LONGFIN MAKO *ISURUS PAUCUS*: THE FORGOTTEN COUSIN

Jim R. Ellis[1], Stuart Reeves[1] and Sophy R. McCully Phillips[1]

SUMMARY

Longfin mako Isurus paucus *is a pelagic shark that is found circumglobally in tropical and subtropical waters, and interacts with pelagic longline fisheries. It is encountered rarely in most areas, although it appears to be more frequent around Cuba - from where the species was described originally. Longfin mako is a data-limited species, though suspected declines have resulted in the IUCN considering this species to be Endangered. Available biological data are collated, and initial analyses of ICCAT Task 1 catch data presented. Despite the apparent rarity of longfin mako, mean annual reported catches have increased from 11.7 $t.y^{-1}$ (1990–1999) to 44.1 $t.y^{-1}$ (2000–2009) and 134.9 $t.y^{-1}$ (2010–2019). The potential reasons for this marked increase in reported catches are discussed.*

RÉSUMÉ

*La petite taupe (*Isurus paucus*) est un requin pélagique que l'on trouve dans les eaux tropicales et subtropicales et qui interagit avec les pêcheries pélagiques palangrières. Il est rarement rencontré dans la plupart des régions, bien qu'il semble être plus fréquent autour de Cuba - d'où l'espèce a été décrite à l'origine. La petite taupe est une espèce pour laquelle les données sont limitées, bien que les baisses suspectées aient conduit l'UICN à considérer cette espèce comme étant en danger. Les données biologiques disponibles sont rassemblées et les premières analyses des données de capture de la tâche 1 de l'ICCAT sont présentées. Malgré la rareté apparente de la petite taupe, les captures annuelles moyennes déclarées ont augmenté de 11,7 t.a-1 (1990-1999) à 44,1 t.a-1 (2000-2009) et 134,9 t.a-1 (2010-2019). Les raisons potentielles de cette augmentation marquée des captures déclarées sont discutées.*

RESUMEN

El marrajo carite (Isurus paucus*) es un tiburón pelágico que se encuentra en todo el mundo en aguas tropicales y subtropicales, y que interactúa con las pesquerías de palangre pelágico. Se encuentra en pocas ocasiones en la mayoría de las zonas, aunque parece ser más frecuente en los alrededores de Cuba, donde la especie fue descrita originalmente. El marrajo carite es una especie con datos limitados, aunque las sospechas de disminución han hecho que la UICN considere que esta especie está en peligro. Se cotejan los datos biológicos disponibles y se presentan los primeros análisis de los datos de capturas de la Tarea 1 de ICCAT. A pesar de la aparente excepcionalidad del marrajo carite, la media de las capturas anuales declaradas ha aumentado pasando de 11,7 $t.y^{-1}$ (1990–1999) a 44,1 $t.y^{-1}$ (2000–2009) y 134,9 $t.y^{-1}$ (2010–2019). Se debaten las posibles razones de este notable aumento de las capturas declaradas.*

KEYWORDS

Catch statistics, fishery biology, life history, longfin mako, shark fisheries

[1] Centre for Environment, Fisheries and Aquaculture Science (CEFAS), Pakefield Road, Lowestoft, Suffolk, UK; Email: Jim.ellis@cefas.co.uk

1. Introduction

Mako sharks (genus *Isurus*) comprise two extant species, namely shortfin mako *Isurus oxyrinchus* Rafinesque, 1810 and longfin mako *Isurus paucus* Guitart, 1966. There have been numerous studies relating to shortfin mako (e.g., Stevens 2008), which is the more abundant of the two at a global scale, whilst longfin mako is regarded as being the rarer of the two species and information far more limited.

The distinction of longfin mako from shortfin mako (see **Table 1**) was described independently by both Guitart Manday (1966), based on specimens from Cuba, and by Garrick (1967), based on specimens from the Pacific Ocean. Garrick (1967) named the species *Isurus alatus*, although he acknowledged in his final manuscript that this would be a junior synonym, given that the Guitart Manday's (1966) description of *I. paucus* was published the preceding year and took precedence.

Given the apparent rarity of *I. paucus*, there are limited published biological data (e.g., White 2007, Ruiz-Abierno *et al.* 2021b) and much of the published scientific literature has focused on describing observations of occurrence. These observations have confirmed the presence of longfin mako from Florida (Dodrill and Gilmore 1979), Gulf of Mexico (Killam and Parsons 1986), Colombia (Gamez-Barrera *et al*. 2012) and Mexico (Wakida-Kusunoki and Anda-Fuente 2012) in FAO Area 31, California (FAO Area 77; Ebert 2001), Chile (FAO Area 87; Bustamante *et al*. 2009), Indonesia (White 2007) and eastern Australia (14–32°S, FAO Areas 71–81; Stevens and Scott 1975), the North Atlantic, including Iberian waters, off north-west Africa and around the Azores (FAO Areas 27 and 34; Moreno and Morón 1992, Queiroz *et al.* 2008, Mucientes 2013) and Algeria (FAO area 37; Hemida and Capapé 2008).

Overall, longfin mako has a circumglobal distribution in tropical and subtropical waters of the Atlantic, Pacific and Indian Oceans, and individuals may also range into the western parts of the Mediterranean Sea. Whilst Compagno (1984) initially listed longfin mako as occurring in FAO Fishing Areas 21, 31, 34, 51, 57 (?), 71 and 77, subsequent information (see above) would indicate that it occurs in FAO Fishing Areas 21, 27, 31, 34, 37 (west), 41, 47, 51, 57, 61, 71, 77, 81, 87 (Compagno 2001).

Within the North Atlantic fishing grounds west of the Azores, Mucientes *et al.* (2013), using logbook data for the years 1997–2012, reported that the ratio between longfin mako and shortfin mako was 1 : 364. Moreno and Morón (1992) previously reported information relating to the species composition of mako sharks from Spanish longline fisheries operating in the North-east Atlantic, examining 45 679 shortfin mako and 51 longfin mako; a ratio of approximately 1 : 896.

Whilst Moreno and Morón (1992) reported longfin mako from fishing grounds ranging from the Straits of Gibraltar southwards to Liberia, they also encountered mako sharks from around the Azores that they considered to be a variant of shortfin mako, the vernacular name being 'marrajo criollo'. This form, which they also referred to as *Isurus* sp., appeared to be endemic to the Azores and, whilst the darker ventral colouration was suggestive of longfin mako, the dentition was indicative of shortfin mako. Moreno and Morón (1992) also noted that "*Captures of 'marrajo criollo' have decreased slightly, especially within the last few years, and the presence of this species in fish markets is now quite rare, suggesting that the population may have been depleted by fishing*".

Despite the apparent rarity of longfin mako in most areas, it may be more frequent in some specific areas, such as around Cuba. In this area, Guitart Manday (1975) noted that longfin mako were caught primarily in April-May and August-November, though this species "*never accounted for more than 7% of the Cuban shark fishery landings*" (Dodrill and Gilmore 1983; see **Table 2**). Aguilar *et al.* (2014) subsequently reported that longfin mako was captured in sport fisheries, for which a sex ratio (females : males) of 2.3 : 1 was observed. More recently, Ruiz-Abierno *et al.* (2021a) reported on the commercial longline fishery from Cojímar (north-west Cuba), noting that longfin mako accounted for 20% of the elasmobranchs caught over the period 2011–2019. Longfin mako (n = 163) were nearly always caught in night-set longlines (99.4% of records, with the remainder from day-set longlines), with more records in November to March, and fewer observations in May to August (Ruiz-Abierno *et al.* 2021a). Once again, females were found to predominate (female : male sex ratio = 1.6 : 1).

That more longfin mako were observed to be caught at night (Ruiz-Abierno *et al.*, 2021a) may be related to diel changes in their vertical movements. Hueter *et al.* (2017) presented the findings from the electronic tagging of two longfin mako, for which the mean depth was approximately 100 m during the night and just over 300 m during the day. The overall depth range observed was 0–1767 m (Hueter *et al.* 2017).

