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Osprey Population Increase along the Willamette River, Oregon, and the Role of Utility Structures, 1976–93

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Abstract – The population of ospreys nesting along the Willamette and lower Santiam Rivers in western Oregon increased from an estimated 13 pairs in 1976 to 78 pairs in 1993. The number nesting on trees (live and dead) was similar in 1976 (13 pairs) and in 1993 (12 pairs). Ospreys were first observed nesting on utility structures (poles and towers) in 1977, and that nesting segment increased at a rapid rate (from 1 pair in 1977 to 66 pairs in 1993). A logistic growth curve was fitted to the data and, assuming that the logistic growth curve was correct, the osprey population nesting on utility structures was estimated to stabilize at 86 pairs in 2004; however, the population data fitted the exponential growth curve nearly as well. The latter model does not permit the estimation of an upper population limit. Ospreys in 1993 were producing young at about twice the rate necessary to maintain a stable population. Improved water conditions and fish numbers in the Willamette River, a new enlightened attitude toward birds of prey which resulted in less shooting, and the osprey's release from DDT-related reproductive problems after the 1972 DDT ban probably contributed to the population increase. The first osprey that nested on a utility pole in the study area may have been produced on a man-made nesting platform established in 1973 at Crane Prairie Reservoir (first US Osprey Management Area) about 160 km to the southeast. A shortage of tree nest sites along the Willamette River may have limited the osprey nesting population in earlier years, but the seemingly learned response to nest on utility structures has resulted in nest sites being almost unlimited now.

Key words: osprey; Oregon; utility structures; population dynamics; nesting success.

Early records of osprey abundance in Oregon were few, and the species was only designated as either "rare" or "common", with no attempt at enumeration, e.g. Woodcock 1902, Jewett and Gabrielson 1929). After reviewing the historical records, Gabrielson and Jewett (1940:199) reported the osprey as:

> "formerly common along the Columbia and Willamette Rivers, in the Klamath Basin, and about the larger Cascade lakes, must now be considered one of the rarer Oregon hawks. It is still present in the Klamath Basin but in sadly diminished numbers. A few are found along the coast, and scattered pairs occur along the larger streams, such as the Rogue, the Umpqua, the Deschutes, the John Day, and the Columbia Rivers."

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The reference to "formerly common" in the Klamath Basin is supported by a Vernon Bailey unpublished report (in Henny 1988) of 500 osprey nests (estimated 250–300 nesting pairs) in extreme southern Oregon at the northeast corner of Tule Lake in 1899. Historical numbers nesting along the Willamette River remain unknown. Henny *et al.* (1978) estimated 308 ± 23 pairs nesting in Oregon in 1976, 94.7% of which were in live or dead trees. Most of the "other" nest sites (13) were platforms constructed in 1973 for ospreys in the central Cascade Mountains at Crane Prairie Reservoir, the first Osprey Management Area created in the United States in 1969 (Roberts 1969). In contrast to Oregon, 69% of ospreys in Chesapeake Bay and coastal New Jersey, Delaware, Maryland, and Virginia (Henny and Noltemeier 1974, Henny *et al.* 1977) nested on man-made structures including utility poles and towers by the mid-1970s and records of such use in the east date back to 1881.

We discuss the population increase of ospreys nesting along the Willamette River of western Oregon from 1976–93 (only a segment of the nesting osprey population west of the Cascade Mountains in Oregon). We also discuss the role of utility poles and towers in the population increase and we suggest a possible reason why the transition to utility structures occurred during this time period.

STUDY AREA AND METHODS

The main-stem Willamette River is a ninth-order river and the tenth largest river in the conterminous United States in terms of total discharge (Sedell and Froggatt 1984). It is the largest river in the United States with restored water quality (Huff and Klingeman 1976). Historically, high loadings of organic wastes produced critically low dissolved oxygen concentrations, floating and benthic sludge, and *Sphaerotilus natans* beds that reduced salmon migration, recreational use, and aesthetic value. Water quality improved dramatically, salmon runs returned, and recreational uses increased after low-flow augmentation from upstream reservoirs and basinwide secondary sewage treatment began in the 1950s (Hughes and Gammon 1987). Huff and Klingeman (1976) and Hines *et al.* (1977) documented improvements in water quality and Dimick and Merryfields (1945) and Hughes and Gammon (1987) documented fish assemblages in 1944 and 1983, respectively.

