Paper - 204 CBCS
From a research Paper.

AQUACULTURE INFORMATICS: INTEGRATION OF INFORMATION TECHNOLOGY AND AQUACULTURE IN INDIA

Dr. Angsuman Chanda

I. INTRODUCTION

Aquaculture would face many challenges over the next decade, notably, combating diseases and epizootics, brood stock improvement and domestication, development of appropriate feeds and feeding mechanisms, hatchery and grow-out technology, as well as water quality management. All these are the present considerable scopes for biotechnological and other technology interventions. [1] Aquaculture informatics or Aquainformatics can be described as the scientific application of information technology in biological concepts that enhance the productivity and economic viability of its various industrial sectors.

The amount of digitally available Aquaculture information is growing exponentially and appropriate steps need to be undertaken to facilitate sharing and consequently reduce costs. These Aquaculture information resources, sometimes located in proprietary applications and using dissimilar data models, hamper information sharing [2]. Additionally, information system designers are sometimes unaware of existing design methodologies, data description standards or freely available tools or applications. The goal of this paper is to bring these new implementers together in a single hub, thus providing both for existing systems and allowing them to contribute to the creation of new ones.

II. AQUACULTURE IN INDIA

India ranks fourth in global fish production [3] and only second [4] to China in the inland fish production. Around seven million people of India are engaged in fisheries and ancillary industries. The fisheries sector contributes around 1.5 percent of the total GDP and around 5 percent to the GDP from the agriculture sector. The fisheries sector contributes over Rupees 6,000 crores to the export earnings. The potential brackish water area available in the coastal region of the country for shrimp culture is estimated between 1.2 and 1.4 million ha. Presently an area of about 1,57,000 ha is under culture with an average production of about 1,00,000 tones per year. Cultured shrimps contribute about 50 percent of the total shrimp exports. Presently the technology adopted ranges from traditional to improved traditional culture within the Coastal Regulation Zone (CRZ) and extensive shrimp farming aside the CRZ. About 91 percent of the shrimp growers have a holding between 0-2 ha, 6 percent between 2 and 5 ha and the remaining 3 percent have an area of 5 ha and above. There are around 260 shrimp hatcheries in this country with an installed production capacity of 11 billion times. About 200 hatcheries are in operation producing about 7 billion shrimp larvae. There are about 33 feed mills whose annual production capacity is 1, 50,000 mt. The current feed requirement is in the tune of 1,35,000 mt. Shrimp farming provides direct employment to about 0.3 million people and its ancillary units provide employment to 0.6-0.7 million people. Environmental issue has always been the point of conflict in shrimp farming development (Supreme Court's Judgment in Writ Petition No 561 (C) of 1994). While production from capture fisheries has stagnated, aquaculture is now viewed as a strong option to increase fish production as it plays a vital role in providing food security [5].

India has moved from the food shortages to self-sufficiency and even exports [6]. While productions of aquaculture commodities have increased tremendously in the last few years, there has been a drastic reduction in productivity and quality. Inefficient resource utilization and unsustainable fishing and aquaculture practice like use of saline water in agriculture land and intensive culture resulted in imbalance in the Industry. Another major

difficulty is competing nations. In order to gain an advantage in the highly competitive global market and to make major profits in the export market, there is an increasing demand for professionally qualified people in this sector. In this context, Aquaculture informatics promises rays of hope. It has a lot of potential in vitalizing the industry and generating huge job opportunities in this sector.

III. ROLE OF INFORMATION TECHNOLOGY

The role of information technology becomes more and more influential to ways of life for all people including fish farmers due to its rapid development. Information technology now represents one of the suiTable- tools for the prosperity of Indian aquaculture. In broad sense, Aquaculture informatics is the application of Information Technology in the field of aquaculture. The application may be in the form of precision farming, analyzing aquaculture information, developing database and algorithms for aquaculture research, analyzing genetic information, transfer of technology, Aqua-business etc. Various Aquaculture informatics based tools like Decision support systems, Remote sensing, Farmer Information System, Management Information System, Geographical Information System, Farm management software and aquaculture databases can provide effective and timely solutions to many problems in aquaculture [7, 8]. (see Fig 1)

