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AN ANALYSIS OF MARINE PRODUCTION AND EXPORTS OF GOA'S FISHERIES SECTOR

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ABSTRACT

Fisheries sector plays a significant role for socio economic development of country.The contribution of the fishing industry to the development of the State economy has been increasing over the years as measured by its percentage share in Net State Domestic Product (NSDP) and its share in the total output of the primary sector, (GOG,2013). The study endeavours to make a comparative analysis of the annual growth rate and compounded annual growth rate of fish production in Goa and India from 2001-2014. It also examines the percentage of jetty-wise fish, variety wise marine and inland fish catch in Goa in from 1998 to 2015. The study focuses on the growth performance in major item wise exports of Goa's marine products during year 2005 to 2014. Secondary data was analysed by using statistical tools ie descriptive statistics i.e mean, standard deviation, coefficient of variation, ANOVA,and simple regression analysis to study the contribution of the fisheries sector to Goa's economy. Gross domestic product of Goa is highly influenced by the contribution made by the fisheries sector in Goa.

Keywords: Marine production, marine exports, compounded annual growth & contribution of fisheries sector to GSDP.

Introduction

India was the second largest producer of fish in the world contributing to 5.68% of global fish production in 2013-14. It is not only a source of livelihood for over 14 million people, but also is important for socio economic development of country. The vast resources of both inland and marine are indicative of the immense growth potential of the sector, (Goswami and Zade (2015).Shrimps form an important component of the marine fisheries of India. Since early 1960s, till today Indian shrimps have found a place in the export market fetching substantial foreign exchange.

Fishing has been one of the chief occupations and the source of livelihood to the population living in the coastal areas of Goa. Fishing is one of the important economic activities of the state, next only to mining and tourism. The fishing industry has made some progress in recent years. Marine and fresh water fishery contributes significantly to the state's economy. Goa has a reasonable scope for fisheries production mainly from marine capture, brackish water and inland culture resources. The study of fisheries sector endeavours to examine the contribution of the fishing industry to Goa' economic development in terms of marine and inland fish production, marine exports and the impact of contribution of the fisheries sector to Gross State Domestic Product of Goa.

Almost 9.7% population is directly or indirectly involved in fishing activities carried across the state.The fisheries population for the year 2013 was 30,225 in Goa and population of active fishermen was 11,944, (GOG,2014). The traditional sector contributes 26% of the total fish landings as against 74% by the mechanized sector.The marine production in Goa has increased from 24,600 to 87,984 tons

during the period of 1965 to 2013, experiencing a fluctuating trend. Mackerels and sardines contribute about 50% of the Marine catch, (GOG, 2014). The maximum sustainable yield for Goa is computed at around 85,407 tons over the years.The dominant species in the state production has been the pelagic resource of mackerels and sardines which has been contributing to around 50% of the oceanic catch.The average marine fish production for the last decade was 89,230 tons a year, (GOG,2015). The dominant demersal species have been the prawns, squids & cuttle fish. These are also the commercially important species of the state, which contributes largely to the exports.The most important species of penaeid shrimp caught along the Goa coast is Metapenaeus dobsoni. In Goa, it is popularly known as the solar shrimp. The species is very important to the entire fishing industry, both traditional and mechanised sectors. The high demand for shrimps in the international market, has led to the indiscriminate exploitation of all the shrimp species.However, its fishery is facing challenging problems of sustainable exploitation and management.

Objectives of the study

Keeping in view the above perspective, the main objectives of the study are set out as follows:

1. To make a comparative analysis of the annual growth rate and compounded annual growth rate of fish production in Goa and India from 2001-2014
2. To study the percentage of Jetty-wise fish, variety wise marine and inland fish catch in Goa from 1998 to 2015.
3. To study the growth performance in major item wise exports of Goa's marine products during year 2005 to 2014.
4. To analyse the contribution of the fisheries sector to GSDP of Goa.

Literature review

This section follows the secondary research methodology and presents a review of literature on marine production and exports of the fisheries industry. This can be justified by the following literature put forth related to the study.

Studies in Indian context:

Studies related to marine production

James (**1988)** in his study analysed that pelagic resources play a key role in the overall marine fish production in India. Marine fish production from the Indian seas has shown considerable increase during the past four decades.

Devaraj et al., (1998) reviewed the marine fish production in the state vis-a-vis the potential yield, assessed the economic performance of trawlers and motorised gillnetters, analysed the distribution pattern of marine fish in the internal market and the performance of marine fishery exports, evaluated the capacity utilisation of processing plants and suggested policy measures for improvements in production and marketing of marine fish in the state of Gujarat.

