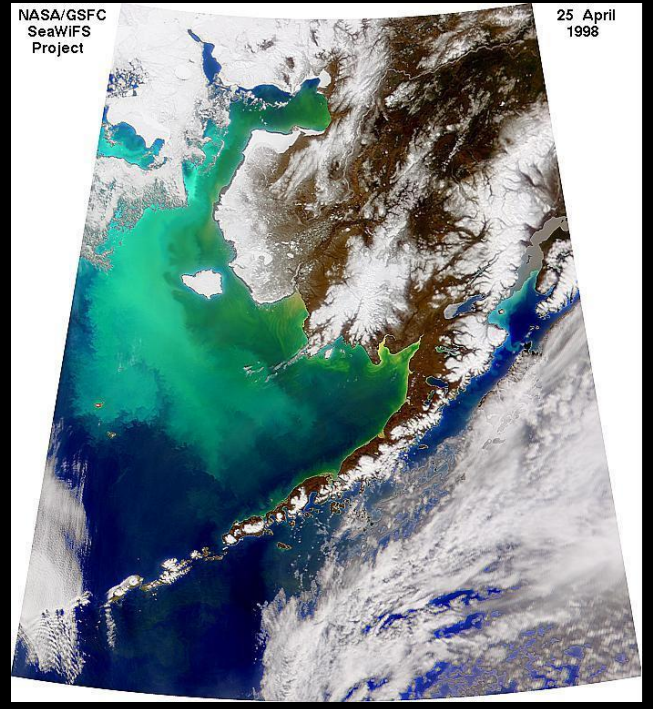
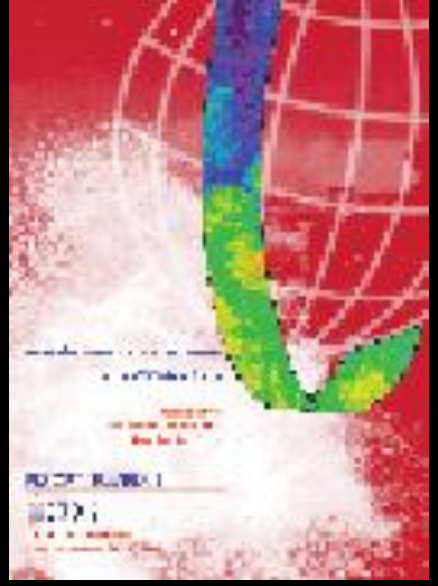
Remote Sensing for Fisheries

Shubha Sathyendranath and Trevor Platt
Plymouth Marine Laboratory
UK

Fisheries Applications of EO include:

- Harvest Fisheries
  - economies of fuel and time
- Fisheries Management
  - intelligence on ecosystem fluctuations and effect on future states of exploited stocks
- Aquaculture Industry
  - carrying capacity, harmful algal blooms
- Protection of Species at Risk
  - exclusion zones and reduction of by-catch
- Marine Protected Areas & Vulnerable Marine Ecosystems
  - delineation of these
- Ecosystem Health and Ecosystem Services
  - monitoring health, evaluating services
- High Seas Governance
  - international governance strategy, ecosystem delineation, straddling stocks

