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Offshore Distances of Gray Whales Migrating Along the Oregon and Washington Coasts, 1990

Abstract

Aerial surveys were conducted during January and March, 1990, to determine the width of the gray whale (*Eschrichtius robustus*) southbound and northbound migration corridors along Oregon and Washington. Migrating gray whales occurred significantly farther offshore during the southbound migration compared to the northbound migration. Also, whales occurred significantly farther offshore Washington than Oregon during both migration periods, which we attribute to a portion the whales following a more direct offshore route between approximately the Columbia River mouth and central Vancouver Island rather than a longer nearshore route past Cape Flattery. When compared with previous studies, the migration corridor along the coasts of Oregon and Washington appears to be both seasonally and annually elastic, and in some locations expanding as far offshore as 43 km. These results question the feasibility of conducting accurate shore-based gray whale censuses along these coasts because of the high proportion of whales traveling beyond a shore-based observer's range of view. These results also suggest that the migration corridor is sufficiently wide, especially during the southbound migration, that it might overlap potential offshore oil development areas on the continental shelf.

Introduction

Nearly the entire population of approximately 21,000 (Breiwick et al. 1988) gray whales (*Eschrichtius robustus*) passes through the waters off Oregon and Washington twice yearly while migrating between winter calving lagoons in Mexico and summer feeding grounds in the Bering and Chukchi seas (Wolman 1985). The southbound migration generally peaks off Oregon and Washington during December and January with approximately 90% passing Yaquina Head, Oregon, between December 19 and January 23 (Herzing and Mate 1984). The first phase of the northbound migration peaks in mid-March, typically followed 7 to 9 weeks later by a second (cow/calf) phase (Herzing and Mate 1984).

Migrating gray whales generally travel close to shore, remaining within 3 km throughout most of the route (Hessing 1981, Braham 1984, Rugh 1984, Herzing and Mate 1984, Brueggeman et al. 1987, Breiwick et al. 1988). For instance, land-based observations by Herzing and Mate (1984) indicated that nearly all southbound and northbound (first phase) migrants passed within 5 km of Yaquina Head, Oregon, from 1978-1981. However, gray whales have been observed traveling through the Channel Islands 80-200 km from the southern California mainland (Rice 1965, Rice and Wolman 1971, Leatherwood 1974, Kent et al. 1980, Jones and Swartz 1987) following a more direct route past the California Bight. Also, Poole (1984) observed that the first phase of northbound migrators in California traveled a straight-line route past Estero Bay while the second cow/calf phase followed the longer coastal corridor inside the bay. Furthermore, in the 1960s, Wilke and Fiscus (1961) and Pike (1962) observed numerous gray whales migrating 8 to 28 km offshore of the Columbia River mouth and the Washington outer coast, and Pike (1962) reported a single sighting of 3 whales 37 km west of Cape Flattery.

In 1989-1990, we conducted aerial surveys for marine fauna (marine mammals, seabirds, and sea turtles) occurring within 185 km of the Oregon and Washington coasts as part of an impact assessment of potential offshore oil development. One objective of the study was to determine the breadth of the gray whale migration corridor along Oregon and Washington relative to the 1990 southbound and first wave of the northbound migration periods to identify where the corridor might overlap with potential oil development areas. This paper reports the results of this investigation.

Study Area and Methods

Aerial surveys were conducted during 3-12 January (southbound gray whale migration) and 11-16

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March (first phase northbound), 1990, along 32 east-west oriented transect lines located between Cape Flattery, Washington, and the Oregon/California border. Spacing between transect lines varied to ensure coverage of areas where marine mammals and seabirds are known to concentrate (bays, river mouths, oceanic banks, etc.), but averaged approximately 22 km. Transect line lengths also varied with 75% of them extending from the coast to the 1,000-m isobath (50-75 km offshore) and 25% extending from the coast to 185 km offshore. This variation in line lengths were established to limit survey effort in typically less productive offshore waters.

Surveys were flown in a 300-series DeHavilland Twin Otter aircraft equipped with bubble windows providing forward and downward visibility. The marine mammal survey team consisted of two observers (one located on each side of the aircraft) and a data recorder. Surveys were flown at a 60-m altitude and a 185 km/hr ground speed.

Statistical comparisons between migration periods and between states (Oregon and Washington) were made using Student's t-test (Zar 1974). Centers and directions of migration corridors were approximated using linear regression (Neter and Wasserman 1974). Data were log-normal transformed before analysis.

Results

A total of 44 groups of 85 gray whales were observed during the January 1990 survey of the southbound migration and 68 groups of 124 whales during the March 1990 survey of the first wave of the northbound migration. Nearly 66% of the southbound migrating groups were >10 km from shore compared to 24% of the northbound groups (Figure 1). Gray whales occurred significantly ($t = 4.78$, $p < 0.0001$) farther from shore during the southward migration ($\bar{x}$ =14.3 km ± 8.2 SD) relative to the northward ($\bar{x}$ = 8.0 km ± 3.9 SD).

