SA-1

Basic study on seabed disturbance by mobile fishing gear

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Unintended consequences of fishing including overfishing, bycatch, and habitat degradation by fishing operation have been in concern all over the world because these issues are likely to affect marine ecosystem. Habitat degradation is relatively new among these issues and available information is very limited. Seabed disturbance by mobile fishing gear is one of the major topics in the issue of habitat degradation and it has been in discussion that seabed disturbance by mobile fishing gear may reduce habitat complexity, expose prey from habitat, or directly kill organisms.[1)] Unfortunately, studies on this topic in Asian region are still behind other regions. Our research team has started basic study on seabed disturbance by mobile fishing gear to understand its impact and to prepare technical counter measure against this unknown topic.

A beginning: The National Research Institute of Fisheries Engineering has been studying fish behavior in relation to fishing operation by attaching underwater video cameras at various parts of fishing gear. We have sometimes observed trenches on the seabed in front of trawl net mouth (Fig. 1). These trenches can be supposed as paths of fishing gear which are operated in the area. It is also believed in some fishing communities in Japan that some of fishing gears are likely to penetrate into seabed and destroy benthic habitat. However, these observations just show possibility of seabed disturbance by mobile fishing gear (circumstantial evidence, that fishing gear might create trenches) and reliable evidence has not been presented in Japan.

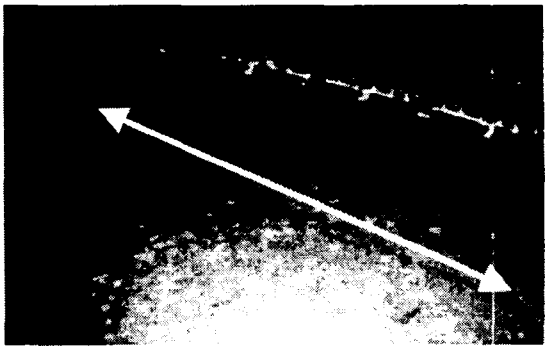

Fig.1. Trench observed in front of trawl net(along arrow line)

Evidence of seabed disturbance by mobile fishing gear: Experimental tows were carried out in Tokyo Bay to observe paths of conventional beam trawl in Tokyo bay using the side scan sonar. The side scan sonar used in the experimen (Fig. 2-1, EdgeTech model DF-100, USA, http://www.edgetech.com) can produce images of the seabed topography in certain observation ranges and detect changes of seabed topography more than resolution (6.5 cm in our case). Beam trawl net (Fig. 2-2) was towed in the experimental area (approx. 1500 x 400 m) at different towing speeds (2.5 and 4 knots). The seabed was mapped before and after each tow, and these maps were overlaid to determine whether disturbances made by tow were detectable. Results showed that 6.5% (113 m) of whole path was identified at 4 knots tow experiment as a trench at least deeper than resolution of the side scan sonar (Fig. 3).[2] Thus, this experiment enabled to present quantitative verified evidence of seabed disturbance.

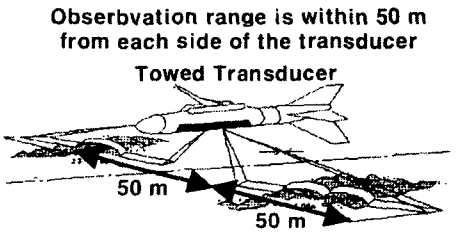

Fig.2-1. Outline of Side Scan Sonar.

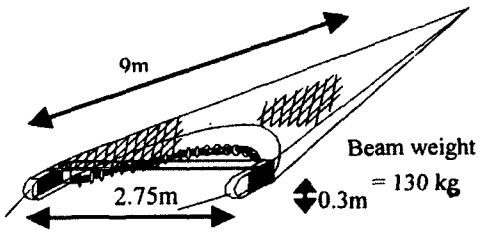

Fig. 2-2. Beam Trawl Net used in the experiment.

We also confirmed smaller scale of seabed disturbance by the tank experiment that was filled with beach sand and water (Fig. 4). Chains (1.38 and 3.75 kg/m) and an iron sinker (10 kg, 0.2 m dia.) as elements of mobile fishing gear were towed in the tank.

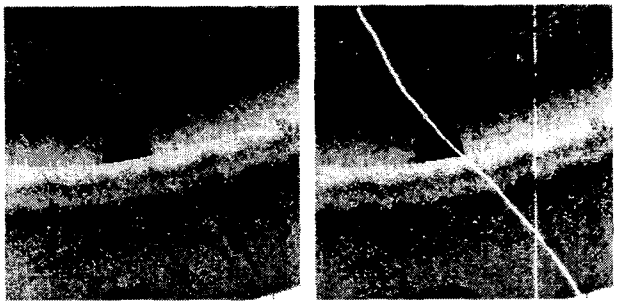

Fig. 3. A trench observed by side scan sonar
(Left; Zoomed image from original map.
Right; Image with highlighting the trench.)

