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Wintering Peregrine Falcon *Falco peregrinus* Habitat Utilization in Grays Harbor, Washington

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ABSTRACT

Western Washington State is an important wintering area for Peregrine Falcons *(Falco peregrinus)*. Grays Harbor, a major coastal estuary, was chosen for studies of habitat and prey utilization. Radio-telemetry was used to assist observation. One Peregrine was radiotagged. Results show that Peregrines in Grays Harbor use intertidal mudflats extensively, particularly near Bowerman Basin, an area with predictable shorebird concentrations. Shorebirds were selected for prey more than 60% of the time. The home range was determined, using harmonic mean measure of activity, for the only radiotagged Peregrine, and equalled 7800 ha.

INTRODUCTION

The Peregrine Falcon *Falco peregrinus* has been the subject of much study since its population began declining in the late 1940s (Ratcliffe 1967, 1980). DDT residues accumulated from ingested prey are thought to have been the cause of the population decline (Nelson 1976; Peakall, Reynolds & French 1976). However, the presence of organo-pesticide contamination is not the only factor. Continuing land development threatens the habitats which support both the Peregrine and its prey.

Western Washington is an important wintering area for Peregrines. There are three areas known to support significant numbers of winter residents each year. These are the Samish Flats (Anderson & DeBruyn 1979; Anderson *et al.* 1980), Sequim (Dobler unpub. data) and Grays Harbor (Fig. 1). In 1981, Grays Harbor was chosen for studies to add to the limited knowledge of the habitats used by wintering Peregrines in this important major estuary.

Incidental observations have contributed some to our knowledge of Peregrines in Grays Harbor. Perhaps the earliest record is by Hubbard (1892), who observed a Peregrine prey on a Bufflehead *Bucephala albeola*. More than twenty winter observations of Peregrines in or near Grays Harbor were compiled by the Department of Wildlife Nongame Data System prior to 1981.

Some earlier studies recorded observations of Peregrines in Grays Harbor. Smith and Mudd (1976) reported a Peregrine (observed on five different occasions) feeding on shorebirds there. Castings taken from a regularly used perch contained Dunlin *Erolia ruficollis* and Western Sandpiper *Ereunetes mauri* remains. They observed no other raptors using the perch and determined the castings to be from the same Peregrine.

The importance of shorebird prey *Scolopacidae* had been suggested by Herman and Bulger (1981). In 14 sightings of Peregrines, shorebirds were observed being chased eleven times. Their study was done in Grays Harbor in April, when shorebirds are the most abundant prey, with over 500,000 present.

STUDY AREA

Grays Harbor lies midway along the coast of Washington, about 45 miles north of the mouth of the Columbia River (Fig. 1). This major west coast estuary is fed by the Chehalis, Humptulips, Hoquiam, Elk and Johns Rivers. At high tide (MHHW) about 24,300 ha (60,000 acres) are covered with water. At low tide (MLLW) more than half that area, about 15,000 ha (37,000 acres) are exposed as intertidal flats. The harbour is partially bordered by salt marshes with coniferous forest covering much of the upland. The east end of the estuary is dominated by the industrial centres of Aberdeen and Hoquiam. Outside the harbour's mouth the coastal ocean beaches extend north and south as broad stretches of surf-washed sand.

