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# TB157: Capture, Care, and Handling of Fishers (Martes pennanti)

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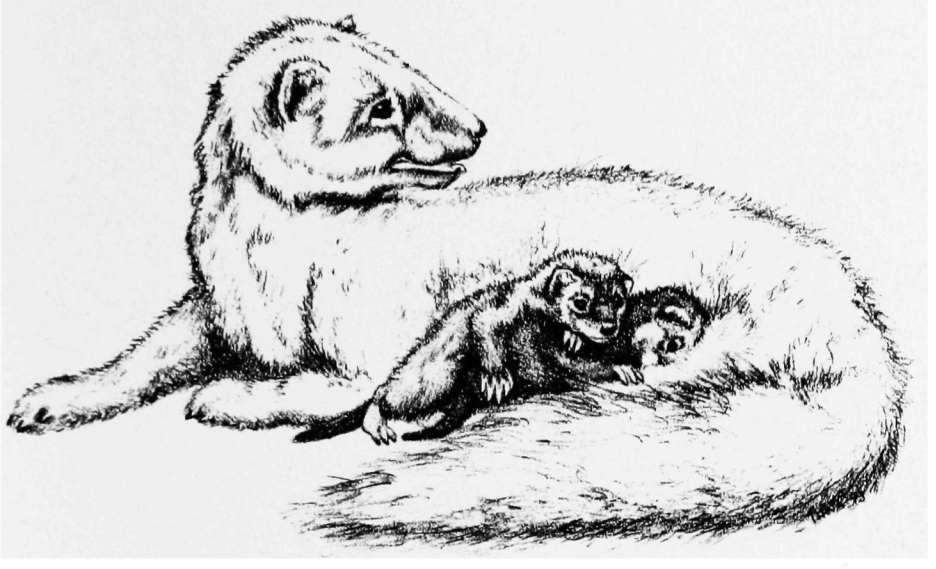

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MAINE AGRICULTURAL AND FOREST EXPERIMENT STATION
University of Maine

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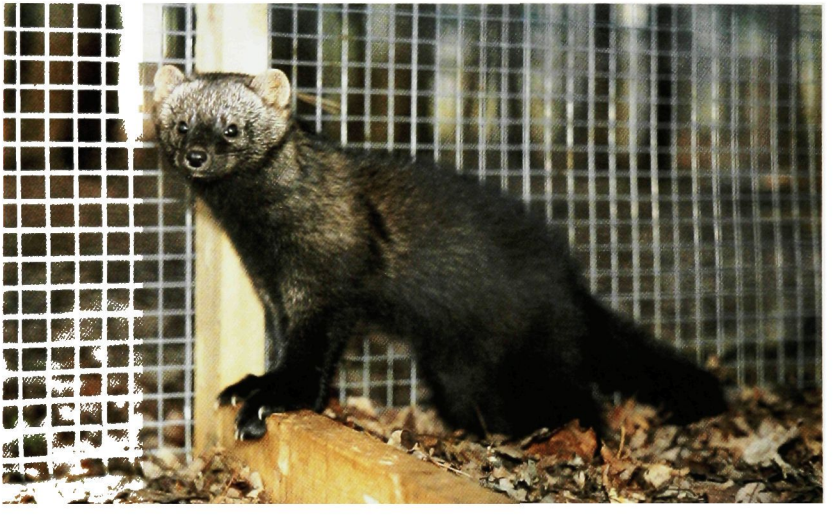

*Frontispiece. Fisher (*Martes pennanti*) kits at the University of Maine, Orono (upper). Juvenile female fisher captured in the fall, 1990 (lower). (Photos by W.B. Krohn)*

# Capture, Care, and Handling of Fishers (*Martes pennanti*)

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We appreciate Shirley Moulton's patience and persistence in typing this manuscript and Randy Boone's skill in creating maps. Special thanks to Tiina Frost for drawing the cover picture.

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# INTRODUCTION

The fisher (*Martes pennanti*) is a member of the weasel family and is the largest member in the genus *Martes*. A medium-sized carnivore unique to North America, fishers are commonly found in northern forests (Douglas and Strickland 1987). Primary foods are snowshoe hare (*Lepus americanus*), porcupines (*Erethizon dorsatum*), squirrels, and small mammals (Arthur et al. 1989a; Douglas and Strickland 1987; Powell 1993). Fishers have been a valuable component of the fur trade throughout North America (Innis 1962) with high-quality pelts bringing as much as $450 in 1986 (Douglas and Strickland 1987).

Fishers are important for both economic and ecological reasons. Trappers view them as a source of income and recreation. To the biologist, fishers are a major forest predator. Because of high pelt value, relative ease of capture, and loss of habitat, fishers have been reduced or eliminated from some of their former range, especially along the southern and western edges of their range in the United States (Powell 1993). Although fisher populations in the Northeast are expanding, in the Pacific Northwest there is concern for its status (U.S. Fish and Wildlife Service 1991).

Many studies have been done on fishers in the past 40 years. Because of their secretive nature and low density, however, fishers are difficult to study in the wild. Early studies were done primarily with carcasses obtained from trappers (Eadie and Hamilton 1958; Wright and Coulter 1967). Carcasses provided data on the age and sex of animals harvested, reproduction, and foods. Snow tracking provided insights into hunting behavior and winter habitat use. This type of information was valuable but incomplete. Powell (1977) and Kelly (1977) used telemetry to determine home range locations and sizes. They increased the understanding of the ecology of fishers, but sample sizes were small and many questions remained unanswered. Arthur (1987) and Paragi (1990), working in southcentral Maine, were the first to capture and radio-collar a large enough sample of fishers to describe social organization, spatial distribution, and estimate reproduction and survival rates.

Fishers have also been studied in captivity (Coulter 1966; Powell 1993). Fisher farming was tried with some success in the 1920s and 1930s (James 1934; Hodgson 1937; Thomassen 1940; Douglas 1943). However, the difficulty of breeding in captivity, the long period before first parturition, long gestation period, and small litters made fisher farming an uncertain business (Douglas and Strickland 1987). Fishers are now kept in captivity primarily by

zoos and a few private individuals. LaBarge (1987) and LaBarge et al. (1991) reported that fishers were a challenging species to keep in captivity, requiring large spaces for their activities and stressing easily.

We brought fishers into captivity to assess the reproductive cycles of both sexes and to monitor females with known reproductive histories. In addition, kits born in captivity were raised to sexual maturity to monitor growth and development (Frost 1994). Here we report on the rates at which fishers were caught, the care and maintenance of fishers while in captivity, and the handling procedures we used with 44 fishers taken from the wild (wild-caught; Appendix A) and 38 fishers conceived in the wild and born in captivity (captive-born; Appendix B), during the period from 1990 to 1993.

## CAPTURING WILD FISHERS

### Capture Methods

Adult fishers of the same sex have home ranges that are essentially exclusive, but that overlap between sexes. In Maine, adult male and female home ranges averaged 30.9 $km^2$ (11.9 $mi^2$) and 16.3 $km^2$ (6.3 $mi^2$), respectively (Arthur et al. 1989b). Because of large home ranges and low density, we contracted with cooperating trappers to increase the size of the area sampled and maximize the livetrapping effort each year.

Fishers were captured in central and eastern Maine (Figure 1, Appendix A). Cooperating trappers worked during the regular furbearer season (November and December), 1990–1992, and operated by state trapping regulations (e.g., valid Maine trapping license, no traps in the woods before or after the trapping season, trapper identification visible on each trap, and check each livetrap daily). The Maine Department of Inland Fisheries and Wildlife (MDIFW) issued permits to allow the cooperating trappers to transport and hold live animals until they could be moved to the University of Maine in Orono (Figure 1).

