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## MODERN DISTRIBUTION OF THE HUMPBACK WHALE (MEGAPTERA NOVAEANGLIAE) IN POORLY-STUDIED AREAS OF THE NORTHWEST ATLANTIC

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INTERNATIONAL
WHALING COMMISSION

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**Abstract**

Most current humpback whale (*Megaptera novaeangliae*) research in the Caribbean has focused on the Dominican Republic due to the greater abundance of whales in that area, while the remainder of the Wider Caribbean Region remains poorly studied in contrast. For the Southern Gulf of Mexico, Southern Caribbean, South-eastern Caribbean, Central America, and The Guianas, we reviewed published and gray literature, online biodiversity platforms (OBIS SEAMAP, GBIF), social media, news sites, and our field books. A total of 228 records were compiled for 1913-2023. These included sightings (60.1%), intentional takes (20.2%), strandings (3.9%), acoustic detections (15.4%), and bycatch (0.4%). Scientific activities and citizen-based contributions generated 81.1% and 18.9% of the records, respectively. Most of the records (82.8%) were concentrated in the Southern (54.6%) and South-eastern Caribbean (28.2%). The presence of humpback whales in the ABC islands, Venezuela, and French Guiana in the period August-November is consistent with the presence of humpbacks from the Southern Hemisphere on their breeding grounds in tropical waters. Documented threats to the humpback whale in the study area include bycatch, direct takes, and disturbance from maritime traffic and oil and gas activities. Our findings provide evidence that humpback whales from both the northern and southern Hemispheres may utilize the waters of the Guianas region, the ABC Islands, and Venezuela, during their respective wintering seasons, highlighting the need for increased monitoring and research efforts.

## Introduction

Humpback whales (*Megaptera novaeangliae*) from the North Atlantic Ocean migrate south to calving grounds in the West Indies region (Winn et al. 1975; Whitehead and Moore 1982; Stevick et al. 1998; Smith et al. 1999). Historical records from the "American" whaling industry demonstrated that humpback whales were formerly common throughout the Lesser Antilles, along the Caribbean coast of Venezuela, in the Gulf of Paria (located in northeast South America, shared between Trinidad and Tobago, and Venezuela), and along the southern coast of Trinidad during January through May but, currently, most aggregation occur on the Silver Bank, Navidad Bank, and Samana Bay, in the northern coast of the Dominican Republic (Reeves et al. 2001). The calving peak for the species is January through March, with some animals arriving as early as December and a few not leaving until June (e.g., Stevick et al. 2018; Heenehan et al. 2019). Recent research demonstrates that humpback whales wintering in the West Indies belong to at least two distinct populations from the Northeastern and Northwestern Atlantic that distribute themselves throughout the region during the winter (Kennedy et al., 2014; Stevick et al., 2018). In general, humpback whales generally are not expected in the Caribbean during summer-autumn months (June-November) since they should already be found further north on their feeding grounds.

Most of the research efforts on the humpback whale in the Caribbean Sea have been focused on the northern part of the Antilles (i.e., Greater Antilles; Kennedy and Clapham, 2017) and, more recently, on the northern-central part of the Antilles, around the French islands (Stevick et al., 2018). According to these authors (Reeves et al., 2001; Kennedy and Clapham, 2017; Stevick et al., 2018), the remaining areas of the region can be considered as "poorly and sporadically studied". In addition, a comparison between historical records from the 19$^{th}$ century whaling operations of the American whaling fleet with modern records (last four decades) indicates that the Lesser Antilles host a lower density of whales than was apparent in the 19$^{th}$ century (Reeves et al, 2001; Swartz et al., 2001, 2003). Thus, this review focused on those other areas of the Wider Caribbean Region (defined below) where humpback whale occurrence is less understood, including 1) the southern Gulf of Mexico, 2) Central America, 3) the Southern Caribbean, 4) the South-eastern Caribbean, and 5) the Guianas.

