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Review of the proposal to de-list the American peregrine falcon

Brian A. Millsap, Patricia L. Kennedy, Mitchell A. Byrd, Gordon Court, James H. Enderson, and Robert N. Rosenfield

Abstract On 30 June 1995, the U.S. Fish and Wildlife Service published an Advance Notice of an Intent (Notice of Intent) to remove the American peregrine falcon (*Falco peregrinus anatum*; hereafter referred to as American peregrine) from the list of endangered and threatened wildlife. In October 1995, the Raptor Research Foundation (RRF) appointed an ad hoc committee to review scientific data available on the American peregrine's status. This paper summarizes the committee's findings and recommendations, which were based on a comparison of current biological data with recovery goals specified in recovery plans. Our review indicated that: (1) goals for numbers of territorial pairs in regional recovery plans appeared to have been reached or exceeded by 1995 in the Alaska Recovery Region, Pacific Recovery Region, Rocky Mountain Southwest Recovery Region, and Canadian Recovery Region, but not in the Eastern Recovery Region; (2) state or zone goals within recovery regions for numbers of pairs were known to have been met by 1995 in only the Canadian Recovery Region; (3) goals for sustaining the desired number of territorial pairs over time were not known to have been met in the Alaska Recovery Region (the only region with such a recovery goal); (4) goals for the average number of young fledged per territorial pair were known to have been met by 1995 in the Alaska and Rocky Mountain Southwest Recovery Regions, but were not known to have been met in the Pacific and Canadian Recovery Regions; and (5) goals for levels of organochlorine pesticide contamination in American peregrine eggs were not known to have been met by 1995 in the 2 recovery regions where such goals had been established. Despite the fact that data were not available to document achievement of all recovery goals, we concluded that the available population data demonstrated a consistent picture of nearly a range-wide population increase over at least the past decade. We unanimously thought that the status of the American peregrine warranted down-listing or de-listing. However, a minority of members was concerned that sufficient data were not available to evaluate the sustainability of recovery and whether or not causes of endangerment had been eliminated. A majority of members concluded that populations in the Alaska, Pacific, Rocky Mountain Southwest, and Canadian recovery regions are not at risk of becoming endangered in the immediate future because numeric population recovery goals had been attained and, therefore, should be removed from the list of federally threatened and endangered wildlife. A majority of members regarded breeding peregrines in the Eastern Recovery Region as less secure and recommended that the population in the eastern United States be down-listed but not de-listed until numeric goals for numbers of nesting pairs are met. Preliminary data suggest that this might have occurred in 1996.

Key words American peregrine falcon, de-listing, endangered species, *Falco peregrinus anatum*, pesticide contamination, recovery criteria, recovery plans

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On 30 June 1995 the U.S. Fish and Wildlife Service (USFWS) published a Notice of Intent to remove the American peregrine (*Falco peregrinus anatum*) from the list of endangered and threatened wildlife (Mesta et al. 1995). The USFWS originally listed the American peregrine as endangered in 1970 under the Endangered Species Conservation Act of 1969 (P.L. 91-135, 83, Stat. 275) and, subsequently, under the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq). No changes in its regulatory status have occurred since 1973. The primary reasons cited for the original listing were range-wide population declines and population extirpation east of the Mississippi River in the United States, linked to DDT (and its metabolite DDE) contamination and associated reproductive failure (Mesta et al. 1995). The American peregrine was 1 of 2 North American peregrine subspecies listed under the ESA, the other being the Arctic peregrine falcon (*F. p. tundrius*), which was listed at the same time and for the same reasons as the American peregrine. The Arctic peregrine was shown to be recovered and was de-listed on 5 October 1994 (Swem 1994). The USFWS began considering de-listing the American peregrine >8 years ago, at about the time the Arctic peregrine's status was being reviewed (T. Swem, USFWS, pers. commun.). However, it was not until 1995 that the USFWS announced its preliminary conclusion that the American peregrine had recovered as a result of (1) restrictions on the use of DDT and other organochlorine pesticides in the United States in 1973 and 1974 and (2) implementation of other management strategies, including the release of captive-bred falcons.

This proposed de-listing action has provoked considerable debate (Pagel et al. 1996, Cade et al. 1997, Pagel and Bell 1997). In an attempt to resolve these issues, in October 1995 the Raptor Research Foundation (RRF) appointed an ad hoc committee to review available biological information and determine if the USFWS de-listing proposal was justified. This report summarizes our findings and recommendations.

Methods

Committee members were selected to represent a geographic and professional cross section of the scientific- and management-oriented membership of the RRF. Members consisted of 2 participants on American peregrine falcon recovery teams, 2 biological administrators of state-provincial fish and wildlife agencies, and 2 university faculty members (both recovery team members were also university faculty). Committee members were approved by the President and Conservation Committee Chairman of the RRF.

We examined all American peregrine recovery plans and copies of all substantive public and agency comments received by the USFWS in response to the Notice of Intent to identify pertinent issues. We also conducted an extensive review and synthesis of published and unpublished information on the status of the American peregrine. Following these reviews, our final recommendations were determined by a vote of the members.

For the purpose of our review, we adopted the following definitions of the terms threatened and endangered (from ESA 1973; 16 U.S.C. 1531 et seq): (1) a *threatened* taxon or distinct population segment is in danger of becoming endangered over a significant portion of its range; and (2) an *endangered* taxon or distinct population segment is in danger of extinction over a significant portion of its range.

Results and discussion

Information reviewed

The USFWS received 171 public comments in response to the Notice of Intent, 151 of which raised important issues and offered recommendations. Of the comments that included a recommendation, 92 (61%) supported de-listing of the American peregrine, and 59 (39%) opposed the proposal. Thirteen (22%) of the opponents supported down-listing to the threatened category. Thirty-one state-provincial resource agencies responded. Of the 24 that expressed a position, 11 (46%) supported the proposal, and 13 (54%) opposed it. Five (21%) of the agencies opposing the proposal supported down-listing to the threatened category.

