INTERNATIONAL DOLPHIN CONSERVATION PROGRAM

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PRELIMINARY ANALYSIS OF DATA OF VESSELS NOT COVERED BY THE AIDCP

The Secretariat has been investigating the potential of a statistically-based system for identifying vessels not covered by the AIDCP that may be fishing for tunas associated with dolphins. The system would identify the data from certain trips as unusual, indicating that the vessel may have made sets on dolphins.

A preliminary analysis of data for vessels of IATTC size class 4 and 5 (well volume 213-319 and 320-425 m^3, respectively, termed "small" vessels) for the 1995-2003 period was performed to determine whether any of these vessels, which are not covered by the AIDCP, might have been fishing on yellowfin tuna associated with dolphins.

The procedure described is statistical, and would thus inevitably not only miss detecting some vessels that made sets on dolphins, but also suggest that some vessels made sets on dolphins when they did not. The risks of the two possibilities are related: reducing the chance of mis-identifying "innocent" vessels will reduce the chance of detecting ones that did set on dolphins. With the data set currently available it is not possible to estimate those risks, and accordingly a first step would be to initiate sampling of unloadings of all small vessels and, after six months of data have been collected, re-examine the technique using the more complete data set. The additional costs of monitoring unloadings of small vessels in 2005 were estimated to be US$60,000-$70,000 (36th Meeting of the IRP, June 2004, Document IRP-36-12).

This preliminary analysis was conducted in two steps. First, computer algorithms developed using information on the location and catch composition of the sets were used to screen the data for unusual sets. Second, the vessels with the largest proportion of anomalous sets were further investigated in terms of the type of gear onboard and size composition of the yellowfin catch. Although results of these analyses suggest that some of these vessels may have made sets on tunas associated with dolphins, a rigorous test of this with existing data may not be feasible, because the data were not collected with this question in mind.

To initially screen the data, two algorithms were developed to predict purse-seine set type (dolphin *versus* non-dolphin) from information on species catch composition, location and local environment of the set. One algorithm was developed using data for class-6 vessels between 1995 and 2003 ("Algorithm 1"). The other algorithm was developed using data for class 4 and 5 vessels between 1959 and 1981 ("Algorithm 2"). (Too few dolphin sets were reported by class 4 and 5 vessels between 1995 and 2003 to build an algorithm using those data.) Although the structure of the algorithms was complex, the most important information for classifying sets as either dolphin or non-dolphin involved the species composition of the catch, the location of the set, the time of the set, the duration of the set and the sea surface temperature. The estimated misclassification rates (the percentage of sets of a given type for which the predicted set type did not match the reported set type) for these two algorithms were 2-4% for dolphin sets and 4-5% for non-dolphin sets. The true error rates, however, are unknown, because neither of the algorithms was built using data similar to those to which they would later be applied. The misclassification rate for Algorithm 1 may be misleading because it has not yet been determined whether differences in gear characteristics (*e.g.*, the depth of the purse-seine net) affect the species composition of the catch. Purse-seine nets of class-6 vessels tend to be deeper (and longer) than those of smaller vessels. In addition, class-6 vessels tend to fish in the coastal areas less frequently than smaller vessels. The misclassification rate for Algorithm 2 may be misleading because, in addition to possible gear differences, changes in dolphin behavior over the last 40 years, and changes in the behavior of fishermen in response to the dolphins, may have led to changes in the predominance of certain set types in coastal areas. For these reasons, these algorithms are viewed solely as data screening procedures.

The predicted set types from the two algorithms were used to identify "unusual" observations. An "unusual" observation was defined as a set reported as non-dolphin in the 1995-2003 logbook data but predicted to be dolphin. Results were summarized by computing the proportion of unusual observations by vessel. Of the 50 class 4 and 5 vessels considered in this analysis, 50% had no unusual observations based on the results of Algorithm 1, while 14% had no unusual observations based on the results of Algorithm 2. Without additional information, it is unclear which of these is more likely to be accurate. Based on previous experience with these techniques applied to other data, and in the absence of a means for assessing the true error of these algorithms, the results of the computer algorithms were treated conservatively, and only the eight vessels common to the upper 25% of the results of both algorithms were considered further. The remainder of the analysis focused on determining whether there was any additional information available to establish if in fact these vessels may have fished for tunas associated with dolphins.