## Material and Methods

### Study area

For this study, we focused on five regions of the Northwest Atlantic for which the information is scarce and fragmented (Reeves et al., 2001; Swartz et al., 2001, 2003; Stevick et al., 2018): 1) Southern Gulf of Mexico (Mexican side of the Gulf of Mexico); 2) Central America (Strait of Yucatán to Panamá, including the Mexican Caribbean, Belize, Guatemala, Honduras, Nicaragua, Costa Rica, and Panama); 3) Southern Caribbean (Colombia, Venezuela, Aruba, Bonaire, Curacao, and Trinidad and Tobago; 4) the South-eastern Caribbean (St. Lucia, St. Vincent and the Grenadines (SVG), Barbados, and Grenada); and 5) the Guianas (, Guyana, Surinam, and the French Guiana, including the Orinoco Delta platform) (Fig. 1).

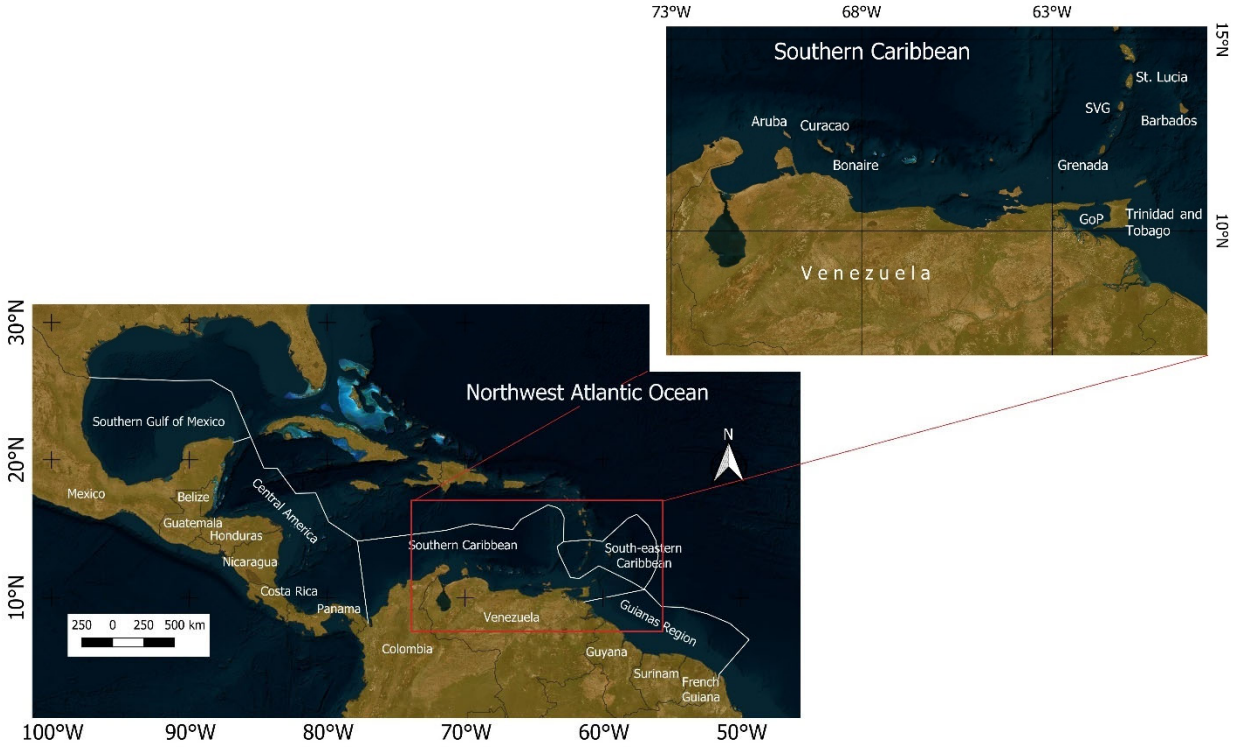


**Figure 1.** Distribution area, indicating regions and states. GoP = Gulf of Paria; SVG = St. Vincent and the Grenadines.