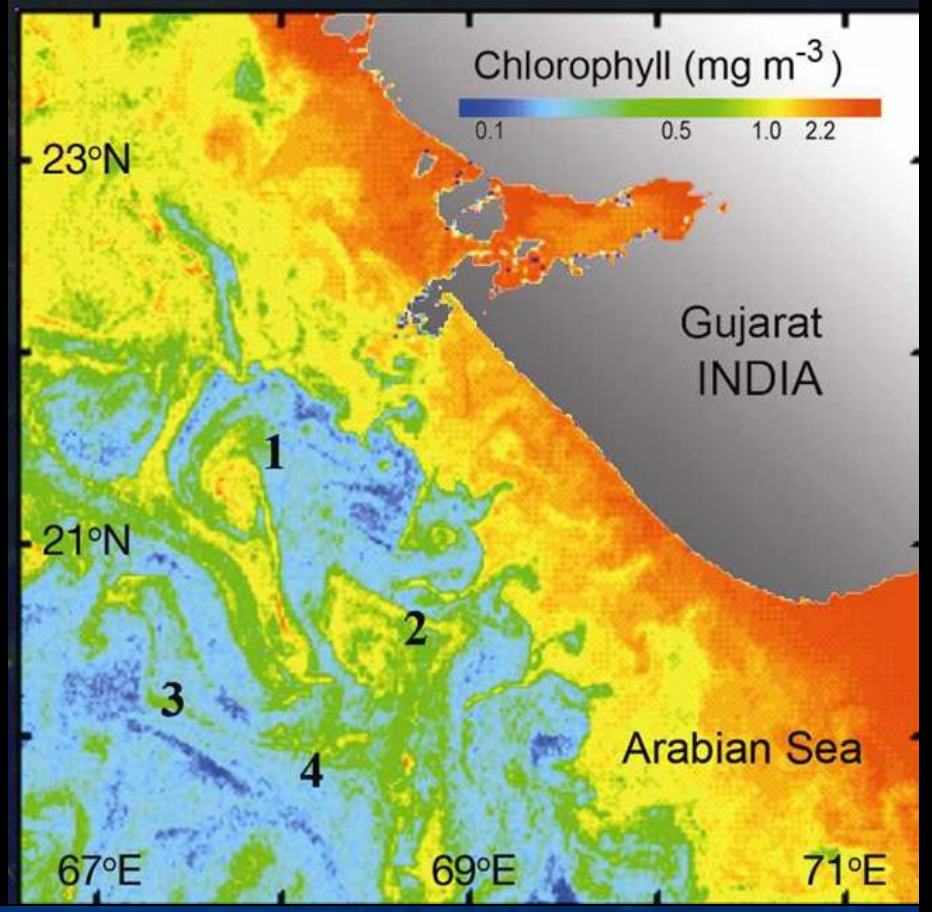




For further details, see IOCCG Report No. 8

What some countries are doing

INDIA Routinely delivers remotely-sensed data (chlorophyll and temperature) to fishing communities all around the coast, in local languages.

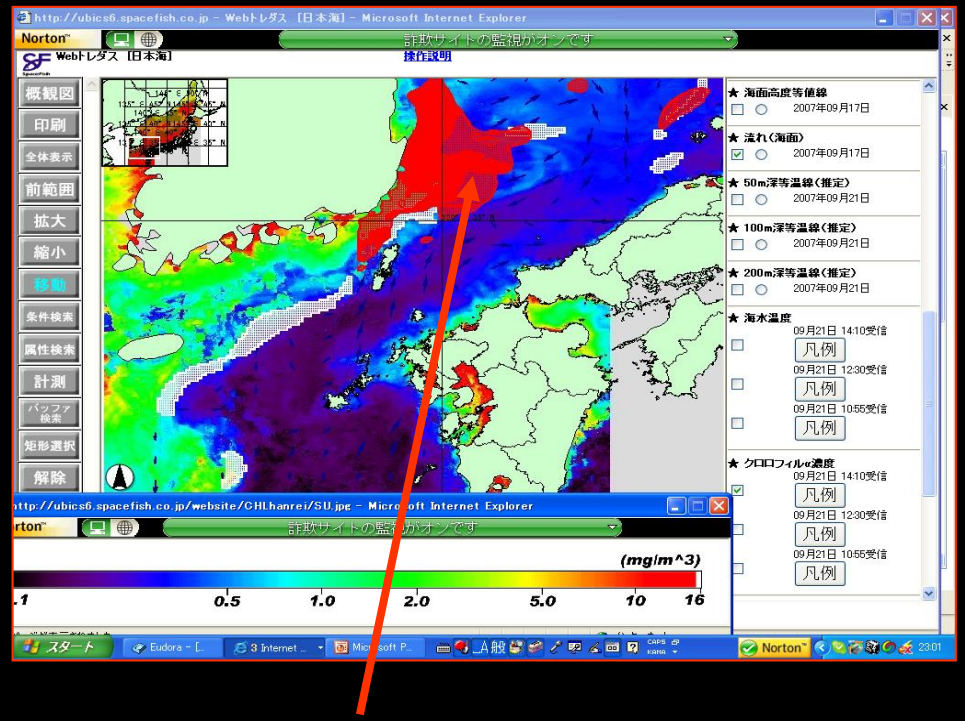


JAPAN Routinely delivers temperature and chlorophyll data to fishing fleets (near-shore and offshore), each vessel equipped with standard computer and standard software.