Each trapper was provided with one of two types of livetraps. One trapper used only 37.5× 37.5×90 cm (14.5×14.5×35.5 in.) wire cage traps (Coon Getter Traps, Miller, SD). All other trappers used modified Tru-Catch Traps (Mechanicsburg, PA) that were 30.5×35.6×91.4 cm (12×14×36 in.). Previous experience with Tru-Catch traps showed that fishers could break the welded wire where the wire mesh was attached to the frame. Extra strength was added by wrapping the wire mesh around the rod iron frame and then

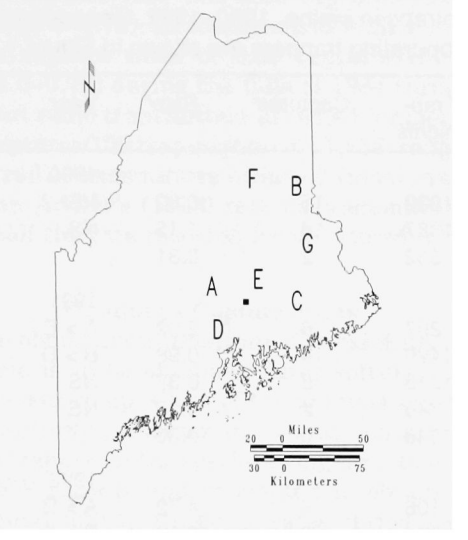


*Figure 1. Areas in Maine where cooperating trappers livetrapped fishers, 1990–1993. Letters correspond to trapper identification used in tables and text. All animals were housed at the University of Maine in Orono (square).*

attaching it. Also, previous experience had shown that if the door of the trap landed on the tail or rear of the animal, fishers could escape. By moving the trip pan to the rear of the trap, the entire fisher was in the cage before the door closed.

Seven trappers cooperated during the three years: three persons in 1990, five in 1992, and three in 1992 (Table 1). Two trappers trapped during all three years. Cooperating trappers were paid $200 per female fisher. Most male fishers were released except four males were purchased for $100 each in 1990 and three for $200 each in 1992. Pelt prices averaged about $43 for females and $14 for males during the three trapping seasons (MDIFW, unpublished data). Cooperating trappers were paid a higher price because we were interested mainly in females and restricting trappers to a relatively small number of livetraps reduced their total catch. Cooperating trappers were provided with instructions and forms to record the number of trap-nights (number of traps set for 24 hours) and number of fishers and other animals caught.

Table 1. Capture rates of wild fishers by cooperating trappers using livetraps in Maine, 1990–1992. General areas used by cooperating trappers are shown in Figure 1.

| Trapper | Trap-nights | Captures[a] | Rate[b] | Year | P-values |
|---|---|---|---|---|---|
| | | | | 1990 | P = 0.149[d] |
| A | 1830 | 15 | 0.82 | NS[c] | |
| B | 1387 | 16 | 1.15 | NS | |
| C | 652 | 2 | 0.31 | | |
| | | | | 1991 | P = 0.004[d] |
| A | 297 | 6 | 2.02 | A > B | P < 0.025 |
| B | 1426 | 14 | 0.98 | B > D | P < 0.001 |
| D | 1345 | 5 | 0.37 | NS | |
| E | 740 | 2 | 0.27 | NS | |
| F | 236 | 0 | 0.00 | | |
| | | | | 1992 | P < 0.001[d] |
| A | 106 | 5 | 4.72 | A > B | P < 0.001 |
| B | 1531 | 9 | 0.59 | B > G | P < 0.005 |
| G | 1797 | 3 | 0.17 | | |
| Total | 11,347 | 77 | 0.68 | | |

[a]One fisher (F717) was caught twice (Appendix A).
[b]Fisher captures/100 trap-nights.
[c]Non-significant (comparing 2 or more proportions) (Zar 1984).
[d]Probability that all capture rates within that year are equal.

### Capture Rates

Capture rates were compared among trappers and years using a test to compare two or more proportions and multiple comparisons for proportions (Zar 1984). Rates did not differ among the three years (P = 0.155). However, rates did differ among trappers within years for two of the three years (Table 1). In 1990, there was no difference in capture rates among individual trappers (P = 0.149). In 1991 capture rates were different among the five trappers (P = 0.004) and in 1992 capture rates were different among the three trappers (P < 0.001). Trappers A and B were the only trappers to trap all three years. There was no difference in capture rates for trapper B among years (P = 0.248). However, there was a difference among years for trapper A (P < 0.001). His rate more than doubled from 1990 to 1991 and again between 1991 and 1992 (Table 1).

The mean capture rate was 0.68 captures/100 trap-nights (n = 11,347; range 0–4.72). In southcentral Maine, Arthur (1988) reported mean capture rates of 0.39 captures/100 trap-nights (n = 255; range 0–0.79) during the falls of 1984 through 1986 for livetraps without radio transmitters attached (unmonitored) compared to 1.94 captures/100 trap-nights (n = 1,857; range 0–3.14) for livetraps with radio transmitters attached (monitored). Our rate was higher than Arthur's (1988) rate for unmonitored livetraps, but less than half the rate reported for monitored livetraps.

## Planning a Capture Study

Studies involving livetrapping must be carefully planned if an adequate sample is to be obtained. After setting a goal for the number and age-sex composition of the animals required to meet the study's objective(s), another important consideration is the expertise of the trapper for the species being targeted. Although we screened MDIFW records and attempted to obtain experienced trappers, we found that livetrapping rates varied greatly among trappers and within individual trappers across years (Table 1). Nevertheless, we still recommend using experienced trappers when trying to capture uncommon and far-ranging animals like fishers.

Another important aspect before undertaking a capture program is to determine how much effort will be required to capture the number of animals for the study. For example, if the objective is to capture 10 adult females with 150 livetraps, Figure 2 shows how to determine the effort needed. Obtaining the goal requires 89 nights, or 13,377 trap-nights of effort under Maine conditions.

Expected values for individual age-sex classes can be calculated using data from Figure 2. Because we could not age male fishers released by cooperating trappers, we examined only female age classes. Cooperating trappers caught a total of 77 fishers (Table 1). A comparison between the number of females expected to be caught in this sample of 77 (age-female proportion [from Figure 2] times total captures; e.g., juvenile females = $0.29 \times 77 = 22$) and the number of females by age-class actually caught was as follows.

| | Juveniles | Yearlings | Adults |
|---|---|---|---|
| Expected | 22 | 9 | 9 |
| Observed | 17 | 6 | 12 |

The correspondence between the expected and observed values ($\chi^2 = 3.71$, $P = 0.16$) suggests that under conditions similar to Maine's, the method outlined in Figure 2 provides a reasonable estimate of the females, by age, one can expect to capture.