Of the eight vessels considered, five are known to have carried two or more speedboats and have had a dolphin safety panel at some time in the past, suggesting that they had the capability of fishing for tunas associated with dolphins. Certain information on vessel characteristics is not updated routinely for all vessels; specifically, information pertaining to gear that might be used to fish for tunas associated with dolphins is currently only updated if there are significant changes to the vessel's fish-carrying capacity.

The length-frequency distribution of yellowfin caught in unassociated sets during the trips by these eight vessels (Figure 1) shows a range of sizes, including large fish (>90 cm). Large fish are, on average, often caught in greater proportions in sets associated with dolphins than in unassociated sets (Figure 2). However, in some regions, there is a lot of overlap between sizes of fish caught in dolphin and unassociated sets, making it difficult to determine the set type from a given distribution of lengths. When the aggregate of unassociated sets for these eight vessels is compared to unassociated sets of class-6 vessels in the same general region and range of years, the distributions of sizes appear to be similar (Figure 1). However, sampling coverage of these two data sets is not necessarily comparable on spatial and temporal scales consistent with yellowfin recruitment. Limiting the comparison to only a few years and smaller areas can yield apparently different results. For example, comparing unassociated sets of trips with unusual sets to unassociated sets of trips of the same vessels that were not identified by the algorithms, from the same few years and sampling areas, suggests that proportionally there are more large fish in the former than in the latter (Figure 3). In addition, comparing these same sets to unassociated sets of class-6 vessels in the same few years and sampling areas shows a similar result (Figure 3). It is difficult to determine whether this is an artifact of sampling variability due to the small sample sizes or a true difference. On small spatial and temporal scales, there can be considerable variability in the size of fish caught in a given set type, and it is not uncommon to find areas where unassociated sets yield large yellowfin tuna. Thus, proper analysis of the length frequency data must be done on a trip-by-trip basis. Such an analysis was attempted, but was found to be infeasible using the length data because nearby "control" trips were often not available (*e.g.*, "control" trips might be found in the same 5°-square area, but separated by many months or several years). This problem can be partially addressed by comparing the age distributions of fish rather than the length distributions. However, it is unclear whether this will be successful, because there may still be a shortage of "control" samples, a result of the fact that the length-frequency sampling program was not designed specifically to answer the question of whether class 4 and 5 vessels fish for tunas associated with dolphins.

CONCLUSION

The examination of data on species composition of catches, location of sets, and environmental variables, together with the size composition of yellowfin in catches, provides a promising means of discriminating between vessels that set on schools of tuna associated with dolphins and those that do not. There are limited data available for class 4 and 5 vessels to refine the technique. If the Parties wish to pursue this avenue, it is recommended that a trial that would include sampling of all unloadings of small vessels and further development of the technique be carried out.