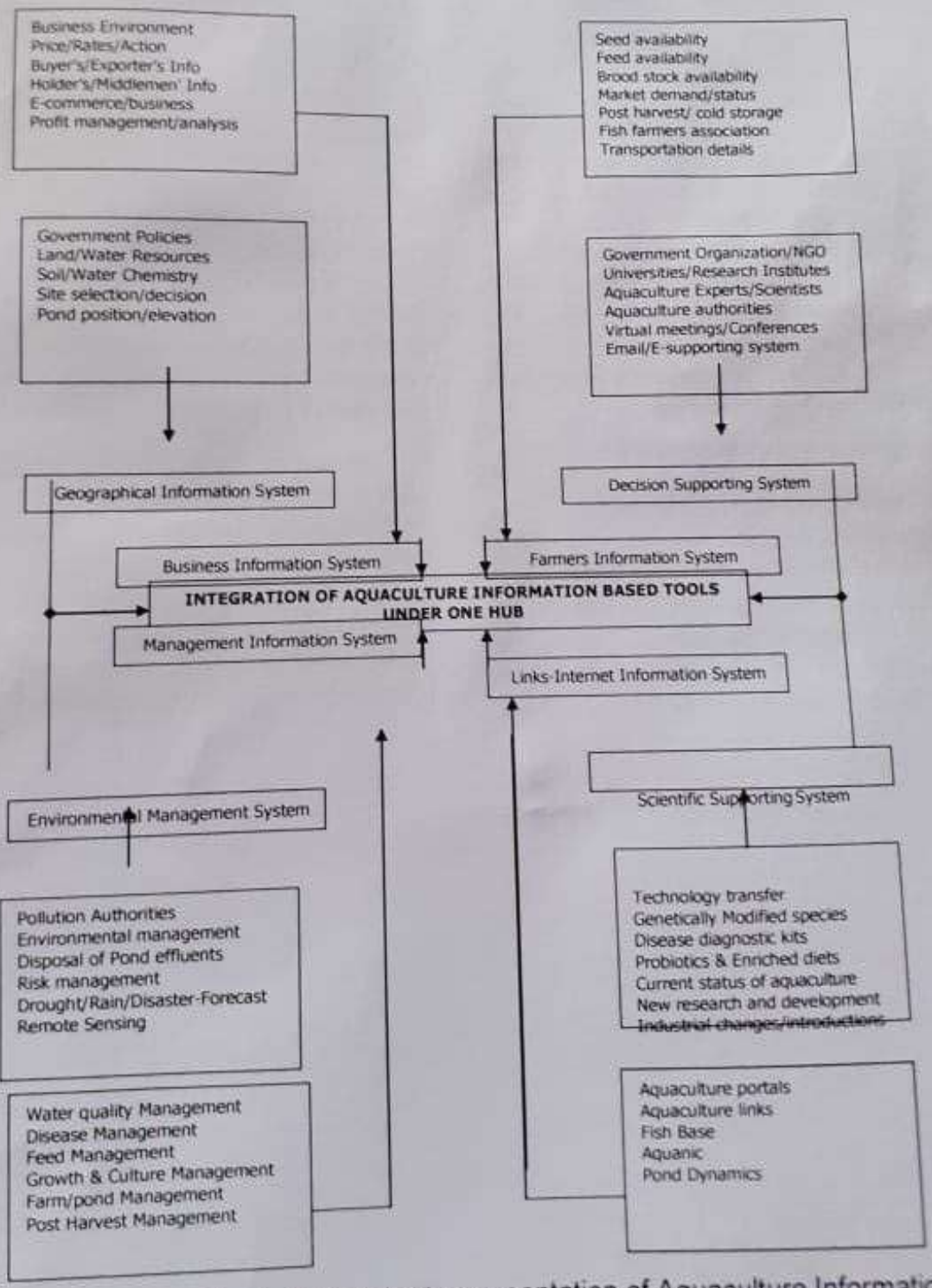

Fig. 1. A flow chart representation of Aquaculture Informatics

To develop the aquaculture sector improved communication strategies are needed, particularly through extension delivery system and Information Technology [9]. Information is power for any sector. Especially in farming, information is the

most important resource that our farming systems are impoverished of [10]. The fish farmers are indigent of the information about potential demand for their fish crops in a specified time schedule, process prevailing in different places, availability of aquaculture inputs such as seed, feed and weather conditions etc. Consequently, fish farmers have not been able to tune themselves to cover their farm area with appropriate fish crops that might minimize risks and maximize profits. Aquaculture informatics is the key to triumph over these hurdles by using its various technologies. For instance, Farmers Information system is a unique type of system where a farmer can get all the aquaculture related information regarding various fish crops, aqua feed details, market information, credit details, transport details and more, at single platform so that he can plan each and every stage of his fish husbandry and can earn maximum.

IV. DECISION-MAKING

Decision making at critical stages is important for the successful fish production, for that the modern farmer often relies on aquaculture specialists to assist him. Unfortunately, aquaculture specialists are not available for consultation at a point of time when fish farmers need them. To solve this problem, Expert system will be developed. Expert system will be a special computer program designed to capture the knowledge generated by the vast network of Aquaculture scientists and encapsulate their expertise to help fish farmers and extension workers in making the required decision for raising the successful fish. The expert system will be designed to answer questions entered to a computer on such diversified topics even for individual fish crops [11]. For example "Shrimp Marketing Advisor" is an expert system for determining marketing alternatives and supports shrimp producers in finding optimal strategies. Individual shrimp farm conditions are considered. Information on post harvest and cold storage availability, price level, price trends government program eligibility, and timing are required as input data. The application of genetics principles to increase production from aquatic animals currently lags far behind that of the plant and livestock sectors. Only a small percentage of farmed aquatic species have been subject to genetic improvement programs [12].

V. INTEGRATING TECHNOLOGIES

Ecological zoning system, methodology and software use several databases, models and decision support tools for better planning, management and monitoring of land resources. Expert system is motivating researchers and professionals to investigate possible application of Expert System in diverse disciplines or modern aquaculture. The use of simulation models as decision support systems can offer an ideal means of achieving economical, environmentally safe and sustainable fish management. "Precision farming" is a current buzzword coined among aquaculture and agriculture circles [13]. The term precision farming means carefully tailoring soil and water management to fit the different conditions found in each pond or farm. Precision farming is sometimes called "prescription farming", "site specific farming" or "variable rate technology". Precision farming is the site-specific management practices are adopted giving due consideration to the spatial variability of land in order to maximize fish production and minimize the environmental damage. It has caused a focus on the use of three technologies that are Remote sensing, Geographic Information System (GIS) and Global Positioning Systems (GPS) [14]. Precision Farming has been evolved to prevent the excess and under-application of inputs and to avoid their ill effects. Soil fertility and water availability status differs from place to place even in the same field. The population of weed is never uniform throughout the fish farm and the pest and predator population also shows variability. Even a pathogen attack would not be uniform throughout the field. Precision aquaculture emphasizes on this aspect and deals with judicious fish management at micro level wherein only required amount of inputs are applied. Fish farmers have services available that involves satellites connecting data, transmitting location information, or providing data from a variety of sources. Fish farmers can analyze this satellite information or they can rely on companies to do this service for them for a fee. Precision farming will make a strong impact on the way fish farmers manage their farm operations in the future. Precision farming envisages precise packages of fish cultivation at micro level, which enable it to increase the productivity. Precision farming techniques closely meet environmental guidelines because fertilizers and pond preparation can be managed to apply to minimum needed for effectiveness.

Remote sensing technology by virtue of many advantages has become a very useful tool in the hand of scientists, planners and administrators to obtain accurate information on various aspects of fish crops, soil, water and land use. GIS technology is being increasingly employed by different users to create resource databases and to arrive at appropriate solutions/strategies for sustainable development of aquaculture resources [15]. The application of remote sensing and GIS techniques in the management of aquaculture resources are increasing

rapidly due to improvement in space borne remote sensing satellites in terms of spatial, special, temporal and radiometric resolutions. Many of conventional approaches of handling multi-thematic information to arrive at optimal solutions are being computerized using GIS utilities. GPS makes use of a series of satellites that identify the location of farm equipment within a meter of an actual site in the field [16].

VI. GENETIC IMPROVEMENT OF FARMED TILAPIA

The Genetic Improvement of Farmed Tilapia (GIFT) project in Asia is an example of a programmed aimed at examining the genetics of an important farmed fish species [17]. The GIFT project has been working with Nile tilapia hybrids and strains in culture around the region, with a view to development of purebred lines and the distribution of strains of improved performance to farmers. The programme is a collaborative effort between ICLARM (International Centre for Living Aquatic Resources Management) headquartered in Malaysia and research institutions in Malaysia, Philippines, UK and USA. The programme has not yet reached the full commercial phase and the 'improved' tilapia in most of the participating countries is still under evaluation by fisheries scientists. The program has, however, shown considerable potential for improving farm production. Similar breeding programmes for commercially important carps could bring comparable benefits. Indeed, because carp fry production is typically more centralized that is the case for tilapia, the spread of improved stocks could occur more readily. The question is whether Indian fish farmers are aware of this technology transfer or not [18, 19, 20].

