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**The Bight of Benin, a North Atlantic breeding ground of a Southern
Hemisphere humpback whale population, likely related to Gabon
and Angola substocks**

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ABSTRACT

Aiming to assess the feasibility for commercial whale-watching in coastal waters of Benin, exploratory boat transects were made from 12-19 October 2000. In 55h48min of observation, covering 349.6 nautical miles, 22 positive sightings of humpback whale and three 'like-humpback whale' groups were recorded. Relative group density was 0.448 sightings/hour observing or 0.072 sightings/nautical mile surveyed. Mean group size was 1.52 individuals (SD= 0.92, range 1-5, $N=25$) and relative density 0.109 humpback whale/nautical mile. Additional evidence showed that other nations bordering the Bight of Benin, i.e. Ghana, Togo and Nigeria also are new Range States. Off Benin we observed three cow/calf pairs; one calf stranded in Ghana and more calves were reported from Togo. The calves, considering their small size and behaviour are thought to be born locally. Adult humpback whales often engaged in aerial display behaviour, including breaching, energetic surfacings, flipper-slaps, lob-tailing and spy-hopping. Two surface-active groups were seen, a behaviour linked to courting and mating. Occurrence off Benin and Togo is seasonal, from early August till early November. Although geographically situated firmly in the North Atlantic (boreal of 06°N), seasonality agrees with a breeding ground of a Southern Hemisphere population for which we propose the name 'Bight of Benin substock'. Likely related to the IWC-defined Gabon and Angola substocks, combined these may form a wide-ranging Gulf of Guinea population. Overall sighting conditions were favorable and each of six trips resulted in at least one whale encounter, confirming whale-watching potential. A single 'like-bottlenose dolphin' group sighting was unrepresentative for small cetacean abundance when checked against frequent opportunistic observations. A collection specimen identified as *Pseudorca crassidens* is the first record of false killer whale in the Bight of Benin.

KEYWORDS : HUMPBACK WHALE, FALSE KILLER WHALE, BREEDING GROUNDS, DISTRIBUTION, ATLANTIC OCEAN, AFRICA

INTRODUCTION

Off western Africa three stocks or substocks of humpback whales *Megaptera novaeangliae* are described, one from the Northeast Atlantic and two from the Southeast Atlantic Ocean. In the NE Atlantic, the species is known to breed only around the Cape Verde islands (Townsend, 1935; Mitchell and Reeves, 1983; Reiner and Wenzel, 1996; Hazevoet *et al.*, 2000). While a few authors reported humpback whales in coastal waters off the northwest African mainland (e.g. Van Beneden, 1889; Cadenat, 1955; Aloncle, 1967; Slijper *et al.*, 1964), there is no evidence for any regular occurrence, much less established feeding or breeding grounds (Reeves and Mitchell, 1990; Van Waerebeek *et al.*, 2000). Slijper *et al.* (1964) argued that data in International Whaling Statistics show that land stations in Spain, Portugal and Spanish Morocco (i.e. Rio de Oro/Western Sahara) 'never took one single Humpback' and that these whales 'probably they avoid the coasts in these regions'. We assume that the individuals which occasionally approach nearshore areas belong to the Cape Verde stock.

Off French equatorial Africa (present-day Gabon and Congo-Brazzaville), humpback whales were hunted periodically from 1909-1959 till depletion (Budker, 1951, 1952, 1954). Few, if any, biological investigations were conducted or published. The humpback whaling season off Gabon lasted from June to October (Slijper *et al.*, 1964). The current status of that population is largely unknown. Two days of aerial transects flown near Cap Lopez (00°37'S, 08°40'E), Gabon, in mid-August 1998 yielded 20 sightings of humpback whales. Three calves were noted during aerial and some boat surveys and surface-active groups suggested mating, which points to possible breeding activity (Walsh *et al.*, 2000). Best *et al.* (1999) undertook a preliminary investigation of migrating humpback whales from three fixed oil drilling platforms off northern Angola. The IWC Scientific Committee, in a preliminary assessment of Southern Hemisphere humpback whales, designated these as the Gabon and Angolan sub-stocks, respectively (IWC, 2000). No breeding activities are linked to the Angolan sub-stock.

Van Waerebeek and Ofori-Danson (1999) reported the live-stranding of a calf humpback whale near the estuary of the Volta river (05°46'N, 00°41'E), eastern Ghana, on an undetermined date in 1997 and suggested that humpback whales may calve nearshore in the northern Gulf of Guinea. A search for historic information however did not yield further clues. Biodiversity accounts for Benin and Togo (Sinsin and Owolabi, 2000), for instance, do not even list cetacean species due to a general lack of data. Recently however a French yachtsman reported regular sightings of humpback whales accompanied by calves off Lomé (06°08'N, 01°13'E), Togo (Franck Barbe, *in litt.* to KVVW, November 2000). With support from the Netherlands Committee for IUCN (NC-IUCN) and the Centre Béninois pour le Développement Durable at Cotonou, the authors organised an exploratory survey in October 2000 to document the hitherto undescribed humpback whale population in the Bight of Benin, results of which we here present.

