

# PEREGRINE RECOVERY IN THE UNITED STATES

TOM J. CADE

*Cornell University, Ithaca, New York*

## ABSTRACT

Our national effort to conserve and restore Peregrine populations in the USA has been carried out primarily under provisions of the Endangered Species Act of 1973. The responsibilities have been divided among four regional Recovery Teams appointed by the Director, U.S. Fish and Wildlife Service: one for Alaska; one for the Pacific Coast states; one for the Rocky Mountains and southwestern states; and one for the eastern states.

A strong, natural recovery of breeding numbers in Alaska, beginning in the late 1970s, has made the introduction of captive-produced falcons unnecessary there, and the main actions have centred on continued surveys of breeding populations and on protection from human disturbance. Along the central coast of California an original population of 17 nesting pairs had been reduced to three non-producing pairs by 1971; from 1977 to 1981 the Santa Cruz Predatory Bird Research Group fostered 27 young into these nests and by 1982 Peregrines were again occupying 12 eyries in this region. A serious decline in the number of occupied eyries in the Rocky Mountains has been arrested by adding captive-produced young into the nests of the remaining wild pairs; and captive-produced Peregrines have been present in the breeding population since 1980.

In the eastern USA, where the original population has been extirpated for 25 years, more than 350 captive-produced young have been released by hacking since 1975. In 1981 there were at least seven territorial pairs present in the new population, four of which hatched young of their own, and single birds were seen at more than ten other locations. With the continued release of young by fostering and hacking over the next five years, ornithologists expect to see a significant recovery of breeding Peregrine populations in the USA.

## INTRODUCTION

The Endangered Species Act passed by the United States Congress in 1973 has provisions not only for protecting and conserving species threatened with extinction, but also going farther by directing the Secretary of the Interior to take whatever actions are necessary to restore endangered species to safe population levels. This objective is now usually referred to as 'endangered species recovery'. For the most part, the specific policies and actions required to achieve this goal are defined and periodically evaluated by special 'Recovery Teams' serving in an advisory capacity to the Director of the U.S. Fish and Wildlife Service. Each team develops a 'Recovery Plan' for the particular species or population assigned to it.

Owing to the very wide geographic distribution of the Peregrine Falcon (*Falco peregrinus*) in North America, these responsibilities have been divided among four regional recovery teams: one for the northern, migratory Peregrines nesting in Alaska; one for the Pacific Coast states; one for the Rocky Mountains and

southwestern states; and one for the eastern states. A strong, natural recovery of breeding numbers in Alaska, beginning in the late 1970s and continuing into the 1980s (White & Fyfe, in press), has made the introduction of captive-produced falcons or other manipulative procedures unnecessary there, and the main actions have centred on continued surveys of breeding populations and on protection from human disturbance. The other three recovery plans all rely heavily on the introduction of captive-raised falcons and other intensive manipulations as the only feasible way to restore breeding populations in the US south of Canada, because Peregrines have here been so drastically reduced in numbers that a recovery by strictly natural processes is unlikely to occur.

In response to concern for the species' survival, in 1970 The Peregrine Fund established a captive breeding programme at Cornell University with the objectives of developing methods for raising falcons on a large scale in captivity, and of learning how to release the progeny in the wild so as to re-establish a breeding population in the eastern United States (Cade 1980). This programme has been under the general management of James D. Weaver since 1972. In 1974 we began a second operation in co-operation with the Colorado Division of Wildlife at Fort Collins in order to increase the density and extend the geographic distribution of the greatly-reduced nesting population in the Rocky Mountains and adjacent western regions. William A. Burnham has been the manager of this programme (Burnham *et al.* 1978). Since 1977 a third operation, organized by the Santa Cruz Predatory Bird Research Group under the supervision of Brian J. Walton, has been under way with the same objective in California and the West Coast. Walton and his group have recently joined forces with the Peregrine Fund, Inc., so that most of the operational aspects of the three recovery programmes in the US south of Canada are now being carried out by personnel of the Fund in association with the three recovery teams and plans.

The results of these efforts to date are summarized below.