Catch and landings data for longfin mako have generally been quite limited, in part due to it being a small proportion of the commercial catch of pelagic longline fisheries, and also that the flesh is considered of lower quality (Ebert 2001, Camhi 2008). Dodrill and Gilmore (1979) also postulated that it may be a more solitary species, given its sporadic occurrence.

Whilst longfin mako has not been subject to a full stock assessment (given the limited data that are available, but also noting the lower commercial importance compared to shortfin mako), it was included in a Productivity-Susceptibility Analysis (PSA) of pelagic sharks in the Atlantic (Cortés *et al.* 2010). In the absence of species-specific data, the latter study assumed that longfin mako would have a similar productivity to shortfin mako (i.e., productivity = 0.018 y^{-1} (0.0.010–0.026 y^{-1})), although the susceptibility was estimated to be lower than for shortfin mako, and so it ranked as the fifth most vulnerable pelagic shark species (Cortés *et al.* 2010). In a similar study for the Indian Ocean, longfin mako ranked as the 7th most vulnerable pelagic shark (Murua *et al.*, 2018).

Whilst subject to limited study from most Regional Fisheries Management Organisations, when compared to shortfin mako and blue shark *Prionace glauca,* longfin mako has been of increasing interest in relation to conservation initiatives. In 2008, longfin mako was listed on Appendix II of the Convention on the Conservation of Migratory Species of Wild Animals (CMS), whilst the most recent IUCN assessment 'suspected' that longfin mako had "*undergone a population reduction of 50–79% globally over the last three generations (75 years)*", and it was listed as Endangered globally (Rigby *et al.* 2019). Given the limited data for longfin mako, in some areas it has been listed as Data Deficient, such as in European waters (Nieto *et al.*, 2015).

Given the much greater commercial importance of shortfin mako, there has been more emphasis on conducting stock assessments for shortfin mako by ICCAT, and other RFMOs addressing large pelagic fish. Similarly, most management actions relating to mako sharks by ICCAT have focused on shortfin mako, especially in terms of the North Atlantic stock. However, given the potential for data for the two species to be confounded, a synthesis of existing biological knowledge and data has been provided here.

2. Methods

A literature review was undertaken for *Isurus paucus* to collate relevant biological data, with ICCAT Task 1 catch data analysed to provide an indication of the reported catches of this species. Nominal landings data for longfin mako as reported to FAO were also downloaded (https://www.fao.org/fishery/statistics-query/en/capture/capture_quantity; accessed 10 March 2022), to examine consistency in reported landings.

3. Results and discussion

Available biological data are summarised in **Table 3**, with data on individual lengths and weights from published sources collated in **Table 4**. Whilst the latter data are extremely limited, these do provide an initial estimation of the length-weight relationship (**Figure 1**). Conversion factors for the various types of length measurement are limited, although Killam and Parsons (1986) gave an unpublished ratio between total length (L_T) and fork length (L_F), based on seven individuals, for which L_T / L_F was 1.152. Standard, or precaudal, length (as a percentage of L_T) has been reported as 79.4% (term pup; Gilmore, 1983); 77.9–79.9% L_T (five individuals of 123–215 cm L_T; Garrick, 1967) and increasing to 84.6–92.6% in individuals of 306 cm L_T (Gamez-Barrera *et al.*, 2012) and 327.8 cm L_T (Gilmore, 1983).

Given the widely perceived natural rarity of longfin mako, catch data have generally been quite low. However, initial examination of available Task 1 catch data (1990–2019; **Table 5** and **Table 6**) suggest an increase in reported catches over the last decade (**Figure 2** and **Figure 3**). Indeed, mean annual reported catches for the period 1990–1999 were 11.7 t.y^{-1}, with this increasing to an average of 44.1 t.y^{-1} (2000–2009) and then to 134.9 t.y^{-1} (2010–2019), when most were reported as landings. In the latter time period, the three nations reporting the greatest catches of longfin mako (including landings and dead discards) were Spain (62.3%), Namibia (19.4%) and USA (10.6%) (**Table 6**).

Despite the increased interest in the status of shortfin mako, and introduction of management measures for fisheries interacting with that species, including ICCAT Recommendation 2021-09, there has been limited management interest in relation to longfin mako, which is also considered to be a low productivity shark species. Hence, the recent increase in reported catches of longfin mako is noteworthy and potentially concerning for a species of this nature. Given that published studies describing the ratio of longfin mako to shortfin mako have ranged from 1 :

364 (Mucientes *et al.* 2013) to 1 : 896 (Moreno and Morón 1992) on important fishing grounds, the scale of current reported catches of longfin mako seem somewhat incompatible given the reported ratios of the two species and the current perception of the shortfin mako stock, unless there have been important changes in species composition, fishing practices or marketability of longfin mako.

Whilst the proportion of longfin mako in reported species-specific catches of 'mako sharks' has increased in the North Atlantic (**Table 7**), there has been no similar increase in the South Atlantic (although noting one outlying value in 2015 for BIL97). However, it is important to recognise that changes in relative proportions of reported catches are influenced by a range of factors, including temporal changes in fishing and discarding practices, species-level reporting, and any changes in management regulations. Whilst there was a notable increase in the proportion of longfin mako in catch data for BIL93, this is an area of known local abundance of longfin mako, and reported landings of shortfin mako had declined.

Increases in reported landings of any harvested species may reflect a number of factors, including changes in stock abundance, marketability or fishing patterns, whilst there is also the potential for misidentification between longfin mako and shortfin mako, as well as input errors (in terms of quantities) and species coding errors. Given the potential for input errors, any potential outlying values could usefully be investigated. For example, Namibia only reported catches of longfin mako in two years (230 t in 2015 and 31.8 in 2016; **Table 6**) and Liberia only reported catches in a single year (19 t in 2018), and such instances of sporadic reporting could usefully be investigated. Potential outliers were also present for other nations. For example, Portugal reported catches in a five-year window, during when reported catches of longfin mako were usually <3 $t.y^{-1}$ but >13 t in a single year (2012). Once again, this potential outlier could usefully be investigated.

Spain reported catches of longfin mako from 1997 onwards. Interestingly, catches were not reported each year, with no reported catches in 1999, 2005, 2006 or 2008. Mean annual catches over the period 1997–2011 (excluding years when no catch was reported) were 51.3 $t.y^{-1}$ (8.2–88.7 t), and so further investigation is required in order to determine whether the years with no reported catches relate to zero catches or missing data. Interestingly, there were reported catches of Lamnidae in 2008 in several of the billfish areas where there were no corresponding reported catches of longfin mako (**Table 8**).

Spanish catch data did not indicate longfin mako were taken in BIL95, and the annual percentage of longfin mako in reported catches was <5% in both BIL96 and BIL97. However, there were several instances where longfin mako accounted for >5% of reported mako catches in BIL94A, BIL94B and BIL94C, especially in recent years (**Table 8**). These areas include the fishing grounds close to the Azores, and so could possibly relate to the Azorean form of *Isurus* sp. described by Moreno and Morón (1992). Improved taxonomic consideration of this form is required, especially as this may be having an impact on the potential quality of fisheries data for both longfin and shortfin mako.

There were also some differences in reported landings/catch between those data collated by ICCAT and by FAO (**Table 9**). Indeed, only those data supplied by Trinidad and Tobago were consistent (other than the data reported to FAO were rounded to the nearest whole tonne). It should be noted that some of these apparent differences were due to different data types being reported, for example the USA reported estimates of dead discards for the years 2008–2019 to ICCAT, over which time there were no landings, as indicated in FAO's database of global capture production. Whilst Liberia reported 199 t of longfin mako in 2017 (FAO data), with no corresponding data to ICCAT, such an isolated high value might indicate a coding error. The high landings reported to ICCAT by Namibia were not observed in FAO data. Data for other nations generally differed to varying degrees.