Most of the issues raised in comments could be categorized into 11 basic areas (Table 1). A majority of members agreed that 8 of these issues were significant and relevant to determining the status of the American peregrine. Three issues were not viewed as essential to determining the American peregrine's status. Two of these 3 issues (issues 2 and 9 in Table 1) dealt with missing demographic information. Our position on these issues was that, although useful in determining status, detailed knowledge of survival and fecundity were not essential to determining status if adequate data on population trends existed because the latter variable incorporated measures (albeit at a very coarse scale) of both demographic parameters. In addition, survival (issue 2) was not a criterion in any recovery plan. We dismissed issue 11 because it dealt with implications of removing restrictions on take (e.g., harassment, falconry harvest) of American peregrines. A majority of members concluded that decisions on the status of the peregrine should be

Table 1. List of major issues raised in written public comments to the U.S. Fish and Wildlife Service's Notice of Intent to delist the American peregrine falcon^a. Significant issues are those a majority of ad hoc committee members considered substantive and germane to the status of the American peregrine.

Issues and questions	Significant?
Issues regarding adequacy of data	
1. Are data on population size and trends of <i>F. p. anatum</i> sufficiently reliable to justify drawing conclusions about the subspecies' status?	Yes
2. How significant is the lack of survival data—and hence the incomplete understanding of population dynamics—from throughout the range of <i>F. p. anatum</i> ?	No
3. Eggshell and contaminant data are lacking for many <i>F. p. anatum</i> populations, even though these data are needed to determine if recovery goals have been met for some populations.	Yes
Status issues	
4. To what extent do reported population increases of <i>F. p. anatum</i> reflect more complete recent surveys than post-DDT population increases? Does this matter in terms of the subspecies' biological status?	Yes
5. Assuming recover of <i>F. p. anatum</i> has occurred, has it proceeded for a sufficient period of time to justify a formal change in status?	Yes
6. Published population models for <i>F. p. anatum</i> in California (Wootton and Bell 1992) suggest that the state's population may decline without continued releases of captive bred birds. Are releases of captive bred peregrines, as opposed to natural population growth, responsible for recent peregrine population increases in any region?	Yes
7. Many of the recovery goals for reclassification or delisting of <i>F. p. anatum</i> are not known to have been met.	Yes
8. Breeding <i>F. peregrinus</i> in the eastern United States occur disproportionately in urban areas, and have not re-occupied historic natural sites.	Yes
9. Does decreasing or low productivity in a <i>F. p. anatum</i> population that appears to be numerically increasing or stable warrant significant concern?	No
10. <i>F. p. anatum</i> has been extirpated from eastern North America (at least in the U.S.) and is now replaced by nonnative subspecies and intergrades originating from captive breeding and release efforts. Accordingly, the taxon warranting listing has been replaced in the eastern United States.	Yes
11. Protective provisions of the ESA limit certain forms of take. Is federal ESA protection still warranted for this subspecies, or should the need for regulations beyond Migratory Bird Treaty Act provision be left to the states?	No

^a Herein, we use the name American peregrine falcon in the broadcast sense, to include all peregrine falcons breeding in the historic range of the American peregrine subspecies.

based solely on biological considerations, not socio-political criteria. In reaching this decision, we noted that the management ramifications of de-listing could be alleviated where needed by promulgation of specific rules by state or provincial agencies or at the federal level through rules under the Migratory Bird Treaty Act (16 U.S.C. 703–711).

Our subsequent deliberations focused on 3 major areas. First, we considered whether the available biological data through 1995 were adequate to evaluate the current status of the American peregrine. Second, we considered whether the available data sup-

ported a conclusion that the American peregrine was no longer threatened or endangered throughout a significant portion of its range. Finally, we considered the additional issues raised in the comments in response to the Notice of Intent (Table 1). Our debate and recommendations on each of these points are discussed below.

Adequacy of available biological information

The majority of current status information on the American peregrine has not been published in peer-reviewed journals (Tables 2–4). Several committee members thought that without the scientific scrutiny afforded by peer review, the reliability of these data was questionable. These members argued that de-listing actions were not conservation crises and did not merit the same kind of emergency action as listings. Therefore, de-listing could await the publication of data through the peer-review process. Status papers on sensitive, threatened, or endangered species are regularly published as peer-reviewed literature (e.g., Dennis and Lashmar 1996, Hall et al. 1997, Kennedy 1997, Yorkston and Green 1997), so data collected to monitor the status of recovering populations are acceptable subjects for publication if they are based on well-designed studies. Con-

versely, data from poorly designed studies would likely not be accepted for publication and may consequently be of lesser or little value in evaluating population status and recovery.

There is, nevertheless, precedent for using unpublished literature to make major listing and de-listing decisions. In fact, such information typically comprises the bulk of data considered in a status review. At least 3 arguments can be raised against the exclusive use of published data. First, publication does not guarantee quality, and unpublished but time-sensitive data can be very useful (nearly all data on American

Table 2. Published and unpublished data as of 1995 on recovery goals and number of territorial pairs of American peregrine falcons in North America.

Recovery plan ^a	Recovery goal for No. of pairs ^b	Most recent published No. of pairs (yr) ^c	Source	Most recent unpubl. No. of pairs (yr)	Source
Alaska	28 (10)			69 (1994)	Mesta et al. 1995
Pacific	185			183 (1994)	Enderson et al. 1995
California	120			224 (?) ^d	Mesta et al. 1995
Oregon	30	90 (1989)	Wootton and Bell 1992	113 (1992)	J. Linthicum, Predatory Bird Res. Group, unpubl. data
Nevada	5			27 (1995)	M. J. Nugent, Oreg. Dep. of Fish and Wildl., unpubl. data
Washington	30			1 (1988)	Walton et al. 1988
Rocky Mountain	183			6 (1985)	Walton et al. 1988
				559 (1994)	Mesta et al. 1995
				400 (?)	Southwest Recovery Team, unpubl. data
Arizona	46	71 (1988) ^e	Brown et al. 1992	198 (1994)	Ward and Siemens 1995
Colorado	31			71 (1994)	P. Olson, Colo. Div. of Wildl., unpubl. data
Idaho	17			1 (1985)	Enderson et al. 1988 ^b
Montana	20			15 (1994)	P. Graham, Mont. Dep. Fish and Wildl., unpubl. data
Nebraska	1			<1 (1994)	Mesta et al. 1995
New Mexico	23			17 (1984)	Enderson et al. 1988 ^b
N. Dakota	1			<1 (?)	Mesta et al. 1995
S. Dakota	1			<1 (?)	Mesta et al. 1995
Texas	8			15 (1995)	A. Sansom, Tex. Parks and Wildl. Dep., unpubl. data
Utah	21			25 (1985)	Enderson et al. 1988 ^b
Wyoming	14			27 (1995)	White 1995
Eastern					
Region 1	20–25 (3)	22–24 (1988)	Byrd 1990	18 (1985)	Barclay 1988
Delaware				>25 (?)	Mesta et al. 1995
Maryland				2 (1995)	A. T. Manus, Del. Div. Fish and Wildl. unpubl. data
New Jersey				8 (1995)	J. L. Sandt, Md. Dep. Nat. Resour., unpubl. data
Region 2	20–25 (3)	12–14	Steidl et al. 1991 (1985–1987)	>25 (?)	Mesta et al. 1995
New Hampshire				6 (1985)	Barclay 1988
Vermont				11 (1995)	J. J. DeStefano, N.H. Fish and Game Dep., unpubl. data
				12 (1995)	A. A. Elser, Vt. Agency of Nat. Resour., unpubl. data