Goal: Capture 10 adult females with 150 livetraps

Given the age-sex composition of fisher harvested in Maine[a] as follows:

| Juveniles | | Yearlings | | Adults | |
|---|---|---|---|---|---|
| male | female | male | female | male | female |
| 0.30 | 0.29 | 0.10 | 0.12 | 0.08 | 0.11 |

1. Determine total number of fishers needed to obtain goal.

$$\frac{\text{Goal}}{\text{Age-sex composition}} = \frac{10}{0.11} = 91 \text{ captures}$$

2. Determine number of trap-nights required to capture 1 fisher.

$$\frac{\text{Number of trap-nights}}{\text{Capture rate (Table 1)}} = \frac{100}{0.68} = 147 \text{ trap-nights}$$

3. Determine number of trap-nights needed to obtain goal.

Total fishers (91, Step 1) × trap-nights per fisher (147, Step 2) = 13,377 trap-nights

4. Determine number of nights of effort needed with only 150 livetraps.

$$\frac{\text{Trap-nights for goal}}{\text{Available traps}} = \frac{13{,}377}{150} = 268 \text{ nights}$$

[a] Data from Maine Department of Inland Fisheries and Wildlife; sample of 2,706 fishers caught by fur trappers, 1980–1984. Age classes: juvenile = 6–11 months, yearlings = 12-23 months, and adult ≥ 24 months.

*Figure 2. Data and calculations needed to estimate livetrapping effort required to capture a specified number and type (age-sex class) of wild fishers. Goals are always study-specific, and the one shown here is hypothetical.*

# FISHERS IN CAPTIVITY

## Transfer to Captivity

Fishers were taken from the woods, covered, and held in the livetrap at the trapper's home until we could transport them to the University of Maine's Animal Research Facility (usually within three days). Care was taken to visually isolate individual animals, especially adults of the same sex, and provide food and water. Not all fishers ate before being moved, whereas all animals readily drank water. Water given while an animal was still in the field appeared to reduce stress. Thus, we recommend providing water as soon after capture as possible as a precaution against stress. In a field study of pine marten (*Martes americana*), Pedialyte (an electrolyte) was administered to help the animal recover from the stress of being captured (D. Harrison, Univ. Maine, pers. comm.).

Fishers were anesthetized (see "Laboratory Handling" section) before being transferred to the university. A tooth ($PM^1$) was removed for aging, individually numbered tags were put in each ear, and standard morphological data were recorded. The sex of each animal was recorded and a preliminary estimate of age (juvenile = 6 to 11 months of ages, yearling = 12 to 23 months, adult $\geq$ 24 months) was made based on palpation of the sagittal crest. Animals with an apparent crest were considered adults, animals with a small crest were called yearlings, and animals with no crest were called juveniles. Once the premolar was processed and growth rings counted, final age class was assigned (Arthur et al. 1992). Each fisher was examined for porcupine quills, external parasites, and other external injuries. Fishers were transported to Orono in a nest box.

Nest boxes were put on the platform next to the cage, and the front door was removed and replaced with a half door that allowed the fisher access to the cage and nest box. When the front door was removed, fishers frequently ran out of the nest box into the end of the holding cage. Therefore, a person would stand at the end of the cage and look at the fisher in the nest box, through the cage. This would keep the fisher in the nest box until the nest box could be secured by installing the outer cover over the nest box (Figure 3). Observations from a distance showed that fishers generally emerged within 10 minutes to investigate the cage. Only one animal was housed per cage except during the late winter/early spring breeding season, when selected males and females were put together, or for females with kits (spring and summer).

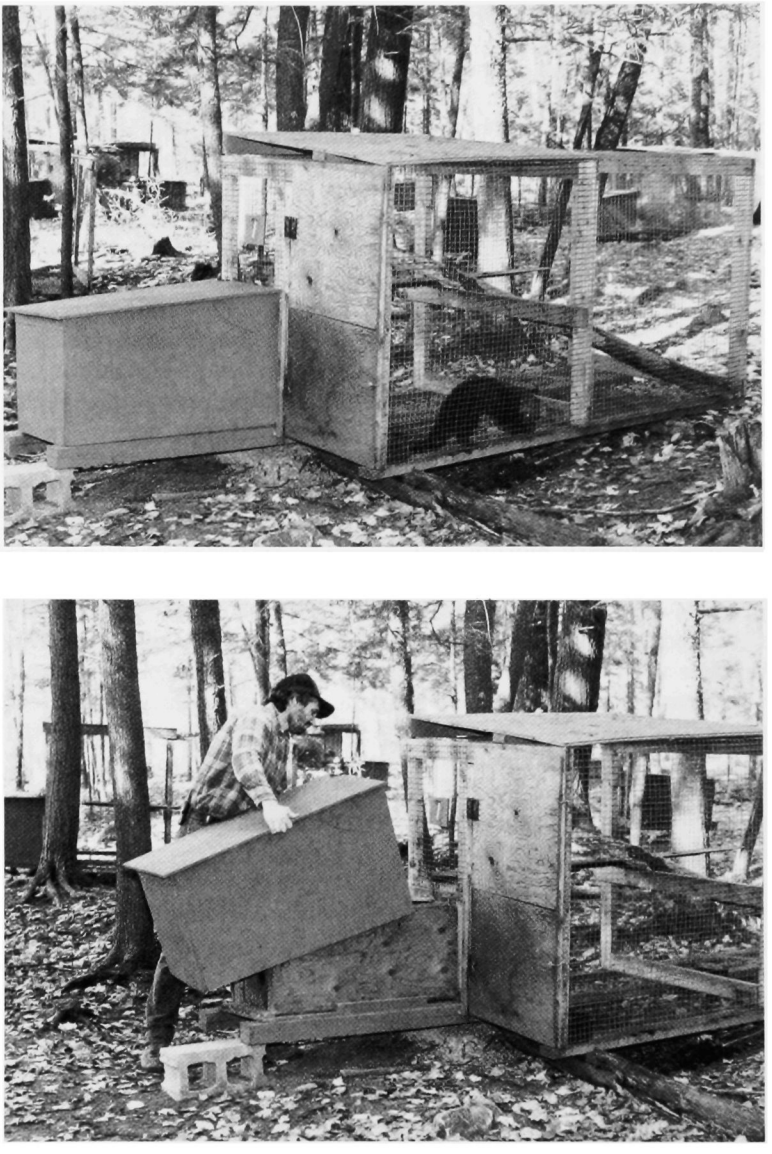

*Figure 3. Fisher in a holding cage with cover box on (upper) and being removed (lower). Cover box protects nest box from the weather. Half the cage is covered and the cage is raised above the ground to facilitate cleaning.*

### Holding Cages

The original cage design came from Paul W. Rego, wildlife biologist with the Connecticut Division of Wildlife. Cages (Figure 3) were made with 2×4 framing (1.2×1.2×2.4 m or 4×4×8 ft.) wrapped with 14-gauge, 2.54-cm$^2$ (1-in$^2$.) galvanized wire mesh. Cages were spaced approximately 1.5–3.0 m (5–10 ft.) apart (Appendices C, D, and E). A 45×100-cm (18×40 in.) platform extended from one side of the cage for the nest box to rest on (Figure 3). Six cages were divided in half with plywood to accommodate captive raised young and to be used for breeding. Nest box platforms were extended on both sides of the divided cages (Figure 4). A wire mesh or plywood door was used in the divider to separate the animals. Because female fishers are smaller than males (2.3 or 5.0 vs. 5.0 or 11.0 lbs), a PVC pipe, 10 cm (4 in.) in diameter on one side and 7.5 cm (3 in.) on the other, was placed in the door to allow passage of a female into the opposite side of the cage (Figure 5). This allowed females free access to males, but males were restricted in their movements through the pipe.