## Records

Our general methodology follows Jefferson et al. (2009); Bolaños-Jiménez et al. (2014, 2021, 2023). We reviewed published and gray literature, online biodiversity platforms (e.g., OBIS-SEAMAP, GBIF, Pelagis Observatory), news sites, and coauthors' field notebooks for confirmed records of humpback whales. Whenever available, we included records from large and small-scale, vessel-based surveys (Swartz and Burks, 2000; Swartz et al. 2001, 2003; Silva et al., 2008; Acevedo et al., 2008; Yoshida et al., 2010; Weir et al., 2011) and aerial surveys (Geelhoed et al., 2013). Following Bolaños-Jiménez et al. (2023), the records were defined as sightings (i.e., encounters with whales at sea), strandings (live or dead stranded animals), takes (i.e., sightings that resulted in the intentional take of a whale) and acoustic (included either underwater detections by swimmers or divers, when the whales were not actually sighted, and detections of humpback whale sound by means of hydrophones). Data records of takes in the aboriginal hunt in Bequia reported by St. Vincent and the Grenadines were downloaded from the International Whaling Commission website[1]. We summarized all of the available records in a single dataset for mapping purposes and statistical analysis. We used the freely available Geographical Information System QGIS v3.22 (QGis.org 2022) to visualize the geographical distribution of records. The spatial occurrence of records was evaluated in the terms of the pre-defined regions and countries/territories. Following Bolaños-Jiménez et al. (2014), the temporal occurrence was evaluated by month and season. Seasons were defined as spring: 1 March–31 May, summer: 1 June–31 August, autumn: 1 September–30 November, and winter: 1 December–28 February (McIntosh, 1963; Bolaños-Jiménez et al., 2014). In general, events that occurred on different days were treated as independent events, with the exception of an entanglement recorded in Guatemala of an individual that was posteriorly stranded in Belize in 2016 (see below).

Following Bolaños-Jiménez et al. (2023), the records were classified as originating from (1) scientific projects or activities and (2) citizen science-based initiatives. Thus, "Scientific projects or activities included gray or published literature, research surveys, reviews of logbooks from whaling ships operating in the 19th and 20th centuries in the North Atlantic and the Caribbean Sea, online biodiversity information systems, and records available in field notebooks from

[1] https://iwc.int/management-and-conservation/whaling/total-catches

researchers. Citizen science included any multimedia material shared on social media or uploaded to video-hosting websites, as well as records provided by organized initiatives from the public, naturalists, whale watchers, and so on (Bolaños-Jiménez et al., 2023).

## Results

We compiled 228 records covering the period 1913-2023 (Fig. 2). Peaks in the number of data records were detected in the years 2000, 2002, 2012, and 2017 (n = 55, 15, 12, and 20, respectively, Fig. 2).

Out of these records, 185 (81.1%) originated from scientific projects or activities, and 43 (18.9%) from citizen science. Records included 137 sightings (60.1%), 46 intentional takes (20.2%), 9 strandings (3.9%), one bycatch (0.4%), and 35 acoustic detections (15.4%) (Fig. 3). All the intentional takes corresponded to 46 takes reported to the International Whaling Commission (IWC) by the Government of St. Vincent and the Grenadines[2] (SVG)

