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REMOTE SENSING OF PHYTOPLANKTON

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TECHNICAL REPORT

PRODUCTION AND DISTRIBUTION OF PHYTOPLANKTON OBSERVED BY ADEOS: APPLICATION OF SATELLITE IMAGERY FOR FISHERIES

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1.0 Introduction

The Japan Fisheries Information Service Center (JAFIC) was established 1972 as a result of request of fishermen and the local communities. JAFIC offers fisheries information to users around Japan. Main information is a prompt report of fishing condition and mapping of the sea surface temperature. The information is provided in co-operation with fishing vessels and researchers located around Japan. The remote sensing technology is also used to process the information and then to come out with the maps. The conventional technique consumes a lot of time, from collecting the water temperature data from the sea to thermal map production. By using the satellite data, this time could be reduced to just a few hours instead a few days using conventional technique. Moreover satellite could provide short-term variation and detail structure in the ocean.

Recently the satellite sensors could observe ocean color not only the temperature, but also phytoplankton distribution. We will provide knowledge, and expect some solution of phytoplankton production system in the South China Sea.

2.0 Advanced Earth Observing Satellite (ADEOS)

ADEOS was expected to acquire data on worldwide environmental changes in order to contribute to international earth observation and systematic environmental monitoring. The National Space Development Agency of Japan (NASDA) successfully launched the ADEOS on 17 August 1996 (JST). ADEOS is also called "*midori*" in Japanese, which mean "green" of phytoplankton. However it had acquired global observation data for 10 months only, before experienced a major failure of its solar panel, and operation was terminated in June 1997.

ADEOS Characteristics

Altitude: 797 km
Orbit degree: 99
Recurrent period: 41 days days (solar-synchronous sub-recurrent orbit)
Sensors:

- Ocean Color and Temperature Scanner (OCTS) by NASDA Japan
- Advanced Visible and Near Infrared Radiometer (AVNIR) by NASDA Japan
- NASA Scatterometer (NSCAT) by NASA America
- Total Ozone Mapping Spectrometer (TOMS) by NASA America
- Interferometric Monitor for Greenhouse Gases (IMG) by IMG Japan
- Polarization and Directionality of the Earth's Refrectance (POLDER) by CNES France
- Improved Limb Atmospheric Sounder (ILAS) by MITI Japan
- Retroreflector In Space (RIS) by IMG Japan

Bands (μm)	Observation data	on ground solubility	observation wide
0.402-0.442	Yellow matters		
0.433-0.453	Chlorophyll maximum absorption		
0.479-0.501	Chlorophyll minimum absorption	local area coverage data	
0.511-0.529	Reference band	680 m	
0.555-0.575	Chlorophyll maximum absorption		
0.660-0.680	Chlorophyll minimum absorption	global area	
0.745-0.785	Revision atmospheric	coverage data 4km	1400km
0.845-0.885	influence		
3.55-3.85	sea-surface temperature	direct transmission for	
8.25-8.80	/ revision atmospheric	local users 7 km	
10.3-11.4	influence	(4 bands)	
11.4-12.7			

Table 1: The OCTS bands characteristics (JARS, 1996).

3.0 Distribution of chlorophyll in the South China Sea

In a mid-latitude area such as Japan, seasonal climate causes variation in plankton production and species composition for example "spring bloom of phytoplankton". Phytoplankton production is limited by nutrient supply in the tropical ocean. Northeast monsoon and Southwest monsoon are seasonal characteristic in South China Sea. These two monsoons develop currents in the sea. The OCTS monthly average image data of both monsoons show us some characteristic of chlorophyll distribution.

4.0 Spring bloom of phytoplankton in the Japan Sea

The OCTS data has shown an interesting spring bloom of phytoplankton phenomenon in the Japan Sea. Weekly average image data from April to May 1997 show us the bloom migration. During this period, the sea surface water was warmer in Japan Sea. The bloom migration veracity was equivalent to warmer velocity. We could observed the phytoplankton bloom in 8-13°C area (JAFIC, 1997).

5.0 Distribution of chlorophyll off Tohoku, Japan

The Northeast Pacific, off Tohoku is a main fishing area in Japan as well as in the world. We expect high production supports high catch volume. The area is characterised by the mixing of Kuroshio warm water and Oyashio cold water. Many fronts are developed well. Recently the remote sensing satellite has observed detail structure that we could not observe by a ship. Warm streamer exists from warm core ring. Observation made by the research vessels, aircraft and satellite evidenced that warm streamer is important route of fish school migration and feeding ground of fishes (Tameishi, 1998).

