

DIGITAL MAPPING OF FISH PROCESSING AND ALLIED INDUSTRY IN RATNAGIRI DISTRICT USING REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM

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ABSTRACT : Remote sensing and Geographical Information System technique have been used to map the fish processing plants, fish meal plants and ice plants. The objects were identified on the basis of ground truth and GIS maps were prepared. The satellite images of IRS P6 LISS, LISS IV and Landsat –Multi-spectral scanner, the Enhanced Thematic Mapper plus (ETM+) images were used for mapping. The images were processed by using ERDAS Imagine 9.1 and Arc Map 10.1 softwares. Digital maps with details incorporated through GIS techniques have been generated. Altogether 47 ice plants, nine fish processing plants, two fish meal plants and four pulverizing units observed in Ratnagiri district were mapped.

Key words : Fish processing and allied industry, remote sensing, GIS.

INTRODUCTION

Ratnagiri with 167 km coastline is one of the important coastal district of Maharashtra. Ratnagiri district are third rank with 87690 mt of marine fish production during 2012-13 (Anonymous, 2014a) among the maritime districts of Maharashtra. On an average Ratnagiri district produces processed sea food to the tune of 553.9 mt. considering the production capacity of the district the fish processing industry showed significant growth in the past.

The commercial trawling was introduced along the coast Maharashtra during the later phase of the decade 1960. This has resulted in the establishment of the processing industry in the state of Maharashtra. Seafood processing units are observed in Greater Mumbai, north part of Raigad, Ratnagiri and only one unit established in 2006 in Sindhuduga district.

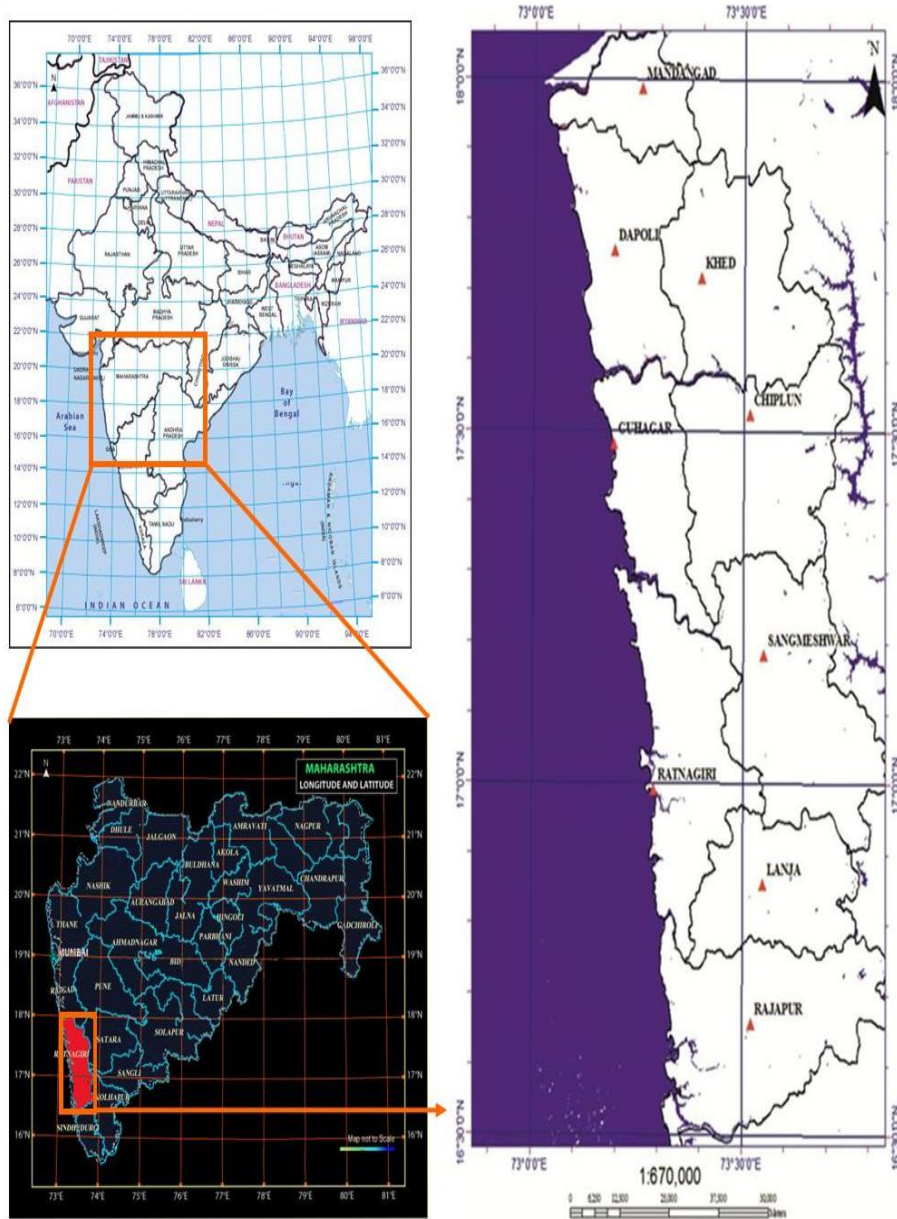
Department of Fisheries, Government of Maharashtra and Central Institutes of Government of India have carried out many surveys to record fisheries resources of State and have documented the same. No attempts have been made to generate the digitized maps of seafood processing and allied industry except processing plants of Greater Bombay district by Ghatage (2008). Similarly, the processing plants in the South Africa have been mapped by Caddy and Garcia (1985). An attempt will be made in the present study to digitize the fisheries resources of Ratnagiri district using the remote sensing and GIS