(continued)

Table 2. (continued) Published and unpublished data as of 1995 on recovery goals and number of territorial pairs of American peregrine falcons in North America.

Recovery plan ^a	Recovery goal for No. of pairs ^b	Most recent published No. of pairs (yr) ^c	Source	Most recent unpubl. No. of pairs (yr)	Source
Region 3	20–25 (3)			10 (1994)	Mesta et al. 1995
Georgia				1 (1995)	D. Waller, Ga. Wildl. Resour. Div., unpubl. data
N. Carolina				4 (1995)	McGrath 1995
S. Carolina				1 (?)	J. A. Timmerman, Jr., S.C. Dep. Nat. Resour., unpubl. data
Virginia				15 (1995)	M. A. Byrd, Coll. of William and Mary, unpubl. data
Region 4	20–25 (3)	30–67 (1991–1995)	Tordoff and Redig 1997	5 (1994)	Mesta et al. 1995
Region 5	20–25 (3)			25 (1995)	G. A. Barnhart, N.Y. Dep. of Environ. Conserv., unpubl. data
New York				5 (1995)	D. Madl, Pa. Game Comm., unpubl. data
Pennsylvania				206 (1990–93)	Mesta et al. 1995
Canadian	60 pairs ^f	>10 pairs in 3 zones	Holroyd and Banasch 1996	50 (1995)	U. Banasch and G. L. Holroyd, Can. Wildl. Serv., unpubl. data
Zone 1	10	39 (1990)	Holroyd and Banasch 1996	14 (1995)	U. Banasch and G. L. Holroyd, Can. Wildl. Serv., unpubl. data
Zone 2	10	2 (1990)	Holroyd and Banasch 1996	18 (1995)	U. Banasch and G. L. Holroyd, Can. Wildl. Serv., unpubl. data
Zone 3	10	5 (1990)	Holroyd and Banasch 1996	106 (1995)	U. Banasch and G. L. Holroyd, Can. Wildl. Serv., unpubl. data
Zone 4	10	97 (1990)	Holroyd and Banasch 1996	112 (1995)	U. Banasch and G. L. Holroyd, Can. Wildl. Serv., unpubl. data
Zone 5	10	83 (1990)	Holroyd and Banasch 1996	19 (1995)	U. Banasch and G. L. Holroyd, Can. Wildl. Serv., unpubl. data
Zone 6	10	0 (1990)	Holroyd and Banasch 1996	49 (1994)	U. Banasch and G. L. Holroyd, Can. Wildl. Serv., unpubl. data
Mexican	No goals				Enderson et al. 1995

^a The 3 levels of headings in this column are (1) the 5 regional recovery plans, (2) within-region zones (if zone goals were identified in the regional recovery plan), and (3) states (if state goals were identified in the regional recovery plan).

^b The number in parentheses is years the goal for number of pairs was to be sustained.

^c This column only includes data published in peer-reviewed literature.

^d ? indicates that the year data were collected is uncertain.

^e Results of survey of Grand Canyon National Park.

^f These are zone goals. The Canadian Recovery Plan called for goals to be revised to include down-listing and de-listing criteria.

Table 3. Published and unpublished data through 1995 on recovery goals and current status for America peregrine falcon productivity (number of young fledged per territorial pair) in North America.

Recovery plan ^a	Goal in No. of young fledged per pair ^b	Most recent published data (yr) ^{d,e}	Source	Most recent unpubl. data (yr)	Source
Alaska	1.8 (10) ^c			>1.8 (1981–1994)	Mesta et al. 1995
Pacific	1.5 (5)			1.0 (?) ^f	U.S. For. Serv., unpubl. data
California	1.5 (5)	1.4–1.06 ^g (1980–1989)	Wootton and Bell 1992		
Nevada	1.5 (5)				
Oregon	1.5 (5)			1.6 (1995)	M. J. Nugent, Oregon. Dep. of Fish and Wildl., unpubl. data
Washington	1.5 (5)			1.17 (1985)	Walton et al. 1988
Rocky Mountain	1.25 (5) ^h			1.52 (1984)	Enderson et al. 1988b
Arizona	1.25 (5)	1.7 (1976–1985)	Ellis et al. 1989	>1.5 (1987–1995)	Southwest Recovery Team, unpubl. data
Colorado	1.25 (5)			1.3 (1989–1994)	J. Enderson, Colorado College, unpubl. data
Idaho	1.25 (5)			1.1 (1992–1994)	Ward and Siemens 1995
Montana	1.25 (5)			1.6 (1986–1995)	P. Oslen, Colo. Div. of Wildl., unpubl. data
				1.0 (1984–1985)	Enderson et al. 1988b
				1.53 (1994)	P. Graham, Mont. Dep. Fish, Wildl. and Parks, unpubl. data
Nebraska	1.25 (5)				
New Mexico	1.25 (5)			1.69 (1992–96) ^j	T. H. Johnson, Los Alamos, N.M., unpubl. rep.
N. Dakota	1.25 (5)				
S. Dakota	1.25 (5)			1.25–0.13 (1991–1995)	McKinney 1995
Texas	1.25 (5)			1.9 (1987)	Enderson et al. 1988b
Utah	1.25 (5)			1.8 (1995)	J. White, Wyo. Game and Fish Dep., unpubl. data
Wyoming	1.25 (5)			2.0 (1979–1985)	Barclay 1988
Eastern	None				
Region 1					
Maryland		2.4 (1988)	Byrd 1990		
New Jersey				2.37 (1995)	J. L. Sandt, Md. Dep. Nat. Resour., unpubl. data
Region 2		1.38 (1979–1985)	Steidl et al. 1991	1.53 (1979–1995)	K. E. Clark, N.J. Dep. Environ. Prot., unpubl. data
New Hampshire					
Vermont				1.3 (1981–1995)	J. J. DeStefano, N.H. Fish and Game Dep., unpubl. data
Region 3				2.0 (1995)	A. A. Elser, Vt. Agency of Nat. Resour., unpubl. data
Virginia					
N. Carolina				1.3 (1995)	M. A. Byrd, Coll. of William and Mary, unpubl. data
				2.3 (1995)	McGrath 1995