Future work

Given the assumed low productivity of longfin mako, and that it is often regarded as a rare species, closer international collaboration in the collection of life-history data is required, including the collection of relevant data and biological material from dead bycatch sampled during observer programmes.

Furthermore, a more detailed appraisal of national catch data is required in order to provide a more robust time-series of 'catch'. Such work could usefully involve ICCAT Parties comparing national data with Task 1 catch data. Additional studies are also required to provide more accurate estimates in the spatial variation of the expected species composition of mako sharks (e.g. from observer data) that may help inform the interpretation of the reported catches. Such work would also inform any future assessments of longfin mako (including stock assessments, PSA and IUCN assessments) and, if some data have been confounded, help develop alternative catch scenarios for the related shortfin mako.

Acknowledgements

Many thanks to Enric Cortés (NOAA) for his comments on the paper.

References

Adams, D.H., Borucinska, J.D., Maillett, K., Whitburn, K. and Sander, T.E. 2015. Mortality due to a retained circle hook in a longfin mako shark *Isurus paucus* (Guitart-Manday). Journal of Fish Diseases, 38: 621–628.

Aguilar, C., González-Sansón, G., Hueter, R., Rojas, E., Cabrera, Y., Briones, A., Borroto, R., Hernández, A. and Baker, P. 2014. Captura de tiburones en la región noroccidental de Cuba. Latin American Journal of Aquatic Research, 42: 477–487.

Bustamante, C., Concha, F., Balbontín, F. and Lamilla, J. 2009. Southernmost record of *Isurus paucus* Gitart Manday, 1966 (Elasmobranchii: Lamnidae) in the southeast Pacific Ocean. Revista de Biología Marina y Oceanografía, 44: 523–526.

Camhi, M.D. 2008. Conservation status of pelagic elasmobranchs. *In* Camhi, M.D., Pikitch, E.K. and Babcock, E.A. (Eds) Sharks of the Open Ocean. Biology, Fisheries and Conservation. Blackwell Publishing, Oxford, pp. 397–417.

Compagno, L.J.V. 1984. FAO species catalogue. Vol. 4. Sharks of the World. An annotated and illustrated catalogue of shark species known to date. Part 1. Hexanchiformes to Lamniformes. FAO Fisheries Synopsis No. 125, Volume 4, Part 1; 249 pp.

Compagno, L.J.V. 2001. Sharks of the World. An annotated and illustrated catalogue of shark species known to date. Volume 2. Bullhead, mackerel, and carpet sharks (Heterodontiformes, Lamniformes, and Orectolobiformes). FAO Species Catalogue for Fishery Purposes No. 1, Vol. 2; 269 pp.

Cortés, E., Arocha, F., Beerkircher, L., Carvalho, F., Domingo, A., Heupel, M., Holtzhausen, H., Santos, M.N., Ribera, M. and Simpfendorfer, C. 2010. Ecological risk assessment of pelagic sharks caught in Atlantic pelagic longline fisheries. Aquatic Living Resources, 23: 25–34.

Dodrill, J.W. and Gilmore, R.G. 1979. First North American continental record of the longfin mako (*Isurus paucus* Guitart Manday). Florida Scientist, 42: 52–58.

Ebert, D. 2001. First eastern Pacific records of the longfin mako shark, *Isurus paucus*, Guitar-Manday, 1966. California Fish and Game, 87: 117–121.

Estupiñán-Montaño, C. and Delgado-Huertas, A. 2022. Longfin mako shark, *Isurus paucus*, in the eastern tropical Pacific: First evidence of trophic ontogeny based on the isotopic analysis of long-term tissues. Thalassas: An International Journal of Marine Sciences, pp.1–7.

Gámez Barrera, D., Nieto Alvarado, L., Morón Granados, E., Caldas, J.P. and Correa, J.L. 2012. Primer registro del tiburón mako aleta larga, *Isurus paucus* Guitart (Chondrichthyes: Lamnidae), para el Caribe Colombiano. Boletín de Investigaciones Marinas y Costeras, 41: 485–490.

Garrick, J.A.F. 1967. Revision of sharks of genus *Isurus* with description of a new species (Galeoidea, Lamnidae). Proceedings of the United States National Museum, 118 (3537): 663–690 + 4 plates.

Gilmore, R.G. 1983. Observations on the embryos of the longfin mako, *Isurus paucus*, and the bigeye thresher, *Alopias superciliosus*. Copeia, 1983(2): 375–382.

Guitart Manday, D. 1966. Nuevo nombre para una especie de tiburón del género *Isurus* (Elasmobranchii: Isuridae) de aguas cubanas. Poeyana, Series A, 15: 1–9.

Guitart Manday, D. 1975. Las pesquerias pelagico-oceanicas de corto radio de accion en la region noroccidental de Cuba. Serie Oceanologica (Academia de Ciencias de Cuba, Instituto de Oceanologia, Habana, Cuba), No. 31: 3–26.

Hemida, F. and Capapé, C. 2008. On the occurrence of the longfin mako, *Isurus paucus* (Chondrichthyes: Isuridae) off the Algerian coast (southwestern Mediterranean). Acta Adriatica, 49: 185–189.

Hueter, R.E., Tyminski, J.P., Morris, J.J., Abierno, A.R. and Valdes, J.A. 2017. Horizontal and vertical movements of longfin mako (*Isurus paucus*) tracked with satellite-linked tags in the northwestern Atlantic Ocean. Fishery Bulletin, 115: 101–116.

Killam, K. and Parsons, G. 1986. First record of the longfin mako, *Isurus paucus*, in the Gulf of Mexico. Fishery Bulletin, 84: 748–749.

Moreno, J.A. and Morón, J. 1992. Comparative study of the genus *Isurus* (Rafinesque, 1810), and description of a form (‘marajo criollo’) apparently endemic to the Azores. Australian Journal of Marine and Freshwater Research, 43: 109–122.

Mucientes, G. 2013. Short communication Updated distribution range of longfin mako *Isurus paucus* (Lamniformes: Lamnidae) in the North Atlantic. Journal of Applied Ichthyology, 29: 1163–1165.

Murua, H., Santiago, J., Coelho, R., Zudaire, I., Neves, C., Rosa, D., Semba, Y., Geng, Z., Bach, P., Arrizabalaga, H., Baez, J.C., Ramos, M.L., Zhu, J.F and Ruiz, J. 2018. Updated Ecological Risk Assessment (ERA) for shark species caught in fisheries managed by the Indian Ocean Tuna Commission (IOTC). IOTC-2018-SC21-14_Rev1; 28 pp.

Nieto, A., Ralph, G.M., Comeros-Raynal, M.T., Kemp, J., García Criado, M., Allen, D.J., Dulvy, N.K., Walls, R.H.L., Russell, B., Pollard, D., García, S., Craig, M., Collette, B.B., Pollom, R., Biscoito, M., Labbish Chao, N., Abella, A., Afonso, P., Álvarez, H., Carpenter, K.E., Clò, S., Cook, R., Costa, M.J., Delgado, J., Dureuil, M., Ellis, J.R., Farrell, E.D., Fernandes, P., Florin, A-B., Fordham, S., Fowler, S., Gil de Sola, L., Gil Herrera, J., Goodpaster, A., Harvey, M., Heessen, H., Herler, J., Jung, A., Karmovskaya, E., Keskin, C., Knudsen, S.W., Kobyliansky, S., Kovačić, M., Lawson, J.M., Lorance, P., McCully Phillips, S., Munroe, T., Nedreaas, K., Nielsen, J., Papaconstantinou, C., Polidoro, B., Pollock, C.M., Rijnsdorp, A.D., Sayer, C., Scott, J., Serena, F., Smith-Vaniz, W.F., Soldo, A., Stump, E. and Williams, J.T. 2015. European Red List of marine fishes. Luxembourg: Publications Office of the European Union.