## THE EASTERN PROGRAMME

For a proper perspective on the eastern programme, it is necessary to look back to the situation that existed in the 1930s and early 1940s, before DDT came into use and before the drastic decline and eventual extirpation of the eastern breeding population occurred in the 1950s (Hickey 1969; Cade & Fyfe 1970; Temple, Fyfe & Cade 1976). The nesting population that existed in those decades provides a goal toward which efforts at restoration can be directed. Much of what we know about the population in those days comes from the work of Joseph J. Hickey (1942) and a group of collaborators who developed a list and history of all known Peregrine eyries in the eastern United States and Canada.

The eastern recovery programme is mainly concerned with the region from the Mississippi River to the Atlantic Coast. In this area there are somewhat more than 200 known places where Peregrines used to nest, and Hickey (1942) estimated the total breeding population in the 1930s and 1940s to be around 350 pairs, with an annual variation of perhaps ten percent either way. Thus, as elsewhere, the breeding population was remarkably stable through time but widely dispersed over some 1,120,000km<sup>2</sup>. That is a thin population indeed, even for the Peregrine; however, the falcons were not uniformly distributed through this vast region, the breeding pairs being clustered into regional population units. There was a group of about 75 eyries in New England—principally in the White Mountains, Green

Mountains and Adirondacks; there were ten eyries along the lower Hudson River (Herbert & Herbert 1965), another sizeable group of some 30 eyries in the Susquehanna River drainage of Pennsylvania (Rice 1969), and then a population of rather scattered pairs on crags throughout the Appalachian Mountains as far south as northern Georgia and Alabama. Isolated pairs were found in some other parts of the East—two tree-nesting pairs along the Virginia coast (Jones 1946) and two in the cypress swamps of western Tennessee (Spofford 1947). There was one other separated population of some 20 pairs nesting along the upper Mississippi and tributaries in Wisconsin and Minnesota, with a scattering of pairs in the upper Great Lakes region (Berger & Mueller 1969).

Apparently there were not many more. The Peregrine has never been a common falcon in the USA compared to its former numbers in Europe and the British Isles (Cramp & Simmons 1980). Ratcliffe (1980) estimated around 800 active eyries in Britain before World War II; more than twice the number estimated for the entire eastern United States. This low density means that restoration by the introduction of captive-produced falcons is not quite so horrendous a job as it might first seem, considering the total uninhabited range involved.

The original population of Peregrine Falcons or Duck Hawks in the eastern US underwent an unprecedented decline in the late 1940s and 1950s, and by the late 1950s there were no pairs known to be nesting anywhere east of the Mississippi River (Hickey 1969), a situation that continued until 1980. The goal of the eastern recovery plan is to establish a breeding population equal to at least half the number of pairs present in the 1940s—before DDT (Bollengier *et al.* 1979).

By 1975 we had produced enough birds at Cornell University for experiments to develop effective methods for restocking the wild to begin. As of 1981 we have released 353 young falcons into ten eastern states from New Hampshire to North Carolina. The principal method we have been using is hacking (Cade & Temple 1977; Sherrod *et al.* 1981), but recently we have also been fostering some young into the nests of adult falcons that have begun to breed in the wild again.

*Figure 1* shows where we have been releasing falcons and indicates where our efforts have been concentrated. In addition to the states along the Atlantic Seaboard, we have also worked briefly in Wisconsin and Minnesota along the upper Mississippi. We have been testing the success of hacking in three different situations. Some hacking stations have been located on natural cliffs, usually historical falcon eyries, in New Hampshire, Vermont, Massachusetts, New York, Pennsylvania and Wisconsin. Others consist of specially constructed artificial towers in habitat highly suitable for Peregrines, mostly in coastal salt-marshes and wetlands from New Jersey to North Carolina and in the Chesapeake Bay. A third group of sites makes use of buildings in cities—New York, Philadelphia, Baltimore, Washington D.C., and Norfolk, Virginia (Barclay & Cade 1983).

The success of hacking can be judged from *Table 1*, which shows the fate of hacked Peregrines in the four weeks immediately after they start flying and up to the time when most have dispersed from the sites. In 1975 we hacked out 16 young and 4 were lost, giving us 75 percent that reached independence and dispersed successfully. The numbers have increased steadily through the years, so that in 1981 we hacked 84 birds, with 24 lost before dispersal for a 71 percent rate of success. Out of the total of 353 released, 92 have been lost during hacking, giving an average survival to dispersal of 74 percent. These losses are fairly comparable to those that occur among wild populations of falcons during the same stage of their lives (Barclay & Cade 1983).

