

The Raptor Research Experiment at Saanichton, B.C.

A continuing series of experiments aimed at the domestication of the Peregrine was begun in 1965 by a team of cooperators programmed under the Raptor Research Foundation. Even with the initial pair the entire background of both birds is known and documented. Also, it is the first time where a continuing supply of young birds of known origin and background are being raised and conditioned for replacements and the setting up of new pairs at widely-separated points across the continent. The pair with which this paper is concerned, therefore, represents but the first nestings by the first pair that has been assigned to, and as much as possible conditioned for, a continuing series of experiments. In this case an obvious pair-bond had been formed and inasmuch as the female produced her first set of eggs by the third year, some of the conditioning techniques that were used should be recorded.

The pair of Peregrines now under discussion consisted of two of eight young of the race pealei taken from the east side of Moresby Island of the Queen Charlotte Islands group in June of 1963. Four males and four females were taken. The females were originally obtained specifically to be trained to attack large gulls in an experiment undertaken for the National Research Council of Canada. Nevertheless, during their first autumn and winter, two of the males were trained and kept with the four females much of the time. While kept leashed to blocks in the traditional manner, which of course does not permit any physical contact between individuals, much of the time they were either in the same room or in close proximity to one another on the lawn-perches. During the two seasons that the four females were flown to gulls, three of them met with accidents and were either killed or otherwise lost. The flights to gulls were terminated at the end of March, 1965. At this time the one remaining female was assigned to my care for the Raptor Research Foundation domestic reproduction experiments. This falcon then, and her mate, both had a very similar and well-documented background. Both had been lure-trained from July to September of 1963. The female had then been flown to gulls from September 1963 until April 1964. The male had been ill from an unknown cause during part of this time, from about September until late January, but had recovered and was being flown to domestic pigeons from January 1963 until March of 1964. The initial training of both birds took place over a hundred-acre saltmarsh some twelve miles north of Victoria, British Columbia. The flights to gulls by the female occurred at random over a much larger area, but never more than eight miles from the original training area. Due to considerable damage to the flight feathers in the numerous encounters with gulls, the female of the pair was not flown during her first moult, and was accordingly not flown from early April until mid-July. The male however was flown to lure and pigeons over the training area through the first moult.

After the 15th of July, and before the flights to gulls were again resumed, the two birds were flown together as a pair for a few times but the female proved to be intolerant of the male in

this situation and these flights were abandoned. She was subsequently flown to gulls for the second season, from October 1964 until the 10th of March of 1965. The male was also regularly flown to lure or to pigeons primarily over the training area. Throughout all this time neither of these birds was exclusively handled by any one person. As many as six different individuals, both men and women, handled them at different times and for widely varying periods of time. No strong association to any one person was therefore made by either bird.

With the cessation of the flights to gulls, and beginning just before the vernal equinox of 1965, the first steps of purposeful pre-conditioning toward eventual pair formation were begun. The two birds were confined together in a compartment of a building that was located on the saltmarsh training ground and from the windows of which much of the area could be seen. The room was not large, measuring only 12 feet by 18 feet by 8 feet, the long axis oriented east and west. Inasmuch as cold weather comes to this area from the northeast and major gales from the southeast, the room had glass windows protected by vertical slats on the north and east walls. The south wall was a featureless partition except for the door to the adjoining room, while the west wall was a continuous open, slatted window beginning some four feet from the ground and carried on up to the roof. Shelf perches were provided at the base of all windows and a pole perch joined north and south walls midway in the room. A small bath, raised some two feet from floor level, was placed against the south wall clear of all perches and a turf-covered nest ledge 2 feet by 4 feet was located some 6 feet above the floor in the northeast corner. The floor was of natural sandy earth covered with about two inches of western hemlock sawdust.

Although the female had never shown the least hostility to this male except when free in the air together, the precaution was taken of tethering the female to a lawn-block set adjacent to the bath for the first week. During this period the food for both birds was nailed to a second block placed exactly at leash-length from the block to which the female was tethered. In this way the female was conditioned to having the male eating from the same food at the same time that she was eating without being able either to take the food from him or to drive him away. Following this, and when observation showed no apparent hostility on the part of the female, she too was liberated in the room. Food was primarily fryer chicken heads or an occasional pigeon.

By March 15th there were some signs of sexual interest developing between the two birds, and some ceremonial bowing and clucking when both birds were on the nest ledge was observed. There was no behaviour that could be interpreted as being the domination of one bird by the other and both often ate together from the same pigeon or chicken head at the same time. Although no feeding of one bird by the other was observed at such times, it may easily have occurred.

