Kerala Environment Congress
18 August 2012,
Rajive Gandhi Centre for Biotechnology,
Thiruvanandapuram

Potential Fishing Zone Advisories and Ocean State Forecasts

S.S.C. Shenoi
Indian National Centre for Ocean Information Services (INCOIS)
Hyderabad – 500 055

Marine Fisheries in India – some facts

Area of country	**3.29 million sq. m**
Area of Exclusive Economic Zone (EEZ)	**2.02 million sq. m**
Length of coastline	**8130 km**
Fish production (Marine)	**2.8 million tonnes**
Estimated production	**3.9 million tonnes**
Contribution to GDP	**1.04 %**
Fishing villages	**3202**
Fish landing centers	**1332**
Fisherfolk families	**7.5 lakhs (approx)**
Fisherflok population	**35.0 lakhs (approx)**
Mechanised boats	**60000 (approx)**
Motorised boats	**75000 (approx)**
Non-motorised	**100000 (approx)**

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Traditional methods of locating the fishing grounds

- Bird Congregation
- Colour
- Bubbles breaking on Surface
- Muddy and oily water and calm Sea
- Reflection in the Night
- *Kaladu* (a kind of smell)

Fish

Availability
Type
Quantity

Traditional methods of locating the fishing grounds

- **Traditionally, the success of fishing trip depended on fisherman's keen sense of sight, smell and hearing.**

- **Often, the fishing trips resulted in spending longer days at sea and returning with low or no catch.**

- **A good catch was mostly ascribed to the 'luck of fisherman'!**

- **It is necessary to examine the scientific data and device methods to pre-determine the locations of probable fishing grounds at sea so that the fishermen need not try out their luck or return empty handed.**

Ariel surveys to locate the fishing grounds

- **Visual fish spotting from aircraft was successfully demonstrated for locating a number of pelagic species such as anchovy, swordfish, menhaden and tuna in western countries.**

- **A trained observer acts as a "sensor", spots the school of fish and communicates with the vessels in the area using radio link.**

- **The trained observer distinguishes the fish shoal based on their colour, behaviour and schooling patterns.**

- **But, use of aircrafts on a day-to-day basis over the vast areas would be prohibitively expensive and unviable.**

- **Use of satellite remote sensing could be the other alternative, but the direct detection of fish using remote sensing is not possible with the current levels of technology.**

Indirect detection is possible by observing the associated sea surface phenomena

Environmental factors

Temperature

Light

Salinity

Chlorophyll

Feeding
Breeding

Dissolved Oxygen

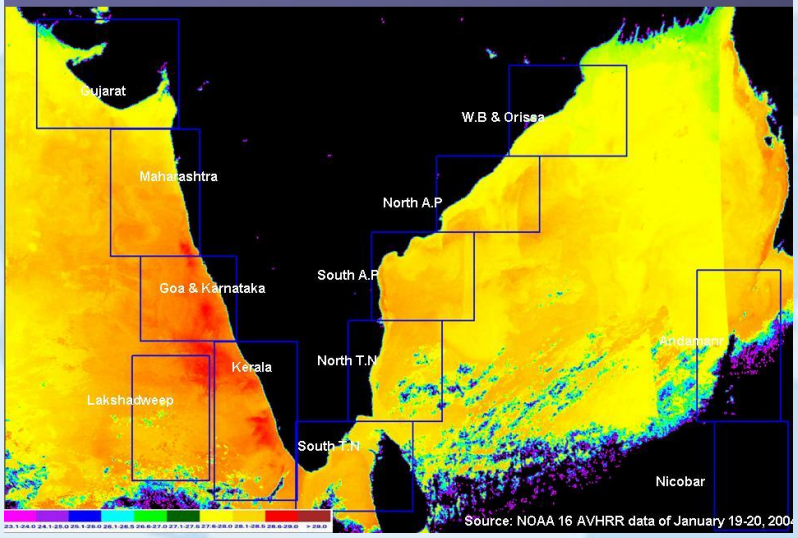
Nutrients

Surface Currents

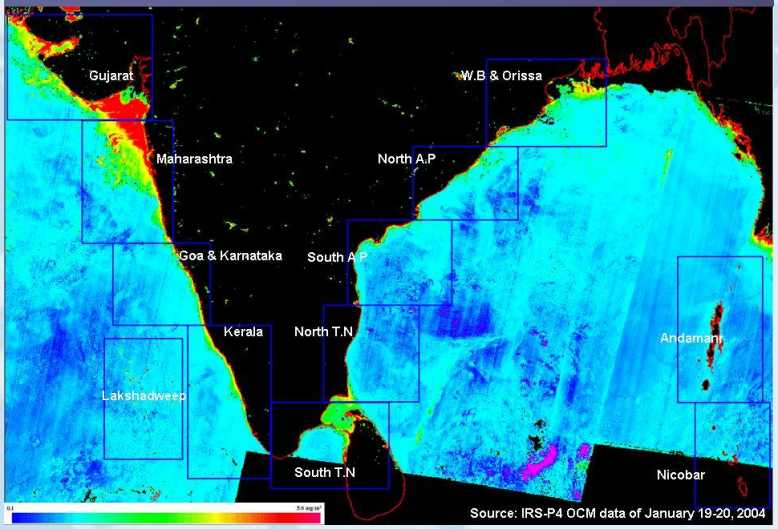
Wind

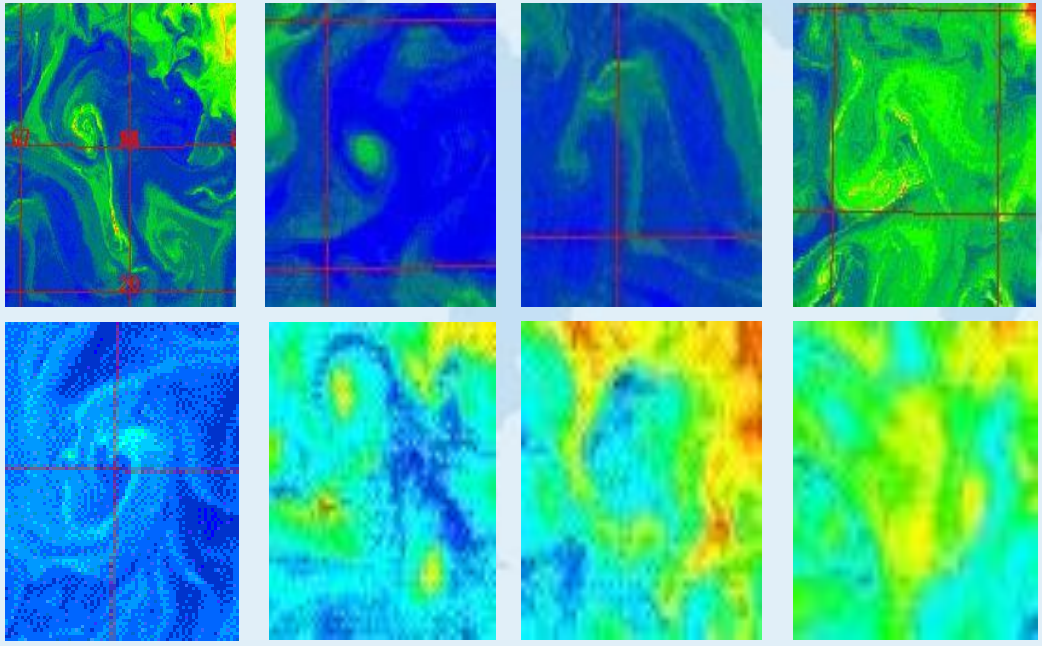
Remote sensing of sea surface parameters

Sample Image of SST



Sample Image of Chlorophyll





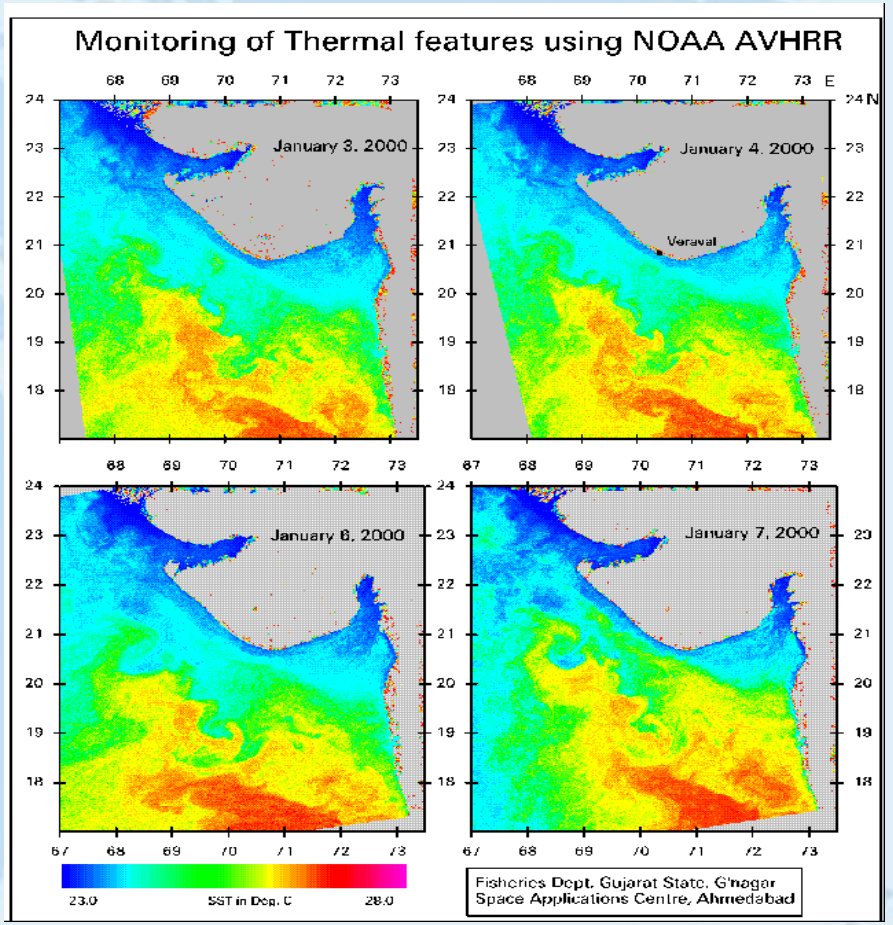
Chlorophyll – biological productivity

SST – thermal fronts, upwelling

Eddies, meanders, upwelling fronts, rings, filaments, etc.

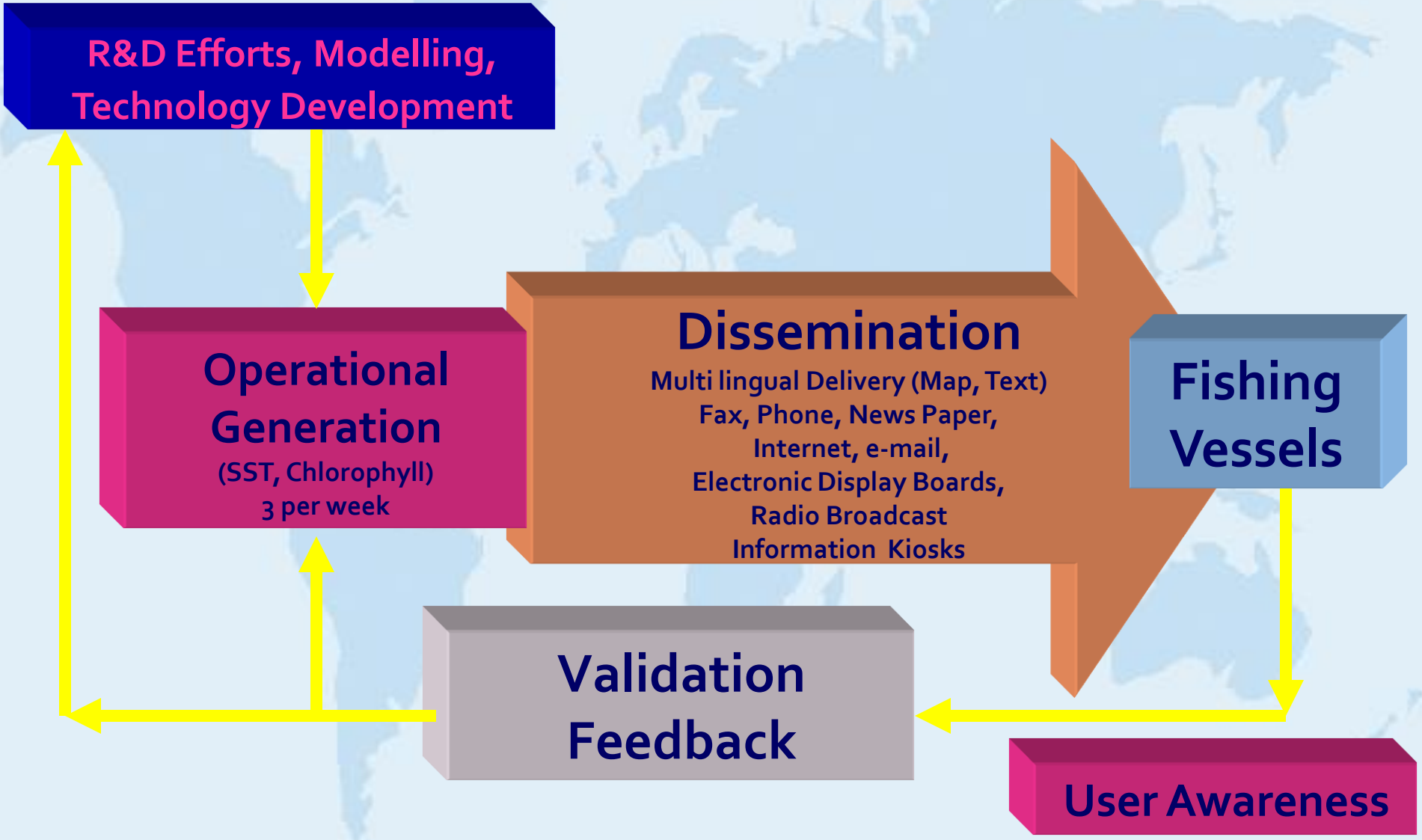
Use of remote sensing to identify the potential locations for fishing

