

Development and improvement of acoustic equipments and systems for fisheries resources survey in shallow area

Yoshinori Miyamoto, Keiichi Uchida, TUMSAT, Japan
Toyoki Sasakura, FUSION INC, Japan, Yap Minlee, RIHN, Japan
Yuttana Theparoonrat, SEAFDEC/TD, Monton Anongponyoskun, KU, Thailand
Kritsada Thongsila, DOF Thailand

Abstract

The acoustic data collection system including equipment modification were conducted for coastal area survey around set-net fishing ground in Rayong province, Thailand. An analysis methodology is also developed and will be using as a tool for acoustic survey methodology education for young scientist in Thailand. The project modified acoustic device with composed of GPS Plotter Fish-Finder (FURUNO GP1670F), Interface unit and personal computer (PC) for using as acoustic data collection system. The equipment modification was performed by importing the echo-sounder transmitting and receiving signal from transducer cable to newly designed data collection system. The data collection system were composed of Pre-Amplifier and Band Pass Filter, Interface unit, Analog to Digital Converter, and PC computer system. The digital hydro-acoustic data were collected to PC hard disc by using "FishFinder" software program. The GPS position data was transfer from GP1670F to PC Computer pass through standard NMEA to USB port. The GPS position data were recorded to PC by using Windows Hyper-terminal program. The data collection system was design to record the echo-sounder signal of 50 kHz only. The recorded data in ".csv" file format were analyzed by Microsoft Excel Program. The data collection system was calibrated by standard target ball (Tungsten carbide, 38.1 mm) in the acoustic experimental water test tank of TUMSAT, Japan. The experiment survey cruise for investigated on the comparison of abundance of fisheries resources during set-net fishing operation season and off season were conducted during December 2013 and April 2014, respectively. Total survey area covering for 16.25 km² of set-net fishing ground with running distant of 38.5 km. The survey results shows a satisfied system performance.

Introduction

This study has been started as part of the RIHN project that is "Coastal area capability enhancement in Southeast Asia". The project aims at investigating the linkage between livelihoods and ecosystem health in the Southeast Asian coastal area are investigated to fully understand its complexity and consequent vulnerability, particularly from the human-related viewpoints through collaborative holistic researches with local peoples. The acoustic data collection system including equipment modification were conducted for coastal area survey around set-net fishing ground in Rayong province, Thailand. An analysis methodology is also developed and will be using as a tool for acoustic survey methodology education for young scientist. Since, depth of the target research area is about 15 meters, a searching range is too narrow for using the scientific echo sounder with available in the market. The project modified acoustic device with composed of GPS Plotter Fish-Finder (FURUNO GP1670F), Interface box and personal computer (PC) for using as acoustic data collection system. The objectives of program are 1) to develop new acoustic data collection system for shallow water, 2) to study on the fisheries resources distribution around set-net fishing ground in Rayong province, Thailand, 3) to estimate the amount of fisheries resources by using acoustic data and fish catch data of set-net fishing operation, and 4) HRD on new acoustic survey equipment and system through on-site training and publication of guideline of acoustic survey for coastal area.

Methodology

Acoustic data collection system including equipment modification were conducted for coastal area survey in Rayong province. The hardware and software system for data collection were developed at Tokyo University of Marine Science and Technology, Tokyo Japan. The first testing of hydro-acoustic equipments and systems for shallow area were conducted at Tateyama Bay, Chiba Prefectures, Japan.

Modification of GPS and echo-sounder system for hydro-acoustic data collection

The hydro-acoustic system for data collection was modified by using FURUNO GPS Plotter model GP-1670F. The GP-1670F was equipped with GPS receiver and chart plotter system. The machine was also equipped with echo-sounder with operated on 50 kHz and 200 kHz simultaneously. The GP-1670F provide a total integrated GPS receiver, color video plotter and color fish finder. The built-in GPS receiver provides highly accurate position, courses and speed information. The fish finder presents vivid underwater images on a high quality LCD.