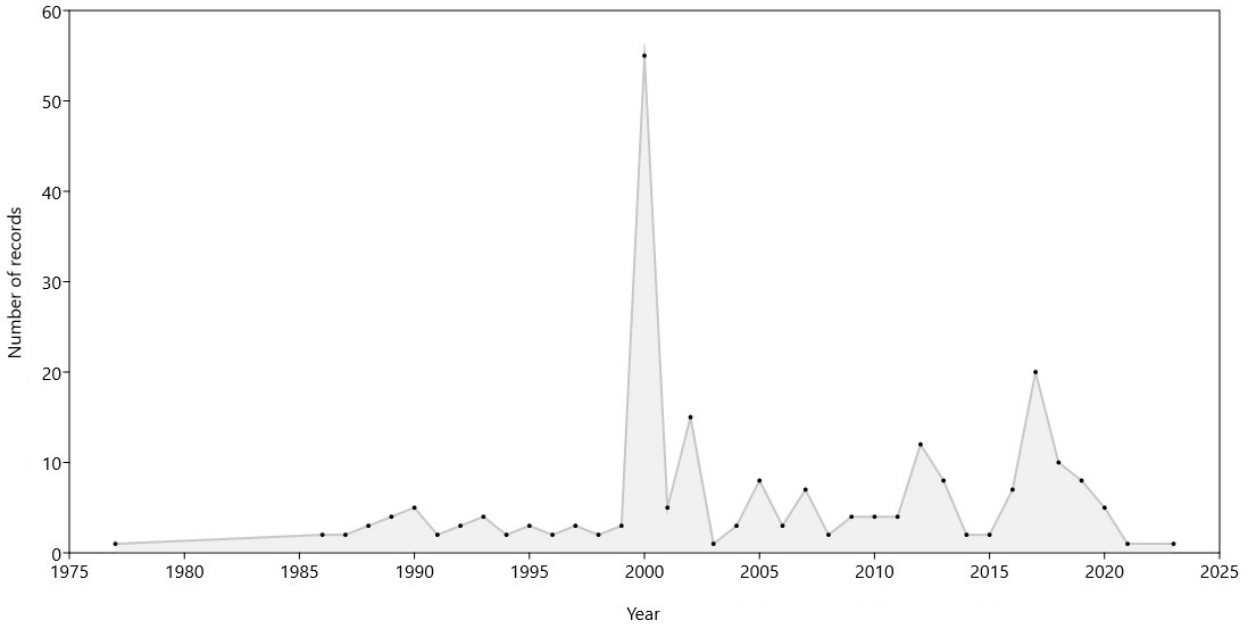


**Figure 2.** Yearly distribution of humpback whale records in poorly-studied regions of the Wider Caribbean Region.

[2] https://iwc.int/management-and-conservation/whaling/total-catches

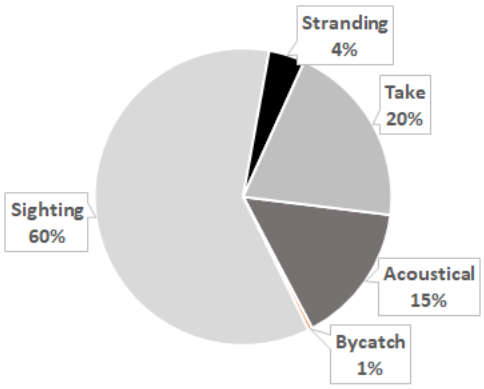


**Figure 3.** Records (by type) of the humpback whale in poorly-studied areas of the Wider Caribbean Region.

## Spatial Distribution

Most records were distributed in the Southern (54.6%), and South-eastern Caribbean (28.2%), followed by the Guianas (15.0%), Central America (1.3%), and Southern Gulf of Mexico (0.9%) (Fig. 4). Most of the records were concentrated in Venezuela (25.6%), St. Vincent and the Grenadines (20.3%), the ABC Islands (Aruba, Bonaire, Curacao; 15.9%) and French Guiana (14.5%) (Fig. 4). There was only one individual whale recorded from Central America. This was an emaciated, lone individual that was seen several times in Guatemalan and Belizean waters between January-April 2016. This individual was entangled in a trammel net, and subsequently stranded in Belize on 25 April 2016 (Ramos et al., 2016; Ortiz-Wolford et al., 2022).

## Seasonal distribution

Data on the month (thereby season) occurrence of records was available for only 180 records. Humpback whales were recorded during all the months, with peaks during February-March ($n$ = 93, 51.7%) and October-November ($n$ = 34, 18.9%) (Figure 5, upper). Seasonally, there were more records in the spring ($n$ = 79, 42.8%) and winter ($n$ = 50, 26.7%, Figure 5, lower), with a very low proportion of records in the summer ($n$ = 12, 6.7%). The monthly distribution of records by region showed a predominance in the Southern Caribbean for the first semester of the year (winter-spring) and in the Guianas for the second one (summer-autumn) (Fig. 7).

**General aspects**

The group size was reported on 214 cases. The number of whales per sighting encounter, including calves, averaged 1.6 individuals (range: 1-10, SD: 1.35, Mode = 1). Cow-calf pairs were reported for n = 18 records (8.3%).