(continued)

Table 3. (continued) Published and unpublished data through 1995 on recovery goals and current status for America peregrine falcon productivity (number of young fledged per territorial pair) in North America.

Recovery plan ^a	Goal in No. of young fledged per pair ^b	Most recent published data (yr) ^{d,e}	Source	Most recent unpubl. data (yr)	Source
Region 4		1.2 (1991)	Redig and Tordoff 1991	2.25 (1995)	USFWS Region 3, unpubl. data
Michigan				1.5 (1995)	G. E. Burgoyne, Mich. Dep. Nat. Resour., unpubl. data
Minnesota				2.4 (1995)	Holmes 1995
Wisconsin				1.6 (1986–1995)	Meyer 1995
Region 5					
New York				1.84 (1995)	G. A. Barnhart, N.Y. Dep. of Environ. Conserv., unpubl. data
Pennsylvania				1.2 (1995)	D. Madl, Pa. Game Comm., unpubl. data
Canadian					
Zone 1	1.5 ^j	1.81 (1990)	Holroyd and Banasch 1996	1.4 (1995)	U. Banasch and G. L. Holroyd, Can. Wildl. Serv., unpubl. data
Zone 2	1.5 ^j	2.0 (1990)	Holroyd and Banasch 1996	1.07 (1995)	U. Banasch and G. L. Holroyd, Can. Wildl. Serv., unpubl. data
Zone 3	1.5 ^j	1.2 (1990)	Holroyd and Banasch 1996	≥1.05 (1995)	U. Banasch and G. L. Holroyd, Can. Wildl. Serv., unpubl. data
Zone 4	1.5 ^j	2.06 (1990)	Holroyd and Banasch 1996	≥1.82 (1995)	U. Banasch and G. L. Holroyd, Can. Wildl. Serv., unpubl. data
Zone 5	1.5 ^j	1.81 (1990)	Holroyd and Banasch 1996	1.32 (1995)	U. Banasch and G. L. Holroyd, Can. Wildl. Serv., unpubl. data
Zone 6	1.5 ^j			3.00 (1995)	U. Banasch and G. L. Holroyd, Can. Wildl. Serv., unpubl. data
Mexican	No goals			0.65 (1984) ^k	Porter et al. 1988

^a The 3 levels of headings in this column are (1) the 5 regional recovery plans, (2) within-region zones (if zone goals were identified in the regional recovery plan), and (3) states (if state goals were identified in the regional recovery plan).

^b The number in parentheses is years the productivity goal was to be sustained.

^c Recovery plan also specified that at least 50 young should be fledged each year.

^d This column only includes data published in peer-reviewed literature.

^e For comparison, we have included data for productivity for all regions even if there was no regional recovery goal.

^f ? indicates that the year data were collected is uncertain.

^g Productivity averaged 1.4 in northern California and 1.06 in southern California.

^h Without manipulation.

ⁱ Report also indicates that productivity has declined recently.

^j These are zone goals. The Canadian Recovery Plan called for goals to be revised to include down-listing and de-listing criteria once these goals were met.

^k Results of a survey conducted in Baja California.

Table 4. Published and unpublished data through 1995 on American peregrine falcon recovery goals and current status for percent eggshell thinning (relative to pre-DDT shell thickness) and DDE residues (ppm wet weight) in eggs from North America.

Recovery plan ^a	Goal		Most recent published (yr) ^{b,c}			Most recent unpublished data (yr)		
	Eggshell thinning (%)	ppm DDE	\bar{x} eggshell thinning (%)	\bar{x} ppm DDE	Source	\bar{x} eggshell thinning (%)	\bar{x} ppm DDE	Source
Alaska Pacific California	<10 (10)	<5 (10)				12.5 (?) ^d 21 (?) 17.9 (1975–1990) 19.0 (1992–1993)	4.1 (1991)	Mesta et al. 1995 U.S. For. Serv., unpubl. data Kiff et al. 1991 S. T. Albright, U.S. Natl. Park Serv., unpubl. data
Oregon						18.1 (1991–1993)	6 of 11 eggs >15	M. J. Nugent, Oreg. Dep. of Fish and Wildl., unpubl. data Ward and Siemens 1995
Rocky Mountain	≤10 (5)		16 (1973–1983)		Enderson et al. 1982	13 (1989–1994)		
Arizona	≤10 (5)		14.2 (1978–1979)	4.85 (1978–1982)	Ellis et al. 1989			
Colorado	≤10 (5)		16 ^e (1973–1983)		Enderson et al. 1982 Jarmen et al. 1993	9.2 (1990–1994)		P. Olson, Colo. Div. of Wildl., unpubl. data
Idaho	≤10 (5)			11.0 ^e (1986–1989)				
Montana	≤10 (5)							
Nebraska	≤10 (5)							
New Mexico	≤10 (5)		16 ^e (1973–1983)	19.6 ^e (1973–1979)	Enderson et al. 1982	12.0 ^e (1985)		Enderson et al. 1988a
N. Dakota	≤10 (5)							
S. Dakota	≤10 (5)							
Texas	≤10 (5)							
Utah	≤10 (5)					14.0 (1985)		Enderson et al. 1988a
Wyoming Eastern	≤10 (5)			8.8 ^f (1986–1987)	Jarmen et al. 1993	11.0 (1986–1988)	7.8 (1986–1988)	Burns et al. 1992
Region 1 New Jersey	None		16.4 (1985–1988)		Steidl et al. 1991	16.1 (1990–1991)	8.2 (1986–1988) 14.6 (1985–1988)	Burns et al. 1992 K. E. Clark, N.J. Dep. of Environ. Prot., unpubl. data

(continued)

Table 4. (continued) Published and unpublished data through 1995 on American peregrine falcon recovery goals and current status for percent eggshell thinning (relative to pre-DDT shell thickness) and DDE residues (ppm wet weight) in eggs from North America.