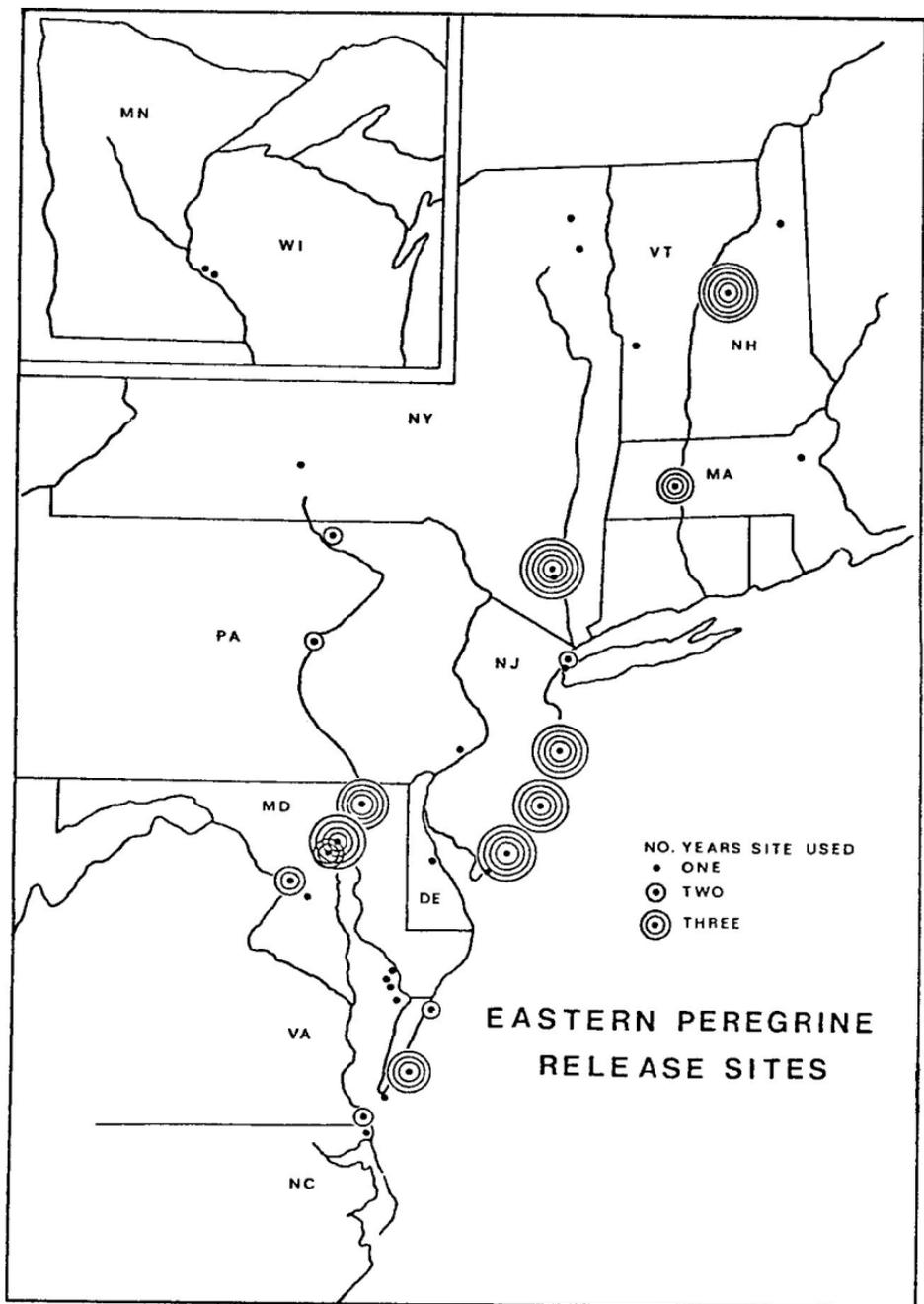


Figure 1: Peregrine Falcon release sites in the eastern states, showing the number of years each site was used.

Table 1: Fate of hacked Peregrine Falcons up to four weeks after release.

