SAFARI Symposium

Remote Sensing & Fisheries

Kochi, India
February 15-17, 2010

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SAFARI International Symposium

Remote Sensing and Fisheries

15 – 17 February, 2010

Kochi, India

Report

The SAFARI International Symposium on Remote Sensing and Fisheries was held from February 15th – 17th, 2010 at the Abad Plaza Hotel in Kochi, Kerala, India. A press release was prepared and a press conference, which was attended by some 30 people, was held at the Ernakulam Press Club four days prior to the symposium. The symposium made the news in both Malayalam (the official language of Kerala state) and English, in newspapers and on television. The press releases in English and Malayalam are available for download (in PDF format) from the symposium website: www.geosafari.org/kochi.

Figure 1: Dr. Meenakumari B. (left) and Dr. Shubha Sathyendranath (right) at the Ernakulam Press Club

Figure 2: (left to right) Dr T.V.Sankar, Dr. Shubha Sathyendranath, Dr. Meenakumari B., Dr. Trevor Platt, Dr. Pravin Puthra and Dr Boopendranath holding a Press converence at the Ernakulam Press Club

There were 157 registered participants from 30 countries at the SAFARI symposium, including 7 keynote speakers (Dr. Emmanuel Chassot, Dr. Simon Jennings, Dr. Sailesh Nayak, Dr. Jeffrey Polovina, Dr. Sei-Ichi Saitoh, Dr. Kenneth Sherman and Dr. Cara Wilson). A full list of participants is provided in Appendix II. All proceedings of this event were filmed by the world-wide television channel MarineBiz.

The symposium opened with a formal inaugural ceremony. Addresses were given by the following panel members (listed in seating order as per Figure 3): Dr. Venetia Stuart (International Ocean Colour Coordinating Group), Dr. B. Meenakumari (Central Institute of Fisheries Technology), Dr. Shubha Sathyendranath (Plymouth Marine Laboratory), Dr. P Krishnaiah IAS (CEO, National Fisheries Development Board), Dr. Shailesh Nayak (Secretary, Ministry of Earth Sciences), Dr. Trevor Platt (Director, Societal Applications in Fisheries and Aquaculture of Remotely-sensed Imagery Project, Chairman, Chlorophyll Globally Integrated Network), Dr. Nicolas Hoepffner (Joint Research Centre), Dr. Jinlong Fan (Group on Earth Observations) and Dr. Pravin Puthra (Central Institute of Fisheries Technology). The inaugural session included an Invocation to the Sea, composed by Dr. Narayanaswami (National Institute of Oceanography, Goa) and rendered by Dr Vishnu Gopan, the lighting of a ceremonial lamp and the singing of the Indian national anthem.

Figure 3: Members of the inaugural ceremony panel: (left to right) Dr. Venetia Stuart (IOCCG), Dr. Meenakumari B. (CIFT), Dr. Shubha Sathyendranath (PML/ChloroGIN), Dr. P. Krishnaiah IAS (NFDB), Dr. Shailesh Nayak (IOGOOS/INCOIS), Dr. Trevor Platt (SAFARI/ChloroGIN), Dr. Nicolas Hoepffner (JRC), Dr. Jinlong Fan (GEO) and Dr. Pravin Puthra (CIFT).

Figure 4: The lighting of the ceremonial lamp.

Figure 5: Symposium participants during the opening session.

Key points made by the panel included why India was a natural location for this event, given the strong contribution made by the Indian Space Research Organisation and the Ministry of Earth Sciences to the development of Potential Fishing Zones (PFZs) using satellite data, and the current role India is playing in ensuring the continuous collection and dissemination of ocean colour data given the recent launch of Oceansat-2 carrying the Ocean Colour Monitor-2 sensor. India is at the forefront of ocean-colour research and the application of satellite data to address fisheries-related problems.

In total, 42 oral presentations were given, including 7 keynote addresses. In addition, 39 posters were presented during two evening sessions (February 15th and 16th). More details on the schedules and presentations can be found in Appendix I. Session topics focused on the following ocean colour themes:

1. Remote Sensing for Fish Harvesting & Related Issues,
2. Remote Sensing for Ecosystem-based Management of Fisheries,
3. Remote Sensing of Harmful Algal Blooms,
4. Remote Sensing Data in Fisheries Models,
5. Implications of Climate on Fisheries, and
6. Remote Sensing Applications in the Management of Coastal Zones and Fisheries.

Awards were presented to four students and young researchers for the quality of the posters they presented. The evaluation of the posters was based on data presentation, overall perception and layout, understanding of the message and aesthetics by a panel of 6 international researchers. The winners were:

1st place: Elisa Capuzzo, CEFAS, UK
2nd place: Karen Nieto, Pontifica Universidad Catolica de Valparaiso, Chile
3rd place: Kate Munnik, University of Cape Town, South Africa
3rd place: Irene Alabia, University of the Philippines, Philippines

During the valedictory closing session on February 17th, Dr. Trevor Platt and Dr. Shubha Sathyendranath thanked all of the organisers, sponsors and participants. The excellence of the local organizsation by CIFT and SOFTI, under the leadership of Dr. Meenakumari (Director, CIFT), was gratefully acknowledged. Dr. Boopendranath (CIFT) presented the draft recommendations culled from the oral and poster presentations and the discussions (as described below).

