Testing Flexible Turtle Excluder Devices (TEDs) in the Demersal Trawl Fishery off Suriname

Prueba de Dispositivos de Exclusión de Tortugas Flexibles (DET) en la Pesquería de Arrastre Demersal en Suriname

Test de Dispositifs Flexibles d'Exclusion des Tortues (DET) dans la Pêcherie au Chalut de Fond au Large du Suriname

TOMAS WILLEMS[1]*, NICHOLAS HOPKINS[2], and YOLANDA BABB-ECHTELD[1]
[1]*Fisheries Department, Ministery of Animal Husbandery, Agriculture and Fisheries, Cornelis Jongbawstraat 50, Paramaribo, Suriname.*
*Tomaswillems@Gmail.Com
[2]*NOAA — NMFS, Harvesting Systems Unit, 202 Delmas Av., Pascagoula, Mississippi 39567 USA.*
Nick.Hopkins@NOAA.Gov

EXTENDED ABSTRACT

Demersal trawl fisheries are generally poorly selective, with significant proportions of the catch being discarded back to the sea (Kelleher 2005). Trawler discards may include species of conservation concern such as sea turtles, marine mammals, shark and ray species (Stevens et al. 2000). Fishing gear modifications are an important tool to reduce bycatch and discards in demersal trawl fisheries (e.g. Broadhurst 2000). A well-known example is the Turtle Excluder Device (TED), a rigid grid installed near the codend of shrimp trawls guiding turtles to an escape opening while the targeted shrimp are retained in the codend. A TED functions as a sorting grid, allowing any organism or object larger than the TED's bar spacing (typically 4 inches) to escape the trawl (e.g. Brewer et al. 2006). As such, TEDs also reduce capture of other marine megafauna such as rays and sharks (e.g. Willems et al. 2016). TEDs are now widely used in tropical shrimp trawl fisheries. Transfering the TED technology to fish trawls, however, is challenging. Fish trawls are often longer and heavier than shrimp trawls which lead to the application of net reels to retrieve and deploy them. Winding a trawl onto a net reel creates torsion in the cables and webbing that easily crushes rigid grids. To overcome these problems, flexible TEDs made of steel cable, referred to as Cable TEDs or CTEDs, have been developed and tested in various fisheries. In this study we tested two prototype CTEDs in the multi-species demersal trawl fishery off Suriname. The fishery interacts with several vulnerable marine species including rays, sharks and turtles. The aim of this study was to evaluate whether the CTEDs would work in the fishery in terms of reducing the bycatch of megafauna, while retaining the target catch to a maximum extent. Further, we wanted to assess whether the devices are practicle in their deployment and handling.

The CTEDs were tested onboard FV Minerva, a Scottish-type stern trawler rigged for twin trawling. The trawling gear included two identical nets, each with a 24 m-long footrope, attached to a mid-trawl sledge and connected to steel otter doors using 75 m-long bridles. Mesh size of each trawl ranged from 200 mm in the body and wings of the trawl, down to 80mm in the codend. Twin trawl gear is ideal for catch comparison experiments as it allow to test the performance of the experimental net (with CTED) versus the control net (standard equipment) while fishing the same area at the same time. The protype CTEDs evaluated in this study had a vertical bar spacing of either 7 or 5 inches to ensure maximal retention of target catch. The two CTEDs, referred to as 7-inch and 5-inch CTED, respectively, were otherwise identical. They had five horizontal bars ('backstraps'), positioned 12 inches apart. The grids were constructed from stainless steel cable and each grid was encased in webbing that matched the trawl webbing at the grid installation site (120 mm Euroline). The grids were installed to function as bottom shooters. A total of 41 catch-comparison hauls were successfully completed and sampled. The hauls were done during two commercial fishing trips which took place in October 2017 and February 2018. In total, 16 comparative hauls were done with the 5-inch CTED and 25 hauls with the 7-inch CTED. The sea trials were done under commercial fishing circumstances, in which four to five hauls were done each day. Hauls lasted on average 3h11' ± 0h26' at a speed of ca. 3 knots, according to normal fishing practice. After haulback the experimental and control net were brought onboard simultaneously and each codend was emptied in a separate container, connected to a hopper system. Before and during the processing of the catch by the crew, the following information was collected, for both the control and experimental net: total catch weight, discarded catch weight, retained catch weight (per species), discarded catch composition and numbers and size of megafauna (rays, sharks, turtles; per species). Weights were recalculated to Catch-Per-Unit-Effort (CPUE; in $kg.h^{-1}$) and the catches of control and test net were compared using Paired t-test.

