

Assessing the Stability of Male Bottlenose Dolphin (*Tursiops truncatus*)

Pairs at Adjacent North Carolina Study Sites

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◆ Abstract

Bottlenose dolphins (*Tursiops truncatus*) live in fission-fusion societies, although adult males may form stable associations with one or two individuals for easier access to mates. The objectives of this study were to quantify the social associations of male bottlenose dolphins occurring in Nags Head, NC, and examine the stability of these associations in Beaufort, NC. From 2007 – 2014, opportunistic (N = 93) and dedicated (N = 62) photo-identification surveys were conducted in Nags Head. Dorsal fin photos were graded for quality and matched to the OBXCDR catalog. We calculated the half-weight coefficient of association (COA) for 19 males to determine the stability of their associations. In Nags Head, COA values ranged from 0.3-0.9, where more than 50% of the pairs were loosely associated (COA = 0.3 – 0.39). When the COA values for four highly associated pairs (COA = ≥ 0.7) in Nags Head were compared to their COAs in Beaufort, we found two pairs exhibited similar association indices while two pairs experienced substantial drops in their COAs. By studying male pair associations within a seasonally resident population, we can determine the extent of mixing between populations and examine factors such as site fidelity and distribution for conservation purposes.

◆ Study Sites

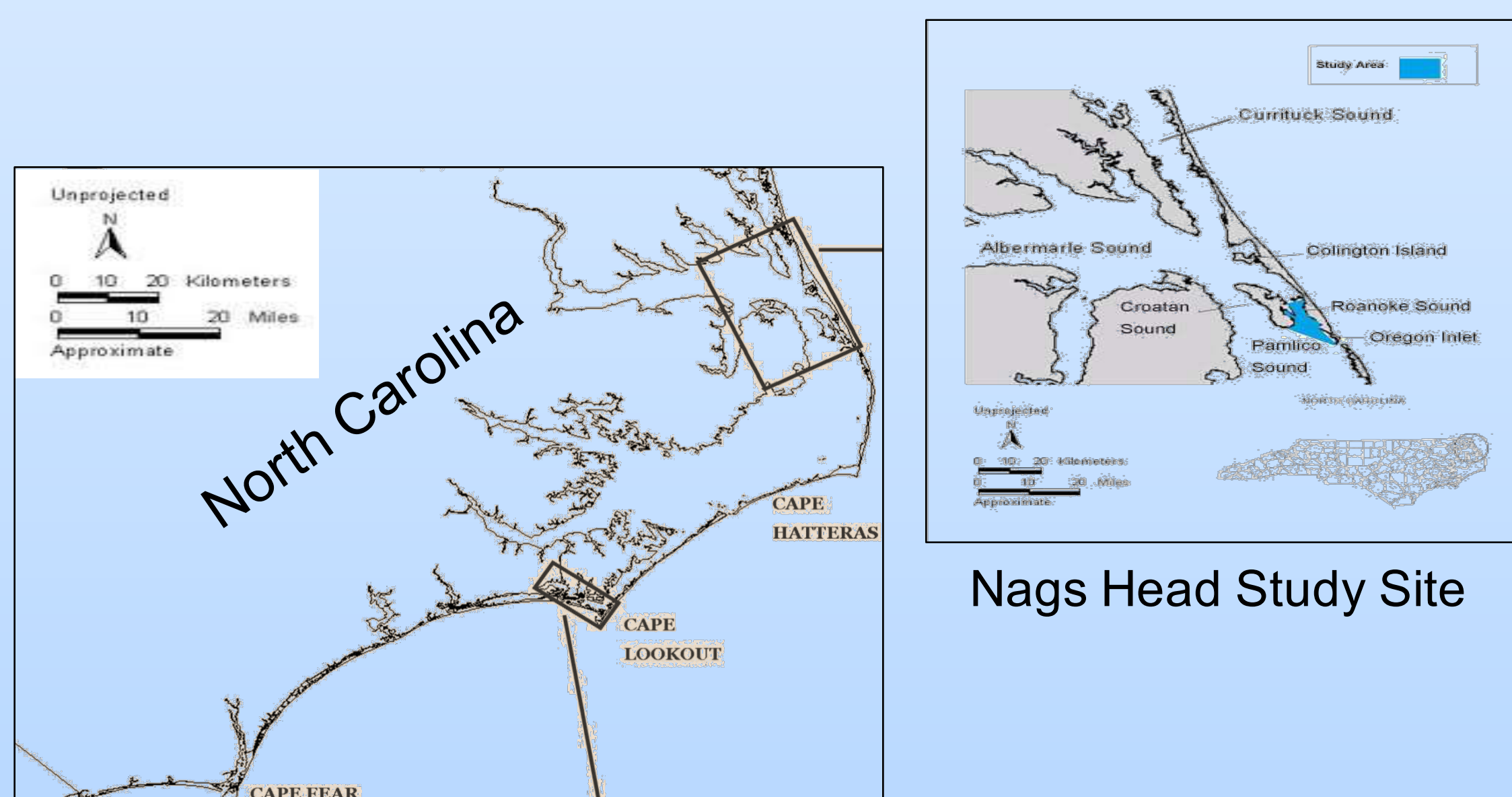
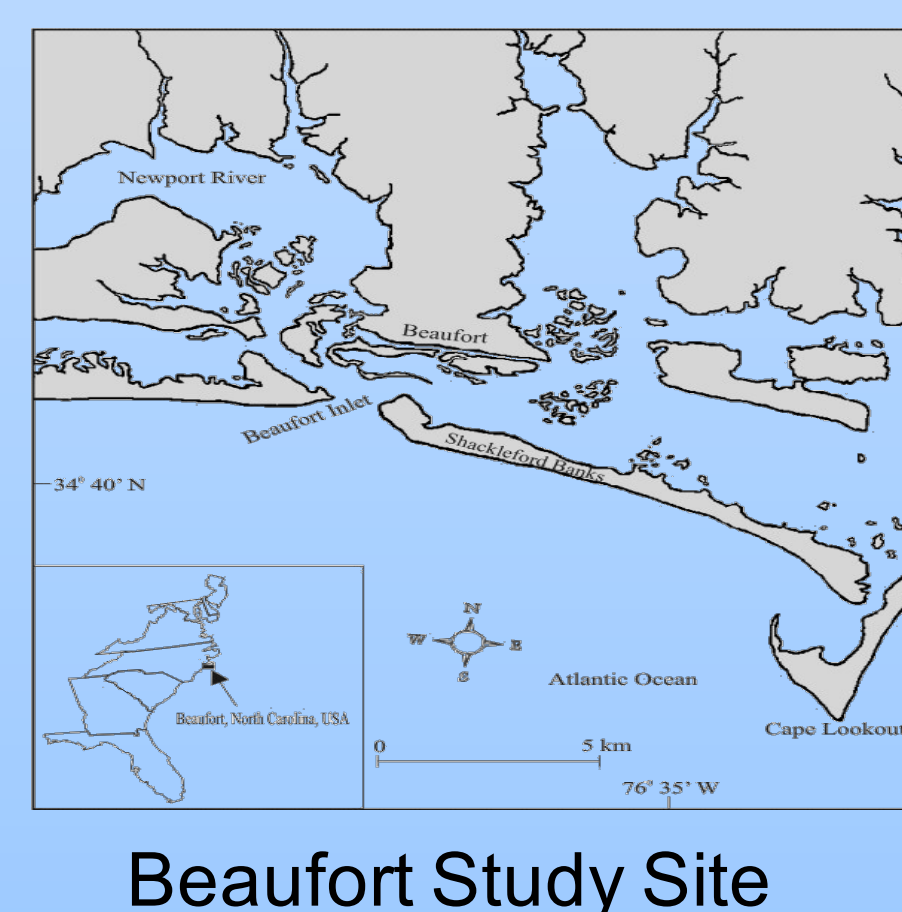