Goswami and Zade (2015), made a study on 'Statistical Analysis of Fish Production in India', to understand actual growth rate comparison to previous years. Their study showed that India is a major producer of fish through aquaculture and ranks second in the world after China.

Studies on marine exports

Balassa (1965) suggested that Export Performance Ratio (EPR) can be used to indicate the comparative advantage of the fisheries sector. The comparative advantage of fisheries sector for India

has been measured by the share of fisheries in the India's total exports(Sij) relative to the fisheries share in total world exports (Siw). The study assumes that important variables that determine the demand for fisheries products (Qxd) from India are: (i) Indian export prices (IEPx); (ii) non-Indian international prices of fisheries products (WPx); (iii) amount of international trade in fisheries (ITF); and (iv) the exchange rate, i e, rupees per dollar (ER).

The Marine Products Export Development Authority (MPEDA, 2002), found that the quantum of export earnings from capture shrimp has been more or less around 50 -55 thousand tonnes, in spite of several fold increase in the fishing effort. Thus, the study logically concludes that the only alternative for augmenting export earnings is to culture shrimp.

Batziosc (2014), studied about investigating export performance and competitiveness of Balkan and eastern European fisheries sector. Their study concluded that estimated RCA indices reveal a competitive advantage for the most important species exported in all individual countries.

Salim et al., (2015), made a study titled'Does India Really Need to Export Fish: Reflections and Upshots'. In their study they found that the status of fish food security in India production across sectors, export growth analysing price realization in the domestic and export markets. The price comparison of exported fish species has indicated higher prices in domestic than export market. The study has revealed significant deleterious fish demand-supply mismatch in domestic market and has advocated for government interventions in regulating fish exports.

Studies related to Fisheries Sector in Goa

Parulekar (1989) worked on how to increase the marine fish production, and suggested the strategies to future development of fisheries production of Goa.

Jakati (2011) studied very systematically fishing industry of Goa, highlighting types of fisheries, varieties of fish catch in Goa, and the factors that controls the fishing activities in Goa.

Morkar (2014) studied 'Prospects of Fishery Sector in Goa'. He examined the growth of fishing industry problems and prospects of fishing activities. He concluded that share of fishery in GSDP of agriculture and allied sector was 1.23% in 2011-12. According to his study, during the year 2012 the marine fish production was 86628 tonnes and inland fish production was 3887 tonnes from which 40000 tonnes was exported and Rs 36844 lakhs foreign exchange was earned.

Research Methodology

The study covers the state of Goa. The methodologies followed in the research study are systematically presented under the following major heads.

(i) Type of data collection
(ii) Hypotheses of the study.
(iii) Statistical tools used for analysis
(iv) Variables
(v) Data analysis and interpretation
(vi) Findings and conclusion

i)Type of data collection

The study is based on secondary data. In this phase the researcher has made an analytical study to analyse the contribution made by the fishing industry to Goa's economic development in terms of fish

production and exports.Secondary data is collected on marine production, exports from Handbook of Statistics, Government of India (2014), Directorate of Fisheries, Government of Goa (2015), Food and Agricultural organization (FAO) 2011, Fisheries journals, MPEDA, Directorate of Planning, Statistics and Evaluation, Indian Council of Agricultural Research Complex Old Goa(I.C.A.R.), CMFRI etc,.

ii) Hypotheses of the study

In the study hypotheses have been formulated for fish production and exports in Goa which are covered in the study.

iii)Statistical tools used for data analysis

The data for the above objectives is time series data. For analyzing the data collected during investigation, statistical tools/statistical techniques used for the study include descriptive statistics i.e mean, standard deviation, coefficient of variation, ANOVA, and simple regression analysis

iv)Variables

The variables taken for the study are fish production of India and Goa, species wise fish exports in Goa, important variety wise quantity of Inland Fish Catch in Goa and marine fish catch in Goa (in M.tonnes), Jetty wise fish production in Goa, variety wise exports of fish from Goa.

v) Data Analysis and Interpretation

Data on fish production and marine exports in Goa is analysed in the form of tables and graphs. Data of India and Goa is also analysed in the below given tables and graphs. The findings and conclusions are drawn from the study given below:-