Fish Harvesting – commercial applications TOREDAS System – Japan Information system using RS/GIS for the offshore fisheries activities around Japan

Sei-Ichi Saitoh[1, 2], Fumihiro Takahashi[2] and colleagues

[1]Hokkaido University
[2]SpaceFish LLP

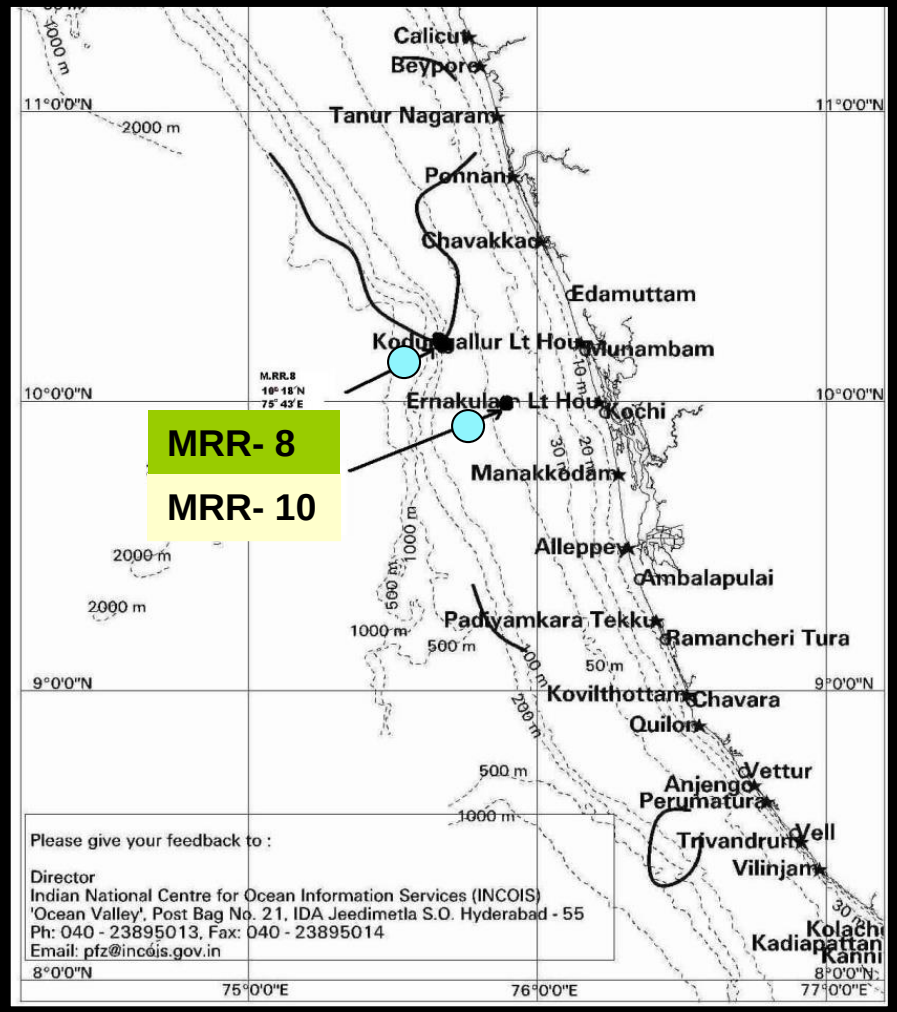


Use Chl-a, currents and SST fronts to determine squid fishing grounds (red）

Target species: Japanese common squid, Pacific saury, albacore tuna, skipjack tuna

Saithoh et al. (2010)

Potential Fishing Zone Identification by Remote Sensing: Results of Indian Assessment of Economic Benefits (Kerala Coast)



PFZ Forecast based on SST and Chl
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