VII. TRANSGENIC TECHNOLOGIES

Transgenic technologies can enhance growth rates and market size, feed conversion ratios, resistance to diseases, sterility issues and tolerance of extreme environmental conditions. In the shrimp aquaculture sector, transgenic shrimp have been reported, but there has been no successful development till date for commercial culture. However, the use of transgenic organisms in aquaculture (as in other sectors) is controversial and issues of consumer education and acceptance must be addressed [21]. Carp and tilapia culture in Asia is benefiting from genetics research in a number of areas, including genetic sequencing and the development of specific genetic markers. Markers are short unique pieces of genetic code that can help locate genes that are important for growth, sex determination factors or disease susceptibility. Improving genetic understanding across millions of small-scale farms in India is a difficult challenge, especially since traditional approaches have focused on improvement of core stocks that can then be distributed to farmers. [22, 23]

VIII. NUCLEIC ACID (DNA & RNA) BASED PROBES

Considering the major contribution of Penaeus monodon to the global shrimp production and the economic loses encountered due to both facultative and opportunistic disease outbreaks [24]. It is appropriate and timely to concentrate further research to develop specific and non-specific resistant broodstock – especially for P. monodon. Infectious disease is currently the single most devastating problem in shrimp culture and presents ongoing threats to other aquaculture sectors. In addition, there is increasing concern over the consequences of newly emerging disease in aquaculture. Conventional methods of controlling such diseases, such as chemotherapeutants, are ineffective for many new pathogens; thus, molecular techniques are receiving increasing attention for pathogen screening and identification. The increased sensitivity and specificity conferred by nucleic acid (DNA & RNA) based probes has provided significant inroads for early detection of diseases and identification of sub-clinical carriers of infections. This has had a direct effect on enhancing preventive management and control of disease in cultured species. In shrimp aquaculture, commercially available molecular probes have been developed for type-A baculo virus, whereas commercial probes for other viral pathogens, such as white spot are still under development. As noted above, nucleic acid probes are extremely sensitive and can detect microbial infections before they progress to produce clinical signs. But this information should be encapsulated to fish farmers, which inturn pinpoint the need of information and communication technology or Integration of aquaculture information based tools under one hub [25].

IX. E-PROCUREMENT AND E-AUCTION

The values of men, material and money are saved if we introduce the e-procurement and e-auction. If fish farmers in India are aware of e-commerce then they can connect to the business environment from their place with the help of Internet through e-procurement and e-auction. For example, Biz Dimension Co., Ltd. is the leading service provider of e-procurement and e-auction in Thailand. They have been helping hundreds of organizations, both in the private and public sectors, in streamlining and consolidating their procurement activities on numerous products (including shrimps and fin fishes) and services. They have achieved a success rate of over 95% on all auctions and their clients' total accumulated cost savings have exceeded Baht 100 million (www.bizdimension.com). We can achieve these kinds of e business activities through the Integration of aquaculture information based tools under one hub.

Example 1

In the state of Tamil Nadu, on the east coast of India shrimp farmers in the Thanjavur district have formed village level associations and organize regular meetings to follow good management practices for achieving eco-friendly and sustainable shrimp farming. One of the best examples of this association is the "Thambikottai-Vadakadu Shrimp Farmers Association" The members of this Association consult themselves before initiating pond preparation, introducing water in their ponds, selection and stocking of seed, feed management, shrimp health management, prevention of disease, formation of separate channels for draining out waste water, harvesting time, fixing of price, etc.

The Association members also inspect the shrimp hatcheries located at Chennai and Marakanam areas and collect seed samples for testing in three different PCR laboratories to ascertain the presence/ absence of pathogens. The tested seed is purchased in bulk, which is then divided amongst the members of the association to suit their requirement. If a viral disease affects any of the farmer's crop, all precautionary measures are taken to prevent the spread of the disease to the other ponds. The association also compensates the affected farmer's loss. The association takes responsibility of civil infrastructure like laying roads and providing drainage canal and street lamps to the villages adjacent to shrimp farm cluster. The association also organizes meeting of the members on fortnightly basis, discusses and solves their problems with mutual consent.

Example 2

To promote cooperative approach in management of shrimp farming activities and other common issues that commonly arise in cluster-based shrimp farms, aqua clubs have been set up in Andhra Pradesh. A total of 128 aqua clubs with a membership of 3 367 farmers is now existing in the Stat However, one of the best initiatives of this kind is the Sri Subrahmanyeshwara (SS) aqua club in Mogalthur village in West Godavari district of Andhra Pradesh. The SS aqua club comprised of 58 farmers with 108 shrimp ponds spread over the area of 58 ha is mostly involved in small-scale, practice and improved traditional farming method with low cost investments. Based on the technical inputs provided by the Network of Aquaculture Centers in Asia - Pacific (NACA), Bangkok and the Marine Products Export Development Authority, Kochi, the farm level 'better management practices or the BMPs were demonstrated in the shrimp ponds of the SS aqua club with great success.

The above two initiatives by the shrimp farmers in the states of Tamil Nadu and Andhra Pradesh need to be replicated in other coastal states where shrimp farming is fast developing on commercial-scales.

XIII. ROLE OF SELF-HELP GROUPS IN FISHERIES (SHGS)

The southern districts of Tamil Nadu have witnessed significant increase in the number of fisherwomen Self - Help Groups (SHGs). Punnakkayal village in Tamil Nadu has the largest number of SHGs in an Indian village with over 50 groups consisting exclusively of fisherwomen.

Presently, there are several examples of successful fisherwomen SHGs in the region and their experiences need to be promoted to other states. Examples: The fish market at Neelankarai, a coastal village of Chennai on the east coast of India, is managed by fisherwomen belonging to 12 SHGs. The management practices established by this group demonstrate their efficiency and unity. Similarly, the SHGs formed by fisherwomen in Vellapatty village in Tuticorin has enabled its member to conduct individual business proposals involving a wide range of activities, including fattening of crabs for sale in the local market. These SHGs also have good linkages with the NGOs who have helped them in promotion of their business.

XIV. CONCLUSION

Though there are significant developments in various aquaculture sectors around the world, aquaculture in India is still at its infancy and to use the information from different parts of the country. It is nation's part to educate fish farmers and to provide an information system through farmers association [29], in low cost, to fulfill their requirements. Industries and Research institutes in India will work on it for the blue revolution. Activities that improve communication and networking within the region were highlighted as an important means of developing and communicating the knowledge base of aquaculture. Advances in electronic communication, combined with specific cooperative efforts, should be used to increase the information exchange in the region[14]. For efficient management of aquaculture resources, the information generated by various institutes or organizations should be brought under one hub for the benefit of research scientists as well as fish farmers. The information communication technology such as the Internet is now dynamically changing our life style and social consciousness will provide us a best tool for the information sharing in the field of Aquaculture. Several models such as fish growth prediction, decision support, precision farming and GIS ensure effective and sustainable fish production. A large number of trained professionals in aquaculture along with Information Technology are the immediate need of this Aquaculture informatics industry in order to accelerate the research, production and implementation. Thus, the

importance of the studies on Aquaculture informatics is undoubtedly increasing and career / business opportunities are booming. The success of the Blue Revolution of the earlier decades will now have to be repeated through a "Digital Revolution" for an evergreen revolution.