Table 1 - Fish production in Goa and India during 2001 to 2014

Year	Percentage of fish production in India	Percentage of fish production in Goa	% share of Goa in total fish production of India	Annual growth rate		Compounded Annual Growth Rate (CAGR)(%)	
				India	Goa	India	Goa
2001-02	5.83	5.44	1.13				
2002-03	6.07	6.75	1.35	4.10	23.97	0.04	0.24
2003-04	6.26	6.80	1.32	3.21	0.76	0.03	0.01
2004-05	6.17	8.31	1.64	(-)1.47	22.15	(-)0.01	0.22
2005-06	6.43	7.76	1.47	4.23	(-)6.52	0.04	(-)0.07
2006-07	6.72	7.35	1.33	4.52	(-)5.37	0.05	(-)0.05
2007-08	6.97	7.15	1.25	3.76	(-)2.65	0.04	(-)0.03
2008-09	7.45	6.50	1.06	6.83	(-)9.11	0.07	(-)0.09
2009-10	7.82	7.01	1.09	5.04	7.90	0.05	0.08
2010-11	8.05	6.94	1.05	2.91	(-)1.01	0.03	(-)0.01
2011-12	8.48	6.98	1.00	5.28	0.51	0.05	0.01
2012-13	8.84	7.09	0.97	4.32	1.57	0.04	0.02
2013-14	9.37	10.32	1.34	5.96	45.60	0.06	0.46

Source: i) Computed from data of Statistical Handbook, Department of Agriculture and Animal Husbandry, 2014

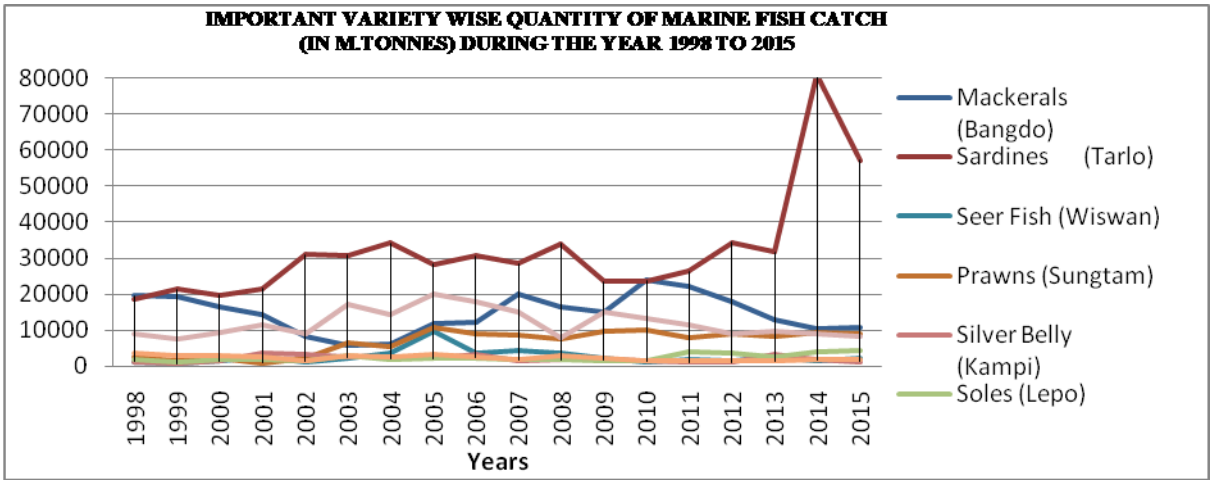
ii) Computed from data of Directorate of Fisheries, Govt of Goa, 2015

The data furnished in Table 1, indicatesthat the percentage share of Goa in total fish production in India has also shown variation from decade to decade. Goa's share in terms of percentage in the total fish production in India has shown signs of decline from 2005-06, 2006-07, 2007-08, 2008-09 & 2010-11. As evident from the explanatory part of the sources, Annual Growth Rate and Compound Annual Growth Rate in the Table 1, have been calculated as under:

Annual Growth Rate:- Growth of Production of an year expressed as a percentage of the preceding years production. i.e. production of (2002-03 – 2001-02) x 100/ production of 2001-02 = growth rate of 2002-03.