Recovery plan ^a	Goal	Most recent published (yr) ^{b,c}			Most recent unpublished data (yr)			
	Eggshell thinning (%)	ppm DDE	\bar{x} eggshell thinning (%)	\bar{x} ppm DDE	Source	\bar{x} eggshell thinning (%)	\bar{x} ppm DDE	Source
Region 2 Vermont						23.5 (1995)	5.0 (1986–1989)	Burns et al. 1992 A. A. Elser, Vt. Agency of Nat. Resour., unpubl. data
Region 3 N. Carolina						8.2 (1993)		McGrath 1995
Region 4			10.0 (1989–1993)	3.61 (?)	Septon and Marks 1996			
Region 5						up to 26.0 (?)	≤25.0 (?)	D. Madl, Pa. Game Comm., unpubl. data G. A. Barnhart, N.Y. Dep. Environ. Conser., unpubl. data
New York								
Canadian			9.13 (1980–1987)		Peakall et al. 1990			
Zone 3			6.21 (1987)		Peakall et al. 1990	12.9 (1983–1992) ^g		Court 1993
Mexican	No goals					17.5 (1967–1984)	4.9(1990–1997) 27.1 (1967–1984)	Stepnisky 1998 Porter and Jenkins 1988

^a The 3 levels of headings in this column are (1) the 5 regional recovery plans, (2) within-region zones (if zone goals were identified in the regional recovery plan), and (3) states (if state goals were identified in the regional recovery plan).

^b This column only includes data published in peer-reviewed literature.

^c For comparison, we have included data for % eggshell thinning and DDE residues in eggs for all regions even if there was no regional recovery goal.

^d ? Indicates that the year data were collected is uncertain.

^e This includes eggs from Colorado and New Mexico.

^f This is $\Sigma \text{ DDT} = \text{DDD} + \text{DDE} + \text{DDT}$.

^g 12.9% thinner than the average thickness for eggs produced under DDT-free conditions.



Adult male Arctic peregrine falcon at an urban nest site. Photo by G. Court.

peregrine populations collected since 1990 are unpublished). Second, the public scientific debate that occurs during listing and de-listing actions subjects unpublished data to a level of scrutiny equivalent to the peer-review process. Third, rapid response time on de-listing is just as important as is rapid response time on listings, and the publication process is perhaps too slow for both processes.

A second major concern was an absence of standardization in methodologies used to monitor American peregrine populations and to report monitoring results among recovery regions, states and provinces, and even entities within states and provinces. In portions of the American peregrine's range, long-term, adequate survey and monitoring programs have been implemented (e.g., Canada [Holroyd and Banasch 1996], midwestern United States [Tordoff and Redig 1997]). Little doubt exists about the American peregrine's status in these regions. However, for other parts of the range, surveys have been intermittent, and results are difficult to compare among years. Pagel et al. (1996) contended that misinterpretation of data from these kinds of surveys might lead to an overestimation of territory occupancy rates in the Pacific Recovery Region and, presumably, elsewhere.

Despite flaws, the available data show that consistent range-wide population increases have occurred over at least the past decade. These increases have been particularly well documented in areas where standardized surveys have been implemented, and nowhere have any surveys shown populations to be declining (Table 2; Cade et al. 1997). Moreover, some variables identified for monitoring in recovery plans, such as eggshell thickness, require a level of consistency in sampling and measurement that is unlikely to be achieved in multiple surveys with many observers. Thus, a majority of members regarded the

paucity of data on eggshell thickness and contaminant loads as unfortunate (and unlikely to change for the better in the future), but not essential to the task of assessing status. Accordingly, the position of the majority of members was that available data were generally adequate for assessing the American peregrine's status. However, a minority of members thought the absence of data on degree of contamination in American peregrine populations was a serious issue because assessment of levels of contamination were part of the de-listing criteria in some recovery plans, and the absence of this information hindered our ability to evaluate objectively whether the cause of endangerment had been eliminated and, consequently, whether recovery was sustainable.

Biological status

Each of the 5 American peregrine recovery plans provided criteria that the recovery teams intended be met before down-listing or de-listing occurred. Accordingly, we compared existing data through 1995 to determine if recovery goals were reached in each region (Tables 2–4).

Goals for number of territorial pairs. Overall recovery goals for numbers of territorial pairs appeared to have been reached or exceeded in the Alaska Recovery Region (ARR), the Pacific Recovery Region (PRR), the Rocky Mountain Southwest Recovery Region (RMSWRR), and in the Canadian Recovery Region (CRR; Table 2). The goal for the Eastern Recovery Region (ERR) was not shown to have been met (ca. 150 pairs in 1994, compared to a goal of 175–200 pairs).

In addition to overall goals for recovery regions, most recovery plans identified state or zone (in Canada and the eastern United States) recovery goals within regions for some biological variables. State or zone recovery goals for numbers of breeding pairs were not met in the PRR, where California, Oregon, Washington, and Nevada did not meet goals based on existing data, nor in the RMSWRR, where Idaho, Montana, Nebraska, New Mexico, and North Dakota were not known to have met goals. In the ERR, recovery goals for numbers of territorial pairs were met in 4 of 5 zones. Unpublished data from 1995 combined with data in Holroyd and Banasch (1996) indicated that goals for numbers of territorial pairs for the CRR had been met for all zones. However, these goals were not de-listing goals per se. Rather, they were intermediate goals that, once met, would trigger the establishment of down-listing and de-listing criteria for the CRR. Thus, true de-listing recovery goals for the CRR had not been established.

Goals for sustaining the desired number of territorial pairs over time had not been achieved in the ARR

(Table 2). The goal for sustaining the desired number of territorial pairs over time in the ERR had been met in 3 of 5 zones. There were no goals for sustaining the desired number of territorial pairs over time established in other recovery regions.