Late in March, on the 21st for the male and the 23rd for the female, both birds entered a very early and very rapid moult that was complete by mid-July.

During May and June the female spent considerable time on the nest ledge in the brooding position, and on two observed occasions she spent the entire night there as well as the greater part of the ensuing day, but no eggs were produced. While none were expected from a bird of this age, there is one observation by Brooks, and two records from Alaska (Cade, T.J., Univ. Cal. Pub. Zool. 63:151-290, 1960) of immature-plumaged wild Peregrines incubating eggs.

The moult was sufficiently complete so that lure flying was resumed by the 22nd of June in the case of the male, and on the 27th of June by the female. By the 4th of July the falcons were under sufficient control that flights with both birds in the air together were again attempted. This time there was no aerial conflict and they were accordingly flown as a pair from the home building and over the home territory to lure, domestic pigeons, and wintering waterfowl until the winter solstice.

On the 22nd of December 1965 the free flights were discontinued, and the pair was strictly confined to the room in the building. The food supply was greatly increased and for about a week they ate nearly twice the amount of food that they had been receiving, then the food intake dropped quite sharply again. Otherwise there was no significant change in the behaviour of the pair for the first four weeks. Beginning early in February of 1966 there was a noticeable increase in the volume and variety of calls from the two birds. By the middle of the month they had become exceedingly noisy, the calls and chirpings of great variety being almost continuous throughout the daytime hours. This noise and apparent excitement built up until the 8th of March. On that date two hours of detailed observations were made. Both birds seemed to be very excited, and the male spent most of the time going through a repetitive ceremony or display. Standing on the nest ledge a little to one side of the nest hollow, a shallow depression the birds had already made in the turf covering the ledge, he would assume a horizontal position bowing three or four times with his eyes focussed on the female, then while making sharp, loud metallic chirps he would rotate his head so that the end of the beak, still pointing directly toward the female, described a small circle some two inches in diameter. This was varied at times by turning the head rather slowly to the upside-down position. Following this he would creep into the nest depression, there to turn around very slowly three or four turns, sometimes settling briefly to the brooding position. This was followed by a quick take-off and rapid flight around the room, past the female, and back to the nest ledge where the entire procedure would be repeated. Both birds were all the while very noisy.

From about mid-February the female had been spending much time, and some entire nights, in the brooding position in the nest-scraper. She spent the night of the 8th of March in the nest. The

next day, the 9th of March, both birds were absolutely silent. This silence was in such contrast to the great racket of the preceding day as to be indicative that egg-laying had probably begun. Two days later, on the 10th, by tossing a freshly killed pigeon into the room I was able to induce the female to leave the nest ledge for long enough for me to look briefly into the nest depression, which contained one egg. The female began her moult on the same day. By the 14th of March there were three eggs. Incubation was apparently begun with the second egg, for on the 12th of March and following, but not before, the eggs were continuously covered by one bird or the other.

During the first week of incubation great care was taken not to disturb the pair lest they abandon or perhaps even eat their eggs, but their unconcerned attitude encouraged observation. At the onset there was little sign from either bird of apprehension or of hostility to close observation. Only when the nest ledge was very closely approached would the female, if incubating, stand up and spread her wings in a threatening attitude. The female spent more time on the eggs than did the male. She always covered the eggs during the night. When food was delivered, it was usually taken by the male who would at once give a sharp, two-syllabled feeding call. The female would generally leave the eggs at once and fly across the room to accept the food from him. The male would then go directly to the nest and cover the eggs while the female ate and sometimes for a considerable period afterward while she bathed and preened or just spent some time perched. After a rather widely varying time interval she would fly to the nest ledge and there would then take place a little ceremony of bowing and clucking as the birds changed places. The female had favored corners into which she would tuck any uneaten portions of food after she had finished her meal. These hiding-places, if such they were, were not at all her secret however, for the male would go immediately to them and remove the food to the block or shelf perch to eat. The incubating female watched from the nest ledge with complete indifference. Occasionally when the male was incubating at the time food was presented, the female would accept the food directly. Usually the female ate first, but this was not an inflexible rule. If the female on the nest ignored his food call, the male would then eat first and cache any remaining food. He would then go to the nest ledge and offer to relieve the female. This offer was sometimes accepted and sometimes not. There appeared to be no fixed time that the male took over except that he incubated only during the day. While the male therefore spent much less time than the female on the nest, he nevertheless so spent some one-third to one-half of the daytime hours.