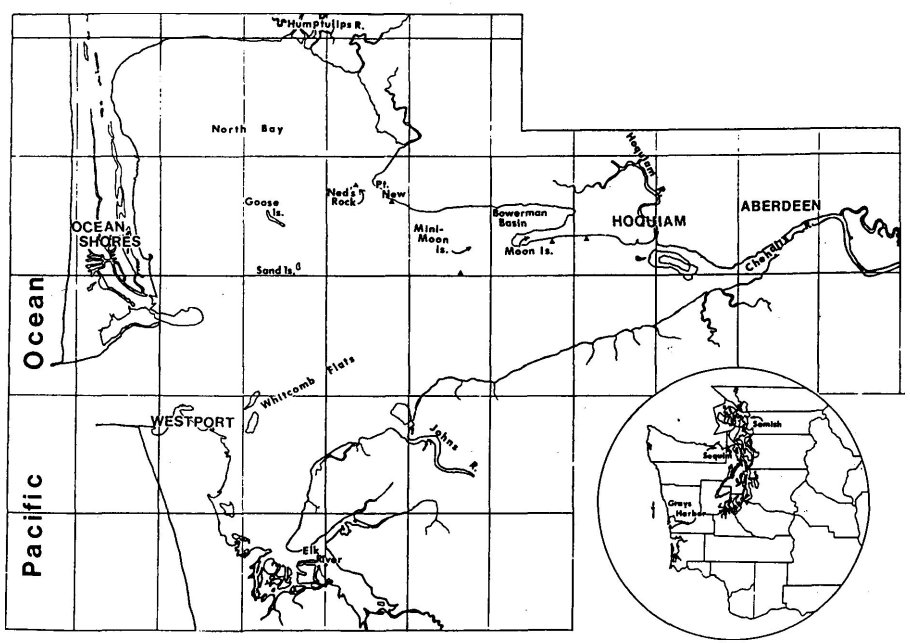

Figure 1. Map of Grays Harbor showing key points. Pyramids indicate night roost locations.

METHODS

This study began on 27 December 1981 and ended on 15 April 1982. Attempts were made to trap and radio-tag Peregrines using standard falconry techniques (Beebe & Webster 1964). One Peregrine, an immature male, was captured and radio-tagged. A six gram transmitter was fitted to a central rectrice, using methods similar to those described by Dunstan (1973).

This Peregrine was followed by use of radio-telemetry and its activities observed and recorded. All perch sites and movements were recorded and the times noted. Any sighting was considered a unique observation when separated by at least 5 minutes from the previous sighting. When the Peregrine was seen with prey, an attempt was made to collect the prey remains after it had finished and departed.

In the course of searching for the radio-tagged bird other Peregrines were noted. These were similarly observed, as far as possible, recording activities and collecting prey remains.

The radio-tagged bird made regular use of a site for perching and feeding. This was visited regularly and all prey remains gathered each time. All other prey remains were from kills where Peregrines were observed feeding.

Home range for the radio-tagged bird was determined by using the computer programme/algorhythm developed by Samuel *et al.* (1983). This algorhythm estimates home range based on the harmonic mean measure of activity method (Dixon & Chapman 1980). Calculations were weighted by time, with a maximum of one record input for each half hour interval within an observation. Each observation was given at least one record, regardless of its duration.

Habitat types utilized by the radio-tagged Peregrine were determined by overlaying the calculated home range with a baseline inventory of land cover and land use for the study area (Sweeny, Nelson & Rodrick 1982). Acreage calculations for each habitat type were measured using a dot-grid overlay.

RESULTS

A minimum of six different Peregrines were observed using the Study Area. Their sexes and ages are shown in Table 1. Three were seen repeatedly, two several times, and one only once, just at the end of the study. Other Peregrines could have used the area without being observed, and some were seen where individual identity could not be determined with certainty.

One other Peregrine, an adult female, was shot by a duck hunter at Oyhut Sink, near Ocean Shores, in November 1981, prior to the study. This bird is not included in Table 1, although it may have been an additional winter resident.

Peregrine subspecies are not easily discernible in the field. However, all Peregrines which could be carefully observed were, with one exception, identified as *F. p. pealei*. The exception was an adult female *F. p. tundrius*, seen once in April.

Table 1. Sex and age of Peregrines observed in Grays Harbor.

	Male	Female	Total
Adult	1	3	4
Immature	1 *	1	2
TOTAL	2	4	6

* This bird was radio-tagged.

Patterns of use

There were 228 individual observations of Peregrines during the study, with a total observation time of more than 168 hours. The radio-tagged bird accounted for 124 hours and one other bird, an adult female, for 22 hours.

In Figure 2 the study area has been overlaid by a grid dividing it into rectangles 2.5 minutes on a side. Each rectangle is 1,471 ha (3,635 acres). The shaded areas show where the Peregrines were observed. The numbers represent the percentage of time Peregrines spent in each rectangular grid area. The vicinity of Point New received the greatest use, followed by Bowerman Basin. These two areas, together with the rectangle adjacent to both, account for 68% of the total observation time (Fig. 2).

The calculated home range for the radio-tagged Peregrine was 7,797 hectares. The core area equalled 1,975 ha and is defined as the maximum area where the observed utilization distribution exceeds a uniform utilization distribution (Samuel *et al.* 1983). Figure 3 shows the home range, with the core area and outer boundary areas.

The habitat components of the calculated home range are shown in Table 2. The largest was mudflats, representing 53% of the total, followed by open water, principally of the bay itself, with over 25% of the total.