The Willamette River flows into the Columbia River at Portland, Oregon and is fed by a number of smaller rivers that originate primarily in the Cascade Mountains to the east. For this study, we included 286 km of the main stem of the Willamette from Eugene-Springfield (at the southern end of the Willamette Valley) to Portland plus the lower 18 km of the McKenzie River (Fig. 1). In addition, we surveyed the 19 km main stem Santiam River and the lower 20 km of the North Fork and lower 10 km of the South Fork. Additional ospreys are known to nest in the Willamette Valley outside the study area and in other portions of western Oregon (see Henny *et al.* 1978, Witt 1990). The river banks in the study area primarily support black cottonwood, with a few Douglas fir,

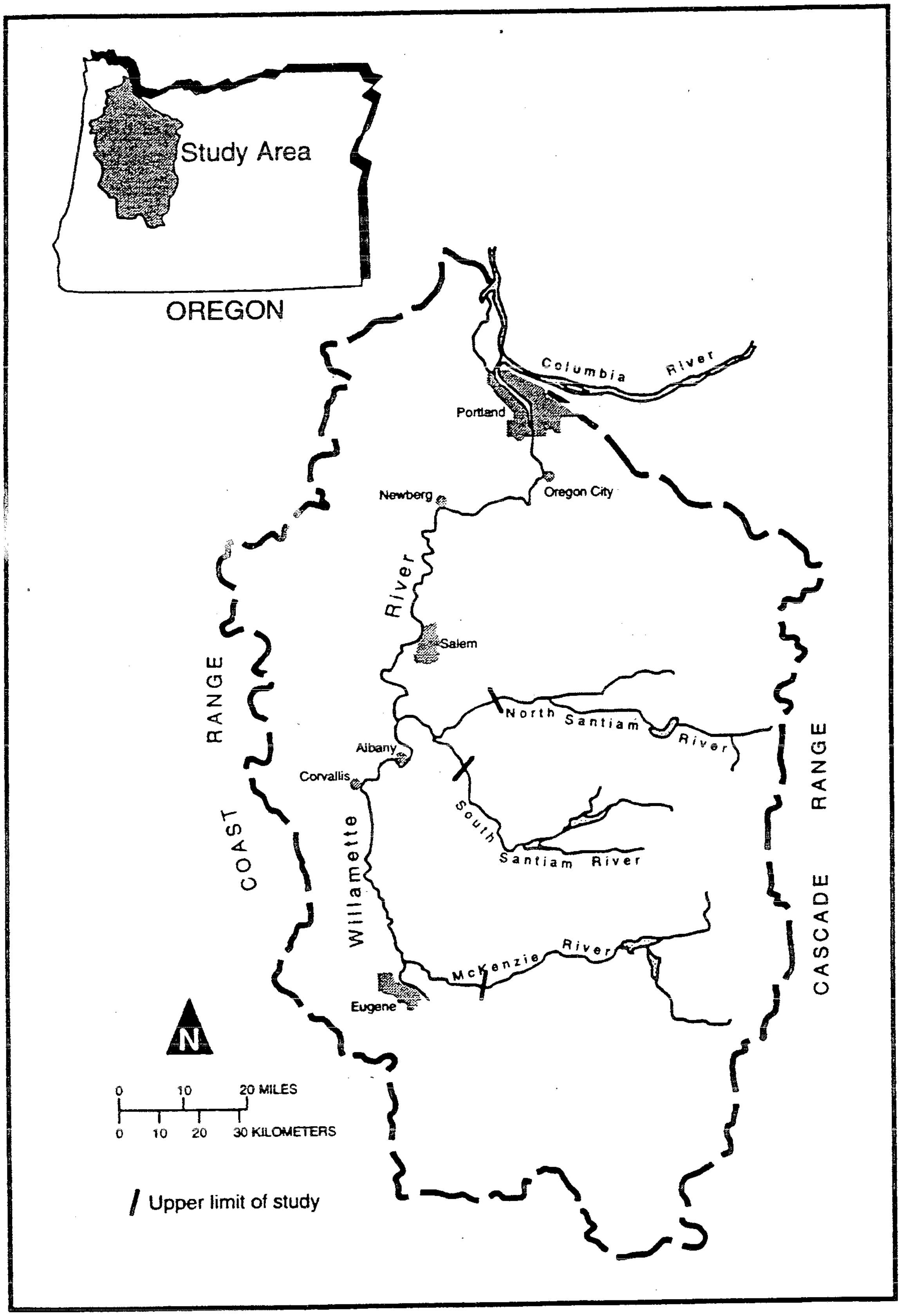

Figure 1. The osprey study area in the Willamette Valley of western Oregon. Only rivers with all or a portion surveyed are shown.

