

Find ~~the~~ goal of your research?  
 • to find the new or potential fishing ground  
 to monitor the illegal fishing activities  
 to predict potential amount of catch  
 • to know ~~where~~ <sup>where</sup> the traces of saury

**The Advantages of GIS Technology on DMSP/ OLS Satellite Image Analysis to Study on Dynamics of Pacific saury Migration**

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**1. Introduction**

A geographic information system (GIS) is a tool can be used for capturing, modeling, manipulating, analyzing and presenting geographical referenced data (Worboys, 1995). Different with manual method, GIS technology provides more efficiency and analytic power to explore the Earth and its resources through the geographic analysis and visualization capabilities of maps (Wright and Bartlett, 1999). One of distinctions of GIS tools is the ability to do analyses in space and time. GIS has been used in various fields, such as environmental management, urban and regional planning and agriculture. In the field of marine resources, however, GIS has been used very little.

Marine animals such as fish have close relationship with oceanographic conditions. From the viewpoint of marine ecology, to develop marine GIS is very useful tool to analyze the above relationship. GIS Products, for example overlaid images, help us to examine the data much easier that can not do by traditional methods. Figure 1 illustrates an example of GIS applied to satellite remote sensing data processing for marine studies. In this study, we demonstrated the advantages of GIS to support the analysis of DMSP/OLS satellite data to study on dynamics of pacific saury migration.

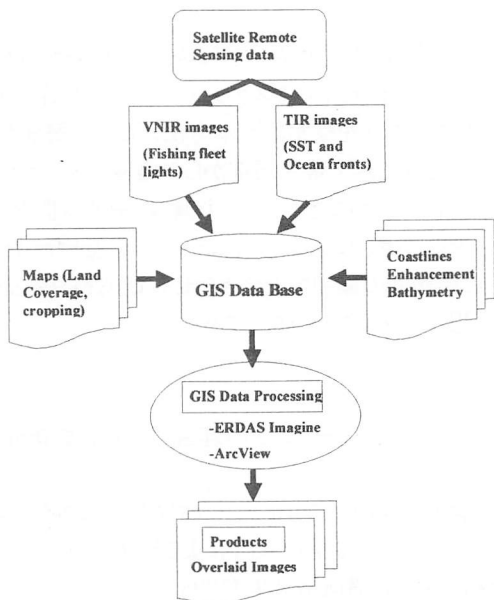
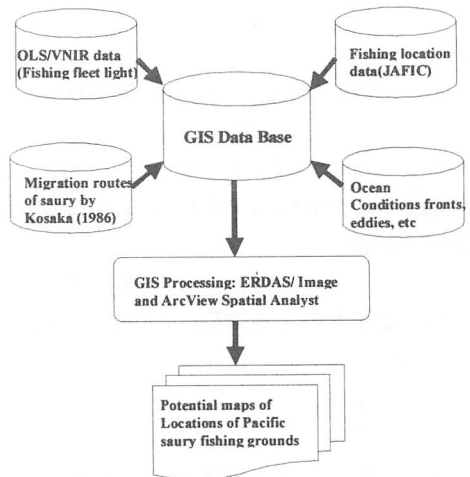


Fig.1. Illustration of marine GIS processing.

**2. Potential map of saury fishing ground locations**

In present study, we used DMSP (Defense Meteorological Satellite Program) /OLS (Operational Linescan System) image data provided by National Oceanic and Atmospheric Administration /National Geophysical Data Center (NOAA/ NGDC). The visible-near infrared (VNIR) channel of the OLS sensor can detect light in nighttime including the light from fishing fleets.

The OLS/ VNIR images contain the light from the saury fishing fleets and squid fishing fleets. Contamination of squid fishing fleets makes a difficulty to analyze location of saury fishing ground. Using GIS, we tried to generate potential maps of locations of pacific saury fishing grounds. For generating the potential map, beside remote sensing data from satellite, it is necessary to gather some referred data including truth data of fishing location, migration routes of saury and ocean conditions such as eddies and fronts. The flowchart shown in Figure 2 is marine GIS was employing to generate the potential maps of location of Pacific saury fishing ground with less



contamination of squid fishing fleets.

Fig.2. Flowchart of generating Potential maps of locations of Pacific saury fishing grounds.

**3. GIS application on saury fisheries**

We produced the OLS images including daily, 10-day, monthly and annually basis images from the OLS raw data obtained during autumn, 1994 and 1995 to analyze distribution of pacific saury fishing location and their relationship to oceanographic condition such as SST.