High-resolution laser displacement sensor was set above the tank and scanned the cross section shape of bottom surface (seabed) along fixed measurement line after every tow. Results(Fig.5) showed that all that all objects scraped the surface of sandy bottom and changed the

bottom topography, although degrees of change were varied by unit weight of towed objects. Multiple passages of towed objects will give some degree of impact to the seabed regardless of unit weight. However, disturbance by mobile fishing gear should be scaled against disturbance due to natural processes to properly assess its relative significance.[3)]

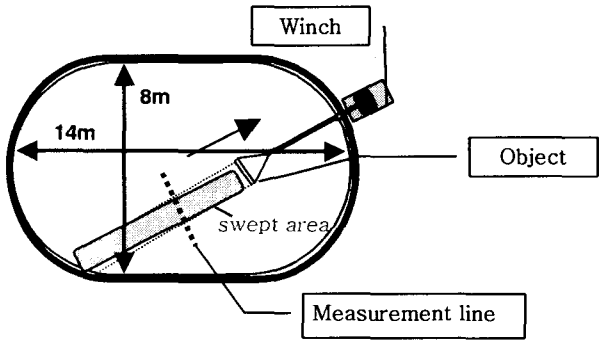

Fig. 4. General arrangement of tank experiment (bird s eye view)

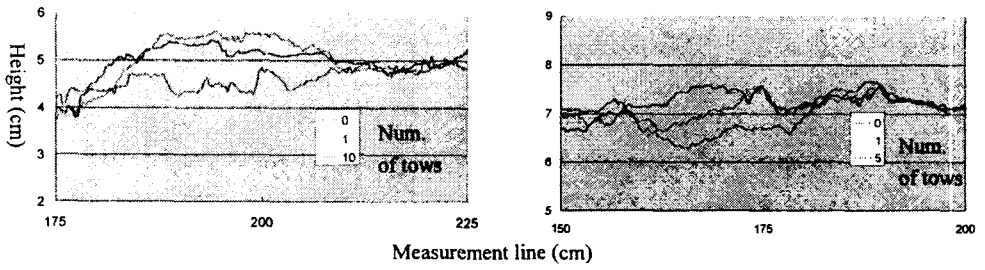

Fig. 5. Change of bottom topographies at the measurement line after multiple tows
Left; Chain (1.38 kg/m), Right; Iron sinker (10kg, 0.2m dia.)

Understanding fishing industries: We need to know detail information on fishing technology as a source of impact and fishing ground as an object suffering impact.

Information on fishing efforts is available for some fishing sectors in Japan because submission of fishing report is mandate for them. Spatial and temporal analysis of fishing efforts is useful to identify hot points/areas where mobile fishing gear heavily passes over. This type of analysis enable to identify important areas where are likely to suffer heavy seabed disturbances in conjunction with information on the seabed characteristics and its roles in

marine ecosystem.

On the other hand, fishing technology is originally optimized for the use at specific fishing ground. However, advances in gear technology such as increase of engine power, high strength materials, and new fishing gear design were likely to raise the limit of operation ability. Besides, advances in navigation technology enables fishermen to operate more accurate pin-point operation that would give concentrated impacts to specific fishing ground. Lack of detail information in fishing technology makes difficult to evaluate and mitigate seabed disturbance. As a starting point, the latest and detail catalogue of mobile fishing gear and methods should be collected and analyzed (e.g. Barnette[4]).

Counter measures: There are several options to mitigate seabed disturbance caused by mobile fishing gear including ban or limitation on fishing operations. One of workable solutions to mitigate seabed disturbance is to utilize fishing gear technology. Carr and Milliken[5] suggested following four solution categories for mobile fishing gear that gear technology could help. 1) To target certain species and modify gear appropriately, 2) To encourage the use of lighter sweep, 3) To reduce the seabed available to industries that fish very irregular terrain, and 4) opt for stationary gear over mobile gear. 1) is a common goal of fishing technology research and development, but it can reduce impact to seabed in certain fisheries, and 2) is considered as a second effort of 1). Method to tune fishing gear up to certain target species and grounds may be best available solution for mitigating seabed disturbance by mobile fishing gear. In addition, new researches are in progress to reduce contact pressure of fishing gear to seabed, such as developing the Soft door flexible kites that are lighter than trawl doors[6] or computer gear modeling technology to reduce gear impact to the seabed.[7] Concerning 3) for example, maximum diameter of Rock-hopper footrope is restricted in New England, USA to prevent operation at rough bottom area and decrease impact to seabed.[8] Thus, technical measures to mitigate seabed disturbance has embarked all over the world except our region. We need to have habitat (seabed) conservation concept for developing fishing technology in the region. In addition, seabed disturbance by mobile fishing gear involves multiple phases on ecological, physical and chemical points of view. We have just touched how mobile gear would penetrate into seabed in the series of study. However, we have realized that there is a lot of lack on basic information,

including fishing ground, fishing gear and activities, to document the issue. We therefore need broad and steady activities for collecting available information.

References

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Enormous references are also available at National Marine Fisheries Service / Alaska Fisheries Science Center web site,
www.afsc.noaa.gov/groundfish/HAPC/references.html