

LONG-RANGE MOVEMENTS OF SOUTH ATLANTIC RIGHT WHALES *EUBALAENA AUSTRALIS*

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ABSTRACT

Movements of southern right whales between Gough Island and South Africa, and between Argentina and Tristan da Cunha, southern Brazil, and South Georgia are documented through matching of six photoidentified individuals. These include the resighting of a male in a mid-oceanic locality some 4,424 km away from (and 11 yr after) its last sighting in a coastal area where it had been seen in six of the preceding eight years, a female photographed in mid-Atlantic resighted with a calf in a coastal nursery area 2,769 km away, resightings of females with calves in different nursery areas 2,051 km apart in different years, and the first example of a link between a coastal nursery area and a feeding ground in high latitudes. The possible implications of these movements for estimates of calving interval and survival rate based on resightings in coastal waters are discussed. The potential for intermingling between populations on either side of the South Atlantic seems greater than was previously considered likely from a comparison of animals photographed in coastal waters.

Key words: *Eubalaena australis*, right whale, migrations.

Right whales can be individually identified by the shape and placement of raised patches of roughened skin or callosities on the tops and sides of their heads and by the shape of white or grey pigmentation patterns on their backs (Payne *et al.* 1983). The use of photoidentification techniques for investigating

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the behavior, movements, and population dynamics of southern right whales was pioneered in Argentina in 1971 (Payne *et al.* 1983). Since then similar projects have started in Western Australia, South Australia, South Africa (including Tristan da Cunha and Gough Island), Brazil, and New Zealand (including Campbell Island). In 1988 it was estimated that photographs of some 1,600 individual right whales were on file in these various catalogues combined (IWC 1990).

Apart from a comparison of photographs of 24 individuals identified by Payne off South Africa in 1974 (Payne *et al.* 1983) with the catalogue from Argentina, there has so far been no concerted attempt to match the individuals on file in these various catalogues. However, a catalogue of the whales photographed in Argentinian waters has been published (Payne and Rowntree 1984).

In this paper six instances of long-range movements of right whales in the South Atlantic are documented. One arose from an internal comparison of whales in the South African catalogue, the second from a casual comparison of a whale in the South African catalogue with the published photographs in Payne and Rowntree (1984), and the remaining four from a comparison of the whales in the Peninsula Valdes catalogue with photographs taken of right whales off Brazil and off Bird Island near South Georgia. It should be stressed that additional matches may be hidden in the data already collected, but await a coordinated attempt at cross-matching of catalogues.

MATERIALS AND METHODS

Photoidentification of right whales off Peninsula Valdes, Argentina has involved photography from fixed-wing aircraft. The techniques used have been described by Payne *et al.* (1983). All whales encountered in surveys along the perimeter of the Peninsula were photographed whenever possible. With the completion of the 1990 surveys, there were 1,099 individuals on file which had been photographed at Peninsula Valdes. In 1974 Payne made a survey of the coast of South Africa covering most of the main nursery areas and took identifying photographs of 24 adults. No matches were found between these 24 whales and the 1,099 individuals identified at Peninsula Valdes as of 1990.

The South African program of photoidentification of right whales began in 1979. It has involved the use of near-vertical aerial photographs, taken from a helicopter, using the techniques described by Best (1990). Photography has been directed almost exclusively at cow-calf pairs, and by the end of 1990 there were some 353 non-calf individuals on file from the South African coast. Starting in 1983, periodic visits have been made to Tristan da Cunha and Gough Island during the annual supply voyage of the *SA Agulhas* from Cape Town. Aerial surveys of the two islands and their environs were made in 1983, 1985, 1986, 1987, and 1989, using the helicopter based on *SA Agulhas*, and whales were searched for and photographed where possible (for details see Best, 1988). Photographs were attempted for all whales encountered, and six individuals are on file.

Right whales were photoidentified from fixed-wing aircraft off southern Brazil

in 1987 and 1988, using photographic techniques described in Payne *et al.* (1983). All whales encountered were photographed whenever possible. In 1987, 35 right whales (29 adults, 6 calves) were sighted and nine whales were photographed and individually identified. In 1988, 20 right whales (12 adults, 8 calves) were sighted and five adults were individually identified. There were no resightings of the identified whales between years.

Distances between resightings have been calculated as great circle routes, avoiding land masses.

RESULTS

On 10 November 1988 a cow-calf pair of right whales was photographed off De Hoop, South Africa (*ca.* 34°30'S, 20°30'E), during a monthly photogrammetric flight. The cow measured 14.42 ± 0.11 m in length (mean of two measurements) and had not been photographed previously on the South African coast. Its calf measured 7.89 ± 0.08 m (mean of three measurements). A comparison of the adult with the catalogue of animals photographed at Tristan da Cunha/Gough Island revealed a match with one of a pair of apparently adult right whales (catalogue number R83/69A) photographed on 10 September 1983, between First Rocks and Hawkins Bay, Gough Island (*ca.* 40°17.66'S; 9°54.5'W). This represents an eastward movement of some 2,769 km (Fig. 1).