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X. SHORT MESSAGE SERVICE

As mobile phones are common to each level of community, information can be passed thorough short message service also. As an example, ThaiFarmZone.com is launching a new information service for entrepreneurs and interested parties in the Thai shrimp industry. The new service is to deliver the daily black tiger shrimp prices from Mahachai central market at Samutsakorn province to the subscriber's mobile phone through short message service (SMS). The SMS shrimp price service is the latest feature provided by the website to serve the Thai agricultural and food sectors with an aim to make useful information accessible by users from anywhere at any time. This can be done by Integration of aquaculture information based tools under one hub.

XI. NEED FOR INFORMATION CENTERS

The advances made by information technology and its impact on aquaculture calls for a renewed thinking with regards to farming production, research and extension systems. A number of aquaculture revolutions over the past two decades have made the industry in India subsistent and sustainable but not self-sufficient. The plateau in the production levels and the difference between data acquired through research and ground truth with the farmers indicate that the information systems require fine tuning to decrease the gap between production and research findings. The backbone for all future information system endeavors will be to transform the aquaculture from subsistence level to commercial operations.

Various aquaculture and rural development projects support and initiate formation of different types of beneficiary organizations and provide technical and financial assistance to them. Such group approach to reorganize extension services has become the rule of the day. However organizations formed by farmers self initiative and engaged directly in providing extension services is rare.

XII. INTEGRATION OF AQUACULTURE INFORMATION BASED TOOLS UNDER ONE HUB

The information system designers, managers and owners will be have access not only to a website that brings together different resource types, but also to mechanisms that facilitate information sharing, consensus building and awareness raising. The aim is to provide all the tools necessary to facilitate interoperability between existing datasets and the creation of new systems using consistent and commonly accepted standards.

Efforts in the development of methodologies, standards and application development in the areas of Aquaculture and Rural Development are at present widely dispersed. The goal of this paper is to create a Hub for Aquaculture Information Management Systems, to allow sharing and promoting the uptake of common methodologies, standards and applications. The expected benefits are reduction in the costs for creation of new systems and increase in the quality of services provided to the users [26].

Due to globalization and liberalization, there is a change in the public extension approach where associations and self help groups are involved in educating the farming community. Integration of aquaculture information based tools in a single hub will be a design to work through a group of community or an association. Success of providing farm information depends on the public participation in these associations. This approach will create a confidence among fish farmers in team work and group mobilization. Fish farmers can learn, online, the best farm practices for their fish, prevailing prices and price trends of fishes in the Indian and world markets. In addition intricacies of risk management and the meteorological data could be accessed. Thus individual farmer get the benefit of expert knowledge for the cultivation and management of their fish crops.

XII. COMMUNITY BASED ORGANIZATION

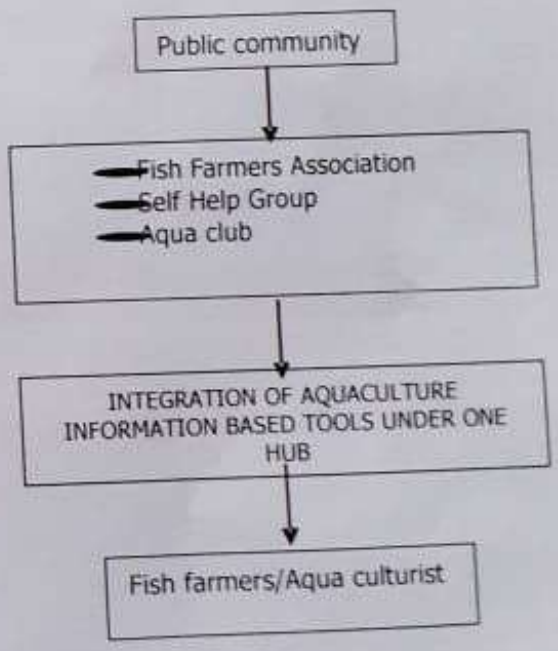
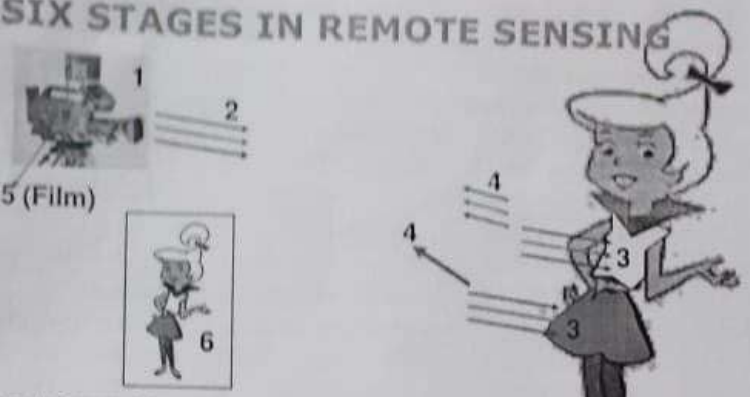


Fig. 2. Structure of the community based organization

Integration of Information technology with aquaculture in India is a societal task, which makes an attractive unit for the technical support to aqua farmers [27]. Providing information or introducing computer based skills to farmers is a task which can be taken up through a community based organization by fish farmers association / self help group / aqua club / bio village.

SIX STAGES IN REMOTE SENSING



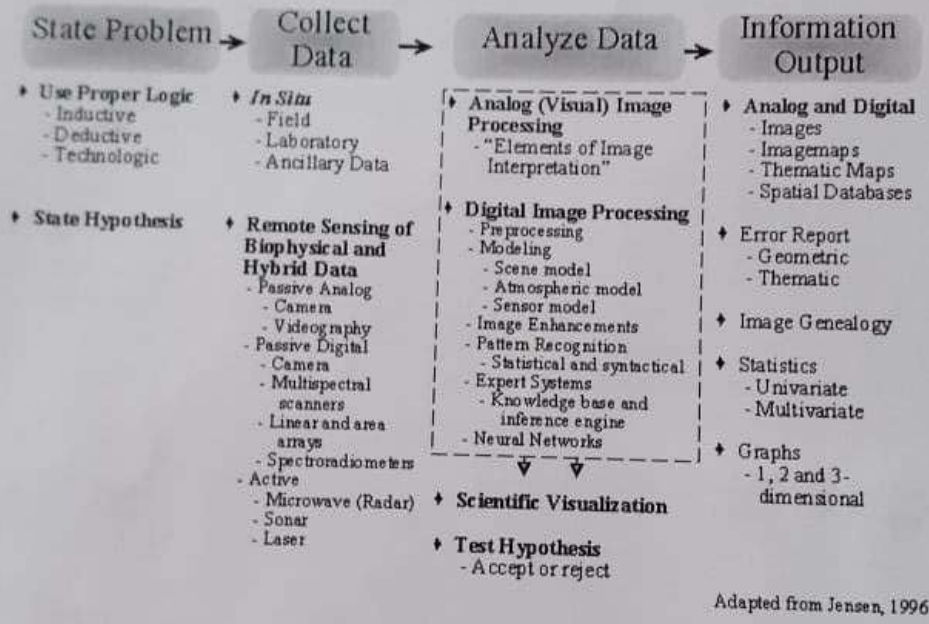
Stage-1. Source of energy
Stage-2. Transmission of EMR towards the Object
Stage-3. Interaction of EMR with the Object
Stage-4. Transmission of Interacted EMR towards the Sensor
Stage-5. Recording of the Image by the Detector
Stage-6. Analysis of the Imagery