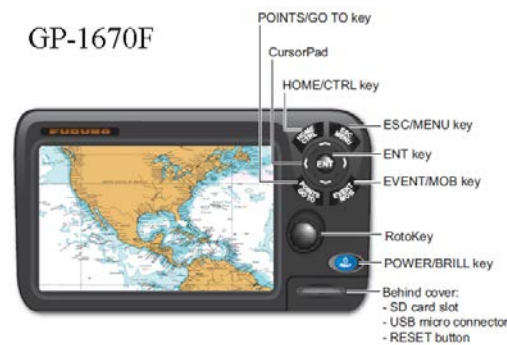


Figure 1. FURUNO GP-1670F display and control panel

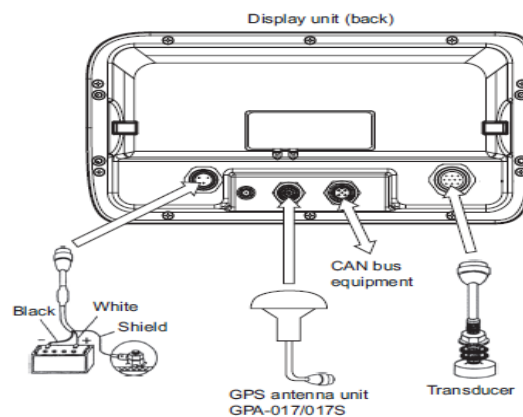


Figure 2. Connection socket of GP 1670F

The equipment modification was performed by importing the echo-sounder transmitting and receiving signal from transducer cable to newly designed data collection system. The data collection system were composed of Pre-Amplifier and Band Pass Filter, Interface unit, Analog to Digital Converter, and PC computer system. The digital hydro-acoustic data were collected to PC hard disc by using “FishFinder” software program. The GPS position data was transfer from GP 1670F to PC Computer pass through NMEA to USB port. The GPS position data were recorded to PC by using Windows Hyper-terminal program. The data collection system was design to record the echo-sounder signal of 50 kHz. only.

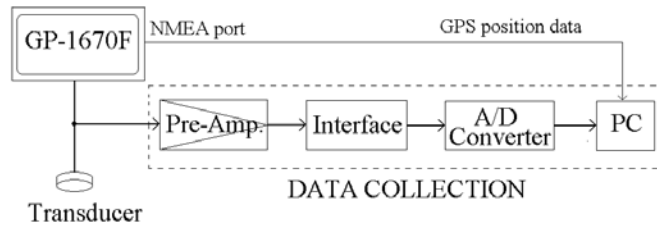


Figure 3. Echo-sounder survey data collection system block diagram

Simplest acoustic data collecting system

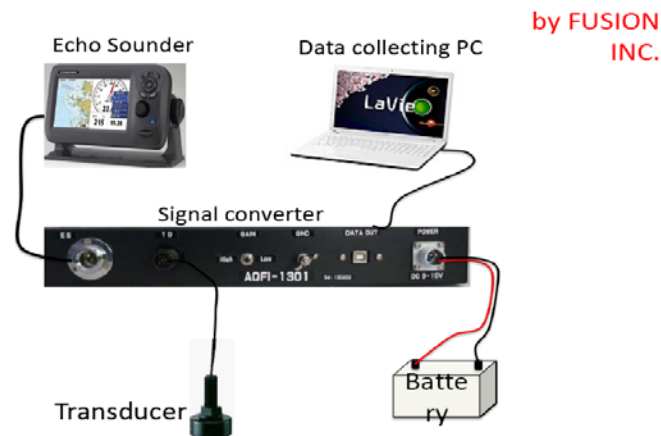


Figure 4. Echo-sounder survey data collection system hardware connection layout

The equipment test were conducted at Tateyama Training Station of TUMSAT in Chiba prefecture during 23-25 October 2012. The survey echo-sounder data collection system was assembly and conduct the sea trial running test on board TUMSAT training boat number 36. A standard target Tungsten Carbine spear ball diameter 38.1 mm. is used for system calibration.

Result of equipment testing

The GPS Plotter GP-1670F operation could be display the boat position, cruising track, speed and direction, and echogram for 50 and 200 kHz. simultaneously. The returned echo signal of 50 kHz imported to hydro-acoustic data collection system was amplify, filled, display and recorded on PC. The echo grams of standard target ball could be clearly detected and record on PC data collector.

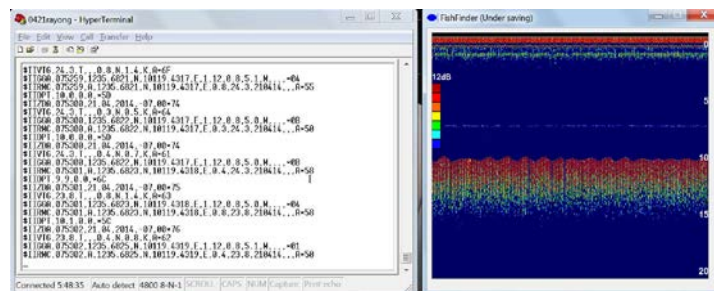


Figure 5. Output of GPS position data (a), and echo gram of standard target ball at 7 m. collected by FishFinder Version 3 Program.