	1975	1976	1977	1978	1979	1980	1981	Total
Number hacked	16	37	46	53	52	65	84	353
Causes of mortality and other losses:								
Great Horned Owl predation	2	—	5	6	3	—	1	17
Retrapped due to owls	1	—	2	5	—	—	—	8 <sup>a</sup>
Fox predation	—	1	—	1	—	—	1	3
Raccoon predation	—	2 <sup>b</sup>	—	—	—	—	—	2
Injured by Osprey	—	—	—	—	1 <sup>a</sup>	—	—	1
Adult harassment	—	—	1	—	2	5	5	13
Died or returned to captivity	—	—	—	2	—	2	6	10
Forced away in storm	—	1	—	3	—	—	—	4
Electrocuted	—	—	1 <sup>a</sup>	—	—	—	1	2
Drowned	—	—	1	—	—	—	—	1
Fell into chimney	—	—	—	—	—	1	—	1
Flew into window	—	—	—	—	—	—	1	1
Drowned in air conditioning	—	—	—	—	—	—	1	1
Ensnared on building	—	—	—	—	—	—	1 <sup>a</sup>	1
Disappeared prematurely	1	8	1	2	6	2	7	27
Total number lost	4	12	11	19	12	10	24	92
Number dispersed normally	12	25	35	34	40	55	60	261
Percent dispersed normally	75	68	76	64	77	85	71	74

Notes: a Returned to captivity.

b Occurred prior to release.

The hacked Peregrines meet death in many, sometimes bizarre ways, but overall the Great Horned Owl (*Bubo virginianus*) has been the single greatest cause of disturbance and death. We feel that many of the young falcons that disappeared prematurely were either killed or frightened away by owls, so that if the whole truth were known, Great Horned Owls have probably been responsible for about 50 percent of the total losses. A few other natural predators are sometimes involved. In cities the young fall into chimneys and air vents, fly into plate glass windows or get caught up in some kind of mechanical contrivance. In New York City in the summer of 1981 one of our birds got caught up in a piece of fishing-line attached to a steel girder on a skyscraper under construction.

When one compares the success of hacking in these three different situations, by far the highest rate has been achieved in *most years* on the towers in the coastal salt-marshes, where there are few Great Horned Owls, few obstructions, and an abundant supply of prey (Table 2). While the metropolitan sites present some problems, they have, on average, still proved more successful than the natural cliff sites. Only about 63 percent of hacked young have dispersed successfully from cliff sites, compared to nearly 80 percent at towers and 83 percent at urban sites. The reason for the poor rate of success at the cliffs is almost entirely owing to Great Horned Owls (Barclay & Cade, in press).

There is no effective way to control the owls, and we are faced with the need to find natural sites in owl-free habitat. Fortunately, we have discovered in the last two years that cliffs higher in the mountains are much less likely to harbour owls than those along the major rivers such as the Susquehanna, Mississippi, Hudson and Connecticut, where we first located hack-sites; and in 1981 we enjoyed a success rate of 83 percent at cliffs.

Table 2: Hacking results according to site type.

Year	Artificial sites				Natural sites	
	Tower sites		Urban sites		Cliff sites	
	No. falcons hacked	Percent dispersed normally	No. falcons hacked	Percent dispersed normally	No. falcons hacked	Percent dispersed normally
1975	10	90	—	—	6	50
1976	14	71	—	—	23	65
1977	23	91	—	—	23	61
1978	29	76	—	—	24	50
1979	32	75	8	100	12	67
1980	33	94	20	85	12	58
1981	37	62	24	75	23	83
Total	178	79	52	83	123	63

As more and more Peregrines have been released, and the spring and summer population has begun to build up and to include more territorial adults and subadults with their activities centred round our release sites, the hacked youngsters have begun to experience considerable harassment from these territorial birds. Losses from intraspecific aggression were significant in 1980 and 1981, and it has become difficult for us to use the salt-marsh towers because of the frequency with which they have been taken over by returning falcons, which often do not make their presence known until after the young are on the wing.

In the wild, Peregrines are known to have a strong tendency to home back to their natal territory, no matter how far they may travel in the post-breeding period, and we have been counting on this strong philopatry to bring our released falcons back to the hack-sites, where we hoped they would settle to nest. We have not been disappointed, as some Peregrines began returning the very next year following the first releases, and the number has been building up slowly each year. The first pairs were seen in 1978; the first eggs were laid in 1979; the first successful production of young occurred in 1980; and in 1981 there were four successfully producing pairs, one on a cliff in New Hampshire and three on towers along the New Jersey coast (Cade & Dague 1981). In addition there were three other non-breeding pairs on territories, and at least ten single adults or subadults scattered along the Atlantic Coast and in the Chesapeake Bay (Figure 2). Five pairs laid in 1982 and raised 12 young; 9 pairs produced 23 young in 1983 with a total of 16 pairs occupying territories.