Queiroz, N., Araújo, S., Ribeiro, P.A., Tarroso, P., Xavier, R. and Santos, A.M. 2008. A first record of longfin mako, *Isurus paucus*, in the mid-North Atlantic. Marine Biodiversity Records, 1, 2 pp.

Rigby, C.L., Barreto, R., Carlson, J., Fernando, D., Fordham, S., Francis, M.P., Jabado, R.W., Liu, K.M., Marshall, A., Pacoureau, N., Romanov, E., Sherley, R.B. and Winker, H. 2019. *Isurus paucus*. The IUCN Red List of Threatened Species 2019: e.T60225A3095898. https://dx.doi.org/10.2305/IUCN.UK.2019-1.RLTS.T60225A3095898.en. Accessed on 18 February 2022.

Ruiz-Abierno, A., Márquez-Farías, J.F., Rojas-Corzo, A., Miller, V., Angulo-Valdés, J.A. and Hueter, R.E. 2021a. Seasonal abundance and size structure of sharks taken in the pelagic longline fishery off northwestern Cuba. Marine and Coastal Fisheries, 13: 275–291.

Ruiz-Abierno, A., Márquez-Farías, J.F., Trápaga-Roig, M. and Hueter, R.E. 2021b. Length at maturity of two pelagic sharks (*Isurus paucus* and *Carcharhinus longimanus*) found off northern Cuba. Bulletin of Marine Science, 97: 77–88.

Stevens, J.D. and Scott, M. 1995. First record of the longfin mako (*Isurus paucus*) from Australian waters. Memoirs of the Queensland Museum, 38: 670.

Stevens, J.D. 2008. The biology and ecology of the shortfin mako shark, *Isurus oxyrinchus*. *In* Camhi, M.D., Pikitch, E.K. and Babcock, E.A. (Eds) Sharks of the Open Ocean. Biology, Fisheries and Conservation. Blackwell Publishing, Oxford, pp. 87–94.

Wakida-Kusunoki, A.T. and de Anda-Fuente, D. 2012. Presence of longfin mako shark *Isurus paucus* (Chondrichthyes: Lamnidae) in the south-eastern Gulf of Mexico, Tabasco, Mexico. Marine Biodiversity Records, 5, e92, 3 pp.

White, W.T. 2007. Biological observations on lamnoid sharks (Lamniformes) caught by fisheries in eastern Indonesia. Journal of the Marine Biological Association of the United Kingdom, 87: 781–788.

Table 1. Identification features of longfin and shortfin mako. Adapted from Garrick (1967), Moreno and Morón (1992), Compagno (2001) and Ebert (2001).

Feature	**Longfin mako**	**Shortfin mako**
Body shape and colouration	Relatively slender body; dark blue dorsal colouration	More robust body; brilliant blue dorsal colouration
Snout shape and colouration	Bluntly pointed; underside of snout and mouth dusky coloured	Acutely pointed; underside of snout and mouth usually white
Dentition	Cusps of anterior teeth (in upper and lower jaws) straighter and tips not reversed Third upper tooth (from the symphysis) straighter and more symmetrical, with a smaller diastema	Cusps of anterior teeth (in upper and lower jaws) narrow and flexed, with tips reversed Third upper tooth (from the symphysis) curved and with a larger diastema
Pectoral fin length and shape	Pectoral fin length longer than head length; pectoral fins broad-tipped.	Pectoral fin length shorter (usually ca. 70%) than head length; pectoral fins pointed.
Anal fin	Origin of the anal fin behind the posterior insertion of the second dorsal fin; anterior margin of the pelvic fin is equal to (or slightly shorter than) the length of the distal margin	Origin of the anal fin under the middle of the base of the second dorsal fin; the anterior margin of the pelvic fin is very much shorter than the length of the distal margin.
Eye diameter	Eye diameter >33% of snout length	Eye diameter <33% of snout length

Table 2. Average annual catches (kg per day) of sharks by the Cuban fleet (1971–1973) and estimated species composition. Adapted from Guitart Manday (1975). The values for the average catch rates in the table below were derived from the annual data and some values differ slightly to the average values given originally by Guitart Manday (1975).

Scientific name	Average catch rate (kg per day)				Species composition			
	1971	1972	1973	Mean	1971	1972	1973	Mean
Carcharhinus falciformis	9.51	13.73	13.67	12.30	21.0%	29.0%	27.7%	25.9%
Isurus oxyrinchus	8.49	8.60	12.06	9.72	18.7%	18.2%	24.5%	20.5%
Carcharhinus signatus	12.18	5.81	4.67	7.55	26.9%	12.3%	9.5%	16.2%
Alopias superciliosus	3.54	7.73	9.37	6.88	7.8%	16.3%	19.0%	14.4%
Carcharhinus longimanus	3.70	3.25	3.34	3.43	8.2%	6.9%	6.8%	7.3%
Isurus paucus	**2.71**	**2.94**	**0.00**	**1.88**	**6.0%**	**6.2%**	**0.0%**	**4.1%**
Sphyrna spp.	1.65	1.71	2.24	1.87	3.6%	3.6%	4.5%	3.9%
Galeocerdo cuvier	1.14	2.17	2.09	1.80	2.5%	4.6%	4.2%	3.8%
Carcharhinus obscurus	1.00	0.93	1.76	1.23	2.2%	2.0%	3.6%	2.6%
Prionace glauca	1.29	0.21	0.08	0.53	2.8%	0.4%	0.2%	1.2%
Carcharhinus altimus	0.14	0.21	0.00	0.12	0.3%	0.4%	0.0%	0.3%
Total	45.35	47.29	49.28					

Table 3. Life-history data for longfin mako.

Parameter	Male	Female	Combined	Source
Maximum length			417 cm L_T	Compagno (2001)
Smallest mature	208 cm L_T	220 cm L_T	–	
50% maturity	215 cm L_T	230 cm L_T	–	Ruiz-Abierno *et al.* (2021b)
Largest immature	224 cm L_T	257 cm L_T	–	
Length-at-birth			86–97 L_T [2]	Gilmore (1983) Ruiz-Abierno *et al.* (2021b)
			92–120 cm L_T	Compagno (2001)
Fecundity (litter size)			2–8[3]	Gilmore (1983) Compagno (2001)
Trophic level			3.5–5.7	Estupiñán-Montaño and Delgado-Huertas (2022)

Table 4. Published length-weight information for longfin mako. The average values have been given in those instances where published data were provided as an approximate range. The total length of the term pup reported by Guitart Manday (1975; 92 cm standard length) was estimated by assuming that standard (precaudal) length is 0.79 of total length in longfin mako of that size (Garrick, 1967; Gilmore, 1983).

Total length (cm)	Total weight (kg)	Source
97	5.2	Gilmore (1983; term pup)
116	12	Guitart Manday (1975; term pup)
201	56.5	Stevens and Scott (1975)
215	56	Queiroz *et al.* (2008)
218	70	Garrick (1967)
245	91	Queiroz *et al.* (2008)
306	160	Gamez-Barrera *et al.* (2012)
307	249	Adams *et al.* (2015; weight estimated at 226–272 kg)
310	200	Bustamante *et al.* (2009)
315	300	Ebert (2001; length estimated at 3.0–3.3 m)
372.8	351	Gilmore (1983)

[2] Gilmore (1983) reported a term pup 97 cm L_T from a female of 372.8 cm L_T whilst Ruiz-Abierno *et al.* (2021b) reported a specimen of 86.3 cm L_T from samples caught by longline. It is uncertain whether this specimen was a free-swimming individual caught on the line, or a pup shed from a captured female. Guitart Manday (1975) reported a term pup of 92 cm standard length, with the estimated L_T (116 cm) within the length range given by Compagno (2001).

[3] Whilst Gilmore (1983) observed only a single embryo in the right uterus of the specimen he examined, he also noted that "*the greatly expanded and vascularized left uterus indicated that a second embryo had been present but was apparently aborted shortly before or during the process of capture*". Guitart Manday (1975) also reported on the presence of two term pups.