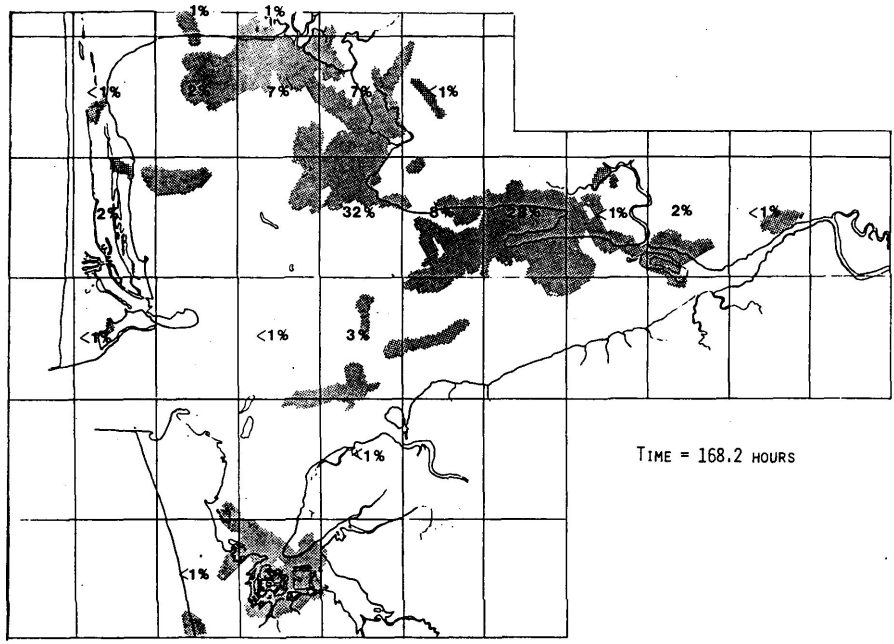

Figure 2. Areas used by Peregrine Falcons studied in Grays Harbor. Numbers are percent utilization.

Table 2. Habitat component of the calculated homerange of the radio-tagged Peregrine in Grays Harbor.

Habitat Type	Hectares (Acres)	Percentage
Mudflats, fine sand gravel, cobble, etc.	3935 (9724)	53
Bays, estuaries, ponds, lakes.	1991 (4921)	27
Forested uplands, includes all seral stages.	852 (2107)	12
Residential, commercial, industrial, port facilities.	314 (777)	4
Field crops, pasture.	232 (575)	3
Freshwater forest swamps, saltwater marsh.	46 (113)	1
Inland pond	4 (10)	< 1
Island, rock	2 (5)	< 1
TOTAL	7376 (18232)	100%

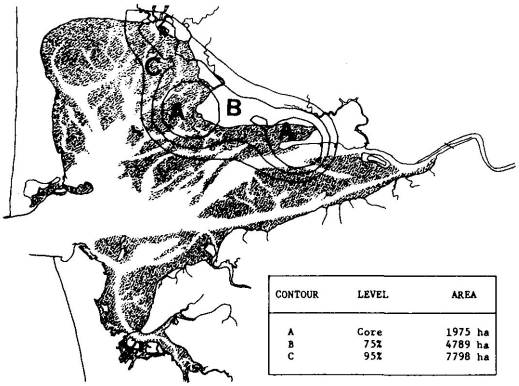

Figure 3. The calculated home range of the radio-tagged Peregrine.

Food habits

Twenty-nine samples of prey killed by Peregrines in Grays Harbor were collected. In addition, 62 attempts to capture prey were observed but no prey remains were collected. Some of these attempts ended in kills but are not represented in the sampled prey remains. Table 3 shows the prey utilization for Grays Harbor.

Table 3. Prey selected by Peregrines in Grays Harbor.