- **Evolved from the MRSIS programme of DOD in early 1990's**
- **Used satellite derived SST for the demarcation of 'potential shoals of fish aggregation' in the Indian waters**
- **Generation of PFZ advisories started during 1996-97 at National Remote Sensing Agency, Hyderabad using NOAA-AVHRR derived SST data.**
- **Disseminated through state fishery departments using FAX and TELEFAX**
- **Due to the usage of data from single satellite, at least 3 days data was required to cover the Indian coast and to generate the PFZ maps**

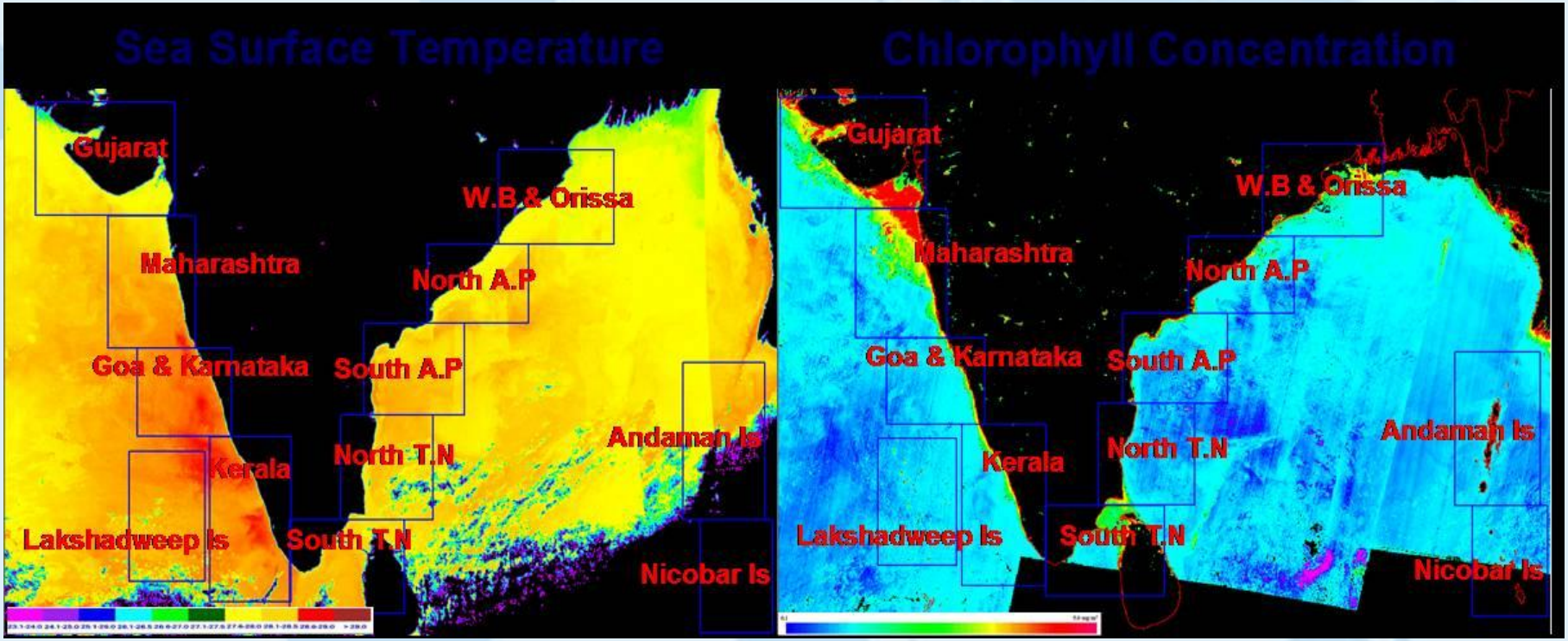


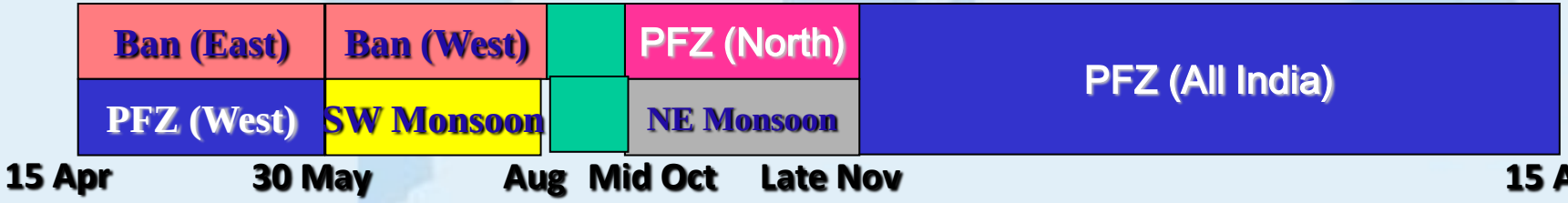
Thus the PFZ advisory service was limited to twice a week.

Establishment of INCOIS and PFZ Mission



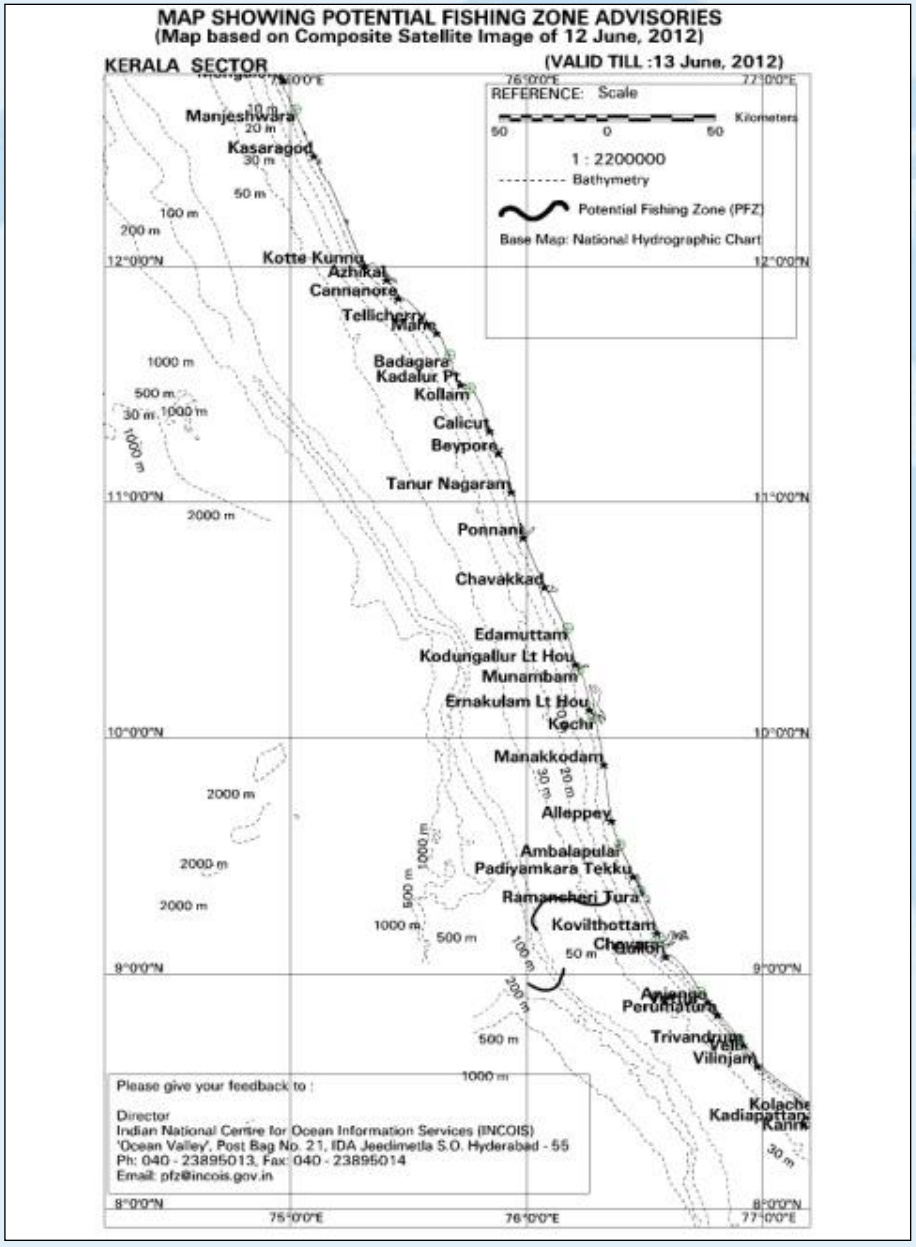
Establishment of INCOIS and PFZ Mission





Three times a week (Mon, Wed, Fri)
(non-cloudy, non-ban period)

PFZ map and text



KERALA

കേരളം

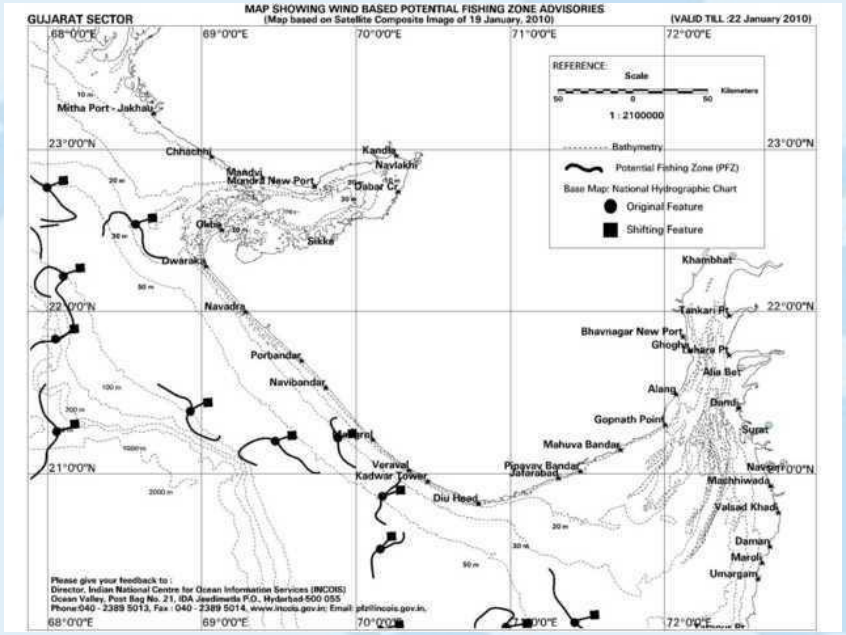
SATELLITE DATA SHOWS LIKELY AVAILABILITY OF FISH STOCK TILL 13 ജൂൺ 2012

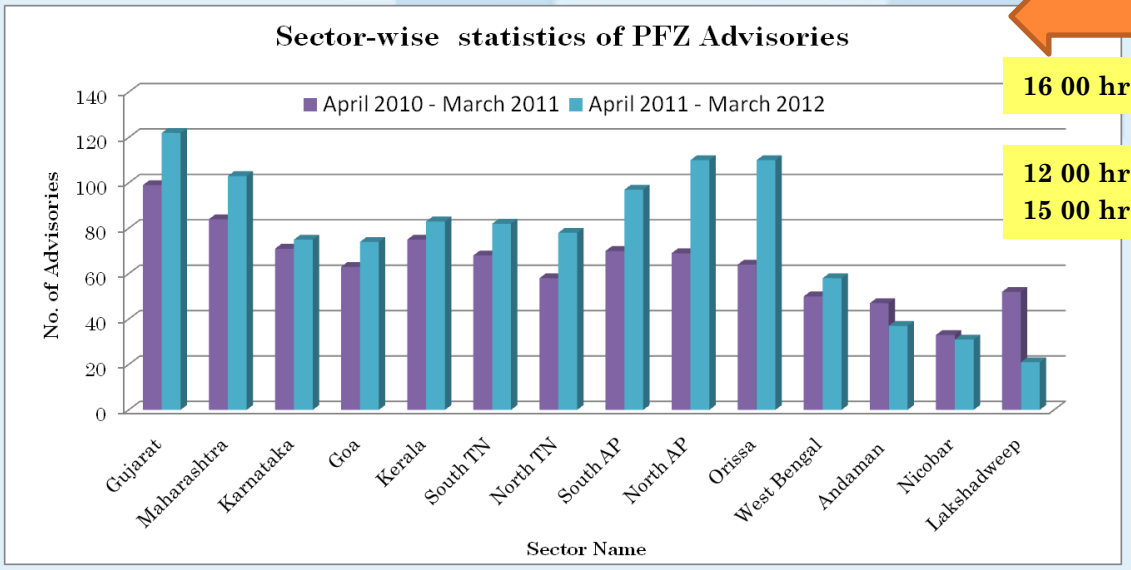
ഉപഗഹ വിവരമനുസരിച്ച് 13 ജൂൺ 2012 വരെ കൂടുതൽ മÕറം ലഭിക്കുവാൻ സാധ്യതയുള്ള Øല