true fir (*Abies* spp.) and bigleaf maple. The cottonwoods, although large in many places, are generally inadequate to support osprey nests. Snags and broken top live trees are scarce. Most of the river in this study area flows through fertile privately owned farmland.

In 1976, osprey nests were located from a Cessna 206 flown about 60–100 m above the ground along the Willamette and the Santiam Rivers. An adjustment factor was used to estimate the total nesting population based on air:ground visibility rates (see Henny *et al.* 1978). On 21 April 1993, an aerial survey was made with a Cessna 182 at the same altitude to locate occupied nests. The area of coverage was similar in 1976 and 1993, i.e. up to 2 km from the river. Once it became apparent that many of the nests were on utility poles and towers, we contacted the utility companies to check their records for nesting ospreys. An essentially complete ground count of the study area was also made. Nest sites were visited (not climbed) at least six to eight times during the nesting season, and the number of young produced at each nest was determined from the ground with the aid of a spotting scope. Active and occupied nests followed the definitions of Postupalsky (1977). Young were conspicuous when prey was delivered, therefore the count of young present near fledging time in each nest was made after a prey delivery.

To provide additional information on the growth rate and the timing of the transition to utility structure nest sites, we asked each landowner how long the nest site(s) on their property had been occupied. If alternate nests, i.e. several power poles nearby, were used in different years presumably by the same pair, the territory was considered always occupied. Although osprey territories occupied in 1993 were not necessarily occupied annually from the initial date of occupancy, the population increase over time was estimated by assuming annual territory fidelity. Therefore, we provide an estimate of the number of nesting osprey pairs using utility structures for each year from 1977–93. The number of nests in trees was essentially the same in 1976 and 1993, and we assume it remained unchanged during the interim. When landowners indicated an inexact number of years that a territory was occupied, we approximated the initial occupation dates, e.g. for three nests first occupied 8–10 yr ago, we assigned one nest at 8 yr, one 9 yr, and one 10 yr. As a quality check, we compared individual nest records with information in the Oregon Department of Fish and Wildlife data base and other sources, including nearby farmers. These records may not be entirely accurate, but we believe occupancies were correct within a few years. No source indicated that utility structures were occupied in 1976 or earlier.

RESULTS

Nesting along Willamette River, 1976

An estimated 13 pairs nested in our defined Willamette Valley study area in 1976 (Table 1). Two pairs on the upper Santiam River were outside the study

Table 1. Distribution of nesting ospreys in the Willamette Valley study area in 1976 (Henny *et al.* 1978) and 1993 (this study).

Location	1976		1993	
	Nests	Nests/km	Nests	Nests/km
Springfield to Corvallis[a]	5	0.05	24	0.26
Corvallis to Salem (excluding Santiam R.)	4	0.05	20	0.26
Santiam River[b]	0	–	20	0.41
Salem to Newberg	0	–	12	0.22
Newberg to Portland	2	0.04	2	0.04
Total	11 (13)[c]	0.03–0.04	78	0.24

[a]Includes lower 18 km of McKenzie River.
[b]Within boundary established in Study area and methods.
[c]Observed nests from air (estimated nests).

area and excluded. All nests were in live or dead trees. The following year (1977) a nest on a power pole near the Ankeny National Wildlife Refuge adjacent to the Willamette River was observed and its notoriety warranted a sentence in Henny *et al.* (1978), although their survey was completed a year earlier.

Nesting along Willamette River, 1993

There were 78 pairs of nesting ospreys in the study area in 1993, a six-fold increase since 1976 (Table 1). The increase occurred throughout most of the study area, and was more pronounced in the farmland along the lower Santiam River. A large population increase also occurred on the farmland along the Willamette River. The non-farmland downstream from Newberg to Portland (mostly suburban and urban) showed no increase in ospreys. Perhaps equally important as the population increase was the change in types of nesting sites occupied (Table 2). Most nests (85%) were on utility poles or towers. The utility companies responded to osprey nesting attempts over the years by modifying over half of the nest sites (32 of 58) on power poles both to reduce adverse effects on power delivery and to accommodate the nesting needs of ospreys. Usually, platforms were built above the crossarms and powerlines or new poles with nesting platforms were placed nearby.