Species	Number of Prey Samples Collected	Number of Attempts	Total
Fork-tailed Petrel (Oceanodroma furcata)	1		1
Green-winged Teal (Anas carolinensis)		2	2
Widgeon (Mareca americana)		1	1
Bufflehead (Bucephala albeola)		5	5
Duck spp.		1	1
Merlin (Falco columbarius)		1	1
Black-bellied Plover (Squatarola squatarola)	1	1	2
Dunlin (Erolia alpina)	13	39	52
Shorebird spp.	1	4	5
Gull spp.		2	2
Flicker (Colaptes cafer)	1		1
Yellow-bellied Sapsucker (Sphyrapicus varius)	1		1
Robin (Turdus migratorius)	1	1	2
Varied Thrush (Ixoreus naevius)	6		6
Meadowlark (Sturnella neglecta)	1		1
Blackbird spp.		1	1
Pine Siskin (Pinus spinus)	1		1
Fox Sparrow (Passerella iliaca)	2		2
Unidentified		4	4
N = 17	29	62	91

The data for attempts and prey remains collected were combined and grouped into common families (Table 4). Unidentified prey were omitted from this table and the percentage occurrence is calculated on the basis of the prey represented in Table 4 only. The sandpiper family is the most important single group, accounting for over 65% of the selections.

Table 4. Prey selected by Peregrines in Grays Harbor by family. Unidentified prey are excluded.

Family	Total	Percent
Storm Petrels (Hydrobatidae)	1	1.1
Ducks (Anatidae)	9	10.3
Falcons (Falconidae)	1	1.1
Plovers (Charadriidae)	2	2.3
Sandpipers (Scolopacidae)	57	65.5
Gulls (Laridae)	2	2.3
Woodpeckers (Picidae)	2	2.3
Thrushes (Turdidae)	8	9.2
Meadowlarks (Icteridae)	2	2.3
Finches (Ploceidae)	3	3.4
Total	87	99.8

Perch selection

The perches selected by Peregrines in Grays Harbor are shown in Figure 4. Driftwood lodged on the tidal mudflats was selected most often (23% of the time). The other most frequently used perches, whether man-made or natural, were also objects on or near the tidal lands. When live or dead trees were chosen, they were most often along the shoreline of the harbour.

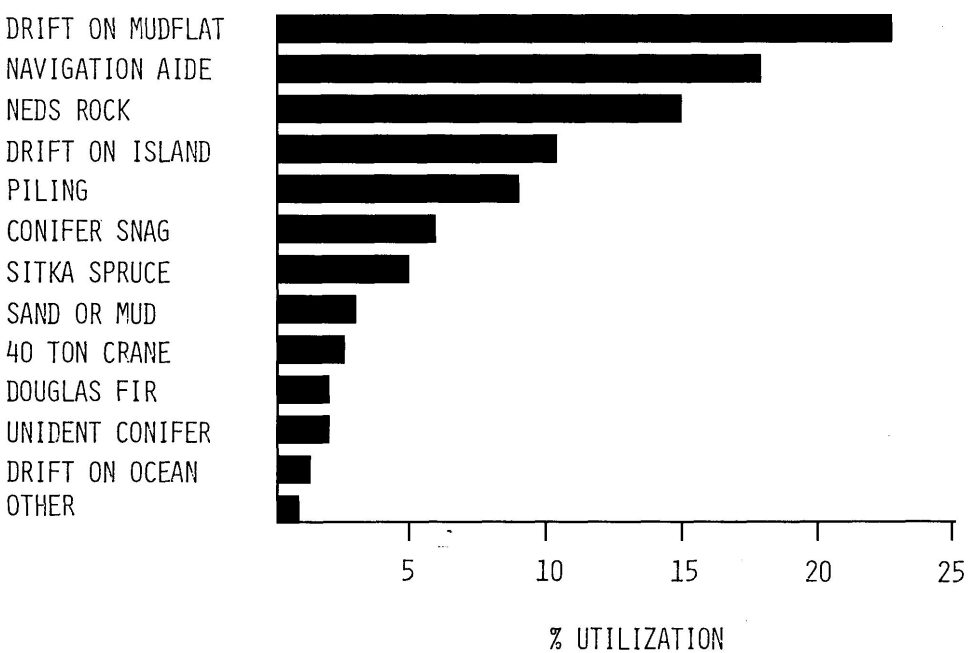

Figure 4. Percent utilization for each type of perch used by Peregrine Falcons in Grays Harbor, Winter 1982. N = 298.

Night roosts

Night roosts were located for two of the Peregrines. Figure 1 shows known roost sites. The radio-tagged bird made regular use of Ned's Rock, a pinnacle of clay rising about 15m above the mudflat near Pt. New. This bird also made frequent use of the navigation aid adjacent to Hoquiam Airport (at Moon Island), and once of the navigation aid east of the finger pier at the end of Paulson Road. These navigation aids were large wooden frame platforms built on pilings located 50m or less from the shoreline.