Coastal Regulation Zone (CRZ) Share on email Share on facebook Share on twitter Share on print Share on google May 24, 20111 Comment India has a long coastline of 7,500km, ranging from Gujarat to West Bengal, and two island archipelagos (Andaman Island and Lakshadweep). Our coastal ecosystems provide protection from natural disasters such as floods and tsunamis to the 250 million people who live in our coastal areas. Coastal waters provide a source of primary livelihood to 7 million households. Our marine ecosystems are a treasure trove of biodiversity, which we are only beginning to discover and catalogue. Thus our coastline is both a precious natural resource and an important economic asset, and we need a robust progressive framework to regulate our coast. The Ministry of Environment & Forests has released the CRZ Notification, 2011 which has now replaced the CRZ Notification, 1991. Apart from that, the Island Protection Zone Notification, 2011 has been notified for the first time covering the Andaman and Nicobar Islands and Lakshadweep. Objectives: Protection of livelihoods of traditional fisher folk communities Preservation of coastal ecology Promotion of economic activity that have necessarily to be located in coastal regions. Background: The CRZ Notification 1991 has been amended for 25 times up till now and among the new features, it includes Goa, Kerala, Greater Mumbai and critically vulnerable coastal areas (CVCAs) like Sunderban Mangrove Area, Chilka and Bhitarkanika (Orissa), Gulf of Khambat and Gulf of Kutchh (Gujarat), Malwan (Maharashtra), Karwar and Kundapur (Karnataka), Vembanad (Kerala), Coringa, East Godavari and Krishna Delta (Andhra Pardesh), Gulf of Mannar (Tamil Nadu). Definition of CRZ Area CRZ area now includes the water area up to 12 nautical miles in the sea and the entire water area of a tidal water body such as creek, river, estuary, etc. Restriction on Fishing? The CRZ Notification does not impose any restrictions of fishing activities. Coastal Zone Management Plan The CRZ notification 2011 enshrines that concept of a Coastal Zone Management Plan (CZMP). It will be prepared with the fullest involvement and participation of local communities. No

which includes a combination of various disciplines such as optics, photography, computer, electronics, telecommunication and satellite-launching etc.

Posted by Sudur Samvedan at 12:05 AM

The Remote Sensing Process



Adapted from Jensen, 1996

development Zone The "no development zone" definition has been changed. It is reduced from 200 metres from the high-tide line to 100 meters only. This has been done to meet increased demands of housing of fishing and other traditional coastal communities. proposed enactment to protect the traditional rights of the Fishermen As per recommendation of the expert committee headed by Dr. M.S. Swaminathan, that Government should enact a law to protect the traditional rights and interests of fishermen and coastal communities, is under proposal. This law would be somewhat along the lines of the Forest Rights Act, 2006. Fishermen associations have supported this recommendation. The MoE&F has already prepared such a draft law in this regard and put it in the public domain for comments and suggestions. Regarding Coastal Zone Regulation law There has been a demand from fishermen associations that instead of having a Notification under Environment Protection Act, 1986, Government should enact a coastal zone regulation law to be passed by Parliament. This is because a notification does provide considerable flexibility to the Executive. The ministry acknowledges and appreciates that a law passed by Parliament will enhance public confidence and trust that amendments are introduced after adequate debate and Advertisement Comments
http://www.gktoday.in/coastal-regulation-zone-crz/

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Satellite/sensor : ADEOS/OCTS
Location : global ocean

Sea surface temperature of global ocean. The data is average value acquired from March 30 to April 5, 1997.

Satellite/sensor : MOS-1b/VTIR
Location : around Miyako Island

Temperature distribution of typhoon. Reddish co higher temperature, and bluish lower temperature

(2) Microwave sensor

Microwave sensors receive microwaves, which is longer wavelength than visible light and infrared ra observation is not affected by day, night or weather. There are two types of observation methods usin microwave sensor: active and passive.

a) Active type
The sensor aboard earth observation satellite emits microwaves and observes microwaves reflected by surface. It is suitable to observe mountains and valleys.

b) Passive type
This type observes microwaves naturally radiated from land surface. It is suitable to observe sea surfa temperature, snow accumulation, thickness of ice.

Satellite image observed by microwave sensor

Satellite/sensor : JERS-1/SAR
Location : Mt. Fuji and vicinity

Not being affected by clouds or moisture in air, this sensor can obse detail of land surface. Rough landform can be clearly seen.

The range of wavelength a sensor can observe depends on the type of sensor. This is because each sen a specific observation purpose and wavelength range to operate at to achieve it.
You can see specifications of sensors aboard earth observation satellites at this page.

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ZOOLOGY
Dr. Angsuman Chandra.

Type of sensor

We have learned that sensors play an important role to receive information from the ground. Here, we ll the various types of sensors. Sensor type is roughly divided into two: Optical sensor and Microwave sen

(1) Optical sensor

Optical sensors observe visible lights and infrared rays (near infrared, intermediate infrared, thermal i There are two kinds of observation methods using optical sensors: visible/near infrared remote sensing thermal infrared remote sensing.

a) Visible/Near Infrared Remote Sensing

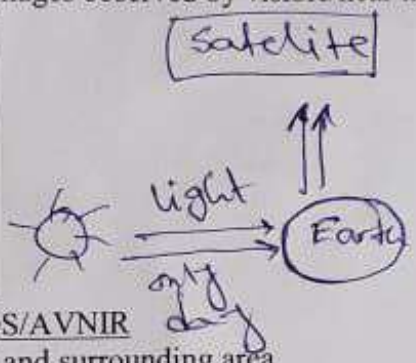
The observation method to acquire visible light and near infrared rays of sunlight reflected by objects ground. By examining the strength of reflection, we can understand a conditions of land surface, e.g., distribution of plants, forests and farm fields, rivers, lakes, urban areas.

During period of darkness, This method can not be observe. Also, clouds block the reflected sunlight, method can not be observed areas under clouds.

Satellite images observed by visible/near infrared remote sensing of optical sensor

Satellite/sensor : ADEOS/AVNIR
Location : Awaji Island and surrounding area

Gray depicts urban area, dark green is vegetation and blue is sea water.



