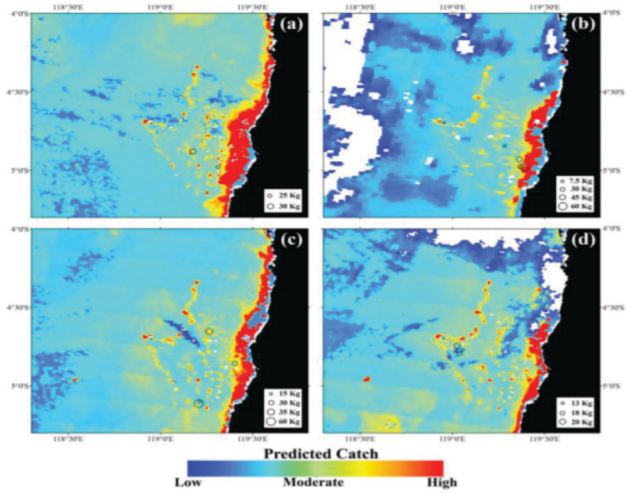


Figure 94. Examples of potential fishing maps: all prediction maps showed the possible fishing grounds which occurred along the coasts

Source: *Suhartono* et al., *2015*

Issues and Challenges

Several concerns and obstacles had been associated with the implementation of this project that includes the following:

a) The tropics have a high cloud cover rate which is greater than 50 % that prevents the daily generation of the potential fishing zone (PFZ) using the MODIS data
b) The use of low-resolution satellite imagery is not ideal for developing this project, despite the fact that it can solve the issue of cloud covering
c) Apart from a lack of technological skills, fisherfolks take a long time to adapt to the latest technology
d) There are challenges encountered in acquiring extensive information on catch, locations, and expenditures from fishers, owing to their low sensitivity to data gathering and storage
e) Need to enhance the initiatives that focus on the involvement of the FSI system by local fisherfolks associations to distribute PFZ to trawl operators

4.1.2.3 Technology on Preservation Onboard Fishing Vessels

SEAFDEC/TD has been developing a design and also initiating the construction of an onboard refrigeration system to be used for fishing vessels by adopting a hybrid technology that can make use of multi-mode operation sources, *e.g.* from the propulsion engine or diesel generator or electricity from the shoreline. In addition, the design also utilizes various types of preservation tools onboard that are more suitable for the fishing gear and target species, such as the refrigeration seawater (RSW) and air blast freezing system. The possibility of using both RSW and air blast freezing systems in unison is also being explored as means of prolonging the freshness of the catch at their premium quality onboard, taking into account the optimum utilization of energy.

Refrigeration seawater (RSW)

Refrigeration seawater (RSW) is a system used onboard fishing vessels to preserve the freshness of the catch. The advantage of using the RSW system is its cost-saving capacity and its ability to preserve the catch at premium quality until it is unloaded ashore or for further processing. Its cooling efficiency is improved, cooling down the catch close to the freezing point much faster than using ordinary ice or limited ice, thus, ensuring the freshness and fresh quality of the catch while being transported onboard. It should be noted that the approximate electricity consumption per ton of ice (box) produced for the icemaker and refrigeration plant for temperate and tropical areas, is approximately 60 kWh/t (Myers, 1981). This does not include requirements for handling, crushing, or storage.

Airblast freezing system

The use of airflow to improve heat transfer from the product being cooled through the refrigeration system is probably the most common method used in commercial fishing vessels. However, the natural convection of the air alone would not give a good heat transfer efficiently, therefore, forced convection using fans has been introduced. To enable the product to reach the freezing point within a reasonable time, the airflow rate should be fairly high (2-6 m/s). Also, to obtain uniform cooling rates throughout the freezer, the airflow should flow over each fish in every fish container.

Power take-off (PTO)

The power take-off is any of several methods used for taking power from a power source, such as the main engine, and transmitting it to an application such as a water pump, hydraulic pump, and/or compressor for the refrigeration system. Usually, the refrigeration system whether in an industrial establishment or on a fishing vessel uses an energy source which is either from the electric motor or engine, to keep the compressor of the refrigeration system going. It is designed to be capable of using more than one type of energy source which consists of the 1) main engine and the 2) electric motor.