6.0 Forecast of fish ground area in use OCTS data.

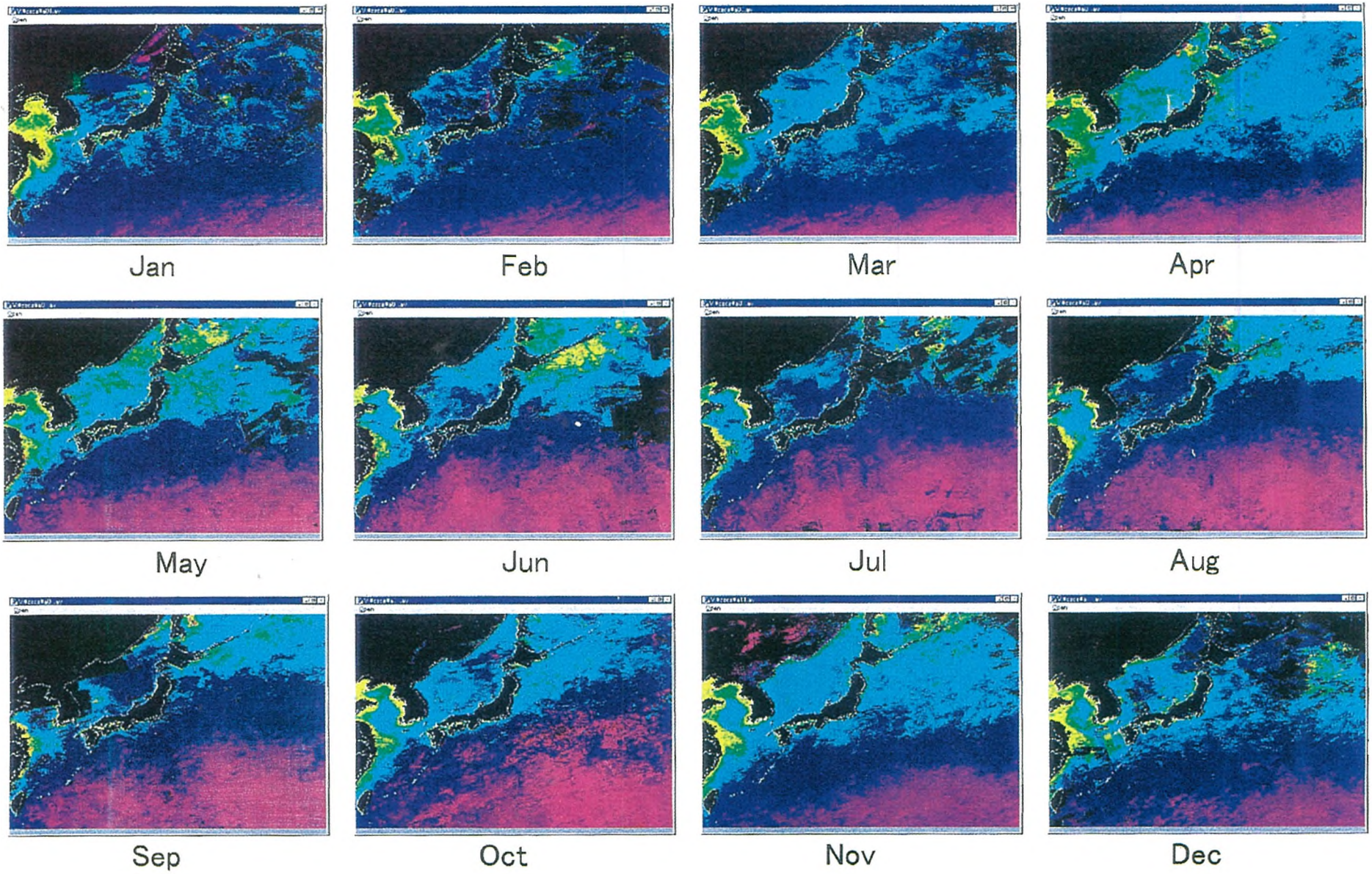
Each fish species has their favorite temperature range. Most of the fishermen interested with ocean temperature information. Food availability also could not be ignored as fish school gathering factor. JAFIC have mapped favorable temperature and favorable ocean color for mackerel, and determined the fishing ground area (JAFIC, 1997)

