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Preliminary results of the development of identification guide for dressed billfish

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Introduction

Despite relatively low number of species among Indian Ocean representatives of the families Istiophoridae and Xiphiidae (5 species and 1 species respectively), known as billfish, their identification for a long time was (and actually still is) a problematic issue either for scientists, scientific observers and in higher scale to fishermen and fishing industry.

Taxonomic studies of Nakamura (Nakamura, 1983, 1985) resolved most of questions of correct identification of intact fish for scientists, while later guide of SPC (Chapman et al., 2006) and WCPFC (McAuliffe et al., 2007) transferred this knowledge to fishermen and general public. In the Indian Ocean perspective FAO guides (Nakamura, 1984, 1984a) and, in particular, recent work of IOTC (IOTC, 2012) were important steps for overall improvement of situation.

In the same time there is urgent need for correct identification of billfish, that were dressed onboard of fishing vessel and not identified to species level or when verification of initial identification is necessary. There are no dedicated guides for dressed billfish while guide developed for intact fish are not always useful when identification occurs at landing or during the fish processing.

Objective of this study is to develop field guide of identification for dressed billfish (sailfish, *Istiophorus platypterus*; marlins *Makaira indica*, *M. mazara*; and spearfish *Tetrapturus audax*[1], *T. angustirostris*) unloaded in the fishing ports of the Reunion Island. This guide aimed to help local fisheries sector (fishermen, processing factories) in identification of dressed billfish based on typical post pre-processing characteristics of every species during or after unloading from the fishing vessel.

It is recognised that recent advances in molecular analysis of billfish genetics allowed to develop extended revision of the billfish taxonomic status and hierarchy, in particular re-establishing of genus *Istiompax* and *Kajikia* (Collette et al., 2006). Earlier same approach lead to apparent synonymysation of Indo-Pacifica blue marlin *Makaira mazara* and Atlantic blue marlin *M. nigricans*, preserving the latter as a valid name (Buonaccorsi et al., 2001; Graves, McDowell, 2003). In spite of that advanced approach we are following to ‘conservative’

[1] It should be noted that common name for *Tetrapturus audax* both in English and French is striped marlin (marlin rayé). It is considered as marlin by fishermen and not like a spearfish.

taxonomy of billfish based on morphological and morphometric studies developed by Nakamura (1983).

Material and methods

There is two phases of the study:

- Pilot phase. An estimation of feasibility of billfish sampling during commercial vessel unloading in the fishing harbours of Reunion Island.
- Second phase. In case of feasibility of sampling during unloading – collection of morphometric and photographic data sufficient for the development of a guide of identification of dressed billfish.

A data collection sheet (Appendix I) and protocol were developed to collect data on: “Vessel name” and “Captain name”, “Date” and “Time” of unloading, billfish species “Common name” and “Latin name”, manner of fish dressing, “presence/absence of fins” and its damage level, “Colour of flesh”, “Morphometric measurements”, “Skin colour” and “Presence of colour pattern” (stripes/dots), “relative position of second dorsal and anal fins”. A manner of dressing was taken after Prager et al. (1995) studies, however expecting local/regional peculiarities in billfish processing, we developed sampling form that allows to draw and document an approach to dressing of every individual for a species identification purpose. It should be noted that principal billfish species targeted by the local fisheries based on Reunion Island: swordfish *Xiphias gladius* (SWO), was excluded from sampling protocol since its identification does not posed any problem either in intact or dressed state.

Data sampling during unloading should permit to collect both: data required for the development of identification guide as well as data on occurrence of various billfish species in the local catch:

- Number of billfish by species (besides swordfish) unloaded by every vessel sampled,
- Availability of fish for measurements/photographing,
- Manner of fish dressing,
- Image of every billfish (except SWO) unloaded (preferable suspended in the air), showing specific characteristics for identification.
- In case of fish availability: data and images for development of

identification guide

A sampling protocol used in this work is as follows:

1. Observation started with at the beginning of unloading and finish at the end of unloading;
2. All billfish (except SWO) was processed independently on species and general conditions;
3. The following information was recorded (please see also sampling form, Appendix I):
    a. Vessel and cruise information, including: vessel name, captain name, period of cruise, name of samplers, port of unloading and place of sampling: port or factory and name of factory (if applicable). Period of sampling and species unloaded and sampled should be noted. Please see form No CAP RUN BILL-DRESS-2013-01 Page 1.
    b. Date and time of sampling, species, manner of dressing (Prager et al., 1995), colour of meat, presence/absence of fins and their state, size (LJFL[2] and EFL are mandatory, if particular parts of fish are still present; on head absence PFL is used) and weight (if possible). Please see form No CAP RUN BILL-DRESS-2013-01 Page 1 (Appendix I).
    c. All measurements should be taken with a caliper with 1 cm precision.
    d. Digital photographs of whole fish and characteristic parts which could be used for identification should be taken in regular basis.
4. Requirement for digital photography:
    - Specific images of identification details should be taken during sampling:
        - Shape and rigidity of pectoral fins,
        - Height of the first dorsal fin and relative ratio of dorsal fin height/body depth,
        - Relative position of second dorsal fin and second anal fin,
        - Anus position,
        - A photograph of body cross-section showing flesh colour.

