Indian J. Anim. Res., **46** (1) : 1 - 7, 2012

AGRICULTURAL RESEARCH COMMUNICATION CENTRE
www.arccjournals.com / indianjournals.com

GEOSPATIAL MAPPING OF FISHERIES PROFILE OF ANDAMAN AND NICOBAR ISLANDS OF INDIA THROUGH GIS

R. Singh, P.K. Pandey, N. Ram and C.S. Chaturvedi

Central Institute of Fisheries Education,
Versova, Mumbai- 400 061, India

Received : 12-04-2011 Accepted : 21-11-2011

ABSTRACT

Geospatial mapping is a location-based study and a part of GIS which is expected to be useful tool for fisheries scientists, aquatic resource managers and policy planners in developing and planning strategies for fisheries resources of the country. In this context, a study was performed where mapping of fisheries profile of Andaman and Nicobar Islands was performed by GIS tool having critical geographic dimensions. For this purpose, at the core of the system, fisheries data of Andaman and Nicobar were accessed and integrated from different sources at district and taluka level. Data were brought in tabular form through Microsoft Excel and then joined to digitized Map of Andaman and Nicobar to enable mapping using Arc info 9.3 GIS software. This was further synchronized and integrated to generate four thematic maps based on different criteria. Map 1 contains searchable criteria as regards to fishermen population as well as their classified categories according to their occupation. Map 2 contains fish production district-/taluka-wise and growth rate for 2000-2007 and district-wise area of ponds/tanks and reservoir along with fish production. With this mapped information, planners and various stakeholders will have readily accessible district/tehsil level data on various components of fisheries of Andaman and Nicobar Islands, thereby facilitating better planning, management and development of fisheries sector.

Key Words: GIS, Geospatial data, Buffer zone, Thematic maps.

INTRODUCTION

In the age of information and technological advancements, location-awareness is becoming a key feature in management of natural resources. Geospatial mapping is a location based study and is a part of intelligence GIS which is expected to be useful tool for fisheries scientists, aquatic resource managers and policy planners in developing and planning strategies for fisheries resources of the country. Andaman and Nicobar Islands are typically tropical and oceanic. Their landforms contain low range of hills and valleys. The Islands have a coastline of 1,912 km (Anon, 2000) which is about ¼ of the coastline of India. The continental shelf area of the Islands is 35,000 sq km and the EEZ (Exclusive Economic Zone) is 6.0 lakh sq km amounting to about 28% of the total EEZ of the country (Anon, 2008). Andaman and Nicobar Islands, comprising 0.03% of the country's landmass, have about 86% of their total geographical area under very fragile tropical, rain, forest and great diversity with nearly 5,500 animal and about 2,500 indigenous and non-indigenous angiosperm species with high level of endemism (13%) in its floral components. History of human occupation of the Islands dates back to 1858 and later the refugees from neighboring countries added to the population.

EEZ of Andaman and Nicobar Islands has an estimated fishery potential of 1.48 lakh tonnes comprising 32,000 tonnes of demersal, 56,000 tonnes pelagic and 60,000 tonnes of oceanic fishes (Anon, 2008). The pelagic resources include anchovies, sardines, mackerels, neretic tunas, baracuda etc. The demersal fishery constitutes perches, silver bellies, pomfrets, scianids, nemipterids, shrimps, lobsters, squids etc. The oceanic resources comprises skipjack tuna, big-eye tuna, bill-fishes (sail fish, martin and sword fish) etc.

*Corresponding auther's E mail: pkpandey_in@yahoo.co.uk

The study was conducted with a view to help planners and researchers for better utilization of fisheries resources by facilitating better planning, management and sustainable development of fisheries sector of the twin islands (FAO, 1995).

