Engineering Bycatch Reduction in St. Thomas Fisheries:
Characterization of Bycatch from St. Thomas Fisheries

Ingeniería Utilizada en la Reducción de Pesca Incidental en las Pesquerías de St. Thomas:
Caracterización de la Captura Incidental de la Pesca de St. Thomas

Techniques de Réduction des Prises Accessoires dans les Pêches de Saint-Thomas :
Caractérisation des Prises Accessoires de Pêche de Saint-Thomas

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EXTENDED ABSTRACT

National Standard 9 of the Magnuson-Stevens Fishery Conservation and Management Act [as Amended Through January 12, 2007 (Section 104-297)] states that *Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch*. The current paper represents work by the St. Thomas Fishermen's Association (STFA) to obtain detailed information on bycatch by means of "observer" trips, a direct "trip ticket" with local fishermen and port sampled trips by member fishermen. This work was conducted with partners such as MRAG Americas and NMFS and provides a detailed characterization of fisheries effort and bycatch for fisheries of the northern U.S. Virgin Islands (USVI).

The commercial fisheries in the USVI differ between the northern islands of St. Thomas and St. John and the southern island of St. Croix. In the northern islands fish and lobster traps continue to account for about 70% of the total landings, with hand line and seine net landings constituting significant but smaller proportions, while in St. Croix the fisheries have evolved towards greater emphasis on SCUBA techniques and the use of nets. In our study we were able to account for a majority of the reported commercial landings during the study period and provide some guidance on accuracy of reporting. We documented effort and bycatch for 4 principal fisheries: Fish traps [767 trips, 62,641 kg (138,099 lbs.) landings], Lobster traps [364 trips, 24,760 kg (54,587 lbs.) landings], hand lines [410 trips, 18,155 kg (40,026 lbs.) landings], and Seine nets [247 trips, 27,358 kg (60,314 lbs.) landings]. Some data on diving, rod and reel, and spearfishing were also collected.

All bycatch decisions were made by project fishermen, designating whether or not each particular fish was targeted as catch or bycatch and why bycatch was being discarded. Fishermen identified several reasons for discarding fish:
  i)   Risk of ciguatera fish poisoning,
  ii)   Fish too small to sell in the market,
  iii) Species was non-commercial (could not be marketed), or
  iv)   Regulatory discards, including species discarded during seasonal closures, spiny lobsters with carapace length smaller than the 3.5 inch minimum allowable size, or female spiny lobsters carrying eggs ("berried").

Samples from the fish trap fishery illustrate project results. A total of 73 different taxa were identified as bycatch from the fish traps; however, nine species accounted for 93.8% of the bycatch individuals, small boxfish species made up 38% and small surgeonfish made up 23% of the total numbers. Species posing a risk of ciguatera poisoning (*Lutjanus apodus* and *Caranx ruber*) constituted 12% of the mix. Non-commercial species (*Diodon holocanthus, Chaetodon striatus*) made up 3%, and spiny lobsters and small commercial species the remainder.

Bycatch mortality was also estimated for a subset of the effort. A total of 25,591 bycatch individuals was recorded distributed among 16,670 trap hauls in the mortality study for fish traps, 3,516 for lobster traps, 228 for hand line, 80 for rod and reel and 16 for diving fisheries. Highest mortality rates were found in species belonging to the Chaetodontidae (butterflyfish) and Pomacanthidae (angelfish) families. Numerically, the two surgeonfish species (*A. coerulus* and *A. chirurgus*) suffered the highest number of trap deaths with the banded butterflyfish (*Chaetodon striatus*) close behind. Boxfishes (Ostraciidae), which were the most common element of the bycatch, suffered no mortality. The species suffering the highest mortality rates were species with a laterally compressed body shape. This offers some hope for bycatch reduction if escape panels can be introduced to let individuals of these species escape without reducing landings of desirable species (Olsen and Hill 2013).

In addition to quantifying bycatch, the large detailed samples allowed calculation of fishery management parameters that should be applicable beyond this study. Available data from local studies, obtained from FishBase (Froese and Pauly 2012), on length at first reproduction was used to evaluate capture lengths against reproductive states. Length-frequency distributions for those species with more than 100 individuals in the catches were generated and parameters were derived for L_{min} (the minimum size retained by project fishermen), L_{avg} (the average size retained for sale by the project fishermen), L_{50} (the length at which 50% of the population is retained by the gear), L_{100} (the length at full recruitment to the gear), trap selectivity by species, and estimates of total mortality (Z) for species where von Bertalanffy growth parameters were also available. Typical results show that, for the most part, St. Thomas fishermen are harvesting at sizes, which are above the minimum size at reproduction for most species. The main exceptions are angelfishes (family Pomacanthidae) and several snappers. Angelfish mortality is almost entirely due to barotrauma occurring during hauling of fish traps. During the diving portion of the current project when traps were being hauled at approximately half the normal rate in order to provide fish for stocking (Hill et al., In prepeparation) there was no mortality of angelfish. Snapper mortality is occurring almost entirely during closed seasons for those species. The species involved would normally be retained as catch.

The series of studies highlighted here represent a transition from a near total lack of knowledge of bycatch in USVI fisheries to an ongoing effort to engineer bycatch reduction in those fisheries (Olsen and Hill 2013). The data from these studies have greatly improved understanding of St. Thomas' fisheries and the degree to which bycatch issues exist. In addition, information on the fisheries parameters and life histories should provide guidance for management and improve information-based decision making. All of this has been accomplished through studies designed to maximize involvement of the fishermen, allowing then to share their knowledge of the fishery, and to solicit input in order to improve the studies themselves. It is hoped that studies such as the present effort, coupled with existing and improved catch reporting, and port sampling can significantly increase the information content upon which management strategies are based. In addition, the participation of stakeholder fishermen in research projects such as these provides information exchange between scientists and fishermen and provides educational benefits in fishermen's understanding of how research is conducted and applied to management decisions.

LITERATURE CITED

Froese, R. and D. Pauly (Eds.). 2012. *FishBase*. World Wide Web electronic publication. www.fishbase.org.

Olsen, D.A. and R.L Hill. 2013. Engineering bycatch reduction in St. Thomas fisheries: development of escape vents for St. Thomas fish traps. *Proceedings of the Gulf and Caribbean Fisheries Institute* **65**:341-345.