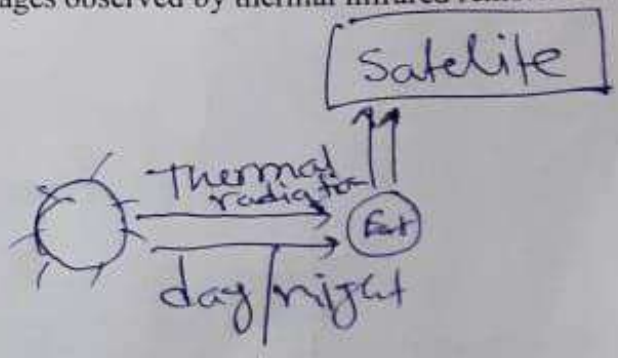
Satellite/sensor : JERS-1/OPS
Location : Kyoto

Green depicts vegetation and raspberry is urban a residential areas.

b) Thermal Infrared Remote Sensing

The observation method to acquire thermal infrared rays, which is radiated from land surface heated b sunlight. Also it can observe the high temperature areas, such as volcanic activities and fires. By exam the strength of radiation, we can understand surface temperatures of land and sea, and status of volcan activities and forest fires. This method can observe at night when there is no cloud.

Satellite images observed by thermal infrared remote sensing of optical sensor



interesting that the sea, one of our oldest channels of transportation, has been revolutionized by GPS, the newest navigation technology. Today we can find GPS receivers on vessels the world over, from hardworking fishing boats and long-haul container ships, to elegant luxury cruise ships and recreational boaters. GPS can be used to locate the best fishing holes without wandering into the wrong waters in the process. By providing more precise navigation tools and accurate landing systems, GPS not only makes sailing safer, but also more efficient. With precise point to point navigation, GPS saves fuel and extends fisher's range by ensuring captains don't stray from the most direct routes to their destinations. GPS accuracy will also allow closer fishing vessels separations on more direct routes, which in turn mean more vessels, can occupy our limited fishing grounds.

GPS technology helps with traffic routing, underwater surveying, navigational hazard location, and integrated mapping (Figure.1). Commercial fishing fleets use it to navigate to optimum fishing locations and to track fish migrations. Furthermore, the system is easier to operate than a traditional survey system as Total Station. So many applications of RTK-GPS have been investigated in Japan[4][5]. There were several GPS-Based Control Stations (GPS-Based CS) transmitting the correction data on a mobile radio communication system, called DMCA (Digital Multi- channel Access [6].

B. GPS in other Fields of Fisheries:

Fishing is the one of the primary producers and more profitable and sizeable% of GDP of coast based nations. With GPS applications, Fisheries Development can be done in many disciplines. Even the contour maps of productive grounds and existing fishery can be prepared and their magnitudes can be worked out. This will help to year- mark the targets of production and also to plan out resource exploration/exploitation. In exploration and exploitation of fishing grounds the spontaneous productivities during particular calendar months species-wise/size-wise. The Indian National Centre for Ocean Information Services (INCOIS), Hyderabad[7], an autonomous body of the Ministry of Earth Sciences (MoES) is the responsible agency for the generation and dissemination of PFZ information. INCOIS disseminates these advisories by Telephone, Fax, Internet, Email, Doordarshan as well as Electronic Display Systems. INCOIS forecast more than 300 stations of Potential Fishing Zone (PFZ) of entire country in its website www.incois.gov.in in two times for every week from the processed satellite images (Table.1). At present operational fishery forecast in India is based on the features observed in the SST (Figure.2) and Chlorophyll [8].

The information related to the PFZ will consist of the following.

a. GPS Readings: Latitude and Longitude in DMS format. (Ex: 17 25 55 N, 78 26 45 E)
b. Direction Information: One/Two Alphabetical characters like N,NE,E,SE,S,SW,W,NW
c. Bearing Angle Information: Maximum three numeric Letters (0-9). Ex: 154, 270, 90,265, 310, etc.
d. Distance Information: Maximum three numeric characters (Units in Kilometers)
e. Depth Information: Maximum four numeric characters (Units in meters/ local units)(weblinks).

By using even handheld GPS can identify the PFZ very easily which enhance the fish catch with less effort. For Example, Goa and Karnataka region's PFZ is given on 8th Feb 2010.

The data verified and validated by many scientists. The information was disseminated to Porbander for validation. Gill-netters used for experimental fishing. Suggested areas were located using GPS. The feedbacks received from fishing sites were analysed. The catch per gill net operation was normalised and compared with month wise normal catch available around Porbander. About 2-3 fold increase in the catch in PFZ area observed (figure.3) [9].

Table 1 Potential Fishing Zone (PFZ) of Southern Tamilnadu Coast from the processed satellite images (INCOIS)

From the Coast of	Direction	Bearing In Degrees	Distance in Kilometres		Depth in Metres		Longitude / Latitude
			From	To	From	To	
Point Calimere	NE	64	78	83	200	500	80 31 29.75 E 10 35 47.47 N
Vedaranniyam	NE	70	77	82	200	500	80 31 36.95 E 10 37 14.13 N
Velanganni	SE	93	72	77	200	500	80 31 44.12 E 10 39 16.89 N
Nagappattinam	SE	101	72	77	200	500	80 31 29.75 E 10 37 28.57 N
Nagore	SE	103	75	80	200	500	80 31 44.16 E 10 38 40.79 N
Karikal	SE	110	77	82	200	500	80 31 58.56 E 10 39 31.34 N
Tranquebar	SE	117	81	86	200	500	80 31 44.16 E 10 40 29.13 N
Kaverippattinam	SE	124	87	92	200	500	80 31 44.16 E 10 39 31.34 N
Covelong - Kovalam	NE	33	74	79	200	500	80 37 58.66 E 13 22 00.42 N
Cathedral - Madras	NE	53	47	52	200	500	80 37 51.46 E 13 18 59.88 N
Madras	NE	57	42	47	200	500	80 37 58.66 E 13 20 12.10 N
Ennur	NE	69	33	38	200	500	80 37 51.46 E 13 21 31.93 N
Pulicat	SE	102	32	37	200	500	80 37 44.26 E 13 21 09.87 N

Paper. 204 CBCS
ZOOLOGY

Application of Gps in Fisheries and Marine Studies

Dr. Angsuman Chanda.

I. INTRODUCTION

Global Positioning System is a satellite based navigation system determining the accurate position or location of an object on earth's surface. It stands for NAVSTARGPS (Navigation Satellite Timing and Ranging Global Positioning System). A GPS receiver's job is to locate four or more of these satellites, figure out the distance to each, and use this information to calculate its own location. This operation is based on a simple mathematical principle called triangulation. In a sense it's like giving every square block on the planet a unique address. When people talk about a "GPS", they usually mean a GPS receiver in order to calculate the exact position on earth. GPS receiver measures the signal transit time between the point of observation and four different satellites whose positions are known. Each satellite transmits its exact position and its precise on board clock time to earth at a frequency 1575. 42 MHz. These signals are transmitted at the speed of light (300,000 km/sec) and therefore require approximately 67.3 m/s to reach a position on the earth's surface located directly below the satellites. Further 3.33micro second is required for the signals for each excess kilometre of travel. By comparing the arrival time of the satellite signal with the on board clock time, the moment the signal was transmitted, one can determine the transit time.