Dr Antonio Gagliardini (Argentina) thanked Drs Sathyendranath and Platt for all their hard work over the years in capacity building for remote sensing and for their many contributions to ocean-colour science and applications. The success of the symposium could be traced to their sustained nurture of the ocean-colour community for more than two decades.

Figure 6: Keynote speaker Dr. Shailesh Nayak delivers his talk.

Figure 7: Keynote speaker Dr. Kenneth Shermann delivers his talk.

Figure 8: The venue for the symposium.

Figure 9: Susanna Nurdjaman (right) presenting her poster to Nidhi Nagabhatla (left) and Meshkatul Jannat (middle).

Figure 10: Poster award winners with Dr. Trevor Platt and Dr. Shubha Sathyendranath (left to right): Karen Nieto, Elisa Capuzzo, Dr. Trevor Platt, Dr. Shubha Sathyendranath, Kate Munnik and Irene Alabia.

This event was a success thanks to the hard work, dedication, efficiency and hospitality of many local sponsors and organisers (listed below). In particular, the members from CIFT (Director, Dr. Meenakumari B.) were excellent hosts, organising the venue, dinner arrangements and local transport for all participants. Their help in the success of this symposium was paramount.

Recommendations and conclusions based on presentations and discussions:

Remote sensing of ocean properties provides us with a window into the ocean ecosystem on synoptic scales and has the potential to provide essential information for the governance of ocean ecosystems on global and regional scales. Various environmental properties that influence fish distribution, abundance and migration, and the application of remote sensing in monitoring these factors, should be studied in greater depth. The SAFARI Symposium on Remote Sensing and Fisheries has provided a platform for deliberations on the latest developments in this field and has highlighted case studies using earth observation data with contributions from key fisheries systems around the world. The recommendations from the symposium are anticipated to enhance the assimilation of earth observation data into fisheries research and management and to facilitate the application of remote sensing in fisheries and aquaculture.

1. There is need to further increase both spatial and temporal resolution of satellite-borne sensors for earth observations and incorporate the use of microwave-based sensors that can see through cloud cover to detect variables such as winds and sea-surface roughness, in order to enhance the utility of remote sensing in fisheries and aquaculture.

2. The current ocean colour sensors (SeaWiFS, MODIS-Aqua and MERIS) are operating beyond their planned lifespan and need replacement with technologically advanced systems. The recently-launched Indian sensor OCM-2 is important to cover potential gaps in data.

3. It is essential to maintain high quality *in situ* observations of environmental and bio-optical variables for the development of conceptual models and validation of remote sensing estimations and model performance.

4. The status of currently available algorithms for assessing chlorophyll in optically complex coastal waters, inland water bodies and estuaries, affected by CDOM and suspended matter, are being evaluated and their limitations addressed. Evaluation of errors and further improvements in the interpretation of ocean-colour data in coastal and inland water bodies would be particularly useful for fisheries applications.

5. Although remote sensing is of immense importance for providing reliable and accurate data at high spatial and temporal resolution, it has to be complemented with work on: (i)

tailor-made algorithms for retrieval of Chl-a, total suspended sediments and coloured dissolved organic matter from Case II waters (optically-complex coastal and inland waters); (ii) ocean general circulation models at sufficiently high resolution, (iii) *in situ* measurements using coastal buoys and ships of opportunity; as well as (iv) data dissemination systems.

6. The use of remote sensing for the assessment of Potential Fishing Zones (PFZs) needs to be carried out in conjunction with a suitable strategy for ecosystem-based fisheries management with a view to the avoidance of overfishing.

7. There is a need for continuous archiving of satellite remotely-sensed data, such as: sea-surface temperature, chlorophyll, sea-surface height and surface winds. Near real-time data need to be made available at low or no cost to facilitate research and PFZ forecasting.

8. Efforts may be made to replicate and extend the success of PFZ advisories based on satellite remote sensing and Information and Communication Technologies made available to the fishing communities in India and elsewhere. This will enhance the efficiency of harvesting operations based on precautionary and sustainable principles, reduce the fuel consumption and enhance socio-economic benefits.

9. Success of PFZ forecasts may be further improved by synergistic analysis of signatures of satellite-derived chlorophyll concentrations, sea-surface temperature, sea-surface height anomalies and other parameters.

10. Efforts may be made to inform fishing communities about the benefits of remote sensing applications in fisheries and aquaculture through training and education.

11. The 64 Large Marine Ecosystems (LMEs) of the world contribute goods and services worth an estimated US $12.6 trillion annually to the global economy, which includes 80% of the world fish catch. The primary production appropriated by current global fisheries has been estimated at 17-112% higher than that appropriated by sustainable fisheries. There are indications that global primary production is declining in some parts due to climate variability and change, which may be reflected in fish catches. The application of satellite remote sensing technology to support management practices in recovering depleted marine fish stocks, restoring degraded habitats, controlling pollution, monitoring eutrophication and ocean acidification, conserving biodiversity and adapting to climate change need to be supported and encouraged by developing new methodologies for measuring the spatial and temporal environmental conditions of LMEs.

