Successful breeding area or nest. A breeding area or territory, or nest within a breeding area or territory, where advanced young are produced. Advanced young are young of the year at or near fledging age.

All nest sites are visited a minimum of twice: early for an activity (incubation) check and later for a productivity check. In most cases, additional activity checks are necessary to more clearly document activity or to locate new alternate nest sites. Nesting chronology is monitored where reliable data can be obtained. Activity checks are completed by a combination of aerial and ground or boat surveys as suggested by experience with past surveys (e.g. Whitfield et al 1993). Most early ground checks are from long distance with spotting scopes to avoid disturbance to adults.

Later visits are made to measure productivity at active nest sites. Nestlings are banded during this visit where nest trees can be safely climbed. Our experience of 11 years of monitoring bald eagle nesting activity and productivity in this region suggests an area-specific strategy for bald eagle monitoring that is outlined in Appendix Table 1.

Development of Raptor Monitoring Program

Our raptor inventory is iterative over the five years of the project, with an additive progression through phases as the data is collected and analyzed. We include here a description of the methods to be used over the life of the project to provide perspective for each year's work. Sampling methods, including raptor species detection and estimation of relative abundance and breeding productivity, must be species specific.

Once our inventory has provided a reliable baseline, we will develop a long-term monitoring program for the raptors of the South Fork study area. This program will employ a sampling design that will yield statistically reliable species-specific measures of breeding pair density and productivity. Time and cost efficiency will be emphasized to ensure that long-term monitoring is practical. Suggestions for applicability to other areas and other biological groups will be made.

Breeding Raptor Detection.

We apply species-specific raptor detection methods. We provide a literature review of raptor detection methods in the results section. We will also analyze delectability models from a statistical perspective as the project progresses.

Raptor Inventory

Our raptor inventory occurs in two phases as follows:

Phase 1. Presence/Absence Sampling. Sample sites are selected to cover a broad array of biological and physical attributes; such coverage will help assure adequate representation of species composition and distribution over the study area. Sampling must be exhaustive enough to minimize under-sampling effects on patterns while allowing true patterns or gradients across the study area to be identified, described and predicted. With respect to monitoring, sampling must also ensure that study-wide trends and change can be distinguished from localized fluctuations (McKenzie et al. 1991). Hence the number, placement, and size of the sample sites will require careful consideration from both the biological and statistical perspectives.

The study area will be stratified on habitat classifications and other physical factors such as land use. Sample site placement, size and number will depend in part on size of the stratum, homogeneity within strata, and degree of spatial coverage over the stratum including edges. Data recorded at each sample site will consist in part of the following: sample date and geographic location, stratum type, habitat patchiness with estimated relative percentages of patch-type, raptor species present, and the within site geographical location of individuals, nest sites and the like. Statistical analyses will provide information on species composition and habitat associations. These results will be used to predict geographical

distributions of presence for individual species and species assemblages over the study area. To be of value to a long-term, broad-scale monitoring program, these predictions must be ground-truthed and refined.

In our first cut at presence/absence sampling in 1994, we did a two-stage simple, random sample selection, first by 10-mile river section, and then by 1 square mile topographic legal sections within river sections. We used mapped legal sections because there are often section markers on the ground that aid in sample location. We selected from all square mile sections that were at least 50% within 1 mile of the river. We then individually sampled all 40-acre quadrats (16 per square mile section) within selected sections.

Data and results obtained from this survey will be invaluable for the second phase of the project: estimating relative abundance and distribution of key species This phase will commence in the third year of the project.

Phase 2. Estimating Relative Abundance. Sampling to estimate relative abundance is considerably more complicated than the methods used to determine presence or absence of a species. The area or quadrat size that can be exhaustively searched for breeding individuals will tend to be smaller than the sample site size discussed above, and is likely to be somewhat species-specific. At this finer scale, some species (e.g. flammulated owls, *Otus flammeolus*) could occur at relatively low densities with spatial distributions that appear to be aggregated so that locating quadrats with species present may be more difficult. Once presence is established at a selected sample site, detecting all individuals, that is obtaining accurate counts, can be difficult. Detection methods will be species-specific.