Figure 1. North Carolina study areas



Beaufort Study Site

◆ Introduction

- Adult males are known to form first-order alliances with one or two individuals, which are meant to increase mating success with receptive females (Connor *et al.* 1992a).
- Male pairs are much more prevalent than female or mixed sex pairs. Usually, mothers with dependent calves will form loose bonds to teach their young how to become successful adults (Gibson & Mann, 2008a; Wells 2003; Wells *et al.* 1987). Typically, males and females only pair briefly to reproduce (Smolker *et al.*, 1992; Wells *et al.* 1987).
- Two first-order alliances may combine to form a second-order alliance, which allows males to overtake a female from another first-order alliance or defend females from other potential mates (Connor *et al.* 1992a).
- Adult males show affiliation through spatial proximity, physical contact and synchronous movements (Connor 2000).

◆ Methods & Materials

- From 2008-2014, dedicated and opportunistic surveys were conducted in Nags Head from May – October, respectively. In Beaufort, surveys were conducted year-round from 1990 – 2016. Standard photo-identification techniques were used at each location (Würsig & Würsig, 1977).
- FinBase was used to analyze sighting data collected in Nags Head (Adams *et al.* 2006) and an MS Access database was used to analyze sighting data collected in Beaufort.
- Sighting data was provided from Beaufort on the four highly associated pairs in Nags Head to determine male pair stability. All individuals were known or presumed males; presumed males were never seen with a calf for at least five years.
- Associations were quantified using the half-weight coefficient of association: $COA = 2J/(a+b)$ (Schaller 1972). 'J' represents the total number of times dolphins A and B were sighted together, 'a' is the total number of sightings of dolphin A, and 'b' is the total number of sightings of dolphin B. The resulting value lies between 0 and 1, and reflects the percentage of time both individuals spend together.

