

ADVANCES ON THE COLLABORATIVE WORK TO ASSESS SEA TURTLE BYCATCH IN PELAGIC LONGLINE AND PURSE SEINE FLEETS (ATLANTIC AND INDIAN OCEANS AND MEDITERRANEAN SEA)

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SUMMARY

A collaborative work to assess the impact of pelagic longline fleets on sea turtles in the Atlantic Ocean from an entirely scientific perspective was initiated in 2018. This report updates the advances achieved after the Workshop II held in Malaga (Spain) between 27 and 31 January 2020. The objectives of this process include determining the spatio-temporal trends of the incidental catch of sea turtles in pelagic longline and purse seine fisheries in the Atlantic and southwestern Indian Ocean, as well as, from the Mediterranean Sea, aiming a wider geographical perspective of this issue. For this purpose, fine scale bycatch data from several longline and purse-seine fleets, covering a period of circa 20 years, includes available information gathered through national observer programmes on incidental capture of sea turtles in the Atlantic and southwest Indian Oceans from longline fleets of Brazil, Canada, Spain, Portugal, South Africa, and Uruguay, including the effort of foreign fleets that have operated in the EEZs of some of these countries. In addition, there is also data available from the Spanish pelagic longline fleet operating in the Mediterranean.

RÉSUMÉ

Un travail collaboratif visant à évaluer l'impact des flottilles de palangriers pélagiques sur les tortues marines dans l'océan Atlantique d'un point de vue entièrement scientifique a été lancé en 2018. Ce rapport fait le point sur les avancées réalisées après l'atelier II qui s'est tenu à Malaga (Espagne) du 27 au 31 janvier 2020. Les objectifs de ce processus comprennent la détermination des tendances spatio-temporelles des prises accidentelles de tortues marines dans les pêcheries palangrières pélagiques et de senneurs dans l'Atlantique et le sud-ouest de l'océan Indien, ainsi que dans la mer Méditerranée, en vue d'une perspective géographique plus large de cette question. À cette fin, les données de prises accessoires à échelle fine de plusieurs flottilles de palangriers et de senneurs, couvrant une période d'environ 20 ans, comprennent les informations disponibles recueillies par les programmes d'observateurs nationaux sur la capture accidentelle de tortues marines dans l'Atlantique et le sud-ouest de l'océan Indien par les flottilles palangrières du Brésil, du Canada, de l'Espagne, du Portugal, de l'Afrique du Sud et de l'Uruguay, y compris l'effort des flottilles étrangères qui ont opéré dans les ZEE de certains de ces pays. En outre, on dispose également de données provenant de la flottille espagnole de palangriers pélagiques opérant en Méditerranée.

RESUMEN

En 2018 se inició un trabajo de colaboración para evaluar el impacto de las flotas de palangre pelágico sobre las tortugas marinas en el océano Atlántico desde una perspectiva totalmente científica. Este informe actualiza los avances logrados tras el Taller II celebrado en Málaga (España) entre el 27 y el 31 de enero de 2020. Los objetivos de este proceso incluyen la determinación de las tendencias espacio-temporales de las capturas incidentales de tortugas marinas en las pesquerías de palangre pelágico y de cerco en el Atlántico y el suroeste del océano Índico, así como, del mar Mediterráneo, con el objetivo de obtener una perspectiva geográfica más amplia de esta cuestión. Para ello, los datos de capturas fortuitas a escala fina de varias flotas de palangre y de cerco, que abarcan un periodo de unos 20 años, incluyen la información disponible recopilada a través de los programas nacionales de observadores sobre la captura incidental de tortugas marinas en los océanos Atlántico e Índico suroccidental por parte de las flotas de palangre de Brasil, Canadá, España, Portugal, Sudáfrica y Uruguay, lo que incluye el esfuerzo de las flotas extranjeras que han operado en las ZEE de algunos de estos países. Además, también se dispone de datos de la flota palangrera pelágica española que opera en el Mediterráneo.