MATERIAL AND METHODS

Study Area

Andaman and Nicobar Islands stretch over 800 km2 in Bay of Bengal between 06o5' and 14o45'N latitude and 92o and 94oE longitude. The total geographical area of the two groups of Islands is 8,249 km2. Nicobar Islands are a group of 28 small islands, located at the southern side with a total area of 1,841 km2, separated from Andaman group of Islands (6,408 km2) by a channel. It is among the richest national forest region and contains great assemblage of endemic plant species owing to the diversity of soils, climate geology, physical isolation, topography and geography. The terrain is mountainous with less elevation but long ranges of hills enclosing narrow valleys. The lands capacity is characterized by high and low formations, sloping down to the coast of Andaman Sea. Andaman Islands show similarity to the flora of the northeastern India, Myanmar and Thailand while Nicobar Islands bear resemblance to Malayasian and Indonesian flora. The Islands are characteristized by two distinct native ethno-cultures. Negroid population in Andaman include Jarwa, Onges, Great Andamanese and Sentinels while Mongoloids (Nicobarege and Shompens) are confined in Nicobar. Mean annual temperature of the islands is nearly 26.4oC and relative humidity varies from 65-89%. The mean annual precipitation (rainfall) is around 3,100 mm and rough weather prevails at the beginning of the south-west monsoon (in March). The mean wind speed ranges from 5 to 15 km/h. In the last few decades, large area of the forests have been cleared by the settlers to practice agriculture which is evident with a population growth rate of 26.94% against the national average 21-34% during the last decade 1991-2001 (Anon, 2008).

Geospatial Mapping

Geospatial mapping of fisheries profiles of Andaman and Nicobar Islands of India was performed through GIS tool (Arch Info 9.3.1) having critical geographical dimensions (Burrough, 1986). Each aspect of map and graph has different components involved. For the present work, data were accessed and integrated from secondary source, namely Andaman and Nicobar Fisheries at a Glance 2008, Department of Fisheries, Andaman and Nicobar Administration, Port Blair. For the present study, marine, inland and total fish production data were collected for all the districts and taluka over the period of 2000-2007 and brought in tabular form through Microsoft Excel by allotting an ID number to each Taluka (Gujrati, 2003). This data have been used for GIS analysis and preparation of different thematic maps for fisheries profile of Andaman and Nicobar Islands (FAO, 1987, 1995).

Analysis

For analysis and preparation of various thematic maps, Arc Info (9.3.1) GIS software was used and digitization of map of Andaman and Nicobar at district/taluka level has been done.