## ROCKY MOUNTAIN PROGRAMME

The number of Peregrine eyries known to have been used at one time or other in the Rocky Mountains and associated regions in Idaho, Montana, the Dakotas, Utah, Colorado, Arizona, New Mexico and Texas is around 177 (131 to 197, according to Craig *et al.* 1977). The historical use of these eyries is best known in Colorado (Enderson 1965, 1969; Enderson & Craig 1974; Enderson *et al.* 1982) and in Utah (Porter & White 1973). If one assumes that 90 percent were occupied on average each year, then the breeding population was around 160 pairs in a region exceeding 2.4 million km<sup>2</sup>, again a very thinly distributed population, even

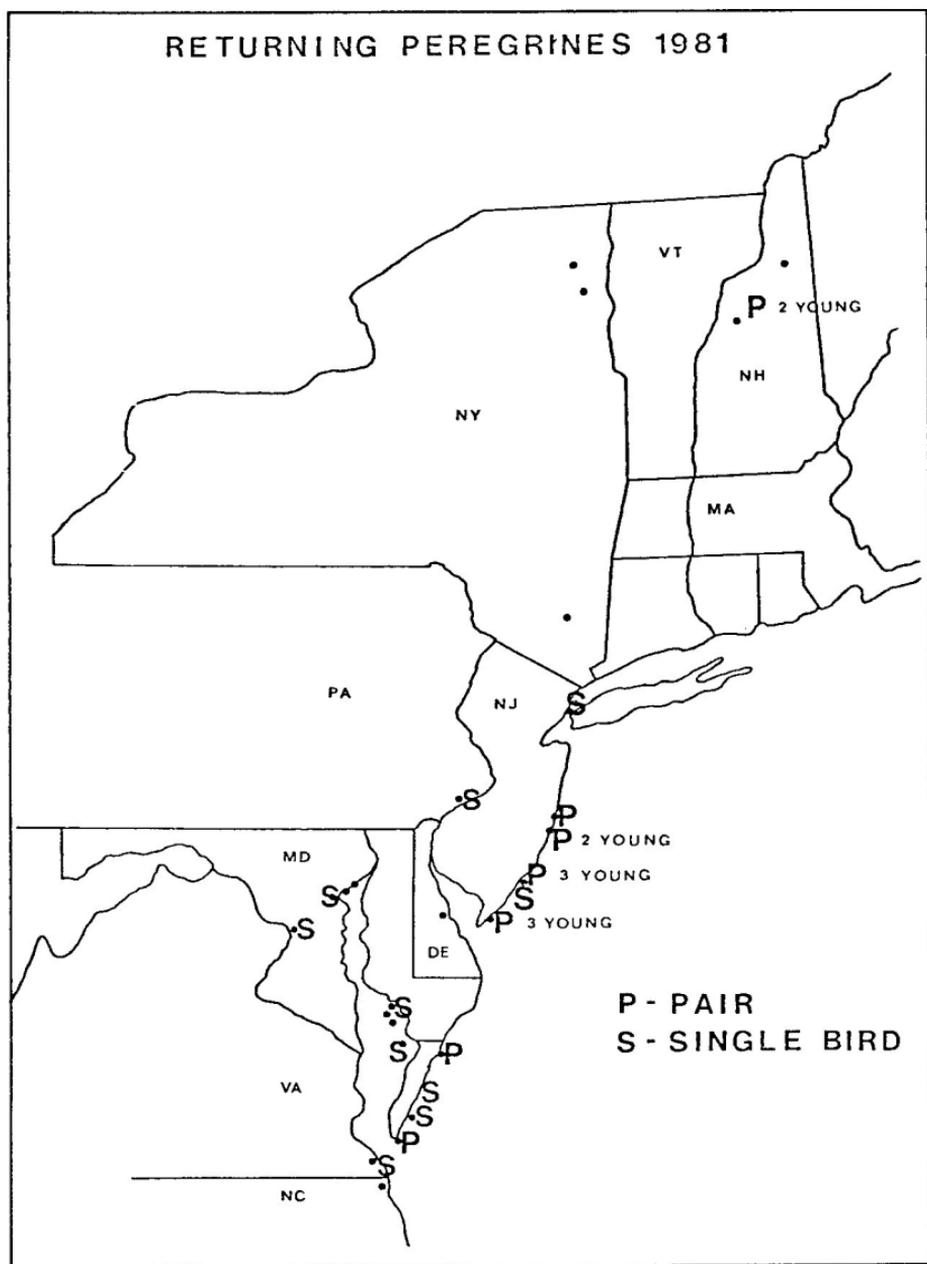


Figure 2: Returning Peregrine Falcons, 1981, with an indication of single bird, pair, and number of young.

sparser than in the east. However, the rate at which new eyries have been found in Colorado even in the post-DDT era of the 1970s—14 new sites added to 20 old ones—indicates that probably not more than half the historically used sites are known in the Rocky Mountain region. The total population may once have numbered around 300 pairs.

Unlike the eastern situation, there are still a few pairs of wild Peregrines nesting or attempting to nest in the Rocky Mountains. There are about 15 occupied sites in Arizona, 17 in New Mexico, 6 in Texas, 10 in Colorado (only 6 productive in 1981), about 6 in Utah, perhaps one in Montana, and none known in Idaho, Wyoming and the Dakotas (White & Fyfe, in press). Perhaps 20 percent of the original population of this region remains, but unfortunately many of these pairs still experience reproductive problems associated with high DDE residues in their prey and egg contents (Enderson *et al.* 1982).

Here the strategy has been primarily to add captive-raised young into the nests of wild pairs in the hope that their very low rate of production can be augmented sufficiently to arrest further decline in the breeding numbers and at least hold the populations stable until such time as the DDE problem ameliorates. Recently some hacking has also been done in an attempt to establish new pairs at abandoned historical eyries or at new locations where Peregrines were not known to nest in the past, so as to increase the density and distribution of this montane population.

We fostered the first two captive-produced young to wild parents at an eyrie in the Royal Gorge of Colorado in 1974, in co-operation with James H. Enderson and Gerald Craig of the Colorado Division of Wildlife. Since then our workers at the Fort Collins facility have released 247 young Peregrines by fostering, cross-fostering and hacking, and 181 or 73.3 percent successfully fledged and dispersed (Table 3). Our cross-fostering projects with Prairie Falcons (*Falco mexicanus*) have not worked out well for reasons incidental to the procedure itself, and for the time being we have discontinued this method of release.