Adaptive sampling techniques (e.g. Thompson 1990, Munholland and Borkowski 1993b) are very useful and efficient when searching for rare or spatially clustered populations, since sampling effort is dependent on species presence. Statistical methods which account for less than perfect delectability of individuals within selected sites must also be applied to the recorded abundances; in some cases such methods exist, while in others, delectability models must be developed.

Nesting activity and productivity

Our raptor inventory is adaptive and cumulative as we build our data baseline over the years. Later in the project, we will monitor all raptor nest sites to measure productivity parameters, as we now do for bald eagles. This monitoring is complicated by the dynamic nature of the activities we are measuring. For example, nesting surveys that begin late in the nesting season may miss nests that fail early, and therefore overestimate nesting success and productivity (Steenhof and Kochert 1982). Raptorial birds that nest in the study area begin to actively repair and build nests and to lay and incubate eggs in March-June. During this stage, we recheck all nests located earlier, usually from a long distance with a scope, to determine if nests are occupied and identify species. We attempt to determine nesting activity during the incubation period in a non-invasive manner that does not displace incubating adults. We also document activity at newly constructed or occupied nests found throughout the breeding season. Definitions for occupied and active nests follow those used for bald eagle monitoring.

We return to a sample of known active nests after the pairs are at least 10 days into incubation in 2 or 3 person teams to measure clutch size. We will use tools designed to minimize time at nests, e.g. Hayward (1993). We later revisit nests to document nesting success and number of young produced.

Habitat description

For Phase 1 surveys (presence/absence) completed in 1994 and reported here, we characterized each 40 acre sample quadrat by general vegetation cover type according to the system developed by Ulliman et al. (1991), which includes 30 cover types (Table 2). We indicate the

dominant cover type found within each quadrat, with recognition that many quadrats feature a complex mosaic of vegetative cover types (Appendix Table 5).

As the project matures, our habitat measures will become more refined to characterize features selected by individual raptor species. We hope to characterize, at a landscape level, habitat features found within areas estimated to include the home ranges of nesting raptor pairs. We will also measure habitat features around all nest sites to determine those features of importance to nest occupancy and success (see Appendix A, Table 4). This step will occur after fledglings have left the area, from August-October in most cases.

Table 2. Snake River study area vegetative cover types after Ulliman et al. (1991).

Level I	Level II	Level III
1 Urban	11 Residential	111 Residential
	12 Commercial	121 Commercial
	13 Industrial	131 Gravel pits, quarry
	14 Transportation	141 Roads, transportation services
2 Agriculture	21 Cropland, Pasture	211 Tilled cropland
		212 Permanent pasture
	24 Other	241 Buildings and associated areas
		242 Irrigation canals
		243 Dikes and dams
3 Rangeland	31 Grassland	311 Upland grasslands
	32 Shrubland	321 Sagebrush-bitterbrush
		322 Mountain mahogany
		323 Upland shrubland
4 Forestland	41 Deciduous	411 Aspen, closed (› 75% cover)
		412 Aspen, open (‹ 75% cover)
	42 Evergreen	421 Douglas-fir
		422 Juniper
5 Water	51 Riverine	511 Upper perennial
		512 Lower perennial
6 Riparian	61 Nonwoody	611 Grasses
		612 Sedges
	62 Woody	621 Willow
		622 Dogwood
		623 Cottonwood
7 Barrenland	74 Exposed Rock	741 Bedrock outcrops
		742 Scree slopes

Results

Bald Eagle Activity and Productivity

In 1994 we documented activity and productivity at 39 bald eagle breeding areas (Table). All observations at individual nesting areas are reported elsewhere (Whitfield et al. 1994). Bald eagle productivity rebounded in 1994 from the very low levels reported in 1993. In 1994, 38 of 39 known territories were occupied, and 36 were active. Known productivity at these sites was 1.13 advanced young per occupied nest (43 young at 38 breeding territories). Most notable productivity increases were at Palisades Reservoir and in Island Park. The 5 nests found near Palisades Reservoir produced 7 advanced young in 1994 (only 1 in 1993, 7 in 1992). The 9 active pairs of the South Fork Canyon produced 11 young in both 1993 and 1994, slightly below the average performance of these nests in recent years, and the lower river nests were also similar in productivity in the two recent years. However, the Continental Unit rebounded from only 8 advanced young at 16 established nests in 1993 to 18 advanced young in 1994. The Riverside Territory (18-IC-15) in Island Park finally became active again; a new nest site was located in this territory that had not been detected as occupied since 1990.

