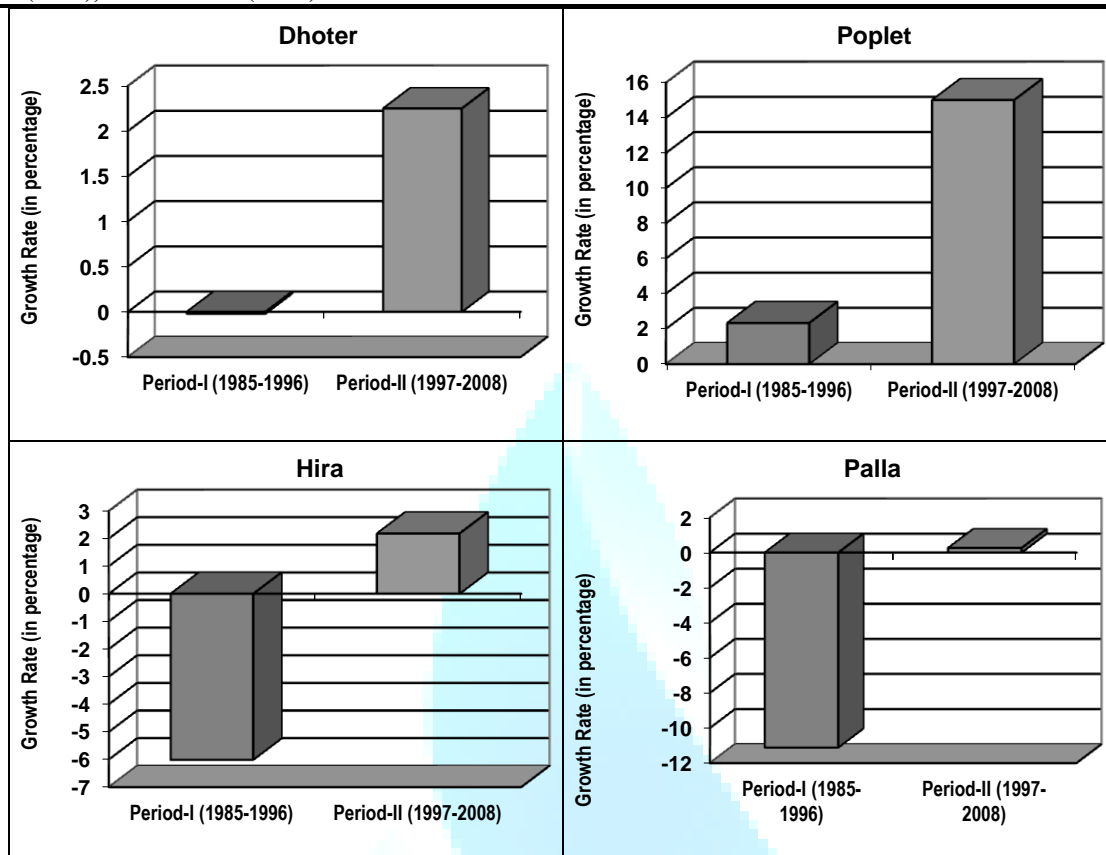
Marine Fish Species	Period-I (1985-1996)	Period-II (1997-2008)
Dawan	11.41 (2.05)**	-0.02 (0.02)
Sole	4.63 (3.09)*	-8.01 (5.73)*
Mangra	9.14 (4.90)*	-21.11 (11.12)*
Pitton	5.11 (3.73)*	-3.48 (3.02)*
Tarli	6.54 (3.21)*	2.23 (1.16)
Khagga	5.97 (1.58)***	2.48 (3.31)*
Aal	10.98 (5.33)*	-11.83 (8.86)
Mushka	0.36 (0.18)	3.79 (2.45)**
Surmai	-1.39 (0.89)	10.58 (8.06)*
Shrimps/Prawn	0.59 (0.85)	-0.17 (0.17)
Dhoter	-0.02 (0.001)	2.25 (4.52)*
Poplet	2.34 (2.21)**	15.01 (6.67)*
Hira	-6.01 (2.20)**	2.18 (2.27)**
Palla	-11.11 (8.25)*	0.26 (0.08)

Source: Figures in parentheses indicate 't' values.

*, **, *** Significant at 1, 5 and 10 percent level of significance respectively.