Order of observations: type of dressing, state of fins, photographing, measurements, meat colour (if possible).

[2] LJFL – lower jaw – fork length, EFL – Eye – fork length, PFL – pectoral fin – fork length (Appendix I).

Results and discussion

At this stage we have only preliminary results: 2 unloading were sampled, 4 billfish (besides swordfish): 2 blue marlins, *Makaira mazara* and 2 black marlins, *Makaira indica*.

In addition some observations and photo were developed during research cruise onboard F/V 'Manohal' in July 2013.

Offloading and cruise data

Fish dressing practice in Reunion Island is different from dressing practice described for US North Atlantic fisheries (Prager, 1995). All observed fish were headless while fin removal was non-uniform. Irrespectively of species, all observed fish lacking major fins: pectoral and caudal. One processor removed also anal fin, keeping firs dorsal fin in place. Another one kept anal fin but remove first dorsal fin in one of two fishes. In this context, it was not possible to use major fins as a principal identification feature. However second dorsal and second anal fins were usually intact; therefore their relative position could be then used to separate two species of *Makaira* genus (Fig. 1). Pelvic fins were resent also.

Skin colour patterns deteriorated highly after several days of fish storage in ice. There were no any obvious stripe or dot patterns. Colour of all fish (both species: black and blue marlin) was black on the nape and back, fading into silvery-grey on the sides and belly (the latter was partially white in some fish).

Body cross-section shape and number of lateral keels are principal identification factors to distinguish between Xiphiidae and Istiophoridae (Nakamura, 1983)(Fig. 2). We believe body cross-section could serve also as a secondary feature for istiophoirids segregation: in particular species of *Makaira* genus have much robust, less compressed, body than *Tetrapturus* and *Istiophorus*.

Anus position is important identification feature for Istiophorids (Nakamura, 1983; Arocha, Beerkircher, 2013). Relative position of anus to origin of the first anal fin and first anal fin length is widely used for identification of Atlantic species of *Tetrapturus* genera (Arocha, Beerkircher, 2013). Most of *Tetrapturus* species have anus positioned at a distance from anal fin base while Makaira and Istiophorus species have anus positioned closely to origin of the first anal fin (Fig. 2, 3). Since first anal fin often absent, length of first anal fin base can be used for

comparison with anus relative position for Indian Ocean dressed billfish. Our observation during fishing cruise suggested that anus position for *Tetrapturus audax* is also at the distance form anal fin in opposite to figure presented in Nakamura (1983) study (Fig. 2).

Based on these very preliminary observations we present here **draft** guide for dressed billfish identification. (Appendix II). We developed this guide presuming 'worst scenario' of fish dressing: absence of head, major fins (pectoral, first dorsal, anal, and caudal), with no visible species-specific skin colour pattern. A supplementary key for 'less than worst scenario' will probably also useful.

Further sampling is necessary to establish robust keys for identification of dressed billfish. Such works are planned for the last months of 2013 and in forthcoming 2014.

Figure 1. Relative positions of the second dorsal and second anal fins in blue marlin, *Makaira mazara* (left panel; photo: E.V. Romanov) and black marlin, *Makaira indica* (right panel; photo: L. Le Foulgoc).

