

Studies on the American Style Purse Seiner-II

Comparison with the Stern Trawler

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The American style purse seiner of 500 GT class was studied in comparison with the stern trawler of 500 GT class originally developed in England and improved and established in Japan, in terms of principal particulars and other items expressed in mean value of four vessels each as the previous paper.

The American style purse seiner is 15.8 % broader in actual size than the stern trawler and 12 % broader in L/B. The cruising speed of the purse seiner at 3/4 load of full load condition is 14.7 knots which is faster than the stern trawler by 2.8 knots.

The purse seiner has the hull form of greater midship section coefficient and smaller block coefficient, i.e., the hull form of fat midship and slim bow and stern together with a fine streamline shape of the bottom in front of the propeller and the broad stern deck.

As to the motion characteristics of the purse seiner in longitudinal wave, the relative pitching of the bow against the wave surface shows a 20~30 % greater amplitude when synchronized with the severest head sea as compared with the conventional average Japanese fishing vessels. However, since consideration has been given to the height of the bow freeboard and to the increase of flaring, the splash of waves from the bow may not be particularly strong.

The history, current status and hull form of the American style purse seiner are described in the previous paper (1).

The Fairtry (2,605 GT, England) built in 1954 was the first stern trawler in the world (3). In Japan, the first stern trawler is the Umitaka Maru (1,388 GT), a training ship of the Tokyo University of Fisheries, which was built in 1955. Among the private companies, the No. 51 Taiyo Maru (1,497 GT) of the Taiyo Fishery Co., Ltd. was built in 1957 as the first stern trawler. Since then, side trawlers were remodeled into stern trawlers (2).

The author studied the American style purse seiner in comparison with the stern trawler originally developed in England and improved and established in Japan, in terms of various specific items.

Method

Four American style purse seiner of 500 GT class and four stern trawler of about the same size listed in Table 1 were compared for their respective principal particulars, speed, hull form and conditions expressed in mean value in Table 2 (4~6).

Table 1. Four stern trawler (T-1~4) and four American style purse seiner (S-1~4) in the study.

| No. | Gross ton | Name |
|-----|-----------|-----------------------|
| T-1 | 499 | AA-Marun (4) |
| T-2 | 499 | BB-Marun (5) |
| T-3 | 495 | CC-Marun (6) |
| T-4 | 549 | DD-Marun (6) |
| S-1 | 499 | Hayabusa-Marun |
| S-2 | 499 | Wakaba-Marun |
| S-3 | 499 | Fukuichi-Marun |
| S-4 | 499 | Hayabusa-Marun, No. 2 |

Table 2. Means of principal particulars, speed, hull form and conditions in the stern trawlers (ST) and American style purse seiner (ASPS).

| | ST | | ASPS | |
|--------------------------------------|--------|-----------|--------|-----------|
| Principal particulars | | | | |
| Length registered, L (m) | 48.99 | | 52.08 | |
| Breadth, B (m) | 9.50 | | 11.00 | |
| Depth, D (m) | 4.13 | | 6.88 | |
| L/B | 5.16 | | 4.73 | |
| L/D | 11.86 | | 7.57 | |
| B/D | 2.30 | | 1.60 | |
| GT/LBD | 0.27 | | 0.13 | |
| Trial speed (knots) | | | | |
| Load | | | | |
| 1/4 | | | 11.56 | |
| 2/4 | 11.05 | | 13.71 | |
| 3/4 | 11.95 | | 14.74 | |
| 4/4 | 12.78 | | 15.41 | |
| over load | 13.05 | | 15.65 | |
| Conditions | | | | |
| | Light | Full load | Light | Full load |
| For. draft (m) | 1.32 | 2.98 | 2.96 | 3.52 |
| Aft. draft (m) | 4.24 | 4.68 | 2.71 | 4.66 |
| Mean draft (m) | 2.78 | 3.83 | 2.84 | 4.09 |
| Trim (m) | 2.92 | 1.70 | -0.25 | 1.14 |
| Displacement tonnage (t) | 727.85 | 1149.79 | 763.70 | 1296.00 |
| Midship area (m ²) | 22.65 | 32.95 | 27.61 | 42.09 |
| Midship section coefficient, Cm | 0.921 | 0.942 | 0.966 | 0.977 |
| Block coefficient, Cb | 0.596 | 0.661 | 0.518 | 0.583 |
| Prismatic coefficient, Cp | 0.646 | 0.701 | 0.537 | 0.596 |
| Water plane coefficient, Cw | 0.757 | 0.890 | 0.660 | 0.765 |
| Tons per cm immersion (t) | 3.644 | 4.238 | 3.703 | 4.315 |
| Moment to change trim one cm (t-m) | 9.576 | 13.766 | 8.420 | 12.540 |
| Height of metacenter, KM (m) | 4.821 | 4.520 | 5.140 | 4.860 |
| Height of center of buoyancy, KB (m) | 1.458 | 2.053 | 1.450 | 2.200 |
| Height of center of gravity, KG (m) | 4.177 | 3.751 | 4.640 | 3.930 |
| Metacentric height, GM (m) | 0.644 | 0.769 | 0.500 | 0.930 |
| KG/D | 1.013 | 0.912 | 1.040 | 0.859 |
| Free-board (m) | 1.608 | 0.557 | 1.996 | 0.696 |