KEYWORDS

Incidental capture; Loggerhead; Leatherback; Olive Ridley; tuna fisheries

Background

A Workshop was conducted in Uruguay in April 2018 to assess the impact of ICCAT fisheries on sea birds. During this Workshop a collaborative work to assess the impact of pelagic longline fleets on sea turtles in the Atlantic Ocean from an entirely scientific perspective was initiated (Workshop I). Scientists from Brazil, Japan and Uruguay participated in this workshop. The participants of this first Workshop acknowledged that this meeting was an important starting point to construct future collaborative works on sea turtles with many countries involved in the ICCAT fisheries. The Second meeting (Workshop II) on collaborative work on sea turtles took place between 27-31 January 2020, in the city of Malaga, Spain with the participation of researchers from Brazil, Japan, Spain and Uruguay, as well as the Coordinator of ICCAT's Atlantic-Wide Research Programme for Bluefin Tuna (GBYP). Scientists from France, Portugal and South Africa also sent data on their fisheries to contribute to the process. The possibility of including the Mediterranean Sea and extending the assessment to purse seine fisheries was explored. Based on the new information that became available and the discussions maintained during the workshop, the most immediate objectives of the collaborative process were redefined. It was decided to include the Southern Indian Ocean for the purpose of considering the potential continuity between the Atlantic and Indian Oceans. During the 2020 Intersessional Meeting of the Sub-Committee on Ecosystems the outputs of the Workshop II were presented (SCRS/2020/40). During this meeting scientist from several countries expressed their intention to participate in the collaborative process and send data from their respective fleets. A workshop had been planned for the end of 2020, however due to the COVID-19 pandemic it could not be held. This report includes the new information and summarize the discussion from a virtual workshop celebrated by participant of the process in 30th April 2021.

The short-term goal of this process is to determine the spatio-temporal trends of the incidental catch of marine turtles in pelagic longline and purse seine fisheries in the Atlantic Ocean and southern Indian Ocean. Secondary objectives set include 1) Carry out a bibliographical revision of the interaction of sea turtles with other fisheries that do not belong to ICCAT in the Atlantic Ocean and Mediterranean Sea, to enable contextualization of the impact of ICCAT fisheries within a more global framework; 2) Review the information available on the state of the sea turtle populations in the Atlantic Ocean and Mediterranean Sea; and 3) Identify information gaps.

A complementary objective was also considered. If the information allowed, a case study could be carried out in the Mediterranean Sea on the potential impact of the pelagic longline fisheries on sea turtles. For this purpose, the following would be considered 1) densities of sea turtles obtained in the aerial surveys of the GBYP, 2) distribution of the incidental catch of sea turtles in the pelagic longline fishery, and 3) situation of the populations in the Mediterranean Sea affected by these fisheries, if possible.

New data and integration of database

After the 2020 Intersessional Meeting of the Sub-Committee on Ecosystems data from the pelagic longline fleets of Portugal (Indian Ocean) and Canada (North Atlantic) and the purse-seine fleet of France (Atlantic and southwest Indian Ocean) were incorporated. **Annexes 2 and 3** contain the minimum requirements of incidental catch data on sea turtles requested of researchers in relation to the catch and effort data of each country for pelagic longline and purse seine fisheries. In turn, **Annex 4** sets out the minimum requirements for biological information on sea turtles taken incidentally in both fisheries. A database on catch and effort for pelagic longline was created and another for purse seine in relation to fishing sets.

The spatial distribution of fishing effort for current integrated data on longline and purse seine in the Atlantic and southwest Indian Ocean is shown in **Figure 1**. Both databases cover the period 1998-2018. The effort for pelagic longline in the Mediterranean Sea is also shown in **Figure 1**. The integrated total effort for pelagic longline comprised a total of 42,139 fishing sets and 76,373,842 hooks observed. The data refers to the fleets of Brazil (Atlantic), Canada (Atlantic), Portugal (Atlantic and Indian), Spain (Indian and Mediterranean), Uruguay (Atlantic) and South Africa (Atlantic and Indian), in addition to foreign vessels (mainly from Japan, China and Spain) operating in the waters of Brazil, Canada, and Uruguay for the Atlantic, and South Africa for the Atlantic and Indian. In the case of purse seine, the effort observed

corresponded to 60,754 sets carried out in the Atlantic Ocean and southwest Indian by tropical purse seine vessels from France, Spain and the associated fleet of the Netherlands Antilles, Belize, Cabo Verde, Curaçao, El Salvador, Guatemala, Iran, Panama, Korea (Rep.), Senegal, Seychelles, and St. Vincent and the Grenadines. The spatio-temporal distribution of the fishing effort in period of four years is shown in **Figure 2** (Pelagic longline) and **Figure 3** (Purse-seine).

