

FISHING SITE IDENTIFICATION SYSTEM USING REMOTE SENSING AND GIS

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ABSTRACT: Malaysian Remote Sensing Agency (ARSM) with the Department of Fisheries Malaysia, Fisheries Development Authority Malaysia and National Fishermen's Association (NEKMAT) have collaboratively developed a Fishing Site Identification System (FSI System) using information derived from Aqua and Terra satellites data. The system development started in 2007 and its operation began in July 2010. It is currently being operational throughout Malaysian waters. FSI system consists of four components, namely; image receiving and processing, potential fishing areas modelling, database, and dissemination system. Daily Sea Surface Temperature (SST) and chlorophyll concentration derived from Moderate Resolution Imaging Spectroradiometer (MODIS) sensor images are being analyzed to derive information on potential fishing locations. The location is then disseminated to fishermen through short messaging system (SMS) and web portal. The FSI system has managed to increase fishermen's income through reduction of time for searching of fishing locations, fuel usage and increase fish catch.

1. INTRODUCTION

The traditional method of identifying the prolific locations for fishing as being practised by fishermen is based on experience and sharing of information. Such traditional practice is less efficient, and therefore, a new method needs to be introduced to meet the increasing food demand, increase the income of fishermen and to further develop the fisheries industry in the country. Modern technology such as remote sensing has been used to replace this traditional method. Remote sensing data provide information on sea surface temperature (SST) that influence the existence of phytoplankton, which is the primary food source for fish, and therefore becoming areas of fish concentration. From this information, potential fishing locations can be determined more quickly and accurately. It also increases the potential of finding new fishing grounds.

Malaysian Remote Sensing Agency (ARSM), Department of Fisheries Malaysia (DOF), Fisheries Development Authority of Malaysia (LKIM) and National Fishermen's Association (NEKMAT) took the initiative to develop a computerized system known as Fishing Site Identification System (FSI). The system uses information from remote sensing satellite images that are acquired daily by ARSM ground receiving station. The development of this system began in 2007 with the east coast of Peninsular Malaysia as the pilot study area. The system is now being adopted throughout Malaysia.

2. OBJECTIVE

The main objective of the system development is to support national fisheries agencies in improving socioeconomic well-being of the fishermen through utilization of remote sensing, GIS and ICT technologies.

3. STUDY AREA

FSI system initially covered the east coast of Peninsular Malaysia. Since end of 2010, it has been extended to cover the whole country (Figure 1). To date, the system has benefited 20,300 fishermen whom are using purse seines and drift nets. By the end of 2012, 25,000 fishermen are expected to use this system.

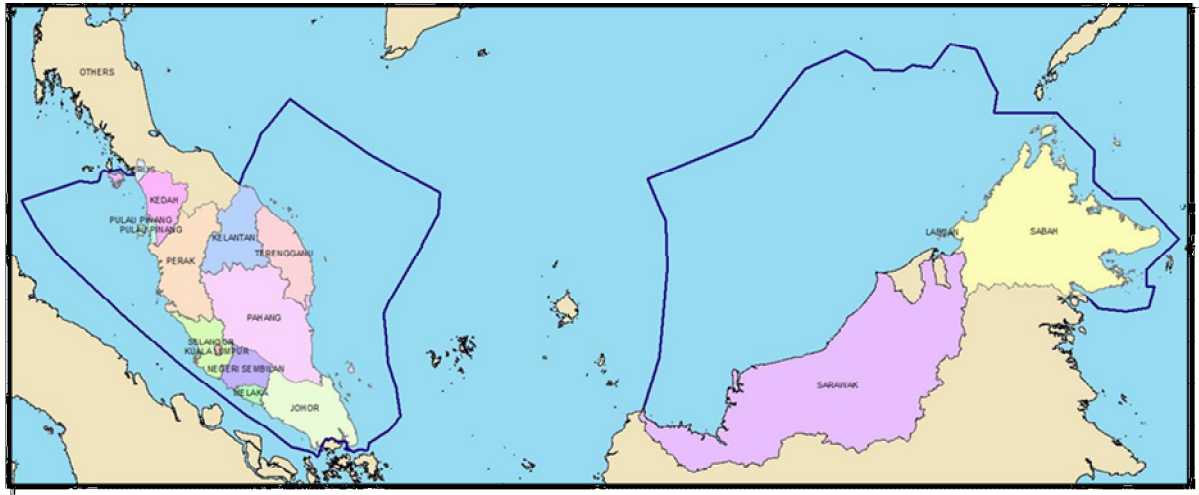


Figure 1: Map of territorial waters of Malaysia

4. FSI COMPONENTS

FSI system consists of four (4) main components (Figure 2);

- a. Image Receiving and Processing.
- b. Modeling of potential fishing areas.
- c. Database.
- d. Information dissemination system (IDS).