Compound Annual Growth Rate (CAGR): It is the geometric mean growth rate on an annualized basis. CAGR is calculated as follows:
CAGR= ((end value/start value)) ^ (1/n))-1.
Table 1, shows that the annual growth rate of total fish production in India has shown variations over the years. It has become negative for the year 2004-05, i.e 1.47.The annual growth rate was highest for the year 2008-09, i.e 6.83. The annual growth rate of total fish production in Goa has shown negative growth for the years 2005-06, 2006-07, 2007-08,&2008-09 &2010-11. However, it was highest for the year 2013-14.
Table 1,also brings to light the Annual growth rate figures of fish production of India and the state which is highly inconsistent. In case of India, the annual growth rate was negative for the year 2004-05. In case of Goa it shows negative figures for 5 years ie 2005-06 to 2008-09 and 2010-11. It is characterized by wide fluctuations over the last 13 years.
The compounded annual growth rate data showing "geometric mean growth rate on an annualized basis" as shown in the table 1 seems to be more insignificant because of their inconsistency over the years from 2002-03 to 2013-14. The CAGR of India has increased from 0.04 to 0.06 except for the year 2004-05 it has become negative 0.01% and that of the Goa the CAGR has increased from 0.24 to 0.46 %. However, there are wide fluctuations in case of the CAGR of the state ie it has become negative for 5 years. It is alarming for the years 2005-06 to 2008-09 and 2010-11.

Exhibit 2. Line graph showing variety wise quantity of marine fish catch in Goa from 1998-2015



Source: (Line graph prepared from data of Directorate of Fisheries , Goa, 2015)

Table 2. Percentage of important variety wise quantity of marine fish catch in Goa (in m.tonnes) during the year 1998 to 2015

Year	Mackerals (Bangdo)	Sardines (Tarlo)	Seer Fish (Wiswan)	Prawns	Silver Belly (Kampi)	Soles (Lepo)	Sciaenoids (Dodiaro)	Others
1998	34.05	32.09	2.20	4.59	2.13	3.14	6.11	15.69
1999	34.55	38.25	1.64	2.91	1.24	2.35	5.32	13.73
2000	29.76	35.58	2.51	4.10	2.75	3.65	4.95	16.70
2001	24.09	36.41	4.66	1.48	6.47	2.96	4.16	19.78
2002	13.93	53.20	2.11	3.95	5.73	2.89	2.80	15.39
2003	8.12	43.41	3.20	9.36	3.85	4.13	3.94	23.99
2004	8.87	48.15	4.90	7.86	3.50	2.84	3.71	20.17
2005	13.69	32.20	10.89	12.08	2.33	2.34	3.66	22.80
2006	15.07	37.60	4.33	11.15	3.92	2.88	2.96	22.09
2007	24.29	34.73	5.36	10.50	2.02	2.37	2.36	18.37
2008	21.81	44.76	4.96	9.80	2.22	2.36	3.65	10.43
2009	21.23	32.88	3.20	13.71	2.77	2.14	3.09	20.99
2010	31.12	30.99	1.60	13.02	2.07	2.10	1.80	17.30
2011	29.00	34.58	2.42	10.49	1.33	5.24	1.90	15.05
2012	22.78	43.79	2.06	11.44	1.46	4.70	2.08	11.68
2013	17.81	43.35	3.77	11.48	4.56	3.53	1.95	13.54
2014	8.68	68.09	1.37	7.82	1.68	3.35	1.52	7.49
2015	11.39	59.99	2.48	9.44	1.30	4.70	2.06	8.64
Total	19.61	42.82	3.59	9.00	2.73	3.24	3.04	15.97

Source: (Computed from data of Directorate of Fisheries , Goa, 2015**)**

The above table 2and line graph exhibit 2 shows the important marine fish catch in Goa from 1998 - 2015. The highest marine fish catch was of Sardines, followed by mackerals , and others. Silver Belly is the lowest marine fish catch during the above period.

Table 3. Percentage of important variety wise quantity of inland fish in catch in Goa (In M.tonnes) during the year 1998 to 2015