उपग्रह आकडों से 13 जून 2012 तक की संभावित मत्स्य भंडार की उपलब्धि

	തീരത്തു നിന്ന്	ദിശയിൽ	ദിശ (ഡിഗ്രി)	ദൂരം കിലോമീറ്ററിൽ		ആഴം മീറ്ററിൽ		Longitude Latitude
				മുതൽ	വരെ	മുതൽ	വരെ	
	അലപ്പുഴ (Alleppey)	നൈരുതി	220	50	55	80	85	76 00.60 09 07.80
	അമ്പാലപുലൈ (Ambalapulai)	നൈരുതി	229	38	43	70	75	76 04.20 09 08.40
	പാഡിയാമകര തെക്കു (Padiyamkara Tekku)	നൈരുതി	251	29	34	60	65	76 08.40 09 09 N
	രാമാചെരി തുരാ (Ramancheri Tura)	നൈരുതി	254	23	28	50	55	76 13.80 09 06.60
	കൊവില്തോട്ടം (Kovilthottam)	വായുവ്യമു	299	28	33	40	45	76 16.80 09 07.20
	കൊല്ലം (Quilon)	നൈരുതി	256	51	56	100	200	76 05.40 08 45.60
	വെട്ടൂർ (Vettur)	വായുവ്യമു	271	69	74	200	500	76 03.60 08 43.80
	Chavara	നൈരുതി	247	51	56	100	200	76 05.40 08 46.80

PFZ advisories - weekly thrice to daily





Time line of the Operational Process before and after OceanSat-2 Ground station

Previous day data

Before	After		
14 00 hrs	15 00 hrs	7	Dissemination
13 00 hrs	14 30 hrs	6	Advisory Generation
11 00 hrs	14 00 hrs	5	Interpretation
10 00 hrs	13 30 hrs	4	OCM / MODIS Processing
07 00 hrs	13 00 hrs	3	OCM / MODIS Data Reception
	OCM / MODIS Pass Time: 12 00 Hrs		
16 00 hrs	14 30 hrs	2	AVHRR Processing
12 00 hrs, 15 00 hrs	11 00 hrs, 14 00 hrs	1	AVHRR Reception

Multi-satellites Oceansat-2, MODIS, METOP, NOAA-18 & 19) and GHRSST)

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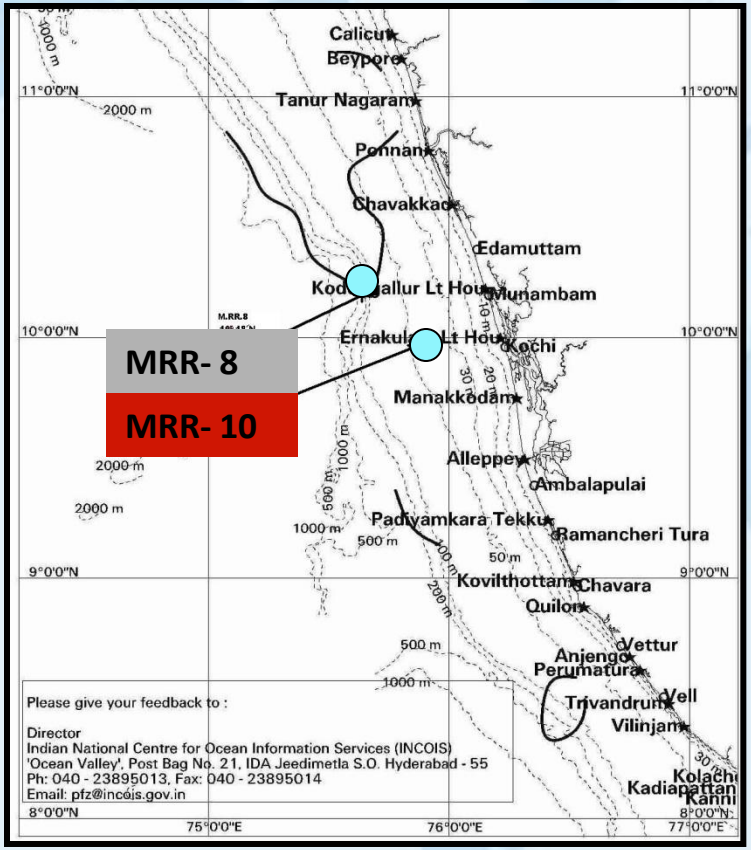
Validation of Potential Fishing Zone advisories

Area: Kerala Sector



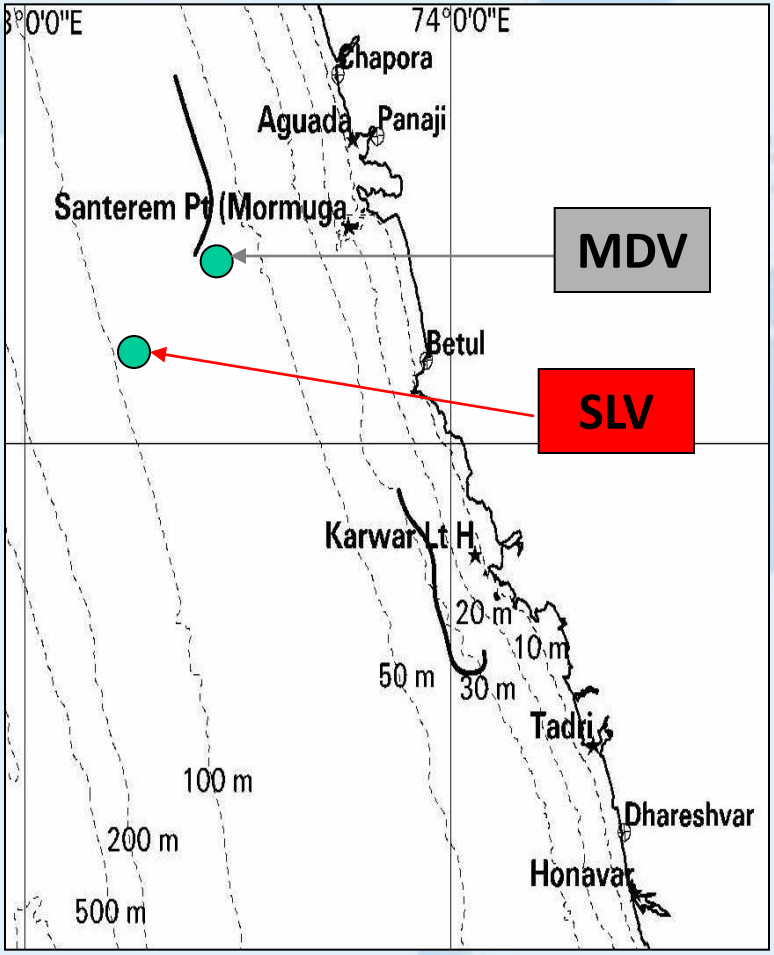
PFZ Forecast based on SST
Issued: Dec 15, 2006
Valid up to: Dec 18, 2006

Details	PFZ	Non PFZ
Name of the Boat	MRR-8	MRR-10
Type of Boat	Mech. Ring Seine	Mech. Ring Seine
Duration of Total Trip	9 Hrs 30 Min	7 Hrs 15 Min
Number of fishing hours	01	01
Number of Hauls	01	01
Number of Fishermen Engaged	37	36
Total Catch (Kgs)	7200	1800
Major Species Caught	Carangids	Carangids
Approximate cost of total catch (Rs) (@ 50 Rs /Kg)	3, 60, 000	90, 000
Total Expenditure in Fishing Operation (Rs)	77, 600 (Fuel: 5, 400) (Wage:72, 000)	21, 440 (Fuel: 3, 240) (Wage:9, 000)
Net Profit	2, 82, 400	68, 560

Details of Simultaneous Fishing Operation by Two Vessels (PFZ & Non PFZ) on December 16, 2006

Validation of Potential Fishing Zone advisories

Area: Goa Sector



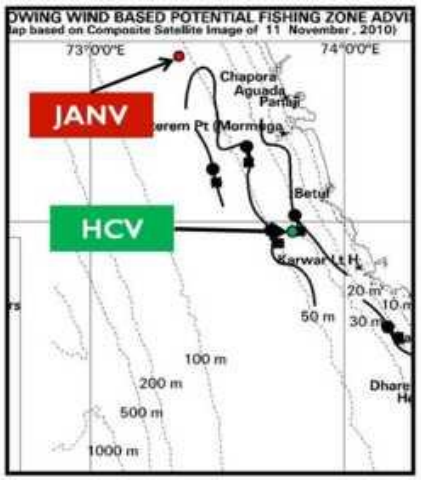
Details	PFZ	Non PFZ
Name of the Boat	MDV	SLV
Type of Boat	Purse Seiner	Purse Seiner
Duration of Total Trip	24 Hrs	24 Hrs
Number of fishing hours	02	01
Number of Hauls	02	01
Number of Fishermen Engaged	23	23
Total Catch (Kgs)	12,193	4,000
Major Species Caught	Coastal Tuna	Pomfrets
Approximate cost of total catch (Rs)	12,00,000	6,00,000
Total Expenditure in Fishing Operation (Rs)	36,000 (Fuel: 10,000) (Wage:20,000) (Other: 6,000)	26,050 (Fuel:9,000) (Wage:15,000) (Other: 2,400)
Net Profit	11,64,000	5,73,950

PFZ Forecast based on SST/Chlorophyll image of 06-07 April 2006

Issued: April 08 2006 & Valid up to: April 11, 2006

Details of Simultaneous Fishing Operation by Two Vessels (PFZ & Non PFZ) on April 10, 2006

Validation of Potential Fishing Zone advisories



Area: Karnataka & Goa Sector

PFZ Forecast based on SST & CHL

Issued: Nov 12, 2010

Valid up to: Nov 15, 2010

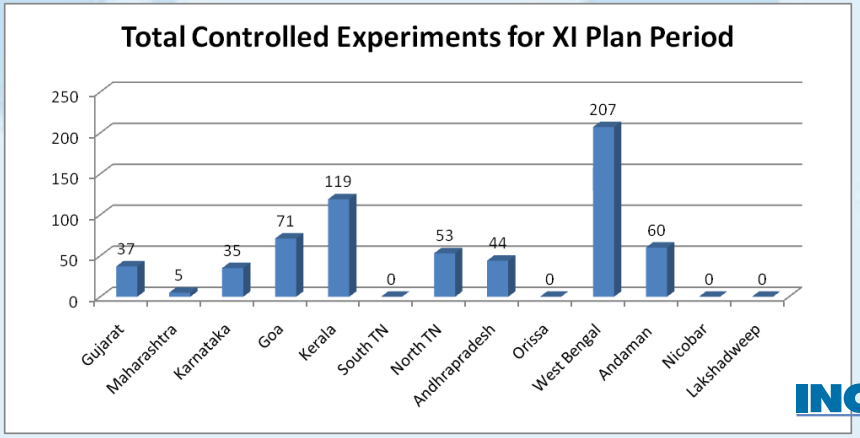
- Success Rate: ~ 80%
- Net Profit: 03 – 04 times
- Less Searching Time: 30 to 70%

Details	PFZ	Non PFZ
Name of the Boat	HCV	JANV
Type of Boat	Purse-Seine	Purse-Seine
Duration of Total Trip	12 Hrs 30 Min	24 Hrs
Number of fishing hours	01	1.5
Number of Hauls	01	01
Number of Fishermen Engaged	28	23
Total Catch (Kgs)	3500	2000
Major Species Caught	Indian Mackerel	Horse Mackerel
Approximate cost of total catch (Rs)	1,75,000 (@ 50 Rs /Kg)	1,20,000 (@ 60 Rs /Kg)
Total Expenditure in Fishing Operation (Rs)	51,340 (Fuel: 11,340) (Wage: 25,000) (Other: 15,000)	49,980 (Fuel: 18,480) (Wage: 19,500) (Other: 12,000)
Net Profit	1,23,660	70,020

Details of Simultaneous Fishing Operation by Two Vessels (PFZ & Non PFZ) on November 13, 2010

- **Validations of PFZ advisories using same type of fishing vessels and fishing gears**

- **630 validations were carried out during 2007-2012**



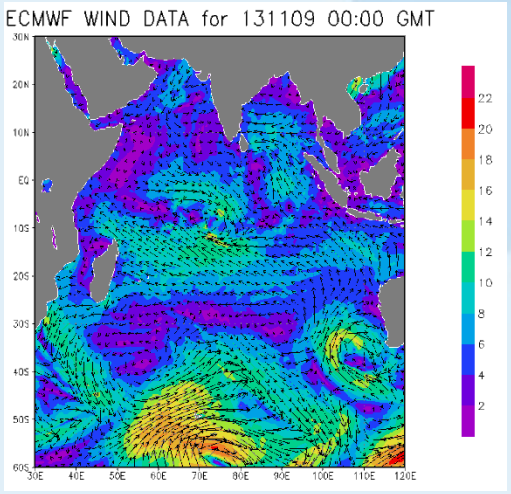
Cost - benefits

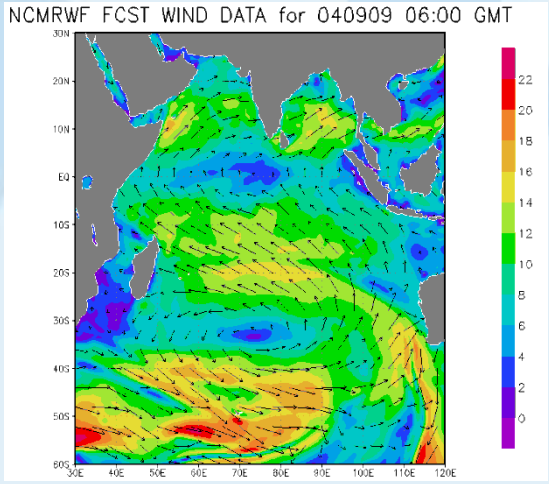
- On an average 50% reduction in search time indicates that annual savings on account of diesel consumption for
  - mechanised vessels is about Rs.6.0 lakhs (5500)
  - motorised boats is Rs.1.95 lakhs (14000)
  - small motorised boats is Rs. 1.65 lakhs (10000)
- Considering that 25% of the boat owners are using PFZ advisories this amounts to a saving of Rs. 163 crores for Kerala.
- If 100 % of the mechanized and motorized boats operating in Kerala use PFZ advisories, this will account for annual savings of about Rs. 600 crores just on account of diesel savings in addition to the valuable human effort.
- Extrapolation of the above results to the national scenario indicates a savings of Rs. 1351 crores for 25 % usage and Rs. 5000 crores for 100% usage