technique.

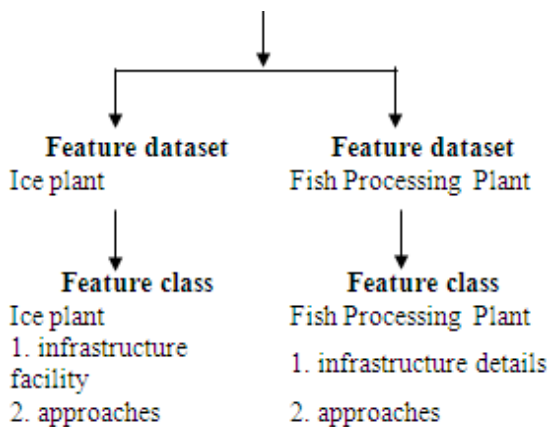
MATERIALS AND METHODS

Sea food processing and allied industry lying between 18°04' N latitude and 73°02' E longitudes to 16°31' N latitude to 73°52' E longitudes within the Ratnagiri district of Maharashtra state was considered for mapping (Map 1). List of the all the sea food processing plants and allied industry of the Ratnagiri district was obtained from the published sources (MPEDA, 2014; Anonymous, 2014b). The geographical location of each processing and allied industry was recorded using handheld GPS. In addition to this the required information about the processing and allied industry was collected by intervening the owner or else the officials of the industry (McGoodwin, 2001).

The satellite images of sensor LISS III and LISS IV were procured from NARSA, Hyderabad (Table 1) and were processed in ERDAS Imagine 9.1. Using appropriate fusion techniques high spatial resolution panchromatic imagery can be combined with multispectral imagery of lower resolution. In this way, the spectral resolution may be preserved, while a higher spatial resolution is incorporated, which represents the information content of the images in much more detail (Franklin and Blodgett, 1993; Pellemans *et al*, 1993). The digital satellite images used for the present work were with different spatial resolutions, therefore, the resolution merge was performed to bring all the images with same