Years	Prawns Small	Mullets	Gerres	Cat Fish	Pearl Spot	Ambasis	Black Water Clamps	Fals Clamps	Miscellaneous
1998	22.35	5.30	0.71	9.70	1.36	2.98	7.08	10.41	34.44
1999	18.54	6.79	3.81	8.28	0.93	3.41	19.14	1.59	30.20
2000	22.45	8.84	6.07	7.29	1.71	3.89	20.97	2.74	18.96
2001	15.50	11.02	6.57	9.28	2.94	3.56	15.20	4.81	23.24
2002	36.15	5.43	2.23	9.58	2.23	4.19	2.26	11.06	19.77
2003	29.28	5.60	2.01	8.72	1.86	2.82	21.67	5.81	17.47
2004	30.02	5.66	1.98	6.23	1.79	2.52	22.99	5.44	18.07
2005	22.29	6.44	2.49	6.54	2.21	2.86	22.29	5.07	23.82
2006	30.18	6.04	2.16	6.04	1.97	2.71	22.13	4.78	18.71
2007	37.12	10.66	3.62	5.08	5.31	0.41	27.64	3.20	0.00
2008	20.04	10.67	2.84	4.04	4.91	0.95	10.78	12.64	27.76
2009	19.78	12.00	3.07	4.61	5.47	1.54	10.63	5.06	31.56
2010	10.85	11.53	3.32	5.44	5.60	1.04	10.75	18.08	26.68
2011	9.11	12.34	4.09	6.75	7.00	2.08	4.16	18.93	27.08
2012	10.85	11.76	3.01	8.06	7.10	2.07	2.29	13.29	34.19
2013	10.23	8.49	2.78	8.36	6.59	3.31	3.01	19.17	29.68
2014	12.17	7.50	2.05	11.12	6.13	4.17	0.68	14.42	30.82
2015	11.24	11.42	2.08	11.26	7.75	4.10	4.02	16.35	19.60

(Source: Computed from secondary data of Directorate of Fisheries , Govt of Goa, 2015)

Table 3, shows important variety wise quantity of inland fish in catch in Goa (In M.tonnes) during the year 1998 to 2015that during the period from 1998-2015, the highest inland fish catch in Goa was of miscellaneous , followed by small prawns and the lowest fish catch was of Ambasis.

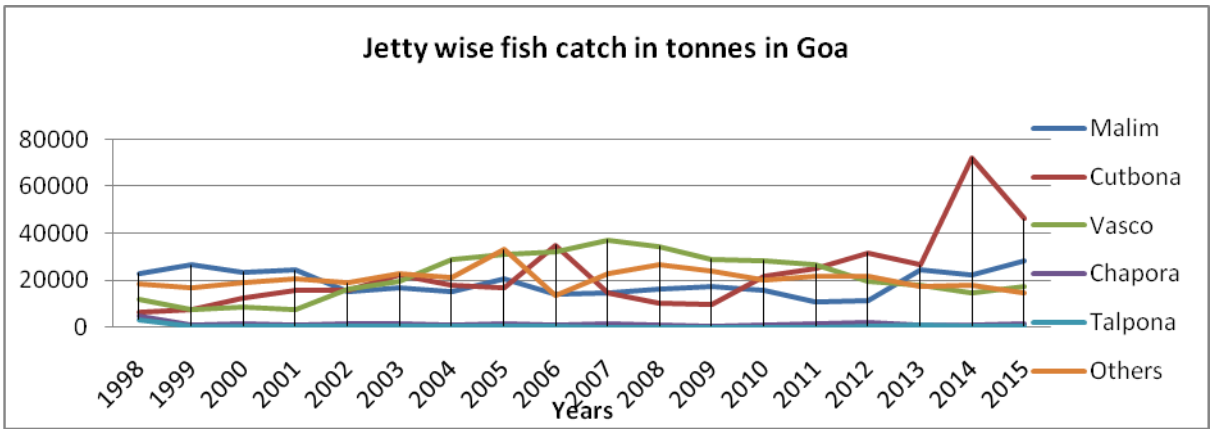
Table 4. Percentage of Jetty-wise fish catch in Goa in tonnes from 1998 to 2015

Year	Malim	Cutbona	Vasco	Chapora	Talpona	Others
1998	34.06	9.19	17.35	6.75	4.79	27.87
1999	44.37	12.28	12.64	1.73	1.24	27.74
2000	36.38	18.72	12.77	1.76	1.01	29.36
2001	35.11	22.40	10.63	1.17	1.21	29.48
2002	22.43	22.64	24.21	1.99	0.70	28.02
2003	20.23	26.14	23.61	1.88	0.60	27.53
2004	18.20	20.75	34.30	0.84	0.59	25.31
2005	19.80	15.95	30.13	1.54	0.41	32.17
2006	14.93	36.27	33.33	0.94	0.44	14.10
2007	16.18	16.01	40.99	1.34	0.17	25.31
2008	18.41	11.30	39.24	0.86	0.12	30.07
2009	21.72	11.63	36.18	0.38	0.20	29.89
2010	18.11	25.11	32.69	0.84	0.11	23.15
2011	12.65	28.87	31.41	1.75	0.17	25.14
2012	12.92	36.55	22.59	2.05	0.66	25.23
2013	27.86	30.22	20.36	0.88	1.04	19.64
2014	17.41	56.48	11.34	0.57	0.37	13.84
2015	26.07	42.66	15.87	1.33	0.34	13.73

Source: (Computed from data of Directorate of Fisheries, Goa, 2015)

Table 4, shows that Cutbona jetty has the highest percentage of fish catch followed by other jetties ,Vasco , and Malim jetty and Talpona has the lowest percentage of fish catch from the years 1998-2015.