Overall 1994 productivity for the Idaho/GYE nesting territories was 1.13 young/occupied nest. Although this productivity is relatively low in the context of the past 7 years (Table 3), it should be noted that 6 new breeding territories have been located in the last 3 years, 3 of these in 1994. Breeding attempts in new territories are frequently unsuccessful or low in productivity.

Three new breeding territories were located in 1994. These include the Market Lake territory (18-IS-22) on the main Snake below the confluence, the Upper Teton territory (18-IS-21) in Teton Valley, and a nesting attempt on the Buffalo River (18-IC-17) in Island Park. In 1994, 28 Idaho/GYE nestlings were banded with numbered Fish and Wildlife Service leg bands on the right leg and color bands with stamped two digit alphanumeric codes on the left leg.

Table 3. Advanced young per occupied nest with known outcome for years 1988-1994.

Year	Advanced young/occupied nest
1988	1.70
1989	1.35
1990	1.59
1991	1.45
1992	1.23
1993	0.69
1994	1.13

Table 4. Activity and productivity status for bald eagle breeding territories within the Idaho portion of the Greater Yellowstone Ecosystem, 1994.

TERRITORY NAME	TERRITORY NUMBER	STATUS	NUMBER ADVANCED YOUNG	NUMBER YOUNG BANDED	COMMENTS
PALISADES RESERVOIR AREA					
Hoffman	18-IS-01	Active, successful	2	2	
Williams Creek	18-IS-02	Active, successful	1	1	
Van Point	18-IS-03	Active, successful	2	2	New alternate nest
Edwards Creek	18-IS-17	Active, unsuccessful	0	0	
King Creek	18-IS-18	Active, successful	2	2	Rebuilt old nest
SOUTH FORK SNAKE RIVER					
Palisades Creek	18-IS-04	Active, successful	2	2	
Swan Valley	18-IS-05	Active, successful	1	0	New alternate
Conant Valley	18-IS-06	Active, successful	2	2	
Pine Creek	18-IS-07	Active, unsuccessful	0	0	
Dry Canyon	18-IS-08	Active, successful	2	0	
Gormer Canyon	18-IS-09	Active, successful	2	2	
Wolverine	18-IS-10	Active, successful	1	1	
Antelope Creek	18-IS-11	Active, successful	1	0	
Cress Creek	18-IS-12	Active, unsuccessful	0	0	Nest blowdown
MAIN SNAKE RIVER					
Confluence	18-IS-13	Active, successful	1	0	New alternate
Market Lake	18-IS-22	Active, successful	1	1	New territory
LOWER HENRY'S FORK, SOUTH FORK, FALL AND TETON RIVERS, SNAKE UNIT					
Cartier Slough	18-IS-14	Active, successful	1	0	
St. Anthony	18-IS-15	Active, successful	2	0	
Singleton	18-IS-16	Active, successful	1	0	
Lower Fall River	18-IS-19	Unoccupied,	0	0	No eagles seen
Menan Buttes	18-IS-20	Active, successful	1	0	
Upper Teton River	18-IS-21	Active, successful	0	0	New territory

Table 4. Activity and productivity status for bald eagle breeding territories within the Idaho portion of the Greater Yellowstone Ecosystem, 1994 (cont.).

TERRITORY NAME	TERRITORY NUMBER	PRODUCTIVITY STATUS	NUMBER ADVANCED YOUNG	NUMBER YOUNG BANDED	COMMENTS
CONTINENTAL UNIT, UPPER HENRY'S FORK SNAKE RIVER					
Kerr Canyon	18-IC-01	Active, successful	2	0	
Pine Haven	18-IC-02	Occupied,	0	0	
Box Canyon	18-IC-03	Active, successful	1	1	
Coffee Pot	18-IC-04	Active, unsuccessful	0	0	
Bishop Lake	18-IC-05	Occupied,	0	0	
Sheridan	18-IC-06	Active, successful	2	0	
Lucky Dog	18-IC-07	Active, successful	2	2	New alternate
Henry's Lake	18-IC-08	Active, unsuccessful	0	0	
Staley Springs-Targhee Creek	18-IC-09	Active, successful	2	2	
Hale Canyon	18-IC-10	Active, successful	1	1	
Moonshine	18-IC-11	Active, successful	1	1	
Last Chance	18-IC-12	Active, successful	2	2	
IP Bills	18-IC-13	Active, successful	1	1	
Flat Rock	18-IC-14	Active, successful	1	1	
Riverside	18-IC-15	Active, successful	2	2	New alternate
Snake River Butte	18-IC-16	Active, successful	1	1	
Buffalo River	18-IC-17	Active, unsuccessful	0	0	New territory