A 2.5-m (8-ft) perimeter fence surrounded the holding cages. Cages were placed under natural tree cover, resting on logs, approximately 10–20 cm (4–8 in.) above the ground. Half of each

*Figure 4. Holding cage with nest boxes on each end. Such cages provide additional space for mother with growing kits. Cages with two nest boxes can also be used to house pairs during the breeding season.*

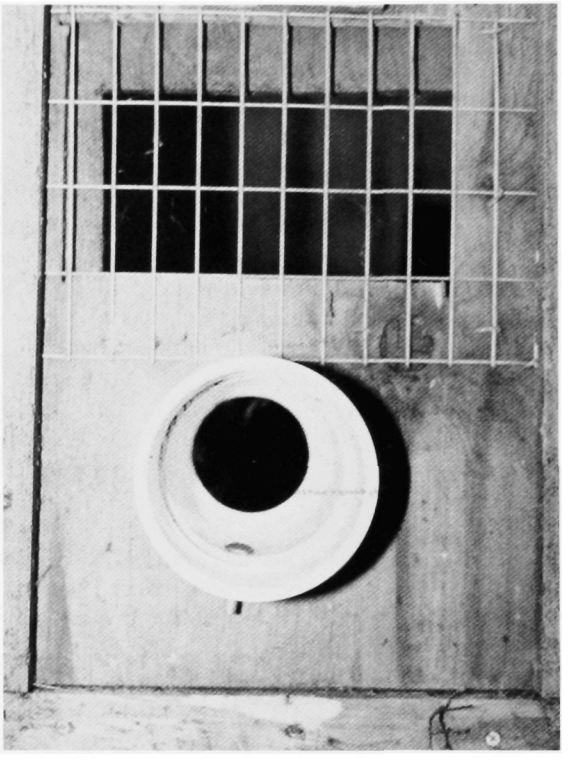

*Figure 5. Partition in the middle of holding cage with two nest boxes showing constricted PVC pipe that allows passage of female fishers, but restricts males.*

cage was covered with plywood for additional cover (Figure 3) to meet with the U.S. Department of Agriculture's care and use protocol. Logs were placed in the cages diagonally and resting boards were built into each cage that allowed the fisher to be off the wire bottoms and use the entire cage (Figure 6). Plastic buckets were attached to the side of the cages to give additional resting areas.

Cages were hosed down weekly during spring, summer, and fall. During winter, feces that had not dropped through the cage bottom were removed manually. Feces were removed from under each cage 4–5 times per year. Cages were inspected weekly for signs of damage or wear, and repairs were made immediately.

*Figure 6. Close-up of a holding cage showing the resting platform, climbing log, and plastic nest bucket. These additions allowed fishers to make greater use of the cage space and provided additional resting areas away from the nest box.*

**Nest Boxes**

Nest boxes were made of 0.2-cm ($^3/_8$-in.) plywood (40.6×40.6×45.7 cm or 16×16×18 in.) and framed with 2.5×5.0 cm (1×2 in.) pine strips. Each box had two compartments to facilitate handling and moving animals (Figure 7). Both end doors had holes drilled through them into the framing of the nest box. Double headed nails were inserted so that the nest box could be lifted by the door handles (Figure 8). The middle door had a 15.0×15.0-cm (6×6-in.) hole so that body heat would be contained in a smaller compartment during cold weather. The middle door could also be replaced with a solid door to aid in moving animals from the nest box into the squeeze cage. The rear compartment had a plexiglass

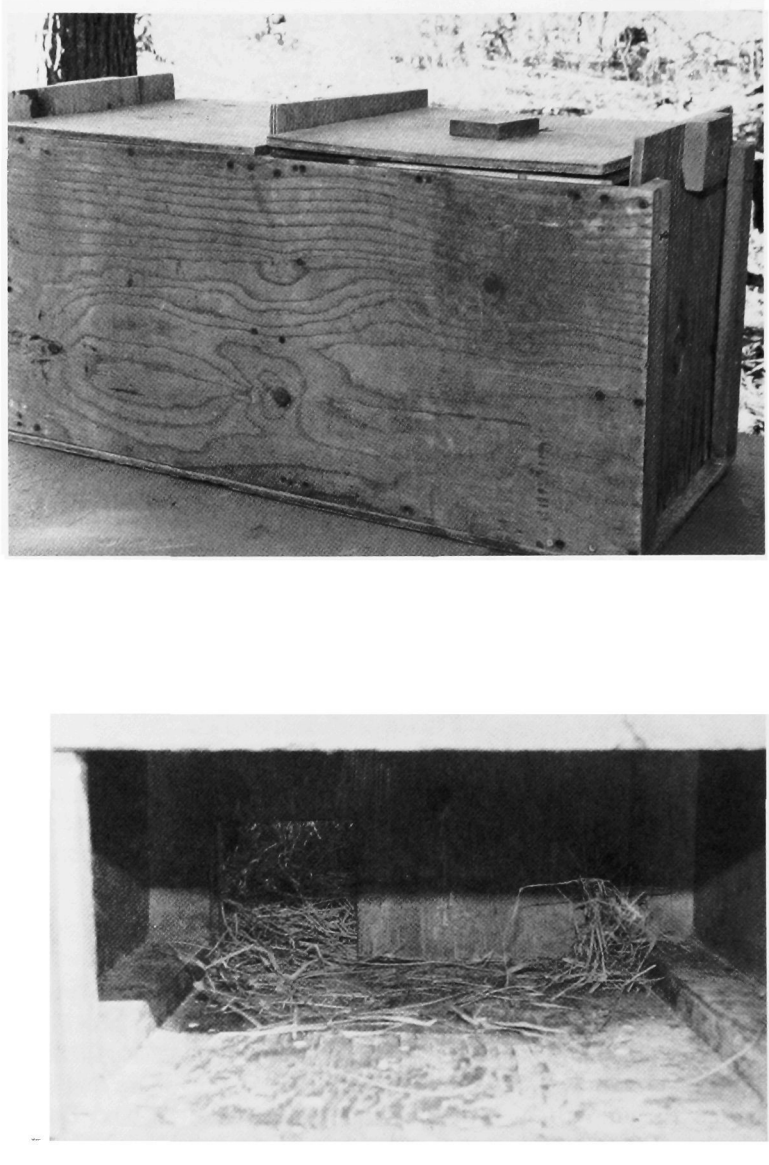

*Figure 7. Nest boxes consisted of three doors and two compartments (upper). The rear compartment contained wood shavings or hay (lower).*