We encountered 2 major problems in our evaluation of the population data. First, there were little or no recent data for comparison with the recovery goals for many states and zones within recovery regions. Some committee members thought these data gaps should be filled, and attainment of state or zone goals confirmed before proceeding with de-listing. However, a majority of the committee thought adequate data existed to determine whether regional recovery goals for numbers of pairs had been attained, and these members thought that the regional scale was appropriate for evaluating whether or not the American peregrine remained threatened or endangered over a significant portion of its range. The second problem was that it was unclear to what extent reported increases in populations were the result of more thorough recent surveys rather than actual increases. The designs of population surveys in most recovery regions prevented an objective evaluation of this issue. Nevertheless, the majority of members thought the preponderance of evidence (including the improving trend in other measured variables) supported the conclusion that population increases were real.

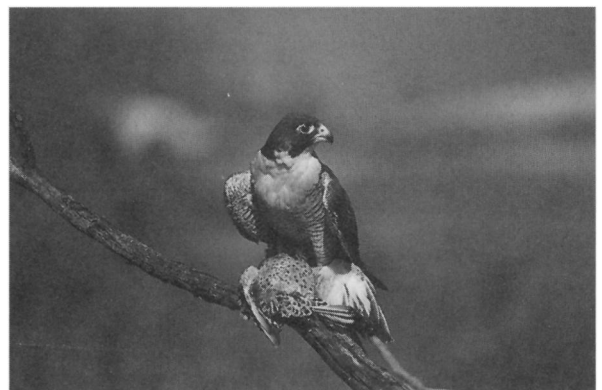
Productivity goals. Goals for average number of young fledged per pair appeared to have been met or exceeded on a regional basis in the ARR and RMSWRR (Table 3). Goals had not been documented as met in the PRR or in the CRR. There were no productivity goals for the ERR. Goals for state or zone productivity were not known to have been met in all of the recovery regions that established such criteria (reported productivity was less than the goal in all 4 PRR states, in 4 of 11 RMSWRR states, and in 4 of 6 CRR zones). Goals for sustaining desired productivity over time had been exceeded in the ARR and in 3 of 11 states in the RMSWRR (Arizona, Colorado, and New Mexico), but not in any state in the PRR (Table 3).

We recognized several problems with assessing productivity goals. Productivity of *F. peregrinus* varies annually, spatially, and, possibly with population density (Hunt 1988, Mearns and Newton 1988, Swem 1994). Given this variability, it is difficult to assess the significance of mean estimates of productivity without additional information on population characteristics, sample sizes, and some measure of data dispersion about the mean. The only conclusion we thought reasonable from the data available was that, on average, productivity of American peregrines

was no longer substantially depressed as it had been previously (Hickey 1969).

Goals for eggshell thickness and DDE residues. Overall eggshell thickness goals were not known to have been met in the ARR or in the RMSWRR (Table 4). There were no goals for eggshell thickness in the PRR, ERR, or CRR. At the state scale, eggshell thickness goals had been met in 1 of 11 RMSWRR states (Colorado), where the eggshell thickness objective had been exceeded for 5 years. Only the ARR had established goals for DDE levels in American peregrine eggs. This goal was met in 1991, but it was not clear whether levels had been monitored since then. The goal was to have been met for 5 years before reclassification of the species to threatened and 10 years before de-listing.

Much of these contaminant data came from peregrine falcon eggs that failed to hatch and eggshell fragments that were collected opportunistically (e.g., Enderson et al. 1988a, Ellis et al. 1989, Steidl et al. 1991). Accordingly, we regarded these data as not necessarily representative of eggshell thinning and contaminant levels in American peregrine eggs. A majority of members thought that increasing population size and a general absence of depressed reproduction was adequate evidence that pesticides no longer posed an immediate threat to the American peregrine. However, a minority of members thought that some measure of the risk of contamination (e.g., eggshell thinning and DDE concentrations in fertile eggs) should have been completed before de-listing was contemplated because DDT contamination had been the cause of endangerment. DDE residues >5 ppm (the ARR goal was 5 ppm) were still being recorded in eggs (Table 4), and eggshells were substantially thinner than in the pre-DDT era (Table 4). These members pointed out that recent studies on organochlorine levels in prey (Ellis et al. 1989, Kennedy et al. 1995) suggested that peregrines might still be exposed to DDE-contaminated prey, even though DDT was banned in the



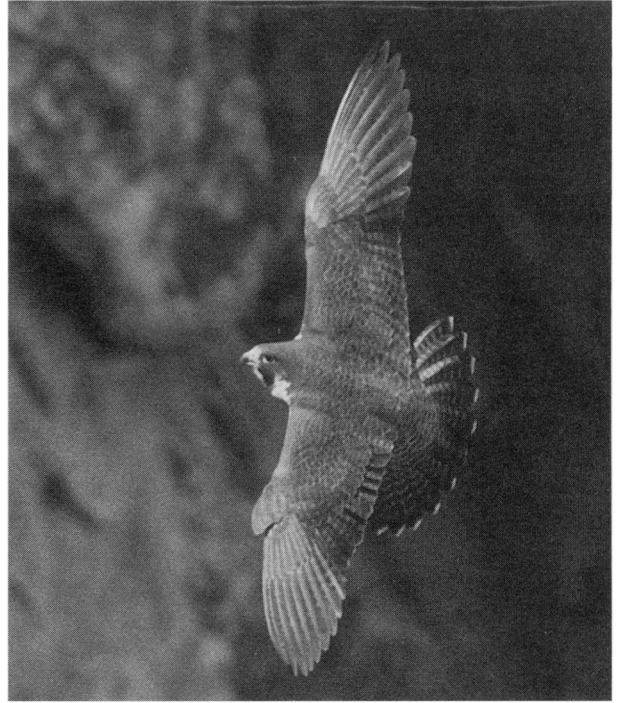
Peregrine with common flicker. Photo by G. Court.

United States. Likely sources of DDE include residual (pre-1972) DDT in the environment, DDE ingested by peregrines on wintering grounds where DDT is still applied, global fallout, recent illegal DDT uses, and DDE derived from Kelthane (Ellis et al. 1989, Kennedy et al. 1995). These members thought that without information on eggshell thinning and DDE residues, we could not determine whether the current demographic trend was sustainable without augmentation.