Ocean State Forecast

Irrespective of the level of technology they would like to know

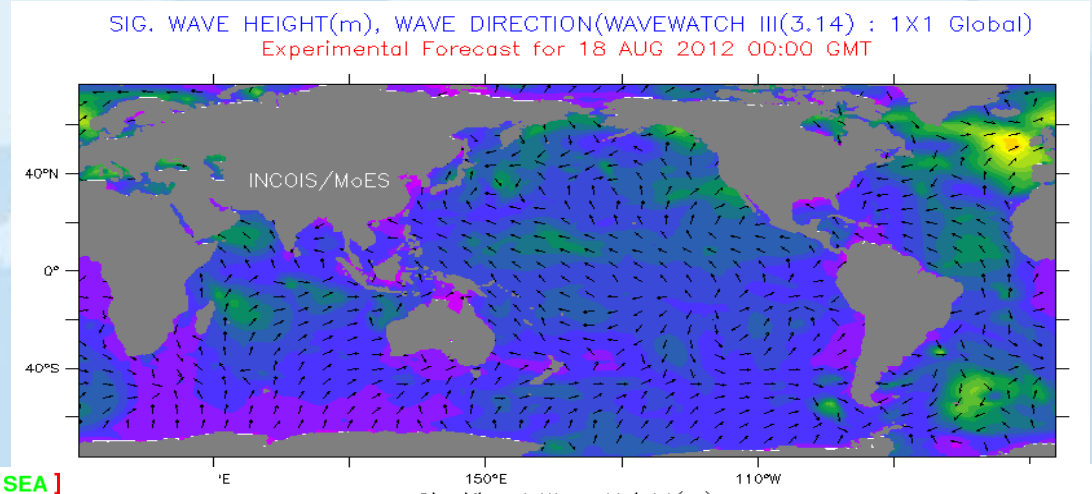
'how it is going to be out there when they are at sea'.

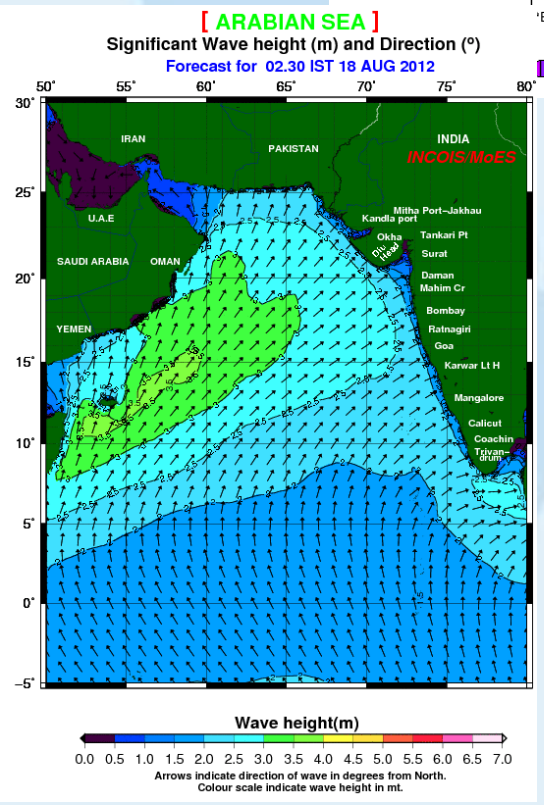




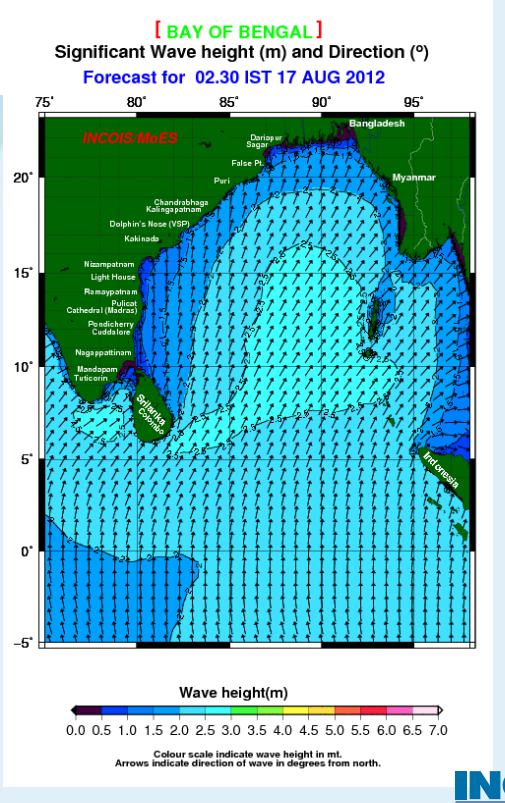
→ **Numerical Models** → **Forecasts**

Ocean State Forecast





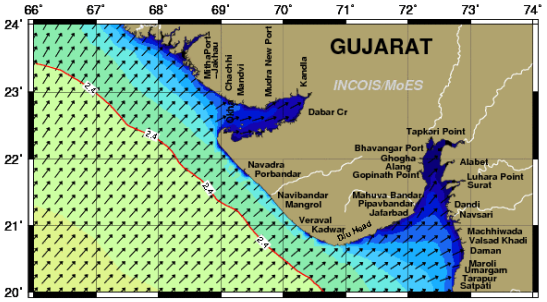
Wave height and direction forecasts



Wave forecast for coastal states

Significant Wave height (m) and Direction (°)

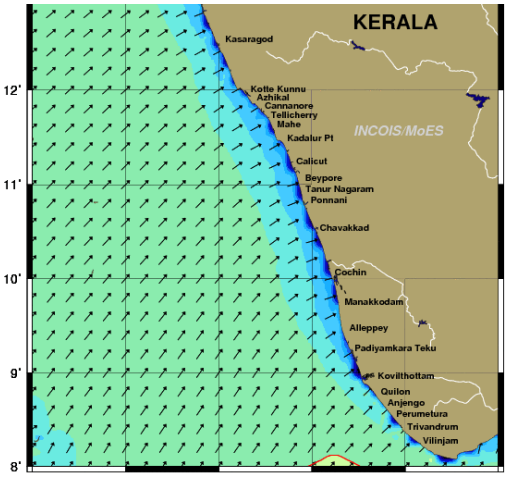
Forecast for 02.30 IST 17 AUG 2012



Wave height(m)

0.0 0.3 0.6 0.9 1.2 1.5 1.8 2.1 2.4 2.7 3.0 3.3 3.6 3.9 4.2 4.5 4.8 5.1

Arrows indicate direction of wave in degrees from North
Colour Scale indicate wave height in m



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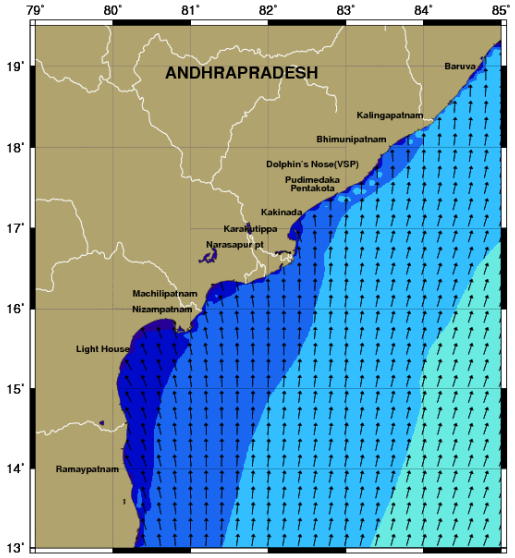

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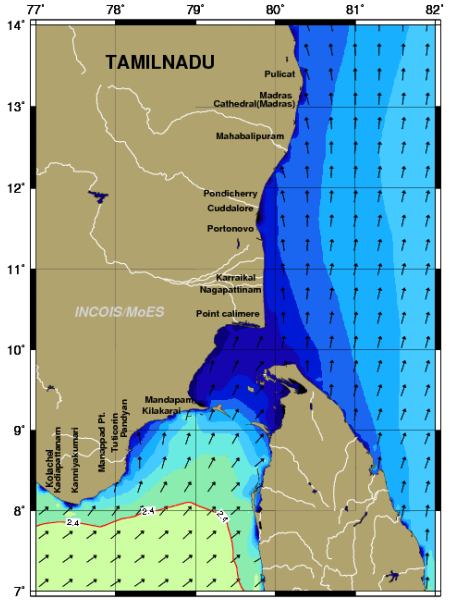

Wave height (m)

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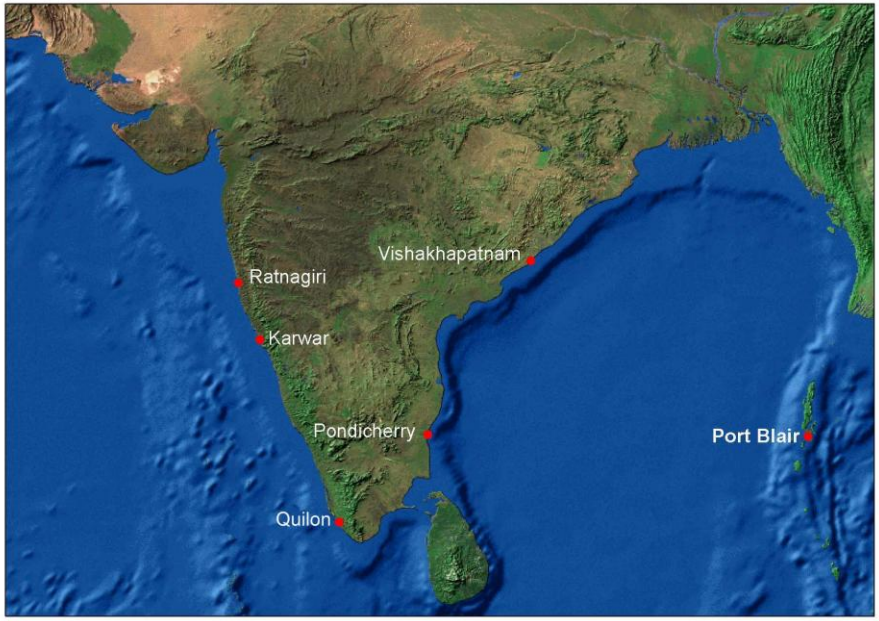
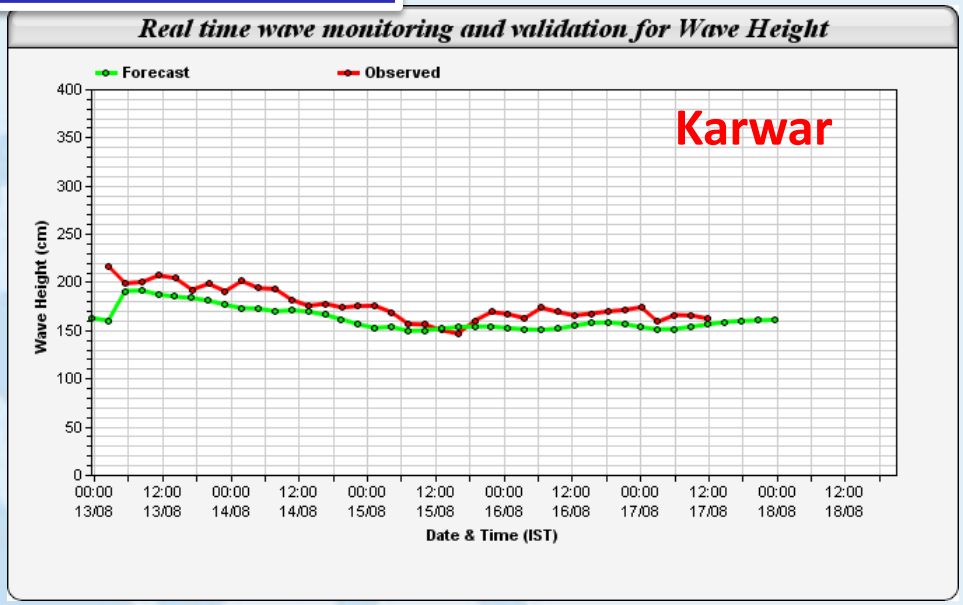
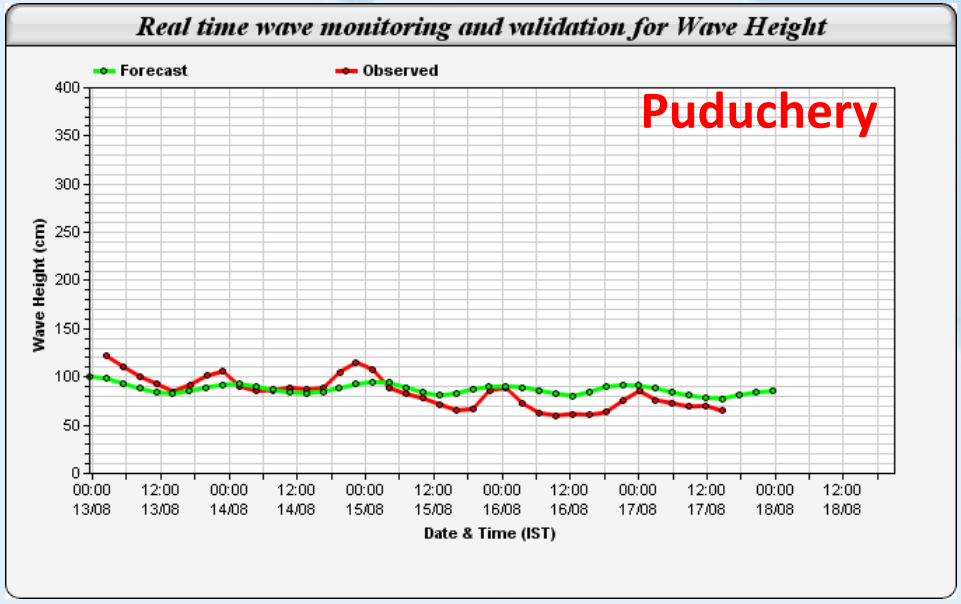
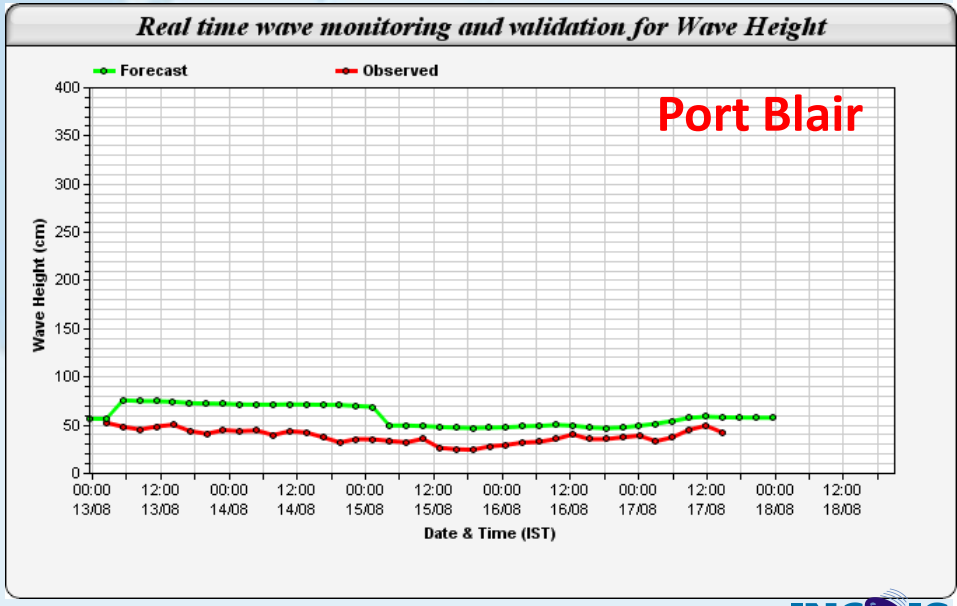
Ocean State Forecast