The CTEDs proved practical to handle on board and were easily rolled onto the ship's net drum upon haulback. Both CTEDs caused large and significant reductions in discards (Figure 1). Catch rate of discards (by weight) decreased by 68 % using the 7-inch grid and by 75 % using the 5-inch grid. These reductions were mainly caused by exclusion of rays from the trawl. Ray catch rate was reduced by 79 % using the 7-inch CTED and by 94 % with the 5-inch CTED. Three olive ridley turtles were caught in the control net, and none in the experimental net. Despite the reductions in discards, the catch of marketable fish was negatively affected by the cable grids, with significant reductions of respectively 36 % and 30 % for the 7- and 5-inch CTED. Reduction was dependent on the species and the CTED used. The 7-inch CTED caused significant reductions for Southern kingcroaker *Menthicirrhus americanus* (66%), prawns *Penaeus spp.* (64%), Largehead hairtail

Trichiurus lepturus (53%), Corocoro grunt *Orthopristis ruber* (46%), Coco sea catfish *Bagre bagre* (41%), Lane snapper *Lutjanus synagrus* (32%) and Jamaica/Tonkin weakfish *Cynoscion jamaicensis/similis* (27%). For the 5-inch CTED significant reduction were observed for Southern kingcroaker *M. americanus* (89%), Guachanche barracuda *Sphyraena guachancho* (67%) and Serra Spanish mackerel *Scomberomorus brasiliensis* (64%).

CTEDs clearly have a great potential to reduce bycatch of vulnerable species in the demersal trawl fishery off Suriname. At current, the loss of target catch is too high for the devices to be acceptable for commercial use in the fishery. The fishery clearly interacts with large numbers of stingrays. It is most likely, from observervations made during the sea trials, that rays occasionally get stuck onto the grid. This deflects the waterflow, opening up the escape flap and allowing fish to escape the trawl. This might be the main reason for the observed losses of target catch. Further modifications to the CTEDs will therefore focus on avoiding the blocking of the grid by rays.

KEYWORDS: Turtle Excluder Device, seabob shrimp trawl, Suriname

LITERATURE CITED

Stevens, J.D., R. Bonfil, N.K. Dulvy, and P.A. Walker. 2000. The effects of fishing on sharks, rays, and chimaeras (chondrichthyans), and the implications for marine ecosystems. *ICES Journal of Marine Science*. **57**:476–494.

Kelleher, K. 2005. Discards in the Worlds Marine Fisheries. An Update. *FAO Fisheries Technical Paper* **470**. Fishing Technology Service FAO Fisheries Department. Rome, Italy.

Broadhurst, M.K. 2000. Modifications to reduce bycatch in prawn trawls: a reviewand framework for development. *Reviews in Fish Biology and Fisheries* **10**:27 - 60.

Brewer, D., D. Heales, D. Milton, Q. Dell, G. Fry, D. Venables, and P. Jones. 2006. The impact of Turtle Excluder Devices and Bycatch Reduction Devices on diverse tropical marine communities in Australia's northern prawn trawl fishery. *Fisheries Research* **81**:176 –188.