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Figure 3 shows the distribution of fishing fleet lights during October and November 1995. In October 1995, fishing fleet lights occurred mostly in southeastern side of Hokkaido and along the Sanriku coast. In November 1995, concentration of fishing fleet lights in southeastern side of Hokkaido was reduced and moved southward to the area of Sanriku waters. Based on these facts, we can understand that Pacific saury moved southward during October to November 1995,

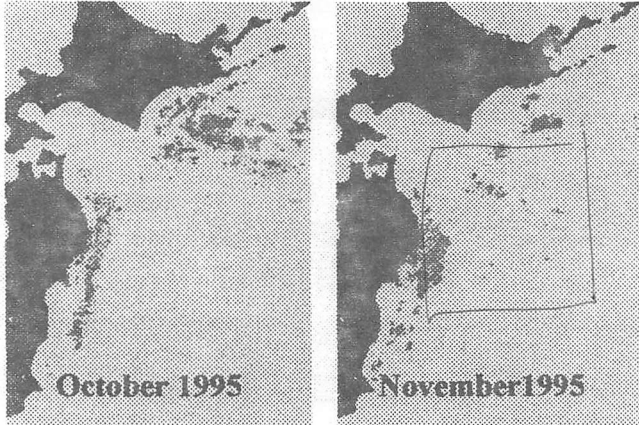


Fig.3. Teen-day overlaid image of OLS in mid of October 1995. Dark tones represent the fishing fleet lights.

The distribution of the fishing grounds of Pacific saury is closely related to sea surface temperature (SST) (Uda, 1936; Hughes, 1974 and Tameishi, 1991). Using GIS tool, we constructed daily basis overlaid images between OLS/VNIR channel images and OLS/ TIR (Thermal Infrared) channel images, to examine the relationship between fishing fleets distribution and SST or front distribution. We found that most of the fishing fleet lights occurred in the colder side of the Oyashio fronts and cold streamers. Figure 4 shows daily basis overlaid image between OLS/ VNIR for fishing fleet lights and OLS/ TIR for the ocean front on October 18, 1995.

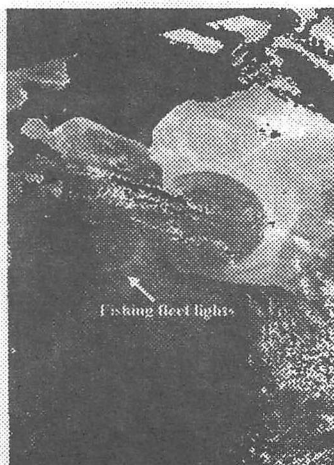


Fig.4. Daily basis overlaid image between OLS/VNIR and OLS/TIR on October 18, 1995.

Different with 1994, in 1995 the coalescence between Tsugaru Warm Current Gyre (TWCG) and Kuroshio Warm Core ring (KWCR) 93-A, the saury took offshore course during their southward migration. Figure 5 shows the possible migration routes of the saury in 1994 and 1995.

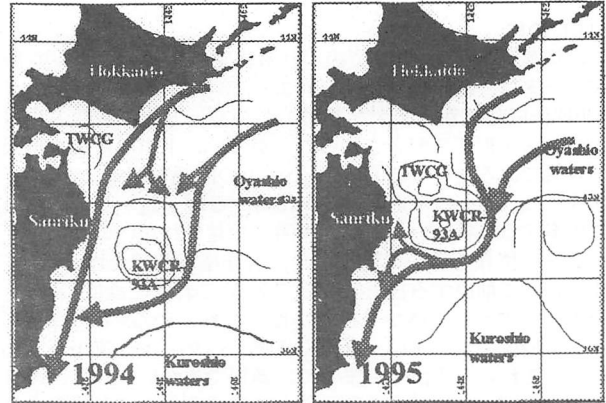


Fig.5. Schematic features of possible of migration routes of Pacific saury in 1994 and 1995. Thick arrows represent the migration routes of the saury.

#### 4. Concluding Remarks

It is necessary to take into consideration that GIS tools can be obviously used to assist on analyzing DMSP/OLS image data in time and space. Marine GIS can provide maps that can be applied examine the relationship between Pacific saury fishing ground location and oceanographic condition such as SST and ocean fronts. In term of year to year variation, marine GIS become useful tools to estimate the possible of migration routes of Pacific saury.

In future studies, it is necessary to develop marine GIS using multisensor satellite data with longer observation period and qualitative data to make better analysis and result.

#### 5. References

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