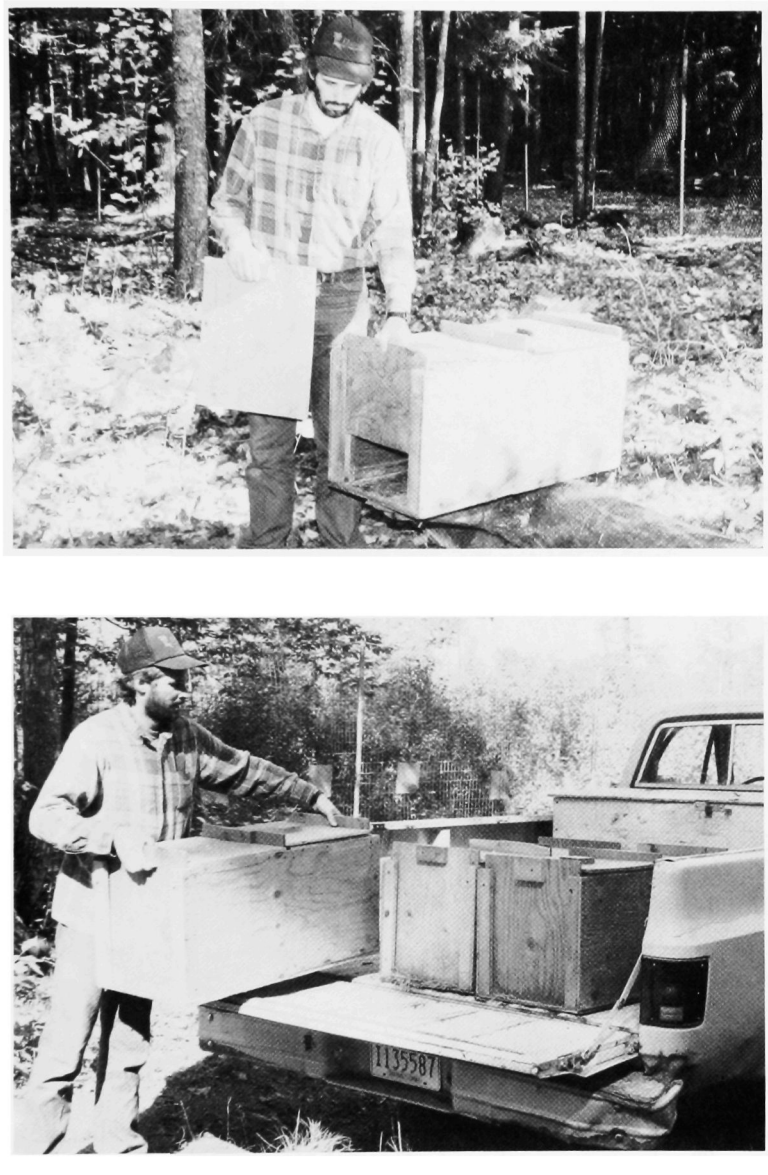


*Figure 8. Fishers can be confined in a nest box by replacing the short, entryway door with a full length-door (upper) while the nest box is against the holding cage. Once the doors are secured, animals can be moved (lower).*

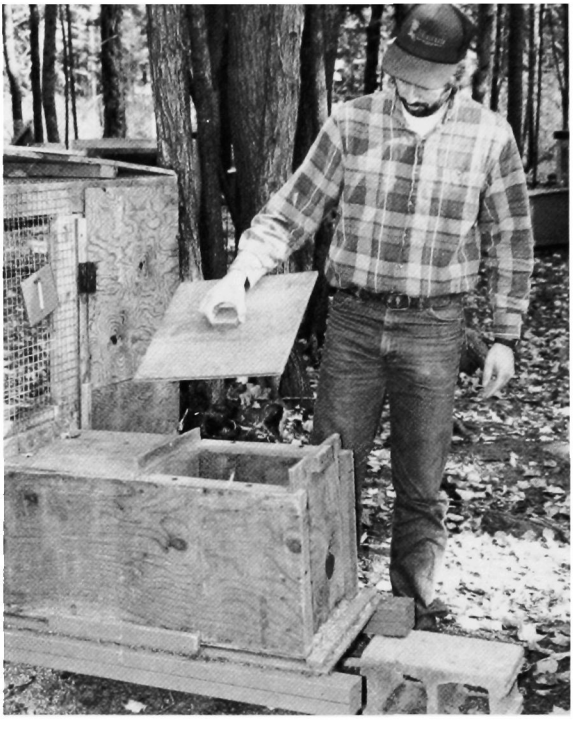

*Figure 9. Nest boxes were equipped with plexiglass tops and covers over the back compartment to observe animals. Plexiglass was especially useful when monitoring mothers with kits or when moving animals from the nest box into the squeeze cage (see Fig. 10).*

window where animals could be observed (Figure 9). Nest boxes were seated on a platform outside the cage with an exterior box covering the nest box for protection against the weather (Figure 4). Fishers chewed on the interior framing and close attention was paid to any damage that occurred between cleanings. Supports and doors were replaced when the damage was determined to be severe. Wood shavings were placed in the rear compartment for bedding.

The back compartment of nest boxes housing pregnant females was fitted with a false bottom. This gave the nest box an extra layer of insulation. In addition, when the kits or adult urinated, the urine was absorbed by the wood shavings under the false bottom,

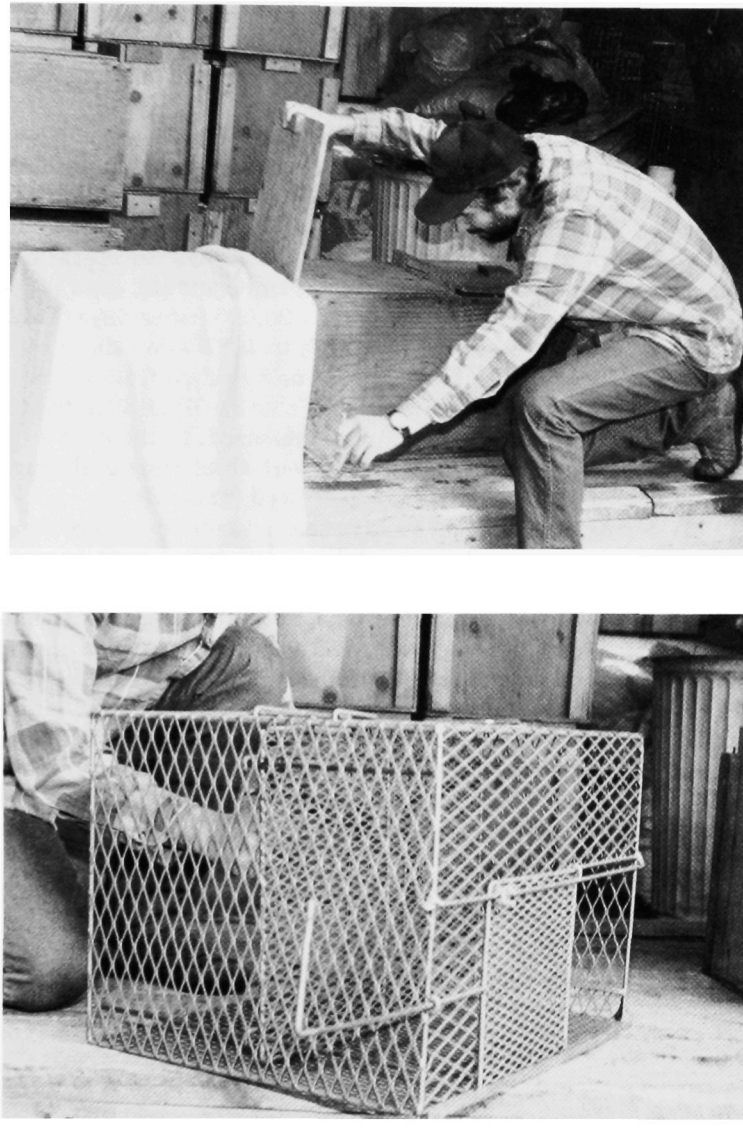

*Figure 10. Moving a fisher from a nest box into a covered squeeze cage (upper). Once in the squeeze cage, animals were restrained against the cage so that a drug could be administered (lower).*

keeping the kits dry. Hay was used as bedding material for kits instead of the wood shavings because of the fine dust found in the shavings, which might cause respiratory problems for the kits.

### Adjustment to Captivity

Fishers adapted well to captivity. However, wild-caught fishers would not eat for 2–4 days or as long as 10 days after being put in the cage. This was a concern until we recalled that wild fishers often go for up to a week without eating after snowstorms (Maine Cooperative Fish and Wildlife Research Unit, unpubl. data).