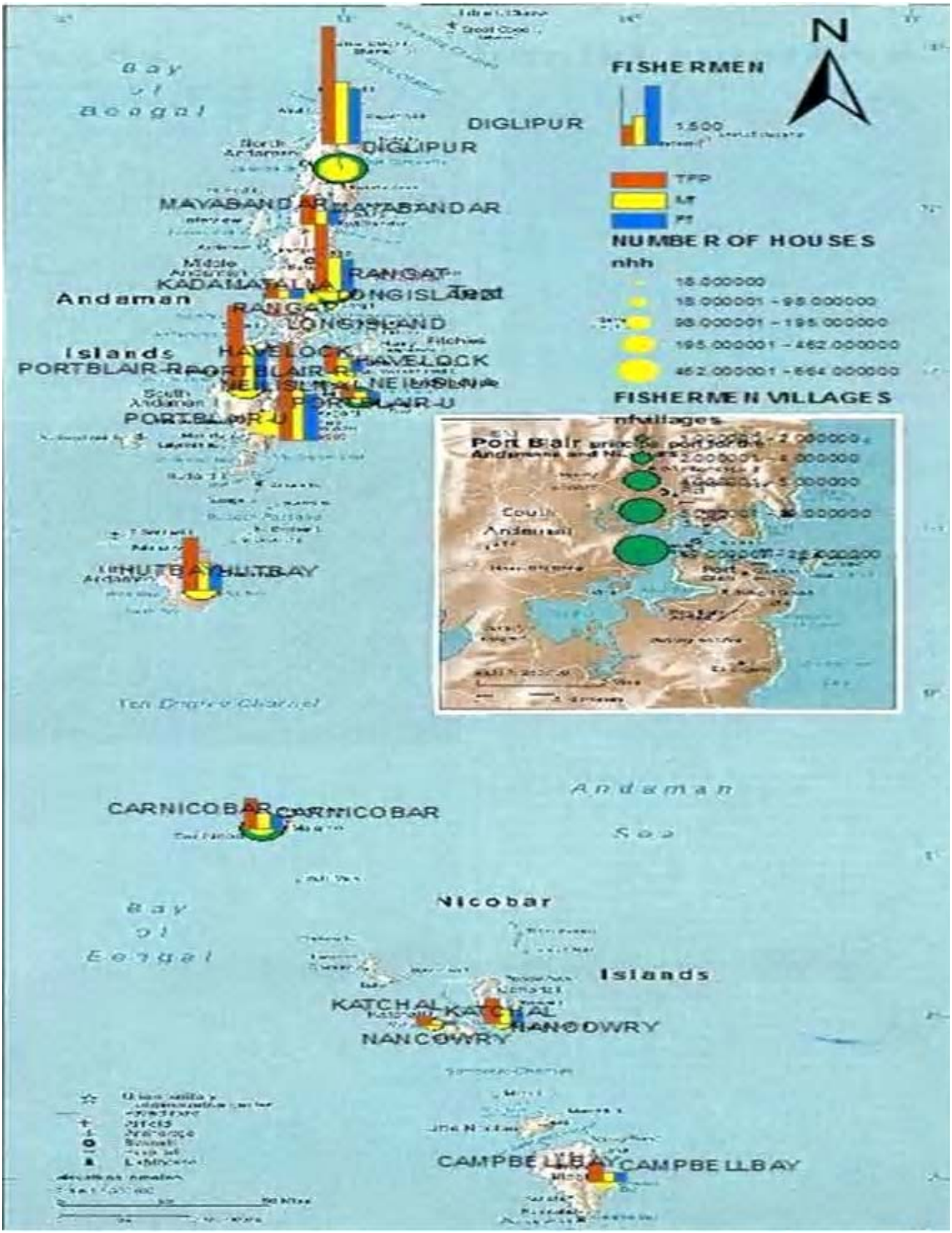
RESULTS AND DISCUSSIONS

Distribution of Fishermen Population

The total population of the Islands is 3.56 lakh (2001) with fishers' population 15,320 out of which, 5,617 are full-time and 718 are part-time fishermen engaged in marine fishing (Anon, 2008). It contains three layers - (i) fishermen population (total, male and female), (ii) number of fishermen villages and (iii) number of fishermen houses in each village (Gaffar, 1996). According to Map 1 and Table 1, the total fishermen population of Andaman and Nicobar Islands are divided in four categories. Category I comprises more than 2,000, category II between 1,000-2,000, category III between 500-1,000 and category IV contains less than 500 fishermen. In category I, the three areas, namely Diglipur, Port Blair (Urban) and Port Blair (Rural) dominate with respect to fishermen population. While Diglipur is the part of North Andaman and the rest two are part of South Andaman.

Diglipur comprises 3,068, Port Blair-Urban 2,555 and Port Blair Rural 2,158 fishermen. In Diglipur, there are 26 fishing villages whereas in Port Blair (Rural), there are only 5 fishing villages. The average family size of this category is 4.4. The category II, which is based on 1,000-2,000 fishermen, is represented by only two areas- Rangat (Middle Andaman) and Hutabay (Little Andaman). Rangat consists of 1,743 fishermen while Hutbay 1,370 with the respective size of family 4.79 and 4.41.