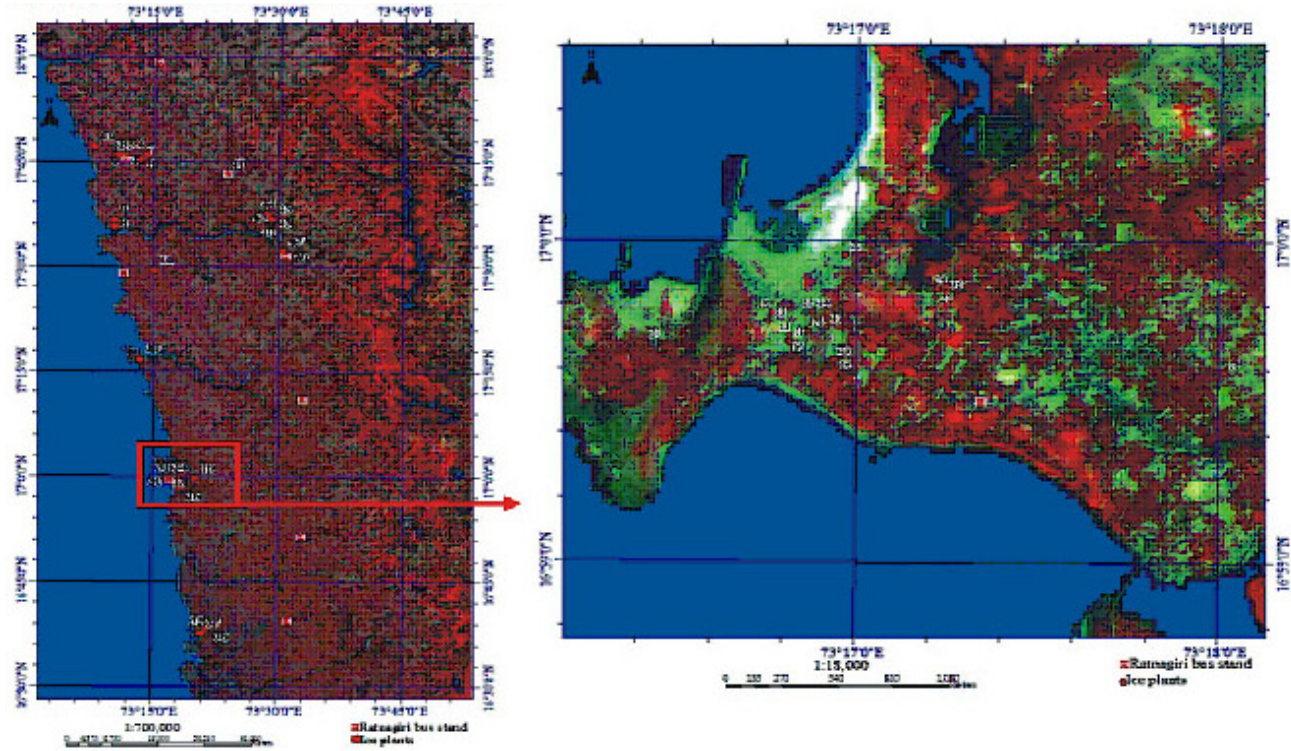


Map 1 : Study area.

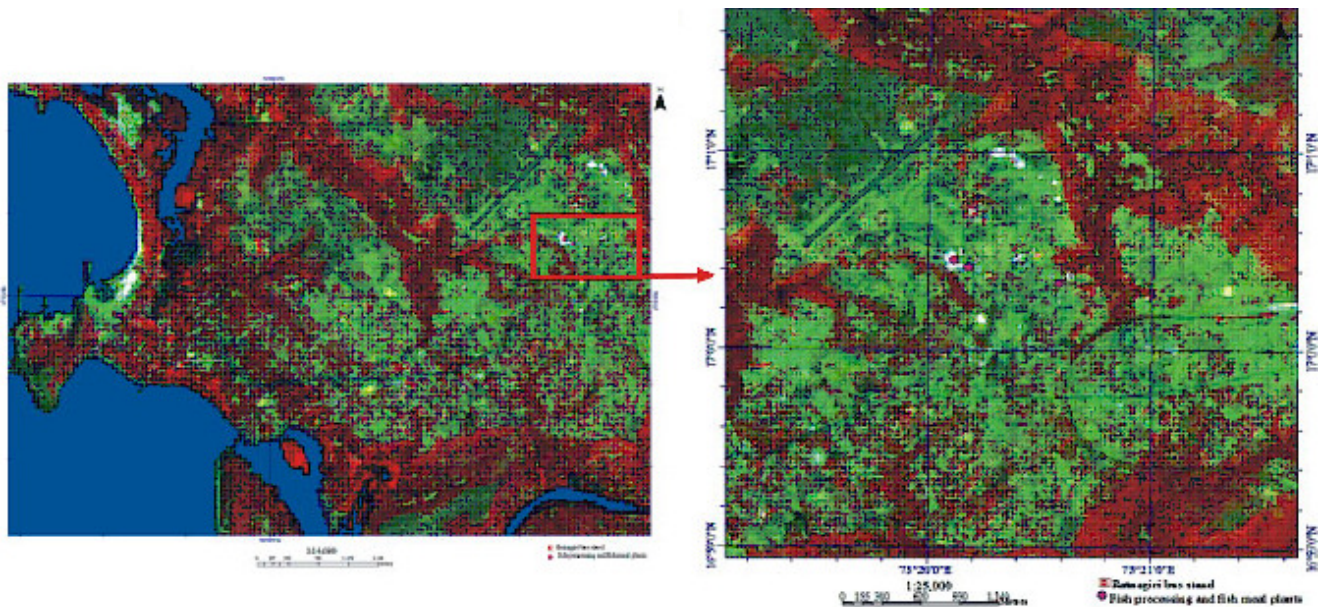


Flow chart 1 : Procedure for creation of feature class from feature dataset.