Fishers were held in captivity for > 23,000 fisher-days (Table 2). Forty-six percent of those days were in 1992 when there were several kits born besides new animals being taken from the wild and holdovers from the previous years (Table 3). Of the 82 individuals handled during the study, 35 were released, 23 died, 13 were given to zoos, six escaped (three chewed out, three ran out through an unlatched door), and five were sacrificed (Table 3).

Wild-caught fishers were rarely seen outside their nest boxes unless provoked. Only two, a male and female, ever became accustomed to human presence to the extent of remaining outside the nest box when a person was next to the cage. Several wild-caught fishers partially emerged from the box and watched during feeding. But when approached, the fisher moved back into the nest box. Fishers would occasionally be out in the cage when the handler arrived to feed. But when the worker was detected, the fisher disappeared. Captive-born fishers responded differently. They would remain out in the cage and often approach the sides and doors of the cage during feeding and cleaning. At feeding time,

Table 2. Number of animal-days fishers were kept in captivity at the University of Maine, 1990–1993.

| | Age Classes[a] | | | | |
|---|---|---|---|---|---|
| Year | Kits | Juveniles | Yearlings | Adults | Total |
| 1990 | 0 | 451 | 203 | 189 | 843 |
| 1991 | 1,295 | 1,484 | 883 | 2,754 | 6,416 |
| 1992 | 2,696 | 2,010 | 2,219 | 3,727 | 10,652 |
| 1993 | 492 | 543 | 1,560 | 2,635 | 5,230 |
| Total | 4,483 | 4,488 | 4,865 | 9,305 | 23,141 |

[a]Age classes: kits = 0–5 months, juveniles = 6–11 months, yearlings = 12–23 months, adults ≥ 24 months.

Table 3. Number and fate of fishers held in captivity at the University of Maine as of January 1 of each year, 1991–1993.

| | | | Fate of individuals | | | | | |
|---|---|---|---|---|---|---|---|---|
| Year | Captured | Born[a] | Released[b] | Died | Given to zoos | Escaped | Sacrificed[c] | Held-over |
| 1991 | 19 | 0 | 0 | 2 | 0 | 0 | 0 | 17 |
| 1992 | 14 | 13 | 8 | 7 | 0 | 1 | 4 | 24 |
| 1993 | 11 | 21 | 12 | 13 | 2 | 5 | 1 | 23 |
| 1993[d] | 0 | 4 | 15 | 1 | 11 | 0 | 0 | 0 |
| Totals | 44 | 38 | 35 | 23 | 13 | 6 | 5 | 0 |

[a]Mothers of captive-born animals were bred in the wild before they were brought into captivity. Thirty-eight births came from 14 litters.
[b]See Table 8 for details.
[c]Frost (1994) for details.
[d]As of October 1993 (end of study).

captive-born animals often became agitated and lunged toward the workers.

During periods of extreme cold temperatures ( < -18°C or 0°F), wild-caught fishers remained in their nest boxes for long periods (> 24 hours) without eating or drinking. When observed in the nest box, these animals appeared to be in a deep sleep. King (1989) stated that torpor was impossible for many mustelids because of their small size and inability to store fat. However, Harlow (1994) suggested that American martens may have shallow daily torpor, especially during inclement weather, to maintain energy balance. Captive fishers may enter periods of dormancy because of high nutritional status and low energy output.

The behavior of individual fishers toward people determined the relative ease with which an animal could be moved, fed, or its cage cleaned. Wild-caught fishers, in the presence of people, were usually in their nest boxes, therefore stress was minimized when they needed to be attended. However, captive-born animals usually had to be lured into their nest box with food. Once inside they often scratched and chewed at the sides and supports of the box. Although kits were raised by their natural mothers, they apparently did not fear people, which made handling them more difficult.

Kits were kept in the same cage as their mother until August of each year. Arthur et al. (1993) found little evidence of association between adults and juveniles after August. Coulter (1966) observed that a captive female became increasingly aggressive toward her kits beginning late in July (four months of age). At 5½ months one kit was killed by the mother and the other injured. We kept two male kits with their mother through October in 1992 because behavioral observations between individual kits and their mother were being conducted. The mother finally had to be separated because she was not getting any food and weighed only 1.6 kg (3.5 lbs.) compared to and average female mass of 2.3 kg (5 lbs.).

### Health and Nutrition

Food was obtained from road-killed deer (*Odocoileus virginianus*) and moose (*Alces alces*), hard-boiled chicken (*Gallus gallus*) eggs, culled mice (*Mus* sp., from Jackson Laboratory, Bar Harbor, ME) and commercial mink (*Mustela vison*) chow (Gro-Fur darks, Milk Specialties Company, New Holstein, WI). Diets were supplemented with beef (*Bos* sp.) liver and poultry as they became available. Vitamin E (Roche Vitamins and Fine Chemicals, Nutley, NJ) was added on the advice that vitamin E deficiencies could inhibit breeding (D. Kwiatkowski, Wyoming Game and Fish De-

partment, pers. comm.). Initially, only meat chunks were fed daily and any uneaten food was removed the next day. Records were kept daily, and over time it was determined how much food each individual fisher consumed. In 1991 mink chow was added to the diet and the meat was ground, and a fisher chow was prepared of 50% mink chow, 40% meat, 10% liver, and 100 IU Vit E/kg of feed. This was similar to the diet outlined by LaBarge (1987). Fishers were locked in the nest boxes to prevent them from escaping (Table 3) when food or water was put into cages, or when cleaning cages.

In captivity, wild-caught fishers were less active than captive-born fishers and gained weight after becoming accustomed to their cages. Weights were taken monthly throughout the year and weekly during the breeding season. Females came into captivity at a mean weight of 2.23 kg (4.9 lbs.) (n = 37, range 1.9–2.9 kg or 4.1–6.4 lbs.) and males at 4.71 kg (10.4 lbs.) (n = 7, range 3.8–5.2 kg or 8.4–11.4 lbs.). Female weights were kept at 2.30 kg (5.0 lbs.) and males at 5.00 kg (11.0 lbs.). If fishers became over weight ( > 15% over target weight), rations were decreased until the weight stabilized or decreased to the desired level. All fishers were fed once daily, whatever their weight. However, amounts fed varied with larger animals receiving less food. Females were fed ad-libitum after whelping until weaning. Water was given ad-libitum and changed daily.

One concern when keeping wild animals in captivity is the potential for disease. Fisher cages were surrounded by a 2.5-m- (8-ft-) high chain-link fence to keep potential sources of disease or disturbance away from the study animals. Livetraps were set within this fence to remove any raccoons (*Procyon lotor*), skunks (*Mephitis mephitis*), foxes (*Vulpes fulva*) or domestic cats (*Felis catus*) that got through or over the fence. No immunizations were given to the fishers. However, when a fisher became sick or behaved abnormally, care was taken not to mix feed, water, or cleaning equipment among animals. We had no deaths resulting from any contagious diseases (see the "Mortalities" section).

In June 1992, 18 (16 females, 2 males) blood samples from fisher captured in the wild, 1990–1992, were evaluated for canine distemper. Three samples (two females, one male) had positive antibody titers indicating these fishers were exposed to distemper. Although these data show that fishers can survive a canine distemper infection, it was impossible to determine what percentage of the wild population survived infection. For captive fishers, the FrommD vaccine would probably be safe to prevent canine distemper (B. Williams, Wyoming State Veterinary Laboratory, pers. comm.).