MAP 1: FISHERMEN VILLAGES, HOUSES



MAP 2: NUMBER OF OPONDS AND THEIR AREA IN ha

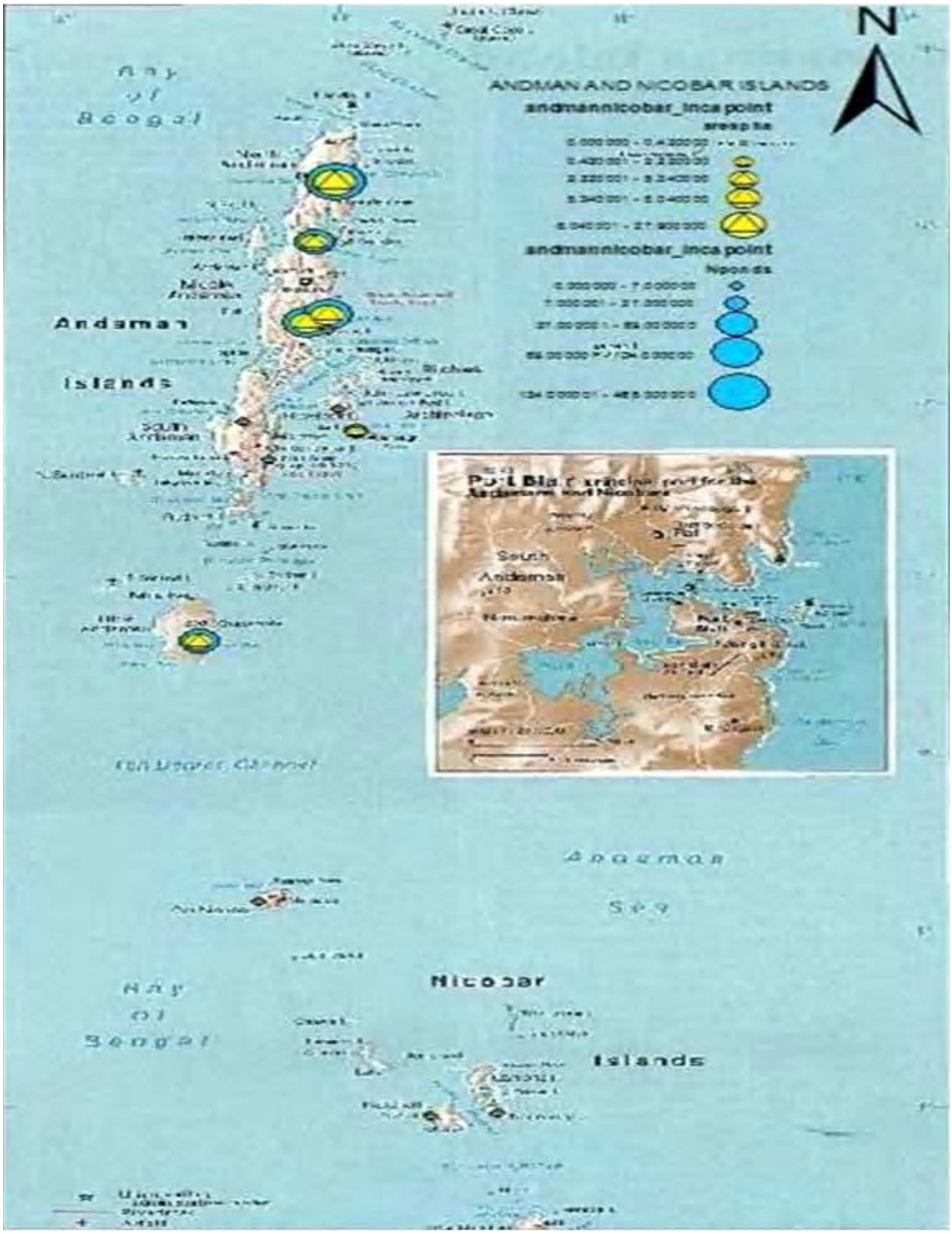


TABLE 1: Fishermen, fishing village, fishermen houses and family size (2007)

Category I	Fishermen	Fishing villages	No. of Houses	Family size
Diglipur	3068	26	664	4.62
Port Blair (U)	2555	03	290	4.66
Port Blair (R)	2158	05	110	4.67
Category II				
Rangat	1743	19	220	4.79
Hatbay	1370	05	90	4.41
Category III				
Car Nicobar	782	16	130	4.01
Maybunder	753	04	146	5.16
Havelock	651	03	119	5.47
Nanacowry / Kamrom	624	03	130	6.37
Campell Bay	504	01	112	4.06
Category IV				
Kadamatalla	426	02	81	5.26
Neil Island	344	05	390	4.59
Katchad	250	04	93	3.82
Long Island	92	01	18	5.11

TABLE 2: Average fish production and growth rate (2000 to 2007)

Species	Growth rate	Standard error	Average Production
Elasmobranch	10.84	0.20	1013.25
Sardines	-10.93	-0.57	2595.88
Thissocles	-68.10	-3.74	299.00
Anchovies	9.65	0.42	1392.63
Silver Bellies	1.97	0.06	1352.88
Mackerel	-3.26	-0.13	1721.25
Carangids	-27.06	-0.36	2442.00
Seer Fish	-3.62	-0.22	1090.13
Tuna	25.01	0.59	845.88
Bill Fishes	-59.09	-3.10	274.88
Baracuda	-9.39	-0.68	840.38
Pomfrets	-8.73	-0.31	434.13
Mullets	-12.26	-0.84	1056.25
Hilsa	-10.90	-0.71	207.75
Perches	-5.97	-0.48	6069.13
Belonids	-11.41	-0.35	143.63
Chirocentridae	-49.14	-1.96	72.83
Cat Fish	-9.89	-0.33	265.88
Polynemids	-13.72	-0.56	30.25
Scieanids	39.76	0.71	245.13
Prawns	-1.98	-0.09	444.00
Crabs	-3.48	-0.16	433.88
Ribbon Fish	-51.74	-3.93	118.63
Miscellaneous	-26.43	-1.87	2104.50
TOTAL	-5.27	-0.37	25170.63