On 14 October 1989 two adult right whales and a calf were photographed in Dead Man's Bay, Tristan da Cunha (37°09'S, 12°17.67'W). Both adults had white marks on the back, and had not been photographed earlier off South Africa or at Tristan da Cunha or Gough Island. However, a clear match could be made between one of the adults and whale PV162 in Payne and Rowntree's (1984) catalogue of whales off Peninsula Valdes, Argentina (*ca.* 42°30'S, 63°30'W). This represents an eastward movement of some 4,424 km (Fig. 1).

On 1 September 1987 two mother-calf pairs of right whales were photographed separately off Laguna, Brazil (*ca.* 28°29'S, 48°45'W). A third mother-calf pair was photographed off Praia Azul, Brazil on 18 August 1988 and rephotographed 100 km to the north off Laguna, Brazil on 28 September 1988. These were the only times these whales had been photographed off Brazil. All had been photographed previously at Peninsula Valdes (the first two as catalogue PV28 and PV366 and the third as PV256), 2,051 km to the south of Laguna (Fig. 1).

A right whale was photographed on 11 March 1984 off Bird Island (54°S, 38°02'W), near South Georgia, by Ben Osborne while he was working for the British Antarctic Survey. The same whale (PV378) was photographed once off Peninsula Valdes in 1975. This represents a southeastward movement of 2,272 km (Fig. 1).

DISCUSSION

Whale R83/69A was seen off Gough Island in 1983 and off De Hoop, South Africa with a calf in 1988. While it had not been photographed off

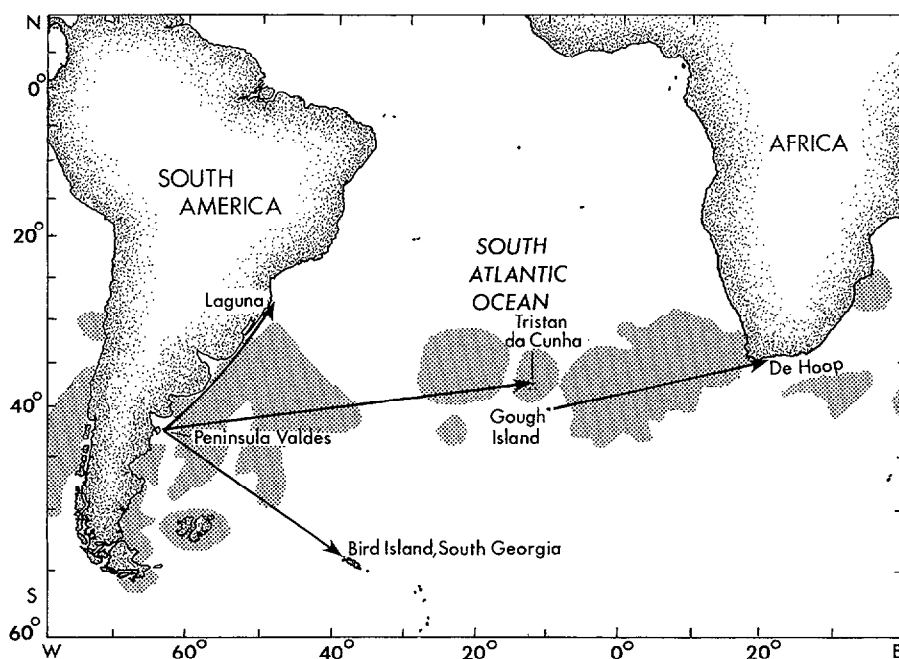


Figure 1. South Atlantic Ocean, showing movements of six right whales and shaded areas corresponding to Townsend's (1935) plots of nineteenth-century catches.

South Africa in nine years of surveys, its length in 1988 was large for a primiparous female, only one of 23 such females photographed off South Africa being larger (Best and Rüther, 1992). It may therefore have been a "transient" animal (Whitehead *et al.* 1986).

Whale PV162 was sexed as a male from observations of its anogenital configuration (Payne and Dorsey 1983). It was photographed at Peninsula Valdes in 1971, 1972, 1973, 1975, 1976, and 1978. It has not been seen off Argentina since 1978. In 1971 (when it was first photographed) Payne *et al.* (1983) report that whale PV162 was a non-calf with an estimated age of seven years (but with very wide confidence limits). This would mean that in 1989, when it was seen off Tristan da Cunha, it was approximately 25 yr old. Its absence from Peninsula Valdes for 11 yr, after being seen there in six of the preceding eight years, implies that adult males may effectively "emigrate" from coastal waters on occasion, thus potentially complicating analyses of survival rate based on resightings in coastal waters [although Payne *et al.*'s (1990) calculations specifically excluded males].