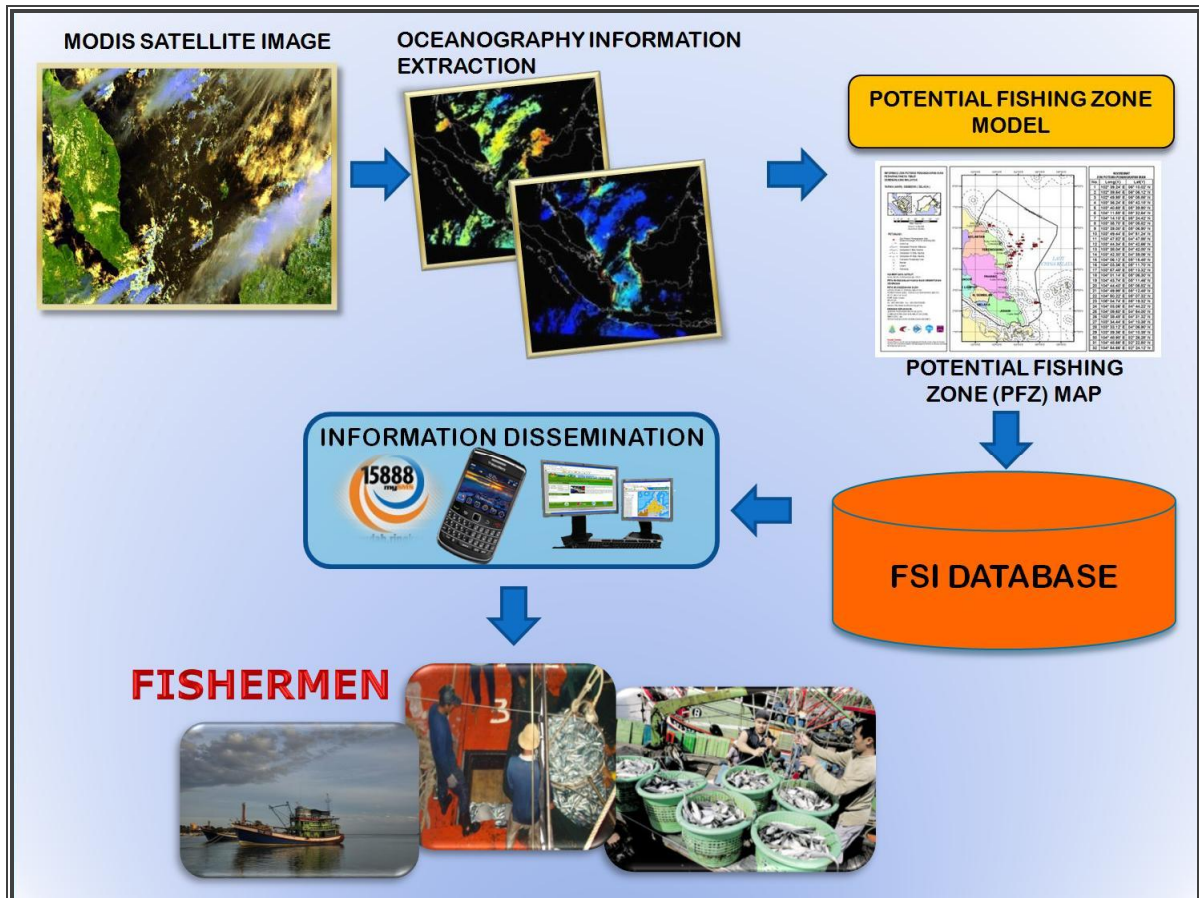


Figure 2: FSI components

4.1 Image receiving and processing

MODIS (Moderate Resolution Imaging Spectroradiometer) data acquired daily at ARSM Ground Receiving Station in Temerloh Pahang will be pre-processed before being transmitted to ARSM headquarters in Kuala Lumpur. This data will then be processed to produce maps of sea surface temperature (SST) and chlorophyll maps (Figure. 3). Both products are then analyzed to obtain the thermal front to determine the location of fishing.