How much weight should be placed on the recovery plan goals? Given the problems outlined above, we were divided over the extent to which recovery criteria should be weighed in the decision-making process on de-listing. We unanimously recognized a problem in the lack of standardized recovery criteria among regions. A majority of members were concerned that several of the variables that had been selected for monitoring in recovery plans could not realistically be assessed on such a broad scale without more coordination than was provided. Some members thought that goals for productivity (and perhaps eggshell thinning) appeared, in hindsight, to be more conservative than necessary to achieve recovery. Given these issues, several members thought that we should disregard the existing recovery goals in our deliberations. Other members viewed the recovery-plan goals as the only available, objective, a priori criteria against which to assess the biological data. These members thought that existing criteria should be viewed as guidelines before making a decision about changing the listing status of the American peregrine. In the end, the majority of members placed heaviest emphasis on the regional recovery goals for numbers of territorial pairs in each recovery region in formulating their recommendation.

Additional issues raised in comments on the notice of intent

To what extent are releases of captive-bred peregrines responsible for recent population increases? We viewed this issue as significant because it addressed the sustainability of recovering peregrine populations. Population models by Wootton and Bell (1992), although not accepted as accurate by all members, suggested that the reported population for southern California may have been dependent on released birds. Rowell and Stepnisky (1997) reported that in Alberta, American peregrine population increases occurred province-wide from 1991 to 1996, but growth in the north had apparently occurred naturally, whereas increases in the south were attributable largely to releases of captive-bred birds. In addition, American peregrine populations in the northern tier of western states and in some eastern states in the United



Adult American peregrine falcon in flight. Photo by G. Craig and J. Enderson.

States might have been bolstered by continued releases of captive-bred peregrines (Enderson et al. 1995).

Regional variation in the contribution of captive-bred birds to local populations may exist; few consistent efforts have been made to resight banded birds or estimate temporal trends in such contributions (Bednarz 1989; an exception is Tordoff and Redig 1997). We could not determine from existing information whether the observed recovery trend was the result of releases. However, >99% of peregrine releases in the United States took place before 1992 (Enderson et al. 1995), and the majority of members thought it unlikely that direct numeric effects of releases were responsible for current positive population trends in most regions.

Should urban peregrine territories be counted toward attainment of numeric recovery goals? This issue was significant for the committee because a large proportion of established peregrine pairs in the ERR occurred in urban areas (Cade et al. 1996, Tordoff and Redig 1997). We unanimously agreed that there was no inherent reason to discount the contribution of urban pairs toward recovery goals because urban landscapes provide suitable habitat for many raptor species, including peregrines (Bird et al. 1996). Accordingly, the ad hoc committee decided that these pairs should be counted toward recovery goals in the absence of biological data indicating they were not functional. We found no such evidence in our review.

How should the taxonomic status of peregrines in the eastern United States affect listing under the Endangered Species Act? The listed subspecies of peregrine, *F. p. anatum*, is regarded as extirpated from the United States east of the Mississippi River (Hickey 1969, Enderson et al. 1995, Mesta et al. 1995). The ERR population that exists today is largely the result of widespread peregrine reintroduction efforts conducted from 1975 to 1992 (Barclay 1988). Most territorial peregrines in the ERR are progeny of captive-bred peregrines from a variety of subspecies, including *F. p. anatum*, *F. p. cassini*, *F. p. brookei*, *F. p. pealei*, *F. p. peregrinus*, *F. p. tundrius*, and *F. p. macropus* (Barclay and Cade 1983). Many of these taxa are not listed under the ESA. The eastern United States peregrine falcon population numbered ca. 150 pairs in 1994 (Table 2). These peregrines, and all other free-flying peregrines in the contiguous 48 states (including migrant and wintering individuals of other subspecies), are currently afforded protection by the ESA under a similarity of appearance provision. Biological questions exist about the legitimacy of including this population of mixed subspecies of peregrines and their progeny in the ERR under the protective provisions of the ESA. Because many American peregrines were released in the ERR and because this region is within the historic range of that subspecies, we consider it legitimate to manage the existing peregrine population in this recovery region as American peregrines.

Recommendations

Our recommendations represent the consensus of the group by majority vote. Consequently, the recommendations do not necessarily concur with the opinions of individual members on all issues. Virtually every member of the ad hoc committee voted in the minority on ≥ 1 issue.

De-listing the American peregrine falcon

We initially considered 3 options for the American peregrine's listing status: (1) de-list the subspecies range-wide, (2) down-list the sub-species to threatened range-wide, and (3) retain the sub-species as endangered range-wide. Two committee members voted to de-list range-wide, 4 voted in favor of down-listing to threatened range-wide, and no member regarded the American peregrine as endangered. However, 5 of 6 committee members thought the scientific evidence supported de-listing the American peregrine in at least the ARR, PRR, RMSWRR, and CRR. Four committee members regarded peregrines

in the ERR as threatened, but 2 of these believed that this subpopulation should be considered recovered once numeric goals for numbers of nesting pairs in the ERR had been met. One committee member voted to only down-list range-wide because the available data suggested that all recovery goals were not met in most regions.

Based on these votes and subsequent discussion, a majority of members concluded that American peregrine populations in the ARR, PRR, RMSWRR, and CRR were not at risk of becoming endangered in the immediate future and, therefore, should be de-listed. A majority of members regarded American peregrine populations in the ERR as less secure. However, the committee was divided over the issue of whether the ERR population warranted retention on the list by itself because the ERR contains only about 25% of the overall geographic range of the subspecies. This may be a moot point, because data compiled from eastern and mid-western states for 1992–1997 (L. Kiff, The Peregrine Fund, pers. commun.) show that numeric goals for numbers of nesting pairs of peregrines in the ERR were probably exceeded in 1996 and 1997. If this proves to be the case, a majority of members would support de-listing the American peregrine range-wide.

We recommend the USFWS carefully review current information on the population status of peregrines in the ERR; if regional numeric recovery goals have been achieved, the American peregrine should be de-listed range-wide. If these goals have not been met, we recommend that the USFWS down-list American peregrines in the ERR to threatened status until such time as the numeric goals for number of pairs are met.