Figure 4 shows the spatial distribution of catch per unit effort (CPUE) observed for the major species of sea turtle (*Caretta caretta*, *Dermochelys coriacea* and *Lepidochelys olivacea*) taken incidentally in the pelagic longline and purse seine fisheries in the Atlantic and southwest Indian Ocean. Data for Pelagic longline is also included for the Mediterranean Sea. For the period under study (1998-2018), it was observed in the pelagic longline fishery that the CPUE values of *Caretta caretta* were higher in the southwest Atlantic, in waters adjacent to North East Africa and in the Mediterranean Sea (**Figure 4**). The catches of *Dermochelys coriacea* in the pelagic longline fishery were widely distributed in the Atlantic, with the highest CPUE values being recorded in tropical waters. Finally, the highest CPUE values of *Lepidochelys olivacea* in the pelagic longline fishery were distributed throughout the tropical waters of the Atlantic. For the purse seine fleet, the CPUE values of *Caretta caretta* were higher in the tropical waters of the Atlantic adjacent to North East Africa, coinciding with one of the areas with the highest CPUE observed in the pelagic longline fishery. The catches of *Dermochelys coriacea* by purse seine were widely distributed throughout the region where the fleet operated, but no clear pattern was observed. For *Lepidochelys olivacea* taken by purse seine, it was observed that the catches were widely distributed throughout the tropical area close to Africa, with the highest CPUE values being concentrated off the coast of Angola (**Figure 4**).

Incorporation of environmental variables into the database

For the purpose of the spatial-temporal patterns of incidental catch several environmental and operational variables have been considered during the discussion in the virtual workshop. Some of them are already included in the minimum data requirements (**Annexes 2 and 3**). The minimum information on pelagic longline and purse seine includes the ID of the fishing trip, ID of the set, ID of the vessel and country, in addition to the year and month (hence, season) and latitude and longitude of each fishing set observed. In turn, for longline, the vessels were classified into surface longline directed at swordfish and shark and deep longline directed at tuna. In the case of purse seine, the sets were classified into those targeting free schools or schools associated with floating objects (FOBs). After received all the additional data this year, several additional covariates were extracted. These included sea surface temperature (https://podaac.jpl.nasa.gov/dataset/MUR_JPL_L4_GLOB_v4.1), Chlorophyll a concentration (<https://climate.esa.int/en/projects/ocean-colour/>; ESA CCI Ocean Colour Product: CCI ALL v4.2 8DAY and CCI ALL v4.2 Monthly), depth, changes in depth and Depth, and distance to bathymetric features (GEBCO 2020), the fraction illuminated of the moon and moon phases were extracted for each fishing set. In addition, during the virtual workshop it was discussed the possibility of included as candidate covariates the eddy kinetic energy (EKE), thermal fronts, sea surface height, distance to nesting sites, among others.

Next steps

Until now, the main output of this process has been the creation of a fine scale (at fishing set level) database of the fishing effort observed in multiple pelagic longline and purse seine fleets operating in the Atlantic and Indian Oceans, covering a period of 21 years. These data already include several extracted covariates needed for analyses. Although the available information covered a period from 1978 to 2020, data prior 1998 and post 2018 were from a specific region. During the virtual workshop (April 30th, 2021) the group decided to conduct the analyses from 1998 to 2018 based on the spatio-temporal coverage of the available information (**Figures 2 and 3**). Scientists from U.S. expressed their intention to provide data for their pelagic longline fleet in the Atlantic. Similarly, scientists from Spain expressed their intention to provide data from longline in the Atlantic and to extend the purse-seine data beyond the southwest Indian Ocean. The group discussed that once these new data can be incorporated, the database for this stage of the collaborative process could be considered closed, in order to initiate data analyses. During the remainder of the year, the database will be completed, including the information from the scientists who expressed their willingness to collaborate at this stage. The extraction of the environmental covariates for the total database will in turn be completed.