### Laboratory Handling

Fishers were locked in their nest box and transported 0.8 km (0.5 mi.) to the laboratory, by truck (Figure 8). Fishers were then transferred from the nest box to a squeeze cage (Figure 10). Initially, they were moved from their nest box into a modified cage trap. A squeeze board or (Jessup 1986) was used to push the animal into the back of the trap where the animal was injected by hand. This method was slow and ineffective for the number of animals that needed to be handled in a short period. When the fisher was confined to the back of the trap, it was difficult to determine where the animal was being injected. Therefore, a squeeze cage (Animal Care Equipment and Services, Crestline, CA) was used (Figure 10). This proved satisfactory because the cage was large enough (61.0×51.0×43.5 cm or 24×20×17 in.) that as the cage was collapsed, the animal flattened out (instead of curling up), facilitating the identification of drug injection sites.

Fishers were moved from their nest box into a squeeze cage by covering the squeeze cage and matching the doors of the squeeze cage and nest box (Figure 10, upper photo). The front and middle doors and the cover to the plexiglass portion of the nest box were removed. Most fishers walked out of the nest box and into the squeeze cage. However, some fishers hesitated, and handlers used a plunger to force the fisher into the squeeze cage. Fishers were seldom pushed because as the plunger approached, the fisher generally moved away. Because small cuts were occasionally observed, we recommend that the squeeze cage be coated with plastic or rubber.

Once in the squeeze cage, fishers were immediately anesthetized with a mixture of 10 parts ketamine hydrochloride (KH, 100 mg/ml) (Ketaset Fort Dodge Lab. Inc., Fort Dodge, IA) and 1 part acepromazine maleate (AM, 10 mg/ml) (Acepromazine, TechAmerica, Fermenta Animal Health Company, Kansas City, MO) with a hand syringe. KH is classified as a rapid-acting, nonbarbiturate that creates dissociative anesthesia. Reflexes such as coughing and swallowing are maintained; however, thermoregulation is affected. Temperatures need to be monitored when KH is used. AM has a depressant effect on the central nervous system that causes sedation and muscle relaxation. It acts rapidly and has a calming effect on the animal. The effect of AM is additive with other drugs. When semen was being collected from males, only KH was used because using a KH-AM mixture could result in the bladder muscles relaxing and urine contaminating the semen sample (D. Kwiatkowski, Wyoming Game and Fish Department, pers. comm.). After injection, the squeeze cage was covered with a

blanket which provided a less stressful environment for the animal while the drug took effect. When a second injection was needed, dosage rates were based on the activity level of the fisher.

In captivity, individual body mass was fairly constant, so a standard amount was given based on sex and age-class. All females >6 months of age were given a mean dose of 20 mg/kg of KH-AM. All males >6 months of age were given a mean dose of 23–24 mg/kg of KH-AM or KH only. Kits were not immobilized before 126 days after birth, and then were given a mean dose of approximately 14 mg/kg of KH-AM.

Once sternal or lateral recumbency was attained, the fisher was removed from the squeeze cage and laid on its back on a stainless steel table. A rectal temperature was taken immediately with a digital thermometer. Elevated body temperatures often occurred and ice packs were used to help lower the animal's core temperature. Extended high body temperatures can result in heat exhaustion or heat stress. After the temperature was determined, we proceeded with measurements and other procedures. If the animal started to regain consciousness before completion of the laboratory examination, another dosage of approximately 13 mg/kg was administered.

Induction time was defined as the time between first injection and the first temperature reading. This time is beyond when the animals first become immobilized and thus induction times reported here will be longer than those reported by Belant (1991). Heart rate and respiration were monitored visually. No animals exhibited severe respiratory or cardiac depression while under anesthesia. Other intervals, such as arousal time and recovery time, were not recorded because the animals were placed back in the nest box and allowed two hours to recover before being transferred to holding cages. Analysis of variance was used to test for differences between age classes for dosage rates, induction times, and temperatures.

Individual fishers were immobilized repeatedly during the study. Eleven adult, 21 yearling, 23 juveniles, and ten kit females were immobilized 702 times with KH-AM (Table 4). Initial dosage rates were higher for animals $\geq$ 1 year of age than for those < 1 year old ($P < 0.001$). Second dosage rates did not vary among age classes ($P = 0.105$, $\bar{x} = 13.5 \pm 5.1$), nor did induction time vary among age classes ($P = 0.096$, $\bar{x} = 6.0 \pm 2.0$). There were no differences in temperature among age classes at 0 minutes after injection ($P = 0.044$, $\bar{x} = 40.1 \pm 0.5$) or at 15 minutes post-injection ($P = 0.752$, $\bar{x} = 39.3 \pm 0.6$).

Table 4. Responses of female fishers, by age-class, to immobilization with ketamine hydrochloride and acepromazine maleate.

| Age-class[a] (# of individuals) | | Dose 1[b] (mg/kg)[c] | Dose 2[b] (mg/kg) | Induction time (min) | Temperature 0 min (°C)[d] | Temperature 15 min (°C) |
|---|---|---|---|---|---|---|
| Adult | $\bar{x}$ | **20.1** | **13.4** | **6.0** | **40.1** | **39.3** |
| (11) | SD | 5.2 | 4.8 | 3.0 | 0.5 | 0.7 |
| | Max | 37.5 | 25.0 | 27.0 | 41.2 | 41.0 |
| | Min | 8.1 | 7.0 | 1.0 | 37.7 | 35.9 |
| | n | 287 | 75 | 287 | 287 | 287 |
| Yearling | $\bar{x}$ | **20.0** | **12.7** | **5.0** | **40.1** | **39.3** |
| (21) | SD | 4.3 | 5.2 | 2.0 | 0.5 | 0.7 |
| | Max | 37.5 | 29.1 | 14.0 | 42.1 | 40.8 |
| | Min | 9.7 | 6.8 | 2.0 | 38.7 | 36.1 |
| | n | 221 | 72 | 221 | 221 | 221 |
| Juvenile | $\bar{x}$ | **21.1** | **14.8** | **6.0** | **40.2** | **39.4** |
| (23) | SD | 4.2 | 5.0 | 3.0 | 0.5 | 0.7 |
| | Max | 51.3 | 27.3 | 18.0 | 41.7 | 41.3 |
| | Min | 13.4 | 8.5 | 1.0 | 38.2 | 37.1 |
| | n | 182 | 57 | 182 | 182 | 182 |
| Kits | $\bar{x}$ | **15.6** | **15.6** | **5.0** | **39.8** | **39.2** |
| (10) | SD | 6.0 | 8.5 | 1.0 | 0.4 | 0.5 |
| | Max | 26.4 | 21.6 | 8.0 | 40.0 | 40.1 |
| | Min | 9.0 | 9.6 | 3.0 | 39.3 | 38.3 |
| | n | 12 | 2 | 12 | 12 | 12 |

[a]Kit = 1-5 months, juvenile = 6-11 months, yearling = 12-23 months, adults ≥ 24 months.
[b]Consists of 10 parts ketamine hydrochloride and 1 part acepromazine maleate.
[c]1 kg = 2.2046 lbs.
[d]°F = °C x 1.8 + 32.

Five adult, nine yearling, eight juvenile, and nine kit males were immobilized 177 times with KH-AM (Table 5). Initial dosage rates were higher for animals ≥ 1 year of age than for those < 1 year old ($P < 0.001$). There were no differences among age classes in second dosage rates ($P = 0.337$, $\bar{x} = 12.7 \pm 5.8$), and induction time was similar for all age classes ($P = 0.186$, $\bar{x} = 6.0 \pm 2.0$). Temperature at 0 minutes after injection did not differ by age-class ($P = 0.169$, $\bar{x} = 39.8 \pm 0.6$). However, temperatures 15 minutes post-injection were higher for adults than juveniles ($P = 0.001$). Adults are large animals and could maintain body heat longer than younger, smaller animals. Differential cooling rates could cause this difference.

