

# Short Communication: First documented humpback whale (*Megaptera novaeangliae*) photo-identification match and round-trip migration between Iceland and the Turks and Caicos Islands

CATHY E. BACON<sup>1</sup>, KATHARINE A. HART<sup>1,2</sup>, TED CHEESEMAN<sup>3,4</sup>, LEE MUNSON<sup>5</sup>,  
MARIANNE H. RASMUSSEN<sup>6</sup>, VALERIE CHOSSON<sup>7</sup> AND CHARLA J. BASRAN<sup>6</sup>

Contact email: [tcιωhales@gmail.com](mailto:tcιωhales@gmail.com)

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## ABSTRACT

In the North Atlantic, some humpback whales (*Megaptera novaeangliae*) from the Icelandic feeding grounds are known to migrate to the breeding grounds in the West Indies. The Turks and Caicos Islands (TCI) are historically considered part of the larger breeding range; however, very little humpback whale data has been reported for TCI and there have been no previously confirmed matches or round-trip migrations to the Icelandic feeding grounds. Here, we present the first documented photo-identification match and round-trip migration of a humpback whale between Iceland and the TCI.

**KEYWORDS:** HUMPBACK WHALE; MIGRATION; PHOTO-ID; ATLANTIC OCEAN; TURKS AND CAICOS ISLANDS; BREEDING GROUNDS; ICELAND; FEEDING GROUNDS

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The majority of humpback whales (*Megaptera novaeangliae*) make annual migrations following direct routes that are spatially and temporally distinct in the North Atlantic; however, these patterns are often poorly understood (Stevick *et al.*, 2003; Horton *et al.*, 2011). North Atlantic humpback whales migrate south to mate and calve in breeding grounds in the West Indies each winter and return to their northern feeding grounds (primarily the Gulf of Maine, Norway, Iceland, West Greenland, Newfoundland and Labrador) each spring (Winn *et al.*, 1975; Mattila *et al.*, 1989; Katona and Beard, 1990; Clapham and Mattila, 1990; Smith *et al.*, 1999; Stevick *et al.*, 2003). Individuals breed and calve around the Turks and Caicos Islands (TCI) (Hart and Bacon, 2022) (including Mouchoir Bank) and in other areas in the Caribbean (such as Silver Bank, Navidad Bank and Samaná Bay – Dominican Republic) (Winn *et al.*, 1975; Balcomb and Nichols, 1982; Whitehead and Moore, 1982; Mattila *et al.*, 1989; 1994; Swartz *et al.*, 2002; Betancourt *et al.*, 2012; Kennedy *et al.*, 2014), where they spend time in the shallow waters near islands and offshore banks (Balcomb and Nichols, 1978; Whitehead and Moore, 1982). Lower numbers of individuals have been reported in adjacent waters to the east, including Mona Passage (Puerto Rico) (Winn *et al.*, 1970; 1975; Mattila and Clapham, 1989; Mignucci-Giannoni, 1998; Smith *et al.*, 1999; Swartz

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<sup>1</sup> Turks and Caicos Islands Whale Project, Grand Turk, Turks and Caicos Islands.

<sup>2</sup> Deep Blue Charters, Grand Turk, Turks and Caicos Islands.

<sup>3</sup> Marine Ecology Research Centre, Southern Cross University, Australia.

<sup>4</sup> Happywhale, Santa Cruz, California, USA.

<sup>5</sup> Big Blue Collective, Providenciales, Turks and Caicos Islands.

<sup>6</sup> University of Iceland, Húsavík Research Center, Húsavík, Iceland.

<sup>7</sup> Marine and Freshwater Research Institute, Hafnarfjörður, Iceland.

*et al.*, 2002; 2003; MacKay *et al.*, 2016; 2019), Virgin Bank and Anguilla Bank (Winn *et al.*, 1975; Mitchell and Reeves, 1983; Mattila and Clapham, 1989; Swartz *et al.*, 2003; Fossette *et al.*, 2014; Kennedy *et al.*, 2014) and Guadeloupe (Rinaldi *et al.*, 2009; Gandilhon, 2012; Kennedy *et al.*, 2014; Stevick *et al.*, 2018). The entire West Indies Chain from Cuba and the TCI to Venezuela is widely treated as a single breeding population (Fleming and Jackson, 2011; Bettridge *et al.*, 2015; Stevick *et al.*, 2018); however, unlike the Dominican Republic and Puerto Rico, research on humpback whales around the TCI is extremely limited.