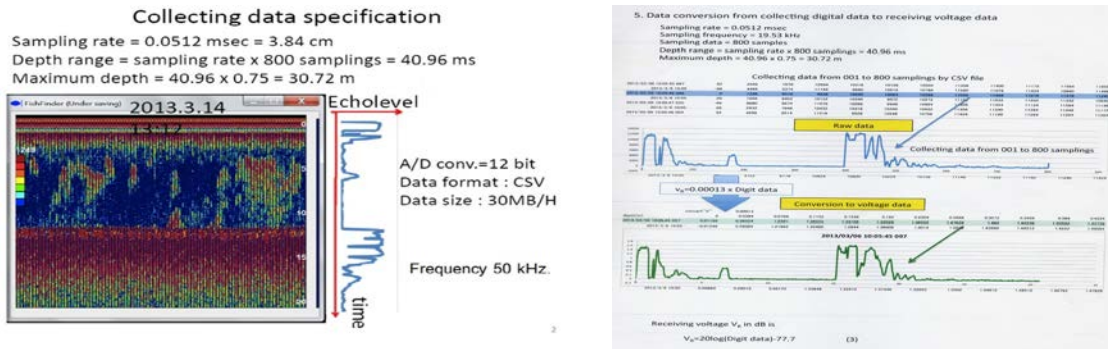


Figure 6. Output data recorded by data collecting PC

In order to investigate the effect of ship avoidance behavior of fish school during acoustic cruising survey in shallow waters, the tested cruising survey by using small scale fishing boat and auto-pilot kayak boat were conducted in the set net fishing ground at Rayong province. The tested acoustic cruising survey were conducted on board small squid cast-net fishing boat and self auto-pilot kayak boat with running on the same cruising tract in the same day. Program “FishFinder Version 1”, for Windows XP was used for echo data recorded. Data of return echo signal from fish school of both survey were compared for the appearance of fish school. The result showed that no effect by ship avoidance behavior of fish school during acoustic cruising survey in shallow waters by small squid cast-net fishing boat and self auto-pilot kayak boat.

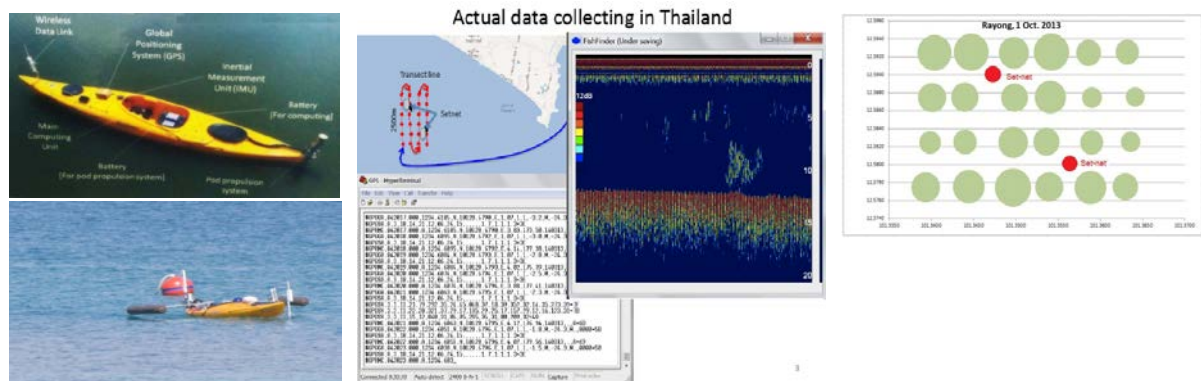


Figure 7. Auto-pilot kayak boat and output data recorded.

The cruising survey using hydro-acoustic equipments and system for shallow waters areas was conducted at set-net fishing ground in Rayong province, Thailand. The program “FishFinder Version 3” for Windows 7 and new design receiver gain circuit were used for the survey. Total survey area covering for 16.25 km² with running distant of 38.5 km. The hydro-acoustic survey was conducted one day ahead of set-net fishing operation performed. The recorded data are under analyzed at Faculty of Fisheries, Kasetsart University.

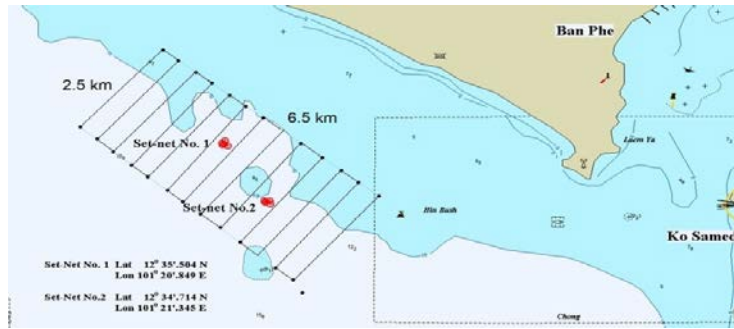


Figure 8. Hydro-acoustic survey cruise tract around set-net fishing ground in Rayong province.