

Assessing the misidentification rate for bigeye and yellowfin juveniles in brine sampled at Port Victoria (Indian Ocean): consequences for the species composition estimates of landings

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Abstract

It is widely accepted that the identification of small to medium sizes of frozen bigeye (*Thunnus obesus*, BET) and yellowfin (*Thunnus albacares*, YFT) tunas is an especially difficult task, mainly at fork lengths (FL) under 50 cm. This is due to the fin damage, discoloration, skin abrasion and distortion of crushing during the storage process. For this reason, certain level of misidentification would be expected. The main aim of the current study is to analyze the potential misidentification rates of small YFT and BET during purse seiners sampling at port, in Port Victoria (Seychelles). Our results suggest that Error observed for YFT was almost negligible. However, certain level of misidentification was observed in the case of BET, with about 5% error but with a high variability (from almost 0 to 16%). Unfortunately, the low number of BETs obtained in the sample taken at port (3 BET vs. 97 YFT), makes it difficult to draw conclusions. We believe that this type of exercise should be performed again up scaled, and with more means for which greater funding is required.

Introduction

It is generally acknowledged that species composition records in tropical tuna purse seiner's logbooks are frequently biased due to misidentification by the crew (Fonteneau, 1976). Consequently, routine processing corrections (based on a specific sampling design and multispecies size-frequency samples, collected at landings) were performed since 1980 for the purse seiner fleet (Pallarés and Hallier, 1997; Pianet et al., 2000). To achieve this goal, landings of tunas caught by the purse seine fleet in the Indian Ocean are sampled at port by local teams, following a scientific protocol coordinated between IRD (*Institut de Recherche pour le Développement*), IEO (*Instituto Español de Oceanografía*), and SFA (Seychelles Fishing Authority) for the adjustment of the nominal catches using the Tropical Tuna Treatment (T3) (for example Lechauve, 1999; Pallarés and Hallier, 1997; Pianet et al., 2000; Báez et al., 2018).

On the one hand, Herrera and Báez (2019) identified potential biases in catch composition estimates obtained from T3, which probably were originated as result of the use of outdated length-weight keys to estimate sampled weights, and from an inappropriate reliance on large spatio-temporal strata (Duparc et al. 2018 and Duparc et al. 2019). These issues suggest that improvements in T3 are needed to obtain more accurate estimates of species composition and size distributions for the European purse seine fleet catches. On the other hand, it is widely accepted that the identification of small to medium sizes of frozen bigeye (*Thunnus obesus*, BET) and yellowfin (*Thunnus albacares*, YFT) tunas is an especially difficult task at port, mainly at FL under 50 cm. This is due to the fin damage, discoloration, skin abrasion and distortion of crushing of the specimens during the storage process of the catch (for example Roul et al., 2016). For this reason, certain level of misidentification could be expected. Therefore, estimating the misidentification rate and detecting the hypothetical taxonomic biases is an important issue in species composition estimates.

The main goal of the current study is to assess the potential misidentification of small YFT and BET during sampling at port.

Material and Methods

The data collection was performed at Port Victoria (Seychelles) on 29th of August. One collaborating vessel provided us with the first one hundred YFT and BET specimens

with FL under 55 cm extracted from the same well. None of the members of the sampling team (neither checked, nor checkers) participated in the selection of fishes. Thereby, the selection was randomly done. Finally at the end of the identification process, we obtained 97 YFT individuals (47.2 cm FL in average, range 38-52 cm) and 3 BET individuals (47.67 cm FL, range 49-46) which were used during the exercise/test.

All fishes were tagged randomly next to the tail, using cable ties (Figure 1) threading a small plastic key chain. With a Magic (indelible) ball pen, each copy was tracked with a code of letters and numbers.