A workshop had been planned for the end of 2020, however due to the COVID-19 pandemic it could not be held. Although a virtual meeting was held, it did not allow progress in the same way as the face-to-face meeting. If the situation of the pandemic allows it, a workshop could be held in late 2021 / early 2022 in order to address the immediate objective of characterizing the patterns of distribution of the bycatch. This would allow carrying out the analyses during a meeting, in a collaborative way, protecting aspects related to

the confidentiality of the data and considering the knowledge of the researchers from the national fleets that make up this process. A final document is expected to be published before the 2022 Intersessional Meeting of the Sub-Committee on Ecosystems. On the other hand, the scientists involved have agreed on the importance of this collaborative work and the opportunities that exist with this alliance to continue working together and address other objectives that allow a deeper understanding of the interactions and better management and conservation of these species.

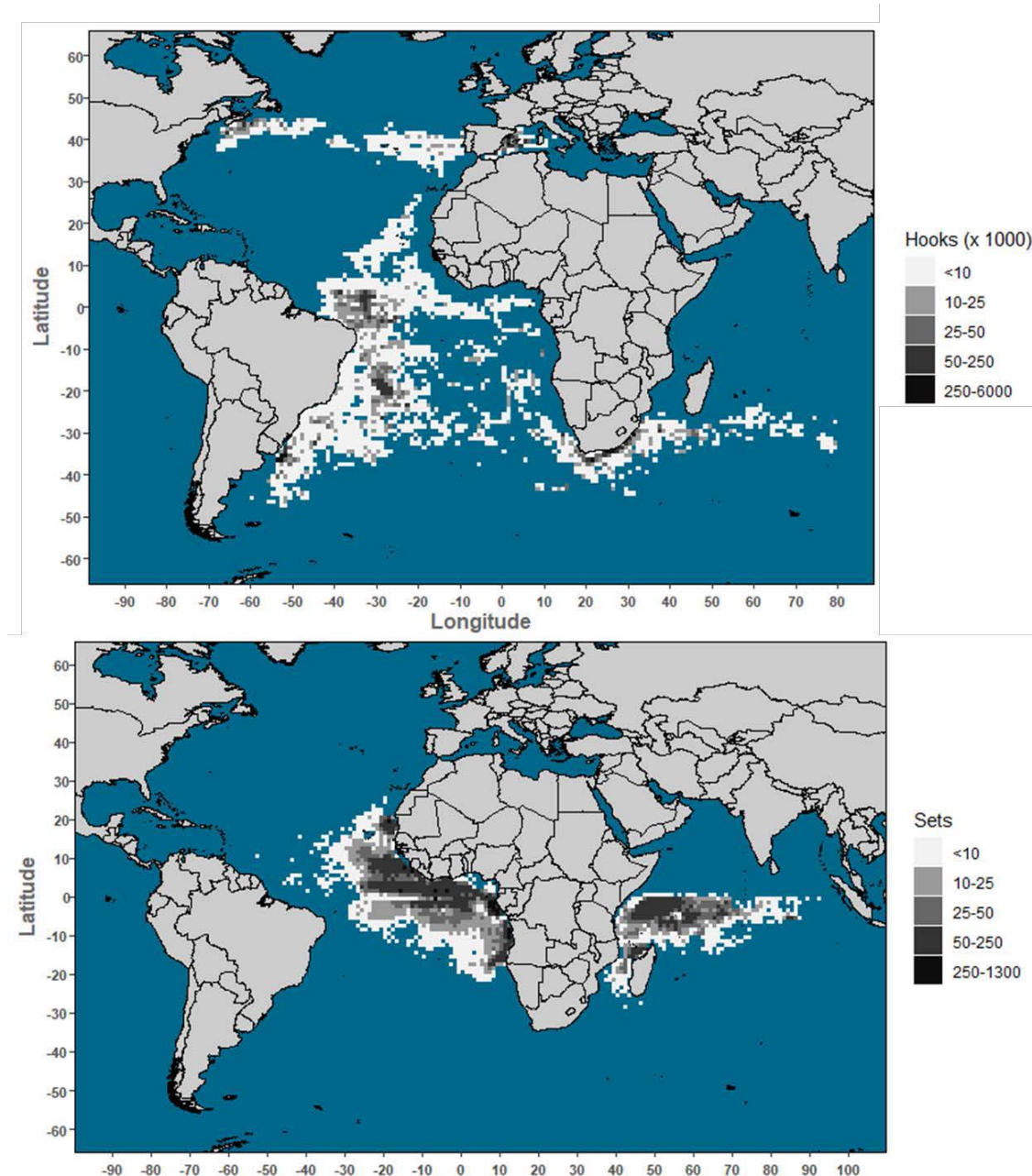


Figure 1. Distribution (resolution of 1x1 degree) of the observed nominal effort in pelagic longline fisheries (number of hooks) and purse-seine fisheries (number of sets) for fleets operating in the Atlantic and southern Indian Ocean over a period of 21 years (1998-2018). Longline data also include Mediterranean Sea. Data provided from onboard observers on pelagic fleets of Brazil, Canada, Portugal, South Africa, Spain and Uruguay and foreigner fleets (Japan, China and Spain) authorized to fish in the Economic Exclusive Zones (EEZs) of Brazil, Canada, South Africa and Uruguay. The data for the purse-seine fisheries was provided by France and Spain, and include vessels flagged to the Netherlands Antilles, Belize, Cabo Verde, Curaçao, El Salvador, Guatemala, Panama, Korea, Seychelles and St. Vincent and Grenadines.