12. There is an urgent need to move towards open-access global time series databases of remotely sensed data, *in situ* observations and reliable catch estimates. It is also important for international collaboration to facilitate the development of models and work towards better governance of our oceanic resources on global and regional levels.

13. The fishing advisory TurtleWatch in the Pacific Ocean has been based on information obtained using electronic tags and complemented by satellite remotely-sensed sea-surface temperature, surface chlorophyll, sea-surface height and surface wind data. The success of this programme may be evaluated for adaptation in other areas affected by fishing-induced by-catch mortality of species at risk.

14. The effectiveness of probabilistic models, such as Bayesian networks, may be further refined and validated to estimate primary production and fisheries potential from satellite remote sensing of ocean colour, sea-surface temperature and wind, in addition to *in situ* observations.

15. The composite-frontal map approach combines the location, strength and persistence of ocean thermal and colour fronts, observed over several days, into a single map via an automated clustering algorithm and allows intuitive interpretation of meso-scale structures. The use of frontal maps to study the distribution and management of commercial species and delimitation of biodiversity hotspots and marine protected areas may be further explored.

16. Integrated systems for early warnings of emerging Harmful Algal Blooms (HABs) and monitoring of HABs based on earth observation data, field observation and modelling need to be further refined; sensor technologies and algorithms need to be developed for species-specific detection and forecasts.

17. Models based on remotely-sensed estimates of phytoplankton biomass partitioned according to size, predator-prey ratios and food chain length must be further refined and validated for rapid estimation of potential fish production.

18. Approaches based on simple successful models using remotely-sensed water quality properties, *in situ* observations and GIS-based analysis may be adapted and popularized for site selection in coastal aquaculture.

19. The success achieved in correlating remotely-sensed data to shrimp growth and recruitment (*Pandalus borealis*) has shown a new approach to the ecosystem-based management of the eastern Scotian Shelf shrimp fishery. Similar approaches may be applied to other fisheries for the determination of diagnostic indicators of stock health, based on remotely sensed data, and to formulate fishery management plans.

20. TOREDAS (Traceable and Operational Resource and Environment Data Acquisition System) is a very important tool for sustainable fisheries management for fishermen targeting Japanese common squid and skipjack tuna with PFZ forecasts and Vessel Monitoring Systems (VMS). Similar approaches are possible, and may be adopted, in other fishery systems.

21. The use of remote sensing in monitoring climate change and the impacts of extreme weather events (i.e. tsunamis) is well documented. Remote sensing applications in the forecasting and monitoring of such events, for disaster management and mitigation, may be further cultivated.

22. The participants noted that the international symposium on remote sensing and fisheries was the first of its kind, had created a very strong interest, and suggested strongly that it be repeated at a future date.

Evening Activities:

1. Monday, February 15th: A CIFT-sponsored cultural event was held, following the poster session, in the symposium meeting room. The cultural programme included a wind ensemble playing traditional temple music and dance performances in Bharatnatyam and Mohiniattam styles by CIFT scientists and colleagues. The welcome dinner was held on the rooftop terrace of the Abad Plaza Hotel and was co-sponsored by CIFT and the Abad Group.

Figure 11: CIFT-sponsored cultural entertainment on Monday night.

Figure 12: CIFT-sponsored dinner on Abad's rooftop.

Figure 13: CIFT-sponsored cultural entertainment on Monday night.

Figure 14: CIFT-sponsored cultural entertainment on Monday night.

2. Tuesday, February 16th: A SAFARI-sponsored dinner was held at the Bolgatty Palace Hotel on Bolgatty Island. Participants were shuttled to the estate by bus where dinner was served in the garden, facing the Kochi backwaters. Several talented local scientists and participants provided musical entertainment and dancing.

Figure 15: Arrival at the SAFARI-sponsored dinner at Bolgatty Palace Hotel.

Figure 16: The SAFARI-sponsored dinner at Bolgatty Palace Hotel.

Figure 17: Group photo at Bolgatty Palace Hotel.

Figure 18: After-dinner dancing (led by local participants) at Bolgatty Palace Hotel.

Sponsors

International:

- Canadian Space Agency (CSA)
- Group on Earth Observations (GEO)
- International Ocean Colour Coordinating Group (IOCCG)
- Department of Fisheries & Oceans, Canada
- Partnership for Observation of the Global Oceans (POGO)
- Indian Ocean Global Ocean Observing System (IOGOOS)
- National Centre for Earth Observation (NCEO), UK
- Joint Research Centre, European Commission (JRC), Italy
- UNESCO Intergovernmental Oceanographic Commission (IOC)
- International Council for the Exploration of the Sea (ICES)
- Societal Applications in Fisheries and Aquaculture using Remotely-sensed Imagery (SAFARI)

National:

- Central Institute of Fisheries Technology (CIFT), Indian Council of Agricultural Research
- Indian National Centre for Ocean Information Services (INCOIS), India
- Ministry of Earth Sciences (MoES), India
- Indian Space Research Organization (ISRO), India
- National Institute of Oceanography Regional Centre, Kochi (NIO-RC Kochi), India
- Department of Animal Husbandry, Dairying and Fisheries (DAHD&F), India
- National Fisheries Development Board (NFDB), India
- Department of Science and Technology (DST), India
- Society of Fisheries Technologists India (SOFTI) , India
- Central Institute of Freshwater Aquaculture (CIFA), ICAR, India
- Central Institute of Fisheries Education (CIFE), ICAR, India
- Central Marine Fisheries Research Institute (CMFRI), ICAR, India
- Central Institute of Brackishwater Aquaculture (CIBA), ICAR, India
- Marine Products Export Development Agency (MPEDA), India
- Fishery Survey of India (FSI), India

Appendix I: Schedule for the SAFARI Symposium

Inaugural session schedule:

09:00	Invocation	:	
09:05	Welcome address	:	**Dr. B. Meenakumari** Central Institute of Fisheries Technology, India
09:10	Lighting of the ceremonial lamp & inaugural address	:	**Dr. Shailesh Nayak** Ministry of Earth Sciences, Government of India
09:20	Introduction to the Symposium	:	**Dr. Trevor Platt** Plymouth Marine Laboratory
09:40	Presidential address	:	**Dr. P. Krishnaiah, IAS** National Fisheries Development Board, India
09:50	Special address	:	**Dr. Shubha Sathyendranath** Plymouth Marine Laboratory
	Felicitations	:	
10:05		:	**Dr. Jinlong Fan** Group on Earth Observations
10:10		:	**Dr. Nicolas Hoepffner** Joint Research Centre
10:15		:	**Dr. Venetia Stuart** International Ocean Colour Coordinating Group
10:20	Closing Statements	:	**Dr. P. Pravin** Central Institute of Fisheries Technology, India
10:30	Coffee Break		

Symposium schedule:

Monday, February 15th

Session 1: Inauguration, Part A
Chair: Shubha Sathyendranath

09.00 – 10.40: Inaugural Session

~ Coffee Break (10.40 - 11.10) ~

Session 2: Inauguration, Part B
Chair: N.R. Menon

11.10 – 11.50:	**Shailesh Nayak** *(Keynote Speaker)*	Remote sensing applications to fisheries: Indian initiative to the improvement of the socio-economics of fishing communities
11.50 – 12.30:	**Kenneth Sherman** *(Keynote Speaker)*	The application of satellite remote sensing for assessing productivity and fisheries yields of the world's Large Marine Ecosystems (LMEs)

~ Lunch Break (12.30 – 14.00) ~

Session 3: Remote Sensing for Fish Harvesting & Related Issues
Chair: Vivian Lutz

14.00 – 14.20:	**Beena Kumari**	Phytoplankton patch and tuna forage: A study using IRS P4 OCM
14.20 – 14.40:	**Himmatsinh Solanki**	Synergistic analysis of signatures of satellite-derived SSHA, SST and chlorophyll for the exploration of fishery resources
14.40 – 15.00:	**Satsuki Matsumura**	The roles of local scientists for the build-up of sustainable fisheries systems using high technology, such as satellite information
15.00 – 15.20:	**Rajan Nammalwar**	Applications of remote sensing in validations of potential fishing zones (PFZs) along the coast of North Tamilnadu, India
15.20 – 15.40:	**Preetha Nair**	Potential fishing zone advisories for the benefit of coastal fishermen along the Kerala coast: A case study

~ Coffee Break (15.40 – 16.10) ~

Session 4: Remote Sensing for Fish Harvesting & Related Issues
Chair: Kanthi Yapa

16.10 – 16.50:	**Jeffrey Polovina** *(Keynote Speaker)*	Applications of satellite remotely-sensed oceanographic data in research on Loggerhead sea turtle pelagic ecology

16.50 – 17.10:	**John Field**	Using Bayesian networks to estimate primary production and fisheries potential from a combination of satellite surface remote sensing and *in situ* observations in the Benguela upwelling region
17.10 – 17.30:	**Marina Marrari**	Effects of environmental variability at frontal systems on zooplankton and fish of the Southwestern Atlantic Ocean
17.30 – 17.50:	**Jonson Gaol**	Remote sensing applications for fishing ground assessment in Indonesian waters
17.50 – 18.10:	**Mohammad Zahedur Rahman Chowdhury**	Assessing environmental preference of the northern Bay of Bengal pelagic fish species using catch-per-effort and remote sensing data

18.10 – 19.30: Refreshments & Poster Session
19.30 – CIFT Dinner at Abad's Rooftop

Tuesday, February 16th

Session 5: Remote Sensing for Ecosystem-based Management of Fisheries
Chair: Lasse Pettersson