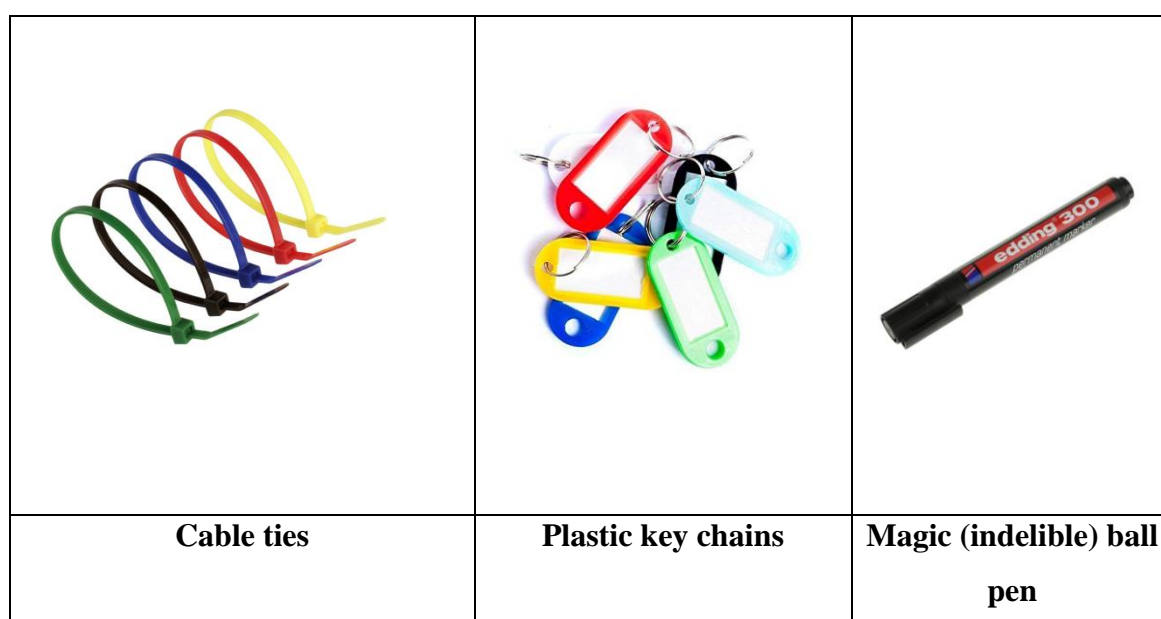


Figure 1. Different materials used to tag the tuna samples. Source: Wikicommons.

At port, each sampling team member was provided with three copies of the same form to match each identified specimen with the corresponding code. We performed three different identification rounds. For each round, the fishes were moved and mixed. Each sampler looked for every code in the form and ticked with an X if it was identified as a YFT or a BET. This way, we can estimate not only the biases in the misidentification error, but also the consistency in the response. Subsequently, in order to estimate the misidentification rate, we performed an identification of these specimens through biometric observations, and extracting their liver. Samplers were all trained persons considered as experts in order to avoid for misidentification due to a lack of experience.

Statistical analyses

We assessed the misidentification rate by species using a generalized linear mixed-effect model with misidentification as response variable (binomial variable coded zero for identification success of the species and one for identification error) and species as predictor. Sampler IDs and replicates (the 3 rounds), nested in sampler IDs, were the random effects to account for variability between samplers. 13 YFT were removed of the dataset because no data values.

Results

A total of eight samplers participated in the test: six local (Seychelles) samplers and two European coordinators, all with a long experience in sampling at port (see Annex).

Some fish, due to an oversight of the sampler, were not identified as BET, nor as YFT, during any of the rounds. The fishes that showed a gap in some of the rounds were removed from the analysis. Finally, there were 84 valid YFT and 3 valid BET individuals, per three rounds per 8 samplers. This involved 2016 responses for YFT and 72 responses for BET. Table 1 summarizes the match and mismatch observed, and the percentage of correct identification and misidentification.

Error rate estimated from the model were 0.045 [0.001; 0.160] and 0.0003 [0.0000; 0.0021] respectively for the BET and YFT (Figure 2). Half of the samplers perfectly identified all individuals whatever the species and only one sampler had a high error rate (number 2, Figure 3).

Table 1. Summary of the match and mismatch observed, and the percentage of correct identification and misidentification by species.