resolution of 15 and 5.8 meter (Ratnagiri block) to improve the spatial quality. As infrared band produces superior contrast between land and water areas showing higher pixel values for land areas and lower pixel values for water areas, land and water areas in infrared band images were separated by using threshold value from transition zone. The pixels with value above threshold were classified as land and those with lesser values were classified as water areas. The binary image thus produced was then multiplied with band ratio images of GREEN/NIR and GREEN/MIR so as to increase the accuracy (Van and Binh, 2008). Unsupervised classification of multi-spectral satellite images was performed using ISODATA clustering technique to classify image pixels



Map 2 : Geographical locations of ice plants in Ratnagiri district.



Map 3 : Geographical locations of fish processing and fish meal plants in Ratnagiri district.

Table 1 : Details of the satellite data.

S. No.	Satellite	Sensor	Acquisition Date	Spectral resolution	Spectral resolution (m)
1.	IRS-P6	LISS IV Mono	7-Mar-12	B2 0.52 - 0.59	
2.	Landsat	ETM+	14-October- 99	PAN 0.520-0.900	
3.	IRS-P6	LISS III Multispectral	7-March-12	B2 0.52 - 0.59	
				B3 0.62 - 0.68	
				B4 0.77 - 0.86	
				B5 1.55 - 1.70	

Table 2 : Details of fish processing plant in Ratnagiri district.

Identity number	Company name and address	Year of establishment	EIA approval	HACCP	Production capacity (mt)/day	Cold storage capacity (mt)	Products	Latitude	Longitude
RTN/FP/1	M/s Gadre Marine Export Pvt Ltd, Plot No. Fp-1, Mirjole Industrial Area MIDC, Ratnagiri	1994	Yes	Yes	95	3600	Crab Sticks, Crab Flakes, Crab Claw	17°0'27"N	73°20'7"E
RTN/FP/2	M/s Gadre Marine Export Pvt. Ltd. (Plant No. 2), Plot No. Fp-1, Fp-1 (Part) Mirjole Block MIDC, Ratnagiri	1992	Yes	Yes	43.20	330	Surimi	17° 0'24.79"N	73°20'10.07"E
RTN/FP/3	M/s Gadre Marine Exports (Plant No.1), 362/5, Mirakarwada, Ratnagiri	1974	Yes	Yes	60	60	Fish fillets, Fish steaks, Masala mackeral	16°59'51.91"N	73°16'54.59"E
RTN/FP/4	M/s Gee Square Exports (I) Pvt. Ltd, Plot No 169, Mirkarwada, Bhagawatti Bunder Road	2007	Yes	Yes	80	150	Freezing of Raw Fish & other fish and Fishery Products	16°59'55.47"N	73°16'56.89"E
RTN/FP/5	M/s Karunya Marine Exports Pvt Ltd, 22, Jai Prabha Housing Society, 80 Feet Road, Mandovi, Ratnagiri	2005	Yes	Yes	80	120	Freezing of fish and fishery products	16°59'38.09"N	73°16'55.56"E
RTN/FP/6	M/s Naik Ice & Cold Storage (Plant-1), Pethkilla, Ratnagiri	1978	Yes	Yes	61	150	Packing of Fresh/ Chilled Fish and Fishery Products	16°59'39.17"N	73°16'46.63"E
RTN/FP/7	M/s Naik Seafood Pvt. Ltd. Ice & Cold Storage (Plant 2), Pethkilla, Ratnagiri	2000	Yes	Yes	104.7	1200	Packing of Fresh/ Chilled and frozen Fish and Fishery Products, Freezing of Raw	16°59'39.45"N	73°16'44.12"E
RTN/FP/8	M/s M. D. Naik Seafood, Naik Complex, Pethkilla, Ratnagiri	2002	Yes	Yes	30	200	Chikuva, Fish biscuit and Fishery Products	16°59'35.73"N	73°16'43.42"E
RTN/FP/9	M/s Teelani Marine Products (Stop Company) Only Supplier, A-1, Yash Residency, 80feet Road, Mandavi	Not registered	No	No	No	No	Freezing of Raw Fish	16°59'44.75"N	73°16'45.42"E
Fish meal plant									
RTN/FMP/10	Fortune Marine Product (Thouwfeeq fish meal and oil Co. Pvt. Ltd.), Plot No-B 27/28, Mirjole, Ratnagiri	2002	No	No	50 t	No	Fish powder and fish oil	17°0'20"N	73°20'35"E
RTN/FMP/11	Munir Fisheries, Mirjole, Ratnagiri	2011	No	No	40 t	No	Fish powder and fish oil	17°1'30"N	73°10'7"E