FIGURE – 2: PERIOD-WISE AND SPECIES-WISE COMPOUND GROWTH RATES OF MARINE FISH PRODUCTION IN SINDH



**PERIOD-I**

During this period the production of dawan increased at the rate of 11.41 percent, sole at 4.63 percent, mangra at 9.14 percent, pittan at 5.11 percent tarli at 6.54 percent, khagga at 5.97 percent aal at 10.98 percent and poplet at 2.34 percent while that of hira and palla decreased at 6.01 percent and 11.11 percent per annum. It means that in Period I the problem of over fishing was not indicated. The coefficient of sole, mangra, pittan, tarli, palla and aal are significant at 1 percent level of significance, dawan, hira and poplet at 5 percent level of significance and khagga at 10 percent level of significance. Other species like mushka, surmai, shrimps/prawn, dhotar increased or decreased but the values are insignificant. The major conclusion that emerges from this period is that out of fourteen species eight species shows significant positive growth.

PERIOD-II

As shown in Table 6 and Figure 2 between 1997-2008, while the growth of sole, mangra, pittan, khagga, and aal, decelerated from 4.63 percent, 9.14 percent, 5.11 percent, 5.97 percent and 10.98 percent to -8.01 percent, -21.11 percent, -3.48 percent, 2.48 percent, -11.83 percent per annum respectively, that of mushka, surmai, dhotar, poplet and hira accelerated from 0.36 percent, -1.39 percent, -0.02 percent, 2.34 percent and -6.01 percent to 3.79 percent, 10.58 percent, 2.25 percent, 15.01 percent and 2.18 percent respectively per annum. The major conclusion is that out of fourteen species five species namely mushka, surmai, dhotar, poplet and hira growth significantly increased while that of sole, mangra, pittan, khagga, and aal growth rate significantly decreased. The declining growth rate of sole, mangra, pittan, and aal clearly indicates the problem of over fishing. As an ecological problem, the problem of over fishing is indicated when total catch size of any species decreases. The problem of over fishing is apparently far more serious in Sindh province because Sindh coast is suitable for trawling. However, the same problem may arise if number of vessels continues to grow as rapidly as they have increased over the past decade.

The causative factors of over fishing are:

1. Increase in number of fish vessels
2. Deep sea trawling
3. Increase in the population of fisheries communities
4. Harmful nets

CONCLUSION

The analysis of specie-wise marine fish production growth is done for two different periods of Sindh. Period I from 1985 to 1996 and Period II from 1997 to 2008. The study confirms that in Period I the coefficients of sole, mangra, pittan, tarli, palla, aal, dawan, hira, poplet and khagga are positively and statistically significant mainly due to proper stock assessment of marine resources, research and development programmes, control fishing, and complete ban on illegal nets. Out of fourteen species eight species shows significant positively growth. Other species like mushka, surmai, shrimps/prawn, and dhotar are statistically insignificant. The study also reveals that in Period II out of fourteen species five species namely mushka, surmai, dhotar, poplet and hira growth significantly increased while that of sole, mangra, pittan, khagga and aal growth rate significantly decreased. The declining growth rate of mangra, sole, pittan and aal clearly indicates the problem of over fishing.

POLICY IMPLICATIONS

The study reveals that in Period II the growth rate of species like sole, mangra, pittan, khagga and aal significantly declined. Therefore in order to increase the production growth rate of the above species, over fishing needs to be eliminated through comprehensive fisheries policy of Sindh government, research and development programme, complete ban on illegal nets, easy credit facilities to fisherman, reducing post-harvest losses through the upgradation of vessels, upgradation of fish harbours, proper marketing and cold-storage facilities.

In order to have a sound National Fisheries Policy the government should take the following necessary measures to increase marine fish production.

At harvesting site, some immediate steps should be taken to protect marine fisheries resources. These are revival of marine resources, ban on illegal nets through the establishment of fishing police force. Areas, where there is heavy fishing pressure have to be identified and alternative employment opportunities should be created through job-oriented training programs and with the formation of Fishermen's Bank. Credit facilities and subsidy on diesel prices should be provided to fishermen, so that it can be viable for them to make trips for fishing purpose. As fish is perishable commodity, quick handling, proper transportation

and storage is must. For this purpose the government should provide infrastructure facilities such as fish landing, handling, marketing facilities, and a reliable supply of electricity and fresh water.

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