National Marine Fisheries Service
TED Technology Transfer Program
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Knot Orientation on TED Flaps

by John Watson

Gear researchers from the NMFS Harvesting Systems and Engineering Branch, Mississippi Laboratories in Pascagoula, Mississippi recently conducted evaluations on the effect of webbing knot orientation on the performance of TED flaps, BRD funnels, and trawl codends. The results of the evaluations was dramatic as was demonstrated in a video presentation at the Industry Workshop on Bycatch Reduction in the Shrimp Fishery sponsored by the Gulf and South Atlantic Foundation, Inc in Tampa FL in October, 1999.

The effect that webbing knot orientation has on gear performance was first reported by researchers at the Australian Maritime College in an article published in Australian Fisheries in June 1991 by Lyndal Wilson. The discovery was made during flume tank experiments with model trawls. Identical model trawls had very different fishing configurations when demonstrated in the flume tank. After a lot of head scratching, Dave Sterling then a student at the Australian Maritime College in Tasmania, Australia reasoned that the hydrodynamic forces associated with the webbing knots might be the cause of the difference in net performance. Tim Paice later confirmed this theory through a series of flume tank experiments. What he found was that the shape of webbing knots creates hydrodynamic lift in either and upward or downward direction depending on the angle of webbing knots relative to the direction of water flow. Tim Paice's research determined that downward lift is generated when webbing knots have a negative angle of attack in both the top and bottom panels of a trawl. Overall trawl performance i.e., how hard a trawl fishes and how high a trawl opens are influenced by webbing knot orientation.

For several years, gear researchers have observed differences in performance of TED exit flaps and BRD and TED funnels when evaluating gear performance. The difference in performance was attributed to different webbing materials and quality and stretching of webbing with use. In the summer of 1999, Kendall Falana, a gear specialist with the Harvesting and Systems Engineering Branch, proposed that the Harvesting Team investigate the effect of webbing knot orientation on the performance of TED exit flaps while conducting BRD diver evaluations off of Panama City, FL,. The results of the evaluations were immediately obvious and dramatic. Poly flaps were evaluated on a TED with a leatherback modification opening, which was required at the time on the U.S. east coast. When the poly flap was installed with the webbing knots in a negative (downward) angle of attack to the water flow the flap gaped open 10 to 12 inches when the trawl was towed at 2.5 knots. When the flap was removed and re-attached with the webbing knots in a positive (upward) angle of attack the flap was closed tightly around the TED frame when towed at 2.5 knots. Subsequent test off of Mississippi with different TED designs have confirmed these results. When tested with a standard TED opening the flap gaped open 3-5 inches or was closed tightly depending on the knot orientation.

Knot orientation also had a dramatic effect on codend shape and BRD funnel shape and performance. With the knots oriented with an outward angle of attack on a 120 mesh codend the codend had an opening diameter of 13 inches, when the knots were oriented with an inward angle of attack the opening diameter was 10 inches. Similar results were seen with a BRD funnel. These observations indicate the importance of knot orientation when constructing fishing gear. In the case of TED flaps it could greatly affect shrimp retention and may also have a significant affect on BRD performance.

The Harvesting Systems and Engineering Branch has produced videotape demonstrating the effects of webbing knot orientation. Copies of the video can be obtained from:

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