

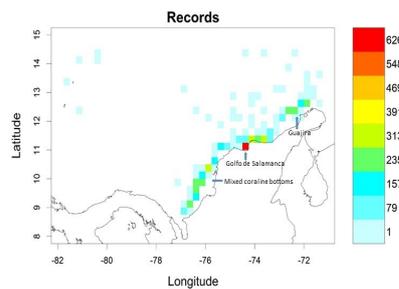
# Geographic patterns of Colombian Caribbean deep demersal fish species richness

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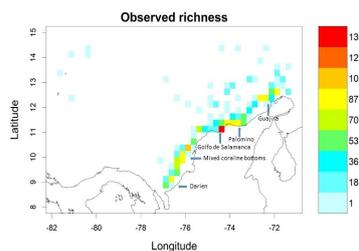
**OBJECTIVE:** We compiled georeferenced records of deep demersal fishes from the Colombian Caribbean Sea in order to assess the level of survey coverage and geographic completeness of species richness inventories.

**MATERIALS AND METHODS:** Georeferenced records of demersal deep fishes (> 200 m) were obtained from Polanco (2015), García and Armenteras (2015, see sources cited), García (2017), Acero et al. (2018), Polanco et al. (2019) and the Global Biodiversity Information Facility (GBIF 2020). A database was constructed with the software ModestR (García-Rosello et al. 2013). The study area, i.e. the Colombian Caribbean EEZ, was divided into spatial cells of size 15 minutes (circa 28 km) by 15 minutes. In order to conduct a search of well and poorly surveyed cells we used the module KnowBR (Lobo et al. 2018; Guisande and Lobo 2019) of the application RWizard (Guisande 2014) designed for such task.

**RESULT 1:** A total of 362 species and 6211 records are the basis of the analysis. Sampling effort is uneven. Taking into account that the cells depicted are the ones with at least one record, it follows that most of the study area had never been visited. The Colombian Caribbean EEZ below 200 m amounts to circa 385000 km<sup>2</sup> while the added cell area is 65072 km<sup>2</sup>, so around 83% of the deep sea bottom has never been visited.

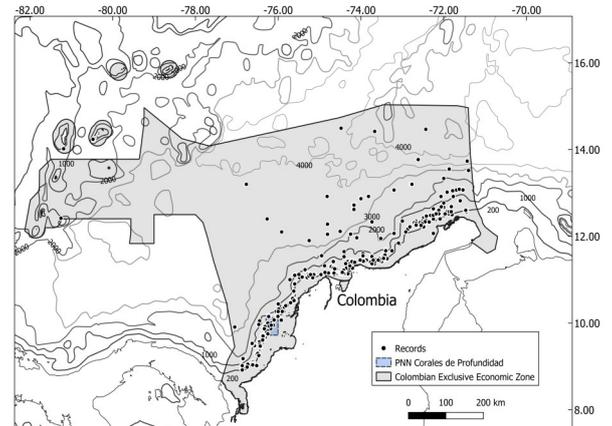


**RESULT 2** Observed richness closely followed the distribution pattern of records in cells with a correlation of 0.9 (Pearson index,  $p < 0.001$ ). The Darien area is added as harboring a high number of demersal fish species

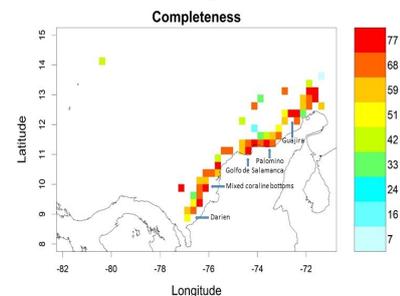


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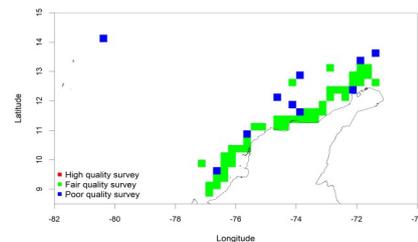
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**RESULT 3:** Completeness ranged from 6.9 % to 76.9 % in cells with 75.9 % of them (41 out of 54 informative cells) showing completeness above 50%; but notice that no cell reached 100 % completeness.



**RESULT 4:** No cell attains the status of “high quality survey”; but most cells were labeled as “fair quality survey” cells with a number of interspersed “poor quality survey” cells.



**CONCLUSION:** The scarceness of samples in depths beyond 1000 m clearly points to the need of increased survey efforts, including for those unexplored areas as well as renewed survey efforts in areas visited in the past, as even the upper slope that has received most records is at best “fairly-sampled” according to the criteria here and at our spatial scale. Nevertheless, this study reveals a rich deep sea fish fauna taking into account that the 362 species in our database are a lower limit of species richness. In view of the results it is probably risky to postulate areas for conservation purposes. Observed richness, however, suggests continental slope areas adjacent to the Gulf of Salamanca, the Rosario Island archipelago, slope areas to the north of the Guajira Peninsula and Darien as locations of accumulation of species. As derived from this assessment, much work remains to be done if we are to protect deep sea fish diversity from threats like deep sea fishing and offshore developments for oil and natural gas.