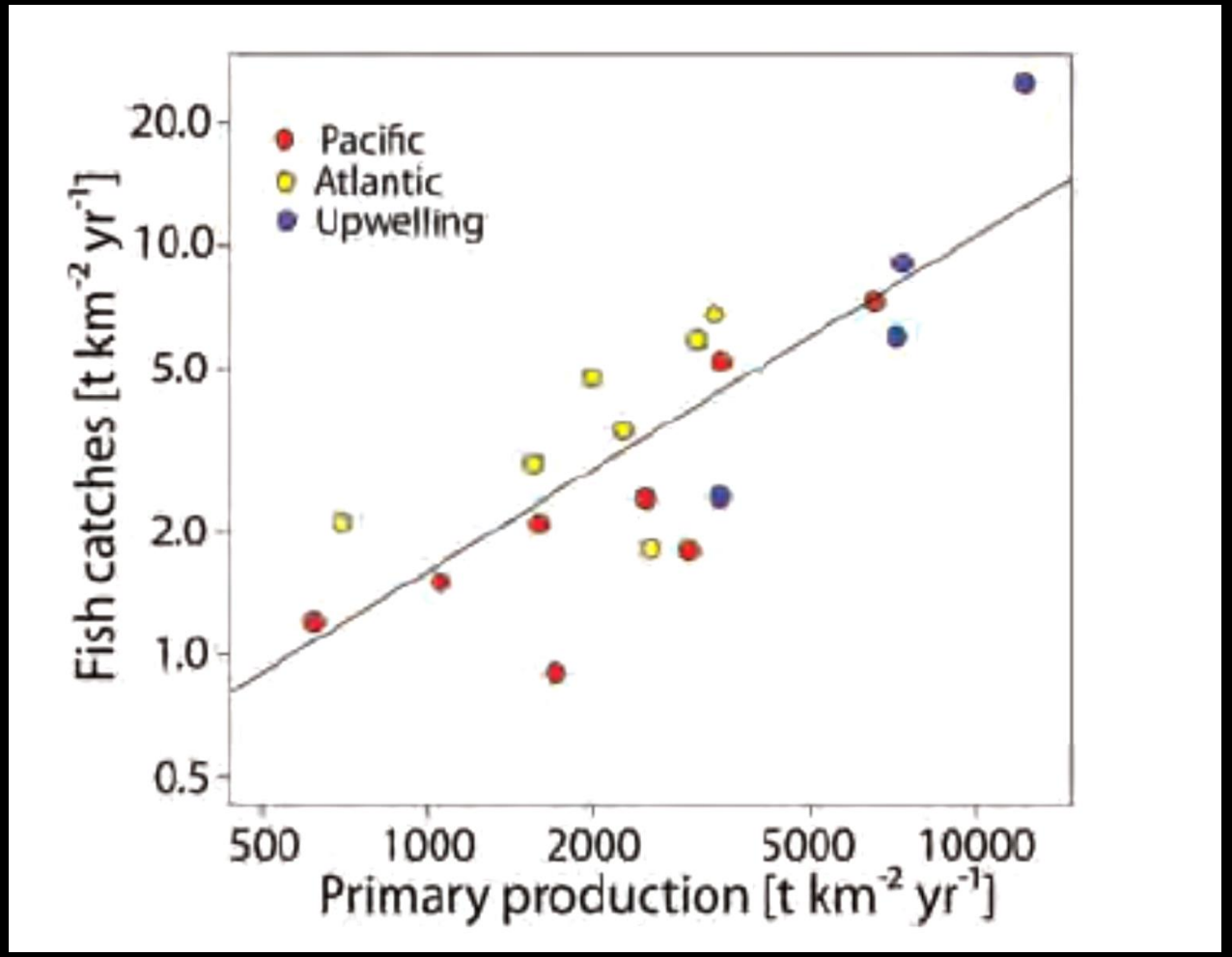
Details of Simultaneous Fishing Operation by Two Vessels (PFZ & Non PFZ) on December 16, 2006

Srinivas *et al.* (2008)