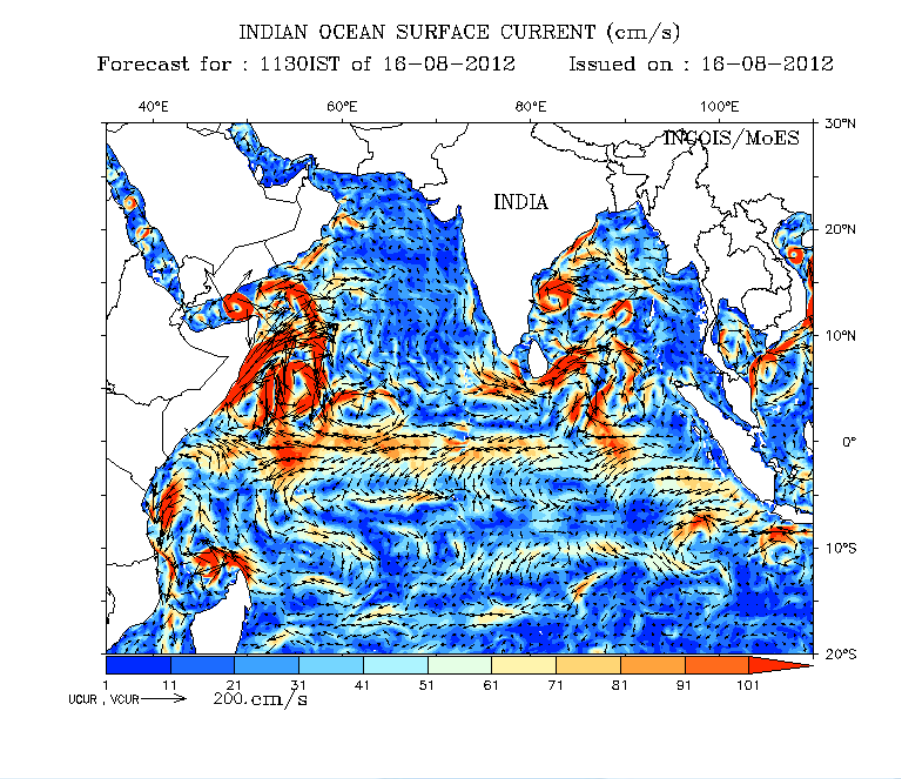


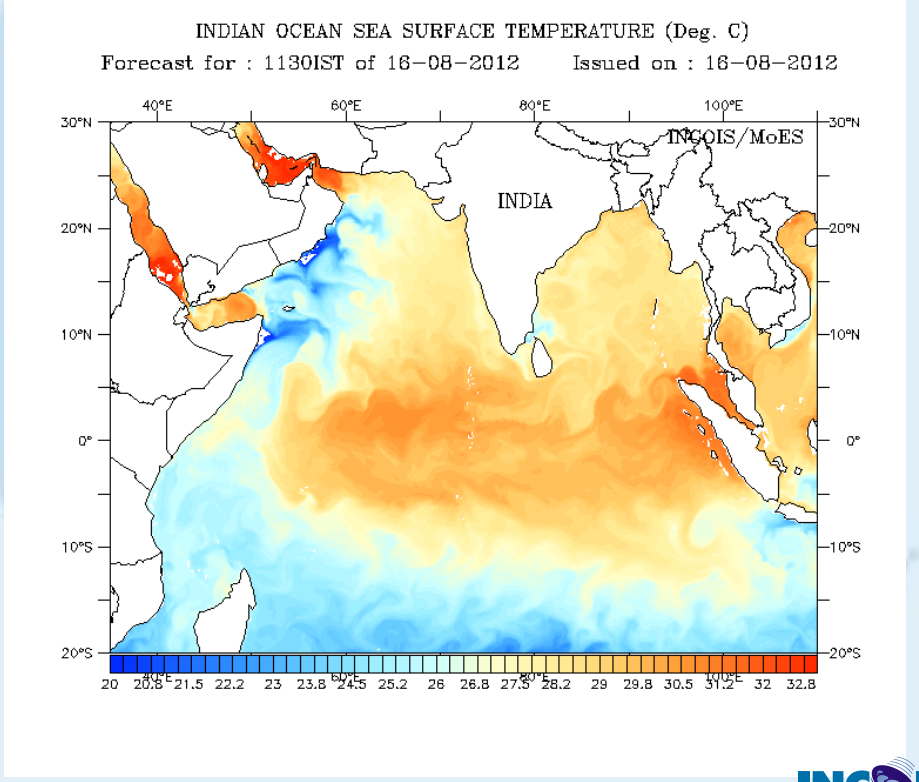




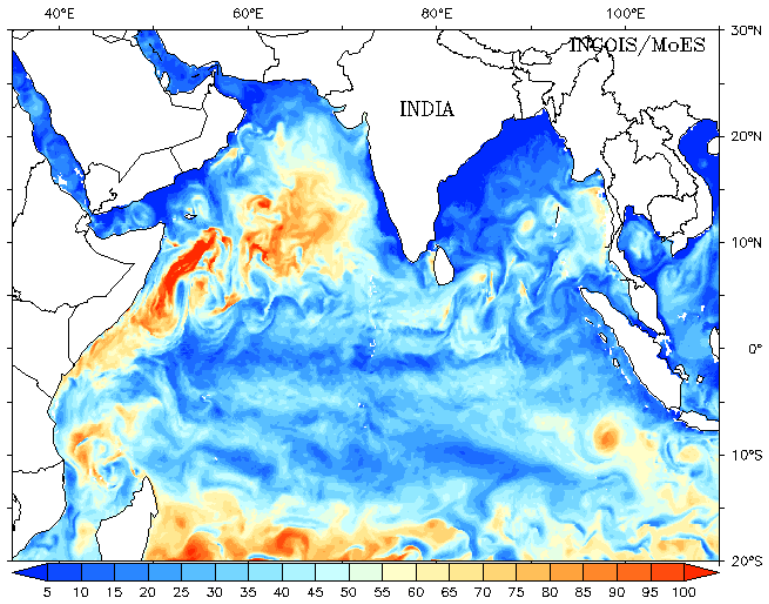


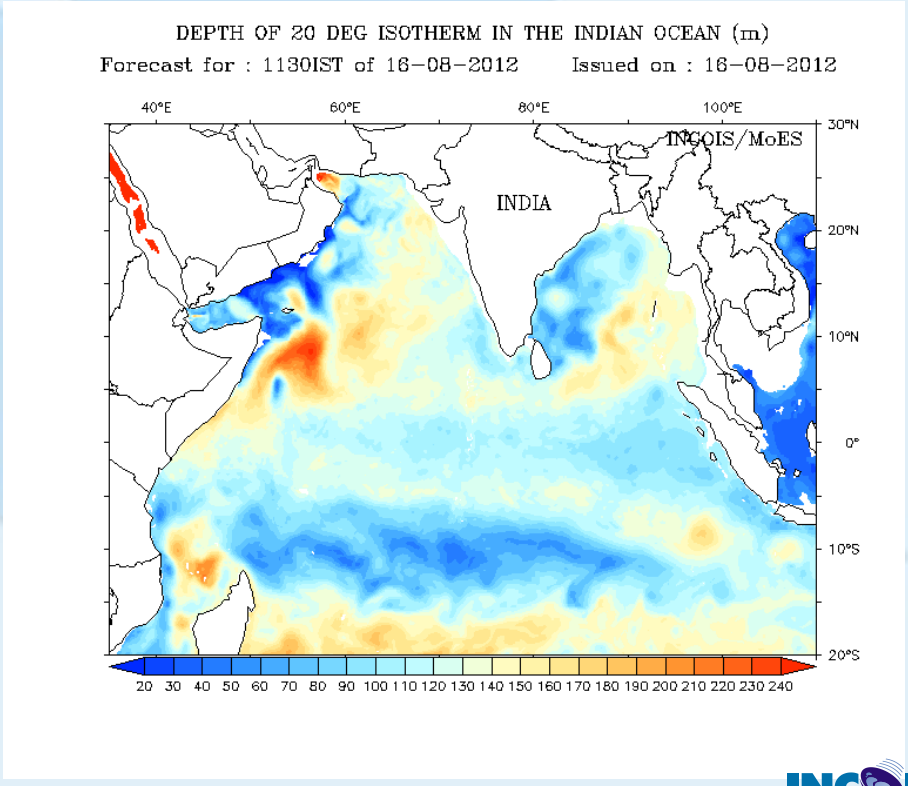
Ocean State Forecast – ocean currents and temperature





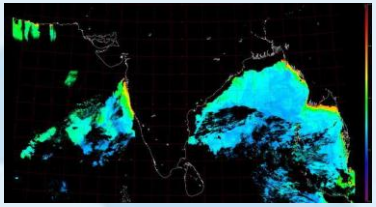
Ocean State Forecast – Mixed layer and thermocline



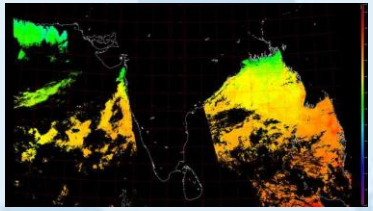


Ocean State Forecast – Mixed layer and thermocline

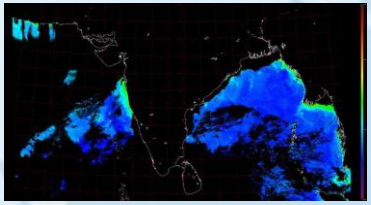
Chlorophyll-a

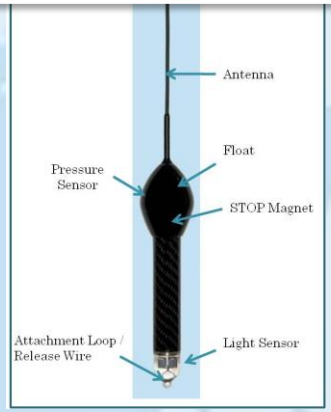


Sea Surface Temperature

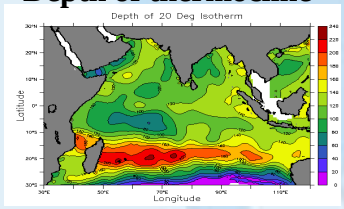


Water clarity ($K_{d\ 490}$)