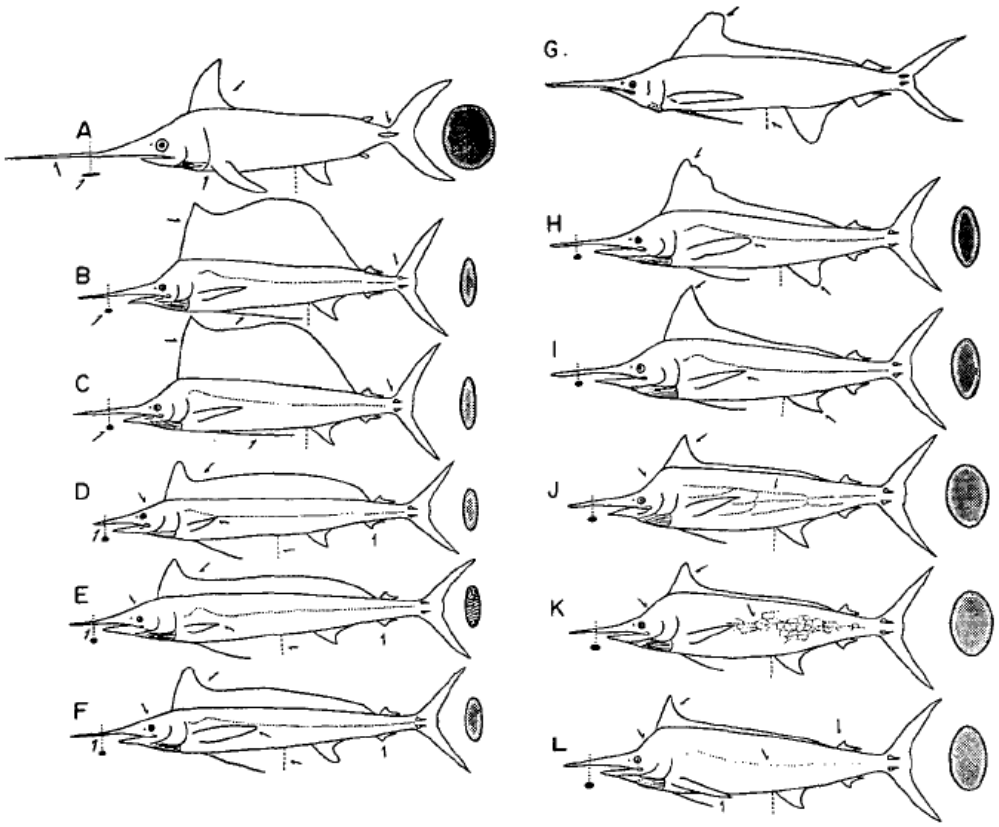

Figure 2. Schematic external appearance of billfishes presented by Nakamura (1983). Body cross-sectional views taken at the base of pectoral fin are shown at the right of each species. A: *Xiphias gladius*; B: *Istiophorus platypterus*; C: *Istiophorus albicans*; D: *Tetrapturus angustirostris*; E: *Tetrapturus belone*; F: *Tetrapturus pfluegeri*; G: *Tetrapturus georgei*; H: *Tetrapturus albidus*; I: *Tetrapturus audax*; .J: *Makaira mazara*; K: *Makaira nigricans*; L: *Makaira indica*.

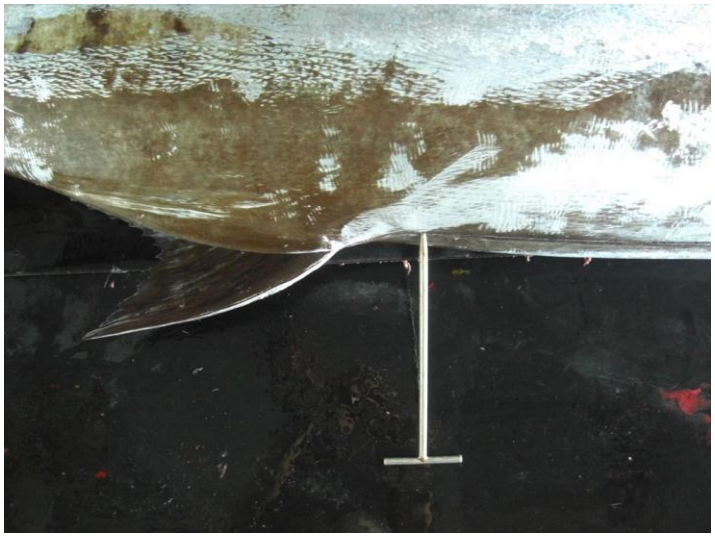

Figure 3. Anus position in blue marlin, *Makaira mazara* (Photo credits: E.V. Romanov).