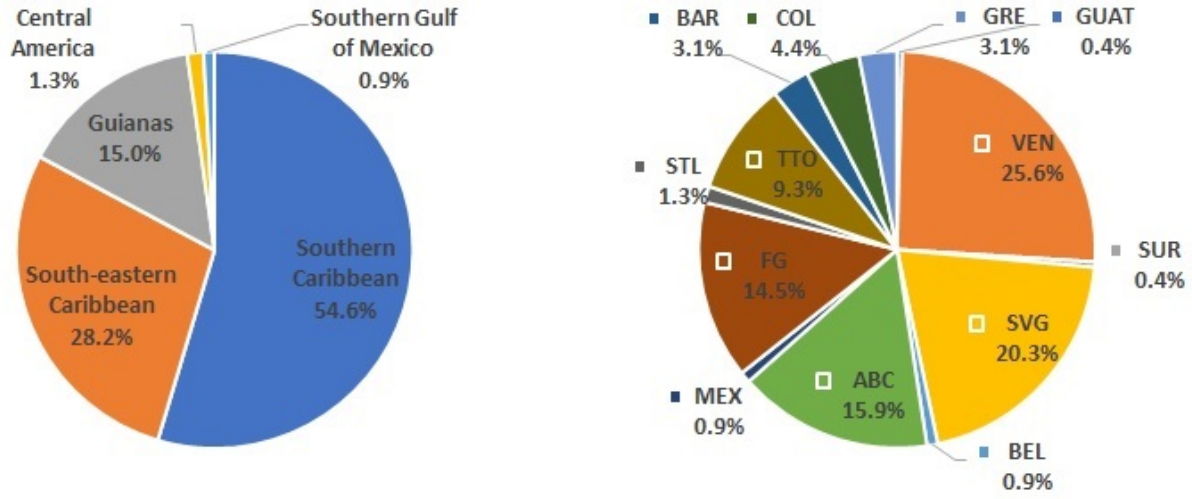


**Figure 4.** Spatial distribution of humpback whale records in poorly studied regions of the Northwest Atlantic Ocean. ABC = Aruba, Bonaire, and Curacao, (Dutch Antilles), BAR = Barbados, BEL = Belize, COL = Colombia, FG = French Guiana, GRE = Grenada, GUAT = Guatemala, MEX = Mexico, STL = St. Lucia, SVG = St. Vincent and the Grenadines, SUR = Surinam, TTO = Trinidad and Tobago, VEN = Venezuela.