Exhibit 4. Line graph showing jetty wise fish catch in tonnes in Goa from 1998-2015



Source: (Line graph prepared with data of Directorate of Fisheries , Goa, 2015)

The above exhibit 4, line graph shows that Cutbona jetty had the highest fish catch followed by Vasco, others and Malim jetty. The lowest fish catch was at Talpona jetty from the years 1998-2015.

Table 5. Descriptive Statistics ie Mean, Standard deviation, & Coefficient of Variation for fish catch at different jetties in Goa from 1998-2015

Jetties	Mean	Standard deviation	Coefficient of Variation
Malim	18953.9444	5250.31779	0.277004
Cutbona	22488.17	16202.78	0.720503
Vasco	21624.67	9720.362	0.449503
Chapora	1272.222	906.1343	0.712245
Talpona	599.1111	699.5701	1.16768
Others	20686.06	4529.397	0.218959

Table 5,reveals that during the period 1998-2015, the mean of fish catch was highest for Cutbona jetty and lowest for Talpona jetty. The standard deviation in case of fish catch at Talpona jetty is higher than the mean so based on standard deviation it can be concluded that there is variability in the fish catch at Talpona jetty. In case of Malim, Cutbona, Vasco Chapora and other jetties the standard deviation is less than the mean so there is no much variability in fish catch at these jetties. The variability in case of other jetties is less as compared to the other jetties. It means the data is consistent.

Following hypotheses have been formulated for fish catch at different jetties in Goa

H_0: Means values of all the jetties in Goa of fish catch are equal.

H_1: Mean values of all the jetties in Goa of fish catch are not equal.

Table 6. Hypothesis results showing mean and variance of fish catch at all jetties

Jetties in Goa	*Sum*	*Average*	*Variance*
Malim	341171	18953.94	27565837
Cutbona	404787	22488.17	2.63E+08
Vasco	389244	21624.67	94485441
Chapora	22900	1272.222	821079.4
Talpona	10784	599.1111	489398.3
Others	372349	20686.06	20515440

The above table 6 shows that the mean values of jetties in Goa for fish catch are not equal.

Table 7. Hypothesis results of one way ANOVA of fish catch between different jetties in Goa from 1998-2015

ANOVA						
Source of Variation	***Sum of squares***	***Degrees of freedom***	***Mean sum of squares***	***F-value***	***P-value***	***F crit***
Between Groups	9.73E+09	5	1.95E+09	28.73056	4.42E-18	2.303493
Within Groups	6.91E+09	102	67734559			
Total	**1.66E+10**	**107**				

From the above Anova table 7, it is observed that the F value ie 28.73056is greater than F critical value, ie 2.303493. Therefore, reject null hypotheses and accept the null hypotheses.

Table 8.Correlation Matrix between the jetties in Goa from 1998- 2015

Correlation	*Malim*	*Cutbona*	*Vasco*	*Chapora*	*Talpona*	*Others*
Malim	1					
Cutbona	0.083080161	1				
Vasco	-0.655295635	-0.06880593	1			
Chapora	0.087430987	-0.20036532	-0.26769	1		
Talpona	0.367727029	-0.22194691	-0.49916	0.849361	1	
Others	-0.312514884	-0.3755244	0.477551	-0.02006	-0.22339	1

According to the above matrix Table 8, the variables either have positive or negative interrelationship amongst them and none of them display linear dependency. In the study we find highest positive correlation of fish catch between Chapora and Talpona jetty from 1998-2015. This means that if the fish catch at Chapora increases than the fish at Talpona also increases. In case of Vasco and Malim jetty there is highest negative correlation. This indicates that if Vasco jetty fish catch is increasing than it means that fish catch at Talpona jetty is decreasing and vice-versa.