Phytoplankton primary production and fish catches

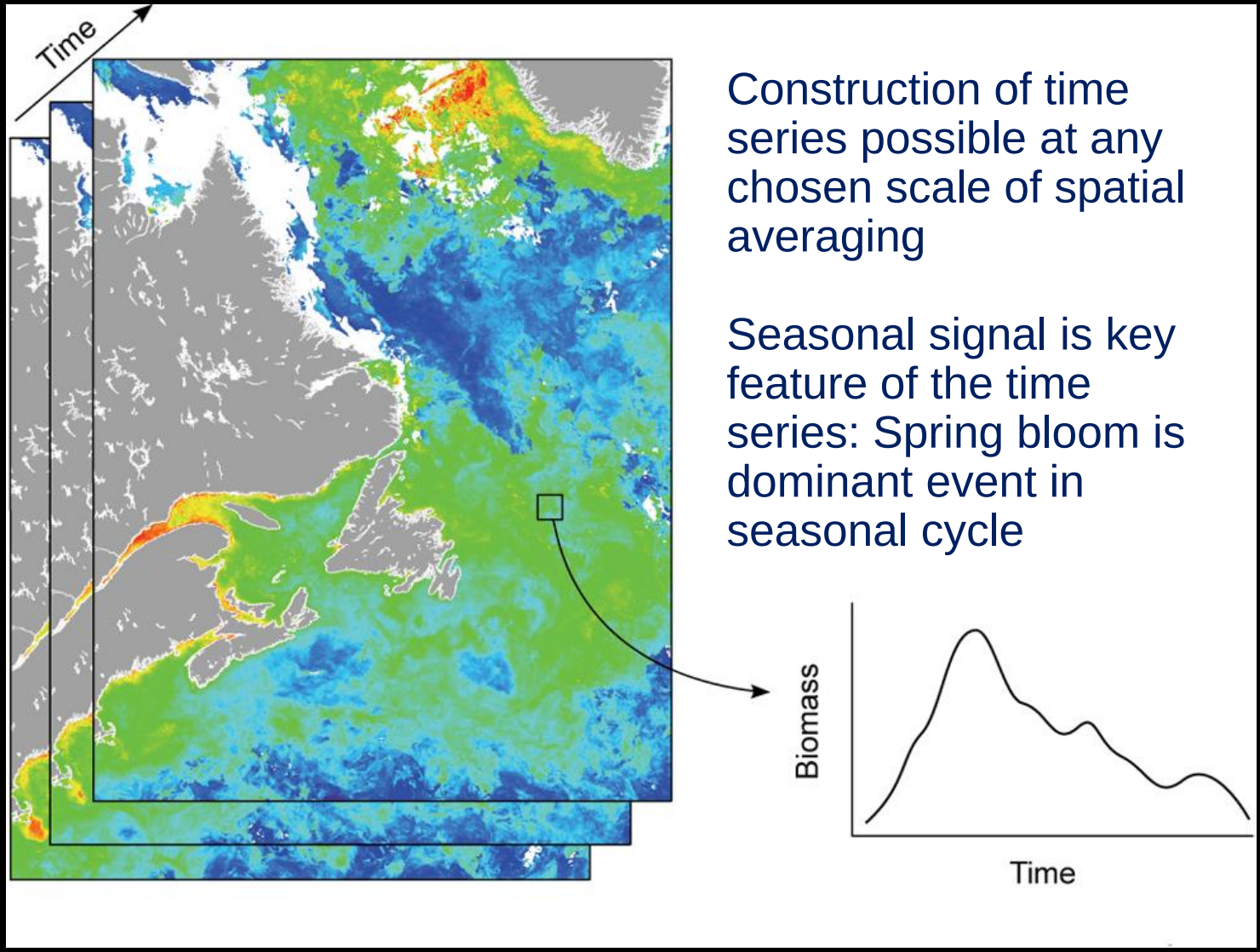
Large-scale trophic coupling

- Fish catch data from 1960s to 1990s (INPFC) and primary production from remote-sensing (SeaWiFS)
- Strong linkage between large-scale, area-specific rates of primary production and fish catches
- Coupling observed in a range of large marine ecosystems



Ware et al., 2000, Ware et al., 2005

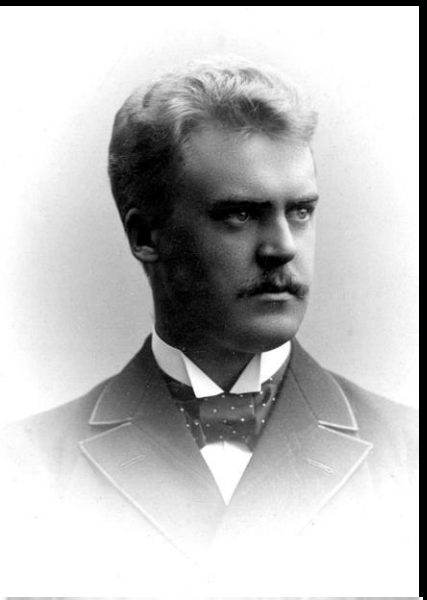
Time Series and Seasonality



Construction of time series possible at any chosen scale of spatial averaging

Seasonal signal is key feature of the time series: Spring bloom is dominant event in seasonal cycle

Testing the Hjort-Cushing Match-Mismatch Hypothesis

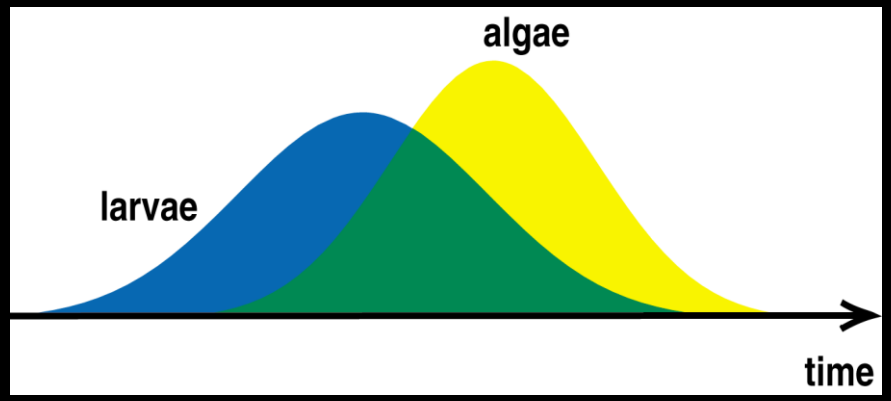


Johan Hjort
For.Mem. RS
(1869-1948)