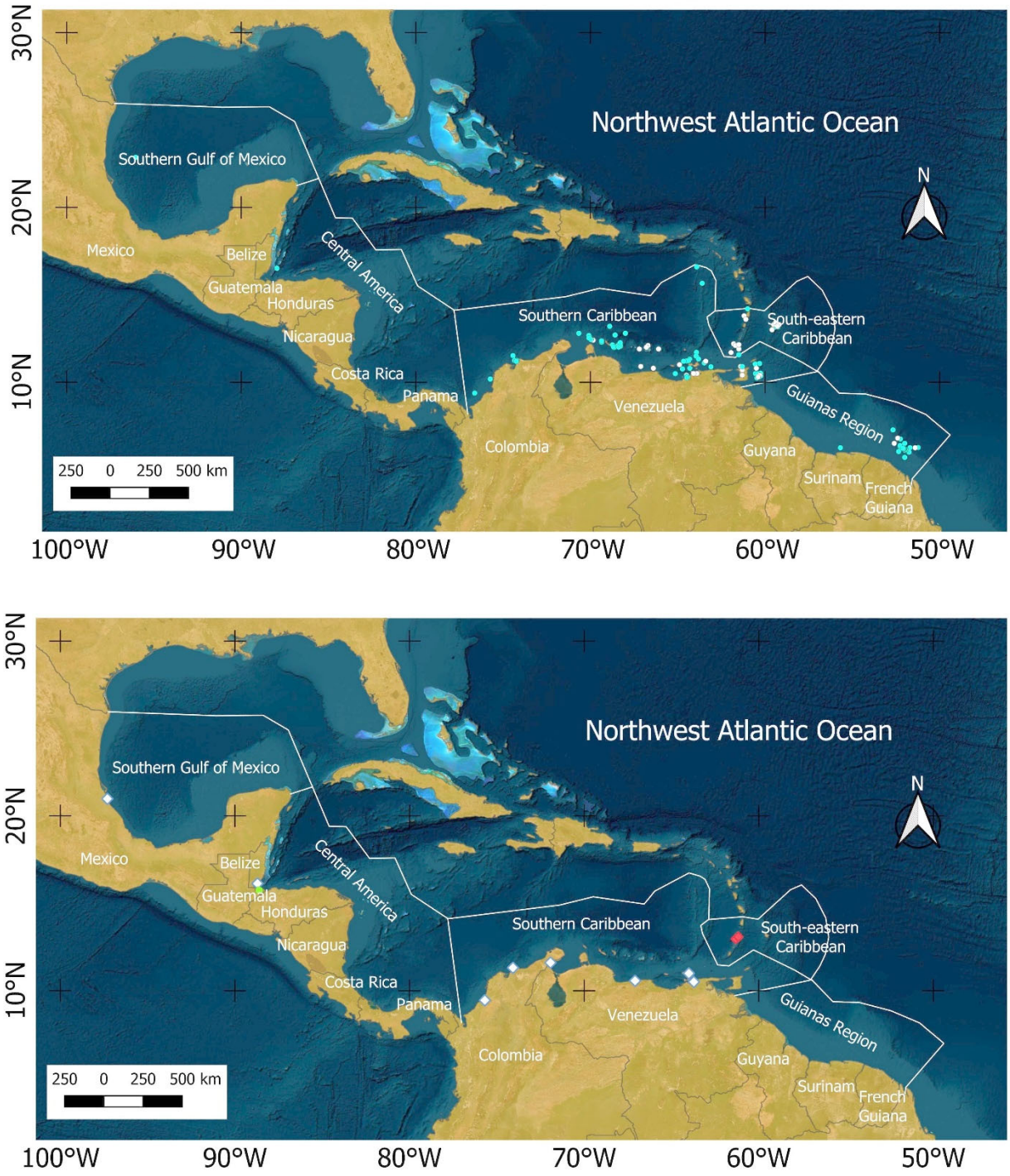


**Figure 5.** Distribution of humpback whale records in poorly-studied areas of the Northwest Atlantic Ocean. Upper: sightings (light blue dots) and acoustic (white dots) records. Lower: strandings (white diamonds), and bycatch (green circle) records; the red diamonds indicate 46 intentional takes in Bequia, St. Vincent and the Grenadines, documented between 1986-2021.

