Experimental Study on the Evaluation of Working a Ro-scull for the Indonesian Outrigger Canoe

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In South-East Asian countries and Japan located in the northwest Pacific, there are many rowing fishing boats used for small-scale coastal fisheries. In general, Indonesian marine activities are supported by small-scale fishing boats in coastal waters. These fishing boats are commonly built in a traditional method according to the carpenters' personal ability without any hull lines and the application of modern techniques in naval architecture.

First of all, Indonesian outrigger canoes are propelled mechanically but many fishermen want to change propelling method to human power due to rising fuel oil prices. In Japan, the traditional boat is known as Wasen. Japanese small fishing boat is used to be propelled with a Ro-scull. The Ro-scull is a traditional propelling device for small boat using hydrodynamic lift force. It runs the boat very gently and economically. However, the wooden Wasen has almost disappeared. The FRP boats are replacing wooden Wasen, whereas they are partly inheriting hull form from Wasen. The present study is to find out the potential of applying the Ro-Scull of Japanese Wasen to Indonesian outrigger canoe.

The second was about the statistical analysis of hull type and the characteristics of Indonesian outrigger canoe and Japanese Wasen. The material consists of the data on 604 Japanese Wasen and 492 Indonesian canoes (in Jawa, South Sulawesi, North Sulawesi and Sulu Island). Indonesian outrigger canoe has a very slim hull with small draft, which means low resistance, and is propelled with paddle and sometimes sail. It has no "Rogui" or a pivot for Ro-scull. Also Japanese Wasen has a very slim hull and is operated with Ro-scull. Indonesian canoes used as fishing boats are separated into three groups that is angling, seiner and gillnet**.** Angling type has the smallest length and the width of outrigger distance BB. The minimum boat length among all types of boats was around 300 centimeters and the BB/2 that was assumed to be the width of Wasen was estimated to be about 99 centimeters. On the other hand, a traditional Wasen boat has also 300 centimeters length and 102 centimeters breadth at minimum. This means there is the possibility of applying Ro-Scull to the remaining type of canoes.

The third experiment was undertaken to examine the stability of canoe after mounting a floating structure on the after part of canoe. The statical stability of canoe was examined from the

data of inclining test and oscillation test. These tests were conducted under the following conditions depending on set outrigger distance: nobody on board (inclining test and oscillation test), one person on board sitting down (inclining test and oscillation test) and one person on board standing up (inclining test only). GM (transverse metacentric height) values were calculated when the outrigger distance was arbitrarily varied. GM value with one person standing up was estimated to be around 1.0 meter in the case of 1.3 meters outrigger distance. Then it was found that working a Ro-scull was possible. In the oscillation test, the boat immediately became still after only one rolling.

The fourth, the experiment of working a Ro-scull of Indonesian outrigger canoe was performed by veteran and non-veteran testee scullers. About 30 strokes of each sculler's motion of working a Ro-scull were recorded with a digital camera which was set at bow. The recorded motions were analyzed about the movement of six points including head, Rosaki (front edge of Ro-scull), right elbow, waist, right knee, and left knee in using the two dimensional video image analyzing software (DippMotion2D V.3.20KP). In working a Ro-scull, a sculler propels a boat by alternately repeating one motion of pushing a Ro-scull away from the body (pressing) and the other of pulling a Ro-scull to the body (reserving). The veteran was working a Ro-scull in stepping back with the right foot from the centerline and it seemed to be simple and could operate long time, however non-veterans were standing with legs open in parallel with centerline and it was difficult to keep balance against canoe’s rolling.

The fifth, as stated above, the author made a comprehensive consideration of the working a Ro-scull experiments to find out a possibility to transfer the Ro-scull of Japanese Wasen and the skills of working a Ro-scull to Indonesian canoes. Consequently, it was revealed there was room for further improvements to transfer the Ro-scull and skills of working it to Indonesian outrigger canoes. However, the video footage that recorded the working a Ro-scull motions and was analyzed became an optimum learning tool to imagine the way of working a Ro-scull when testee scullers who looked a Ro-scull first time to learn working a Ro-scull. In addition, the oscillation test showed a canoe had a characteristic that an oscillation was settled immediately. It was difficult to work a Ro-scull of canoe as well as Wasen in rough waters. From this study, it can be recommended that working a Ro-scull for the Indonesian outrigger canoe, like Japanese Wasen, is more suitable when conducted in the calm surface such as coastal waters and inland waters including lakes and rivers that are numerous in Indonesia.