Owing to the difficult terrain and the vastness of the Rocky Mountains, it has not been easy to determine how many of the released Peregrines have returned to enter the breeding population. One of our ringed males was definitely paired with a wild female at an eyrie in Colorado in 1980, and they raised three young. Unfortunately, he did not reappear in 1981. In that year, however, there was a non-breeding pair of released birds at an historical eyrie near Durnago, Colorado, and another pair at a cliff (not an historical eyrie) where we have been hacking young in the Rocky Mountain National Park. A pair and at least one other adult

Table 3: Number of Peregrine Falcons released in the Rocky Mountain Programme.

Year	Attempted	Successful
1974	2	2
1976	5	5
1977	25	19
1978	40	31
1979	57	31
1980	58	43
1981	60	50
Total	247	181

bird and two subadults were present around towers in northern Utah, and single birds were seen around several other hack sites in Wyoming and Colorado. Since the productivity at the remaining active eyries in Colorado has been dramatically increased during the last five years by our fostering procedures, we believe that we must be making a significant impact on recruitment of new breeders and that a further decline in the breeding population has been prevented in that state.

## THE PACIFIC COAST PROGRAMME

Except for one eyrie at Crater Lake National Park in Oregon (Matthews 1982), all recovery work to date on the Pacific Coast has been carried out in California. Starting with Bond's (1946) original list, Steve Herman (Herman *et al.* 1970; Herman 1971) and Carl Thelander (1977) have tallied a total of 168 verified locations where Peregrines have nested one or more times in California, and an additional 42 suspected locations for a probable total of 210 eyries, some of which were alternate sites in the same territory. The distribution of these eyries is strongly biased toward coastal environments. Thelander (1977) calculated that the three coastal zones, near-shore islands, the immediate coastline and coastal hinterland within ten kilometres of the ocean, comprise about 16,700km<sup>2</sup> or 5 percent of the total breeding distribution in California; yet 90 of the historical eyries occur in these three zones, producing what was one of the highest regional densities known in North America, one nesting location per 185km<sup>2</sup>.