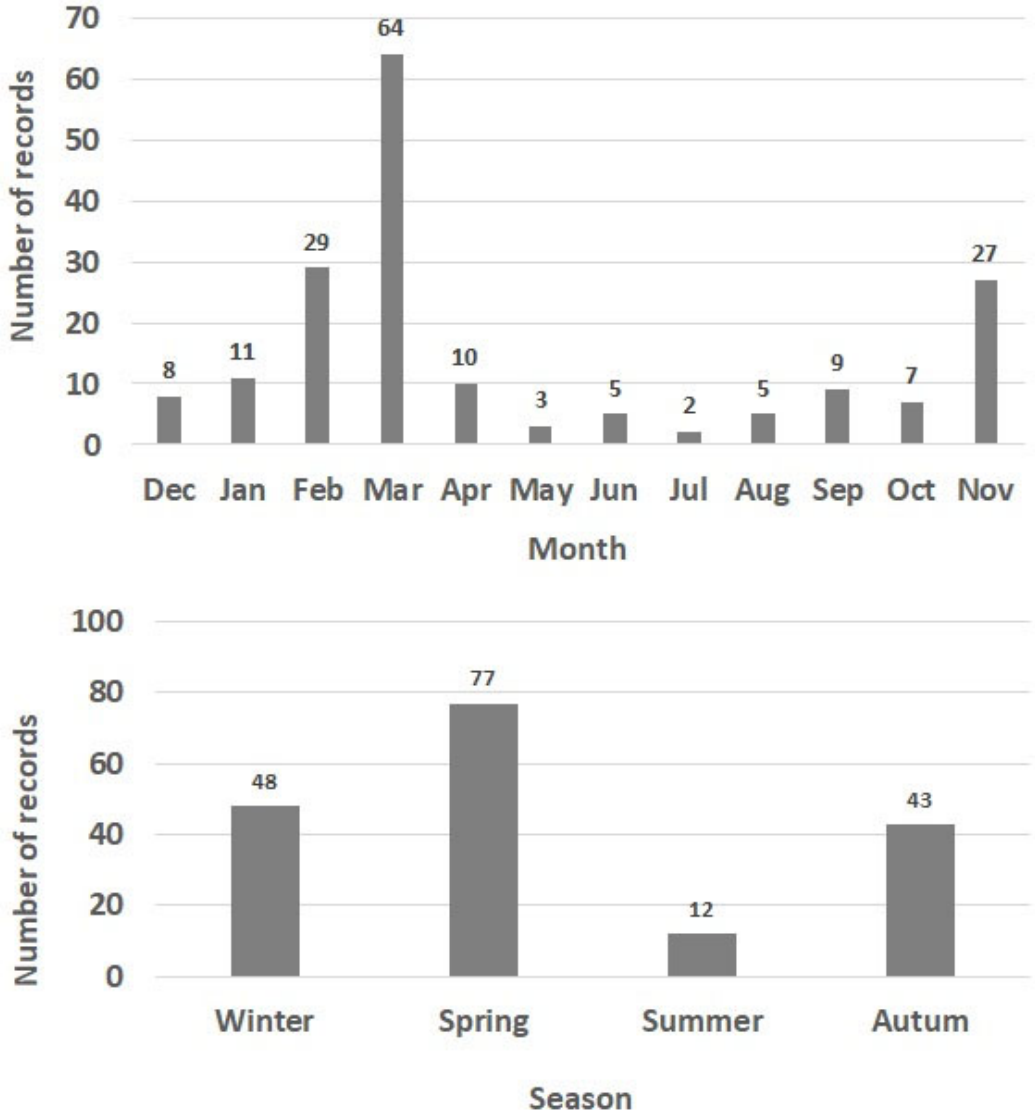


**Figure 6**. Monthly (upper) and seasonal (lower) distribution of humpback whale records in poorly-studied areas of the Wider Caribbean Region. ($n$ = 180 records for which the month is available). Winter = December-January; Spring = February-April, Summer = May-July, Autumn = August-November.

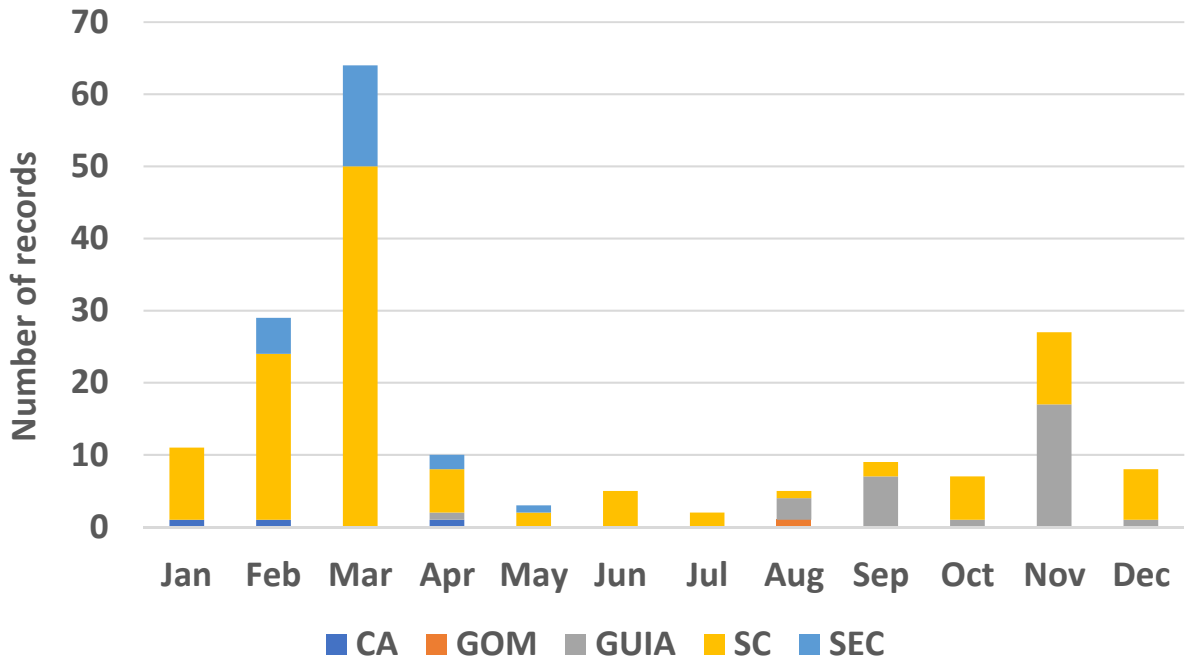


**Figure 7.** Monthly-Regional distribution of records of the humpback whale in poorly studied regions of the Northwest Atlantic. CA = Central America, GOM = Gulf of Mexico, GUIA = Guianas, SC = Southern Caribbean, SEC = South-eastern Caribbean.