The category III comprising fishermen in range of 500 to 1,000, covers five areas. Car Nicobar is having 782 fishermen, 16 villages and 290 houses with family size of 4.01. Mayabhunder contains 753 fishermen with 4 villages, 146 houses and family size of 5.16. Havelock consists of 651 fishermen with family size of 5.47. Nanacory contains 624 fishermen, 3 villages and 130 houses. In this area, the family size is large being 6.51 representing the largest family size in total Andman and Nicobar Islands.

In the category IV, fishermen population is less than 500. Neil Islands contain maximum number of houses (390). In these islands, many fishermen have migrated from other places during the last 20 years and the family size is 4.59. The least number

TABLE 3: Region-wise fish production, variation and percentage change

Name of Region	Distance from Port Blair (km)	2000	2001	2002	2003	2004	2005	2006	2007	Variation (2000-07)	% Change
Diglipur	185	637	1031	1125	1336	1375	914	6823	9823	9186	14.42
Mayabunder	157	578	547	381	221	201	174	714	687	109	0.19
Billiground		-	-	-	-	8	36	338	222	222	25.84
Rangat	93	2780	2729	1659	847	192	160	801	769	-2011	-0.72
Kadamtala	93	-	-	-	-	387	224	365	231	231	-0.40
South Andaman	--	24661	21523	21161	27157	22835	6585	13871	15124	-9537	-0.39
Neil Island	37	-	-	-	-	592	219	220	157	157	-0.73
Havelock	39	-	-	-	-	392	162	233	180	180	-0.54
Little Andaman	122	1013	823	791	619	499	36	171	261	-752	-0.74
Car Nicobar	278	22	18	9	6	9	-	71	64	42	1.91
Nancowry	435	270	299	319	331	276	73	265	217	-53	-0.20
Katchal	422	-	-	-	-	20	5	62	93	93	3.58
Campbell bay	544	378	203	116	119	122	27	107	99	-279	-0.74
Teressa	380	-	-	-	-	-	-	43	66	66	0.55
FSI	-	-	-	-	-	13	20	11	12	12	-0.10
Total		30339	27173	25561	30636	26921	8635	24096	28005	-2334	-0.08

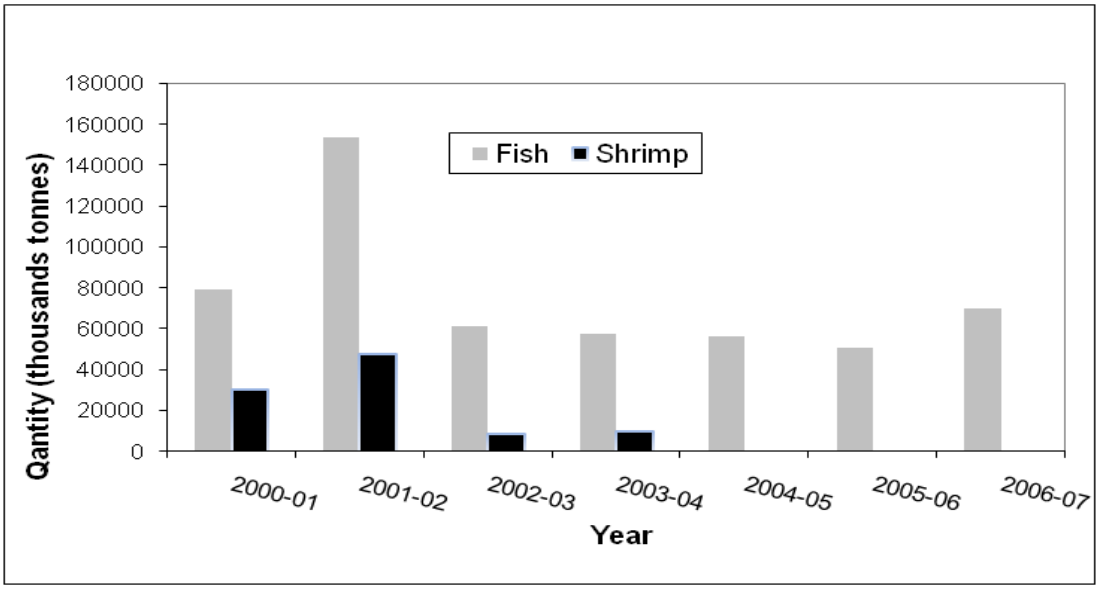
of fishermen are reported from Long Island, the number being only 92 with 1 fishing village and 18 houses but family size is comparatively large (5.11).