During the four-week period that the pair was permitted to incubate, neither of them showed any serious hostility or apprehension to close observation and, accordingly, a large series of 16 mm movies and 35 mm colour photographs was taken. The eggs were removed on April 16 and were later examined at South Dakota State University. No signs of embryonic development could be

found. Pesticide analyses of the three eggs produced in 1966 showed a rather low level of DDT, its metabolite DDE, and endrin (analyses conducted by Patuxent Wildlife Research Center of the Fish and Wildlife Service, U.S. Department of Interior).

The pair was left together from April 16th until June 11th on the chance that there might be another nesting attempt. During this time the pair again became quite noisy, and the female even spent the occasional night on the nest ledge in brooding position, but no more eggs were laid. The most marked change during this time was in the attitude of the female which became very aggressive to anyone attempting to enter the room. There was no apparent change in the behaviour of the male.

On the 3rd of June I left for the northern Queen Charlotte Islands on an expedition for Raptor Research Foundation to obtain a number of young falcons for future breeding experiments. I returned on the 9th of June with ten young Peregrines evenly divided as to sex, but varying in age from medium-sized downies only a little over a week old to well-feathered birds almost ready to fly.

Quite by coincidence all of these young birds were placed in the compartment of the building directly adjacent to the room holding the adult pair. The two old birds became extremely excited on hearing the calls of the young falcons. The reason for this excitement and what it meant was discovered the next day. On the 11th of June I went out to feed the young falcons and on entering the room noticed one of the largest of these standing with the beak pressed into a half-inch crack in the partition separating the two rooms. The young bird appeared to be taking food from one of the adults in the adjacent room. A quick visual check through the window from outside the building confirmed this. Two of the young falcons were therefore at once placed in the room with the two adults and watched closely to see what would happen. The young birds reacted instantly to the sight of the adults, running up to them with hunger screams and begging for food. The reaction of both adults was almost equally quick and definitive. Each immediately retrieved food remnants from their food-cache and each began feeding one of the young birds.

Following this, the care of all ten of the young Peregrines was entrusted to the two adults. Lights and cameras were again set up and a complete photographic record was made of the pair feeding, and the female defending the young. The female was far more aggressive toward people than she had ever been before. The young were subsequently left with the adult pair for periods of time relative to their respective ages. They were removed singly or in pairs as they became fully fledged and capable of flight. The last pair was removed on the 9th of July. The female and some of the young are shown in the upper photograph on page 71.

The parallels between the 1966 Raptor Research experiment and the earlier nestings attempted by Waller's and Stevens' pairs are more striking than the differences. Nevertheless, there are some



Female Peregrine and adopted young, 1966



The author at nest ledge, 1967

contrasts. The female of this pair produced eggs two to four years earlier in life than did either of the other birds. Although the eggs of the first nesting attempt proved to be infertile, it may be significant that similar failures have been uniform with all initial attempts by any one pair, yet Waller's female is reported to have produced fertile eggs, if not young, in all subsequent nestings with each of the two males involved. The dates of egg production of the Raptor Research pair were strikingly similar to the dates set by Waller's female but quite different from those of Stevens' bird. The latter produced her eggs in April at about the same time as would be normal for wild falcons at the same latitude, while the other two were almost a month earlier than normal. One of the most consistent parallels with all of the pairs so far handled, as well as with unmated egg-producing females, is their willingness to adopt and care for young. Waller's pair adopted young Buzzards; Stevens' pair adopted young Merlins, and this before they had even produced eggs; while my pair adopted ten young of their own kind, but of widely varying ages and after a hiatus of some seven weeks following the enforced break-up of incubation. In each case both sexes took part in incubation. With the exception of Waller's female, which in the first instance did not join the male in the care of a young Buzzard, both sexes also took part in the feeding and care of any young in their vicinity, whether their own or not.

The 1967 Nesting Attempt. In late August of 1966 after the last of the adopted young Peregrines had been removed and after the adults had completed their moult an attempt was made to fly the two together during the late autumn months as had been done in 1965. This was not successful and the attempt at retraining was soon abandoned. While neither of the pair showed any tendency to leave the general area, there were some significant changes in behaviour which made both sexes very difficult to control but for rather different reasons. The male quickly took to flying at great heights and regularly refused to come down to the lure, being apparently interested only in live quarry. The female was even more annoying because she tended to ignore both lure and live quarry; much of the time she seemed entirely preoccupied with the defense of the entire area. To this end she would take perch, often well-hidden, in one of the many tall firs overlooking the saltmarsh. There she awaited the passing of any other large raptor such as a Red-tailed Hawk or an eagle, which she would at once attack. She made the area useless and dangerous as a training area for other hawks as long as she was free. Once released, she would refuse to be retaken for two or three days. Her recklessness in attacking other large and powerful raptors coupled with the opening of the autumn shooting season made her behaviour dangerous to her own life. The attempt at autumn flying of the pair was therefore discontinued after a two-week trial. Both birds were then returned to the confines of the building.

