in the Northern Shoveler. Average feeding depths of the species at a given recording event were calculated on the basis of feeding method and morphological (body length, neck length, skull length, bill length) data, following the procedure described in Pöysä (1983b). For the birds picking and straining from surface, I assumed a feeding depth of 1.0 cm.

Results.—During each observation period the average feeding depth of the species increased from the first recording event onward (Table 1). Both in teal and shovelers, a significant positive correlation existed between the average feeding depth and the time since the start of the observation period ($r = 0.72$, N = 11, $P < 0.05$ for teal; $r = 0.76$, N = 9, $P < 0.05$ for shovelers) (Table 1). The average feeding depth of teal also correlated significantly with the number of teal present ($r = 0.70$, N = 11, $P < 0.05$) as well as with the total individual number of dabbling ducks present ($r = 0.63$, N = 11, $P < 0.05$), but not with the number of shovelers present ($r = 0.41$, N = 11, $P > 0.05$). By contrast, the average feeding depth of the shoveler correlated significantly with the number of teal ($r = 0.76$, N = 9, $P < 0.05$), but not with the number of shovelers ($r = 0.20$, N = 9, $P > 0.05$) or all dabbling ducks ($r = 0.57$, N = 9, $P > 0.05$).

Discussion.—The results demonstrate an increase in the feeding depth of shovelers with the presence and increasing numbers of teal. In teal, however, the negative effect of shovelers was minimal, possibly due to the low number of shovelers present; and significant interference was observed only intraspecifically. Moreover, the longer individuals of both of these species spent foraging in the patch, the greater was the shift toward greater feeding depths. These findings support the presence of an interactive shift in feeding depth, as during observation periods as short as those used here, intrinsic (i.e., not caused by the foraging ducks) changes in resource conditions should be minimal. Both passive interference and exploitation (cf. Schoener, Am. Nat. 122:240–285, 1983; Maurer 1984) might have been involved as mechanisms of interaction. When the average feeding depths of teal are compared between the first recording event of a particular observation period and the last recording event of the previous observation period, we see that the profitability of the surface layer has returned. Even though direct measurements of food availability and replenishment were not made, I tentatively suggest that the food resource was not replenished, but that availability of the prey was at least in part temporarily depressed as a result of disturbance of actively moving, foraging dabbling ducks. As the number of foraging ducks at most recording events was large (see Table 1), direct removal and consumption of prey by ducks also was probably important. Further examples of passive interference in other groups have been reported by Goss-Custard (Ardea, 68:31–52, 1980) for wading birds, and by Waite (Behav. Ecol. Sociobiol. 15:55–59, 1984) for corvids.

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Band-rumped Storm-Petrel occurrences in relation to upwelling off the coast of the southeastern United States.—In spite of several storm-related and stranding records of Band-rumped Storm-Petrels (*Oceanodroma castro*) in eastern North America since 1900 (reviewed by Clapp et al., Marine Birds of the Southeastern United States and Gulf of Mexico, Pt. 1, Gaviiformes through Pelecaniformes, U.S. Fish and Wildl. Serv., Washington, D.C., 1982), over 90% of the marine occurrences of the species have been recorded since 1980 (Haney, Oriole 48:21–32, 1983; Lee, Am. Birds 38:151–163, 1984; Sykes et al., Fla. Field Nat. 12:

17–18, 1984). During 1983 and 1984, seabird surveys in the South Atlantic Bight (Cape Hatteras, North Carolina, to Cape Canaveral, Florida) were made during investigations of boundary current upwelling on the outer continental shelf and slope. These studies, which incorporated synoptic coverage of water masses with satellite imagery, indicated that Band-rumped Storm-Petrels exhibit a marked affinity for centers of localized upwelling where food is plentiful. The association of Band-rumped Storm-Petrels with upwelling centers is discussed here in context of suggestions that the species occupies an ecological niche in water masses of low biological productivity in the Atlantic Ocean (Cramp and Simmons, The Birds of the Western Palearctic, Vol. 1, Oxford Univ. Press, Oxford, England, 1977), and is restricted to warm, pelagic marine habitats (Lee 1984).

