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Wintering Peregrine Falcon (*Falco peregrinus*) Habitat Utilization Near Sequim, Washington

Abstract

As DDT residues decrease in the environment, habitat loss becomes the number one threat to peregrine falcons (*Falco peregrinus*) in Washington. This state's population has grown, making it the second most densely populated Western state, and urban expansion threatens peregrine wintering areas in western Washington, including the area around Sequim. Three peregrine falcons were followed by radio-telemetry near Sequim, Washington to determine their habitat (resource) needs during winter, and to provide information to resource managers and planners in the Sequim area, and other similar areas. Two peregrines used two different habitats; an immature female utilized open water habitat significantly more than expected ($\alpha = 0.05$), while an immature male utilized grassy fields significantly more than expected. The home ranges for the male and female were 85.69 km^2 and 65.79 km^2 respectively. Ducks comprised 27% of the collected kills and 44% of other hunts (including missed attempts and uncollected kills). Passerines combined made up 42% of the collected kills and 26% of the other hunts. Conifer snags were the most common type of perch used.

Introduction

Peregrine falcons *(Falco peregrinus)* have been intensively studied since populations began declining in the late 1940's (Ratcliffe 1967, 1980) as a result of DDT residues accumulating in prey (Nelson 1969, Peakall *et al.* 1976). The presence of organo-pesticide contamination, however, is not the only threat to peregrine falcons. Land development is altering the habitats which support both the peregrine and its prey. Between 1960 and 1990 Washington State's human population grew by 70%, making it now the second most densely populated of the western states. Parts of Western Washington, where much of the recent growth has occurred, are important wintering areas for peregrines. In Clallam County, where Sequim is located, population growth has outstripped the rest of the state with an 85% increase in the last three decades. Population densities in Western Washington now equal those found in California, the most densely populated state in the west. Of the 3,760 km of marine shoreline in Washington 89% is privately owned, and while all estuarine environments have undergone modifications, 87% have seen moderate to severe changes. Urban areas are expanding onto wildlands more and more each year.

At least three western Washington areas are known to support winter resident peregrines: the Samish Flats (Anderson and DeBruyn 1979, Anderson *et al.* 1980), Grays Harbor (Dobler and Spencer 1987) and the Sequim area. All are at least somewhat associated with marine shorelines. In 1983, the area near Sequim was chosen for studies of wintering peregrine habitats because, 1) data compiled by the Washington Department of Wildlife and reports from raptor experts identified this area as a center of peregrine activity, and 2) residential development was creating potential conflicts. A better understanding of patterns of use might help preserve the peregrines here and in similar sites.

Study Area

Sequim lies near the northeastern corner of the Olympic Peninsula along the Strait of Juan de Fuca (Fig. 1) on a plain between the foothills of the Olympic Mountains and the strait. This fertile plain is a mixture of small farms and residential developments and is divided by the Dungeness River. Coniferous forests surround the farmlands on the undeveloped uplands and conifer stands grow interspersed throughout the area. Dungeness and Sequim bays form protected water bodies but offer only small areas of intertidal flats. Protection Island and Smith Island lie in the strait east and northeast of Sequim respectively. The area lies in the rain shadow of the Olympic Mountains and receives approximately 40 cm of rainfall.

Methods

Between 21 December 1983 and 21 March 1984, several field assistants and I captured three peregrines, using standard falconry techniques (Beebe and Webster 1985). An immature male (No. 5095) was captured on 4 January 1984, one immature female (No. 5049) was captured on 9 January 1984, and another immature female (No. 5022) on 10 February 1984. We fitted a six-gram