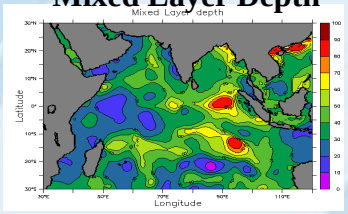




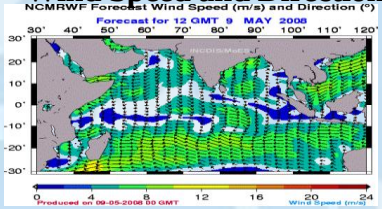
Depth of thermocline

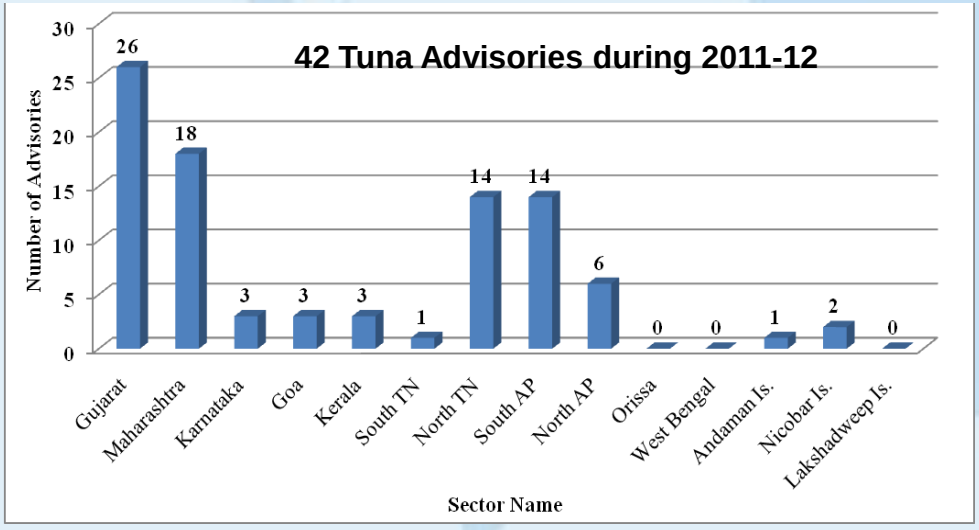


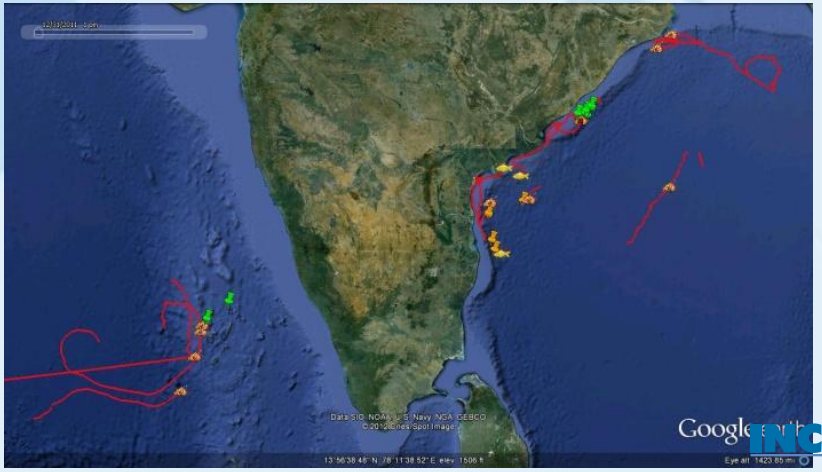
Mixed Layer Depth



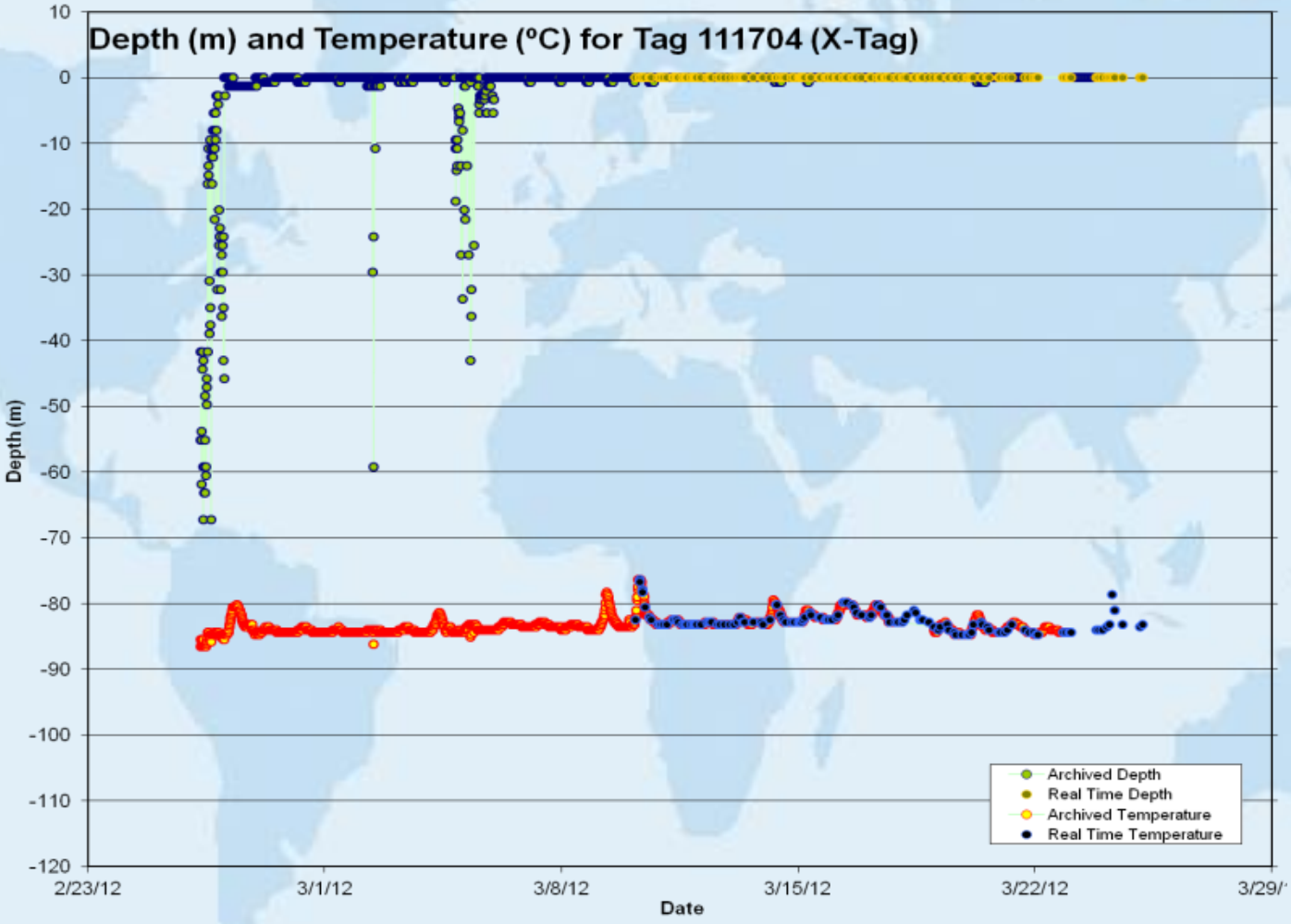
Wind Speed and Direction







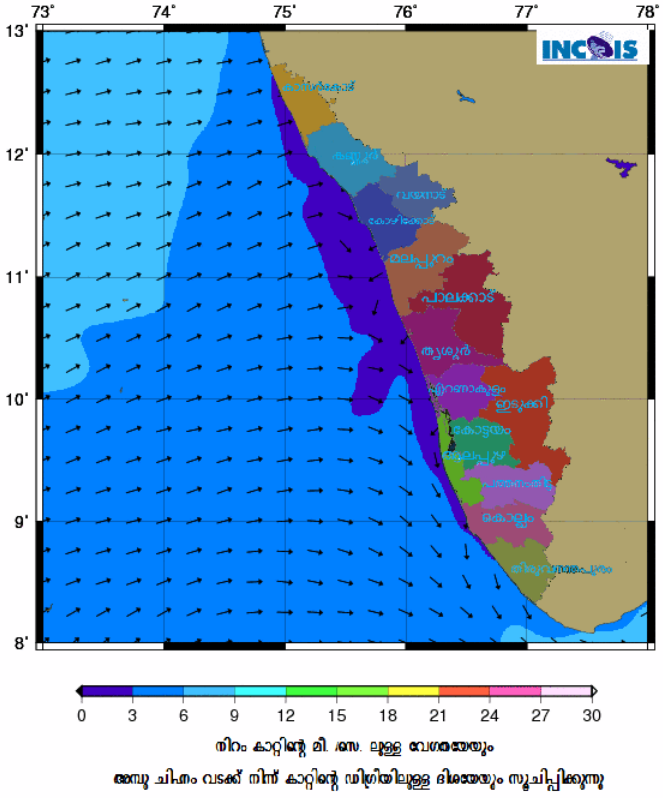
Vertical migration of Tuna off Visakhapatnam



Ocean State Forecast - Winds, waves & currents

കാറ്റിന്റെ വേഗതയും(മീ/സെ) ദിശയും(ഡിഗ്രി)