Table 3 : Details of ice plants in Ratnagiri district

Object id	Name of enterprises and plant address	Year of registration	Total area (sq. m)	Production capacity (tones/day)	Total Production capacity (tones)	Ice storage facility	Distance from bus stand (km)	Latitude	Longitude
DAP/IP/1	M/S Anand ice factory, At-Adkhal, Post-Harnai, Tal-Dapoli, Dist. Ratnagiri. Reg. No. 2913 Contact No. 9270061122	2005	900	20	30	No	2	17°45'38.25"N	73°11'17.90"E
DAP/IP/2	M/S Laxmi ice plant, At-Adkhal, Post-Harnai, Tal-Dapoli, Dist. Ratnagiri Reg. No. 2683 Contact No. 9270061122	1999	1015	28	40	No	1	17°45'44.36"N	73°10'30.48"E
DAP/IP/3	M/S Rht(swastik ice factory and cold storage), At/Post-Karanjani, Tal-Dapoli, Dist- Ratnagiri. Reg. No. 2762 Contact No. 8149403581	2001	1500	30	36	No	3	17°45'49.08"N	73°11'34.89"E
DAP/IP/4	M/S Ruchirani ice plant, At-Aapti, Post-Talsure, Tal-Dapoli, Dist-Ratnagiri Reg. No. Contact No. 02358653463/ 9226369810	2009	1300	40	40	No	8	17°44'51.50"N	73°14'08.50"E
DAP/IP/5	M/S Sahil ice and cold storage, Vanoshi Tarfe Panchanadi, Tal. Dapoli, Dist. Ratnagiri. Reg. No. 2948 Contact No. 9822316287	2006	1011	10	17	No	1	17°45'44.0"N	73°11'01.2"E
DAP/IP/6	M/S Shri Mahalaxmi ice plant, At/Post-Talsura, Tal-Dapoli, Dist-Ratnagiri Reg. No. 20029 Contact No. 9226984044	2009	1011	18	80	No	1	17°45'17.4"N	73°13'29.3"E
DAP/IP/7	M/S Shrinath ice factory, At/Post. Harnai, Tal. Dapoli, Dist. Ratnagiri. Reg. No. 2069	1989	505	4	10	No	2	17°45'10.4"N	73°13'19.3"E
DAP/IP/8	M/S Soham ice factory and cold storage, At/Post. Karanjani, Tal. Dapoli. Reg. No. 27032 Contact No. 8149403581	2006	No	20	36	No	1	17°35'36.10"N	73°10'16.20"E
DAP/IP/9	M/S Super ice plant, Vanoshi Tarfe Panchanadi, Tal. Dapoli, Dist. Ratnagiri. Reg. No. Contact No. 9921252419	2003	1011	5	27	No	0	17°36'36.00"N	73°10'16.90"E
DAP/IP/10	M/S J. K. Enterpriges, Dapoli, Ratnagiri Reg. No. Contact No. 02358234558/ 551069	2001	1350	18	32	10	2	17°47'02.20"N	73°07'51.70"E
GUH/IP/11	M/ S Kokan ice factory, Hissa no. 2, S. No. 69, Shrigargali, Tal- Guhagar, Dist-Ratnagiri. Reg. No. 2892 Contact No. 8237160103/9226120858	2004	1524	16	32	No	0.5	17°29'24.9"n	73°15'08.0"e
RTN/IP/12	M/S Alim arafat ice factory, S. No. 822-A, H. No. 123-6, Rahatgar, Ratnagiri. Reg. No. 2831 Contact No. 02352-232639	2002	1532	20	50	No	1	16°59'38"N	73°16'57"E
RTN/IP/13	M/S Bhagavati ice and cold storage, Plot No. 36, Fisheries Zone, Pethkilla, Ratnagiri. Reg. No. 2817 Contact No. 2352233158	2002		23	50	No	3	16°59'42.10"N	73°16'49.2"E

Table 3 continued....