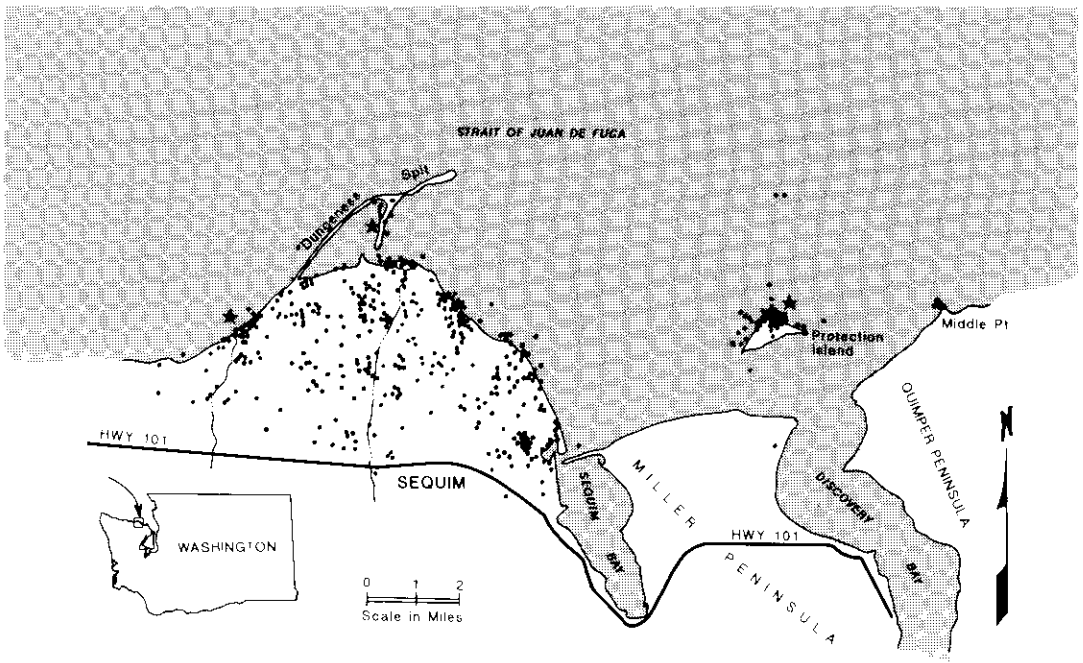

Figure 1. Vicinity map showing peregrine sighting locations. The points represent all observations (except Smith Island which is outside the area shown), and are not weighted by time. Stars are the locations of night roost sites.

transmitter to a central retrice of each bird, using methods similar to those described by Dunstan (1973). Using radio-telemetry, we located the birds and observed their behavior, recording all perch sites used and movements and noting the time at each change in activity. When a peregrine was seen with prey, we attempted to collect the prey remains after it had finished feeding and departed. In the course of searching for the radio-tagged birds we sometimes observed other peregrines, and recorded their activities as long as they could be observed.

I determined home ranges and core areas for the radio-tagged peregrines by using the harmonic mean measure of activity method (Dixon and Chapman 1980) and the computer program algorithm developed by Samuel *et al.* (1983). A core area is defined as the maximum area where the observed utilization distribution significantly differs from a uniform utilization distribution (Samuel *et al.* 1985). I weighted the calculations on the basis of time, using a maximum of one record for each half hour interval within an "observation." (An observation is an unbroken period of time. If a bird was lost for five minutes the next sighting became the start of a new observation period.) Each observation was given at least one record, regardless of the duration of the observation.

The Washington Department of Wildlife Remote Sensing Laboratory determined the habitat classifications utilized by the radio-tagged peregrines using LANDSAT remote sensing techniques. I then compared habitat utilization with availability based upon habitat composition within the home range boundaries and habitat composition of larger areas including the total home ranges. Simultaneous confidence intervals provided the means to compare utilization and availability (Marcum and Loftsgaarden 1980). Available habitat was defined by a boundary enclosing all the observed data points plus an arbitrary border about 2.5 km wide.

Results

There were 342 individual observations of peregrines during the study, with a total observation time of 225 hours. The radio-tagged immature male (bird 5095) accounted for 60 hours and one immature female (bird 5022) accounted for 79 hours. An injured immature female (bird 5049) accounted for 46 hours of observation. Non-radioed birds accounted for the remainder. A minimum of eight different peregrines used this study