All nests in the study area were located within 2 km of the rivers, but 83.3% were within 1 km (Table 3).

Osprey population increase, 1976–93

The number of nests in trees (live or dead) in the study area were similar in 1976 (11 observed, 13 estimated pairs), and 1993 (12). However, those nesting

Table 2. Nesting sites used by ospreys in the Willamette Valley study area, 1993.

Nest structure	Number of nests
Transmission towers	8
Power Poles (total 58)	
Non-energized pole with platform[ab]	13
Energized pole with platform[ac]	19
Energized not modified	26
Natural Nests (total 12)	
live trees	8
dead trees	4
Total number of nests	78

[a]Poles modified by utility company.
[b]Adjacent wooden pole with platform placed nearby to attract nesting osprey away from energized powerline.
[c]Extension built on top of pole to minimize interference with energized powerline.

Table 3. Distance from osprey nest to closest river in Willamette Valley study area in 1993.

Distance to river (km)	Nests	
	Number	Percent
≤0.5	45	57.7
0.6–1.0	20	25.6
1.1–1.5	10	12.8
1.6–2.0	3	3.8
Total	78	99.9

on utility poles or towers increased from 0 in 1976 (Henny 1978) to 66 in 1993, and the population increase fits the standard logistic growth equation very well ($r^2 = 0.995$) (Fig. 2). The upper asymptote of the curve (86 osprey pairs nesting on utility structures) was estimated to occur in 2004; however, the data set fit the exponential growth curve nearly as well ($r^2 = 0.968$). The exponential growth curve does not predict a plateau. The growth parameters of the exponential, $r = 0.270 \pm 0.013$ (se), and logistic, $r = 0.374 \pm 0.026$ (se), curves imply estimated annual rates of increase of 27% and 37%/(1 + exp [37%(t − 76)]/154), respectively.

The observed production rate in 1993 (1.64 young/active nest) was about twice the rate estimated required to maintain a stable population (0.80 young/active nest) in the northeastern United States (Spitzer 1980, Spitzer *et al.* 1983). The collection of one freshly laid egg from each of 10 nests during the contaminant phase of this study (observed young/active nest, 1.50 at 10 nests