Split shaft power take-offs

In a fishing vessel, the propulsion engine or diesel generator has greater capacity in delivering a relatively steady amount of torque at both high and low running speeds. Consequently, the propulsion engine or diesel generator can drive the compressor of the refrigeration system by providing enough power take-off, which is a mechanism to bring power from its operating speed that properly matches with the requirements of the refrigeration unit that utilizes the power source. Split shaft power take-offs have many advantages, making it an excellent option to capitalize on the full potential of the fishing vessels. The split shaft

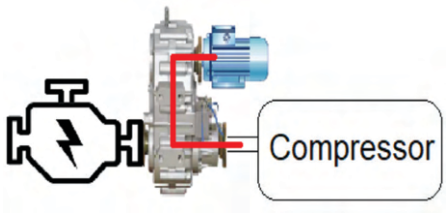
power take-offs are equipment like a gearbox or power take-off application that allows single or multiple pumps to be driven from a single prime mover. This multiple/split type power take-off is a combination of different propulsion technologies. In the hybrid transmission system, an electric motor performs the function in place of the engine, such as exerting force to the transmission shaft.

The split shaft power take-offs are advantageous to use because of their properties that include:

- Multiple outputs
- Various styles and sizes
- Standard PTO is driven by a pulley for versatility
- A shiftable compressor can drive both the electric motor and main engine
- Fuel is utilized efficiently and the cost is beneficially optimized
- Waste from fish preservation onboard is reduced

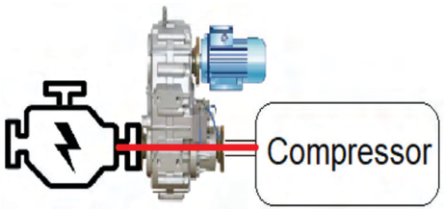
The refrigeration system could use either the electric motor or the engine, as the energy source to keep its compressor going. The functions of such energy sources are summarized below:

1) Hybrid refrigeration system driven by an electric motor



In general, the compressor of the refrigeration system is driven by an electric motor, the size of which depends on the cooling capacity or cooling efficiency of the compressor. This means that a lot of electricity is needed from the diesel generator. Since the electricity demand is defined as fuel consumption, even when a fishing vessel moored at the fishing port/jetty, it will still be able to operate the refrigeration system through the electric motor. This is because fishing vessels must continue to run either through its diesel generator ordinarily or by utilizing the shoreline power source when the main engine stops. But whenever the fishing vessel leaves the pier/port and the main engine is in use, the refrigeration system can change the mode of operation to engine mode so that the compressor would continue to function.

2) Hybrid refrigeration system driven by the propulsion engine



The merit of the refrigeration system is driven by the propulsion engine. Whenever the fishing vessel leaves from the fishing port to the fishing ground for a certain fishing period, it will take time to operate the engine. Therefore, using the engine drive mode will result in energy utilization without using the electricity sourced from the diesel generator.

4.1.2.4 Reduction of Carbon Emissions

Catch per unit of fishing effort and greenhouse gas emission of a purse seine fishing vessel is among the most important factors that determine the impacts of the increasing contribution of Southeast Asian fisheries to global seafood production. Purse seine fishing is one of the activities that significantly contribute to the region's seafood production but requires considerations in terms of the energy use (man and machine), and in mitigating the negative impacts of fishing activities and vessel operations on the environment.

A privately-owned purse seine fishing vessel in southern Thailand, the "Nor Lapprasert 8" has been commissioned by SEAFDEC/TD through a collaborative arrangement since 6 July 2018 for a pilot project on labor reduction onboard fishing vessels during the fishing operations, as well as enhancement of the working practices and living conditions onboard the vessels following proper hygiene and adopting the low-impact and fuel efficient (LIFE) fishing concepts to catch fish, and preserving the freshness of the catch at sea for the benefit of the consumers. The initial activity using this pilot purse seine fishing vessel was launched through a joint fishing operation between the local fishers and SEAFDEC staff from 8 to 12 February 2019 and continued thereafter. During the trial period, the pilot project has shown improved efficiency of the fishing gears (net plan), fishery machinery, and fish handling tools. After more than three years of research on fuel saving/ energy efficiency using this pilot vessel by adopting the appropriate technology on improving energy efficiency, SEAFDEC has contributed to the improvement of fishing practices and working conditions onboard fishing vessels, and reduction of the manpower onboard purse seine fishing vessels. The summary of such efforts made by SEAFDEC/ TD is shown in **Table 64**.

After implementing the project, the new carbon emission record is shown in **Table 65**, while the changes and improvements compared before and after the implementation of the project using the pilot purse seine fishing vessel, are shown in **Table 66.**