Table 9.Simple Regression Analysis showing growth performance in major item wise exports of Goa's marine products (in quantity in tonnes)during year 2005 to 2014

Dependent variable: Quantity of fish exports

Particulars	**Constant**	**Regression Coefficient**	**P- value**	**R squared**	**Coefficient of variation (percent)**
Fr_Shrimps	21770.2	8.53654	0.01059**	0.124013	2.99078
Fr__Cuttle_fish	14399.2	6.55319	0.00291***	0.478722	1.14071
Fr__Squides	14486.3	6.30591	0.00143***	0.569192	1.25580
Fr__Fresh_Fish	21448.6	0.364023	0.31917	0.31917	1.62597
Fr__Tuna	21237	77.8243	0.00586***	0.165298	2.65550
Ribbon_Fish	16497.1	2.28755	0.08956*	0.256322	1.08313
Indian_Mackerels	16404.5	1.72457	0.01487**	0.441383	1.40290
Reef_cod	18969.5	15.4956	0.04199**	0.184270	1.41450
Seer_fish	24192.9	-5.86429	0.71353	0.006991	1.94867
Assorted_Fish	22127.8	1.66594	0.01743**	0.097813	3.32598
Other_fishes	12769.3	1.72825	0.00710***	0.418515	0.905258

Source : (Computed from data of Directorate, Fisheries, Govt of Goa,2015)

NS: * Not significant
**** Significant at 5% level (p≤0.05)**
***** Significant at 1% level (p≤0.01)**

Table 9, shows trend, growth and magnitude of variability of majoritem wise quantity of export of Goa's marine products during year 2005 to 2014**.** It also highlights that there is no impact of the species of Fresh fish , Ribbon fish, and sheer fish on the total quantity of fish exported from Goa. The

remaining species which have impact on the quantity of fish exported are frozen shrimps, Indian mackerals, reef cod and Assorted fish which are significant at 5%. The remaining species which are significant at 1% are Fr cuttle fish, Fr squides, Fr tuna and other fishes are significant at 1% .

Table 10.Simple Regression Analysis showing growth performance in major item wise exports of Goa's marine products (value in lakhs) from 2005-2014

Particulars	*Constant*	*Regression Coefficient*	*P value*	*R squared*	*Coefficient of variation (percent)*
Fr_Shrimps	17994.8	3.01148	0.00005***	0.331126	3.13131
Fr__Cuttle_fish	10508.6	4.72981	0.00007***	0.706223	1.34703
Fr__Squides	10027.1	5.47789	0.00022***	0.790769	1.36351
Fr__Fresh_Fish	20578.9	0.158542	0.78334	0.003172	1.76818
Fr__Tuna	19359.5	3.21003	0.00267***	0.115151	3.27735
Ribbon_Fish	13822.8	3.05088	0.00444***	0.448967	1.56176
Indian_Mackerels	11216.4	2.62153	0.00147***	0.663116	1.39854
Reef_cod	14522	41.2849	0.00171***	0.335312	1.49270
Seer_fish	21293.6	-1.18155	0.95764	0.000234	1.50559
Assorted_Fish	18413.2	7.26533	0.00008***	0.278816	3.31734
Other_fishes	12795.2	1.66553	0.26662	0.156702	0.808781

Source : (Computed from secondary data of Directorate of Fisheries , Govt of Goa, 2015)

NS: * Not significant
**** Significant at 5% level ($p \leq 0.05$)**
***** Significant at 1% level ($p \leq 0.01$)**

The above table 10, shows that Fr Shrimps, Fr Cuttle fish, Fr Squides, Fr Tuna Ribbon Fish, Indian_Mackerels, Reef_cod and Assorted Fish are significant at 1% and have impact on the quantity of fish exported from Goa.

Table 11.Descriptive statistics to study the mean, standard deviation and coefficient of variation of variety wise fish exports in tons from Goa from 2005 to 2014

	Fr.Shrimps	*Fr. Cuttle fish*	*Fr. Squides*	*Fr. Fresh Fish*	*Fr. Tuna*	*Ribbon Fish*	*Indian Mackerels*	*Reef cod*
Mean	168.882	1308.82	1117.65	3795.82	3796.294	671.5294	140.4118	4510.706
Standard Deviation	520.681	1303.56	1585.08	2912.9	4798.804	789.7881	182.2272	5441.566
Coefficient of variation	2.54826	2.06103	2.12526	2.03507	2.09944	2.08591	2.10487	2.09047

The above table 11, reveals that mean for Reef cod fish exports is the highest ie 4510.706, as compared to other species and for Indian mackerels it is the lowest ie 140.4118. Based on the standard deviation it can be concluded that exports of Reef cod fish is highly instable as the standard deviation is very high as compared to the other species of fish. Since the standard deviation of reef cod fish is higher than the mean for the years from 1998 to 2014, there is variability in the exports of reef cod

fish. In case of Fr cuttle fish, Fr fresh fish the standard deviation is lower than the mean, so there is no much variability in the exports of these species and the data is normally distributed. The variability is least in the case of exports of Indian mackerels with standard deviation 182.22. From the descriptive statistics it can be concluded that the variability is very high in case of exports of Reef cod fish as compared to other species of fish and Indian mackerels exports are said to be very stable during the period of study.