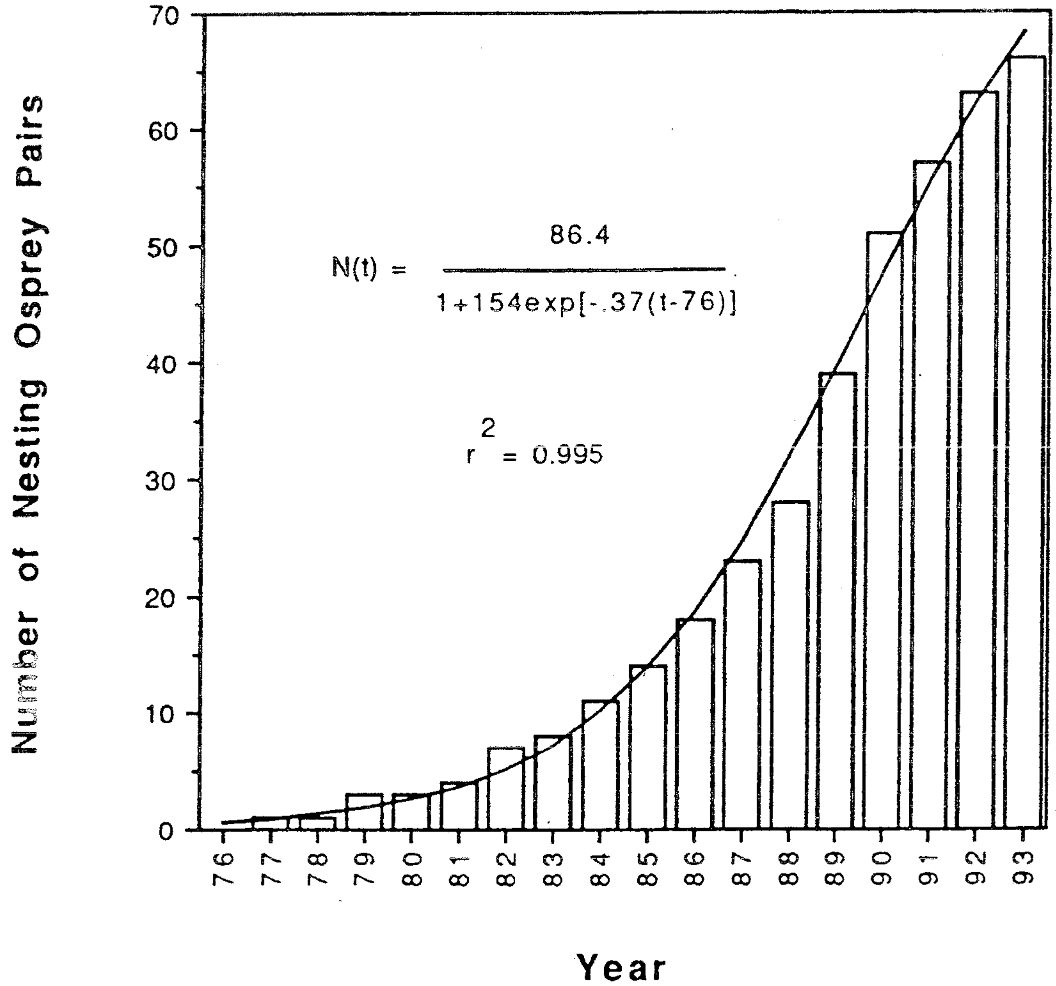

Figure 2. The logistic growth curve and equation for the osprey population nesting on utility structures in the Willamette Valley study area from 1976 to 1993. Information in 1976 and 1993 from actual surveys, and intervening years from landowner observations recorded in 1993.

with egg collected) has a slight negative impact on production. However, the observed production rate in those 63 active nests without an egg collected (1.67 young/active nest) was nearly identical to that for all 73 active nests (1.64 young/active nest).

DISCUSSION AND CONCLUSIONS

The size of the historic osprey population nesting along the Willamette River is unknown, although nesting was reported as early as 1854–55 (Newberry 1857). At that time the valley contained small farms, and an abundance of trees in many regions. Logging and clearing land for farms undoubtedly resulted in a general loss of potential osprey nest sites (broken top trees, snags and live trees)

Table 4. Osprey reproductive parameters in the Willamette Valley Study Area in 1993.

Reproductive parameters	Location		Nest site type		
	Willamette R.[a]	Santiam R.	Trees	Utility structure	Total
Occupied nests	58	20	12 (15.4)[b]	66 (84.6)[b]	78
Active nests	54	19	12 (16.4)	61 (83.6)	73
% Active	93.1	95.0	100	92.4	93.6
Successful nests	39	17	9 (16.1)	47 (83.9)	56
% Nest success, occupied	67.2	85.0	75.0	71.2	71.8
% Nest success, active	72.2	89.5	75.0	77.0	76.7
No. advanced young	82	38	20	100	120
Productivity, occupied	1.41	1.90	1.67	1.52	1.54
Productivity, active	1.52	2.00	1.67	1.64	1.64
Productivity, successful	2.10	2.24	2.22	2.13	2.14

[a]Includes 18 km segment of lower McKenzie River.
[b]% of nest total.

adjacent to the river over the last 100 yr (Sedell and Froggatt 1984). The use of DDT on agricultural crops in the valley also may have affected nesting ospreys during the period after World War II, e.g. see Henny and Anthony (1989). DDT was banned nationwide in 1972, and osprey production at many locations began improving by the mid to late 1970s (Henny 1977). The impact of DDT on osprey populations in western Oregon during the period 1950–75 is unknown because no eggs were obtained for residue analysis, and no historical population data were available. By the early 1980s, DDE in a small series of eggs collected in the Pacific Northwest (none directly from this study area, but some from western Oregon) generally decreased compared with that reported pre-1980 in adjacent states, although some eggs still contained DDE at concentrations sufficiently high to reduce productivity (Henny and Anthony 1989). Therefore, we believe that the population increase associated with the use of utility structures was at least partially due to a gradual release from the effects of DDT and its metabolites.