Fish Production and Export

Table 2 gives percentage change in fish landing of Andaman and Nicobar Islands between 2000 and 2007. It also shows the growth rate changes of different landing centers during 2000-2007. Fig. 1 indicates the status of export of fish and shrimp from Andaman Nicobar.

Three types of growth rate have been identified - (i) increasing trend, (ii) marginal trend and (iii) declining trend (Ramachandran *et al.*, 1998). Only four types of fishery showed increasing trend which includes sciaenids (39.76%), tuna (25%), elasmobranchs (10.84%) and anchovies (9.65%). In the second category of growth rate, only crabs (-3.48%) has been found. In the third category (under declining trend of fish production) are bill-fish (-59.09%), ribbon-fish (-51.74%) and chirocentridae (-49.14%) (Table 2). The

FIG. 1: Export of fish and shrimp



miscellaneous fish production trend is -26.43% which may probably be due to Tsunami.

Maximum varieties of fishes belong to fourth category. The total growth of fish under marginal trend is -5.27%. Diglipur has got major changes during the study period. In 2000, production of Diglipur was 2% only which increased up to 35% in 2007 while production of Campbell was 8.2% in 2000 which was enhanced to 20.10% in 2007 due to tsunami.

Map 2 exhibits two thematic layers- one indicates number of ponds and the other their area in ha. GIS study reveals that category I represents more than 250 ponds. In this category, Diglipur contains maximum number of ponds (465) covering 28 ha followed by South Andaman with 382 ponds and area of 22.92 ha and Billground contains 255 ponds with an area of 15.30 ha. Category II indicates more than 100 ponds in which Kadamtala contains 134 ponds with 8.04 ha area. Rangat contains 118 ponds with an area of 7.08 ha. Category III comprises the places which have less than 100 ponds. In this category, Mayabunder contains 89 ponds with an area of 5.34 ha, Hutbay 75 ponds with the total area 4.50 ha and Havelock 65 ponds with the area of 3.78 ha. In this way, the total numbers of ponds are 1,676 with a water area of 100.56 ha. It is pertinent to remark that in the study area, there are five major reservoirs as well. Region-wise fish production, variations and changes in terms of percentage have been depicted in Table 3. Billiground showed the highest increase, value being 25.84%, while Campbell Bay showed a decline i.e. -0.74% over the period of 2000 to 2007. This may be attributed to enhanced anthropogenic activities in Campbell Bay region.

REFERENCES

Anon (2000). Handbook on Fisheries Statistics. Ministry of Agriculture, Govt. of India, 166 p.

Anon (2008). Department of Fisheries. Andaman Nicobar Administration, Port Blair.

Burrough P. A. (1986). *Principles of Geographical Information System for Land Resources Assessment*. Clarendon Press, Oxford. pp. 6-12.

FAO (1987). Geographic information system and satellite remote sensing to plan for aquaculture development. FAO Technical Paper No. 287. FAO, Rome.

FAO (1995). Geographic systems and remote sensing in inland fisheries and aquaculture. FAO Technical Paper No. 318. FAO, Rome.

FAO (1996). Technical Guidelines for Responsible Fisheries. No.3, FAO, Rome.

Gaffar J. A. (1996). Twenty years of fisheries development in Nigeria. *In* FISON proceeding FISON (Ita, et. al., Eds.), Lagos.

Gujrati D. N. (2003). Basic Econometrics. McGraw Hill Publication, New Delhi. 210 p.

Ramachandran S., Sundaramoorthy S., Krishnamoorthy R., Devasenapathi J. and Thanikachalam M. (1998). Applications of remote sensing and GIS to coastal wetland ecology of Tamil Nadu and Andaman and Nicobar Islands with special reference to mangroves *Current Science,* **75**: 236-244.