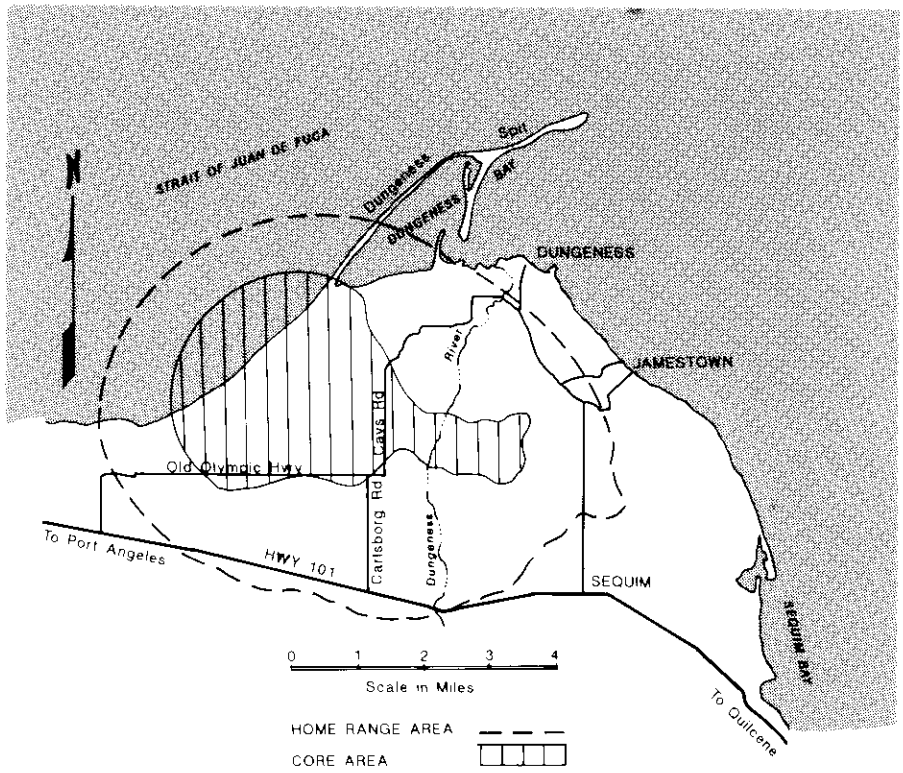

Figure 2. Home range of 5095, an immature male peregrine falcon.

area: three males, one adult and two immature; five females, one adult and four immatures. Six were seen repeatedly, one immature female was observed only two times and one immature male but once. In 21 cases peregrines were observed where individual identity could not be verified. Figure 1 shows locations of peregrine observations. Peregrine subspecies are not easily discernible in the field; however, all peregrines which could be carefully observed were judged to be *F. p. pealei*.

Peregrine No. 5049, had been shot and wounded by unknown persons with a .22 cal. rifle, at least two weeks prior to her capture 9 January, 1984. Her leg injury was apparent when she was first observed 28 December 1983. After capture she was taken to the Washington State Veterinary Clinic. Examination revealed a shattered leg that had mended on its own, although somewhat crooked. After a short observation period it was recommended that she be returned to the wild without treatment (Dr. Erik Stauber, pers. comm.). This bird was radio-tagged and released.

Bird 5095 had a calculated home range of 85.69 km² (Figure 2), and bird 5022 had a home range of 65.79 km² (Figure 3). The core areas equaled 25.34 km² and 13.50 km² respectively. The injured female had a smaller home range than the other two birds, only 5.67 km² with a core area of 1.56 km².

Each of the home ranges contained a different habitat composition. Nine habitat classes were used for comparisons; water, coniferous forest, mixed forest, deciduous forest, shrub-woodland, grass-cropland, sparse grass, beach-bare ground, and other. Grass and cropland represented 62% of the male's home range, and open water comprised 23%. Seventy-two percent of the female's home range was open water, followed by grass and cropland with 15% of the total. Habitat utilization was not analyzed for No. 5049 since her injury might have influenced the size and shape of this home range.

Actual habitat use significantly departed from predicted habitat use (χ^2 = 1443.8 for bird 5095, χ^2 = 556.4 for bird 5022, $P < 0.005$, df = 8). Within the available habitats each bird showed different habitat choices. The male used the