◆ Results

24 associations were documented in Nags Head, and the 4 highly associated pairs were assessed in Beaufort.

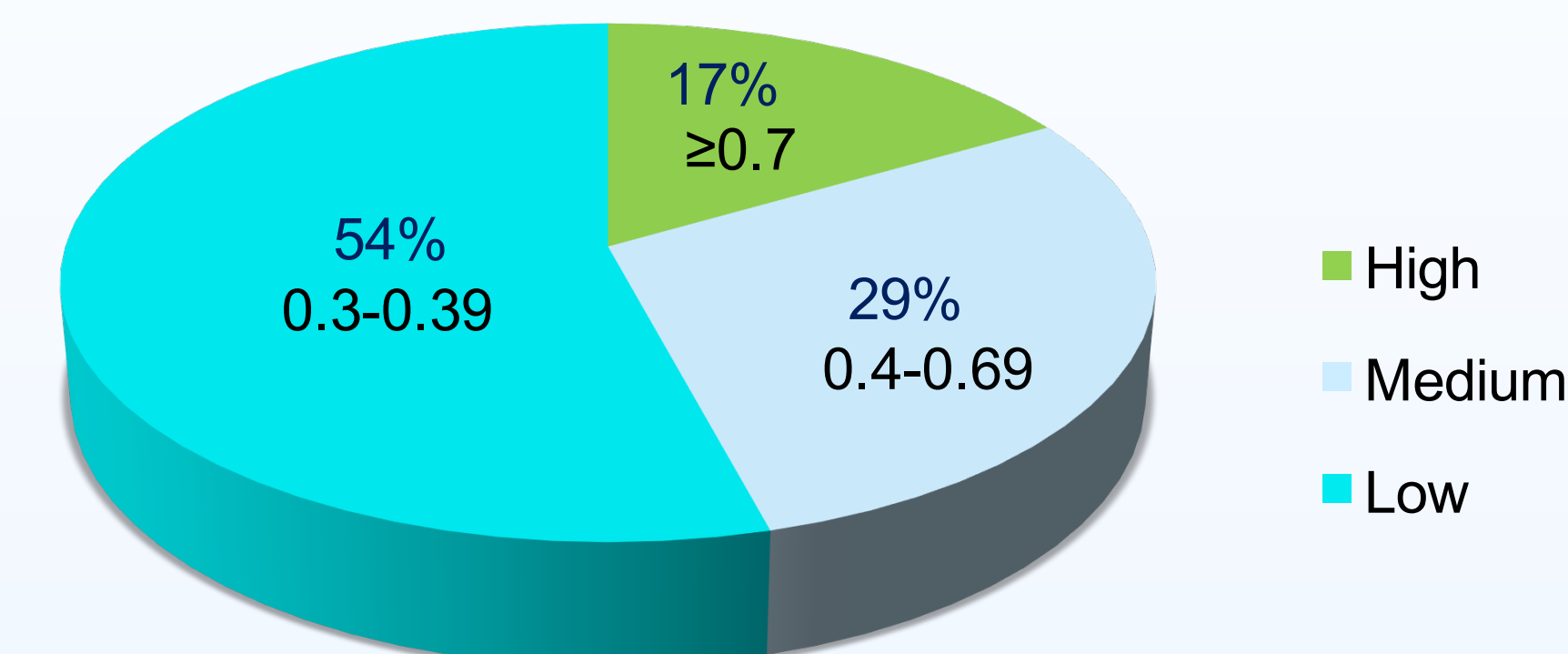


Figure 2. Strength of male associations in Nags Head ranked by COA value.