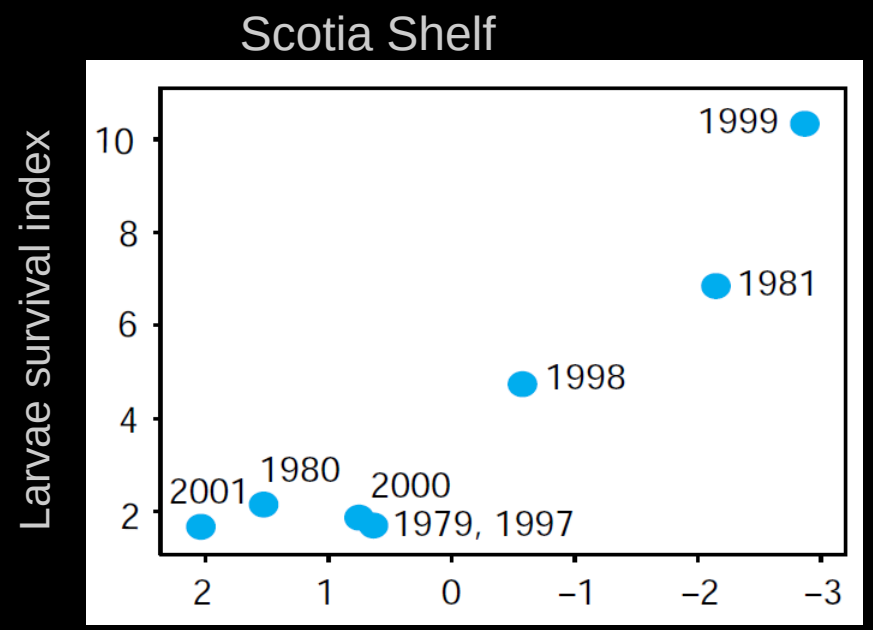
David Cushing
FRS
(1920-2008)

Pioneer in study of relation between ecosystem variability and fisheries

Survival of Haddock Larvae as Function of Timing of Spring Bloom Peak



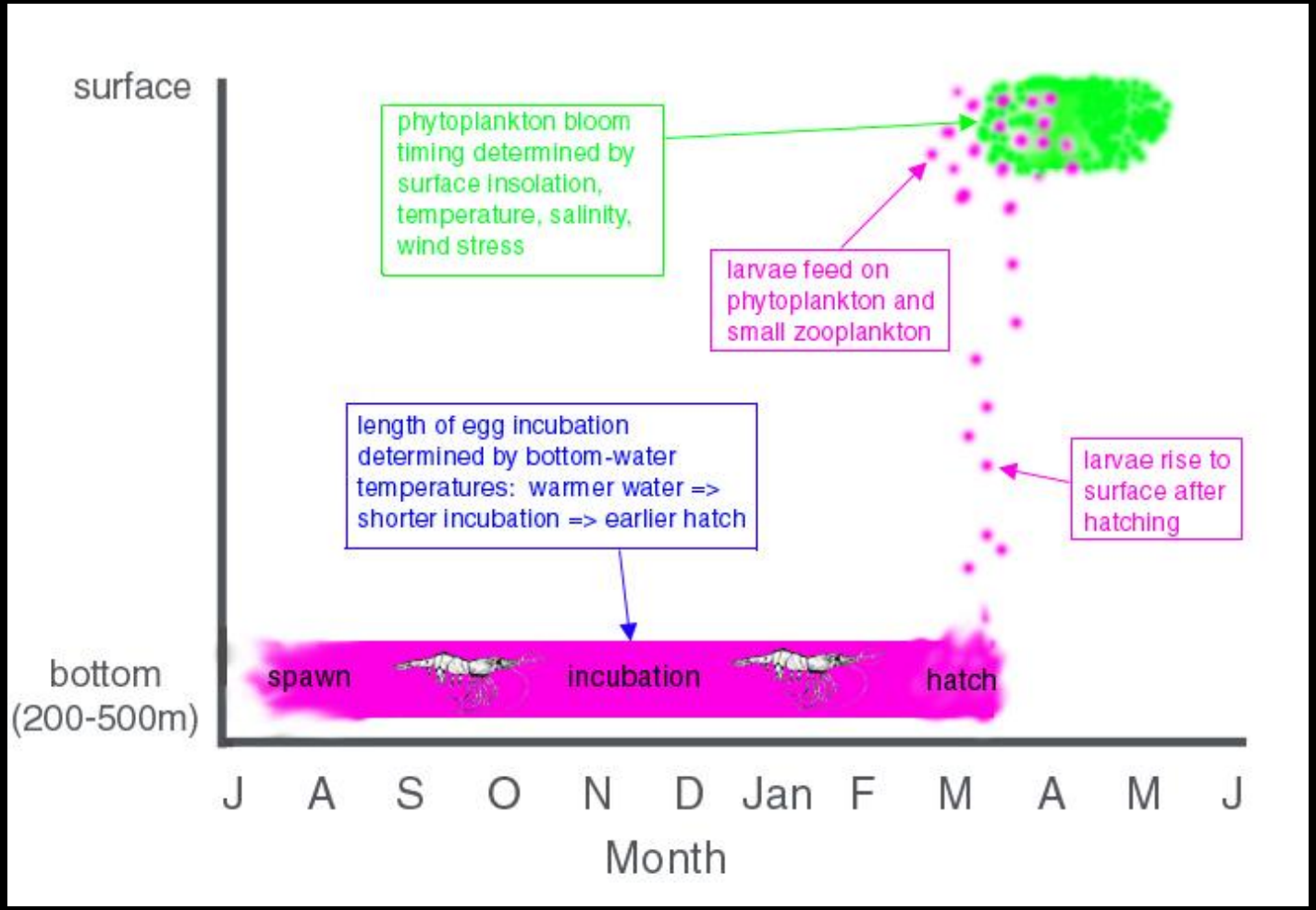
- where number of haddock larvae and biomass of phytoplankton overlap, larvae have food supply adequate for survival
- where this is not so, larvae are vulnerable to death by starvation