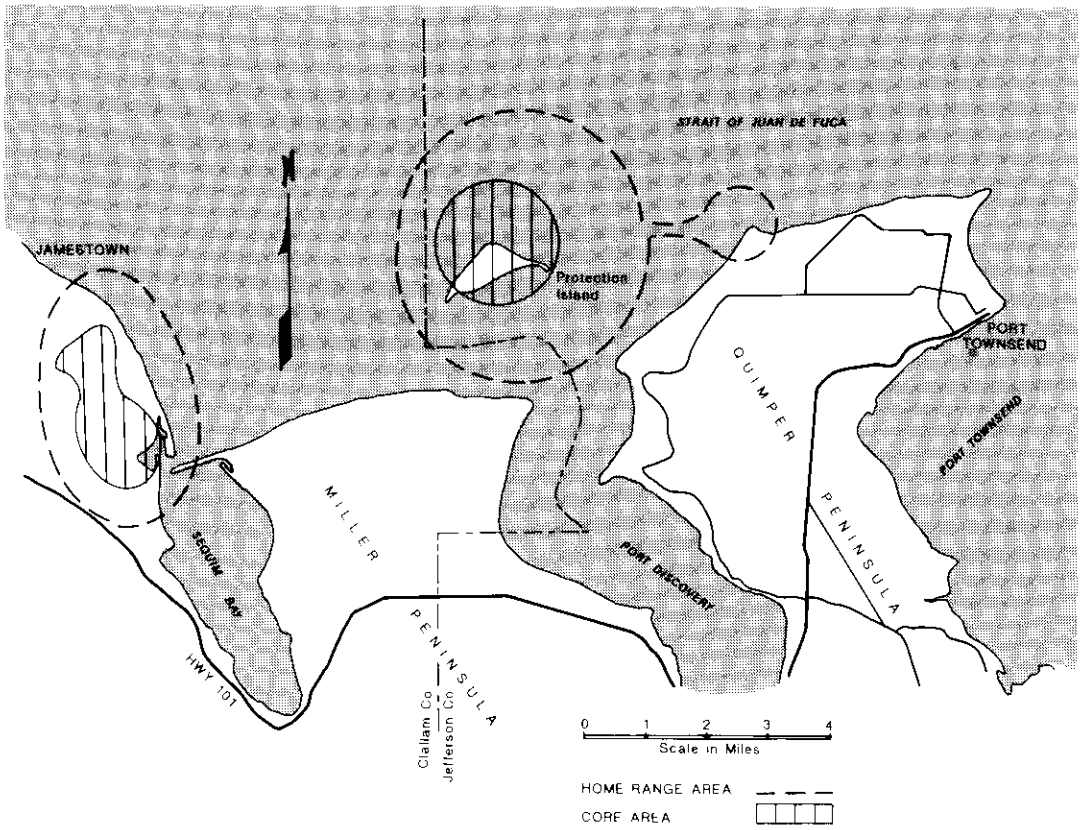

Figure 3. Home range of 5022, an immature female peregrine falcon.

grass-cropland habitat type significantly more than expected ($\alpha = .05$), and conifer forests and water significantly less than expected. The female used water significantly more than expected ($\alpha = .05$) over the total home range, and conifer woodlands, mixed forest and shrub-woodland, less than expected, with conifer woodlands comprising the largest area. Within the core area she used water significantly less than expected and used the categories grass-cropland, sparse grass and beach-bare ground more than expected on the basis of availability, although of these only grass-cropland contributed much to the total core area. Outside the core area these three categories had no higher use than the predicted value.

Feeding Habits

One peregrine, No. 4001, an adult male, used a site on Smith Island for perching and feeding. We collected all prey remains found at this perch site. All other prey remains came from separate locations where peregrines were actually observed feeding. Peregrines were observed to take or pursue members of 22 different species. Prey remains were collected from 33 kills and 86 other hunts were observed where prey identity was determined. Some of these other hunts ended in kills but prey remains were not collected and therefore are not represented in collected prey, but are included as other hunts. In addition three attempts to pirate from a gull were observed.

Twenty-seven percent of kills and 44 percent of the other hunts were waterfowl. While exact species was not always known, 65 percent of the identifiable waterfowl prey were from five species: bufflehead (*Bucephala albeola*), mallard (*Anas platyrhynchos*), wigeon (*Mareca americana*), green-winged teal (*Anas carolinensis*), and common goldeneye (*Bucephala clangula*). Thrushes, American robin (*Turdus migratorius*) and varied thrush (*Ixoreus naevius*), comprised 36 percent of the kills. Passerines combined made up 42 percent of the

kills and 26 percent of the other hunts. Mew gulls (*Larus canus*) were 3 percent of the kills but 17 percent of the other hunts. Attempts to capture cormorants were observed seven times (8% of the other hunts) and ancient murrelet (*Synthliboramphus antiquus*), and pigeon guillimot (*Cepphus columba*) were each observed as prey two times, while rhinocerous auklet (*Cerorhinca monocerata*), black turnstone (*Arenaria melanocephala*), ringnecked pheasant (*Phasianus colchicus*) and merlin (*Falco columbarius*) were each observed as prey once.

Perch Selection and Roost Location

Peregrines in the Sequim area perched in snags 59 percent of the time (Total N = 636). Douglas fir (*Pseudotsuga douglasii*) and western red cedar (*Thuja plicata*) were the most commonly selected, being used 35 percent and 30 percent respectively. Conifer snags (all types combined) comprised 93 percent of the snags selected.

We located night roosts for the three radio-tagged peregrines (Figure 1). Bird 5095 regularly used a bluff near the mouth of McDonnell Creek, usually perching about 5 to 10 meters from the top in one of several depressions formed by erosion of the clay face. This is a north facing bluff along the Strait of Juan De Fuca. Bird 5022 used a bluff on the northeastern corner of Protection Island, also using the eroded clay face similar to bird 5095 above. The injured bird, 5049, roosted in the area of Graveyard Spit, although the exact location varied somewhat. Sometimes she roosted low, perhaps on the ground. At times she roosted on a navigation aide near the shore.