Recovery planning and de-listing decision-making

We encountered several problems in this review. We feel obliged to point out these problems and to offer suggestions for improvement of future recovery efforts and de-listing decisions. Some of our ideas have been identified previously by other researchers whose work focuses on the American peregrine (Pagel et al. 1996; Cade et al. 1997; Pagel and Bell 1997; White and Kiff, In press) or on endangered species in general (Natl. Res. Council. 1995, Ecol. Soc. of America Ad hoc Comm. on Endangered Species 1996; Foin et al. 1998). Having gone through the experience of evaluating recovery goals and available data for the American peregrine, we have some practical experience and insights to offer. Our comments here fall into 4 broad, overlapping areas.

Selection and modification of recovery criteria.

We were frustrated by the inconsistencies in recovery criteria in the various recovery plans and by the lack

of revision of recovery criteria to accommodate new knowledge over time. The most compelling status indicator range-wide for the American peregrine was the trend in the number of territorial adults. Eggshell thinning, egg-contaminant, and even productivity data are difficult to collect rigorously and consistently over large areas, and are subject to considerable natural variability. Inclusion of these as valid recovery criteria would require a rigid sampling protocol administered consistently by a limited number of investigators using comparable methods. We suggest that such an approach be developed and adopted for any future monitoring of American peregrines that considers these variables.

We also suggest that listed taxa with widespread distributions such as the American peregrine be managed under 1 recovery plan with 1 recovery team in the future. In establishing variables for monitoring recovery, the USFWS and recovery team should take the following into account. First, a sampling approach often makes the most efficient use of available resources and avoids making the unrealistic and untested assumption that a complete population census has occurred. Second, monitoring parameters with high sampling or measurement error, or which have an uncertain relationship to population status, are of limited value. Third, knowledge attained through monitoring will likely necessitate modification of recovery criteria at regular intervals (i.e., place recovery criteria in an adaptive management framework). And fourth, funds to implement a monitoring protocol will be limited, particularly as the population recovers and concern decreases. Heavy emphasis should be put on selecting those de-listing benchmarks that can be measured accurately with available resources and which are unambiguously linked to population status and cause(s) of endangerment. This also means that the monitoring would be done by the same limited, small group of scientists or managers. Not every state and federal agency should be involved continuously in data collection. Because resources would be consolidated into region-wide monitoring, we predict that a sampling approach would be cost-effective compared to existing approaches that rely on censuses. For example, monitoring resources could be used to estimate nesting density in sample plots randomly distributed throughout the subspecies range (stratified by habitat type and other relevant covariates). These density estimates could be based on distance sampling methods or counts within fixed-width plots (assuming all territories can be located within each plot). Productivity could be estimated by a random sub-sample of active territories within sample plots. Eggshell thick-

ness and DDE levels could be evaluated from single eggs removed from a random sample of nests throughout the range of the subspecies.

Standardized approach toward monitoring.

Available data on the status of the American peregrine were collected, for the most part, through survey efforts at the management area or state level. While these data sets often provided good information on status locally, the lack of standardization in methods and timing of surveys made it difficult to discern range-wide trends. An example of the value of coordinated surveys can be seen in the data from the 1970, 1975, 1980, 1985–1986, and 1990 peregrine surveys throughout Canada (Holroyd and Banasch 1996) and in data from the Rocky Mountain (Enderson et al. 1988b) and Midwest (Tordoff and Redig 1997) regions in the United States. Data of this magnitude and level of consistency should be the objective of monitoring programs for listed species. We recognize that states, provinces, and local governments are resistant to federal mandates about how recovery money is spent, and that accomplishing consistent survey objectives will demand a long-term commitment by these organizations. For these reasons, all participants should play key roles in the design of these surveys and make commitments to complete their share of the workload.

Funding for status monitoring of listed species.

Funds for conservation of imperiled species are, in general, preferentially allocated to declining and highly imperiled taxa. Recovering species such as the American peregrine are often afforded fewer resources as populations are perceived by managers to be nearing recovery. These funding decisions raise analytical problems when evaluations must be made about de-listing, especially in situations where recovery criteria are best met by consistent, long-term data sets. Several steps could be taken to address this problem: (1) providing additional funds for the purpose of monitoring recovery of listed taxa to ensure detailed recovery criteria are met; (2) establishing less specific de-listing criteria that can be evaluated with limited funding; and (3) as recommended above, enhancing coordination of monitoring efforts to make the most efficient use of available funds.

As scientists, we are reluctant to recommend the second approach because it increases the risk of making a poor decision. It is also difficult to recommend that money needed for management of highly imperiled taxa be diverted to monitoring the final stages of recovery of other species. We believe option 3 has some merit and potential for the American peregrine. According to a report by the International Association of Fish and Wildlife Agencies (Hopkins and Reef

1997), state agencies spent \$356,418 on American peregrine falcon recovery in 1996 (making the American peregrine the tenth highest-funded taxon on the federal list). This figure does not include spending by federal agencies or Canadian provinces (e.g., U.S. For. Serv., Dep. of Defense, Can. Wildl. Serv., USFWS [including Section 6 grant-in-aid appropriations to the states]), so the actual expenditure is probably >\$500,000 per year. We suggest that \$500,000 could pay for a thorough, well-coordinated national monitoring program for the American peregrine. Such a program will be necessary regardless of which de-listing option the USFWS selects, because even if the subspecies is removed from the endangered species list the ESA requires a 5-year post-recovery monitoring period (Mesta et al. 1995). Because most of these funds are spent by states at their discretion, implementation of this recommendation would require voluntary coordination and cooperation among the states. Carrying this out successfully would necessitate a sampling protocol administered consistently by a limited number of investigators using comparable methods.

Publication and peer review of status data.

We have previously discussed this issue at length and given our reasons for concluding that peer-reviewed and other published and unpublished information is adequate to determine the current status of the American peregrine. Nevertheless, we strongly recommend a more concerted effort be undertaken in the future to publish status survey results for listed taxa. These data sets would most likely be improved in quality and rigor though the peer-review process. It would also benefit concerned parties to have the previously unpublished and unreviewed data more readily available. We suggest that the USFWS fund an appropriate and qualified group of scientists to collate the large volume of as-yet-unpublished population data on the American peregrine, subject it to peer review, and publish it.

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