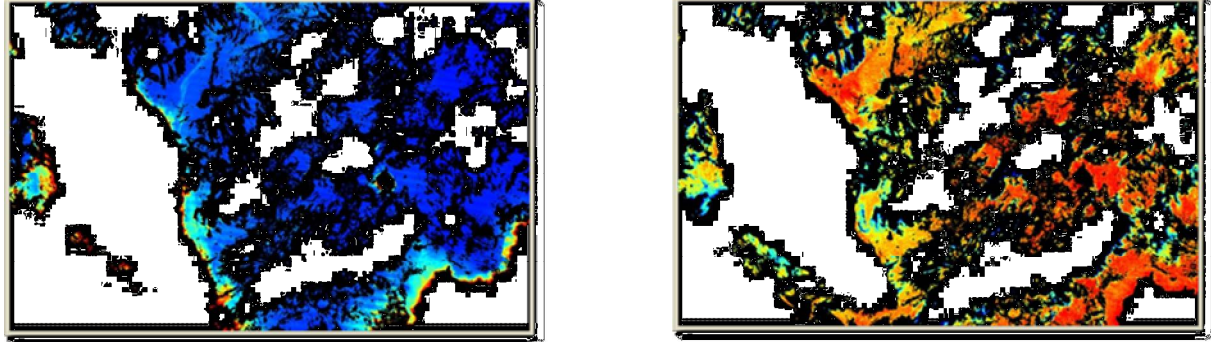


Figure 3: Chlorophyll map (left) and SST map (right).

4.2 Modelling of potential fishing areas

It is a known fact that the presence of chlorophyll indicates the abundance of phytoplankton and this relates to the presence of fish. SST shows a synoptic view of the ocean surface and contouring of this SST will highlight oceanic fronts, currents, eddies and upwelling. These two parameters were analyzed to produce the potential fishing locations which are subsequently stored in geographic coordinate system (longitude and latitude) in the FSI database. Figure 4 shows the FSI Model which is the complete procedure to produce these potential fishing zone (PFZ) map (Figure 4).

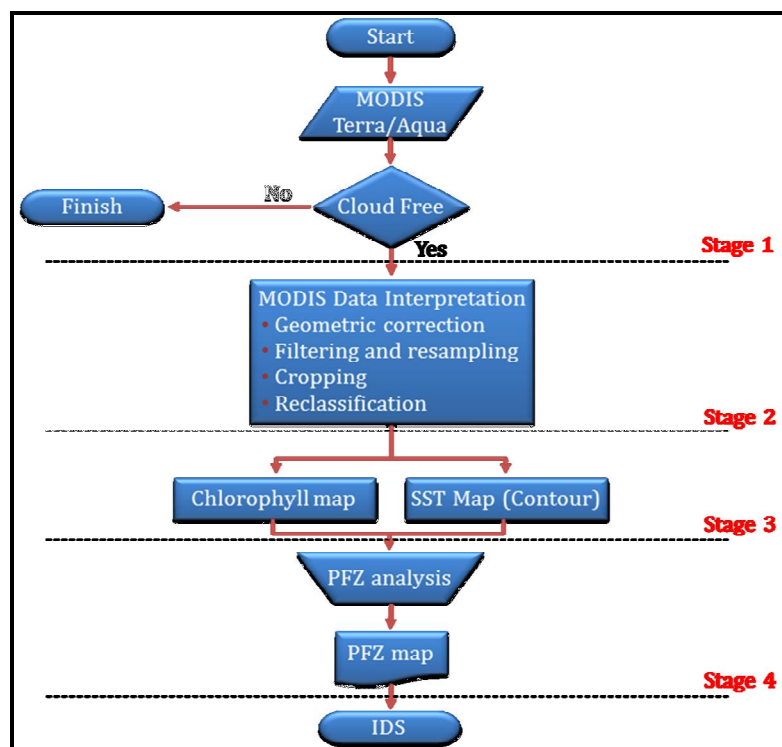


Figure 4: FSI Modelling flowchart

4.3 FSI Database

FSI database developed by ARSM in June 2010 comprises fishing location information, information on oceanography, fishing and vessel information, and information on state and local fishermen's association. Development of the database is a key requirement for providing the access of information for potential fishing locations. A complete, accurate and up-to-date information is an important factor in ensuring the effectiveness of potential fishing location information dissemination to the local fishermen's association center and fishermen.