The TCI are an archipelago of numerous low-lying coral islands divided into two groups: the larger Caicos Islands and the smaller Turks Islands, each surrounded by a continuous ring of reefs (Mills, 2008). From late December to early April, humpback whales are known to occur around these islands, where they typically follow the Caicos Passage and Turks Island Passage, moving along the reef contour of the North Shore of the Caicos Bank from west to east in the early part of the breeding season. The waters around these banks are prime breeding habitat for humpback whales, as they prefer shallow, warm water commonly near offshore reef systems or shores (Katona and Beard, 1990; MacKay *et al.*, 2016; Hart and Bacon, 2022).

Deep Blue Charters, a whale watch company in Grand Turk, began taking photo-identification (photo-ID) images in February 2019. In December 2021, the Turks and Caicos Islands Whale Project (TCIWP), under Scientific Research Permit # 2021-12-29-26, in collaboration with the Department of the Environment and Coastal Resources of the TCI Government and Deep Blue Charters, established the Turks and Caicos Islands Humpback Whale Catalogue (TCIHWC) for photo-ID and scientific research. Contributions of humpback whale sightings and photographs from other whale watching operators and guests have proved to be extremely valuable to the TCIWP. To date, the TCIWP has catalogued over 430 individuals in the TCIHWC (TCIWP unpublished data).

Previous small- and large-scale humpback whale projects have included limited portions of the TCI during surveys (e.g., Winn *et al.*, 1970; 1975; Balcomb and Nichols, 1978; Winn and Winn, 1978; Scott and Winn, 1979; Clapham and Mattila, 1990; Smith *et al.*, 1999; Swartz *et al.*, 2002); however, these projects reported low abundance and are now outdated. No other documented intensive humpback whale photo-ID or research has previously taken place primarily in the TCI. Significantly, whale watching in the TCI did not start until humpback whales began to be seen close to shore in the late 1990s (Hoyt, 1999; Hoyt and Hvenegaard, 2002).

Iceland, situated in the North Atlantic Ocean on the edge of the Arctic Ocean, is a well-known and well-studied humpback whale feeding area (Víkingsson *et al.*, 2004). The estimated summer abundance of humpback whales in the central North Atlantic (with the majority of sightings in Icelandic waters) is 10,000 individuals (Pike *et al.*, 2019). Primarily between May and September, humpback whales are frequently found feeding on krill and small schooling fish in the shallow coastal waters of Iceland's bays and fjords (Víkingsson *et al.*, 2004). Through photo-ID of the unique pigmentation pattern on the ventral side of the whales' flukes (Katona and Whitehead, 1981), humpback whales photographed in Icelandic waters have been previously matched to photographs taken in the breeding grounds around the Dominican Republic, Guadeloupe and Puerto Rico (Martin *et al.*, 1984; Kennedy *et al.*, 2014; Mackay, 2015; Lavin, 2017; Chosson *et al.*, 2022) and Cape Verde (Jann *et al.*, 2003; Wenzel *et al.*, 2009; 2020; Chosson *et al.*, 2022).

Here, we report the first documented photo-ID match and round-trip migration of a humpback whale between Iceland and the TCI.

Relevant information about the individual humpback whale of interest came from three different whale watching/research locations around Iceland: Steingrímsfjörður and Ísafjarðardjúp in the Westfjords, and Skjálfandi Bay in the Northeast. Steingrímsfjörður (65°41'N, 21°36'W) is a large fjord in the southern part of the Westfjords where the cataloguing of humpback whales is relatively new. There are 56 individuals recorded by the Marine and Freshwater Research Institute (MFRI, unpub. data) and approximately 160 individuals recorded by Láki Tours whale watching (J. Scott, unpub. data). Ísafjarðardjúp (66°05'N, 22°48'W) is the largest fjord in the Westfjords region of Iceland. MFRI began identifying and tagging humpback whales in this area in 2010. Since then, with the contribution of different research institutions, such as the University of Iceland and University Centre of Westfjords, the MFRI has centralised a local catalogue of approximately 160 individuals (MFRI, unpub. data). Skjálfandi Bay (66°05'N, 17°33'W) in northeast Iceland is a well-established humpback whale research location. Humpback whale photo-ID research began in 2001. The research is now carried out by the University

of Iceland's Húsavík Research Centre (UIHRC), where the catalogue consists of approximately 1,000 individuals (UIHRC, unpub. data). Photo-ID data is collected by researchers and trained internship students primarily on whale watching tours operated by Gentle Giants Whale Watching and North Sailing. Since 2006, humpback whale photo-ID information from collaborators around the country has been gathered in the Ísland *Megaptera novaeangliae* (ISMN) Catalog, curated by the MFRI, which contains records of more than 1,500 unique individuals observed in Icelandic waters over the last four decades.