Willems, T., J. Depestele, A. De Backer, and K. Hostens, K. 2016. Ray bycatch in a tropical shrimp fishery: Do Bycatch Reduction Devices and Turtle Excluder Devices effectively exclude rays? *Fisheries Research* **175**:35 - 42

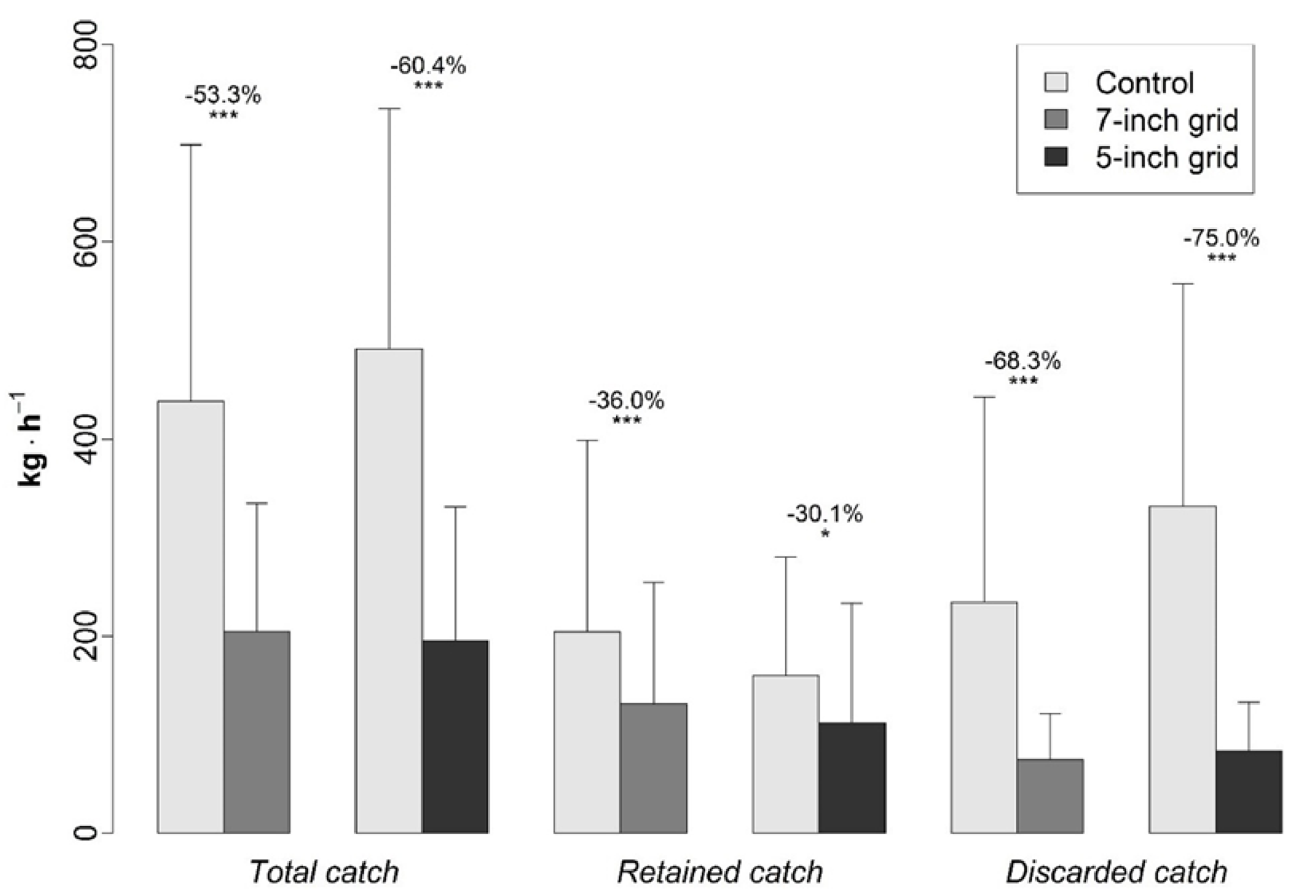

Figure 1. Mean (+SD) catch rate of total, retained and discarded catch for the control net (no CTED; light grey), net with 7-inch CTED (dark grey) and 5-inch CTED (black). Percentages denote reduction in mean catch rate between the control and experimental net. Asterisks indicate significant differences (paired t-test; *** = $p < 0.001$; * = $p < 0.01$).