They were among 1200 GPS-Based CS established at present by the Geographical Survey Institute (GSI) of Japan in order to observe crustal movement for seismic prediction. And since December 2000 for about one year, three types of network-based RTK-GPS[1], the MultiRef of the Calgary University in Canada, the Virtual Reference Station (VRS) of the Trimble Terrasat and the Reference net of the Geo++ GmbH in Germany known as FKP[2] (flachen-korrectur- parameter) system, were operated experimentally and simultaneously in Tokyo area. The methods had been well tested and evaluated by many groups of surveyors and navigation engineers.

The Global Positioning System (GPS) is a world wide radionavigation system formed from a constellation of 24 satellites and their ground stations. It provides continuous three-dimensional positioning 24 hours a day throughout the world .The GPS technology has a tremendous amount of applications in GIS data collection, surveying, and mapping. The advent of geospatial information technologies including Remote Sensing (RS), Geographic Information System (GIS) and Global Positioning System (GPS), individually as well as jointly, are playing a significant role in the development and inclusive growth of the nation.

t and inclusive growth of the nation.

II. APPLICATIONS IN FISHERIES

A. Navigation:

Mapping the fishery and the resources should be among the priority tasks when planning for fisheries management and should not be postpone until "complete" information is available, since redundancies or blanks in the information base will more readily appear in the process of elaboration [3]. GPS helps us determine exactly where we are, but sometimes important to know how to get somewhere else. GPS was originally designed to provide navigation information for ships and planes. So it's no surprise that while this technology is appropriate for navigating on water, it's also very useful in the air and on the land. It's

Coromandel	SE	103	34	39	200	500	80 37 58.66 E 13 22 50.97 N

Figure 1

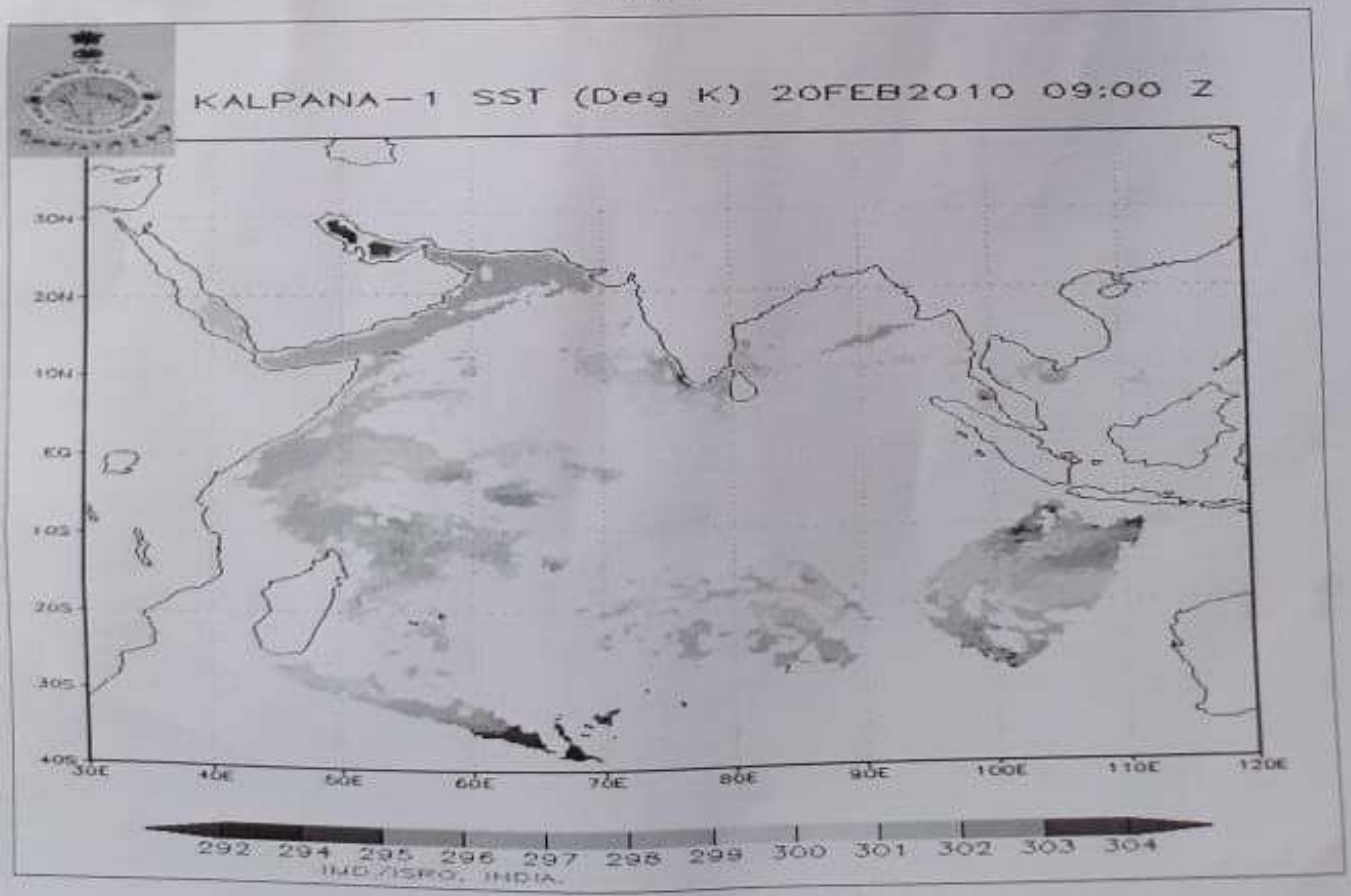


Figure 2 Sea Surface Tempe rapture (SST)

n. Coral reef, sea grass beds, sand dune, mangrove status, ecological benchmark
o. Study of coastal water bodies like swale, dune aquifers etc seasonally
p. Vulnerability of Coastal Communities and Ecosystems
q. LEO (Littoral Environmental observations) data periodically

E. Marine Engineering:

Differential GPS and RTK services is really the only economical way to obtain the repeatable positioning accuracy in 3 dimensions that is required for the following applications.

a. dredging for the maintenance of channels and port areas with very stringent horizontal and vertical absolute accuracy requirements
   i. cable and pipe laying
   ii. construction works
   iii. port approach, port manoeuvres

F. Mapping of Different CRZ:

a. Resetting of people in 200m, 400m and 500m in Coastal Regulation Zone I,II,III and IV of entire coastal regions of the country.
b. Assessment of activities along the coastal zone being undertaken by govt. /other agencies for rehabilitation during calamities.
c. Mapping for CZMP (Improve quality and accuracy of information; identify and facilitate approval processes to ensure all activities internalize environmental , social and economic concerns)
b. Mapping Coastal and marine ecosystem impacts

III. CONCLUSION

The Global Positioning System (GPS) is a revolutionary technology that is changing the way businesses operate in the field. From its origin as a military navigation technology to its use for "black box" tracking of trucks on the road, GPS technology has proven its worth to enterprises worldwide. The combination of GPS, GIS and remote sensing offers solutions that can reach into and improve every aspect of enterprise field operations. GPS and GIS are not only enabling Hydrographic Offices to enhance safety of marine transport by more effective and versatile products and services. It is also shifting the focus of hydrography to data processing ashore from data collection afloat. In addition to navigational safety, GIS has also enabled Hydrographic Offices to discharge their roles effectively in the fields of delineation of maritime boundaries. In recent years, most of the organizations engaged in geospatial technologies activities have felt the need for establishing control points, especially in marine studies. For these tasks, acquisition of Global Positioning System (GPS) has been increasing. Synoptic maps of the main concentrations of fisherman villages, fishing ports and beach landing points, markets, processing, freezing and transhipment points, coastal landforms can be studied with the help of GPS.