Summary Statistics

Total number nesting territories	39	Advanced young/occupied nest: 1.13 (43/38)
Number occupied territories	38	
Number active territories	36	Advanced young/active nest: 1.19 (43/36)
Number successful territories	30	
Number advanced young	43	Advanced young/successful nest: 1.43 (43/30)

Bald Eagle Habitat Observations

Threats to the productivity of bald eagles at several individual breeding areas have increased dramatically in the last few years. Development proposals now being implemented may eliminate bald eagle use of the King Creek, Palisades Creek, Swan Valley, Box Canyon, and I. P. Bills territories within the next few years. Many other breeding areas are experiencing increasing levels of human activity.

Several of the newer Southeast Idaho pairs have exhibited much more resilience to nest site disturbance than anticipated, but now we may be witnessing examples of the longer-term effects of such disturbance. Thelander (1973) documented bald eagle reactions to incrementally increased human activity around a lake in California. Nesting pairs responded by gradually moving their nesting activity farther from the lakeshore. The Cress Creek pair on the South Fork will be interesting to monitor in 1995 as they seek out a new nest site. The old nest, which blew out of the tree in 1994, had in the last few years become the site of considerable disturbance early in the nesting season. This pair's choice of a new site will signal the degree of disturbance that new pair's will tolerate over the long-term.

Bald Eagle Key Use Areas

We provide preliminary information on three bald eagle breeding areas for use in breeding area management planning. We have not conducted intensive observations within these areas, and cannot provide a complete picture of foraging area and home range zones. We provide baseline information only, including: breeding area nesting chronology and past productivity, occupied nesting zones for each breeding area, known foraging and perching areas, and comments on breeding area habitat quality.

Wolverine Creek (18-IS-10)

Breeding Area History. The Wolverine Breeding Area was first occupied in 1992. Prior to that year, adult bald eagles with young were often seen within the breeding area, but eventually it was determined that these young were produced elsewhere. Adults from the Gormer Canyon Breeding Area were observed foraging near Wolverine Creek in 1990 and visually tracked back to the Gormer nest. Some young of the year seen in the area in mid-summer were fledged from Wyoming nest sites as indicated by bands.

The first nesting attempt in the Wolverine area occurred in 1992. On March 12, S. Austin of the Idaho Bald Eagle Research Project saw a bald eagle on a built-up heron nest 0.5 miles south of Wolverine Creek, at the north end of the Great Blue Heron rookery near the east river road (figure 2). An adult was stationary in incubation posture for approximately one hour before it left the nest to soar with another adult. The nest was left unattended for 45 minutes before an adult returned to incubate. B. Alford and others saw an adult in incubation posture in March and early April. K. Aslett reported an incubating adult on April 13, but on April 14, M. Whitfield saw no adults on the nest. Both adults were perched in nearby trees. These behaviors suggest that this was a new pair in its first nesting attempt. The 1992 nesting attempt failed early.

Since 1992, the Wolverine pair, probably the same pair that nested in the heron rookery in 1992, has successfully nested in a large Douglas fir on the west canyon rim opposite Mud Creek. Nest number two for the area is .3 mile upriver of the original nest. Two young were produced here in 1993, one in 1994. Observations in 1993 and 1994 indicate that this pair initiates incubation relatively early, sometime in the first week of March or end of February.

Occupied Nesting Zone, Zone 1. We describe an occupied nesting zone and key use areas in figure 2. This zone includes only nest site #2 for the territory. The initial 1992 nest (#1) was built in early spring before human activity intensified along the South Fork road, and was abandoned early. It does not appear that this nest site is tenable as a productive bald eagle nest, nor that it should be protected under Zone 1 guidelines.