പ്രവചനം 05.30 IST 13 AUG 2012

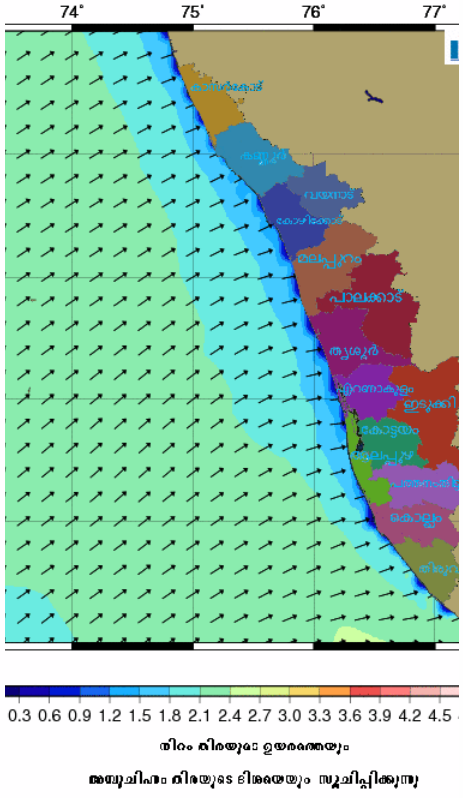


നിറം കാറ്റിന്റെ മീ. /സെ. ലുള്ള വേഗതയേയും

അമ്പു ചിഹ്നം വടക്ക് നിന്ന് കാറ്റിന്റെ ഡിഗ്രിയിലുള്ള ദിശയേയും സൂചിപ്പിക്കുന്നു

തിരയുടെ ഉയരവും (മീറ്റർ) ദിശയും

പ്രവചനം 02.30 IST 18 AUG 2012

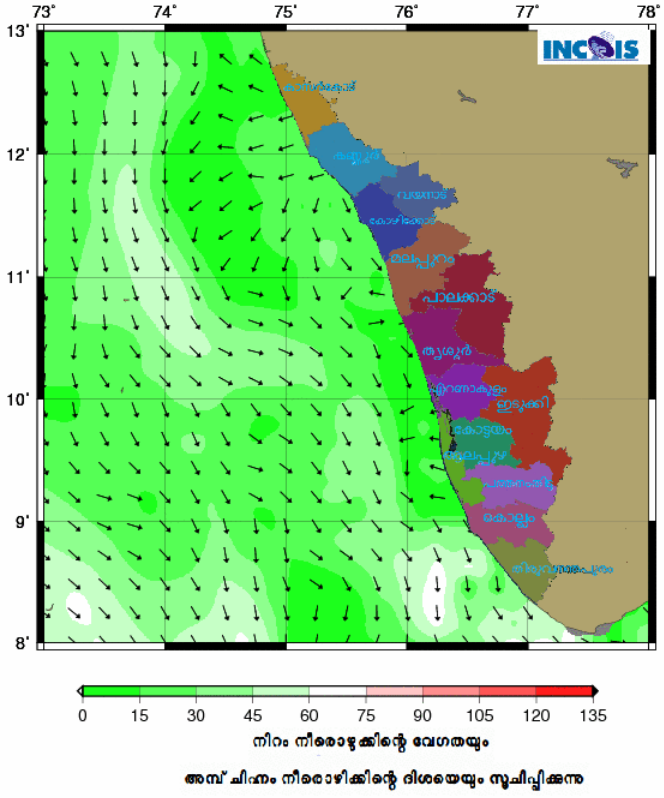


നിറം തിരയുടെ ഉയരത്തേയും

അമ്പുചിഹ്നം തിരയുടെ ദിശയേയും സൂചിപ്പിക്കുന്നു

നീരൊഴുക്കിന്റെ വേഗതയും (സെന്റിമീറ്റർ/സെക്കന്റ്) ദിശയും

പ്രവചനം 05.30 IST 12 AUG 2012

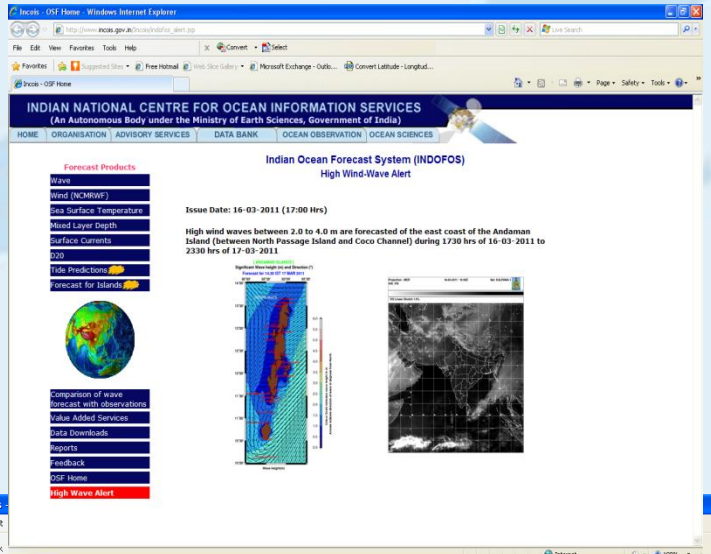


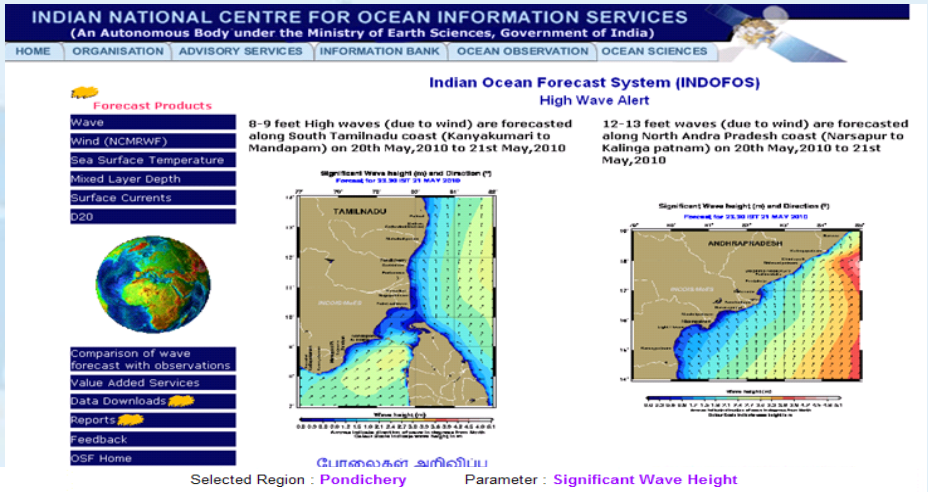
നിറം നീരൊഴുക്കിന്റെ വേഗതയും

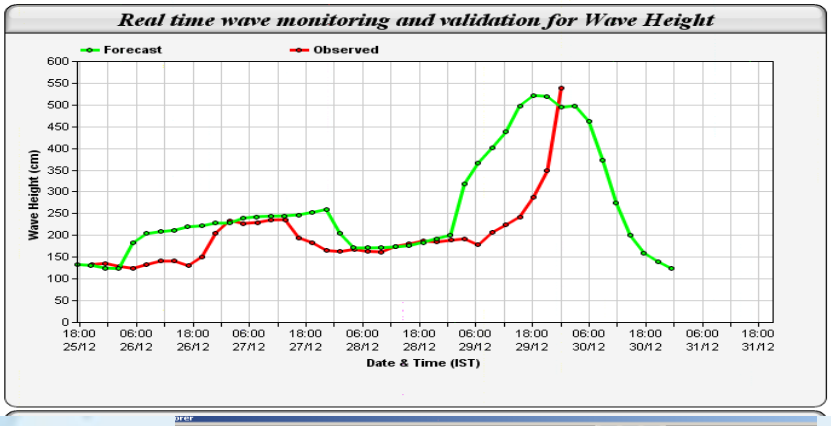
അമ്പ് ചിഹ്നം നീരൊഴുക്കിന്റെ ദിശയെയും സൂചിപ്പിക്കുന്നു

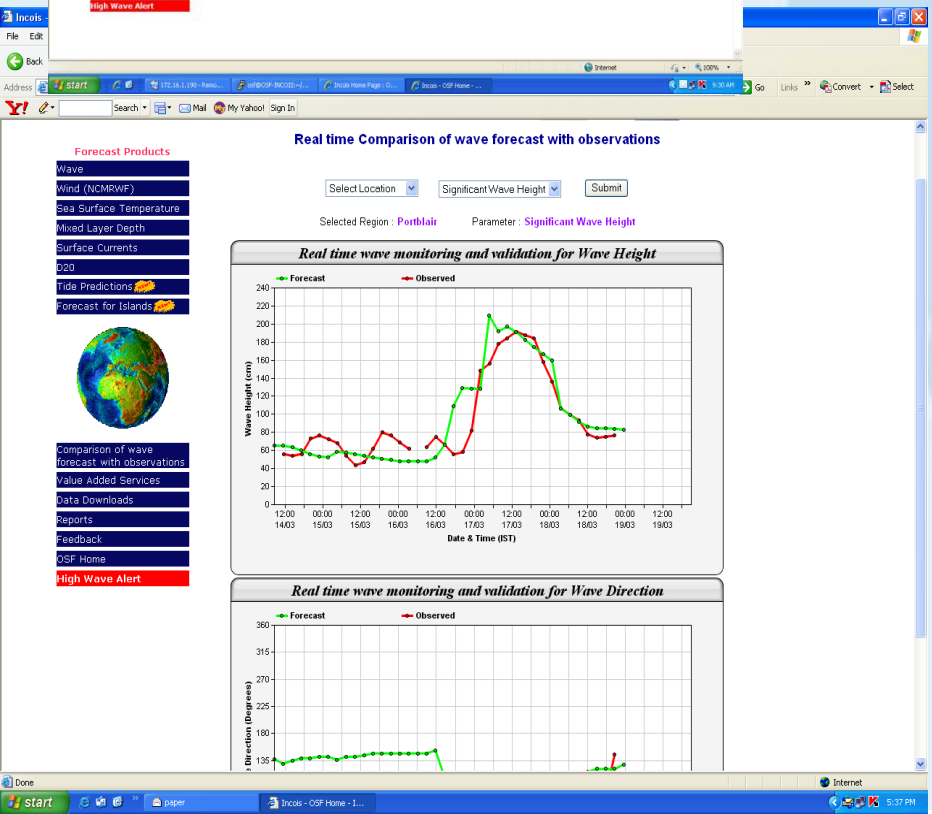
INCOIS

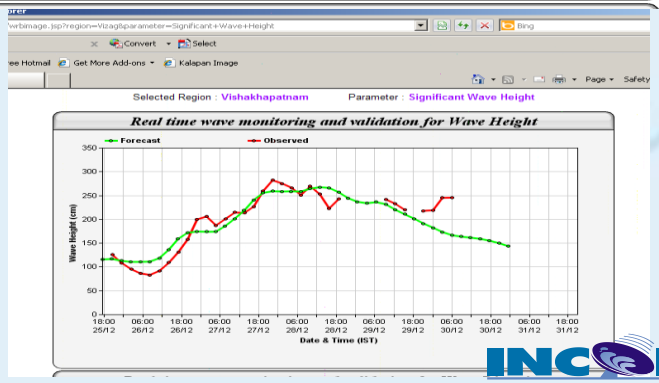
High wave alerts for A & N and Cyclone Thane





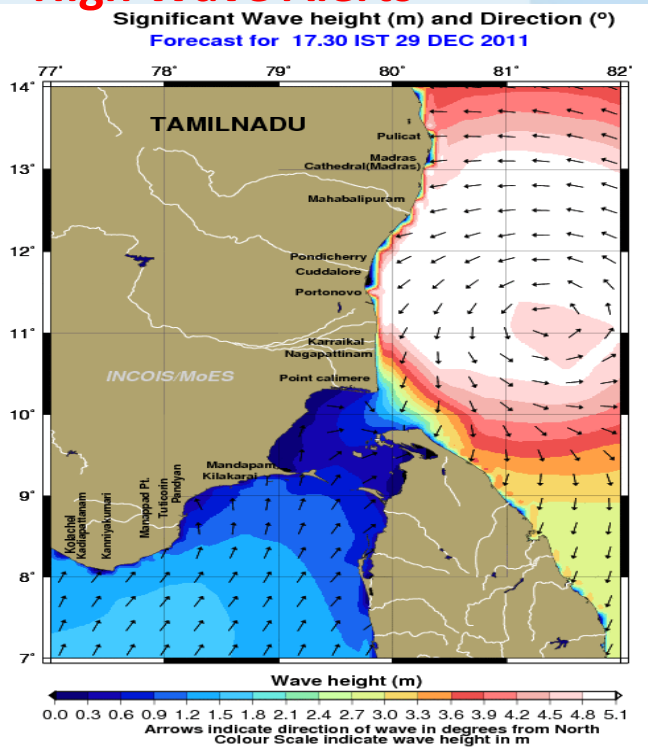






Ocean State Forecasts

High Wave Alerts



பெருங்காற்றலை எச்சரிக்கை --
கொடுக்க பட்ட தேதி -- 29-12-2011

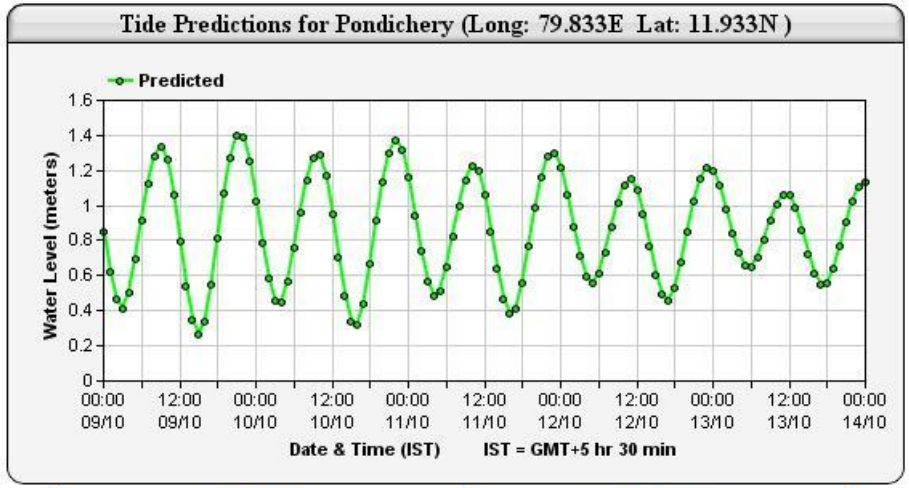
தமிழ்நாட்டின் கீழ்க்கண்ட பகுதிகள்
நாகப்பட்டிணம் – புலிகட் வரை 29-12-20
(1730)மணி முதல் 30-12-2011 (1730) மணி
வரை பேரலைகள் 8-36 அடி உயரத்திற்
இருக்கும் என முன்னறிவிக்கப்படுகிறது.
நாகப்பட்டிணம் – மகாபலிபுரம் உட்பட்ட
பகுதிகளில் அதிக பேரலைகள் இருக்கும்
எதிர்பார்க்கப்படுகிறது

Notes:PLEASE CONTINUE TO UPDATE US YOUR POSITION. REGARDS. DUTY FORECASTER.
Forecast:

ValidAt	Lon	Lat	Wind Dir	Wind speed	Windsea	Swell Dir	Swell Height	Swell period	Sig. Height	MaxWave
05-FEB-2012 12	57.20	-21.79	ESE	9	1.14	ESE	1.63	7.92	1.15	3.14
05-FEB-2012 18	57.18	-21.15	ENE	9	1.06	ESE	1.56	7.95	1.15	3.02
06-FEB-2012 00	57.17	-20.50	ENE	6	0.95	SSE	1.51	7.84	1.16	2.90
06-FEB-2012 06	57.16	-19.85	ENE	6	0.89	SSE	1.46	7.81	1.15	2.81
06-FEB-2012 12	57.15	-19.20	NNE	4	0.80	SSE	1.42	7.75	1.16	2.72
06-FEB-2012 18	57.14	-18.55	ENE	5	0.86	SSE	1.38	8.02	1.07	2.64
07-FEB-2012 00	57.12	-17.90	NNE	3	0.71	SSE	1.34	7.72	1.13	2.57
07-FEB-2012 06	57.11	-17.25	ENE	4	0.81	SSE	1.31	7.89	1.02	2.51
07-FEB-2012 12	57.10	-16.60	ESE	2	0.80	SE	1.28	7.90	1.00	2.46
07-FEB-2012 18	57.09	-15.96	ENE	3	0.79	SSE	1.27	7.80	0.98	2.43
08-FEB-2012 00	57.08	-15.31	SE	4	0.76	SSE	1.26	7.68	1.00	2.42
08-FEB-2012 06	57.06	-14.66	SSW	5	0.67	SSE	1.27	7.52	1.07	2.45

Notes: Wind speeds are in Knots. Wave heights are in metres. The significatnt wave height is def:
the average of the highest 1/3rd of waves.The Maximum wave height is the average of the highest
Forecaster: Krishna Prasad B - INCOIS