METHODS

The aims of the October 2000 boat-based survey off Benin were threefold: (i) determine the presence of humpback whales and other cetaceans in continental shelf waters; (ii) evaluate whale accessibility and available infrastructure as necessary conditions for the development of commercial whale-watching; (iii) provide training to Beninese marine scientists (co-authors ST, JM, GN, ZS, PS) in cetacean species identification and survey techniques. The four Beninese institutions most likely involved in further cetacean research, i.e. the Direction des Pêches (DdP), Université Nationale du Bénin (UNB), the Musée des Sciences Naturelles (ONG Nature Tropicale) and the Comité National Océanographique du Centre Béninois de la Recherche Scientifique et Technique (CON/CBRST), actively participated in the project.

Research platform

Although ubiquitously available and economical in use, field trials in Senegal showed that large, sea-going pirogues are poorly suited to sight cetaceans due to low height above sea-level (Van Waerebeek *et al.*, 2000), and whence were avoided. Instead, Benin's Direction des Pêches offered their 16m glassfibre research stern trawler M/V *Dauphin* as observation platform. Her 240HP diesel engine allows a maximum speed of 8knots. M/V *Dauphin* is equipped with 5000 liter fuel tanks, twin water tanks, hydraulic winches, a bottom trawl net and standard navigation instruments (GPS, VHF radio, radar, two echosounders). For optimal operations (permitting occasional trawling for fresh fish supplies), a crew of five (captain, chief mechanic, 2nd mechanic, cook, seaman) is required. Two observers stood watch on the radar roof-top (primary platform) at 365cm above sea-level and at least one observer searched from the engine roof (at 301cm). The captain (CD) and helmsman also kept watch from the wheel house.

Survey mode

Five full-day and one two-day exploratory boat surveys (in selective closing mode) were made in the period 12-19 October 2000. Only the chief scientist (KVV) had previous survey experience, thus much time and effort had to be dedicated to trials and training. Although basic line-transect survey (LTS) protocol was emulated, we did not attempt to obtain an abundance estimate. Deviations from LTS protocol included incomplete adherence to set tracklines, sampling discontinuity (return to port at night due to shortage of berths) and non-standardized effort. Data however are considered adequate for a crude relative abundance estimator. Initial sighting angles and distances were estimated by eye; geographic positions were read from a Garmin 12XLS GPS. Searching was both by naked eye and 7x50 or 8x40 binoculars from the radar deck. Trainees were asked to sketch observed morphological features and behaviours as identification exercise. Six laypersons, including three adults and three children participated in two sorties as whale-watching 'test public'. This to allow a preliminary assessment of how tourists would react to the vessel, conditions and the opportunity to see whales in Benin.

RESULTS

In seven days, a total of 47h 39min (47.65h) 'on effort' and 8h 9min (8.15h) 'off effort' survey mode were logged. In 'off-effort' observers stayed on watch but either the visibility was diminished due to rain or manoeuvres related to occasional trawling reduced the vessel speed below 2 knots. In 55h 48min total navigation time (combined on-effort and off-effort), a distance of 349.6nm was covered in Benin's continental shelf waters. We registered a total of 26 cetacean sightings, 22 groups positively identified as humpback whales, three 'like-humpback whale' groups and one 'like-bottlenose dolphin' sighting (Table 1). Although some whales may have been re-sighted on subsequent days, tracks were spread out between Benin's territorial sea borders with Togo and Nigeria.

Relative density

Relative humpback whale density was 0.448 sightings/hour navigating during daylight hours (including 'off-effort' sightings) or 0.072 sightings/nautical mile surveyed, assuming that the three 'like-humpback whale' sightings (all sighted at great distance without closing) indeed involved humpback whales considering, firstly, the rather characteristic cues (breaching and other aerial display) and, secondly, that no other whale species were encountered. Mean group size was 1.52 individuals (SD= 0.92, range 1-5, $N=25$), and relative humpback whale density was 0.109 individuals/ nautical mile surveyed. Each of the six trips resulted in at least one whale encounter.

