





TABLE

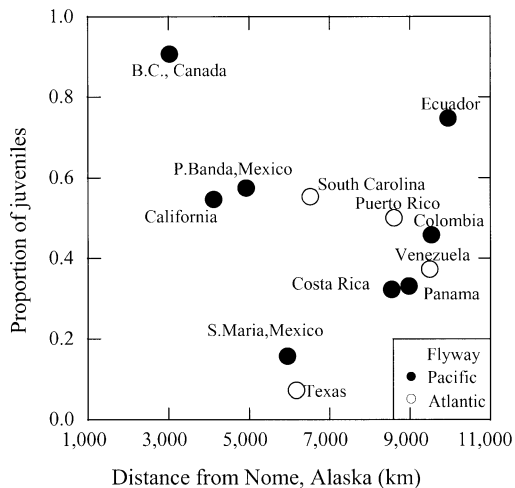


FIG. 3. Age ratio of Western Sandpipers captured at 12 locations. Proportion of juveniles versus lati-

proach involves considering trade-offs between differential costs and benefits among classes of birds with respect to three aspects: (1) performance at the nonbreeding site, (2) intraspecific interactions, and (3) "cross-seasonal interactions" with the breeding season (Myers 1981b).

*Performance at the nonbreeding site.*—Body-size differences may interact with local climate to produce differential distributional optima, principally by sex (Ketterson and Nolan 1976). That is based on a physiological argument: larger individuals can survive longer periods of fasting and are therefore thought to be better suited to survive colder or less predictable climates, typically found at higher latitudes. That prediction has not been supported with unequivocal empirical evidence for shorebirds (Myers 1981a, Shepherd et al. 2001) or any other bird species (Cristol et al. 1999). In Western Sandpipers, members of the larger sex, females, winter farther south. This hypothesis cannot account for the distribution found.

Western Sandpipers feed on invertebrate prey items during the nonbreeding season (Wilson 1994). They use several different modes of feeding, but pecking (with the bill just touching the substrate surface) and probing (when the bill is more deeply inserted) is most common (Sutherland et al. 2000). Female Western Sandpipers have longer bills than males (on average, 12%), whereas other structural measurements differ only slightly (between 0 and 5%; Cartar 1984). The difference in bill length is likely related to habitat use, mode of feeding (Harrington 1982, Durrell 2000), or both. A longer bill may be better suited for probing and probing may be a more profitable feeding mode farther south. That could be caused by a latitudinal gradient in temperature affecting burying depth of invertebrates.

*Intraspecific interactions.*—Asymmetrical interactions among age and sex classes can produce habitat segregation (Marra 2000) and might produce geographical segregation ("dominance hypothesis"; Gauthreaux 1978). Dominant individuals may benefit by monopolizing areas closer to the breeding grounds, thereby lowering "migration costs". If we assume that the larger sex dominates the smaller sex, and that adults dominate juveniles (but see Komers and Komers 1992), we would expect to find higher proportions of females and adults

at more northern sites, in contrast to the patterns observed.

*Cross-seasonal interactions.*—Factors other than maximizing overwinter survivorship may influence nonbreeding distributions (Myers 1981b). In particular, a sex or age class that benefits more from earlier arrival on the breeding grounds will gain by wintering closer to the breeding grounds ("arrival time hypothesis"; Ketterson and Nolan 1976, Myers 1981a). Because males are the primary territory holders in Western Sandpipers and arrive on the breeding grounds before females (Holmes 1971, Warnock and Bishop 1998), this hypothesis predicts the general pattern we observed with respect to sex. However, Western Sandpipers wintering at Punta Banda, Mexico, initiate northward migration two to three weeks earlier than those in central California (Fernández et al. 2001), which could offset the longer distance. Similar differences occur in other shorebird species (Turpie 1994), which may make that effect less important.

*A multifactor hypothesis.*—None of these single-factor hypotheses completely acco6(o)10 -0 9 406.799 42

ed with longer migration distances or induced by higher intensity of ultraviolet light closer to the equator. For juveniles wintering farther

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