Table 5. Nominal catch data, including reported catch, landings and dead discards (estimated), for longfin mako (LMA) in the ICCAT Area by billfish area. ICCAT Task 1 catch data (version of 18/12/2020). See https://www.iccat.int/Data/ICCAT_maps.pdf for locations of billfish areas.

Year	BIL91	BIL92	BIL93	BIL94A	BIL94B	BIL94C	BIL96	BIL97	NA	Total
1990									1.27	1.27
1991	0.08								1.07	1.15
1992									28.85	28.85
1993	0.14		0.16						7.49	7.79
1994						0.08			17.66	17.74
1995	0.65		1.83			0.86			13.30	16.64
1996	0.35		0.33						2.37	3.05
1997						1.19	11.59	13.85	2.02	28.65
1998			0.19		2.58	5.66			1.77	10.20
1999	0.14								1.76	1.90
2000					3.67	12.33	2.57	1.16		19.73
2001					15.88	22.17	5.18	8.02	0.13	51.39
2002			2.00		23.51	29.12	6.95	4.93		66.51
2003				0.85	24.25	27.77	3.71	6.15		62.73
2004			0.40		28.02	19.31	1.69	2.21		51.64
2005			0.27							0.27
2006			0.68							0.68
2007			1.05		16.46	23.77	16.17	7.14		64.59
2008	2.81	8.78	1.42			0.37	1.86			15.24
2009	8.42	10.07	0.50		37.07	28.37	6.78	17.30		108.51
2010	2.23	24.55	0.77		20.53	18.70	6.36	5.86		79.01
2011	1.03	7.64	0.47	1.76	14.81	27.96	4.72	32.34		90.74
2012	4.80	16.11	1.65	1.11	20.74	74.31	8.52	26.86		154.09
2013	6.75	13.36	2.55		15.67	79.36	5.08	6.92		129.69
2014	2.42	8.11	13.15		5.22	59.54	1.01	4.66		94.12
2015	0.99	7.05	13.36	22.48	34.38		2.73	234.55		315.54
2016	0.42	11.46	10.25	14.95	39.63	2.67	1.15	33.52		114.05
2017	0.56	9.77	3.10	47.99	22.40	10.84	0.78	2.26		97.70
2018	0.57	3.29		57.65	85.65	11.32	1.04	3.10		162.61
2019	1.14	9.71	2.14	17.34	54.94	25.67	0.73	0.25		111.92

Table 6. Nominal catch data, including reported catch, landings and dead discards (estimated), for longfin mako (LMA) in the ICCAT Area by party. ICCAT Task 1 catch data (version of 18/12/2020). *Data for the USA (2008 onwards) refer to estimates of dead discards.

Year	Spain	USA	Namibia	Venezuela	Portugal	Liberia	Trinidad & Tobago	Brazil	Total
1990		1.27							1.27
1991		1.15							1.15
1992		28.85							28.85
1993		7.79							7.79
1994		17.74							17.74
1995		16.64							16.64
1996		3.05							3.05
1997	26.63	2.02							28.65
1998	8.24	1.96							10.20
1999		1.90							1.90
2000	19.73								19.73
2001	51.26	0.13							51.39
2002	64.51						2.00		66.51
2003	61.88						0.85		62.73
2004	51.23						0.40		51.64
2005							0.27		0.27
2006							0.68		0.68
2007	63.53						1.05		64.59
2008		11.96*					1.42	1.86	15.24
2009	88.69	19.32					0.50		108.51
2010	48.73	27.71			1.80		0.77		79.01
2011	79.83	10.44			0.00		0.47		90.74
2012	116.54	22.02			13.61		1.65	0.27	154.09
2013	105.23	20.11		2.04	1.81		0.51		129.69
2014	67.45	10.53		11.89	2.98		1.27		94.12
2015	62.34	9.72	230.40	12.75			0.32		315.54
2016	59.96	12.02	31.80	10.11			0.16		114.05
2017	75.86	13.40		8.31			0.13		97.70
2018	132.04	3.86		7.59		19.08	0.05		162.61
2019	92.47	13.00		6.30			0.15		111.92

Table 7. Nominal Task 1 catch data for shortfin mako (SMA) and longfin mako (LMA) by billfish area for the years 1990–2019, and percentage of mako sharks reported as LMA (note: data did not include Lamnidae). See https://www.iccat.int/Data/ICCAT_maps.pdf for locations of billfish areas.

	BIL91			BIL93			BIL92			BIL94A			BIL94C		
Year	**SMA**	**LMA**	**%LMA**	**SMA**	**LMA**	**%LMA**	**SMA**	**LMA**	**%LMA**	**SMA**	**LMA**	**%LMA**	**SMA**	**LMA**	**%LMA**
1990	24.6	0.0	0.0%	2.1	0.0	0.0%	371.3	0.0	0.0%	23.1	0.0	0.0%	266.0	0.0	0.0%
1991	29.7	0.1	0.3%	6.4	0.0	0.0%	323.4	0.0	0.0%	28.0	0.0	0.0%	247.2	0.0	0.0%
1992	39.9	0.0	0.0%	4.7	0.0	0.0%	410.5	0.0	0.0%	39.9	0.0	0.0%	520.5	0.0	0.0%
1993	38.2	0.1	0.4%	1.4	0.2	10.1%	817.6	0.0	0.0%	38.2	0.0	0.0%	508.2	0.0	0.0%
1994	42.0	0.0	0.0%	7.4	0.0	0.0%	490.1	0.0	0.0%	42.0	0.0	0.0%	752.9	0.1	0.0%
1995	49.7	0.7	1.3%	7.4	1.8	19.7%	1579.4	0.0	0.0%	39.2	0.0	0.0%	939.0	0.9	0.1%
1996	30.3	0.4	1.1%	19.7	0.3	1.6%	332.0	0.0	0.0%	35.7	0.0	0.0%	632.5	0.0	0.0%
1997	20.8	0.0	0.0%	10.5	0.0	0.0%	289.4	0.0	0.0%	33.2	0.0	0.0%	765.8	1.2	0.2%
1998	14.8	0.0	0.0%	8.7	0.2	2.1%	256.4	0.0	0.0%	25.0	0.0	0.0%	1022.6	5.7	0.6%
1999	21.7	0.1	0.6%	9.6	0.0	0.0%	164.8	0.0	0.0%	11.5	0.0	0.0%	989.5	0.0	0.0%
2000	29.3	0.0	0.0%	9.0	0.0	0.0%	384.2	0.0	0.0%	11.9	0.0	0.0%	785.1	12.3	1.5%
2001	31.8	0.0	0.0%	25.1	0.0	0.0%	327.1	0.0	0.0%	7.6	0.0	0.0%	636.7	22.2	3.4%
2002	8.4	0.0	0.0%	22.7	2.0	8.1%	354.0	0.0	0.0%	9.7	0.0	0.0%	1065.7	29.1	2.7%
2003	18.9	0.0	0.0%	27.6	0.0	0.0%	84.8	0.0	0.0%	14.3	0.9	5.6%	1641.7	27.8	1.7%
2004	22.1	0.0	0.0%	66.4	0.4	0.6%	438.0	0.0	0.0%	22.8	0.0	0.0%	1444.0	19.3	1.3%
2005	26.0	0.0	0.0%	30.0	0.3	0.9%	375.5	0.0	0.0%	28.5	0.0	0.0%	1631.1	0.0	0.0%
2006	13.8	0.0	0.0%	16.0	0.7	4.1%	386.1	0.0	0.0%	53.8	0.0	0.0%	1390.5	0.0	0.0%
2007	20.4	0.0	0.0%	20.2	1.1	4.9%	277.8	0.0	0.0%	35.3	0.0	0.0%	1435.6	23.8	1.6%
2008	16.1	2.8	14.9%	10.5	1.4	12.0%	281.1	8.8	3.0%	25.9	0.0	0.0%	1299.0	0.4	0.0%
2009	20.8	8.4	28.8%	45.7	0.5	1.1%	308.2	10.1	3.2%	67.1	0.0	0.0%	1586.4	28.4	1.8%
2010	17.3	2.2	11.4%	36.6	0.8	2.1%	345.8	24.6	6.6%	66.6	0.0	0.0%	1484.0	18.7	1.2%
2011	26.1	1.0	3.8%	25.9	0.5	1.8%	316.7	7.6	2.4%	48.9	1.8	3.5%	1498.4	28.0	1.8%
2012	23.2	4.8	17.2%	46.9	1.7	3.4%	359.5	16.1	4.3%	65.8	1.1	1.7%	1891.4	74.3	3.8%
2013	17.1	6.8	28.3%	12.3	2.5	17.2%	368.7	13.4	3.5%	150.3	0.0	0.0%	1021.3	79.4	7.2%
2014	21.1	2.4	10.3%	14.9	13.2	46.9%	962.8	8.1	0.8%	38.9	0.0	0.0%	1092.9	59.5	5.2%
2015	7.7	1.0	11.4%	10.8	13.4	55.3%	622.0	7.0	1.1%	44.1	22.5	33.7%	1048.9	0.0	0.0%
2016	6.7	0.4	5.9%	7.8	10.3	56.9%	316.6	11.5	3.5%	680.6	15.0	2.1%	302.9	2.7	0.9%
2017	8.9	0.6	5.9%	1.9	3.1	61.5%	362.2	9.8	2.6%	946.7	48.0	4.8%	205.6	10.8	5.0%
2018	4.2	0.6	11.9%	0.0	0.0		186.0	3.3	1.7%	735.1	57.6	7.3%	277.6	11.3	3.9%
2019	3.4	1.1	25.4%	3.3	2.1	39.4%	97.1	9.7	9.1%	519.0	17.3	3.2%	202.2	25.7	11.3%
Mean percentage of LMA:															
1990–1999			0.37%			3.37%			0.00%			0.00%			0.08%
2000–2009			4.37%			3.16%			0.62%			0.56%			1.40%
2010–2019			13.14%			31.59%			3.57%			5.64%			4.03%