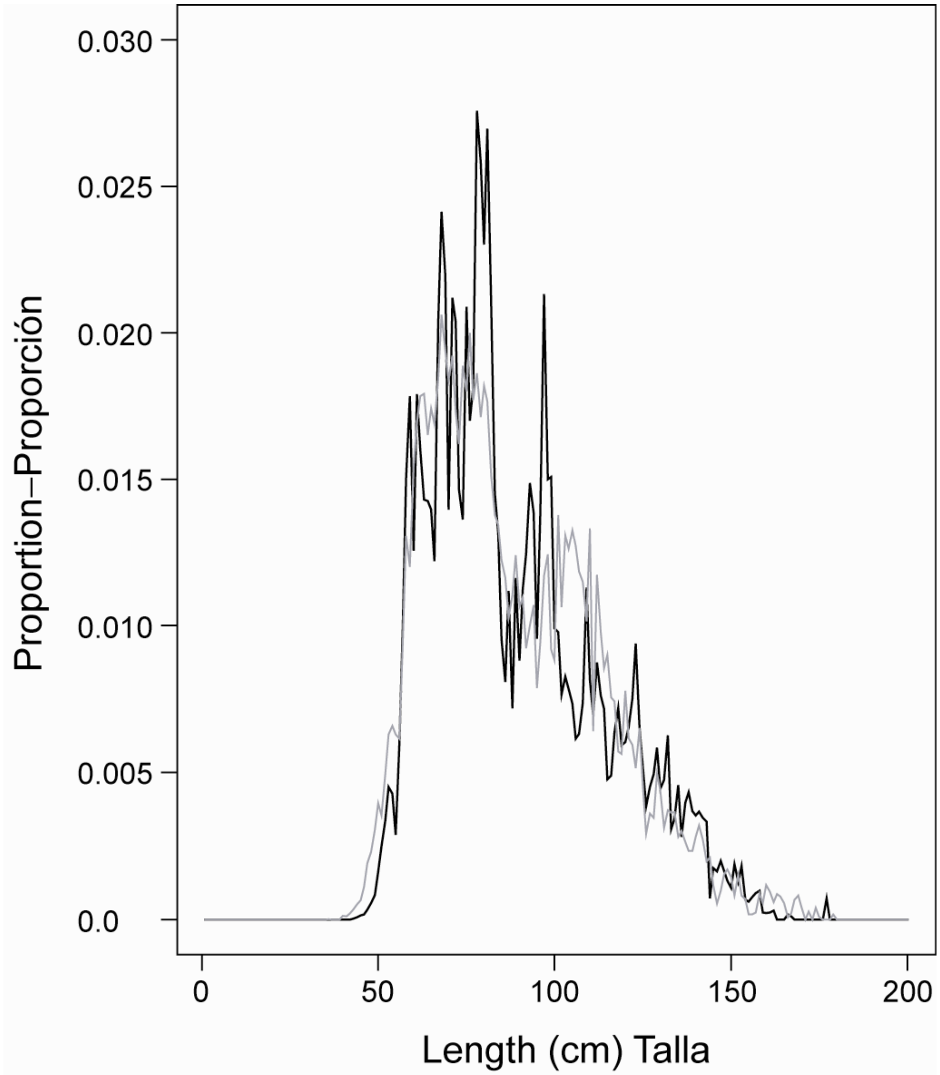

Figure 1. Proportional size distributions of yellowfin tuna caught in unassociated sets of trips by class 4 and 5 vessels containing unusual sets (black line) and in unassociated sets by size class 6 vessels (gray line), 1995-2003 combined.