**Discussion**

The present study summarizes most of the available knowledge on the presence of the humpback whale in poorly studied regions of the Northwest Atlantic and contributes to documenting some specific threats. These include regions where a review of historical whaling logs revealed humpback whales once were abundant during the 19th Century (Reeves et al., 2001). For example, humpback whales were abundant in the Gulf of Paria (Fig. 1) between the 1830s to the1880s but recent surveys (Swartz et al., 2001, 2003) nor our data found evidence of its presence in recent times. Failure of the humpback whale to reoccupy this ecosystem may have occurred because of disturbance, noise, and heavy ship traffic associated with current oil and gas activities inside the gulf (Swartz et al., 2003)

Our research found a great proportion of records for the Southern and South-eastern Caribbean and a very low one in Central America. The higher number of records in the Southern Caribbean is most probably related to both scientific activities (Silva et al., 2006; Acevedo et al., 2008) and solid, long-lasting alliances between local researchers and citizen scientists in Venezuela and the ABC islands (Bolaños-Jiménez and Henriquez, pers. obs.). The high proportion of records in the South-eastern Caribbean is related to the systematic reporting of the government to the International Whaling Commission about aboriginal captures in Bequia, SVG. Conversely, the low number of records in Central America is consistent with previous findings on the killer (*Orcinus orca*), false killer (*Pseudorca crassidens*), pilot (*Globicephala* sp.), and minke (*Balaenoptera acutorostrata*) whales (Bolaños-Jiménez et al., 2014, 2021, 2023; Alvarado Hofmeister, 2021; Valencia Cubillos, 2022) and is probably related to lower densities, lower maritime traffic, lower research effort or a combination of any of these.

It is generally considered that most individual humpback whales in this study area originate primarily from the North Atlantic population. This is partially supported by the seasonality of our records. There are also photo-matched individuals that support a North Atlantic origin for Caribbean sightings. Robbins et al. (2006) reported that two humpback whales were taken in an aboriginal hunt on 6 March 1999 at SVG; the adult was photo-matched as 'Haar' (NAHWC #0694), a cataloged whale from the Gulf of Maine, and the second individual was likely a calf based on reported size. Lastly, Stevick et al. (1999) reported on an individual photographed on 16 March 1996 off Grenada (South-eastern Caribbean) that matched an individual recorded off Greenland in August 1981 and 1982. The presence of humpback whales throughout the year in the Caribbean, especially during the months of the Austral winter and spring (June-November), however, is consistent with the presence of whales from the Southern Hemisphere, which was previously suggested by Martinez et al. (2019) and Pusineri et al. (2021). Based on the seasonality of those published records and the overlap with the humpback whales' migratory timing, those authors speculated these individuals were likely part of the Southern Hemisphere population classified by the IWC as Breeding Stock 'A' that has a peak abundance off north-eastern Brazil during August-November (Zerbini et al. 2004; Andriolo et al., 2010).

Based on the presence of humpback whales in April in Surinam (de Boer and Willems, 2015) and Brazil, Ristau et al. (2020) suggested that humpbacks from the "A" stock are expanding their

range into the Northern Hemisphere and that humpbacks from the Northern hemisphere are expanding their range into the Southern Hemisphere, such as was foreseen by Reeves et al. (2001). Our results agree with this scenario and reinforce that humpback whales from both hemispheres may be sharing the same areas of the WCR in different seasons of the year (Ristau et al., 2020) similar to instances of humpbacks off the Pacific coast of Costa Rica (Acevedo and Smultea, 1995; Rasmussen et al., 2007).

For this review, more than 80% of the data records were related to increased, focal research surveys on humpback whales (Swartz and Burks, 2001, 2003; Silva et al., 2006; Acevedo et al., 2008) and cetaceans in general (Anonymous, 2012; Van Caneyt et al., 2019; Martinez et al., 2019; Chávez-Andrade et al., 2023). This is in contrast with other regional (Caribbean Sea) cetacean reviews (Bolaños-Jiménez et al., 2014, 2021, 2023), for which an important number of records came from the public through so-called Citizen-science.

Documented threats to the humpback whale included bycatch, direct takes, and increased maritime traffic and noise related to oil and gas operations, emphasizing the need for increased research and monitoring of the population status, migratory and local movements, and stock identity, among others.

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