Table 3 continued....

RTN/IP/14	M/S Clifton ice and cold storage, A-1/2, Pethkilla, Ratnagiri. Reg. No. 2670 Contact No. 9270704557	1999	1024	30	60	50	3	16°59'43.00"N	73°16'52.2"E
RTN/IP/15	M/S Gee square exports (i) pvt. Ltd. Plot No 169, Murugwad, Bhagawathi Bunder Road, Ratnagiri Reg. No. 1101 Contact No. 02352-232171/232172	2007	3000	80	150	No	1	16 59 35.50 N	73 18 01.13 E
RTN/IP/16	M/S H. D. Naik industries, Pethkilla, Ratnagiri. Reg. No 82337 Contact No. 02352-232553	1995	32022	120	120	No	2	16°59'45.3"N	73°20'10.3"E
RTN/IP/17	M/S H. Maryam ice and cold storage, Plot No.33 Mirkarwada, Fisheries Zone, Ratnagiri Reg. No.2703211039 Contact No. 02352-232225	2007	1000	20	40	No	2	16°59'41"N	73°16'49"E
RTN/IP/18	M/S Haji Ali ice plant, Plot No.-11, Fishing Zone Mirkadwada, Ratnagiri Reg. No. Contact No. 9096023011	2007	600	40	40	No	4	16°59'46.3"N	73°16'46.4"E
RTN/IP/19	M/S Hanjar ice and cold storage, Plot No.169, Murugwada, Ratnagiri Reg. No. 2883 Contact No. 02352-232171	1991	No	80	100	No	2	16°59'41.10"N	73°16'49.25"E
RTN/IP/20	M/S Hazi amirbi ice factory, S. No. 142, H. No.1- D, Mirkarwada, Ratnagiri Reg. No. 2519 Contact No. 02352-232956	1998	No	40	80	No	2	16°59'57.4"N	73°16'58.40"E
RTN/IP/21	M/S Kadri ice and cold storage, Zadgao Road, Ratnagiri Reg. No. Contact No. 9272676790	2010	1200	20	42	40	1.5	16°59'49.5"N	73°17'13.3"E
RTN/IP/22	M/S Khadeeja ice and Cold storage, Mirkadwada, Ratnagiri Reg. No. 15544 Contact No. 02352-204353	2001	1900	57	60	110	1	16°59'46.70"N	73°16'53.10"E
RTN/IP/23	M/S Kokan ice and cold storage, C-69, Midc, Mirjole. Ratnagiri Reg. No. Contact No. 02352-232791	2001	No	120	120	No	5	16°59'45.3"N	73°20'10.3"E
RTN/IP/24	M/S Kokan marine products, S.No.42 And 123, Pethkilla, Ratnagiri. Reg. No. 2719 Contact No. 02352-232186	2000	No	60	60	No	3	16°59'37.80"N	73°16'56.50"E
RTN/IP/25	M/S Laiba ice and cold storage, K-31, Midc, Zadgao Block, Ratnagiri. Reg. No. 15544 Contact No. 02352-232223	1999	1208	50	91	600	3	16°59'56.6"N	73°18'28.4"E
RTN/IP/26	M/S Naik seafood prt. Lim. At/Post-Karla, Diat-Ratnagiri Reg. No. Contact No. 02352-241388	2005	1624	40	50	30	1.5	16°58'26.00"N	73°18'27.70"E
RTN/IP/27	M/S Nooman ice factory and cold storage, Plot No.43 and 44, Udyamnagar, Ratnagiri Reg. No. 2116 Contact No. 02352-222201	1990	No	40	60	No	2	16°59'40.6"N	73°18'25.4"E
RTN/IP/28	M/S Pawas fisherman co-operative society of ice plant, At/Post-Pawas, Ratnagiri Reg. No. Contact No. 9226782641	2009	15000	40	40	100	1	16°59'26.2"N	73°18'20.5"E
RTN/IP/29	M/S Saibaba ice factory Plot No. 58 Nagarprishad Vasahat, Zadgao, Ratnagiri Reg. No. 2770 Contact No. 02352-232044	2001	1024	30	60	No	0.5	16°59'50.9"N	73°17'13.6"E
RTN/IP/30	M/S Sangitta jindal ice plant, At/Post-Jaigad, Taluka/Dist-Ratnagiri Reg. No. Contact No. 9975962436	2006	1011	10	40	20	4	17°16'44.6"N	73°13'28.6"E

Table 3 continued....