Beginning early in January of 1967 a small amount of wheat germ oil was used as a food additive but was discontinued when it became apparent that this substance was very distasteful to them.

By early February much of the pre-nesting behaviour that had been observed the previous year was again in evidence, but no very detailed observations were made this time.

Egg production dates were very similar to those of 1966, the first egg being laid between 7:00 and 7:30 AM on the morning of March 2nd. Egg laying then continued at regular 48-hour intervals for the second and third egg, the fourth being delayed an additional 24 hours. The set of four eggs was therefore complete on the 9th of March. Incubation had again begun with the second egg, as had been the case in 1966.

All four eggs were removed 24 hours later on the night of March 10th. At the time they were taken the female was covering only three of the eggs; the fourth lay some six inches from the others and was very cold. They were placed at once in an incubator for a two-week period but proved to be definitely infertile.

Inasmuch as the uniform flatness of the gravel-surfaced shelf had resulted in the falcon failing to cover all four eggs, the shelf was resurfaced with a two-inch thick turf that was sloped uniformly inward to a gravelled central depression. No other changes were made.

The recycling of the female was surprisingly rapid. The noise and activity that seem to be the prelude to ovulation were renewed within 48 hours of the removal of the eggs. Then, only two weeks later, on the morning of March 24th, the first of the second set of eggs appeared. In 1966 the moult of the female began with the laying of the first egg on March 5th; in 1967 the moult of the female began with the laying of the first egg of the second set of eggs on March 24th. No copulation was observed at any time, but on the morning that the first egg of the second set appeared the feathers at the base of the upper surface of the wings of the female were disarrayed.

Further egg-laying proceeded exactly as before with a 48-hour interval between the first and second, and second and third egg, and a sixty-hour interval between the third and fourth egg. Incubation began with the appearance of the second egg.

Inasmuch as detailed observations had been made of the behaviour of the pair during incubation in 1966, no close observations were made in 1967 until the end of the incubation period drew near. It was deemed advisable to permit full-term incubation because it was intended to provide the pair with young whether the eggs hatched or not.

During the final week of incubation there was a marked increase of aggressiveness on the part of the falcon. This made daily visual checks of the eggs rather easy, for all that was required to bring her off her eggs was the opening of the door leading into her room. On the 29th of April at 3:00 PM I checked the eggs this way and as the falcon left her eggs and walked with



spread wings and lowered head to the edge of the shelf one of the eggs began to rock violently from side to side, then split open and out rolled a young Peregrine. I left the building at once.

Lights and cameras were at once set up in the room adjacent as they had been in 1966. It seems curious that the opening of the door between the two rooms always aroused the female to threatening aggressive posturing or real attack, while the removal of the eighteen-inch high panels immediately above the door caused no hostility at all. Nor did the placing of cameras and the arranging of floodlights as long as these were placed in position by reaching into the room through the opening above the partition. The partition wall, therefore, appeared to be a very clear and sharply-defined boundary to her nesting territory in so far as humans were concerned. The author at the nest ledge and the pair with eggs are shown in the lower photograph on page 71 and the upper photograph on page 75, respectively.

Few photographs were taken during the afternoon and evening of April 29th, but some very interesting observations were made. While the eggs and the one nestling were covered almost continuously, both birds appeared to be very aware of the newly-hatched chick. I had thought it unlikely that the female would permit the male on the nest once the eggs had hatched, but this was not so. One of the most fascinating of the little incidents observed at this time was of the male coming to the nest ledge and slowly creeping in under the female until he forced her to stand and step carefully back, thus uncovering the squirming peeping baby. At this point both birds stood for some thirty seconds gazing with fascinated intensity at the little one. The female then moved another careful step backward to permit the male to slide in under her and cover the nestling and the remaining three eggs.

Earlier in the day, before the egg had hatched, a rather large dead pigeon had been given to the pair. This pigeon had been partially plucked and tucked into one of the storage crevices at ground level. During the observation period the male began working to get this pigeon up to the nest site. This in itself was interesting and new, for during incubation no food items had been taken to the nest ledge that I had observed. He spent some considerable time in plucking this pigeon before attempting to get it up to the nest ledge, and in the confined area he encountered no end of difficulty getting it up there. Whether his intent was to try to feed the chick or not could not be ascertained, for the female continued to cover the nest. At this point however, a major error in the construction of the nest ledge became apparent, for the pigeon tended to roll down the slope into the nest-hollow and he could not place it, and leave it, on the ledge beside the female. After struggling with it for a time he eventually removed it to a flat shelf ledge above and to the left of the nest ledge and left it there.