Table 7 (continued). Nominal Task 1 catch data for shortfin mako (SMA) and longfin mako (LMA) by billfish area for the years 1990–2019, and percentage of mako sharks reported as LMA (note: data did not include Lamnidae). See https://www.iccat.int/Data/ICCAT_maps.pdf for locations of billfish areas.

	BIL94B			BIL95			BIL96			BIL97		
Year	**SMA**	**LMA**	**%LMA**	**SMA**	**LMA**	**%LMA**	**SMA**	**LMA**	**%LMA**	**SMA**	**LMA**	**%LMA**
1990	1468.6	0.0	0.0%	0.0	0.0		236.4	0.0	0.0%	444.8	0.0	0.0%
1991	1460.0	0.0	0.0%	0.0	0.0		226.7	0.0	0.0%	249.0	0.0	0.0%
1992	1844.9	0.0	0.0%	0.0	0.0		360.3	0.0	0.0%	318.7	0.0	0.0%
1993	2251.9	0.0	0.0%	0.0	0.0		683.5	0.0	0.0%	327.4	0.0	0.0%
1994	2059.6	0.0	0.0%	0.0	0.0		362.6	0.0	0.0%	385.8	0.0	0.0%
1995	1933.4	0.0	0.0%	0.0	0.0		893.0	0.0	0.0%	503.0	0.0	0.0%
1996	3353.2	0.0	0.0%	0.0	0.0		668.2	0.0	0.0%	1095.8	0.0	0.0%
1997	1649.8	0.0	0.0%	5.8	0.0	0.0%	816.7	11.6	1.4%	987.7	13.8	1.4%
1998	1200.5	2.6	0.2%	8.2	0.0	0.0%	712.1	0.0	0.0%	899.2	0.0	0.0%
1999	1388.6	0.0	0.0%	4.7	0.0	0.0%	454.0	0.0	0.0%	803.5	0.0	0.0%
2000	778.8	3.7	0.5%	4.1	0.0	0.0%	663.3	2.6	0.4%	1345.7	1.2	0.1%
2001	1050.0	15.9	1.5%	7.1	0.0	0.0%	957.8	5.2	0.5%	951.7	8.0	0.8%
2002	1036.8	23.5	2.2%	1.7	0.0	0.0%	672.0	6.9	1.0%	944.3	4.9	0.5%
2003	1422.0	24.3	1.7%	2.2	0.0	0.0%	1117.6	3.7	0.3%	1656.9	6.2	0.4%
2004	1179.5	28.0	2.3%	1.8	0.0	0.0%	935.3	1.7	0.2%	944.3	2.2	0.2%
2005	1143.9	0.0	0.0%	16.7	0.0	0.0%	1158.8	0.0	0.0%	1829.0	0.0	0.0%
2006	1248.8	0.0	0.0%	9.9	0.0	0.0%	777.7	0.0	0.0%	2008.9	0.0	0.0%
2007	1362.5	16.5	1.2%	2.2	0.0	0.0%	749.0	16.2	2.1%	1740.3	7.1	0.4%
2008	1774.2	0.0	0.0%	0.9	0.0	0.0%	940.9	1.9	0.2%	819.5	0.0	0.0%
2009	2369.3	37.1	1.5%	0.6	0.0	0.0%	1114.7	6.8	0.6%	948.6	17.3	1.8%
2010	2746.6	20.5	0.7%	1.7	0.0	0.0%	867.2	6.4	0.7%	1589.2	5.9	0.4%
2011	1683.9	14.8	0.9%	2.4	0.0	0.0%	1202.0	4.7	0.4%	2042.6	32.3	1.6%
2012	1908.1	20.7	1.1%	1.6	0.0	0.0%	869.1	8.5	1.0%	2035.0	26.9	1.3%
2013	2033.1	15.7	0.8%	0.0	0.0	0.0%	809.2	5.1	0.6%	1373.5	6.9	0.5%
2014	1336.4	5.2	0.4%	0.2	0.0	0.0%	805.3	1.0	0.1%	2468.6	4.7	0.2%
2015	1547.3	34.4	2.2%	0.2	0.0	0.0%	584.5	2.7	0.5%	2190.0	234.6	9.7%
2016	2041.5	39.6	1.9%	0.0	0.0		653.3	1.2	0.2%	2111.4	33.5	1.6%
2017	1593.4	22.4	1.4%	0.0	0.0		939.7	0.8	0.1%	1846.7	2.3	0.1%
2018	1169.6	85.7	6.8%	0.9	0.0	0.0%	1095.3	1.0	0.1%	2063.1	3.1	0.1%
2019	1057.6	54.9	4.9%	0.0	0.0	0.0%	1306.7	0.7	0.1%	1002.4	0.3	0.0%
Mean percentage of LMA:												
1990–1999			0.02%			0.00%			0.14%			0.14%
2000–2009			1.09%			0.00%			0.54%			0.42%
2010–2019			2.11%			0.00%			0.37%			1.55%

Table 8. Nominal Task 1 catch data reported by Spain for shortfin mako (SMA), longfin mako (LMA) and Lamnidae (MSK) by billfish area for the years 1990–2019, and percentage of mako sharks reported as LMA (note: percentage did not include Lamnidae). Shaded cells indicate where longfin mako accounted for more than 5% of total mako catches.