Happywhale, a research collaboration and citizen science web platform, was founded in 2015 to improve understanding of marine mammals worldwide. The portal is open to the submission of marine mammal photo-ID images, with an emphasis on humpback whale fluke photo-ID. Using fast and accurate automated image recognition (Cheeseman *et al.*, 2021), the platform has gathered 16,530 identified encounters of 8,464 individual North Atlantic humpback whales (in a global dataset of 78,320) as of May 2023. All humpback whale fluke photo-ID images submitted are matched against all known whales, with all proposed matches visually confirmed by trained observers. In TCI waters, Happywhale has recorded 228 identified encounters of 169 individual humpback whales. In Icelandic waters, Happywhale has recorded 3,695 identified encounters of 1,413 individual humpback whales.

An individual humpback whale, catalogued as TCI-36 (also known as na12473 in the North Atlantic Humpback Whale Catalog [NAHWC]), photographed on 21 February 2020, near Parrot Cay, TCI, at 21°55'N, 72°5'W was matched to photo-ID images of a humpback whale in Icelandic waters (known in local catalogues as IsaMn002, HRC-MN833 and SGF21-160, and in the ISMN catalogue as ISMN1084) (Table 1, Figure 1). The humpback whale was encountered during a private charter with Big Blue Collective and was photographed just west of Parrot Cay, moving due east where the reef drops off sharply in roughly 19.8m (65ft) of water (Figure 1) with another adult humpback whale (TCI-101).

In Icelandic waters, the humpback whale had previously been photographed 13 times between June 2018 and November 2019 (Table 1, Figure 1). This humpback whale was then photographed 15 times in Icelandic waters after the sighting off the TCI, between August 2020 and August 2022 (Table 1). The sighting record of this individual humpback whale shows that it repeatedly used the same areas around Iceland during the feeding seasons between 2018 and 2022 (Table 1).

After the initial match was made through Happywhale, images of this individual were sent to Allied Whale (College of the Atlantic, Bar Harbor, Maine, USA) which maintains the NAHWC, containing over 10,000 individuals from all major humpback whale feeding and breeding areas in the North Atlantic since 1977. Allied Whale confirmed that no prior photo-ID matches were documented for this individual or matches between Iceland and the TCI.

Most notable is this individual's round-trip migration within one year (Figure 1). TCI-36 was photographed on 25 November 2019 in Skjálíandi Bay, at 66°2'N, -17°36'W, and re-sighted 88 days later on 21 February 2020, approximately 6,224km (3,361 nautical miles) away, in the breeding grounds off the TCI (Table 1, Figure 1). It was then photographed again in Skjálíandi Bay on 11 August 2020, approximately six months (172 days) later at 66°3'N, -17°31'W, 6,229km (3,363 nautical miles) away from the previous sighting, showing this individual's round-trip migration of approximately 12,453km (6,724 nautical miles) between the two locations (Table 1, Figure 1). Humpback whale sex, age, reproductive status and feeding ground preference heavily influence migratory origin, timing and speed (Chittleborough, 1965; Stevick *et al.*, 2003; Noad and Cato, 2007; Kennedy *et al.*, 2014; Modest *et al.*, 2021). While the sex and age of this humpback whale are unknown, based on the sighting data, it is estimated this individual travelled southbound for a maximum of 88 days to the TCI, equating to an average travel of 70km per day or an average swimming speed of 3km/h. This may be an underestimation, since a satellite-tagged North Atlantic pregnant female humpback whale migrating from Norway to the West Indies swam at an average speed of approximately 5.4km/h (Kettner *et al.*, 2022). That pregnant female was tracked leaving Norwegian waters on 17 February 2019 and arriving off east Iceland on 22 February 2019, where it spent 15 days before continuing the southward migration on 1 March 2019 to the West Indies breeding ground. The trip from east Iceland to the West Indies (Mona Passage, the strait that separates the islands of Hispaniola and Puerto Rico, southeast of the TCI) took 52 days, further suggesting that the calculation for average km travelled

per day and the swimming speed of TCI-36 to the TCI using photo-ID should be considered minimum estimates. TCI-36 was encountered in February off the TCI and it has been shown that males do arrive earlier to breeding grounds than females (Stevick *et al.*, 2003). It has also been demonstrated through satellite tagging that some individuals on the breeding grounds off the Dominican Republic moved to waters off TCI and then east again before starting their northward migration (Kennedy *et al.*, 2014), which could also explain the slower calculated swimming speed. To date, this individual has not been recorded in any other location, so this is only speculative. However, the estimated average swimming speed of TCI-36 does fall within previously reported migratory speeds in the North Atlantic (Kennedy *et al.*, 2014; Kettemer *et al.*, 2022) and in other regions (e.g., Mate *et al.*, 1998; Noad and Cato, 2007; Lagerquist *et al.*, 2008; Zerbini *et al.*, 2011; Riekkola *et al.*, 2020; Modest *et al.*, 2021).