Discussion

The peregrines at Sequim made use of several different habitat types. Although only two home ranges were suitable for habitat preference analysis and represent only one season of use, the data do indicate that birds in the same general area use distinct habitats. The analysis can however overstate the importance of some habitat types and understate the importance of others. One bird (5022), used the shoreline and open water associated with it significantly more than expected over her entire home range, although within her home range core area, water was used less than expected. This is somewhat misleading. Certainly the shoreline was very important to her. However, because wintering peregrines spend over 75 percent of the time perching (Anderson and DeBruyn 1979) and because her hunts usually began and ended with perching, the shoreline perching habit biased the core area analysis in favor of non-water habitats. However, if the direction of this bird's attention could have been considered in the analysis, the outcome would support the importance of the open water, for while her feet may have been on a firm tree branch, her gaze was nearly always out to sea. The harmonic mean analysis did not account for which way she was looking. In addition if our ability to track her over open water had been better its importance would have been even more pronounced. We often lost sight of her and were not able to gain adequate triangulation fixes, although at times the signal bearing changes suggested a meandering flight out over the water. On one occasion she was followed to Smith Island by boat, a distance of over 22 km, and was observed there on one other occasion. The adult male, while not radio-tagged and as a result seen far less frequently, showed a similar kind of behavior in the vicinity of Smith Island, indicating that use of this habitat is not limited to females.

Other peregrines spent much of their time further inland near the open fields and pastures. The immature male (bird 5095), roosted on the shoreline bluff, but almost always began his day by flying inland over fields, and usually remained there throughout the day. He would typically perch in tall snags near open fields, often moving accross the landscape as successive hunts failed. His use of the open water was very infrequent. All the peregrines in the study area, both males and females, frequented marshes at least some of the time.

Sequim is adjacent to the Strait of Juan De Fuca, an area where diving ducks, grebes and other shallow water divers congregate in the winter (Wahl *et al.* 1981). It includes large open pastures where gulls and passerines feed. There are marshes and low areas where standing water attracts wintering ducks. These features all combine to form a diverse association of habitats which together support a variety of bird species, although the number of any one species is not particularly large. The 1983 Christmas Bird Count for the Sequim-Dungeness area reported 24,158 individuals of 127 species with only four species exceeding one thousand; wigeon (5,925), European starling (*Sturnus vulgaris*) (2,058), glaucous winged gull (*Larus glaucescens*) (1,925) and American

robin (1,024). Looking only at species of the size peregrines might consider for food, from medium sized gulls to finches, the Christmas Bird Count for the area recorded over 90 species and twenty thousand individuals.

No single group of prey represented a majority of the prey selected by peregrines at Sequim. In contrast observers in some other areas of Washington reported that peregrines primarily used one major group of prey species. In Grays Harbor, a major shorebird concentration area, dunlin (*Erolia alpina*) were selected 66% of the time (Dobler and Spencer 1987). On the Samish Flats, a major waterfowl wintering area, ducks were the main prey (Anderson and DeBryun 1979, Anderson *et al.* 1980).

There has been an increasing transformation of the Sequim area from small farms with pastures and hay crops into residential developments. This change affects the suitability of habitats for peregrines wintering there. Although peregrines occasionally perch near houses, and hunt in backyards, human habitation creates some conflicts.

Increased dwelling density eliminates large open areas used by peregrines during hunts, thereby restricting pursuit and limiting capture success. In addition, increased housing density increases the liklihood of wire strikes, and shootings.

Some of the undeveloped lands are marshes. Development of marshes requires ditching and draining, which eliminates habitat for waterfowl, an important prey item. When human population density increases, snags, which are important perches for peregrine falcons, are removed, either for safety or for firewood. Habitat development along the shoreline may be especially destructive. The shoreline is often steeply banked with scenic possiblities for development. However the shorelines are critical to peregrines hunting the strait, particularly the snags and old trees growing along the edge. Some sites along the bank are also used as roosts. Increased human use of the shoreline areas, particularly any use of motorized vehicles on the narrow beach below the roost sites, will increase disturbance.

Peregrines tolerate human presence better than many other wildlife species, as exhibited by many nestings and winter sightings in metropolitan areas (Ratcliffe 1980). They will continue to use the Sequim area if key features of the shorelines, marshes, open fields and snags are maintained and some areas are protected from disturbance. Fortunately, the Protection Island National Wildlife Refuge protects one important shoreline site. Management of the refuge to maintain and enhance peregrine habitat and careful development of other lands will be required to conserve this species in this diverse habitat.

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