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Do common thresher sharks *Alopias vulpinus* occur in the tropical Indian Ocean?

by

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ABSTRACT

Presence of common thresher shark *Alopias vulpinus* in the tropical Indian Ocean is questioned referring to absence of validated recent occurrences and doubtful observations in the past. Collection of georeferenced morphological data with simultaneous photo documentation and genetic sampling is suggested as a solution to resolve uncertainties in Alopiid species distribution, occurrence and abundance.

Introduction

Family Alopiidae consists of three valid species (Compagno, 2001): common thresher shark (*Alopias vulpinus*), pelagic thresher shark (*A. pelagicus*), and bigeye thresher shark (*A. superciliosus*). Although study of Eitner (1995) suggested potential existence of unrecognized cryptic species this finding is not currently recognised (Eschmeyer, 2015).

It is widely recognised that common thresher shark *Alopias vulpinus* (Bonnaterre, 1788) is a circumglobal species distributed throughout tropical and temperate waters of all oceans (Compagno, 1984a, 2001, Last, Stevens, 2009). Most of regional checklists and identification guides (Compagno, 1984b; Adam et al., 1998; Winterbottom, Anderson, 1997, Letourneur et al., 2004, Jabado, Ebert, 2015) indicates occurrence of common thresher shark in the Indian Ocean region, in particular equatorial and northern Indian Ocean.

However most reports of *A vulpinus* from tropical Indian Ocean are rather rely on sources from the outdated literature than on documented observations or collected specimens. Old references that demonstrated presence of particular shark species in the tropical Indian Ocean are usually corresponds to period when nomenclature of certain taxa and identifications keys were poorly developed, presenting therefore biased information.

Many historical paradigms on species occurrence and distribution area are currently undertaking major revisions. For example erroneous records of great white shark *Carcharodon carcharias* in the northern Indian Ocean was recently disproved (Cliff et al., 2000; Moore et al., 2007). Apparently time is due to revise old stereotype on common thresher shark biology and distribution and to develop a new one that corresponds to real natural history of this species.

Challenge/Diagnosis

Author of this note have more than 30 years long personal filed experience in the Indian Ocean (in particular with longline fishing operations). Personally participating in cruises that covered Indian Ocean area from Kenya to Sri-Lanka and from Socotra to Reunion Island and Madagascar, I never encountered any single individual of *Alopias vulpinus* while admitting responsibility for several erroneous identifications in early years.

Recent field observations developed by shark taxonomists documented absence of this species in major areas of the Indian Ocean:

- No common threshed shark was listed in recent faunal studies around Arabian Peninsula while other thresher sharks were recorded (Henderson et al., 2007).
- Observation on the landing site in Indonesia reported hundreds of *A. pelagicus* and dozens of *A. superciliosus* between 2001 and 2006 but not a single record of *A. vulpinus* (White, 2007).

Recently published data on presence of this species in the Indian Ocean regions appeared to be doubtful:

- Recent guide on Arabian Seas sharks (Jabado, Ebert, 2015) listed *A. vulpinus* without personal encounter of any single individual of this species from the region (Jabado, 2015, pers. comm.).
- Similarly, checklist of fishes of the Chagos Archipelago (Winterbottom, Anderson. 1997) cited presence of *Alopias vulpinus* from past papers.
- Rezzolla et al. (2014) reported presence of *A. vulpinus* in the Red Sae but images shown in the paper (and once sent privately to the author) shows similarity with *A. pelagicus* (not *A. vulpinus*); image quality makes correct identification impossible. This fact of potential misidentification was acknowledged by the authors (Storai, 2014 pers. comm).
- Romanov et al. (2010) based on historical records mentioned *A. vulpinus* presence in the catches of research longline surveys; however those identifications were made with guides/keys developed in 1960-1970s.
- Paper of Huang, Liu (2010) consists numerous misidentifications both for elasmobranch and teleost species including reporting of pure Atlantic species in the Indian Ocean.
- Manojkumar et al. (2006), Joshi et al., (2008) described significant *A. vulpinus* fisheries off Indian coast but their paper does not contain any proofs of species identification.

GBIF and OBIS data focused on museum records (consulted in 2011 before entering species identification noise from IRD ECOSCOPE and YugNIRO databases) demonstrate strong fidelity of Indian Ocean records to sub-tropical and temperate costs of South Africa and Australia (Fig. 1).