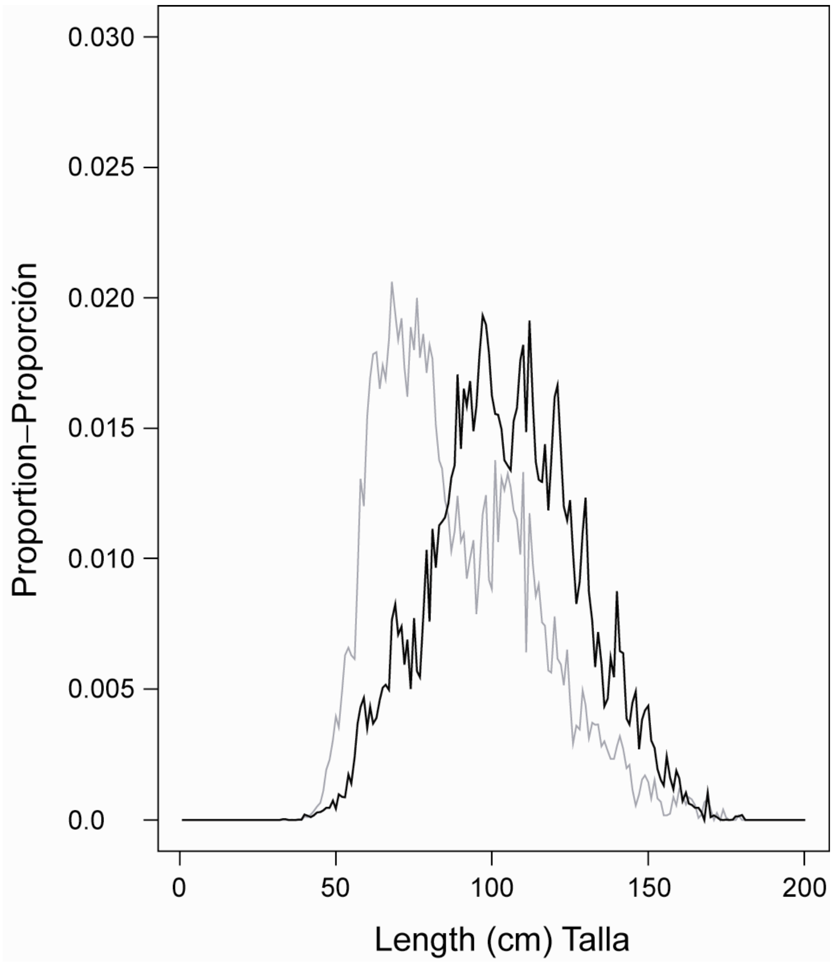

Figure 2. Proportional size distributions of yellowfin tuna from trips by class 6 vessels for unassociated sets (gray line) and dolphin sets (black line), 1995-2003 combined. Data are from the same aggregate of sampling areas as those in Figure 1.

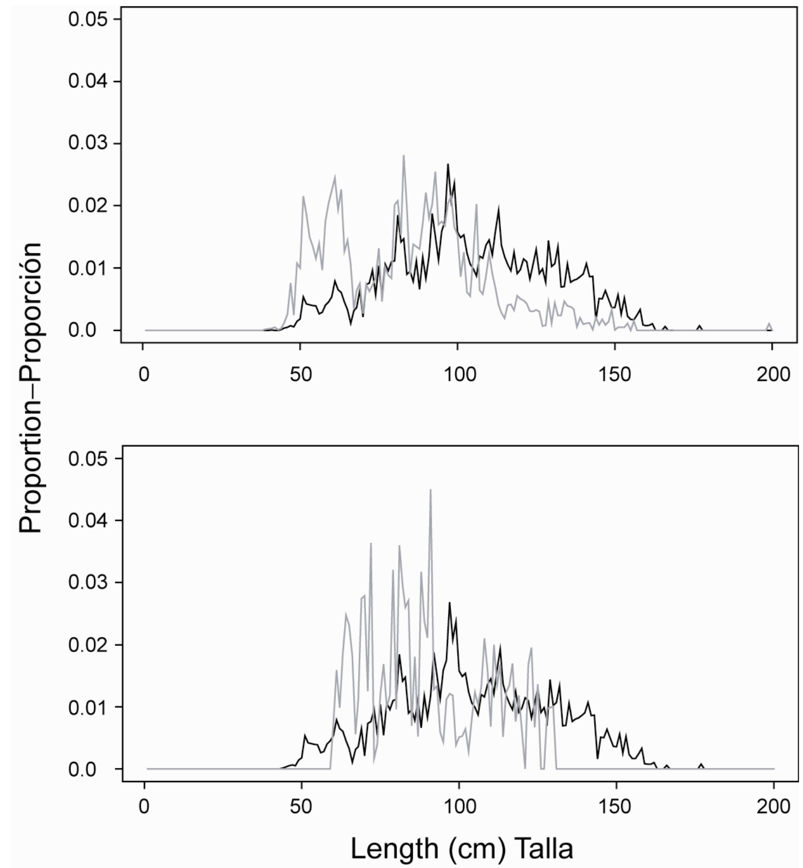

Figure 3. Top panel: proportional size distributions of yellowfin tuna from unassociated sets of trips by class 4 and 5 vessels containing unusual sets, for a subset of the areas and years shown in Figure 1 (black line), and from unassociated sets of trips of the same vessels *not* containing unusual sets, in the same areas and years (gray line). Bottom panel: proportional size distributions of yellowfin tuna from unassociated sets of trips by class 4 and 5 vessels containing unusual sets, for a subset of the areas and years shown in Figure 1 (black line), and for unassociated sets by class 6 vessels in the same areas and years (gray line).