Platt et al., 2003

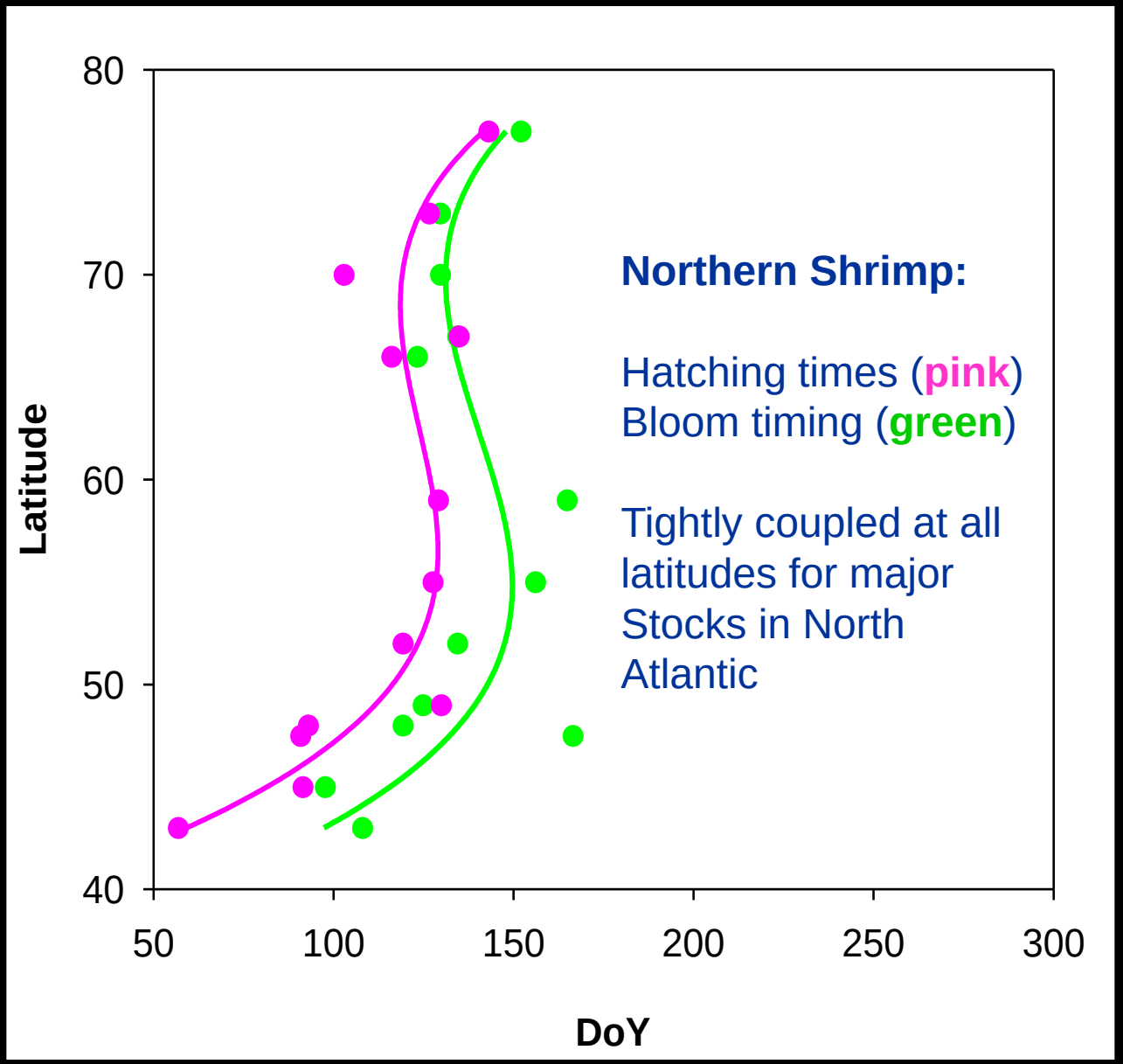
Application of time-series data applied to study growth, survival and distribution of Northern shrimp