References

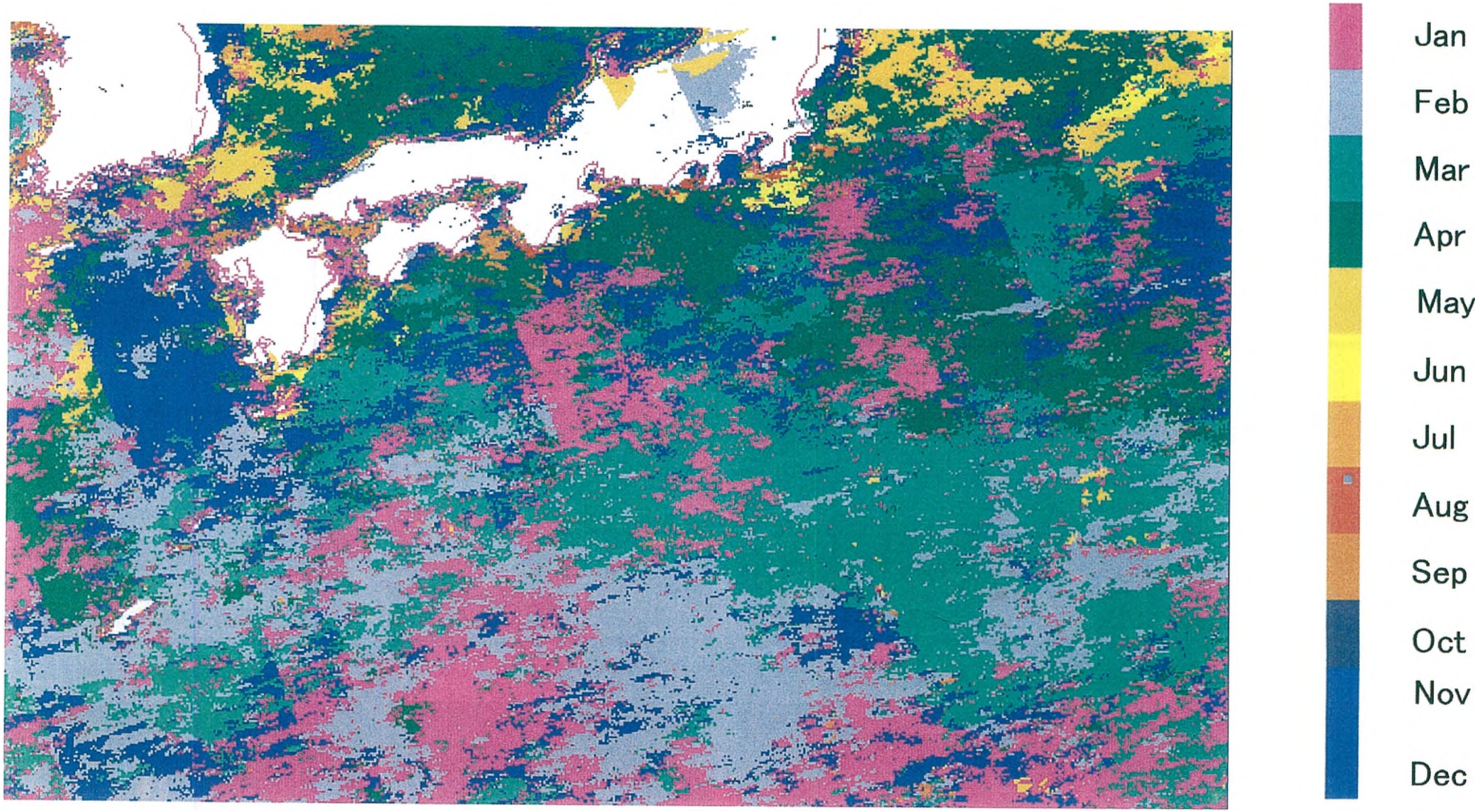
JARS. 1996. Japanese Earth observing satelites. Remote sensing and geographical information system, NASDA 2 (5) 52-55

Tameishi, H. 1998. Studies on the roles of warm cores and warm streamers in fish migration and fishing ground formation. Kaiyo monthly, extra 13, 103-109

JAFIC.1997. Report of develop high analytical system against satellite data 1997. 104-119



Pigment distribution Near Japan



Month of Maximum Pigment Value