Methods.—Seabird surveys were conducted using 15-min count periods and a 300-m band transect (Tasker et al., Auk 101:567–577, 1984). Between April 1983 and October 1984, 1217 counts were made on the outer shelf (40–200 m depth, N =667) and upper slope (200–1000 m, N = 550) of the study area (29° to 33°N latitude). Identifications of Band-rumped Storm-Petrels were based largely on behavioral field marks (Brown, Br. Birds 73:263–264, 1980; Naveen, Birding 14:10–14, 1982; Harrison, Br. Birds 76:161–174, 1983). Observations of one or more individuals (numbers listed chronologically by calendar date) were made on 29 April (1), 30 April (3), 1 May (5), 2 May (3), 7 June (2), 13 June (1), 11 July (1), 12 July (1), 1 August (18), and 2 August (1) 1984; and on 30 August (1) and 4 September (1) 1983. Sea surface temperature (SST) and depths were measured with a continuously recording thermosalinograph and white-line fathometer, respectively, at each sighting.

Upwelling was identified by satellite-derived data in conjunction with shipboard measurements. Surface-manifested upwelling on the outer shelf and upper slope in the South Atlantic Bight may stem from two fundamental sources: Gulf Stream filament eddies (Atkinson, Geophys. Res. Lett. 4:583–586, 1977) and where topographic features of the western Blake Plateau (upper slope) deflect or alter the Gulf Stream flow (Legeckis, J. Geophys. Res. 9:483–497, 1979). Gulf Stream filament eddies were identified with 1983–1984 Gulf Stream System Flow Charts (N = 215; NOAA, Miami, Florida) based on very high resolution infrared satellite imagery. Between 31 July and 2 August 1984, SST isotherms were mapped and seabird counts conducted at an eddy off the Georgia coast. Topographic upwelling was centered mainly at the Stetson Mesa (30°30′N, 79°30′W) and Hoyt Hills (32°00′N, 78°30′W). Upwelling at these sites was detected with vertical temperature profiles derived from deep-water, expendable bathythermograph (XBT) grids.

Results.—Band-rumped Storm-Petrels were observed on only three of nine cruises during 1983 when surveys were confined to the continental shelf, but were seen on each of five cruises to the upper slope in 1984. The storm-petrel was observed mainly off Florida and Georgia where survey effort was most intensive (Fig. 1). Environmental measurements confirmed the species' affinity for warm, pelagic water masses (Lee 1984). Band-rumped Storm-Petrels were not observed in deep water east of the Gulf Stream on the middle Blake Plateau (Fig. 1).

Lee (1984) reported Band-rumped Storm-Petrels at sea surface temperatures (SST) of 26.8° to 28.4°C off North Carolina; 95% of individuals (N = 75) were in waters > 900 m. In contrast, 90% of individuals (N = 38) I observed occurred over shallower waters, <900 m ($\bar{x}$ = 515 ± 209 [SD]), where SSTs ranged from 25.5° to 29.0°C ($\bar{x}$ = 27.4 ± 1.3). As the sightings I made came from a more extended period (29 April to 4 September vs 30 May to 20 August), part of the greater SST range may be attributed to seasonal warming of water masses (Atkinson et al., J. Geophys. Res. 88:4705–4718, 1983). Lee (1984) suggested that depth was a key factor in the distribution of this species. My data indicate that its mesoscale (10–100 km) distribution may not be correlated with depth or SST per se, but rather to dynamic upwelling processes, which in turn affect local productivity and food availability.