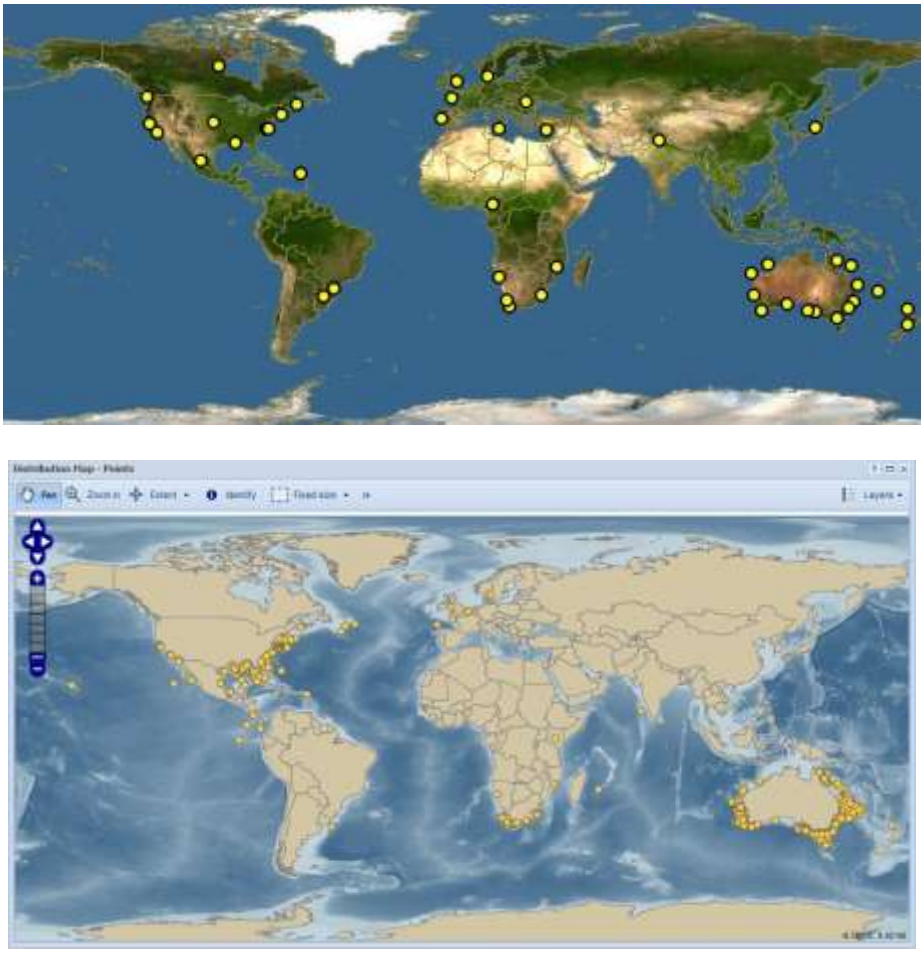

Fig. 1. Occurrences of *Alopias vulpinus* from Discover Life [1] http://www.discoverlife.org (upper panel) and OBIS http://www.iobis.org (lower panel) information systems taken on 23.09.2011. Note, tendency to temperate and subtropical distribution.

Conclusion: no any study exists that may validate presence of common thresher shark in the equatorial and northern tropical Indian Ocean.

[1] Data source is global Biodiversity Information Facility GBIF (http://www.gbif.org)

State-of-art technology: genetics

Apparently genetic studies might shed a light on this puzzle (Holmes et al., 2009, Spaet et al., 2013). Indeed, recent genetic study (Trejo, 2005) indicates presence of *Alopias vulpinus* in the Indian Ocean off South African shores. No samples were taken in the equatorial Indian Ocean in Trejo (2005) study.

In order to obtain more details on current knowledge on genetic structure of the common thresher shark population I have consulted The Barcode of Life Data Systems: a WWW resource designed to support the generation and application of DNA barcode data (BOLD, 2015). I've downloaded all available public records for *Alopias* species (180 genetic sequences in total) representing all 3 valid species, including Indian Ocean and neighboring areas records: 25 records from India, 7 records from Indonesia, 3 records from Australia and 2 records from South Africa. Cytochrome Oxidase sequences downloaded from BOLD were treated and analyzed using MEGA 7.0 Software (Tamura et al., 2015).

Genetics validated my concerns on inability of regional scientist to produce correct morphological identification. It is appeared that all (7) tropical Indian Ocean genetic records of *A. vulpinus* stored in the BOLD system are originated from India, most of them (4) are erroneous and corresponds to bigeye thresher *A. supercilious* and another three are dubious. Other genetic sequences of Alopiid sharks originated from India are also dubius (Appendix I).

