

between years and no consistent year effect (for example, all years down in the same year, up in the next), one survey year would be representative of murrelet use of these stands. However, at sites with only one or a few detections per morning, where more surveys have zero detections, more than one year of surveys may be required to adequately determine murrelet use.

PATTERNS OF VARIATION IN THE DISTRIBUTION OF MARBLED MURRELETS OFFSHORE OF THE SAN JUAN ISLANDS, WASHINGTON

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During the summers of 1994 and 1995, we surveyed for Marbled Murrelets from small boats in the San Juan Islands of Washington. Surveys were conducted approximately once every 10-day period. In areas of murrelet concentrations, we conducted intensive surveys at 100, 300, 500, and 800 m from shore to determine the distribution of murrelets. We analyzed variations in distribution relative to time of day, tide cycles, distance from shore, between years, and between islands. In 1994, we found that, overall, murrelets were much closer to shore than we had found along more exposed coasts of California, most were within 500 m from shore, with a peak at 300 m. However, we found that along some islands in the same year this peak was at 100 m. This peak also changed between years on the same transect. In 1995, we also conducted some all-day surveys, finding a considerable variation in the number of birds through the day at one site, but little change at another site. We discuss the potential impact of these results, including the need for preliminary studies for adequate survey design.

HAWAIIAN STILTS RESPONSE TO HABITAT RESTORATION

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The endangered Hawaiian subspecies of the Black-necked Stilt (*Himantopus mexicanus knudseni*) is found in the Nu'upia Ponds of the Marine Corps Base Hawaii, Kaneohe Bay located on O'ahu. Eight ancient Hawaiian fishponds are bordered by introduced vegetation composed almost entirely of Pickleweed and Red Mangrove. Mangrove and Pickleweed management has been ongoing for many years. Since 1982, the military has used Amphibious Assault Vehicles (AAVs) to break up pickleweed and expose mud surfaces, where stilts nest and feed. In 1987, stilt counts finally exceed those made in 1947 (127 birds). By the 1995, stilt numbers climbed to the highest counts ever recorded in the ponds (150). The stilts using the ponds represents around 10% of the entire Hawaiian population. The recent Legacy Program-funded projects to eradicate mangroves has significantly increased stilt habitat. From December, 1993 to March, 1995 approximately 12.5 acres of mangroves were removed from the Nu'upia Ponds. Stilts quickly exploited modified habitat. In 1995, at least four nests were placed on newly-cleared mangroves shorelines and four nests on artificial nesting islands. In 1996, additional areas will be modified to increase stilt nesting sites.

DISTRIBUTION, ABUNDANCE, AND STRUCTURE OF HARLEQUIN DUCK POPULATIONS IN PRINCE WILLIAM SOUND, ALASKA

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In response to mortality from the 1989 T/V Exxon Valdez oil spill, Harlequin Duck (*Histrionicus histrionicus*) populations were surveyed in Prince William Sound (PWS) in 1995 to assess the extent of recovery of ducks inhabiting oiled areas and determine if low reproductive success resulted in changes in age and sex structure of the population. Shoreline surveys monitored abundance, distribution,

population structure, and productivity in oiled and unoiled areas. Surveys conducted from early May to mid-June compare temporal changes in abundance and population structure (number of breeding pairs, subadult males, unpaired adult males, and unpaired females), within and between oiled and unoiled areas. Breeding pairs were used to evaluate breeding chronology and estimate size of the local breeding population. Plumage patterns in spring were used to age males to 1 of 3 classes (1 yr, 2 yr, adult). Surveys conducted from mid-July through mid-September identify molt chronology and compare changes in sex ratios and abundance. Brood surveys compare productivity. Seasonal changes in population structure throughout the two survey periods provide insight into harlequin duck movements to and from the study area.

HOW COSTLY IS CLUTCH FORMATION IN THE AUDOIN'S GULL?

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To assess female daily and total energy investment in clutch formation for the Audouin's Gull (*Larus audouinii*), we studied the rapid yolk deposition (RYD) period in 24 recently laid eggs belonging to 8 three-egg clutches collected at the Ebro Delta colony. RYD was estimated following the potassium dichromate yolk-staining method of Grau (1976). Stained yolks were photographed and their images were computerized. The number of dark-light bands and their respective volumes were obtained using image processing. RYD lasted 8 days in the Audouin's Gull; the mean volume of dry yolk deposited daily was 1.93 ml, although the rate of deposition was not constant, being higher during the second half of RYD. Total volume of yolk deposited per follicle was 15.24 ml. The maturation of the three follicles lasted from 11 to 14 days, and daily energy investment peaked on day 7 when, on average, up to 8 ml of yolk was