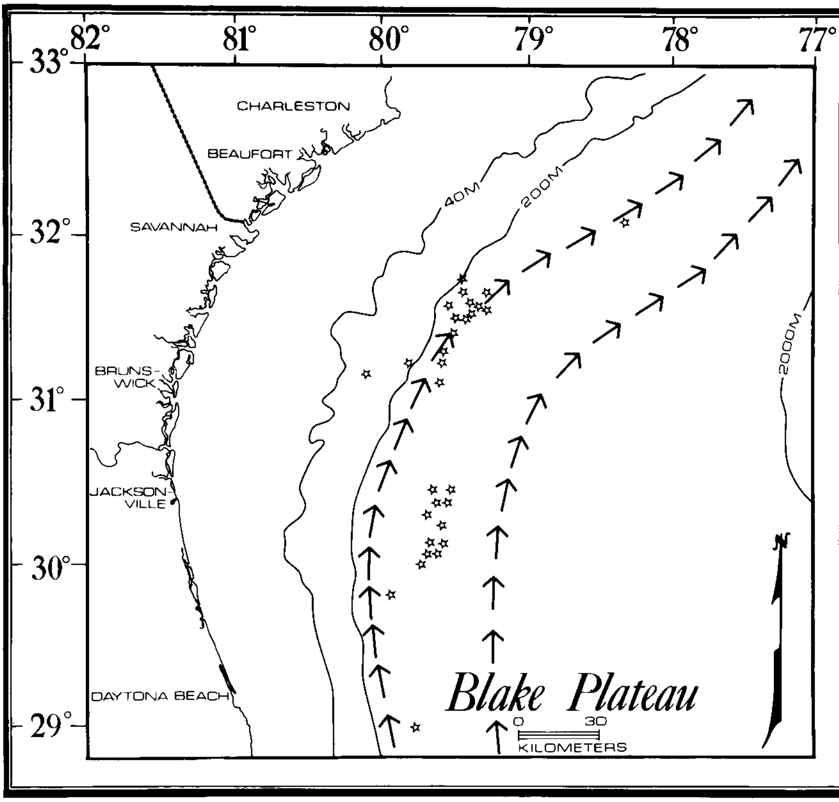

FIG. 1. Locations of Band-rumped Storm-Petrel observations in the South Atlantic Bight, 1983–84. Annual mean positions of the western and eastern Gulf Stream current boundaries are shown by arrows.

Upwelling occurs, however, at different cross-shelf/slope locations in pelagic waters off the southeastern United States as a result of interregional differences in bathymetry, and in the position of the western Gulf Stream front.

Nearly 90% of individuals and 75% of occurrences were associated with locations of upwelling. Sixty-one percent of individuals and 42% of occurrences (N = 12) were at Gulf Stream eddies. Twenty-nine percent of individuals and 33% of occurrences were at topographic upwelling sites. During a cruise across the Georgia continental shelf and slope, 31 July to 2 August 1984, I observed Band-rumped Storm-Petrels exclusively in the cold core of a Gulf Stream filament eddy (Fig. 2). Upwelling in eddy cores results in 10–100 fold increases in primary production compared to adjacent Gulf Stream and resident shelf waters (Yoder et al., Limnol. Oceanogr. 26:1103–1110, 1981). The resident high phytoplankton biomass provides forage for zooplankton and nekton, including small myctophid fish, squid, amphipods, and euphausiids (P. McGillivary, pers. comm.). These items may on occasion comprise the diet of Band-rumped Storm-Petrels (cf. Harris, Proc. Calif. Acad. Sci. 37:95–

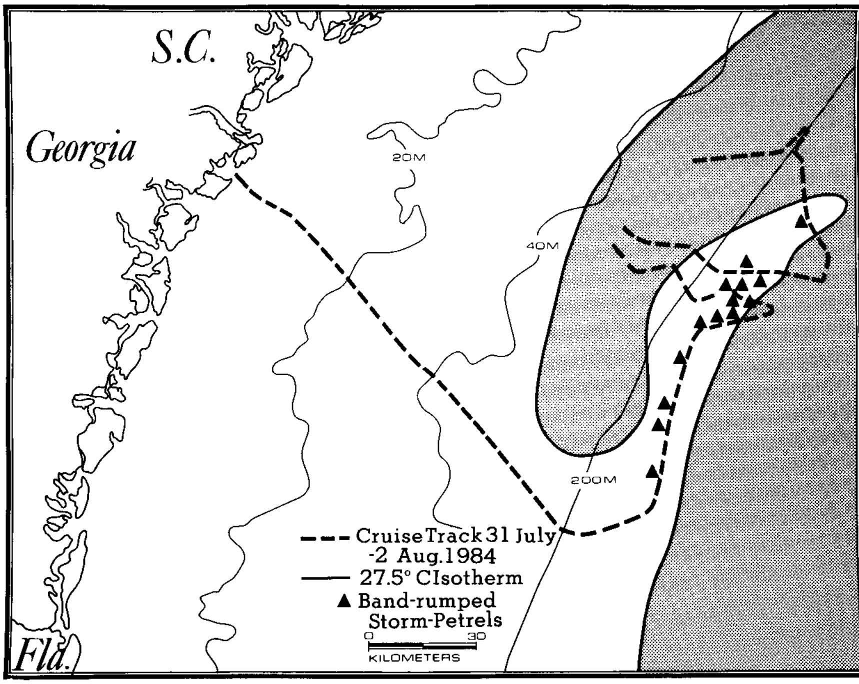

FIG. 2. Band-rumped Storm-Petrel distribution in relation to a Gulf Stream filament eddy. Shaded region is surface Gulf Stream water (>27.5°C) and unshaded region is either shelf or colder, upwelled subsurface Gulf Stream water (<27.5°C). Upwelling occurs in the eddy cold core, between the filament of warm water and the main body of the Gulf Stream. The 27.5°C isotherm defines a region of maximum, horizontal SST gradient between the water masses.