Table 3 continued...

RTN/IP/31	M/S Shankar mahadev ice plant, Bhagvati Road, Pethakill, Ratnagiri Reg. No.Contact No. 9326610808	1997	1015	14	25	No	1	16°59'43.8"N	73°16'55.4"E
RTN/IP/32	M/S Sidhanath ice factory and cold storage, Midc, Nagar Parishad, Zadgaon, Ratnagiri Reg. No.Contact No. 9404763711	1998	1011	12	24	12	1	16°59'50.3"N	73°17'15.1"E
RTN/IP/33	M/S Teelani Marine products, A-1, Yash Residency, 80ft Road, Mandavi Ratnagiri Reg. No.Contact No. 02352-232054/232185	1997	No	30	60	No	1	17°13'28.6"E	73°16'45.8"E
RTN/IP/34	M/S Zam-zam ice factory, Plot No.18 Mirkarwada, Fisheries Zone Ratnagiri Reg. No. 2788Contact No. 02352-233530	2001	No	25	40	No	2	16°59'46.70"N	73°16'53.10"E
RTN/IP/35	M/S Swastik ice factory, At/Post-Nate, Tal-Rajapur, Dist-Ratnagiri. Reg. No. 2676Contact No. 9270323519	1999	9036	30	80	0	0.5	16°37'57.8"N	73°21'26.4"E
RTN/IP/36	M/S Muraslin ice and cold storage , At/Post-Nate, Tal-Rajapur, Dist-Ratnagiri. Reg. No.Contact No. 9221543299	2000	1208	50	50	0	1	16°38'45.00"N	73°21'58.80"E
RTN/IP/37	M/S Ice vashidgruh sakharinet fisharman ice plant, Fansevani, Sakharinate, Dist-Ratnagiri Reg. No.Contact No. 02353-650386	1999	1660	35	65	93	2.5	16°37'40.80"N	73°21'02.40"E
RTN/IP/38	M/S Gagngiri ice factory, B-78, Lote Parshuram Midc, Khed, Ratnagiri-415722 Reg. No.Contact No. 02352-272506	1997	900	6	20	No	20.2	17°36'42.40"N	73°29'15.20"E
RTN/IP/39	M/S Ganesh ice factory, B-69/2, Midc Lote Parshuram, Tal-Khed, Dist. Ratnagiri Reg. No. 2950 Contact No. 02356-272226	2006	900	10	20	No	19.8	17°36'45.3"N	73°29'10.3"E
RTN/IP/40	M/S Laxmi-ganesh ice industries, B-69/3, Midc Lote Parshuram, Tal. Khed, Dist. Ratnagiri Reg. No. 2959 Contact No. 02356-272347	2007	1011	10	20	No	23.6	17°35'50"N	73°30'09.8"E
RTN/IP/41	M/S Madhupeya products, Teen Batti Naka, Nagarpalika, Tal.Khed, Dist.Ratnagiri Reg. No. 26 Contact No. 02356-263070	2000	3000	20	40	No	0.65	17°43'07.3"N	73°23'34.6"E
RTN/IP/42	M/S O.k. Ice plant and cold storage services, B-70/4, Midc, Lote, Tal. Khed, Dist. Ratnagiri Reg. No. 14 Contact No. 02352-272275	1989	1215	15	40	No	19.6	17°36'43.9"N	73°29'11.00"E
RTN/IP/43	M/S Pinto fruti processing otari ice industries, B-67, Midc Lote Parshuram, Tal. Khed, Dist. Ratnagiri Reg. No. 2213 Contact No. 02356-272347, 94223773544	1993	2011	6	40	No	19.7	17°36'50"N	73°29'09.8"E
RTN/IP/44	M/S Raj ice factory, A/P. Awashi, Tal-Khed, Dist-Ratnagiri. Reg. No. 2750 Contact No. 02356-273195	2001	1800	35	60	15	17.4	17°37'32.4"N	73°28'27.4"E
RTN/IP/45	M/S Shri ganesh ice factory, B-69/3, Midc Lote Parshuram, Tal. Khed, Dist. Ratnagiri Reg. No. 2264Contact No. 02356-272225	1994	1011	15	30	No	19.6	17°36'45.5"N	73°29'09.8"E
RTN/IP/46	M/S Shri Anant Kurpa ice plant, Karad road, Chiplun, Dist- Ratnagiri Reg. No.Contact No. 02356-252834	1950	30000	25	50	No	3	17°31'48.2"N	73°31'06.0"E
RTN/IP/47	M/S Otari ice and food products, At/Post- Kalamaste, Tal. Chiplun, Dist. Ratnagiri Reg. No. 2431 Contact No. 02356-272347	1996	15000	15	40	No	2	17°32'09.8"N	73°30'35.7"N