	BIL94A			**BIL94B**				**BIL94C**			
Year	**SMA**	**LMA**	**%LMA**	**SMA**	**LMA**	**%LMA**	**MSK**	**SMA**	**LMA**	**%LMA**	**MSK**
1990				1275.6				261.6			
1991				1146.0				244.1			
1992				1624.9				520.5			
1993				1455.9				508.2			
1994				1410.6				752.9			
1995				1276.4				933.1			
1996				2662.2				631.6			
1997				1649.8				765.8	1.2	0.15%	
1998				1200.4	2.6	0.21%		1022.6	5.7	0.55%	
1999				1062.6				988.3			
2000				775.8	3.7	0.47%		784.9	12.3	1.55%	44.2
2001				1047.7	15.9	1.49%		636.7	22.2	3.37%	
2002				1036.2	23.5	2.22%		1010.4	29.1	2.80%	
2003				800.1	24.3	2.94%		1267.5	27.8	2.14%	
2004				771.3	28.0	3.51%		1316.4	19.3	1.45%	
2005				428.0				1323.3			
2006	24.8			502.9				1390.4			
2007				407.1	16.5	3.89%		1406.5	23.8	1.66%	
2008	3.0			596.8			24.1	1295.5			15.5
2009				663.1	37.1	**5.29%**		1553.0	27.5	1.74%	
2010				622.5	19.5	3.04%		1468.3	17.8	1.20%	
2011				390.9	14.8	3.65%		1276.2	28.0	2.14%	
2012				474.5	19.4	3.92%		1833.5	71.1	3.74%	
2013				507.3	14.7	2.81%		1001.5	79.4	**7.34%**	
2014				445.6	4.1	0.91%		1035.4	59.5	**5.44%**	
2015		21.1	**100.00%**	343.5	34.4	**9.10%**		1018.2			
2016	635.1	14.8	2.28%	667.5	39.6	**5.60%**		271.5	2.7	0.97%	
2017	872.6	39.6	4.34%	731.3	22.4	2.97%		180.1	10.8	**5.68%**	
2018	642.8	50.0	**7.22%**	342.3	66.6	**16.28%**		180.2	11.3	**5.91%**	
2019	415.8	10.9	2.55%	317.6	54.9	**14.75%**		132.8	25.7	**16.20%**	
Total	2594.1	136.3	4.99%	26636.4	441.8	1.63%	24.1	27010.8	475.1	1.73%	59.7
Mean			23.28%			4.61%				3.56%	
Min			2.28%			0.21%				0.15%	
Max			(100%)			16.28%				16.20%	

Table 8 (continued). Nominal Task 1 catch data reported by Spain for shortfin mako (SMA), longfin mako (LMA) and Lamnidae (MSK) by billfish area for the years 1990–2019, and percentage of mako sharks reported as LMA (note: percentage did not include Lamnidae).

	BIL95	BIL96				BIL97				Unknown
Year	**SMA**	**SMA**	**LMA**	**%LMA**	**MSK**	**SMA**	**LMA**	**%LMA**	**MSK**	**MSK**
1990		107.5				444.7				
1991		133.7				193.7				
1992		182.0				239.3				
1993		533.6				238.6				
1994		255.6				296.6				
1995		756.9				327.2				
1996		559.1				922.5				
1997	5.8	528.2	11.6	2.15%		827.8	13.8	1.65%		
1998	6.8	388.1				596.1				
1999	4.7	320.2				541.1				
2000	2.9	257.3	2.6	0.99%	45.3	832.4	1.2	0.14%	69.8	94.9
2001	1.8	460.6	5.2	1.11%		774.0	8.0	1.02%		
2002	1.7	381.0	6.9	1.79%		429.5	4.9	1.14%		
2003	2.1	560.7	3.7	0.66%		597.6	6.2	1.02%		
2004	1.8	440.9	1.7	0.38%		261.8	2.2	0.84%		
2005	1.7	307.5				276.1				
2006	3.7	415.6				248.8				
2007	0.8	346.6	16.2	4.46%		307.3	7.1	2.27%		
2008	0.2	369.0			12.2	259.0			17.4	
2009	0.2	471.5	6.8	1.42%		450.5	17.3	3.70%		
2010	0.9	385.2	5.5	1.42%		806.9	5.9	0.72%		
2011	1.6	506.5	4.7	0.92%		1029.0	32.3	3.05%		
2012	1.5	443.6	7.4	1.64%		763.5	18.6	2.38%		
2013	0.0	373.5	4.3	1.13%		709.1	6.9	0.97%		
2014	0.2	444.5	0.4	0.09%		632.4	3.4	0.53%		
2015	0.2	312.7	2.7	0.87%		548.9	4.2	0.75%		
2016		396.0	1.2	0.29%		486.4	1.7	0.35%		
2017		516.5	0.8	0.15%		532.4	2.3	0.42%		
2018		495.9	1.0	0.21%		547.9	3.1	0.56%		
2019		436.6	0.7	0.17%		653.0	0.3	0.04%		
Total	38.6	12086.4	83.4	0.69%	57.5	15774.0	139.4	0.88%	87.3	94.9
Mean				1.10%				1.20%		
Min				0.09%				0.04%		
Max				4.46%				3.70%		

Table 9. Nominal landings data for longfin mako (LMA) from FAO (https://www.fao.org/fishery/statistics-query/en/capture/capture_quantity; accessed 10 March 2022) and corresponding catch data (including reported catch, landings and estimated dead discards) supplied to ICCAT (ICCAT Task 1 catch data; version of 18/12/2020). Task 1 catch data for USA from 2008 onwards relates to estimated dead discards, hence these data differ to FAO data.

	Brazil		**Colombia**		**Liberia**		**Namibia**		**Portugal**		**Spain**		**Trin & Tob**		**USA**		**Venezuela**		**Total**	
Year	**FAO**	**Task 1**	**FAO**	**Task 1**	**FAO**	**Task 1**	**FAO**	**Task 1**	**FAO**	**Task 1**	**FAO**	**Task 1**	**FAO**	**Task 1**	**FAO**	**Task 1**	**FAO**	**Task 1**	**FAO**	**Task 1**
1990											0				1	1.3			1	1.3
1991											0				5	1.2			5	1.2
1992											0				12	28.9			12	28.9
1993											0				0	7.8			0	7.8
1994											0				5	17.7			5	17.7
1995											0				2	16.6			2	16.6
1996											0				4	3.1			4	3.1
1997											0	26.6			4	2.0			4	28.6
1998											0	8.2			1	2.0			1	10.2
1999											0				3	1.9			3	1.9
2000											0	19.7			3				3	19.7
2001											0	51.3			3	0.1			3	51.4
2002											0	64.5	2	2.0	1				3	66.5
2003									0		0	61.9	1	0.9	1				2	62.7
2004									0		0	51.2	0	0.4	1				1	51.6
2005											2		0	0.3	0				2	0.3
2006											1		1	0.7	0				2	0.7
2007											0	63.5	1	1.1	0				1	64.6
2008		1.9									1		1	1.4	0	12.0			2	15.2
2009											0	88.7	0	0.5	0	19.3			0	108.5
2010									1	1.8	0	48.7	1	0.8	0	27.7			2	79.0
2011										0.0	0	79.8	0	0.5	0	10.4			0	90.7
2012		0.3								13.6	0	116.5	2	1.7	0	22.0			2	154.1
2013									2	1.8	17	105.2	1	0.5	0	20.1		2.0	20	129.7
2014									3	3.0	60	67.5	1	1.3	0	10.5		11.9	64	94.1
2015								230.4	4		38	62.3	0	0.3	0	9.7		12.8	42	315.5
2016								31.8	3		36	60.0	0	0.2	0	12.0	2	10.1	41	114.1

2017					199				4		82	75.9	0	0.1	0	13.4	2	8.3	287	97.7
2018					0	19.1			8		138	132.0	0	0.1		3.9	2	7.6	148	162.6
2019			0.445		0				10		84.384	92.5	0	0.2		13.0	2	6.3	97	111.9
Total	0	2.1	0.445	0.0	199	19.1	0	262.2	35	20.2	459.384	1276.1	11	12.7	46	(82.5)	8	59.0	759	1908.0