09.00 – 09.40:	**Emmanuel Chassot** *(Keynote Speaker)*	Marine primary production regulates world fish catch
09.40 – 10.00:	**Vivian Lutz**	Use of satellite information in fisheries research in Argentina
10.00 – 10.20:	**Peter Miller**	Simplifying satellite ocean front maps and time-series analysis for applications in fisheries management
10.20 – 10.40:	**M. Muralidhar**	Impact of the cyclone Aila on brackish water aquaculture in West Bengal, India: Lessons to be learned for preparedness and adaptive measures

~ Coffee Break (10.40 – 11.10) ~

Session 6: Remote Sensing of Harmful Algal Blooms
Chair: Joji Ishizaka

11.10 – 11.30:	**Tong Phuoc Hoang Son**	Detecting chlorophyll *a* distribution and harmful algal blooms in the Vietnam coastal upwelling by optical satellite imagery high resolution
11.30 – 11.50:	**Tiit Kutser**	Recognising potentially harmful blooms of cyanobacteria by means of optical remote sensing
11.50 – 12.10:	**Jinhui Wang**	Monitoring the bloom of Enteromorpha (*Ulvophyceae, Chlorophyta*) using satellite remote sensing in the Yellow Sea

~ Lunch Break (12.10 – 14.00) ~

Session 7: Remote Sensing of Harmful Algal Blooms
Chair: Srinivas K.

14.00 – 14.20:	**Sumisha Velloth**	Impact of the 2004 earthquake on the coral environs using remote sensing and GIS: A case study of North Sentinel Island, Andaman
14.20 – 14.40:	**Lasse Pettersson**	Integrated monitoring and forecasting of harmful algae bloom events in coastal waters for use by aquaculture
14.40 – 15.00:	**Chiranjivi Jayaram**	Monitoring *Trichodesmium* blooms in the Arabian Sea using *in situ* and satellite products during the past decade
15.00 – 15.20:	**Joji Ishizaka**	Satellite detection and countermeasure of red tides

~ Coffee Break (15.20 – 15.50) ~

Session 8: Remote Sensing Data in Fisheries Models
Chair: Beena Kumari

15.50 – 16.30:	**Simon Jennings** *(Keynote Speaker)*	Linking remote sensing data and food web models to predict consumer biomass in the global oceans
16.30 – 16.50:	**I Nyoman Radiarta**	GIS-based physical models for Japanese kelp (*Lamanaria japonica*) aquaculture and site selection in Southwestern Hokkaido, Japan
16.50 – 17.10:	**Eurico D'Sa**	A Gulf Coast information system using remote sensing products and a 3-dimensional coastal model: Assessing potential applications for fisheries
17.10 – 17.30:	**Shovonlal Roy**	Phytoplankton size-spectrum from remote sensing by sequential data assimilation

17.30 – 19.00: Refreshments & Poster Session
19.10 – SAFARI Dinner at Bolgatty Palace

Wednesday, February 17th

Session 9: Implications of Climate on Fisheries
Chair: Nicolas Hoepffner

09.00 – 09.40:	**Cara Wilson** *(Keynote Speaker)*	The rocky research to operations transition of ocean color – what's fisheries got to do with it?
09.40 – 10.00:	**S. Prasanna Kumar**	Is the Arabian Sea responding to global warming?
10.00 – 10.20:	**Usha Manjusha**	Seasonal and interannual changes in oceanographic features and their

		impact on small pelagic catches off Kerala
10.20 – 10.40:	**Li Zhai**	Phytoplankton phenology on the Scotian Shelf

~ Coffee Break (10.40 – 11.10) ~

Session 10: Implications of Climate on Fisheries
Chair: Mark Dowell

11.10 – 11.30:	**Phiros Shah**	Impacts of the Indian Ocean dipole on major pelagic fish species on the Southwest coast of India
11.30 – 11.50:	**Nidhi Nagabatla**	Landscape level management of seasonal floodplains to create resilient Agro-ecosystems
11.50 – 12.10:	**Adriana Affonso**	Fish–habitat relationships in Amazon floodplain lakes: A Remote sensing approach to the pirarucu (*Arapaima gigas*) fishery
12.10 – 12.30:	**Peter Koeller**	The potential of remote sensing in fisheries management: The case of the Northern shrimp

~ Lunch Break (12.30 – 14.00) ~

Session 11: Remote Sensing Applications in the Management of Coastal Zones and Fisheries
Chair: Milton Kampel

14.00 – 14.40:	**Sei-Ichi Saitoh** *(Keynote Speaker)*	An operational use of remote sensing and marine-GIS for sustainable fisheries and aquaculture
14.40 – 15.00:	**Kanthi Yapa**	Coastal upwelling along the coast of Southern Sri Lanka during the Southwest monsoon for the period 2003 – 2007
15.00 – 15.20:	**François Carnus**	Monitoring the Southwest Indian Ocean marine and fish resources: The AMESD program
15.20 – 15.40:	**Ricardo Oscar Amoroso**	Medium resolution remote sensing in the coastal zone: A frame for small-scale fisheries assessment in Patagonia (Argentina)

~ Coffee Break (15.40 – 16.10) ~

Session 12: Remote Sensing Applications in the Management of Coastal Zones and Fisheries
Chair: Trevor Platt