into several clusters. Clusters belonging to land area in the images were assigned with pixel value of high and those belonging to water areas were assigned with pixel value of zero, so as to produce binary images with land and water classes.

Georeferenced data sets of fish processing and allied industry were created in the personal geodatabase. The feature class of each fisheries resource was created using the Microsoft Access database of fish processing and allied industry (Flow chart 1). The database of the collected information was generated and was linked to the geolocation of identified objects by using GIS capabilities of ArcGIS software 10.1. Map composition satellite images was performed in ArcMap 10.1 to generate digitized maps of seafood processing plants and allied industry of Ratnagiri district.

RESULTS AND DISCUSSION

Ratnagiri district alone contributes more than 19.5% of the total marine fish production of Maharashtra. There are 43 landing centres to land the marine fish production of Ratnagiri district. The total marine fish production of Ratnagiri district during 2012-13 was 87690 mt (Anonymous, 2014a). This has resulted in the nine establishment of seafood processing unit in the Ratnagiri district (Map 2). The nine fish processing plants observed in the Ratnagiri district were only in the Ratnagiri block. The establishment of these plants in Ratnagiri block may be because the availability of required raw material from nearby landing centres in the block. The total fish processing and surimi production capacity of processing industry in Ratnagiri district was 510.7 t and 73.20 t per day, respectively (Table 2). Fish processing industry in India was established to process mainly shrimp for export prior 1973 (Kurian and Seabastian, 1993), but later on due to demand from the international market for other product such as squid and fish, these industries started processing these items. Surimi is being produced by only two plants in Ratnagiri district and required fish for processing is being procured from the stations outside the Ratnagiri district as well as from other neighbouring states. Two fish meal plants were observed, these plant producing fish oil and fish powder by wet reduction technique. This plant was working on the principle of wet reduction and was mainly processing oil sardine for the production of fish meal and fish oil. Ratnagiri is the major landing centre of oil sardine production in Ratnagiri district was 31,645 t during 2012-13 (Anonymous, 2014a). Altogether two fish meal plants and four pulverizing units were also observed in Ratnagiri during the present study. Ice is commonly used for onboard preservation of fish by fisher as well as for transportation of fish up to market

by intermediaries, therefore, 47 ice plants were observed in Ratnagiri district. The details of ice plant are given Table 3 and its geographical location is shown in Map 3. The increased use of ice has augmented the establishment of ice plants in the coastal region. Jadhav (2008) reported that 18 number of ice plant in Ratnagiri block of Ratnagiri district but during present study 23 ice plants were observed in Ratnagiri block of Ratnagiri district and five were establish after 2008. Ghatge (2008) have also mapped the fish processing and allied industry in Greater Mumbai region. On the North West Africa (Caddy and Gracia, 1986) on the similar line the ice plants and fish processing plant of the Ratnagiri district have been mapped by using the Remote Sensing and Geographical Information System (GIS).

CONCLUSION

The present study encompasses to map the processing and allied resources contributory to fisheries. The fish processing resources such as seafood processing plant, fish meal and pulverizing unit were mapped, while ice plant as allied industry. Ice plant were observed in six block coastal as well as adjacent blocks with twenty three number in Ratnagiri block, while processing units, fish meal plants and pulverizing units were observed in Ratnagiri block. Ratnagiri is the headquarters of the district and block is well developed with respect to infrastructure. In addition to this found the major landing centre of Ratnagiri district, Mirkarwada is also situated in Ratnagiri block. These may be the reasons for establishment of concentrated fish processing and allied resources in Ratnagiri block. This information will be beneficial for planners as well as the business men to plan and decide the business strategies, respectively.

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