Life Cycle of Northern Shrimp



Koeller *et al*. 2006; Fuentes-Yaco *et al*. 2006; Koeller *et al*. 2009

Basin-scale coherence of North Atlantic shrimp stocks



Landed annual value of the fishery at the scale of the North Atlantic Basin:
US $ 0.5 Billion

Koeller, Fuentes-Yaco, Platt, Sathyendranath and others (2009)

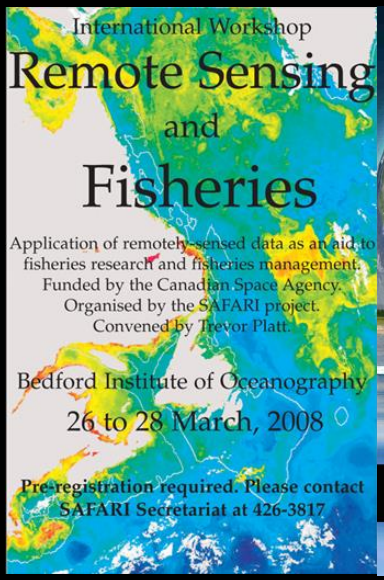
SAFARI (Societal Applications in Fisheries and Aquaculture using Remotely-Sensed Imagery)

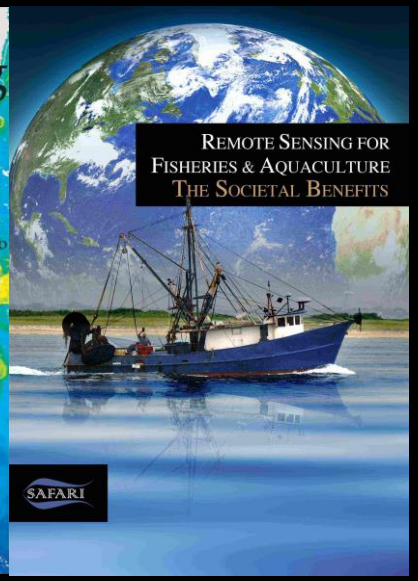
Objectives of SAFARI include:

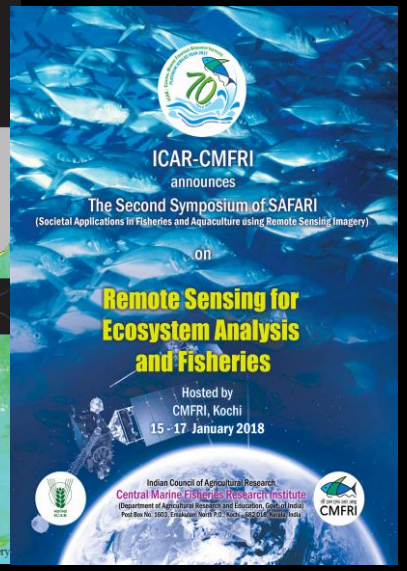
- An international forum for coordination and exchange of views on use of remotely-sensed data in fisheries oceanography
- A stimulus for new research and operations in this subject area
- A vehicle for transfer of knowledge from the research sector to the operational sector

Activities:

- International Workshop, Halifax, 2008
- SAFARI Brochure, 2008
- Monograph in IOCCG series, 2009
- Special session ASLO, Nice (France), 2009
- First International Symposium, Kochi (India), 2010
- Second International Symposium, Kochi (India), 2018
- Third International Symposium, Kochi (India), planned for 2022







Conclusions and Future Directions

- EO can support fisheries in many ways: it is a relatively new field whose economic aspects are largely unexplored.
- The benefits arising from intangibles such as provision of intelligence to aid resource management; negotiation; stewardship; protection of biodiversity; provision of ecosystem services; and high-seas governance, remain to be quantified.
- This task will require a collaboration between scientists and economists, the fishing community and other stake-holders.

- This talk builds on earlier presentations of Trevor Platt on this topic, and is very much inspired by his work.
- SAFARI was his vision, as was GEO Blue Planet.
- I am honoured to have worked by his side on these initiatives.

Thank you