Results and Discussion

Principal Particulars

In comparison with the stern trawler, the American style purse seiner is longer by 6.3% and broader by 15.8%. The length breadth ratio, L/B is 4.73 for the purse seiner and 5.29 for the stern

trawler, thus the purse seiner is 12 % broader in L/B. This is to increase the stability of the purse seiner since its weight on broad is great as stated in the previous paper (1). In comparison with the tuna long liner, the purse seiner is broader by 20.2 % in actual value and 16 % in L/B, and the stern trawler is broader by 3.8 % in actual value and by

4 % in L/B.

Speed

As shown in Table 2, the purse seiner is faster than the stern trawler by 2.7 knots at 2/4 load of full load condition, by 2.8 knots at 3/4 load, by 2.6 knots at 4/4 load by 2.6 knots at over load. In comparison with the tuna long liner, the purse seiner is faster by 1.9 knots at 2/4 load, by 1.9 knots at 3/4 load, by 1.7 knots at 4/4 and by 1.5 knots at overload as shown in the previous paper (1). The stern trawler is slower than the tunalong liner at each load. It is speculated as a result of resistance test in still water that the purse seiner requiring relatively small propulsion horsepower in comparison with its displacement is of the fuel saving full form cable of running at the same speed even with the propulsion horsepower of less than half compared with the other vessels of the existing fat hull forms.

Hull Form

In the purse seiner, the midship section coefficient is greater by 4.9 % in light load and by 3.7% in full load condition, and the area of midship section is greater by 22 % in light load condition and by 28 % in full load condition. However, the block coefficient is smaller by 13 % in light load condition and by 12 % in full load condition. The purse seiner has the hull form of fat midship and slim bow and stern together with a fine stream-line shape of the bottom in front of the propeller and the broad stern deck (7).

Conditions

In the purse seiner, the trim is 0.25 m by the head in light load condition and 1.14 m by the stern in full load condition.

In the stern trawler, it is 2.717 m by the stern in light load condition and 1.701 m by the stern in full load condition. The fact that purse seiner has the characteristic of trim by the head in light load condition has been described in the previous paper (1).

In the purse seiner, the center of gravity is higher by 0.463 m in light load condition and by 0.179 m in full load condition; the center of buoyancy is lower by 0.008 m in light load condition and higher by 0.147 m in full load condition; and the metacentric height (GM) is lower by 0.114 m in light load condition and higher by 0.151 m in full load condition.

As to the motion characteristics of the purse seiner in longitudinal waves, the relative pitching of the bow against the wave surface shows a 20~30 % greater amplitude when synchronized with the severest head sea as compared with the conventional average Japanese fishing vessels. However, since consideration has been given to the height of the bow foreboard and to the increase of flaring, the splash of waves from the bow may not be particularly strong.

References

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米国式旋網船について—II

船尾トロール船との比較

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米国で開発された500総トン級米国式旋網船と英国で開発され日本で改良固定された500総トン級船尾トロール船各4隻の諸要目、速力、船型、性能の平均値を比較検討した。

米国式旋網船は船尾トロール船より巾が15.8%広い。

平均速力は、巡航速力(3/4負荷)における米国式旋網船が2.8ノット速い14.7ノットであり、抵抗試験によれば米国式旋網船は現存の肥大船型に比べて推進馬力が半分以下でも同一速力が出せる燃料節減船型である事が推定されている。

船型は、船体中央部が旋網船が肥っており船首尾でやせており、プロペラ前方の船底部分がきれいな流線型となっている。

旋網船の縦波中の運動特性は、船首の波面に対する相対上下揺振を在来の平均的日本漁船と比べると最もきびしい向い波同調状態時において20~30%程度の振巾増加が見られるが、船首乾舷の高さとフレアーの増大が考慮されているので船首からの波浪打ち込みが特に激しくなる事は無いと考えられる。