pers. comm. in Page et al. 1986). Other birds migrate either north or south to wintering areas (Warriner et al. 1986). Plovers occasionally winter in southern coastal Washington (Brittell et al. 1976). The recent discovery of snowy plovers wintering near Cape Shoalwater in Pacific County, Washington, represents the northernmost record of wintering snowy plovers on the Pacific coast (Scott Richardson, Washington Department of Wildlife, pers. comm., 1994). From 43 to 81 plovers wintered on the Oregon coast between 1982-1990, primarily on 3 beach segments (Oregon Department of Fish and Wildlife 1994). The majority of birds, however, winter south of Bodega Bay, California (Page et al. 1986). Wintering plovers occur in widely scattered locations on both coasts of Baja California and significant numbers have been observed on the mainland coast of Mexico at least as far south as San Blas, Nayarit (Page et al. 1986). Many interior birds west of the Rocky Mountains winter on the Pacific coast (Page et al. 1986, Stern et al. 1988). Birds winter in habitats similar to those used during the nesting season.

Widely varying nest success (percentage of nests hatching at least one egg) and reproductive success (number of young fledged per female, pair, or nest) are reported in the literature. Nest success ranges from 0 to 80 percent for coastal snowy plovers (Widrig 1980, Wilson 1980, Saul 1982, Wilson-Jacobs and Dorsey 1985, Wickham unpubl. data in Jacobs 1986, Warriner et al. 1986). Instances of low nest success have been attributed to a variety of factors, including predation, human disturbance, and inclement weather conditions. Reproductive success ranges from 0.05 to 2.40 young fledged per female, pair or nest (Page et al. 1977, Widrig 1980, Wilson 1980, Saul 1982, Warriner et al. 1986, Page 1988). Page et al. (1977) estimated that snowy plovers must fledge 0.8 young per female to maintain a stable population. Reproductive success falls far short of this threshold at many nesting sites (Widrig 1980, Wilson 1980, Warriner et al. 1986, Page 1988, Page 1990).

Management Considerations

Historic records indicate that nesting western snowy plovers were once more widely distributed in coastal California, Oregon, and Washington than they are currently. In coastal California, snowy plovers bred at 53 locations prior to 1970 (Page and Stenzel 1981). Since that time, no evidence of breeding birds has been found at 33 of these 53 sites, representing a 62 percent decline in

breeding sites (Page and Stenzel 1981). The greatest losses of breeding habitat were in southern California, within the central portion of the snowy plover's coastal breeding range. In Oregon, snowy plovers historically nested at 29 locations on the coast (Charles Bruce, Oregon Department of Fish and Wildlife, pers. comm., 1991). In 1990 only 6 nesting colonies remained, representing a 79 percent decline in active breeding sites. In Washington, snowy plovers formerly nested in at least 5 sites on the coast (Eric Cummins, pers. comm., 1991). Today only 2 colony sites remain active, representing, at minimum, a 60 percent decline in breeding sites.

In addition to loss of nesting sites, the plover breeding population in California, Oregon, and Washington has declined 17 percent between 1977 and 1989 (Page et al. 1991). Declines in the breeding population have been specifically documented in Oregon and California. Breeding season surveys along the Oregon coast from 1978 to 1993 show that the number of adult snowy plovers has declined significantly at an average annual rate of about 7 percent (Oregon Department of Fish and Wildlife 1994). The number of adults has declined from a high of 142 adults in 1981 to a low of 30 adults in 1992 (Oregon Department of Fish and Wildlife 1994; Randy Fisher, Oregon Department of Fish and Wildlife, in litt., 1992). If the current trend continues, breeding snowy plovers could disappear from coastal Oregon by 1999. In 1981, the coastal California breeding population of snowy plovers was estimated to be 1,565 adults (Page and Stenzel 1981). In 1989, surveys revealed 1,386 plovers (Page et al. 1991), an 11 percent decline in the breeding population. The population decline in California may be greater than indicated; the 1989 survey results are considered more reliable than the earlier estimates, which may have underestimated the overall population size (Gary Page, pers. comm., 1991).

Although there are no historic data for Washington, it is doubtful that the snowy plover breeding population in Washington was ever very large (Brittell et al. 1976). However, loss of nesting sites in this state probably has resulted in a reduction in their overall population size. In recent years, fewer than 30 birds have nested on the southern coast of Washington (James Atkinson, pers. comm., 1990; Eric Cummins, pers. comm., 1991). In 1991, only one successful brood was detected in the State (Tom Juelson, Washington Department of Wildlife, in litt., 1992).

Survey data also indicate a decline in wintering snowy plovers, particularly in southern California. The number of snowy plovers observed during Christmas Bird Counts from 1962 to 1984 significantly decreased in southern California despite an increase in observer participation in the counts (Page *et al.* 1986). This observed decline was not accompanied by a significant loss of wintering habitat over the same time period (Page *et al.* 1986).

The most important form of habitat loss to coastal breeding snowy plovers has been encroachment of European beachgrass (Ammophila arenaria). This non-native plant was introduced to the west coast around 1898 to stabilize dunes (Wiedemann 1987). Since then it has spread up and down the coast and now is found from British Columbia to southern California (Ventura County). European beachgrass is currently a major dune plant at about 50 percent of California breeding sites and all of those in Oregon and Washington (J.P. Myers, National Audubon Society, in litt., 1988). Stabilizing sand dunes with European beachgrass has reduced the amount of unvegetated area above the tideline, decreased the width of the beach, and increased its slope. These changes have reduced the amount of potential snowy plover nesting habitat on many beaches and may hamper brood movements. The beachgrass community also provides habitat for snowy plover predators that historically would have been largely precluded by the lack of cover in the dune community. Cost effective methods to control or eradicate European beachgrass have not yet been found.

In the habitat remaining for snowy plover nesting, human activity (e.g., walking, jogging, running pets, horseback riding, off-road vehicle use, and beach raking) is a key factor in the ongoing decline in snowy plover coastal breeding sites and breeding populations in California, Oregon, and Washington. The nesting season of the western snowy plover (mid-March to mid-September) coincides with the season of greatest human use on beaches of the west coast (Memorial Day through Labor Day). Human activities detrimental to nesting snowy plovers include unintentional disturbance and trampling of eggs and chicks by people and unleashed pets (Stenzel et al. 1981, Warriner et al. 1986, P. Persons, in litt., 1992), off-road vehicle use (Widrig 1980, Stenzel et al. 1981, Anthony 1985, Warriner et al. 1986, Page 1988, Philip Persons, in litt., 1992); horseback riding (Woolington 1985, Page 1988, Philip Persons, in litt., 1992); and beach raking (Stenzel et al. 1981). Page et al. (1977)