16.10 – 16.30:	**Mark Dowell**	Primary production estimates for global continental margins: the impact of optically complex waters
16.30 – 16.50:	**Milton Kampel**	Estimation of Primary Production for Fisheries Management in the South

Brazil Bight, Southwestern-South Atlantic

16.50 – 17.10: **Stewart Bernard** Use of remote sensing to detect harmful algal blooms off Southern Africa

17.10 – 17.40: Valedictory Session

Posters Presented:

1. **R. Aishwarya:** Earth geo-observation: Climate change and sea surface temperature

2. **Irene D. Alabia:** Interaction of the Kuroshio with the Northern biocol shelf: Implications on biological productivity

3 .**N. C. Anilkumar:** Impact of potential fishing zone advisories in drift gillnet fishing along the Kerala coast: A comparative study on the technical efficiency of two different drift gillnet fishing sectors off Kerala

4. **P. Muhamed Ashraf:** *In situ* estimation of the underwater light field during the Northeast monsoon in the Bay of Bengal

5. **Raghavan B. R.:** IRS-P4 OCM-derived distribution of chlorophyll off Karwar, central West Coast of India: Implications for potential fishing zones

6. **G. Balamurugan:** Utilizing multi-temporal EO-1 ALI, ASTER data and GIS for assessment of environmental changes on the Cuddalore coast, Tamilnadu

7. **Ray Barlow:** Temporal variability of primary production in the Benguela and Agulhas ecosystems

8. **Usha Bhagirathan:** Bio-optical properties of a phytoplankton bloom in the coastal waters off Cochin during the onset of the Southwest monsoon

9. **B. G. Bhaware:** Marine fishes captured under PFZ and non-PFZ regions through satellite imagery along the coast of the Ratnagiri District, Maharashtra State

10. **Carsten Brockman** MERIS full resolution coastal zone embedded in the international scientific and user communities

11. **Mariana Callejas-Jiménez:** Response of the two shrimp (*Farfantepenaeus californiensis*) and (*Penaeus stylirostris*) to long-term variability in the upper Gulf of California (Mexico) and adjacent areas

12. **Elisa Capuzzo** Primary production estimates from biogeochemical models, satellite and *in*

situ observations as input for a dynamic size-based fish model for the North Sea

13. **Ana I. Dogliotti:** Partition of the Patagonian continental shelf based on remote sensing data: Identification of shortfin squid (*Illex argentinus*) fishing grounds

14. **Gayatri Dudeja:** Comparison of atmospheric correction schemes using MODIS-AQUA data in the Arabian Sea

15. **Luis Escudero:** Remote sensing for artisanal fisheries in Peru

16. **Marie-Hélène Forget:** Phytoplankton size structure, distribution and primary production as the basis for trophic analysis of Caribbean ecosystems

17. **César Fuentes-Yaco:** Condition factors of the Northern pink shrimp (*Pandalus borealis*) in the Northwest Atlantic

18. **D. A. Gagliardini:** Contribution of remote sensing and *in situ* data in fishery ecosystem management in the San Matias Gulf, Argentina

19. **Jenny Huggett:** Can altimetry data be used to predict phytoplankton and zooplankton biomass associated with mesoscale eddies in the Mozambique Channel?

20. **M. Jayanthi:** Macro planning for aquaculture development using remote sensing techniques and GIS

21. **Sourav Maity:** Climate change and its impact on the distribution of marine fish species of coastal waters of Sundarbans, West Bengal

22. **Nandini Menon:** Fluorescence emission ratios as a method for determining the source of coloured dissolved organic matter in the Cochin estuary, SW coast of India

23. **Peter I. Miller:** Monitoring and predicting harmful and nuisance algal blooms using EO data and ecosystem forecasts

24. **Wahid Moufaddal:** Fall and rise of the Egyptian marine fisheries off the Nile Delta: Hypothesis, uncertainties and the role of satellite ocean colour data

25. **Kate Munnik:** The relationship between coastal oceanographic features and the movement of several inshore line-fish species on the Southwestern African coast

26. **Karen Nieto:** Mesoscale oceanic structures in the Canary upwelling system: Possible indicators of transport and retention areas for sardine and anchovy ichthyoplankton

27. **Susanna Nurdjaman:** Monitoring chlorophyll *a* concentration using remote sensing: A case study of Jakarta Bay

28. **Anbiah Rajan:** Estimation of chlorophyll concentration in Abu Dhabi waters using different satellite imagery

29. **K. Gopala Reddy:** Remote sensing applications for marine fishery resources: Validations off the A.P. coast, India

30. **Manjira Roy:** Interannual variability of chlorophyll concentration in the Arabian Sea using GIS

31. **Shaju S. S.:** A comparative study on pre-monsoon inherent bio-optical properties of estuarine and coastal waters of Cochin

32. **Annette Samuelsen:** Environmental monitoring with the Topaz forecasting system

33. **Noela Sánchez-Carnero:** Medium-scale interannual costal dynamics in a NW Atlantic area
(Galicia, NW Spain): Analysis of oceanographic satellite data (CZCS, SeaWIFS and AVHRR)