Fishermen and vessel profile information obtained from the DOF contains information such as on licensing of fishing zones (A, B, C and C2), the personal information of fishermen (mobile phone number, address), state registration of vessels and others. Fishing location information that is disseminated to registered fishermen is based on their class of vessel and state.

4.4 Information dissemination system

This system provides information on potential fishing areas to fishermen depending on the availability of satellite images that are free of cloud cover. Application for fish location information for the current date can be made as early as 5.00 pm on any particular day. This location can be used by fishermen for a period of three (3) days (based on the date of satellite data acquisition) and the accuracy is within 3 km radius from the stated coordinates.

Dissemination of information to fishermen can be made in two (2) ways:

4.4.1 FSI Portal

FSI portal is one of the methods for fishermen to get information on the potential fishing location. The portal consists of three (3) main components:

- Latest fish location coordinates information in tables and GIS Web Map.
- Two-week archive of fish location coordinates information in the form of tables and GIS Web Map.
- Management of fishermen information.

Fishermen will be registered to the FSI System through the respective local fishermen's association center before access is granted. Their informations will be verified and subsequently stored in the database. Local fishermen's association center also serves as the central location for the dissemination of potential fishing location information and manages the fishing catch feedback that can be directly updated via the portal.

Users can access the portal via <http://ikan.remotesensing.gov.my> to get the latest information on fishing location. Figure 5 shows the interface of the main page of FSI portal whilst Figure 6 shows a map of potential fishing areas.



Figure 5: Main page of FSI portal.

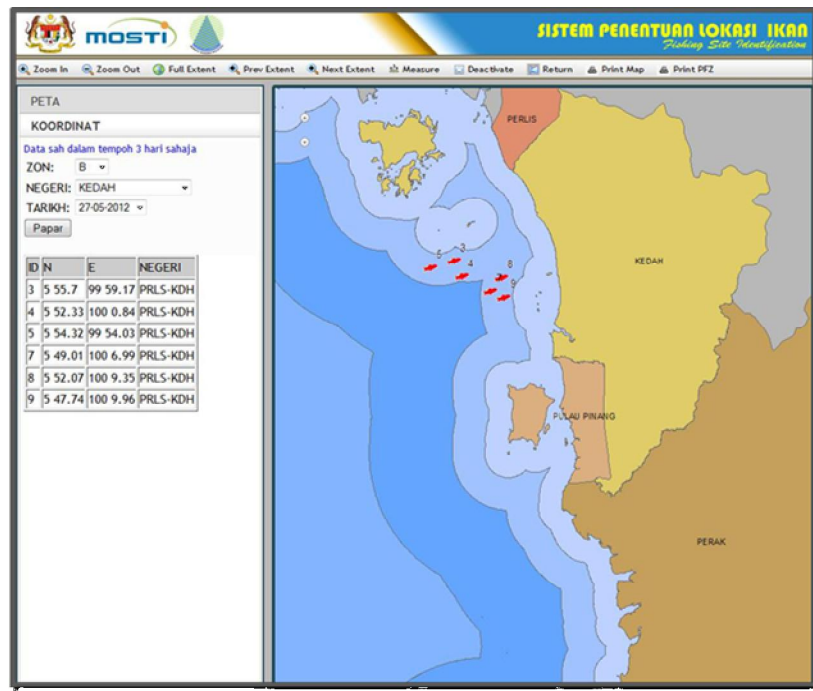


Figure 6: Map with coordinates on potential fishing areas.

4.4.2 Short Messaging System (SMS)

For fishermen who do not have access to computers and internet, SMS is used as an alternative method for data dissemination. The Malaysian Government has developed an SMS service platform called MySMS as an additional communication channel for government services. One of its main objectives is to ensure the availability of information for Malaysians from all walks of life through a common short code.

For the FSI, MySMS operates through information on demand, in which fishermen will need to send an SMS requesting for information on fishing locations. Fishermen just need to type the specific access code.

5. VERIFICATION OF PFZ

Thirty two verification points were undertaken to determine the accuracy of the PFZ generated by the FSI system. All project team members representing each collaborative agency together with the fishermen have participated in this verification exercise to ensure the accuracy of the information generated by this system. The percentage of this accuracy is 94%. Fishermen who are using the system have provided feedbacks on their increase catch and fuel cost savings.

6. CONCLUSION

Overall, the FSI system contributes to the increase in fish catch up to 50% per month. The system is also being used by the respective authorities for surveillance of Malaysian waters from the intrusion of foreign fishermen.

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