Origin of errors: identification is trivial but not simple

Early years until early 1980s

Period of major Indian Ocean fisheries discoveries (starting from ~1950 until 1980) was characterised by poor knowledge of elasmobranch fauna and by lack of complete and accessible (and also affordable) identification guides and checklist. Most widespread guide used during this epoch was Smith's Sea Fishes: a regional guide initially published in 1949 (revised in 1953, and 1965), widely distributed and considered as authoritative guide and check list for whole western Indian Ocean. Alopiidae family page even inside most recent for that period book edition: Smith (1965) consists of a single species listed: *Alopias vulpinus*.

Similarly another regional guide widely used “The fishes of Seychelles” by Smith and Smith (1963) has no information on other threshers, in particular on pelagic thresher, most often confused with common thresher. Using such guides any scientist has no chance to identify other species; origin of misidentification is understandable. Several other guides developed in 1970 while mentioned all *Alopias* species contains poorly developed keys and were poorly illustrated (e.g. Pinchuik, 1972) that contributed to continues misidentifications. That resulted in further apparent errors, e.g. Gubanov (1976, 1978).

Compagno epoch (1980s-2000s)

Works of Compagno (1984a, b, 2001) widely distributed as FAO guides make a breakthrough in elasmobranch identification. Still showing presence of common thresher shark in the tropical Indian Ocean (based on precedent papers) he produces clear and simple identification keys together with correct and detailed illustrations. That makes identification of thresher shark relatively simple for any person intended to spent few time and effort identifying sharks.

Present time

Unfortunately recent guides still contributing to continues misidentification. Ranging from papers that properly illustrated but simply repeating wrong paradigm (Jabado, Ebert, 2015) without personal encounter and/or analysis of any single individual of *A. vulpinus* from the region (Jabado, 2015, pers. comm.) to wrong illustrations and identification keys (Pepperell, 2010). The latter book, brilliantly written and well illustrated, consists a very serious errors in the chapter on thresher sharks (Fig. 2):

- There are only two pictures of thresher sharks in the book (while there are three species in the nature).
- **Both** images DO NOT CORRESPOND to any thresher shark species!!! Pictures have mixed features of all three species. It is impossible to identify species correctly with these pictures.
- But pictures are beautiful! It will be easy memorised by the readers and will be certainly used in the future during sport fishing or field work!
- Furthermore, underwater photograph of the pelagic thresher illustrated this book is marked as photograph of common thresher!!!

- For book directed to general public all these errors will have long-term consequences and will contribute to further misidentifications: illustrations of species and species descriptions are wrong!!!

Diagnosis and perspectives

All three valid species posses specific field marks making precise identification just a matter of knowledge and diligence. Since early 1980-s distinctive features of thresher sharks well described in the many identification keys (Compagno, 1984, Compagno, 2001) apparently makes correct identification of thresher sharks a routine issue.

However personal experience showed that many scientists working in the field with various backgrounds (from first coming students or poorly trained fisheries observers to experienced observers and scientist) often not ready for correct identification of thresher sharks.

1. First and most common reason: **ignorance**. They just don't know about existence of third species: pelagic thresher. Common thresher and bigeye thresher are usually considered as two extant species. Therefore any thresher that is not a bigeye thresher falling into common thresher by default.
2. Misunderstanding of keys. Most common issue is incorrect interpretation of the colouration and the shape of pectoral fins. Silver colour of pelagic thresher body above pectoral fins is confused with white patches above pectoral fins, characteristic of common thresher. Rounded pectoral fin tips of pelagic thresher are confused with relatively pointed pectoral fins of common thresher.
3. Tail as derivant in identification precision. Long tail is apparently most characteristic feature of thresher shark commonly attracted principal attention of fishermen and observers so they loosing focus on other marks that are important for correct identification.