The three right whale females photographed with calves off Brazil were not photographed in the same year off Peninsula Valdes. One of the females (PV28) was seen in seven different years at Peninsula Valdes (1973, 1974, 1977, 1979, 1983, 1984, 1990), including two years when she was photographed with calves (1979, 1984). Another of the females (PV256) was seen in two different years (1971, 1978) at the Peninsula, including a year (1971) when she was

photographed with a calf. The third female (PV366) was seen only once (1975) at the Peninsula, without a calf. These matches provide two instances of the same females being seen with young calves in what appear to be different nursery areas in different years.

There are two possible interpretations of these matches. (a) Some females may not display fidelity to a particular nursery area but may utilize different areas (separated by as much as 2,100 km) in different years. This shift in fidelity could be either temporary or permanent. (b) Some females may move between the two nursery areas in the year their calves are born. A female might calve off Brazil and then move south to Peninsula Valdes, possibly as part of a coastwise migration into higher latitudes as summer approaches (Best 1970, 1981). In the North Atlantic Kraus (personal communication) observed three female right whales accompanied by three-month old calves travel 1,700 km (between the southeastern United States and Cape Cod) in a period of 20 to 34 d between late March and late April. However, it does not appear that all the females seen with calves off Argentina have calved off Brazil. There are fewer females seen with calves in the areas surveyed off Brazil (six calves in 1987, eight calves in 1988) than off Peninsula Valdes (30–40 calves a year), and females are seen at Peninsula Valdes between June and August without calves which are seen later in the season with calves (Whitehead and Payne 1981).

How do these possibilities affect previous estimates of calving interval and survival rate? The most commonly observed calving interval for right whale females at Peninsula Valdes is three years, and most females return to the Peninsula only in years when they calve (Payne 1986). The mean interval between observed calvings at Peninsula Valdes in the period 1971–1986 was 4.5 yr ($n = 248$). However, an analysis of calving intervals based on resightings of known individuals (Payne *et al.* 1990) showed that only about 50% of calvings in the population during this period were actually observed; the true mean calving interval was estimated to be 3.6 years (95% confidence limits 3.3, 4.1 yr). The method of analysis involves no *a priori* assumption about the proportion of calvings that are observed. Hence, calvings outside the study area do not bias the mean calving interval estimated in this manner. The observation that some individuals may use different nursery areas in different years would account for some of the 50% or so of calvings that are estimated to be “missing” from the Peninsula Valdes data. However, because full coverage was difficult to achieve, it is probable that some of the missing calvings occurred at Peninsula Valdes.

If some females “emigrated” permanently to other nursery areas, as opposed to merely using them intermittently, then estimates of survival rate based on resightings in one area would in principle be negatively biased. However, since the estimated annual survival rate of calving females using the Peninsula Valdes area was 0.99 (95% confidence limits 0.95, 1.00; Payne *et al.* 1990), there cannot have been a substantial “emigration bias” in this case.

The sighting of whale PV378 off Bird Island in March is the first match that has been made for the southern right whale between a nursery area and a feeding ground. Right whales gather in concentrations close to shore in the months when

the females are nursing and thus are relatively easy to photoidentify at this time. The areas in the South Atlantic where right whales occur between the months of December and June, the time when the whales are presumably feeding, are currently not well surveyed and thus migratory routes between nursery areas and feeding grounds are not known.

In his plotting of the positions of nineteenth-century whaling ships on days during which one or more right whales were taken, Townsend (1935) illustrates an almost continuous band of catches in the South Atlantic between the latitudes of 30° and 40°S and from the African coast westwards as far as about 28°W. There is a hiatus of some 12° of longitude before the band continues as far as the South American coast (Fig. 1). Most of these catches were made from October to January, and included well-known whaling grounds such as Tristan Ground, Pigeon Ground, False Banks, and Brazil Banks. The width and extent of this band are obviously exaggerated by Townsend's decision not to plot dots on top of each other, but they do indicate the presence of a large number of right whales in the central South Atlantic, whose relationship to right whales on the coasts of South Africa and South America is unknown.

The records in this paper provide evidence that this band could have included females from coastal "populations" in non-calving years, as well as males shifting (temporarily?) from coastal areas. It also shows that the migrations of this species can include a substantial longitudinal as well as latitudinal component.

The timing of conception (and the location of breeding activities) in southern right whales are not well established, but these records of long-range movements of adults indicate the potential for a greater degree of intermingling of individuals from "coastal" populations than might have been supposed from the earlier comparison of whales photographed in the coastal waters of South Africa and Argentina (Payne *et al.* 1983).

An adult male right whale in the Bay of Fundy (western North Atlantic) tagged with a satellite-monitored transmitter travelled at least 1,523 km over a 22-d period, and visited all four known northern aggregation areas of the North Atlantic right whale in the process (Mate 1990). This evidence confirms that adult male right whales at least, can be peripatetic in nature.

Knowlton *et al.* (1992) describe the longest known movement of a North Atlantic right whale, in this case an adult female and its calf, as approximately 4,295 km in six months. The movement of the adult male from Argentina to Tristan da Cunha exceeds this distance by some 129 km, but over a much longer time span, 11 yr.

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