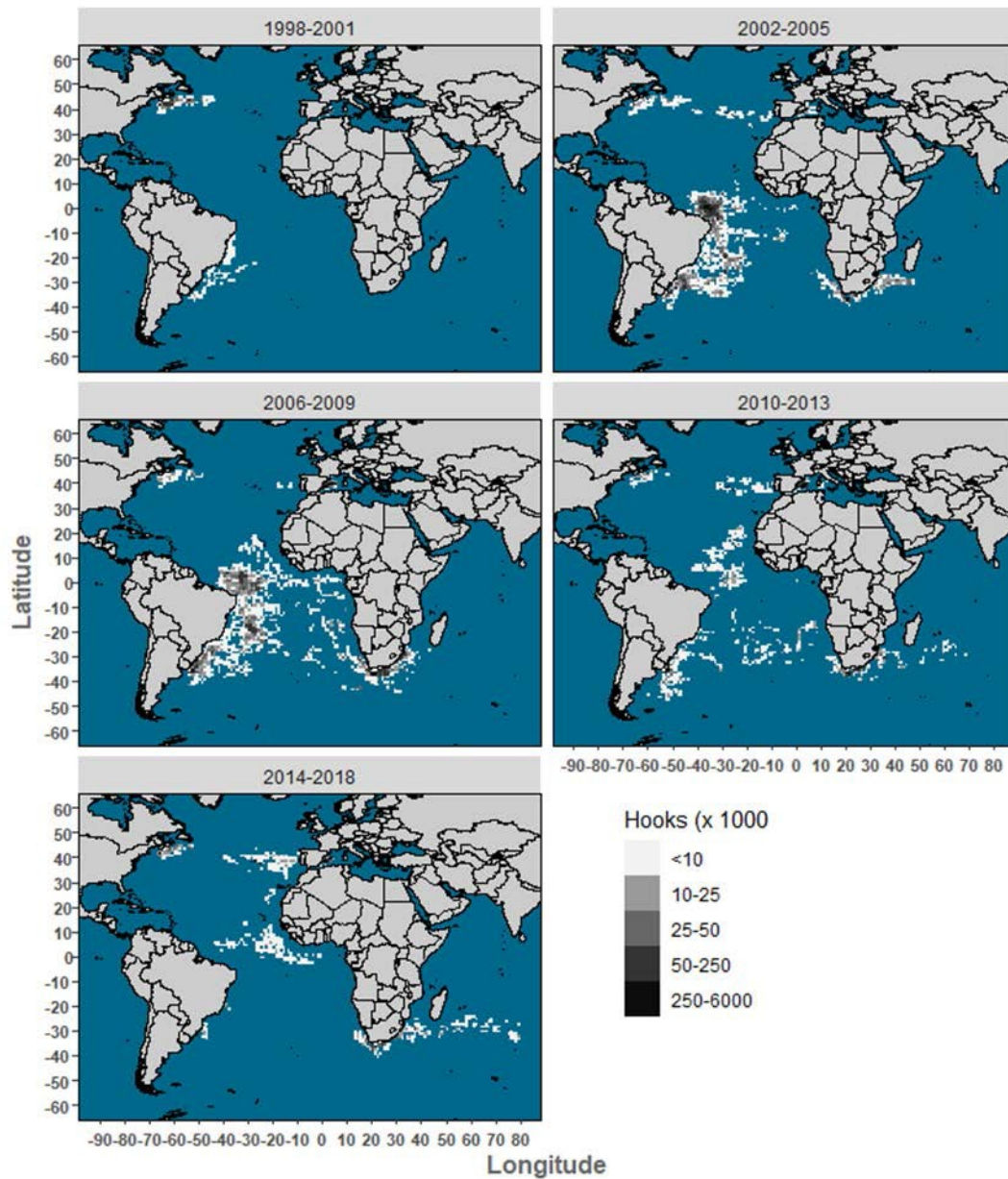


Figure 2. Spatio-temporal distribution (resolution of 1x1 degree) of the observed nominal effort for pelagic longline (number of hooks) fleets operating in the Atlantic and southern Indian Ocean over a period of 21 years (1998-2018) and Mediterranean seas. Data obtained by observers onboard pelagic longline fisheries from Brazil, Canada, Portugal, South Africa, Spain and Uruguay and foreigner fleets (Japan, China and Spain) authorized to fish in the Economic Exclusive Zones (EEZs) of Brazil, Canada, South Africa and Uruguay.