Thelander estimated that in the period 1975–76 there were about 25 occupied eyries in California. Only six of these were in the coastal zone, showing the great impact which DDE contamination has exerted on the marine and marine-associated organisms of the California coast.

In California, The Peregrine Fund, working with Carl Thelander and Brian Walton, fostered the first two captive-produced Peregrines into the nest of the famous falcons at Morro Rock on the coast north of Santa Barbara in 1977, after the birds had broken their eggs earlier in the season. Unfortunately, the adult tiercel was shot shortly thereafter; the surviving female had a difficult time caring for the young by herself, and only one chick lived to fly from the cliff (Cade & Dague 1977).

Following this, Walton and the Predatory Bird Research Group at the University of California, Santa Cruz, began a programme to breed Peregrines in captivity and to hatch wild eggs in incubators as methods to supplement the number of young in eyries. They have concentrated on the now isolated population of the central California coast between Monterey Bay and Santa Barbara. Originally there were 17 pairs known to be nesting in this region, mostly right on the coastline, which is quite precipitous in many places along this 200km stretch. By 1971 this population had been reduced to three pairs, which were failing to reproduce successfully, with a single adult at a fourth eyrie.

Walton and his group began putting young into the nests in 1978, and by the end of the 1981 season had successfully fostered or hacked 27 young in this region, accounting for most of the production in those years (*Table 4*). By 1980 there were five nesting pairs and one single bird at the eyries. A minor population explosion occurred in 1982 with 12 eyries again occupied on this stretch of coast including eight pairs with eggs and four single, territorial birds.

Unfortunately, Walton did not ring his released falcons in the early years of his programme, so it is impossible to be certain how many of these suddenly-appearing new birds are captive-produced and how many are dispersing wild progeny

Table 4: Increase in numbers of Peregrines on the central coast of California.\*

		Fledglings		
		Natural	Fostered or hacked	Total
1971	3 pairs	?	0	?
1977	3 pairs	1	1	2
1978	3 pairs, 1 single	1	2	3
1979	4 pairs, 1 single	0	5	5
1980	5 pairs, 1 single	2	6	8
1981	4 pairs, 3 singles	0	13	13
1982	8 pairs, 4 singles	—	—	—
	Production Totals	4	27	31

Note: \* Date from Brian J. Walton.

coming in from other populations. It seems significant, however, that nowhere else on the coast of California to the north or south has there been a detectable reoccupancy of eyries. The closest coastal nesting Peregrines to the north are on the Olympic Peninsula of Washington; the closest southern ones are in Baja California; and the closest inland eyries are over 300km away.

## CONCLUSION

These encouraging results clearly show that we have begun to build up a small, founding population of released Peregrines in the eastern USA. With the continued support and help of our many friends and colleagues through several more years of hacking about 100 Peregrines a year, it will be possible to establish a wild population large enough to maintain itself and increase slowly through natural reproduction. We believe that in another five years we will have such a population of 20 to 30 pairs nesting on the mid-Atlantic Coast and in the Chesapeake Bay region, and we expect in that same time to have made a good start toward establishing a breeding population in the mountains of Maine, New Hampshire, Vermont and New York, where eventually 50 or more pairs could be accommodated.

In the West, we have been able significantly to augment the poor natural reproductive output by fostering captive-raised birds. As a result, in the Rocky Mountains we appear to have arrested the decline in Colorado, while in California we are beginning to see an increase in the number of occupied eyries on the central coast. We expect continued improvements in both regions in the coming years.

When we began this work in 1970 most people said that it would be impossible to produce large numbers of Peregrines in captivity. The three facilities of The Peregrine Fund now raise more than 200 young a year, and together with our Canadian colleagues and private breeders we have contributed to the production of well over 1000 Peregrine Falcons in North America in the last five years (Harper 1981), not to mention the numbers being produced in other parts of the world. Most people also said it would be impossible to establish domestically raised falcons in the wild and induce them to breed as wild birds. Now many of our released Peregrines are nesting in the wild, and it is just a matter of continuing to release large numbers over several more years in order to effect a significant restoration of this species in the United States.

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