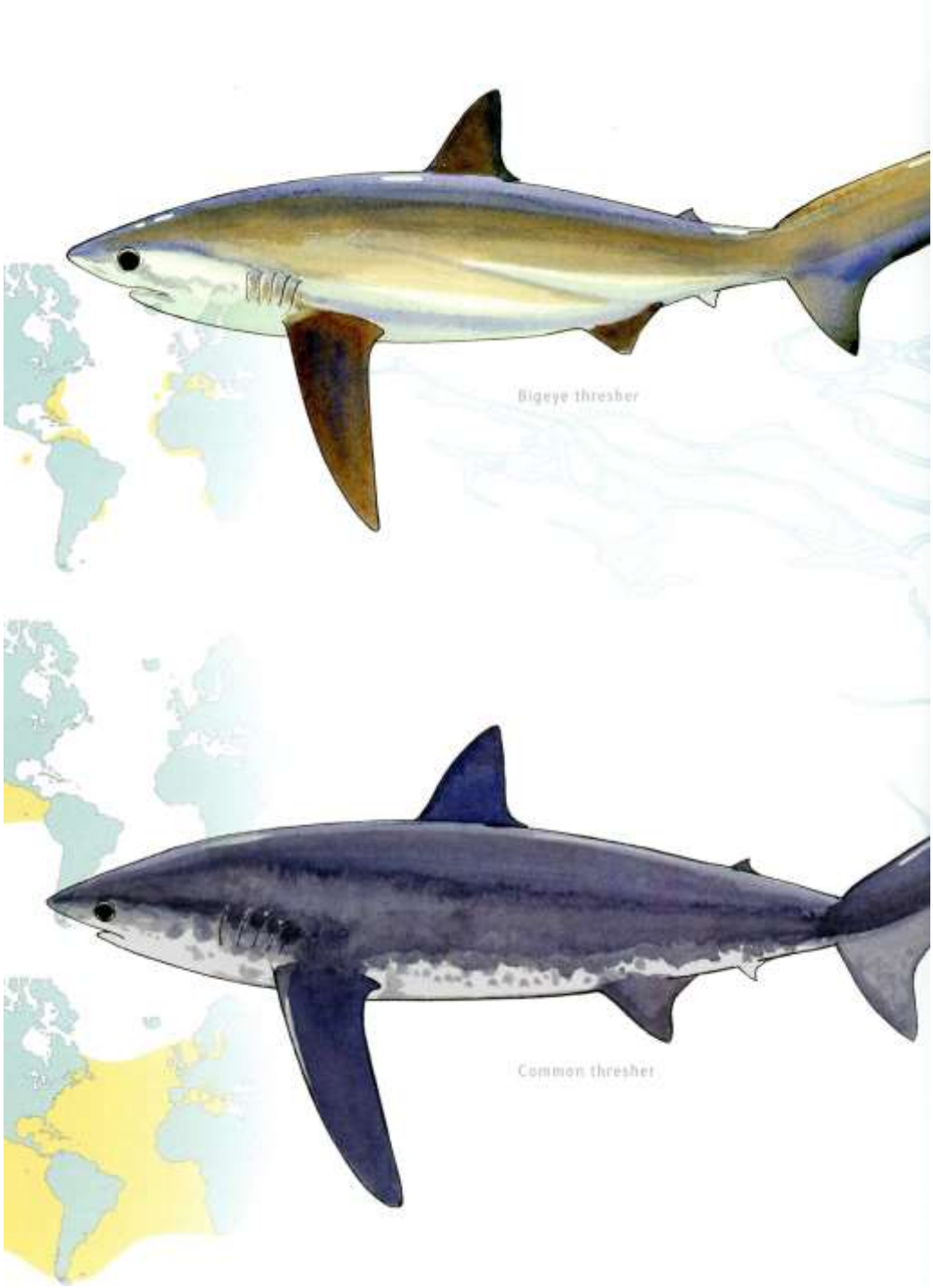

Fig. 2. Thresher shark page from Pepperell (2010). Please not the upper image of ‘bigeye thresher’ lacking characteristic groves on the upper side of head, relatively small eyes instead of big ones and pectoral fin shape that corres[ponds to common thresher. Similarly lower image of ‘common thresher’ that demonstrate long rounded pectoral fins and absence of white patches above it that corresponds to pelagic thresher while lower lateral and pectoral colorations similar to common thresher.

A potential way out from current situation is apparently a specific research program of IOTC (within Indian Ocean Shark Year Program (ShYP)) focused on thresher shark that includes: **Morphological identification, Photo validation, Barcoding.** Simultaneous collection of georeferenced biological, photo and genetic information may help resolve the puzzle and also will help to improve genetic data pool currently available for thresher sharks. Since BOLD genetic database are polluted with incorrectly identified individuals, an efforts to correct morphological identification are important.