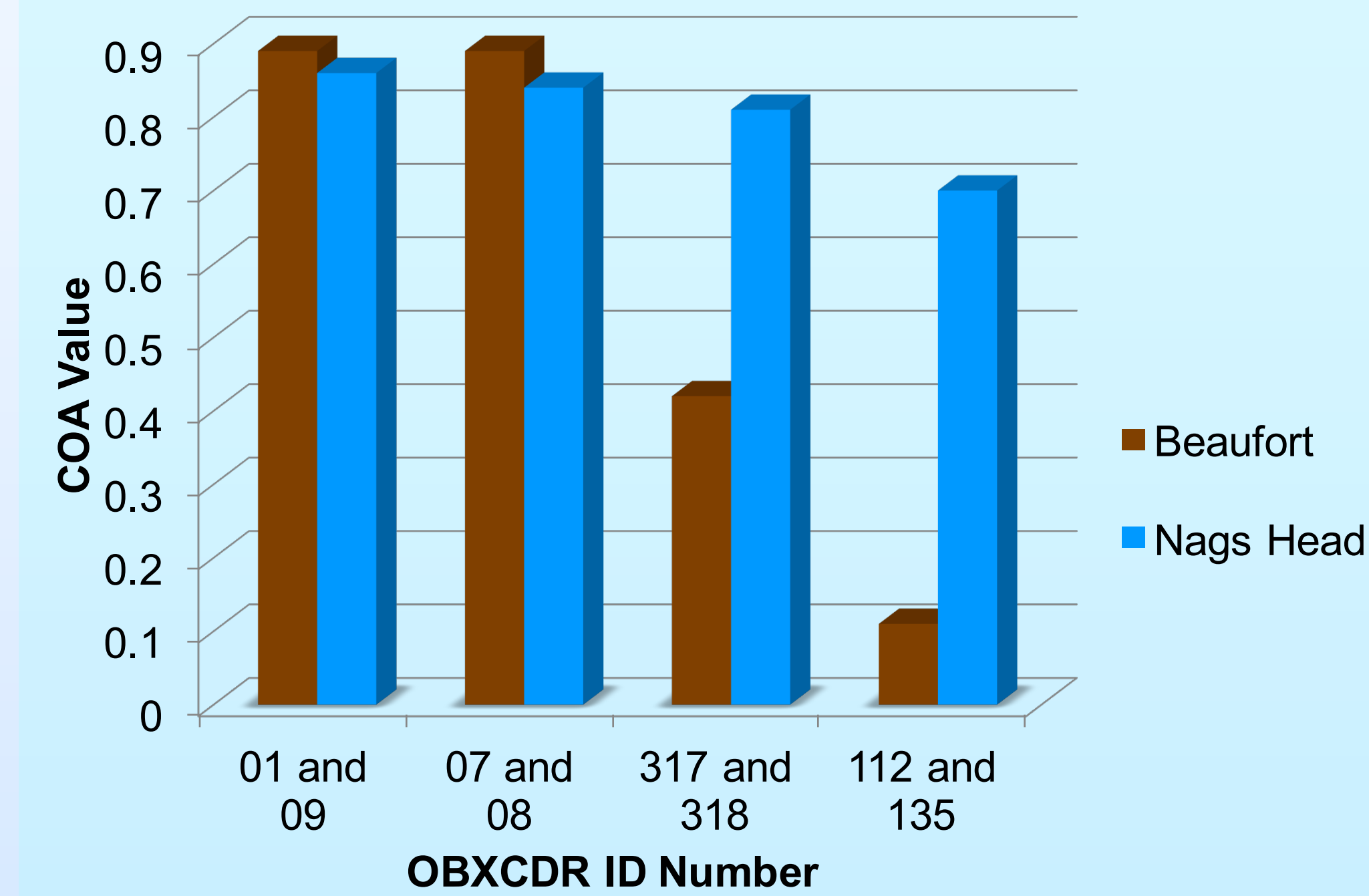


Figure 3. COA values of the four highly associated male pairs in each study area.



◆ Discussion

- Wells (2003) defined males as paired if their COA remains ≥ 0.8 over time. Based on long-term data from Bowles and Rittmaster (1998) and Taylor *et al.* (2011), we concluded that male pairs do exist and can remain stable across migration sites.

Table 1. Male pair stability in both study areas from 1998 – 2014.

Male Pairs	OBXCDR ID Numbers	Year	COA (Beaufort)	COA (Nags Head)
1	01 and 09	1998	0.77	
2	07 and 08	1998	0.89	
1	01 and 09	2011	0.89	0.9
2	07 and 08	2011	0.91	0.95
4	112 and 135	2011	0.58	0.92
1	01 and 09	2013	0.89	0.86
2	07 and 08	2012	0.89	0.84
4	112 and 135	2014	0.11	0.7

- Each area is unique in terms of pressures that may affect the male pair bond. Future studies should include offshore waters to increase the sighting dataset size and better understand which factors are causing such a fluctuation in these COAs.

Ecological	Environmental	Reproductive
Increased competition or predation risk may have favored relocation or second-order alliance formation	Unfavorable water conditions (e.g. low salinity, pollution) may have favored relocation	High female encounter rate may have reduced the need for cooperation in pairs

Figure 4. Pressures that may affect male pair bonds

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