The high productivity in 1993 was uniformly found at tree nests as well as the utility structures; therefore the utility structures themselves did not seem to be a factor in the high productivity. This finding contrasts with many other studies (see Poole 1989), where higher productivity was reported at more stable man-made nesting structures likes power poles, towers and nesting platforms. The use of man-made structures theoretically should result in higher rates of population increase. However, since only 12 tree nests were in the study area, the 1993 findings concerning relative success at utility structure nests and tree nests seem inadequate to reach firm conclusions.

Why would nesting osprey begin using the utility structures in 1977 and not decades earlier? The first osprey nesting platform program in Oregon began at Crane Prairie Reservoir in 1973, when 39 platforms were established in the

Cascade Mountains (Henny *et al.* 1978) about 160 km from the first power pole nest (1977) discovered in the Willamette Valley. Could ospreys that used man-made platforms at Crane Prairie Reservoir (first used in 1974) have produced a female (the sex most likely to disperse long distances) that pioneered pole nesting in the Willamette Valley in 1977? Ospreys are known to first nest as 3 year olds (Henny and Wight 1969), and some female first-time breeders are known for their long dispersal distances from natal areas, especially in the western United States (Johnson and Melquist 1991). After nesting the first time, they generally remain faithful to the nesting territory in subsequent years.

Hughes and Gammon (1987) reported a considerable change in the fish assemblages of the Willamette River since 1944. In their study, 16 of 18 sites formerly sampled by Dimick and Merryfield (1945) had more species, more intolerant species, i.e. to organic pollution, warm water, and sediment (see Hughes and Gammon 1987), and fewer tolerant species. However, the most important prey species of the osprey in 1993 was the largescale sucker (authors unpubl. data), which is a native omnivorous species classified as tolerant. Largescale suckers were collected at all 14 of our collection sites in 1993 (from river km 80 to km 269), at all Hughes and Gammon (1987) collection sites, and nearly all Dimick and Merryfield (1945) collection sites except below km 82. The overall change in the fish assemblage since 1944 may be of minor importance to the recent osprey increase since the tolerant largescale sucker (the key prey species) was always present. Although consistently present in the river, the largescale sucker now may be more abundant. Since the first installation of a revetment in the Willamette River in 1888, there has been a tremendous loss of secondary side channels, backwaters, and oxbows; but the largescale sucker is among five fish species that appear to benefit from revetments (Hjort *et al.* 1984, Li *et al.* 1984). Largescale suckers graze on diatoms and stone revetments provide good substrate for periphyton (Li *et al.* 1987).

Because of intensive farming, natural nesting sites (trees and snags) may have limited the number of pairs nesting along the river in the 1950s through the early 1970s prior to ospreys adopting power poles and towers. The utility poles used since 1977 were primarily those poles in fields related to farmers' electric irrigation pumps. Many times, the terminal pole at the pump was chosen for the nesting site. Irrigation systems on farmland became common in the study area during the mid-to-late 1950s (about 20 years before use by ospreys). Once it became apparent to the first osprey that utility poles and towers provided adequate alternate nest sites, others seemed to learn quickly.

Although we have no specific quantitative information about osprey shooting in the Willamette Valley, shooting by fisherman, hunters and farm boys may have been a factor in keeping the population low in earlier years. The ospreys' presence at conspicuous nests makes shooting them easy. Some shooting still occurs, but ospreys banded in the United States and bands reported to the Bird Banding Laboratory as "bird shot" represented a high percentage of those reported in earlier years (Henny and Wight 1969). Attitudes towards birds of prey have changed dramatically over the last several decades, and now, most farmers along the Willamette River refer to nesting ospreys as their birds.

Ospreys nesting at their farm appear to be a status symbol for most farmers. One farmer even has an original oil painting of his osprey at its nest.

In summary, the observed osprey population increase probably resulted from a combination of factors including:

(1) Willamette River cleanup and associated fish response;
(2) the banning of DDT in 1972 and associated improvement in osprey production;
(3) a change in human attitude toward birds of prey, and
(4) the apparent learned response of ospreys to nest on utility structures (decades after similar structures were first used in eastern North America) which resulted in nest site availability improving from perhaps being a limiting factor, to being essentially unlimited.

Contaminants in osprey eggs (10 were collected), more detailed information on fish species captured by ospreys, and contaminant burdens in fish will be the subject of a future report.

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