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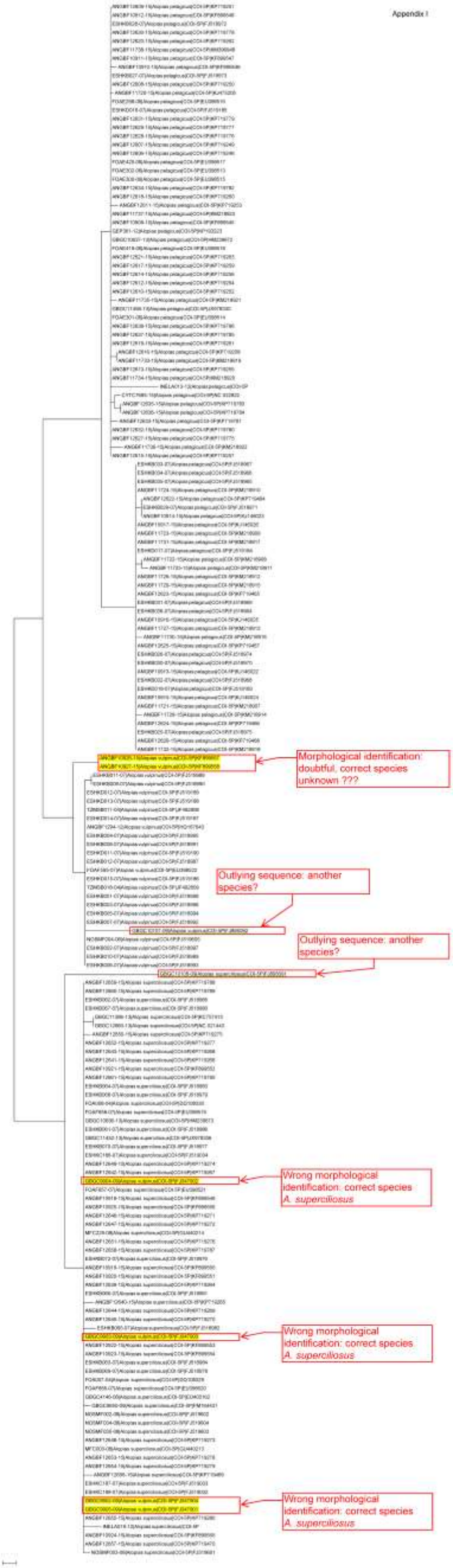

Phylogeny reconstruction tree (PRT) of COI sequences. PRT analysis, carried out in MEGA7 using Maximum likelihood method and Jones-Taylor-Thorbnton model all thresher shark COI barcode sequences available as public domain in BOLD.