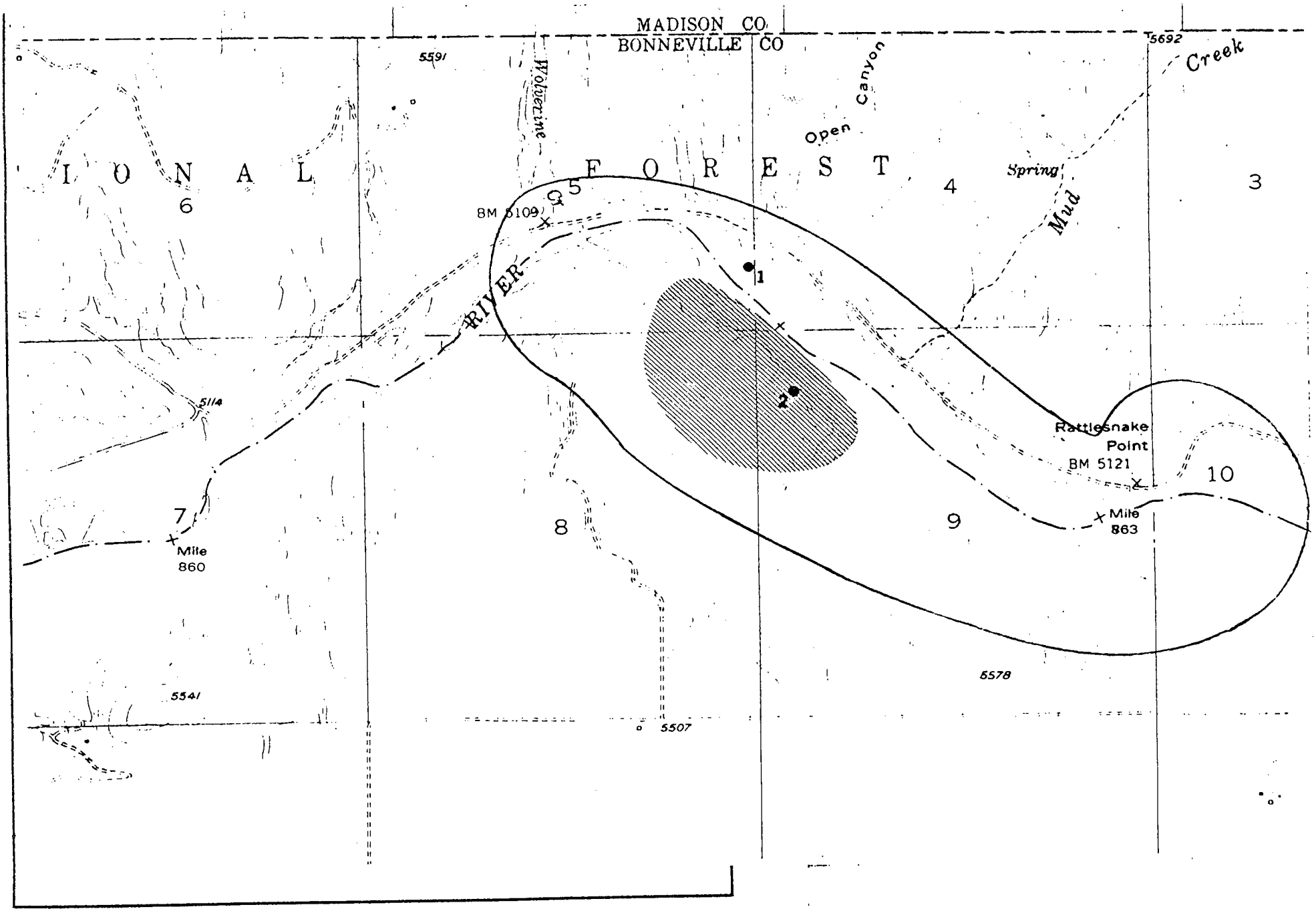

Figure 2. The Occupied Nesting Zone (Zone 1) and known key use areas within the Wolverine Bald Eagle Breeding Territory, 1994. No intensive monitoring has occurred at this breeding area, and the information portrayed is preliminary only. Numbers indicate known nests, lined area is Zone 1, and red line encloses PMP.