Gray whales occurred significantly ($t = 3.10$, $p < 0.007$) farther offshore Washington ($\bar{x}$ =18.5 km ± 11.9 SD) than Oregon ($\bar{x}$= 9.2 km ± 4.2 SD) when data from both migration periods were combined. This difference was especially apparent during the southbound migration when Washington observations ($\bar{x}$= 25.2 km + 13.2 SD) were on average over 13 km farther offshore than Oregon observations ($\bar{x}$ = 11.9 km + 3.9 SD; $t = 2.81$, $p < 0.025$). Differences during the northbound migration period were less significant ($t = 2.21$, $p < 0.059$) although Washington sightings ($\bar{x}$= 11.8 km + 5.4 SD) still averaged over 4 km farther offshore than Oregon sightings ($\bar{x}$= 7.5 km + 3.4 SD). The farthest offshore distance during the southbound migration off Washington was 43 km (5 groups) and off Oregon 23 km (2 groups). During the northbound migration the farthest offshore sightings were 20 km off Washington (1 group) and 19 km off Oregon (1 group).

The linear regression analysis showed that the center of both the southbound ($r^2 = 0.0003$) and northbound ($r^2 = 0.033$) corridors did not change in respect to latitude off Oregon, while off Washington the distance whales traveled from shore increased dramatically with increasing latitude during both migration periods (southbound, $r^2 = 0.803$; northbound, $r^2 = 0.636$) (Figure 2).

All whales observed on full-effort (2 observers at full attention) transects migrating past Washington were >5 km offshore. Eight whales, however, were incidently observed migrating within 5 km of the Washington coast during transit flights. Although gray whales were generally found closer to shore along the Oregon coast, only 16% of these whales were observed within 5 km.

Discussion

Although gray whale migration patterns are relatively predictable with respect to timing and location, the extent of the migration corridor may change annually. Our observations off Oregon (only 16% of all whales passing within 5 km of shore) are in contrast with Herzing and Mate's (1984) shore-based observations of nearly all southbound and first phase northbound migrants passing within 5 km of Yaquina Head, Oregon, suggesting a change in the offshore distribution has occurred since their study ended in 1981. Past studies have also suggested that the width or location of the migration corridors may fluctuate over time. For instance, Hubbs (1959) and Rice and Wolman (1971) suggested that the few whales observed along traditional migration routes off California in the late 1800s and early 1900s (Townsend 1887, Andrews 1914, Howell and Huey 1930) was due to animals traveling farther offshore to avoid shore-based whaling pressure rather than an overall population decline.

That gray whales migrate within 5 km past Cape Flattery can not be refuted based on