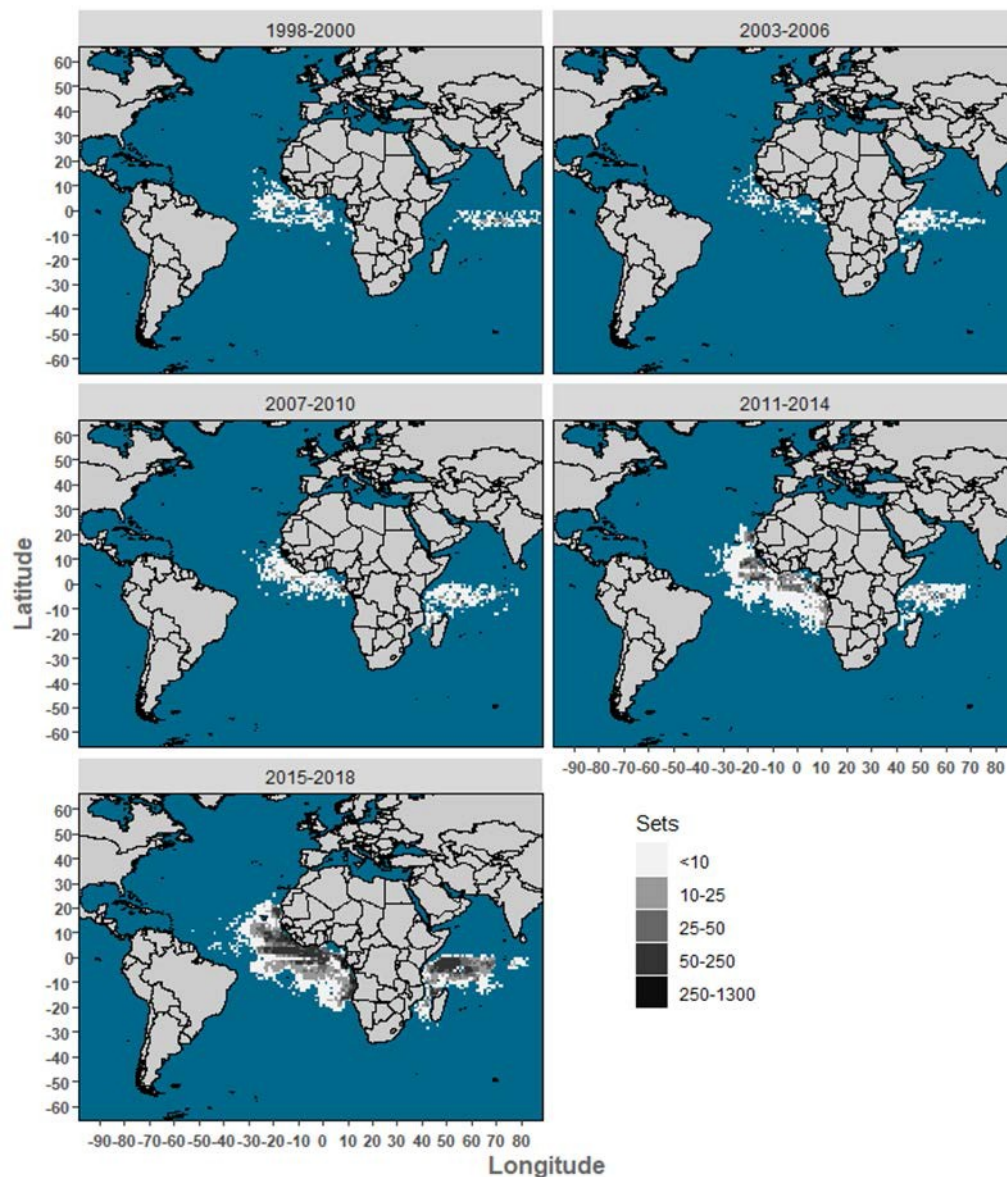


Figure 3. Spatio-temporal distribution (resolution of 1x1 degree) of the observed nominal effort for purse-seine (number of sets) fleets operating in the Atlantic and Southern Indian Ocean over a period of 21 years (1998-2018). Data obtained by observers onboard purse-seine fisheries from France and Spain, and include vessels flagged to the Netherlands Antilles, Belize, Cabo Verde, Curaçao, El Salvador, Guatemala, Panama, Korea, Seychelles and St. Vincent and Grenadines.