Seasonality and stock identity

Humpback whale presence in the Bight of Benin is strongly seasonal. While the evidence is largely anecdotal, it is also compelling. One of us (CD), chief captain for the Direction des Pêches, navigates year-round in Benin's coastal waters but has encountered humpback whales only from early August till early November. In 2000, as noted in the M/V *Dauphin* logbook, CD sighted the season's first humpback whale on 8th August at position 06°18.20'N, 02°21.94'E in shallow water (16m depth). Franck Barbe (*in litt.* to KVV) operates a small humpback whale-watching business out of Lomé, Togo, but only from August till late October. Three specific sightings in coastal waters off western Togo included (J. Vlaar, pers.comm. to KVV): (i) two slow-travelling adult humpback whales on 1 November 1999; (ii) a cow/calf pair, moving slowly, on 24 September 2000; and (iii) a group of six humpback whales (supported by photographs) engaged in breaching and other surface-active behaviour on 23 September 2000. Unidentified dolphins accompanied this group.

Off Benin we observed three cow/calf pairs (Table 1). Some of the distant sightings not closed on may also have included calves. From their small size (< 5m) and constant proximity to the mother, the calves are estimated aged a few weeks, or months at most. Parturitions likely occurred within a limited radius from the sightings. One cow was seen suckling a calf (adult turned on its side and calf positioned at right angles with its belly).

Although at 06°N of the equator records are firmly situated in North Atlantic waters, their seasonality in the Bight of Benin agrees with a breeding ground occupation by a Southern Hemisphere population for which we propose the name 'Bight of Benin substock', in line with IWC (2000) terminology. Future genetic work and a photo-identification catalogue should help to determine this substock's relationship with the Gabon and Angola substocks (IWC, 2000). Ventral fluke patterns of three individuals were photographed as a starter.

New Range States

Humpback whales are seasonally common in Benin waters (Table 1). Multiple sightings of humpback whales by F. Barbe (pers. comm. to KVV) and J. Vlaar (Table 1), several of these supported by photographs, substantiate the species' regular presence off Togo. From a position on Benin's eastern maritime border with

Nigeria, KVV sighted two groups of humpback whale at great distance (3 and 5 nautical miles) in easterly direction, i.e. in territorial waters of Nigeria (Table 1). As reported above, a live-stranded calf was photographed on a beach near the Volta River mouth in eastern Ghana (Van Waerebeek and Ofori-Danson, 1999). We conclude that Ghana, the Republic of Togo, the Republic of Benin and Nigeria, all bordering the Bight of Benin, are newly recognized Range States for the humpback whale. None of these nations are member of IWC, however all are Parties to the Bonn Convention on the Conservation of Migratory Species of Wild Animals (CMS/UNEP).

Behaviour and habitat

The humpback whales engaged in frequent aerial display. Breaching was the most common initial sighting cue and the only cue that permitted locating whales at a distance up to 5nm. Other common aerial behaviour included energetic surfacings producing white-water, flipper-slaps, lob-tailing, fluking up and spy-hopping (one observation). Two large surface-active groups were reported (one each off Benin and Togo), a behaviour which has been linked to mating (Tyack and Whitehead, 1983). We did not observe any feeding. The three cow/calf pairs seen (Table 1) were either milling or slowly distanced themselves from the boat when at 300-400m. One cow/calf pair was encountered at dawn at c. 300m from the beach and must have been clearly visible for a shore-based observer. Slowly travelling parallel to the coastline and temporarily stopping at various points is reported as typical behaviour for cow/calf pairs off Hawaii (Glockner and Venus, 1983). All humpback whales were sighted above the continental shelf or near the slope, mostly within 10 nautical miles from shore. Water depth was a shallow 14 -32m (mode: 24m; n=7) as determined by echosounder, with sandy or muddy bottoms (chart data). It should be pointed out that no search effort was conducted in offshore waters.

Assessment of whale-watching potential

Overall sea conditions were favorable for touristic whale-watching. Sea surface state (SS) was fair, ranging 2-4 Beaufort. Swell was low (modal condition) to moderate, with average wavelength (scale 1-4). Visibility ranged from good to excellent at all times. On average, wind is stronger and the sea rougher during the early months (June-August) of the rainy season, however days with good conditions occur. Rain itself can be a disturbing weather factor for whale-watching, but off Benin rain typically falls in short showers alternated by longer, dry periods. The cloud cover actually helps to keep air temperature and UV exposure reasonable. Sea surface state co-determines the incidence of sea-sickness, a factor which greatly influences the sense of satisfaction among whale-watching tourists (Orams, 2000). Although at least two of the six test persons suffered symptoms of seasickness at some point, none felt impeded to appreciate the whales. All expressed satisfaction with the trip and added that they would set out to sea again if given the chance.

The crew, although briefed on the research mission, was reluctant or experienced difficulties in approaching whales closer than 250m. The need exists for crew members to familiarize themselves with close encounters and generally working around whales, including to position the vessel in the whales' expected path. Closer approaches (100m and less) will ofcourse be needed for effective biopsy and photo-identification. Another DdP boat, the smaller M/V *Sakana* is slower, less stable, has a lower observation platform and less deck space; however operation costs are lower. She may well be a suitable platform to accommodate small groups of whale-watchers for short trips, in fair weather.