34. **Eduardo Santamaría-del-Ángel:** Relationship between climate change and shrimp fisheries in the Gulf of California (Mexico) and Adjacent Areas

35. **Venetia Stuart:** Evolution of ocean colour radiometry: The role of the IOCCG

36. **Jemima Undrajavarapu:** A Frame-work for an operational ocean colour data processing chain

37. **Anil Kumar Vijayan:** A multi-band ratio scheme for the detection and monitoring of algal bloom events in the Arabian Sea

38. **Teja Arief Wibawa:** Oceanographic preferences of bigeye tuna (*Thunnus obesus*) in the Southern Indian Ocean, Java-Bali, Indonesia

39. **Robert Williamson:** Developing a Bayesian network to relate *in situ* measurements to satellite remote sensing surface observations for the estimation of primary production and fisheries potential

Appendix II: List of Symposium Participants

	Name	Institute	Country
1	Adriana Affonso	Instituto Nacional de Pesquisas Espaciais - Observação da Terra-SERE.	Brazil
2	Joseph K Ajith	Nansen Envr. Res.	India
3	Irene Alabia	University of the Philippines	Philippines
4	TV Ambrose	CMFRI	India
5	Ricardo Oscar Amoroso	CENPAT-CONICET	Argentina
6	Lotliker Aneesh	INCOIS	India
7	Kumar Aneesh	CIFT	India
8	Kumar N.C. Anil	Kerala State Remote Sensing and Environment Centre	India
9	Thomas A. Anit	Cochin University	India
10	G. Archana	CIFT	India
11	Muhamed Ashraf	CIFT	India
12	Rezah Badal	Mauritius Oceanography Institute	Mauritius
13	A.N. Balchand	Cochin University of Science and Technology	India
14	Beena Kumari	Indian Space Research Organisation	India
15	Stewart Bernard	CSIR	South Africa
16	Usha Bhagirathan	CIFT	India
17	M.R. Boopendranath	CIFT	India
18	Carsten Brockman	Brockmann Consult	Germany
19	Sue Budge	Dalhousie University	Canada
20	Bhaware Budharatna	Babasaheb Ambedkar Marathwada University	India
21	Mariana Elvira Callejas Jimenez	UABC	Mexico
22	Elisa Capuzzo	CEFAS	UK
23	Francois Carnus	Mauritius Oceanography Institute	Mauritius
24	Ravishankar Chandragiri	CIFT	India

25	Emmanuel Chassot	IRD	France
26	Jayaram Chiranjivi	Nansen Environmental Research Center	India
27	Mohammad Zahedur Rahman Chowdhury	Institute of Marine Sciences and Fisheries	Bangladesh
28	Eurico D'Sa	Louisiana State University	USA
29	Shibsankar Das	CIFT	India
30	Lisa Delaney	Dalhousie University	Canada
31	Reny Devassy		India
32	Ana Dogliotti	Inst. de Astr. y Fisica del Espacio(IAFE)-CONICET	Argentina
33	Mark Dowell	JRC	Italy
34	Gayatri Dudeja	INCOIS	India
35	Leela Edwin	CIFT	India
36	Luis Orlando Escudero Herrera	Instituto del mar del Peru	Peru
37	Jinlong Fan	GEO Secretariat	Switzerland
38	John Field	University of Cape Town	South Africa
39	Marie-Helene Forget	Dalhousie University	Canada
40	Cesar Fuentes-Yaco	BIO	Canada
41	Domingo Antonio Gagliardini	Instituto de Astronomía y Física del Espacio/Centro Nacional Patagónico	Argentina
42	Upendra Ganga	CMFRI	India
43	Johnson Gaol	Bogor Agricultural University	Indonesia
44	Grinson George	CIAE, Port Blair	India
45	Nikita Gopal	CIFT	India
46	Shaikh Halima - bi Shagufta	NIO	India
47	Patnala Hari Prasad	Andhra University	India
48	C.K. Haridevi	NIO	India
49	Masataka Hayashi	Tokai University	Japan
50	Nicolas Hoepffner	JRC	Italy
51	Joji Ishizaka	Nagoya University	Japan
52	Jethva Jagdish	CIFT	India
53	Meshkatul Jannat	University of Dhaka	Bangladesh

54	Girija Jayaraman	Indian Institute of Technology	India
55	Jose Jean	JRF, COMAPS	India
56	Simon Jennings	CEFAS	UK
57	Nimit Joshi	JNTU	India
58	Milton Kampel	INPE	Brazil
59	Geeta Chandrakant Kanolkar	NIO	India
60	Peter Koeller	BIO	Canada
61	P. Krishnaiah	NFDB	India
62	Ritu Kumari	NIO	India
63	Tiit Kutser	Estonian Marine Institute	Estonia
64	Margareth Kyewalyanga	University of Dar es Salaam	Tanzania
65	P T Lakshmanan	CIFT	India
66	K V Lalitha	CIFT	India
67	Vivian Lutz	INIDEP	Argentina
68	Boopendranath M R	CIFT	India
69	Ramakrishnan Madhu	CIFT	India
70	Sourav Maity	Jadavpur University	India
71	Jayanthi Marappan	Central Institute of Brackishwater Aquaculture	India
72	V E Nethaji Mariappan	Sathyabama University	India
73	Marina Marrari	NASA Goddard Space Flight Centre	USA
74	P T Mathew	CIFT	India
75	Suseela Mathew	CIFT	India
76	Satsuki Matsumura	Natural Resources Institute for Far Sea Fisheries	Japan
77	B. Meenakumari	CIFT	India
78	NR Menon	NIO Goa	India
79	Nandini Menon	Nansen Environmental Research Center	India
80	Peter Miller	PML	UK
81	C O Mohan	CIFT	India
82	Wahid Mohamed Moufaddal	National Institute of Oceanography and Fisheries	Egypt