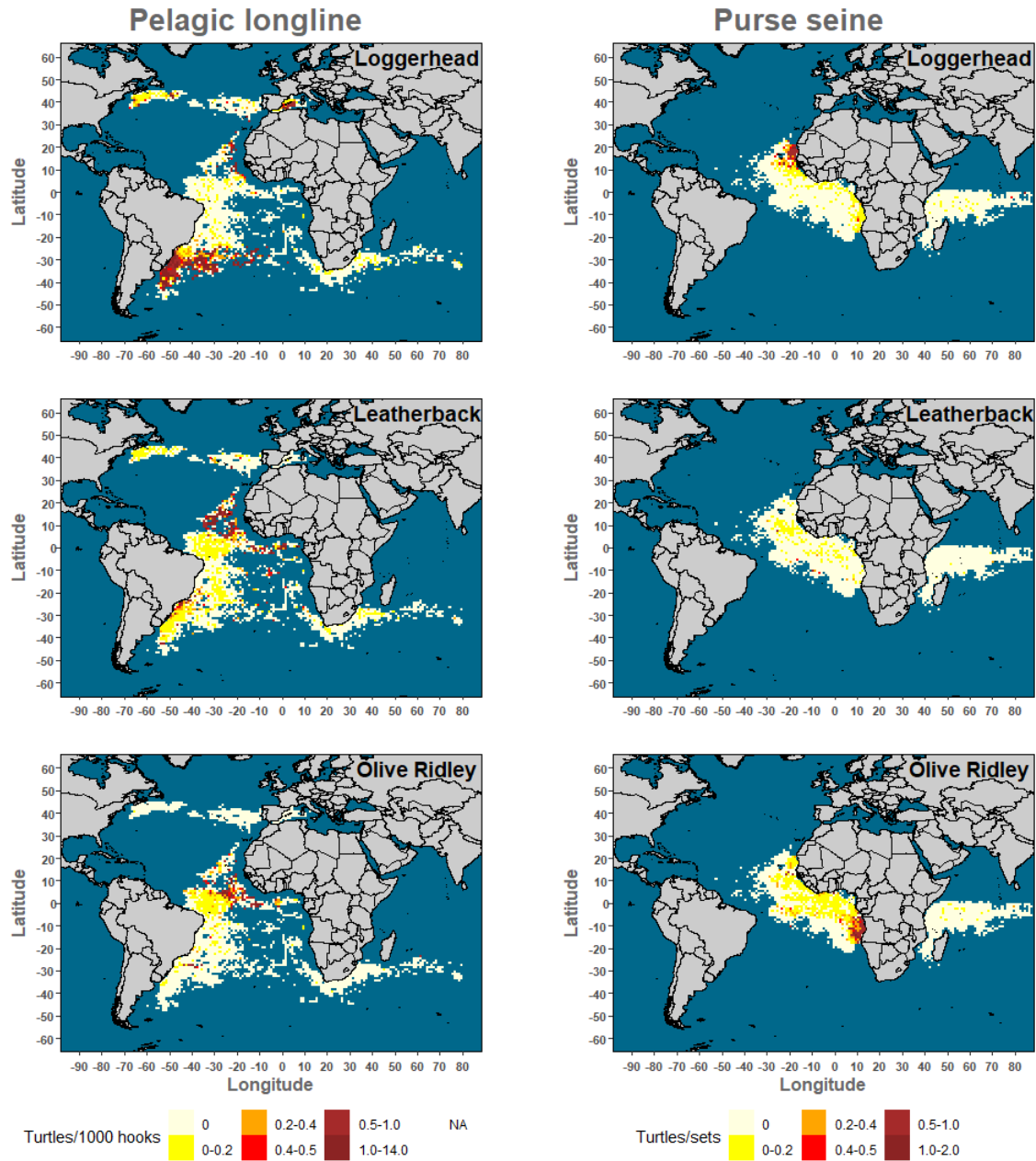


Figure 4. Distribution (resolution of 1x1 degree) of the observed nominal incidental catch rate of loggerhead, leatherback and Kemp's Ridley turtles in pelagic longline fisheries (catch rate= number of turtles/1000 hooks) and purse-seine fisheries (catch rate= number of turtles/sets) for fleets operating in the Atlantic and Southern Indian Oceans over a period of 21 years (1998-2018). Longline data also include Mediterranean Sea. Data provided from onboard observers on pelagic fleets of Brazil, Canada, Portugal, South Africa, Spain and Uruguay and foreigner fleets (Japan, China and Spain) authorized to fish in the Economic Exclusive Zones (EEZs) of Brazil, Canada, South Africa and Uruguay. The data for the purse-seine fisheries was provided by France and Spain, and include vessels flagged to the Netherlands Antilles, Belize, Cabo Verde, Curaçao, El Salvador, Guatemala, Panama, Korea, Seychelles and St. Vincent and Grenadines.

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Minimum catch and effort data requirements related to the incidental catch of marine turtles in pelagic longline fisheries

1. Trip ID
2. Set ID
3. Country
4. Vessel ID
5. Year
6. Month
7. Day
8. Latitude Exact position
9. Longitude Exact position
10. Target

Four categories in Target:

1. TUNA1: Deep longline fisheries targeting any tuna species, usually with small tuna hooks: e.g. Japanese fishery.
2. SWO2: Shallow longline fisheries targeting swordfish or sharks, usually with large J hooks: e.g. American type longline.
3. DOL3: Surface longline fisheries targeting dolphinfish, usually with small J hooks: e.g. Brazilian fishery.
4. Others

Items 11 to 14 are not parts of the minimum data requirement:

11. # of hooks per basket