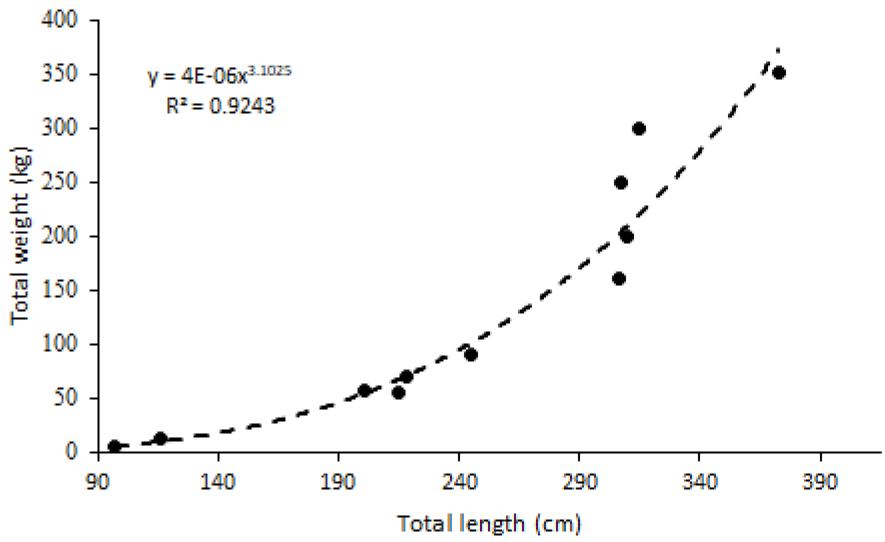

Figure 1. Preliminary estimate of length-weight relationship for longfin mako (n = 11) based on published data (see **Table 4**).

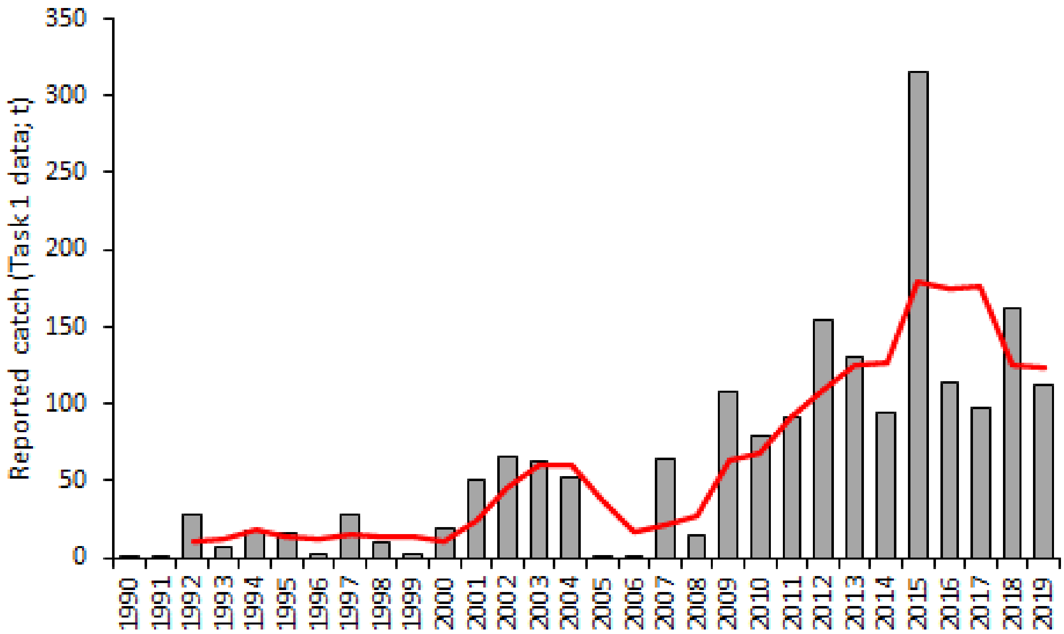

Figure 2. ICCAT Task 1 data (1990–2019) for longfin mako (LMA, grey columns) and three-year running mean.

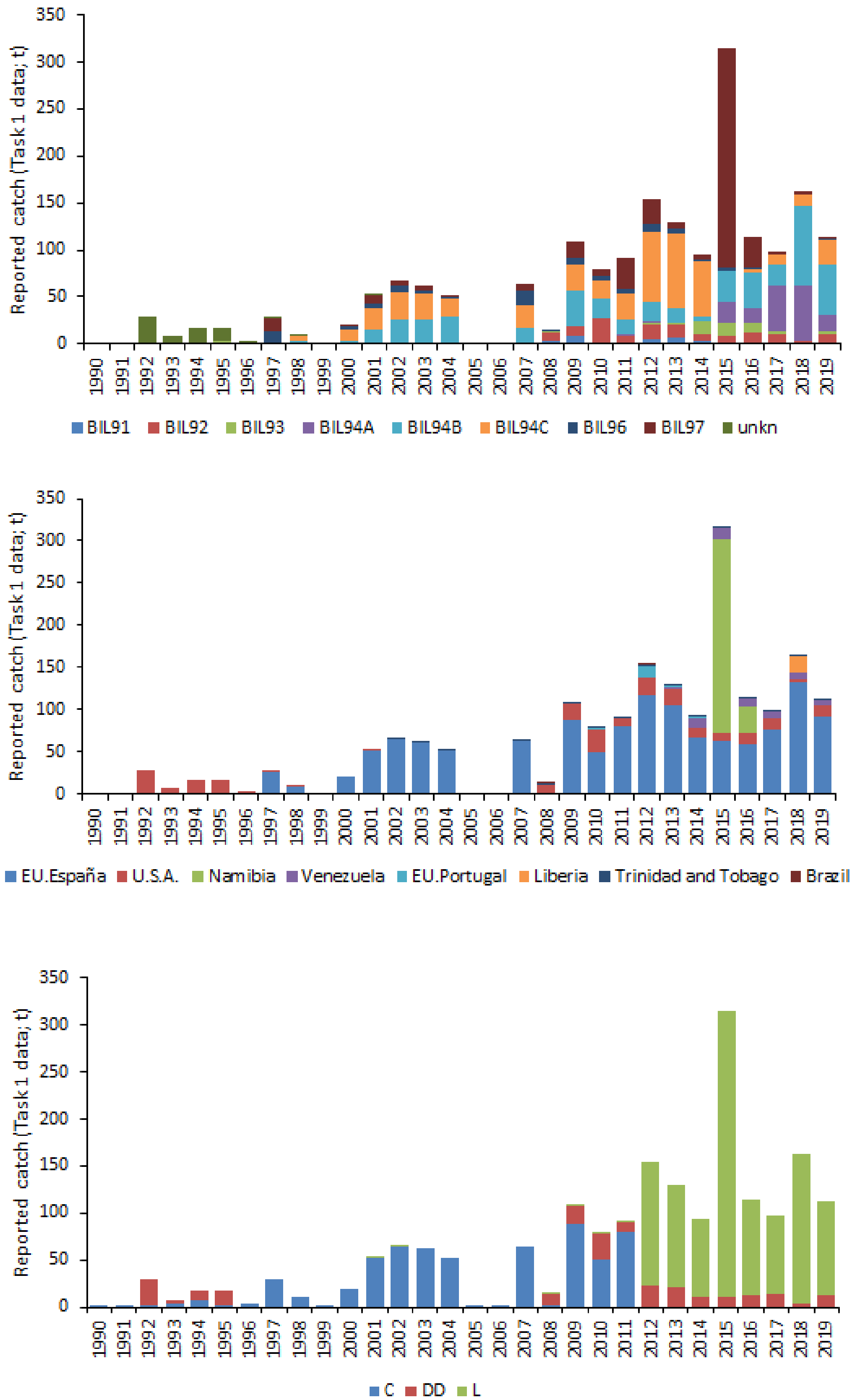

Figure 3. ICCAT Task 1 data (1990–2019) for longfin mako (LMA) by billfish area (top), party (centre) and reporting category (bottom; C = catch, DD = dead discards, L = landings)