Thresher sharks

Alopias pelagicus
Pelagic thresher

Alopias superciliosus
Bigeye thresher

Alopias vulpinus
Common thresher

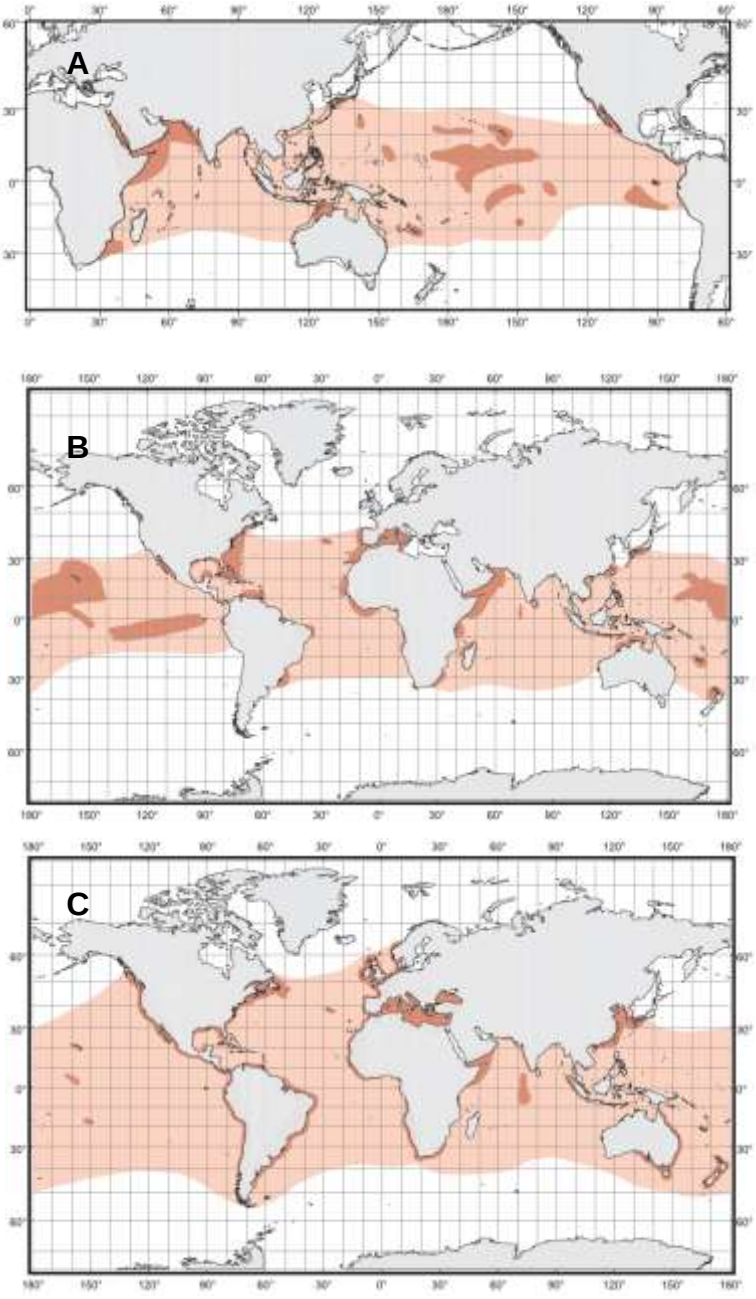

Fig. 3. Distribution area of thresher sharks. **A.** Pelagic thresher, **B.** Bigeye thresher, and **C.** Common thresher (Compagno, 2001)1

WANTED !!!

Call for georeferenced photos

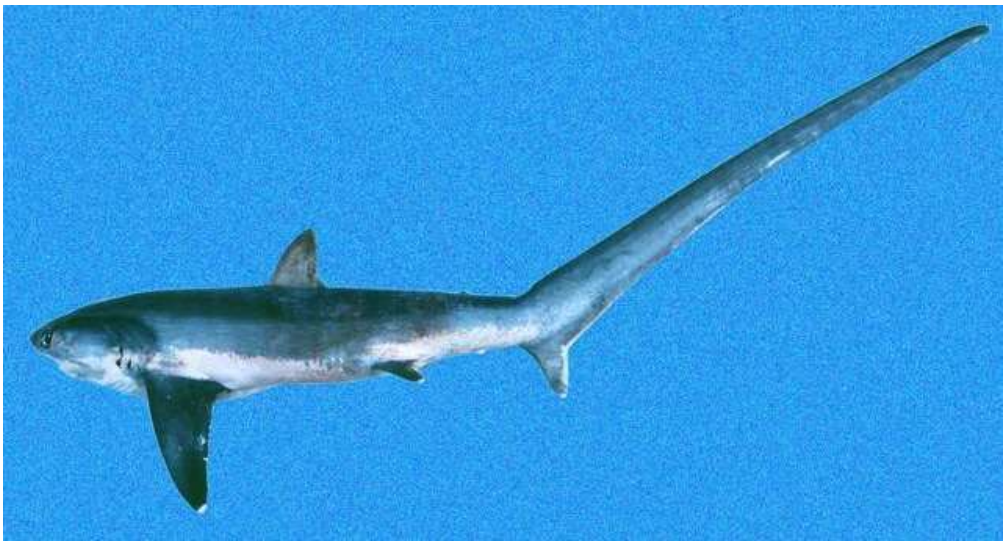

Photo source: http://www.discoverlife.org Photographer: CSIRO (G. Johnson)

Common thresher shark from tropical Indian Ocean

Scientific name: *Alopias vulpinus* (code FAO – **ALV**)

This is a largest thresher shark > 600 cm of total length (size at birth TL 114-160 cm). Pectoral fins are pointed and often white-tipped. White-tipped anal fins. Clear white (not silver or bluish) colour on the sides above pectoral fins. Relatively small eyes. It is considered to be a common species in the tropical Indian Ocean. However verified records are rare, mostly from temperate zone.

If you caught or see common thresher, please take a photo and write down **vessel name/site name**, **fishing date** and **fishing position (lat and long)**.

Contact me by e-mail providing contact address for eventual feedback.

Evgeny Romanov (prosper.arda@orange.fr)	**CAP RUN – HYDRÔ REUNION** **97420 Le Port (La Réunion)** **Tel : 02.62.96.45.06 / 02.62.55.15.22**

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