Sometimes at dark this bird could not be found, often during inclement weather. Near the end of the study we discovered that a bluff just east of Point New had been used regularly, probably as a night roost by the radio-tagged male. An alcove offered good protection from the south-westerly storms, and there was the characteristic whitewash present to indicate frequent perching by a falcon. By that time, the radio-transmitter was not transmitting and the roost could not be verified.

On two occasions an adult female Peregrine, the individual seen most frequently in this area, perched on a large navigation aid south-west of Mini Moon Island. The bird was observed late in the day. Then as darkness fell it hopped up into the interior of the structure. This structure was later checked and a number of castings found, indicating that it was being used regularly, probably as a night roost.

DISCUSSION

The results of this study clearly support the connection between Peregrines and shorebird prey. In Grays Harbor, shorebirds are the most important group of prey species, being selected over 65% of the time by wintering Peregrines. The Dunlin is the most abundant and accounted for all identifiable shorebird prey (Table 2).

The Peregrines were observed to adjust their activities to take best advantage of the Dunlin's habits. This is demonstrated by the extensive use of the tidal mudflats, particularly of Bowerman Basin and its vicinity (Fig. 2). On rising tides this area is the last in the harbour to be covered by water, and on falling tides the first to be exposed (Herman & Bulger 1981). Flocks of shorebirds (6,000 or more in the winter) are often found concentrated there, and the Peregrines prey upon these. During this study it was common to see more than one Peregrine using Bowerman Basin at the same time. Once as many as three were all hunting there simultaneously.

Another area of high use was Point New (Fig. 2). Several Peregrines were observed using the area, and in one instance two were seen there at once. This was a major use area of the bird radio-tagged (Fig. 3). He perched here during the day, often hunted in the area, and spent nights on Ned's Rock.

The preference given to this area by the only radio-tagged bird certainly biased the results, giving the area the highest use figures in the harbour. Even so, Point New is an important area. When wintering Peregrines are present in the harbour, Point New will be used. Its isolation and proximity to the shorebird concentrations at North Bay, Bowerman Basin and Ned's Rock combine to make this a preferred habitat.

North Bay, with more than 16% utilization (Fig. 2), was the third area of significant use. This extensive mudflat attracted shorebirds to its high flats adjacent to the mouth of the Humptulips River. Several Peregrines hunted the shorebird concentrations found here.

The mouth of the Elk River regularly attracted waterfowl but only held a small number of shorebirds. Peregrines used this but not as frequently as the above areas. This part of the harbour was not used often by the radio-tagged bird, and was not an easy place to search for unmarked Peregrines. However, extra effort was expended to ensure that it was adequately sampled and that the results are reliable.

The central parts of Grays Harbour were hard to survey. The large distances (up to 3km) made searching from the shoreline difficult. Boat survey was often dangerous and at other times impractical because of the extensive shoals. Inclement weather was common and compounded the problems of visibility and boat travel. The radio-tagged Peregrine could sometimes be located out in the central part of North Bay, but in many of these cases the location could be established only by triangulation of two or more telemetry signal bearings. Without radio-telemetry detection of the movements of birds in the central flats was even more difficult. It is certain that Sand and Goose Islands, and Whitcomb Flats, were used more than the data reflect.

The importance of the intertidal area is apparent from the data (Table 2). Mudflats were used more than 50% of the time by the radio-tagged Peregrine, and open estuary and mudflat combined comprised over 80% of the area selected. Bowerman Basin, Point New and the area between them account for 68% of the Peregrine use. This 4,400ha (10,900 acre) area is the centre of observed activity in the harbour. The nucleus is Bowerman Basin, and the reason is high shorebird concentrations. The perches, and to some degree even the night roosts, are selected to place the Peregrine in a good position to capitalize on the shorebird prey. No other family of prey was a significant contributor, although both ducks and thrushes were pursued over 5% of the time (Table 2). Shorebirds were also the most plentiful prey bird at this time of year. The Christmas Bird Count for 1981 shows that there were about 23,000 Dunlin present at the start of the study period.

Peregrines, catching nearly all their prey while in flight by direct pursuit, require abundant prey in a vulnerable situation to insure multiple opportunities for success. Shorebirds using the mudflats in Grays Harbor supply these requirements, and form the principal feature which attracts wintering Peregrines to this area.

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