Prediction of tides along the Indian coast



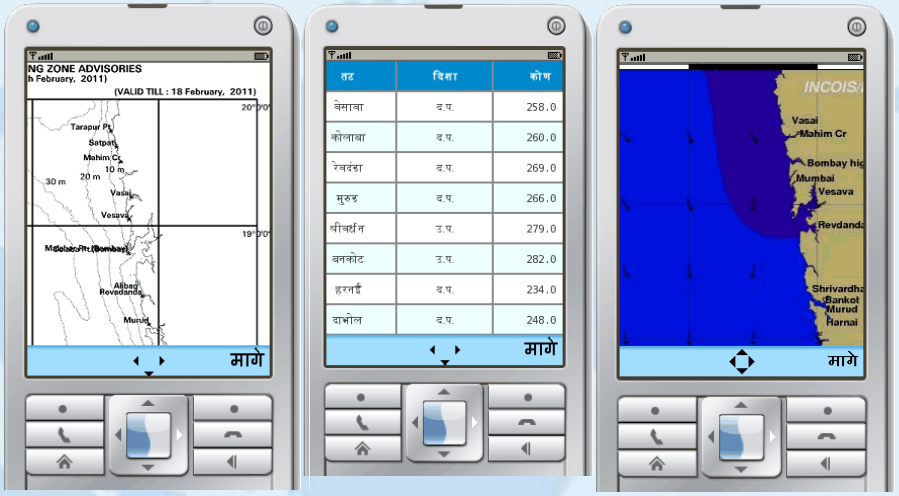
High Tide		Low Tide	
Time (IST)	Level (m)	Time (IST)	Level(m)
09-10-2010 08:58 AM	1.34	09-10-2010 02:51 AM	0.41
09-10-2010 09:26 PM	1.41	09-10-2010 03:01 PM	0.26
10-10-2010 09:37 AM	1.29	10-10-2010 03:34 AM	0.43
10-10-2010 10:04 PM	1.37	10-10-2010 03:39 PM	0.31
11-10-2010 10:16 AM	1.23	11-10-2010 04:14 AM	0.48
11-10-2010 10:41 PM	1.31	11-10-2010 04:15 PM	0.38
12-10-2010 10:51 AM	1.15	12-10-2010 04:53 AM	0.56
12-10-2010 11:19 PM	1.22	12-10-2010 04:49 PM	0.46
13-10-2010 11:26 AM	1.07	13-10-2010 05:35 AM	0.65
13-10-2010 11:56 PM	1.14	13-10-2010 05:21 PM	0.55

Dissemination mechanisms

- Telephone / Fax
- Electronic Display Boards
- Emails
- Website
  - Text
  - Web GIS
- SMS
- Radio and Doordarshan
- Local News Papers
- Information Kiosks

Radio Benziger

mKRISHI – MOBILE APPLICATION (DISSEMINATION)



mKRISHI

- Perceived as a large scale impact on fishing community safety, and livelihood.
- Clear impact on the **environment**.
- World bank found it effective & looking at scaling up.

Increase in Self-esteem, Safety (two major incidents highlighted)

Impact

- Social
- Economic
- Environmental
- Research

Reduction in Diesel, Carbon Credit

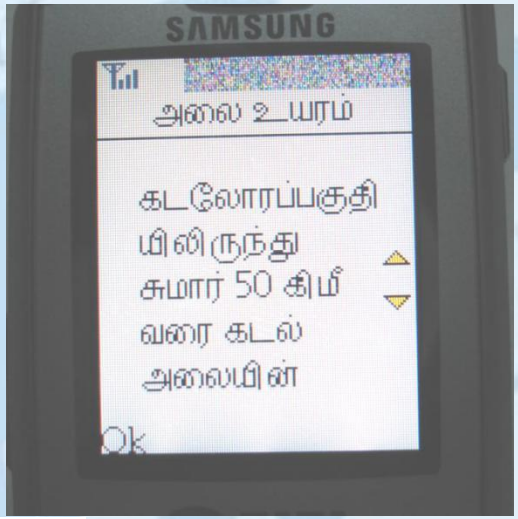
Upto 50% Cost saving (diesel, labor), Subsidy

Feedback based model innovation

Implementation: CMFRI-RC, Mumbai and TCS

INCOIS

FISHER FRIEND MOBILE APPLICATION - BRINGING HELPFUL INFORMATION TO RURAL FISHERMEN (DISSEMINATION)



Box 6: Technology helps deliver a big catch: *taking a chance on new information*

Name: A. Alphonse
Location: *Koyalam* village (Pondicherry)
Segment: Fibre Boat (small-medium fisherman)
Service: Fisher freind

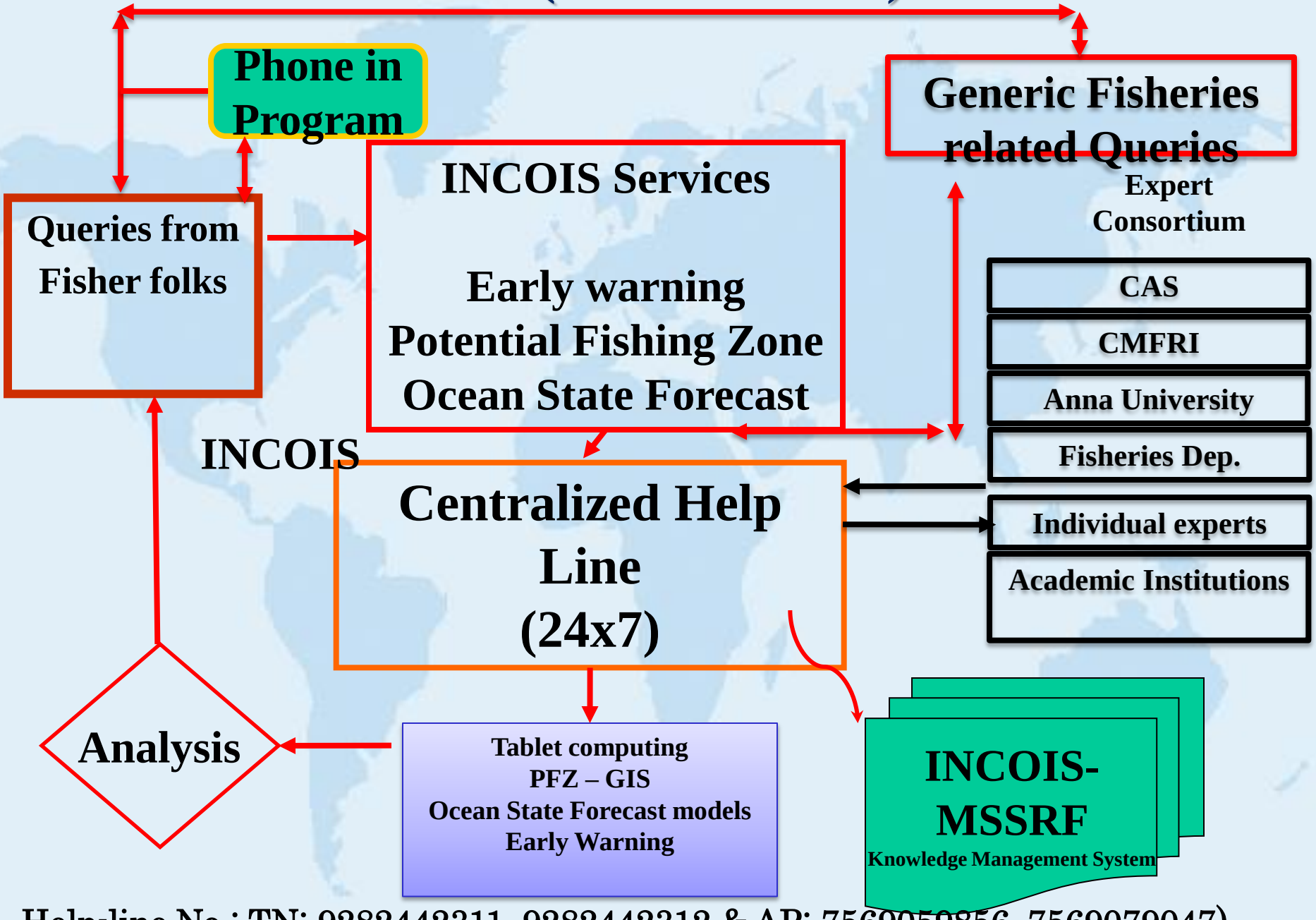
Impact of mobile phone:
a) Revenue – increased catch
b) Information sharing – ability to contact other fishermen from the sea

Evaluating sea conditions using traditional methods, the fishermen of this village judged that fishing would be poor on this day and did not venture out to sea.

One of the fisherman, who was part of the fisher friend programme, chose to rely on the optimal fishing zone information delivered to his mobile and discovered a large pool of fish. He immediately called a friend on land with his mobile and the news spread among the villagers. This prompted the fishermen to venture out to sea, resulting in an overall haul worth Rs.2500,000 for the village.

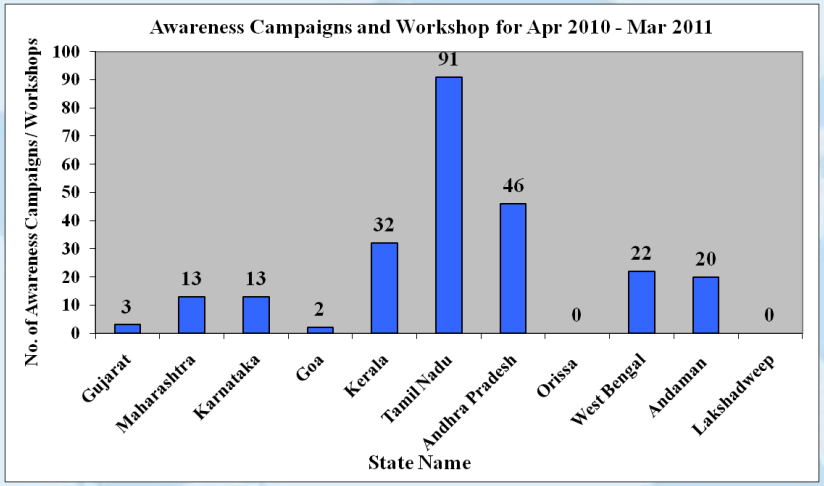
Information on Potential Fishing Zone, Wave height, Weather, Flash News, Government Schemes / announcements, Market, Rural Yellow Pages

FISHERMEN HELP-LINE(DISSEMINATION)



Help-line No.: TN: 9282442311, 9282442312 & AP: 7569059856, 7569079047)

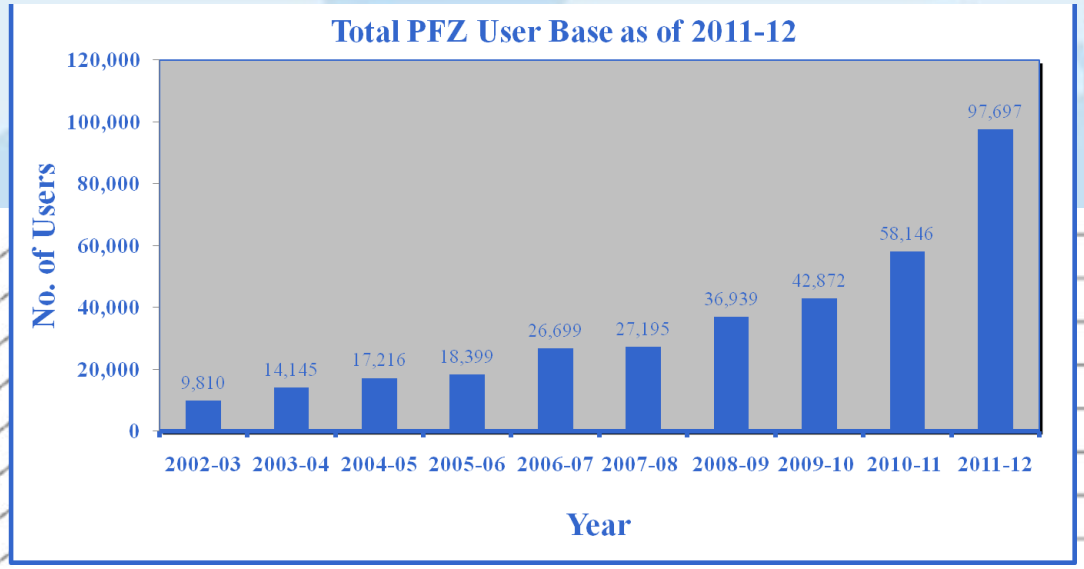
Workshop /Awareness Campaigns



User Interaction Workshops

User Interaction in Danavaipet, E G Dist, Andhra Pradesh

Increasing user base



Benefits from PFZ advisories and ocean state forecasts

Impact Assessment and Economic Benefits

- Identifications of PFZs as well as Ocean State forecast by INCOIS are found to be both timely, accurate and of significant value to the fishing community.
- The economic benefits resulting from identification of PFZ is estimated as:
  - If Only mechanized crafts adopt PFZ: contribution to national GDP can go up from 0.81 % to 1.47%.
  - If both mechanized and motorized crafts adopt PFZ: contribution can go to 1.58-2.00 % of national GDP
  - If all mechanized crafts, motorised crafts and traditional crafts adopt PFZ: contribution to national GDP would be ~ 2.04 %.
- Total Annual net income due to PFZ: `34,000 to 50,000 Crore'
- Catalytic roles by MS Swaminathan Research Foundation (MSSRF), Village Resource Centres (VRC) and Village Knowledge Centre (VKC) in raising awareness and facilitating the knowledge transfer
- The proactive role of INCOIS with the catalytic role of the partnering agency like MSSRF and NGOs could be major milestones in the road map for the progress

From the Executive Summary of a National survey by National Council of Applied Economic Research (NCAER)


Thank You