Table 12.Gross State Domestic product of Goa at current and constant prices with (Base year-2004-05)

Years	Fisheries Sector of Goa	
	% share of Fishing Industry of Goa in GSDP of Primary sector	% Growth of fisheries sector
1997-98	3.05	35.18
1998-99	1.69	-31.92
1999-00	2.17	101.20
2000-01	2.55	11.65
2001-02	2.46	0.01
2002-03	2.33	2.43
2003-04	2.96	36.92
2004-05	2.04	23.25
2005-06	2.38	25.71
2006-07	2.04	-5.58
2007-08	1.80	-7.14
2008-09	1.55	-5.02
2009-10	1.43	1.35
2010-11	1.25	2.09
2011-12	1.02	-1.79
2012-13	0.87	-11.05

Source: (Computed data from Economic Survey of Goa from,1998-2013)

The contribution of the fishing industry to the development of the State economy may be measured in terms of:

- Its contribution to Gross State Domestic product of Goa (GSDP) &
- Its share in the total output of the primary sector.

  Table 12, reveals that the contribution of fishing industry in Goa's GSDP since 1998-99 has never exceeded 3 percent. There is a lack of steady growth in the contribution of fishing industry to the development of the Goa's economy. The decline in its contribution in 2012-13 is a cause of concern.

Simple Regression to analyse the impact of contribution of the fisheries sector to GSDP of Goa.

Dependent variable: Total GSDP of Primary sector

Independent variable: Fisheries sector

Following two hypotheses are formulated

H_0: There is no significant impact of fisheries sector on Gross State Domestic Product of primary sector in Goa

H_1: There is a significant impact of Fisheries sector on Gross State Domestic Product of primary sector in Goa.

Table 13. Hypothesis results for impact of fisheries sector on GSDP of primary sector of Goa

Particulars	**Constant**	**Regression Coefficient**	**P- value**	**R squared**
Sectorwise of fishing_sector	2.85201e+06	-876772	0.00001***	0.715907

From the above Table 13, it is evident that the gross domestic product of Goa is highly influenced by the contribution made by the fisheries sector in Goa. Since the p- value obtained is significant at 1% i.e. The p- value is less than 0.01, thus reject null hypothesis. The r-squared of 0.71 indicates that the 71% of variations in GSDP of primary sector is explained by the fisheries sector.

Findingsof the study

The following findings were drawn from the statistical analysis

Analysis of marine production & exports of Goa

- The compounded annual growth rate of marine and inland fish production of India has fluctuated from 2001-2014.
- Annual growth rate figures of fish production of India and the state is highly inconsistent
- Cutbona jetty has the highest percentage of fish catch followed by other jetties ,Vasco and Malim jetty and Talpona has the lowest percentage of fish catch from the years 1998-2015.
- There is highest positive correlation of fish catch between Chapora and Talpona jetty in Goa from 1998-2015. The mean values of jetties in Goa are not equal.
- The highest marine fish catch during 1998-2015 was of sardines, followed by mackerals , and others, silver belly is the lowest marine fish catch.
- There is a significant impact of Fisheries sector on Gross State Domestic Product of primary sector in Goa.
- From the descriptive statistics it can be concluded that the variability is very high in case of exports of Reef cod fish as compared to other species of fish and Indian mackerels exports are said to be very stable during the period of study.

Conclusion

Goa has remarked its significance to generate substantial employment in the sector, towards production, processing, storage, transport and marketing. The substantial growth of the average fish production being increased over the number of years, remarks the domain of its bureaucracy in adhering its policies in maintaining pace with the growing needs and available resources. The State Government has geared up its activities towards sustainability, in the form of open sea cage culture and is in the process of augmenting its resources. Thus, gross domestic product of Goa is highly influenced by the contribution made by the fisheries sector in Goa.

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