North Atlantic humpback whales are known to migrate from Iceland to the West Indies (Martin *et al.*, 1984; Katona and Beard, 1990; Stevick *et al.*, 2003; Brooks *et al.*, 2009; Kennedy *et al.*, 2014; Basran *et al.*, 2019; Kettemer *et al.*, 2022). However, there are no known records of photo-ID matches or round-trip migrations of humpback whales between Iceland and the TCI. To date, few North Atlantic humpback whale round-trip migrations and feeding/breeding ground swim speeds have been reported (e.g., Kennedy *et al.*, 2014; Kettemer *et al.*, 2022). Most studies in the North Atlantic have tracked humpback whales from breeding grounds to feeding grounds or vice versa (e.g., Clapham and Mattila, 1988; Stevick *et al.*, 2003; Reeves *et al.*, 2004; Robbins, 2007; Kennedy *et al.*, 2014), making this first reported match and round-trip migration from Iceland to the TCI a significant observation adding to our understanding of North Atlantic humpback whale migration.

Table 1

Documented sighting history of humpback whale na12473 (TCI-36) in the Turks and Caicos Islands and Iceland.

HRC-Mn = Húsavík Research Centre *Megaptera novaeangliae*; IsaMn = Ísafjörður *Megaptera novaeangliae*; ISMN = Ísland *Megaptera novaeangliae*; SGF = Steingrímsfjörður; TCI = Turks and Caicos Islands; UIHRC = University of Iceland's Húsavík Research Centre. Gray cells represent round-trip dates.

Day/month	Year	Location	Photographer/entity	Entity or catalogue name	Local catalogue no.	National catalogue no.
29 Jun.	2018	Ísafjarðardjúp, Iceland	Justin Brown	Ísafjörðurdjúp Humpback Whale Catalog	IsaMn002	ISMN1084
30 Jun.	2018					
6 Jul.	2018					
12 Jul.	2018					
22 Jul.	2018					
22 Aug.	2018					
6 Sep.	2018					
15 May	2019	Skjálfandi Bay, Iceland	UIHRC	UIHRC	HRC-Mn833	
24 May	2019					
25 May	2019		Charla Basran			
7 Nov.	2019		UIHRC			
23 Nov.	2019		UIHRC			
25 Nov.	2019					
21 Feb.	2020	Parrot Cay, TCI	Lee Munson	TCI Humpback Whale Catalogue	TCI-36	TCI-36
11 Aug.	2020	Skjálfandi Bay, Iceland	UIHRC	UIHRC	HRC-Mn833	ISMN1084
16 Aug.	2020					
17 Aug.	2020		Charla Basran			
19 Aug.	2020					
21 Aug.	2020		UIHRC			
22 Aug.	2020					
24 Aug.	2020		Charla Basran			
25 Aug.	2020					
26 Aug.	2020		UIHRC			
27 Aug.	2020					
28 Aug.	2020					
3 Nov.	2020	Ísafjörður, Iceland	Edda Magnúsdóttir	University of Iceland	IsaMn002	
8 Aug.	2021	Steingrímsfjörður, Iceland	Judith Scott	Láki Tours	SGF21-160	
13 Jul.	2022					
14 Jul.	2022					
15 Jul.	2022					
16 Jul.	2022					
17 Jul.	2022	Herve Siebert				
17 Jul.	2022	Judith Scott				
14 Sep.	2022	Ísafjörður, Iceland	Nicole Lidholm	University Centre of the Westfjords	IsaMn002	