83	Remesan MP	CIFT	India
84	Kate Munnik	University of Cape Town	South Africa
85	Raghavendra Mupparthy	INCOIS	India
86	Mani Murali	NIO	India
87	M. Muralidhar	Central Institute of Brackishwater Aquaculture	India
88	Nidhi Nagabhatla	WorldFish	Malaysia
89	Kumar M Nagaraj	INCOIS	India
90	Preetha Nair	CMFRI	India
91	Rajan Nammalwar	INCOIS	India
92	Madhavan Narayanan	Anna University	India
93	Shailesh Nayak	Ministry of Earth Sciences	India
94	Karen Nieto	Pontifica Universidad Catolica de Valparaiso	Chile
95	Susanna Nurdjaman	Bandung Institute of Technology	Indonesia
96	Sreejith P Thilakan	CIFT	India
97	Sunita Pandey	NIO	India
98	A Parvathi	NIO	India
99	Sony Paul	CMFRI	India
100	Lasse Pettersson	Nansen Environmental Research Center	Norway
101	Narayana Pillai	CMFRI	India
102	PJ Vidya	NIO	India
103	Trevor Platt	PML	Canada/UK
104	Jeffrey Polovina	NOAA	USA
105	K Ponnusami	Central Institute of Brackishwater Aquaculture	India
106	Raghu Prakash	CIFT	India
107	Kumar Prasanna	NIO	India
108	Pravin Puthra	CIFT	India
109	Tiago Queiroz	University Agostinho Neto	Angola
110	I Nyoman Radiarta	Hokkaido University	Indonesia
111	Anbiah Rajan	Environment Agency Abu Dhabi	UAE

112	Radhika Rajasree	Sathyabama University	India
113	A Ramachandran	CUSAT	India
114	Gopala Reddy	Andhra University	India
115	Remya Remadevi	CMFRI	India
116	Manjira Roy	Barkatullah University	India
117	Shovonlal Roy	Dalhousie University	Canada
118	Kali Charan Sahu	Berhampur University	India
119	Sei-Ichi Saitoh	Hokkaido University	Japan
120	R Sajeev	Cochin University of Science and Technology	India
121	Annette Samuelsen	Nansen Environmental and remote Sensing Center	Norway
122	Noela Sanchez	University of Coruna	Spain
123	MG Sanilkumar	Cochin University	India
124	TV Sankar	SOFTI	India
125	Eduardo Santa Maria	University Autonoma de Baja California	Mexico
126	AV Saramma	Cochin University of Science and Technology	India
127	A. Saravanakumar	Annamalai University	India
128	Shubha Sathyendranath	PML	Canada/UK
129	Phiros Shah	Cochin University of Science and Technology	India
130	S.S. Shaju	CIFT	India
131	Paresh Shashidev Khanolkar	CIFT	India
132	SC Shenoi	Director, INCOIS	India
133	Latha Shenoy	Central Institute of Fisheries Education	India
134	Kenneth Sherman	NOAA	USA
135	R Shibu	COMAPS	India
136	Himmatsinh U. Solanki	ISRO	India
137	T Srinivas Kumar	INCOIS	India
138	Venetia Stuart	BIO	Canada
139	Khade Sunil	Dr. Blasaheb	India
140	Saly Thomas	CIFT	India

141	Tong Phuoc Hoang Son	Nhatrang Oceanography Institute	Vietnam
142	Sandra Edith Torrusio	CONAE	Argentina
143	Jemima Undrajavarapu	INCOIS	India
144	Manjusha Usha	CMFRI	India
145	Sreedhar Utravalli	CIFT	India
146	Sandesh Varik	NIO	India
147	Radhakrishnan Vasudevan Nair	CIFT	India
148	Sumisha Velloth	INCOIS	India
149	Anil Kumar Vijayan	INCOIS	India
150	PK Vijayan	CIFT	India
151	E. Vivekanandan	CMFRI	India
152	Jinhui Wang	East China Sea Environmental Monitoring center	China
153	Teja Arief Wibawa	Institute for Marine Research and Observation	Indonesia
154	Robert Williamson	University of Cape Town	South Africa
155	Cara Wilson	NOAA	USA
156	Kanthi Yapa	University of Ruhuna	Sri Lanka
157	Li Zhai	BIO	Canada