166; Lee 1984). Seabird densities in the cold core are 10–20× higher than in adjacent waters (Haney, unpubl. data), further attesting to the significance of eddy-associated upwelling for marine organisms.

The biological conditions stemming from upwelling are not available continually for foraging storm-petrels in the South Atlantic Bight. Gulf Stream eddies, for example, are small features (20–50 km wide, 70–120 km long) that form and degrade in 2 to 14 days, and move northward with the Gulf Stream at 35 to 40 km/day (Lee and Brooks, Geophys. Res. Lett. 6:321–324; Blanton et al. 1981; Lee et al. 1981). These upwelling events are nonseasonal, and at any given time eddies (and upwelling) may be present along the outer shelf and upper slope between North Carolina and Florida.

Discussion.—Storm-petrels show widespread affinities for regions of upwelling (Gould, Ph.D. diss., Univ. Arizona, Tucson, Arizona, 1971), including upwelling at small-scale features (e.g., submarine canyons in the Pacific; Stallcup, West. Birds 7:113–136, 1976). Patchy, localized upwelling could account for the occurrence of Band-rumped Storm-Petrels elsewhere in western North Atlantic waters off the southeastern United States. Blanton et al. (Deep-Sea Res. 28:393–405, 1981) describe upwelling induced by a combination of Gulf

Stream flow and the diverging isobaths "downstream" (north) of Cape Canaveral, Florida. Virtually all North Carolina sightings of Band-rumped Storm-Petrels occurred downstream of the diverging isobaths north of Cape Hatteras (Lee 1984) (Fig. 1). Both regions contain similar bathymetry and both are strongly influenced by eastward Gulf Stream meanders that cause upwelling (Atkinson 1977; Lee et al., Deep-Sea Res. 28:347–378, 1981). Prior to 1984, more records of Band-rumped Storm-Petrels existed for the Gulf than the Atlantic coast of Florida (Sykes et al. 1984). Eddies of the Loop Current in the northeast Gulf of Mexico cause upwelling off western Florida, providing similar physical and biological conditions to those in the South Atlantic Bight (Paluszkiewicz et al., J. Geophys. Res. 88:9639–9651, 1983). The occurrence of Band-rumped Storm-Petrels in this region has been considered underestimated due to lack of observation and misidentification (Clapp et al. 1982).

Band-rumped Storm-Petrels are more solitary than the other Atlantic storm-petrel species (Cramp and Simmons 1977), and may more frequently exploit the localized and transitory patches of productivity found in tropical and subtropical water masses off the southeastern United States. Although I also observed Leach's (*O. leucorhoa*) and Wilson's storm-petrels (*Oceanites oceanicus*) at upwelling sites, their abundance relative to *Oceanodroma castro* was low compared to the abundances of these storm-petrels elsewhere in the Atlantic. For instance, at the eddy studied 31 July to 1 August 1984 (Fig. 2), 38% of 45 storm-petrels were *castro,* compared to 58% *oceanicus* and 4% *leucorhoa.* Leach's and Wilson's storm-petrels were common in the study area only during spring migration (May–June). The occurrence of Band-rumped Storm-Petrels in these generally oligotrophic water masses may lend support to previous speculations regarding the species as a low-density occupant of the Atlantic Ocean where other storm-petrels are scarce (Cramp and Simmons 1977, Naveen 1982).

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Nest, seasonal movements, and breeding of Buffy Hummingbirds in xeric habitats of northeastern Venezuela.—The Buffy Hummingbird (*Leucippus fallax*) is restricted to the "...arid Caribbean littoral of Colombia in eastern Santa Marta and the Guajira Peninsula eastward along the Venezuelan coast to Sucre..." and some islands off northeastern Venezuela (Meyer de Schauensee, The Species of Birds of South America and their Distribution, Livingston, Narberth, Pennsylvania, 1966). The species also occurs farther inland (e.g., in the State of Lara; Phelps and Phelps, Bol. Soc. Venez. Cienc. Nat. 90:1–337, 1958). It