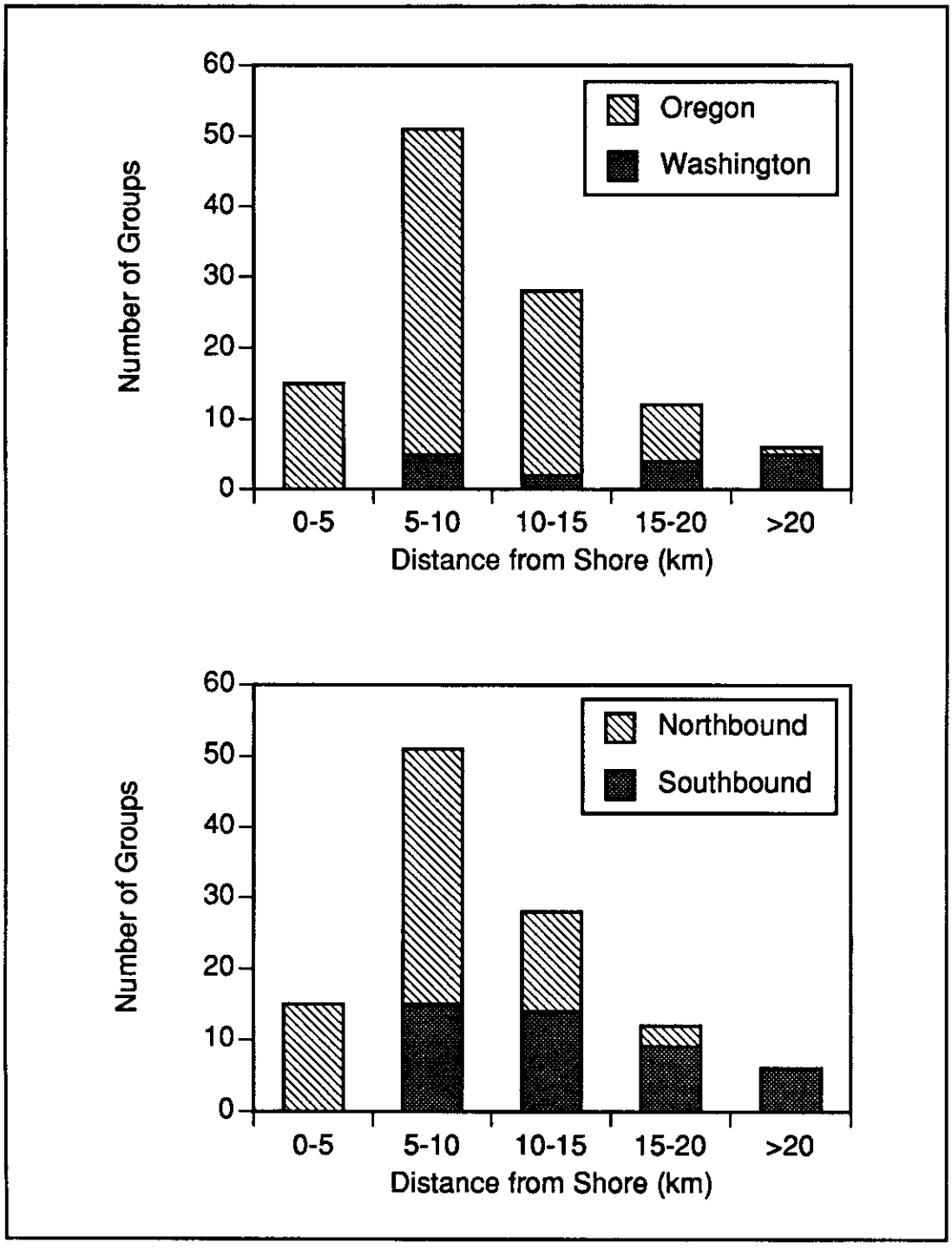

Figure 1. Distances from shore of migrating gray whales comparing between Oregon and Washington, and between the southbound and first phase of the northbound migrations, 1990.

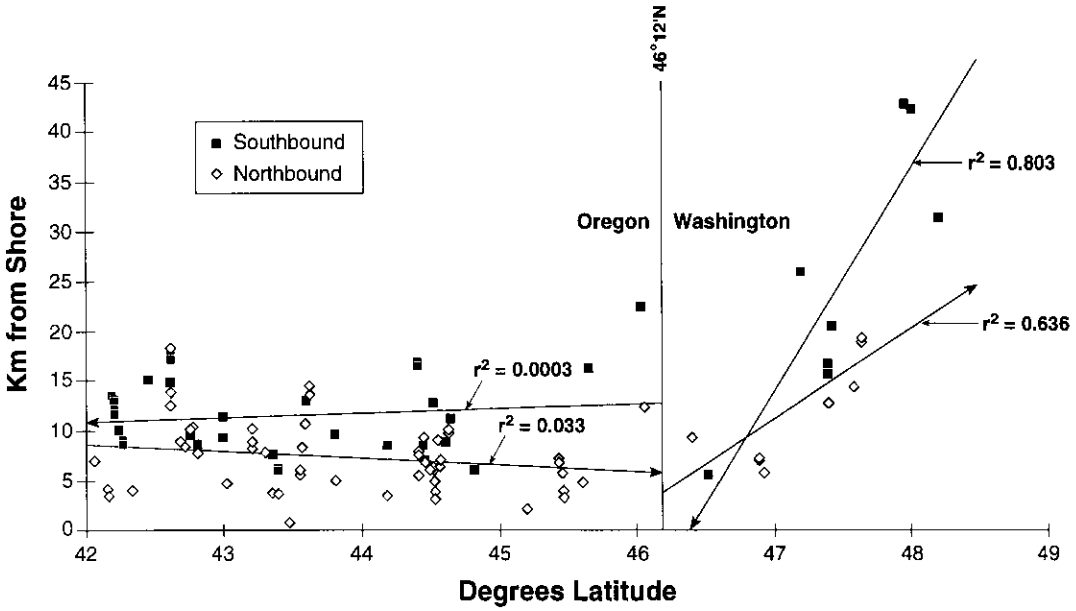

Figure 2. Distribution and mean directions of travel for gray whales migrating along the coasts of Oregon and Washington, 1990.

observations by Pike (1962) and Hatler and Darling (1974). However, our sightings of whales traveling 5-43 km offshore of Washington coupled with observations by Wilke and Fiscus (1961) and Pike (1962) of whales traveling 9-37 km off Washington support the occurrence of either a single, very broad corridor or an alternate offshore route. We suggest that the some portion of the population take a more direct route to and from the central coast of Vancouver Island thereby avoiding the longer coastal route past Cape Flattery. Previous researchers in California have noted migrating whales following more direct routes past coastal indentations such as the California Bight (Rice 1965, Rice and Wolman 1971, Leatherwood 1974, Kent et al. 1980, Jones and Swartz 1987) and Estero Bay (Poole 1984). The Washington offshore route also allows whales to cross the deep (250-650 m) Juan de Fuca submarine canyon at its narrowest point (a pattern reported by Brueggeman et al. [1987] in the southeastern Gulf of Alaska), and the whales are able to travel in relatively shallow (100-150 m) water off the north coast of Washington as the continental shelf (water <200 m deep) here extends nearly 75 km from shore.

Our study also supports previous observations (Pike 1962, Braham 1984, Brueggeman et al. 1987) that the southbound migration in general occurs farther offshore than the northbound, and further suggests that the southbound migration corridor, in particular, could overlap potential offshore oil development areas.

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