Species	Match	Mismatch	Total
BET	65 (90.3%)	7 (9.7%)	72
YFT	2014 (99.9%)	2 (0.1%)	2016
<i>Total</i>	<i>2079</i>	<i>9</i>	<i>2088</i>

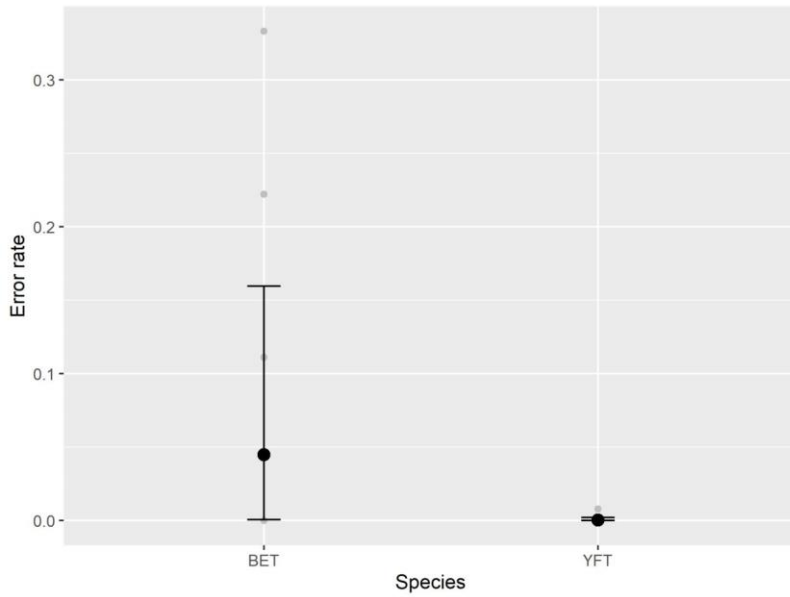


Figure 2: Mean and 95% CI of error rate of identification for Bigeye tuna (BET) and Yellofin (YFT) estimated from linear mixed effect model.

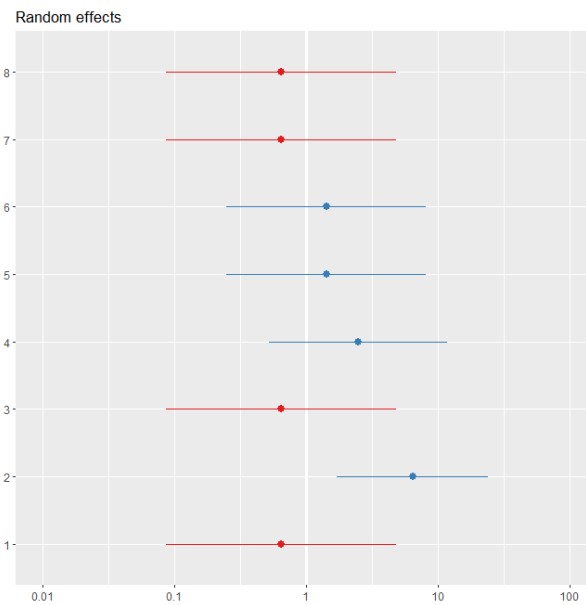


Figure 3: Forest plot of the random effect from linear mixed effect model. Number 1 to 8 are the sampler IDs.

Discussion

Error observed in the identification of YFT was almost negligible. However, certain level of misidentification was observed in the case of BET, with about 5% error on average but with a high variability (from almost 0 to 16%). This misidentification could

have consequences for the species composition estimates of landings. However, the low number of BETs obtained in the sample taken (3 BET vs. 97 YFT), makes it difficult to draw conclusions on the actual error rate of misidentification for the BET. Furthermore, in our study, the range of individual length was narrow and we could expect that the misidentification rate increases for the smaller bigeye tunas.

It is necessary to perform quality controls on sampling equipment to avoid misidentification. We believe that this type of exercise should be repeated on a larger scale, and with more logistics for which greater economic funding is necessary.

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Annex

Photographs taken during the exercise