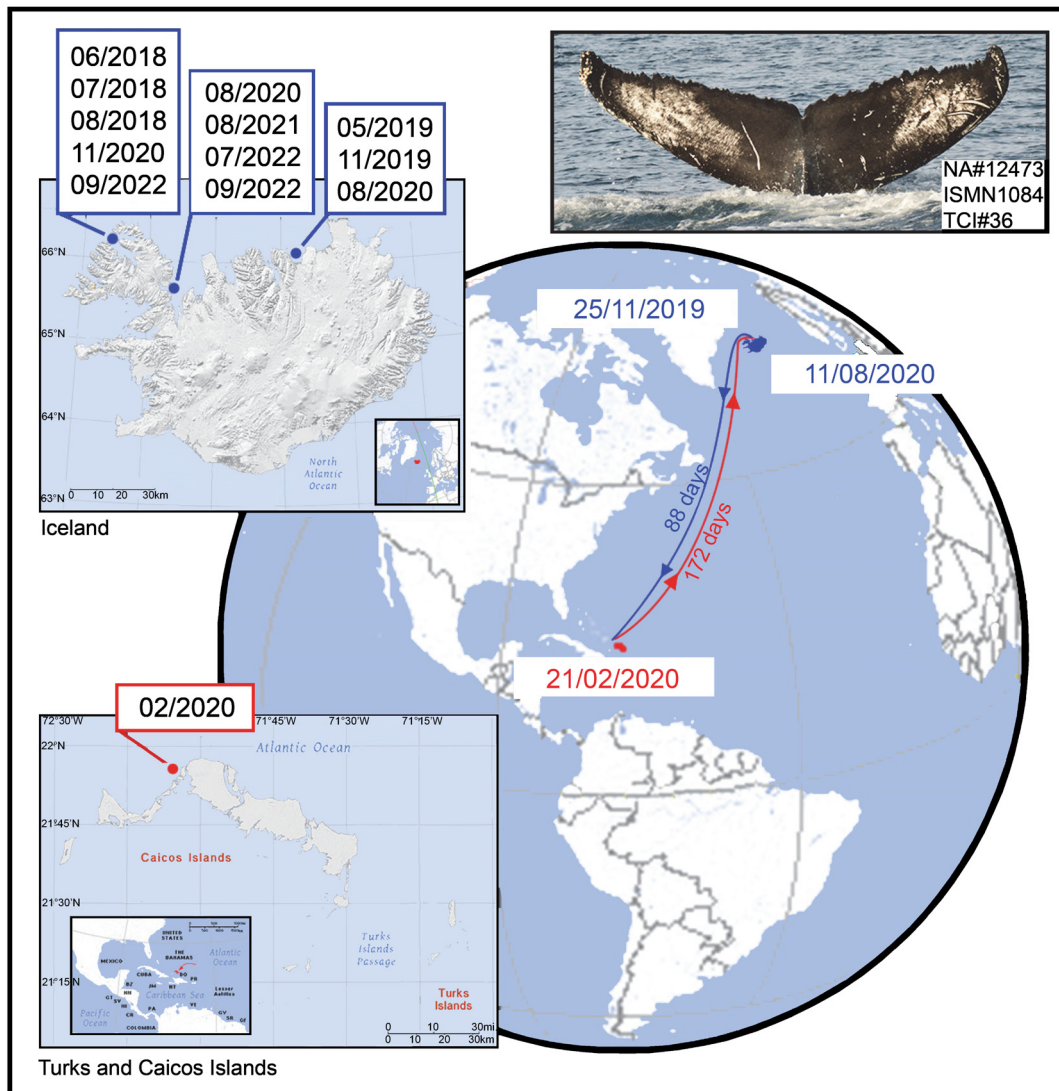


Fig. 1. Photo-identification image, sighting locations, sighting dates (month/year) and round-trip migration of humpback whale na12473 in Icelandic waters and the Turks and Caicos Islands.

The TCI are historically considered part of the breeding range for North Atlantic humpback whales in the West Indies. Although they are frequently observed by water sport operators as they pass through the Caicos Bank, the Turks Bank is recognised as the primary location to observe these humpback whales. Protecting breeding grounds, such as TCI waters, allows humpback whale populations to continue to recover and provides researchers with the opportunity to fully understand the importance of the region to humpback whales. Photo-ID of individual humpback whales can facilitate a greater understanding of behaviour, social interactions and life history characteristics, including migration patterns. It may also highlight the importance of TCI waters for this species as a specific breeding/calving area within the larger West Indies breeding grounds or as a resting point during their migration to other areas in the West Indies.

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whale so that we could include the individual North Atlantic Humpback Whale Catalogue number in this manuscript. The Turks and Caicos Islands Whale Project would like to thank the Department of Environment and Coastal Resources (DECR) of the Turks and Caicos Islands Government for their collaboration and support throughout this work. Happywhale would like to thank Herve Siebert and all citizen science contributors to Happywhale for sharing images and encounter data for North Atlantic humpback whales.

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