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Appendix I

Sampling form for dressed billfish identification

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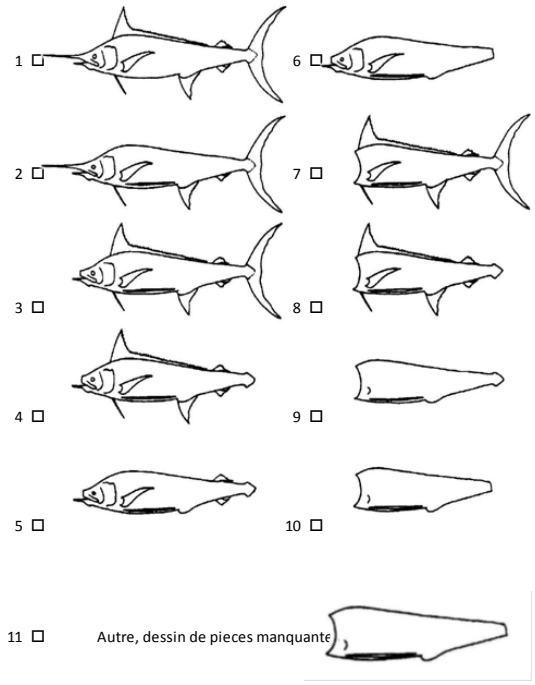
Nom du Bateau		Nom de patron	

N° Obs		N° filage	

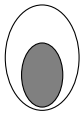
Date			Heure		Nom de sampler
jour	mois	année	HH	mm	Nom de sampler
					Nom de sampler

Espece	
Nom commun	Nom Latin

Mode de découpe, preciser position de anus



Couleur de chair	
Rouge	☐
Orange	☐
Rose	☐
Gris	☐
Blanc	☐
Brune	☐
	☐

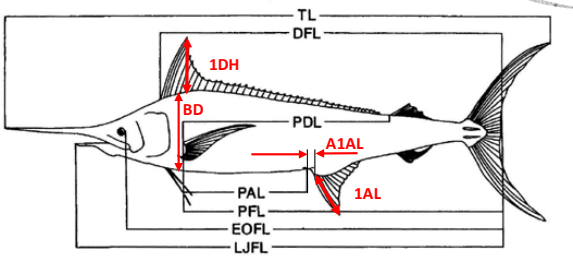


Etat des nagoires	Absente	Présente, forte endommagée	Présente et peu endommagée	Présente et intacte
Dorsale	☐	☐	☐	☐
Pectorale	☐	☐	☐	☐
Caudale	☐	☐	☐	☐
Caudale fourchette	☐	☐	☐	☐
2eme dorsale	☐	☐	☐	☐
Anale	☐	☐	☐	☐
2eme anale	☐	☐	☐	☐

Mensuration, cm
LJFL
EOFL
BD*
1 DH*
1 AL*
A1AL*
BW

* Mesurations obligatoires

Poids, kg	



Notes
Couleur de peau
Presence de raies
Position 2 dorsal - 2 anale

*Length codes, for selected measurements used for recording lengths of billfishes (Istiophoridae): TL, total length; DFL, Dorsal-fork length; PDL, Pectoral-second dorsal length; PAL, pectoral-anus length; PFL; pectoral-fork length; EOFL, eye orbit-fork length; UFL, lower jaw-fork length (Prager et al., 1995); BW, body width; **BD, body depth at pectoral origin; 1AL, length of the first anal fin (Nakamura 1983); 1DH, height of the first dorsal fin; A1AL, anus to first anal fin distance (this study)**. Measurements in **red** are obligatory for this study.

Appendix II

A **draft** identification key for dressed billfish

1 (2) Body cross-section round, no pelvic fins, one large median caudal keel on each side of caudal peduncle, skin scaleless (except individuals less than 90 cm LJFL), – ***Xiphias gladius***, swordfish;
2 (1) Body cross-section compressed laterally, pelvic fins present, two caudal keels on each side of caudal peduncle, body covered with small, elongate bony scales – often immerged in the skin, – 3;
3 (4) Distance between anus and first anal fin base is more than half (>50%) of anal fin base length – ***Tetrapturus*** (9) (*should be verified for Tetrapturus audax*);
4 (3) Distance between anus and first anal fin base is less than half (<50%) of anal fin base length – 5;
5 (6) Body slender, strongly laterally compressed, pelvic fins (if present) very long, almost reaching anal fin. If present, first dorsal fin is sail-like and high – ***Istiophorus platypterus***, sailfish;
6 (5) Body robust, slightly laterally compressed, pelvic fins (if present) short, well separate from origin of anal fin – ***Makaira*** (7);
7 (8) Second dorsal fin base slightly forward of second anal fin base – ***Makaira indica***, black marlin;
8 (7) Second dorsal fin base slightly backward of second anal fin base – ***Makaira mazara***, blue marlin;
9 (10) Body slender, strongly laterally compressed – ***Tetrapturus angustirostris***, shortbill spearfish;
10 (9) Body robust, moderately laterally compressed – ***Tetrapturus audax***, striped marlin.