Pair with eggs, 1967



Newly hatched Peregrine, 1967

It appeared that something much smaller was needed. I went outside and caught a bantam chick three weeks old and tossed it in with the Peregrines.

Some observers of wild raptors are quite convinced that the presence of young in the nest somehow inhibits adult raptors from making kills in the near vicinity of the aerie site. This idea did not stand the test of experiment. The bantam chick was instantly attacked by the male and the female was aroused and went to the edge of the nest-ledge but the male had already caught the chick. He killed it at once, took it to the plucking block and spent the next hour plucking it of every vestige of feather or down. He ate the head and then stored the body without taking it up to the nest ledge.

After dark on the evening of April 29th the lights were turned off and the three eggs were taken from under the falcon for examination. Two eggs were pipped, one of which was silent and which appeared, even then, to be dead, and the other was very much alive. The third egg showed no sign of hatching. All three were placed back under the falcon, and the shed was vacated until the next day.

At 11:00 AM on April 30th observations were again begun with the idea of taking a full series of photographs, but when after a time the birds moved about and permitted a look into the nest there was no movement or sound from the nestling and within an hour or so it became obvious that it had died sometime during the night or early in the morning. The large dead pigeon was still, or again, on the same ledge where the male had placed it the day before. Before the dead chick was removed at about 3:00 PM, both adults had made what appeared to be attempts to rouse it, pushing at it a little with the rounded top of the beak and even gently picking up and lifting the head.

On the morning of the 1st of May a second egg appeared to have hatched as there was a half-shell in the nest, but no young was observed. Later in the day the falcon picked this shell up in her beak and removed it from the nest, at which time it was apparent that this was the egg containing the dead embryo which had somehow broken open in the nest. This half-shell containing the dead embryo was later retrieved and frozen.

The third egg was examined on the morning of May 2nd and found to contain a living chick, but the shell of the egg was somewhat crushed on one side. This egg hatched later in the day with some help and the hatching and subsequent drying of the tiny falcon was photographed (lower photograph on page 75). It was placed in an artificial brooder. The chick was still alive and peeping at midnight of the 2nd but was dead at 7:00 AM of the 3rd of May. Two days later the fourth egg was removed from the nest. It still showed no sign of hatching and on examination proved to be infertile.

If the first egg produced was the infertile egg and the egg with the dead embryo was the second, then the three eggs hatched, or were due to hatch, on a perfect thirty-two day interval from the date of laying. This is two to three days longer than the time interval (29 to 30 days) listed in the literature as being the normal incubation period for Peregrines. However, the death of the chicks so quickly after hatching suggests weakened chicks that may have been in the egg too long. The naturally hatched nestling could conceivably have been killed mechanically by having the large dead pigeon roll down onto it (and later removed) or by accident by one of the adults. Neither seems likely. In view of the obvious difficulty encountered in hatching by the other two chicks, it seems more probable that the cause of death was that of too much energy being expended in getting clear of the egg. Possibly there was an inadequacy in the diet of the adult falcon at the time of ovulation or possibly there was insufficient humidity in the nest. While the general humidity during incubation and at the time of hatching was never below sixty percent, and the turf surrounding the eggs was damp enough to support some growth of the grass in the turf, the gravelly sand in which the eggs lay was very dry. Moreover, and this may be important, the depth of material directly under the eggs was not more than two inches; there was an inch or so of gravel and sand, then a one-inch thickness of wood, below which was air. The eggs could have dried from below. There is a suggestion here that the artificial nest site should be constructed to take the form of a built-up ledge of some material such as turf or concrete, in constant contact with the ground, that will conduct moisture to the eggs from below, instead of a soil or gravel-covered shelf.

The possibility of the death of the chicks being due to pesticide poisoning seems unlikely, yet should not be disregarded. Analyses are to be made of the 1967 eggs and nestlings.

### Conclusions

On the basis of the 1966 experiments the successful domestic reproduction of the Peregrines appeared likely. It would seem to be important to have pairs that have been taken as nestlings and raised to reproductive age in close association both with mankind and with one another. To date there are only three recorded instances of females taken as nestlings being provided with natural mates and given a physical situation under which reproduction could be attempted, and it is significant that reproduction was attempted in all three cases.

Stevens, who began his experiments with a seven-year old female that did not produce eggs until her ninth year, felt that the length of time required for the female to reach reproductive age probably constituted a major problem. However, the experiment with the Raptor Research pair proved that ovulation can occur as early as the third year and may indicate that the need of a preconditioning period of some duration in company with a male may have been the reason for the two-year delay in ovulation observed by Stevens.