Other cetacean species

A single group of dolphins was sighted, briefly. The pigmentation pattern could not be discerned due to back-lighting. The stocky body shape, falcate dorsal fin, fairly large size, and a short snout suggest bottlenose dolphin *Tursiops truncatus*, however the similarly bodied Atlantic spotted dolphin *Stenella frontalis* can not be excluded. Greater numbers of small cetaceans were expected in Benin's coastal waters, considering the high species diversity off Ghana, barely 200km to the west (Van Waerebeek and Ofori-Danson, 1999). Short survey period and seasonality may help explain apparent dolphin scarcity. From long-time experience, one of us (CD) suggests nearshore dolphin abundance to be linked to temporal inshore presence of 'blue water' and an eastbound current. For the duration of our survey, green plankton-rich waters and a westbound current (cf. heading bows of ships anchored off Cotonou) were prevalent. This interesting hypothesis deserves further testing.

Two marine biological collections were perused in Cotonou. The Direction des Pêches collection holds the mummified head (no catalogue number) of an adult false killer whale *Pseudorca crassidens* (tooth counts: UL8, UR8, LL10, LR10; teeth circular in cross-section). No voucher data are available but the conservator confirmed its local origin, hence it is the first false killer whale record for Benin (new Range State) and the third authenticated for all of West Africa. One stranded at Assini, Ivory Coast (van Bree, 1972) and another at Cap Esterias, Gabon (Van Waerebeek and De Smet, 1996). The nearly complete vertebral column (lacking data) of a small, physically immature, delphinid (probably *Stenella* sp.) could not be studied in detail.

The Musée des Sciences Naturelles (ONG Nature Tropicale) does not currently hold any cetacean specimens, however this museum has the appropriate infrastructure to serve as future depository for a national cetacean reference collection.

CONCLUSIONS

New data demonstrate that Ghana, Togo, Benin and Nigeria are Range States for *Megaptera novaeangliae*. Currently known longitudinal range for this hitherto undescribed 'Bight of Benin substock' extends from the Volta river mouth to western Nigeria. However, we hypothesize that further research effort may show humpback whale occurrence in continental shelf waters to be continuous southeast into eastern Nigeria, Cameroon, Equatorial Guinea and Gabon (Budker, 1951, 1953, 1954; Walsh *et al.*, 2000), forming a single large Gulf of Guinea population.

The sighting of four cow/calf pairs (Benin, Togo), the stranding of a neonate (Ghana), dynamic surface-active behaviour (Benin, Togo) and additional circumstantial evidence (Togo) strongly suggest that the warm and shallow shelf waters of the Bight of Benin are humpback whale calving and mating grounds. Walsh *et al.* (2000) concluded similarly for the Cap Lopez area off Gabon. A seasonal presence limited to August-early November, i.e. austral winter and spring, points to a Southern Hemisphere population. We plan to biopsy sample and apply photo-identification techniques to verify these findings. At this point the possibility of a few individuals residing year-round, or sizable numbers moving offshore but not migrating to the Antarctic, although unlikely, can not be excluded.

In Benin the density of humpback whales found nearshore is sufficiently high to support commercial whale-watching activities. Small-scale whale-watching has been operated successfully for several years from neighbouring Togo (F. Barbe, pers.comm. to KVV). The whale season (August-October) partially overlaps with the major summer holidays in Europe and North America. Other parameters relevant to successful whale-watching operations (cf. Orams, 2000) including whale encounter rate, distance from port, average sea state and weather, and logistics are fair or highly favourable. Appropriate vessel availability may pose some problem. At the port of Cotonou it is essential that bunkering be completed at least one day before scheduled departure as to avoid unacceptable delays.

Unexpectedly only a single school of (like-bottlenose) dolphins was observed, explainable by the short sampling period (55.8hours in one week) and possibly periodical unfavourable oceanographic conditions. Frequent incidental sightings of large dolphin schools by several of us during other boat sorties underscore the need for continued surveying to determine the diversity and abundance of small cetaceans. A museum specimen is voucher for the false killer whale as a newly recorded cetacean for the Bight of Benin.

This NC-IUCN project cadres within the wider framework of WAF CET programme of the Convention on the Conservation of Migratory Species of Wild Animals (UNEP/CMS), which aims *inter alia* to document the distribution and movements of cetaceans in West African waters and help build local expertise. Though recent and relatively small-scale, WAF CET has started to yield some interesting results (Murphy *et al.*, 1997; Van Waerebeek and Ofori-Danson, 1999; Van Waerebeek *et al.*, 1997, 1999, 2000), while spurning other much-needed field projects (like the one reported here) in this understudied region.

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