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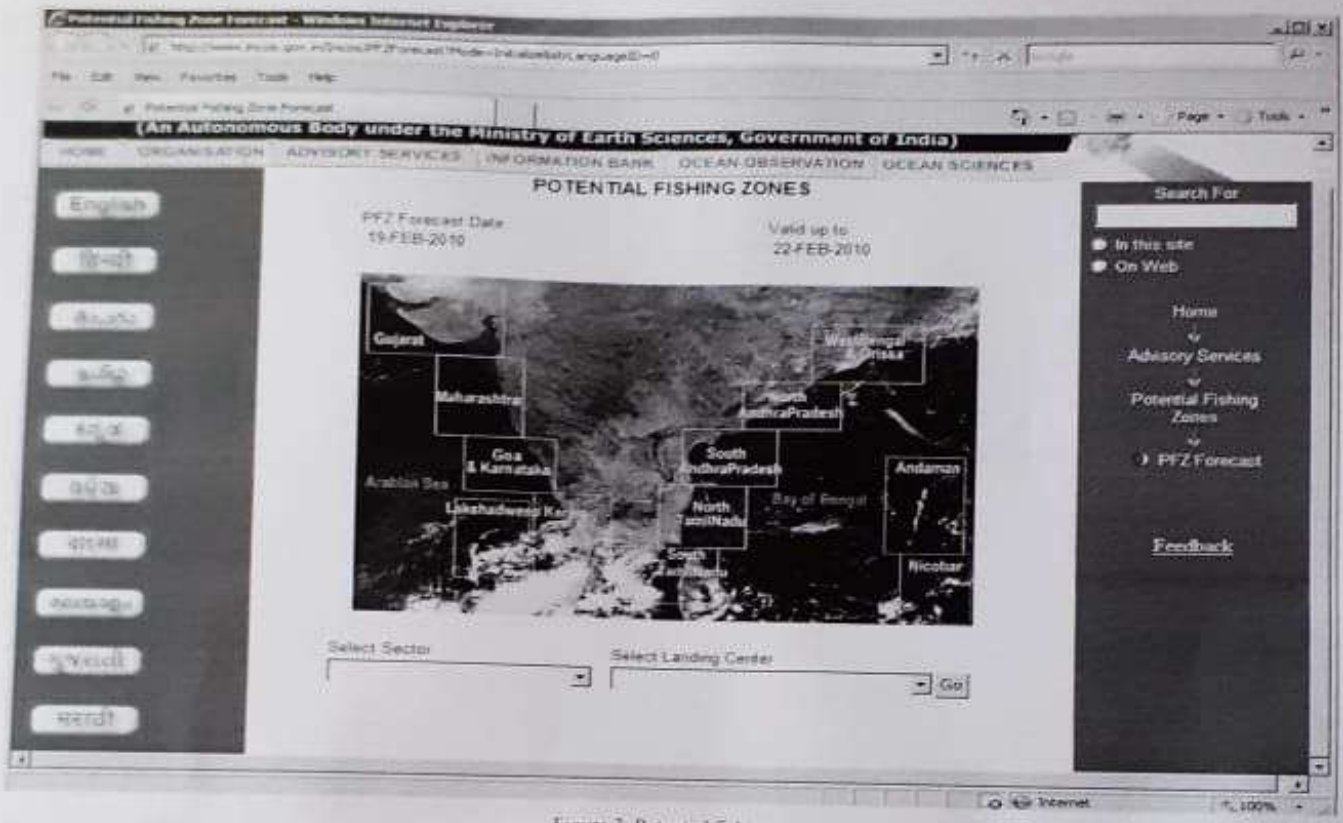

Figure 3 Potential fishing zones

C. *Preparation of navigational charts:*

GIS and GPS technologies have been used in the field by the Naval Hydrographic Department (NHD) for the preparation of electronic navigational charts (web links). Data streams from several sensors onboard survey ships and boats are digitally logged on a common GPS position and time stamp. A wide range of GPS methodologies are used for surveys. GPS, DGPS (Differential GPS) and RTK (Real Time Kinematic) GPS are used for afloat surveys. For geodetic control ashore, point positioning methods and baseline methods are used. For mapping the coastline, DGPS and RTK GPS are normally used. The latter is used onboard a helicopter increasingly. We to day have system which packs sensors like echo sounders, sonar and GPS in the same portable box. A novel application of GIS, GPS and satellite communications now allows both the processes to be executed digitally in real time. The product of this application is called an Electronic Navigational Chart (ENC). This is a GIS produced and GIS enabled version of the paper navigational chart. The Electronic Navigational Chart (ENC) and GPS position of ship, when input to a computer system called an Electronic Chart Display and Information System or ECDIS provides a real time graphic display of ship's position on a video screen along and with respect to the geographical information contained in the ENC.

D. *Identify and Periodical Investigation of Coastal Landforms:*

For marine studies, the locations on ground (study area) were identified with the help of the SOI topographical maps and GPS [10]. The following studies can be conducted with the help of GPS.

a. Bio-shields (promote – how, where and to what extent)
b. Artificial Barriers Vs regeneration of natural barriers (Working out the optimal balance)
c. Mangroves (Are we overselling? Where, when, how does this work)
d. Casuarinas plantations (Should they be promoted at all, ecological impacts, social impacts)
e. Sea walls and embankments (When are they appropriate?)
f. Sand dunes/ coral reef (their roles and impacts of destruction)
g. Identify marine siltation and debris
h. Monitoring of estuaries
i. Seasonal Shoreline changes, submergence of low lying coastal areas and formation of new beaches
j. damage to coral reefs
k. Monitoring the different ecosystems of coast in different periods
l. Effect of sand mining in coastal regions
m. Study of coastal geomorphological changes before and after event occurs like tsunami, storm, hurricane, earthquake

Paper-2 Geography CBCS

Active Sensor	Passive Sensor
(i) The sensor has abroad earth observation. Satelite emits microwaves and observe microwaves reflected by surface.	(i) This type observes microwaves naturally radiated from land surface.
(ii) Provide energy of its own.	(ii) Provide energy by natural source.
(iii) Source of energy is mainly from radar.	(iii) Source of energy is mainly from Sun.
(iv) It is not weather dependent	(iv) It is affected by day, night or weather.
(v) It is suitable observe mountains and valleys etc.	(v) It is suitable to observe sea surface temp.; snow accumulation, thickness of ice etc.

fig:-