12. Hook type
13. Light stick
14. Sea surface temperature
15. Total # of hooks
16. # of hooks observed
17. Loggerhead (*Caretta caretta*): Number of individuals captured
18. Leatherback (*Dermochelys coriacea*): Number of individuals captured
19. Olive Ridley (*Lepidochelys olivacea*): Number of individuals captured
20. Green (*Chelonia mydas*): Number of individuals captured
21. Hawksbill (*Eretmochelys imbricate*): Number of individuals captured
22. Unidentified turtles: Number of individuals captured
23. Kemp's Ridley (*Lepidochelys kempii*): Number of individuals captured

**Minimum catch and effort data requirements related to the incidental catch of
marine turtles in purse-seine fisheries**

1. Trip ID
2. Set ID
3. Country
4. Vessel ID
5. Year
6. Month
7. Day
8. Latitude Exact position
9. Longitude Exact position
10. Target
11. School type FOB or free schools
12. Sea surface temperature **not part of the minimum data requirement**
13. Unidentified turtle. NO Leatherback. Number of individuals captured

14. Loggerhead (*Caretta caretta*). Number of individuals captured
15. Leatherback (*Dermochelys coriacea*). Number of individuals captured
16. Olive Ridley (*Lepidochelys olivacea*). Number of individuals captured
17. Green (*Chelonia mydas*). Number of individuals captured
18. Hawksbill (*Eretmochelys imbricate*). Number of individuals captured
19. Unidentified turtles. Number of individuals captured
20. Kemp's Ridley (*Lepidochelys kempii*). Number of individuals captured

Minimum biological data requirements related to the incidental catch of marine turtles in pelagic longline and purse-seine fisheries

1. Trip ID
2. Set ID
3. Country
4. Species name
5. Condition dead/alive
6. Carapace length cm
7. Measurement type curve/straight