Five adult, nine yearling, and eight juvenile males were immobilized with KH 76 times (Table 6). There was no difference in initial dosage rates ($P = 0.221$) or second dosage rates ($P = 0.380$) among age classes. This was probably because a larger amount of KH was used to keep the animals down during electroejaculation. All animals were given between 11.7 mg/kg and 61.2 mg/kg. Induction times were not different among age classes ($P = 0.111$, $\bar{x} = 6.0 \pm 3.0$). Temperatures at 0 minutes post-injection were higher in juveniles than in yearlings or adults (adults $P = 0.001$, yearlings $P = 0.026$). This could be a result of juveniles having a higher stress level while being moved from their cages to the lab. Adult, wild-caught animals were passive in their boxes while juvenile, captive-born animals scratched and tried to get out. Temperatures did not differ by age at 15 minutes post-injection ($P = 0.056$). Again, adult males were larger and could retain body heat longer than juveniles. Juveniles began with a higher temperature but cooled faster because of smaller body size.

Females with kits were not anesthetized in 1990. When a litter was born, the female and kits were not disturbed for 7–10 days. After this waiting period, the female was removed from the nest box and the kits were weighed and measured. The female was then allowed to return to the nest box.

In 1991 and 1992, kits were handled shortly after birth. Mothers were removed from the kits and anesthetized 24–36 hrs after giving birth. Kits were weighed and measured then put back in the nest box with the anesthetized female. She was allowed to wake up before returning the nest box to the cage.

### Births and Deaths

All of the adult females brought into captivity gave birth. A total of 38 kits were born to 14 females, yielding a mean litter size of 2.7 (Table 7). Although the number of kits born was not statisti-

Table 5. Responses of male fishers, by age-class, to immobilization with ketamine hydrochloride and acepromazine maleate.

| Age-class[a] (# of individuals) | | Dose 1[b] (mg/kg)[c] | Dose 2[b] (mg/kg) | Induction time (min) | Temperature 0 min (°C)[d] | Temperature 15 min (°C) |
|---|---|---|---|---|---|---|
| Adult | $\bar{x}$ | **22.6** | **12.3** | **6.0** | **39.9** | **39.4** |
| (5) | SD | 5.1 | 5.2 | 2.0 | 0.4 | 0.4 |
| | Max | 40.8 | 29.2 | 14.0 | 40.9 | 40.6 |
| | Min | 14.3 | 7.1 | 1.0 | 38.9 | 38.3 |
| | n | 66 | 28 | 66 | 66 | 66 |
| Yearling | $\bar{x}$ | **23.8** | **11.3** | **6.0** | **39.7** | **39.2** |
| (9) | SD | 4.6 | 2.5 | 3.0 | 0.6 | 0.6 |
| | Max | 40.5 | 13.8 | 15.0 | 40.8 | 40.2 |
| | Min | 14.0 | 5.6 | 1.0 | 38.4 | 37.9 |
| | n | 38 | 8 | 38 | 38 | 38 |
| Juvenile | $\bar{x}$ | **24.7** | **14.9** | **7.0** | **39.7** | **39.0** |
| (8) | SD | 7.3 | 8.0 | 3.0 | 0.7 | 0.7 |
| | Max | 49.2 | 34.3 | 15.0 | 41.2 | 40.8 |
| | Min | 12.0 | 5.4 | 2.0 | 37.6 | 37.4 |
| | n | 58 | 14 | 58 | 58 | 58 |
| Kit | $\bar{x}$ | **13.1** | **7.4** | **5.0** | **39.7** | **39.1** |
| (9) | SD | 3.7 | | 1.0 | 0.5 | 0.6 |
| | Max | 19.4 | | 9.0 | 40.6 | 40.1 |
| | Min | 7.1 | | 3.0 | 38.8 | 38.1 |
| | n | 15 | 1 | 15 | 15 | 15 |

[a] Kit = 1-5 months, juvenile = 6-11 months, yearling = 12-23 months, adults > 24 months.
[b] Consists of 10 parts ketamine hydrochloride and 1 part acepromazine maleate.
[c] 1 kg = 2.2046 lbs.
[d] °F = °C x 1.8 + 32.

Table 6. Responses of male fishers, by age class, to immobilization by ketamine hydrochloride.

| Age-class[a] (# of individuals) | | Dose 1[b] (mg/kg)[c] | Dose 2[b] (mg/kg) | Induction time (min) | Temperature 0 min (°C)[d] | Temperature 15 min (°C) |
|---|---|---|---|---|---|---|
| Adults | $\bar{x}$ | **41.2** | **15.2** | **7.0** | **39.7** | **39.2** |
| (5) | SD | 6.6 | 6.9 | 3.0 | 0.3 | 0.6 |
| | Max | 59.1 | 31.2 | 21.0 | 40.3 | 40.1 |
| | Min | 19.3 | 8.8 | 1.0 | 38.9 | 37.7 |
| | n | 37 | 15 | 37 | 37 | 37 |
| Yearlings | $\bar{x}$ | **44.1** | **19.7** | **5.0** | **39.8** | **39.4** |
| (9) | SD | 4.5 | 5.7 | 2.0 | 0.5 | 0.6 |
| | Max | 51.7 | 23.5 | 14.0 | 40.6 | 40.4 |
| | Min | 32.8 | 9.8 | 1.0 | 39.1 | 38.0 |
| | n | 28 | 5 | 28 | 28 | 28 |
| Juvenile | $\bar{x}$ | **44.5** | **13.4** | **6.0** | **40.2** | **39.7** |
| (8) | SD | 13.6 | 8.9 | 2.0 | 0.5 | 0.7 |
| | Max | 61.2 | 23.1 | 11.0 | 41.1 | 40.6 |
| | Min | 11.7 | 5.6 | 3.0 | 39.7 | 38.3 |
| | n | 11 | 3 | 11 | 11 | 11 |

[a]Kit = 1-5 months, juvenile = 6-11 months, yearling = 12-23 months, adults > 24 months.
[b]No male kits or females were anesthetized with ketamine hydrochloride.
[c]1 kg = 2.2046 lbs.
[d]°F = °C x 1.8 + 32.

Table 7. Reproductive histories of adult female fishers, and kit survival through their first month, held in captivity at the University of Maine, 1991–1993.

| Year | ID Number | (Age) | Number Alive: Birth M[a] | Birth F[a] | 7 Days M | 7 Days F | 30 Days M | 30 Days F |
|---|---|---|---|---|---|---|---|---|
| 1991 | F711 | (3) | 3 | 0 | 3 | 0 | 3 | 0 |
| | F712 | (2) | 2 | 1 | 1 | 0 | 0 | 0 |
| | F713 | (2) | 2 | 1 | 0 | 0 | 0 | 0 |
| | F715 | (3) | 0 | 2 | 0 | 2 | 0 | 2 |
| | F716 | (2) | 1 | 1 | 1 | 1 | 1 | 1 |
| 1992 | F732 | (3) | 2 | 0 | 2 | 0 | 2 | 0 |
| | F733 | (2) | 1 | 2 | 1 | 2 | 1 | 2 |
| | F734 | (3) | 0 | 3 | 0 | 3 | 0 | 3 |
| | F735 | (2) | 2 | 1 | 1 | 0 | 1 | 0 |
| | F736 | (3) | 3 | 1 | 3 | 1 | 3 | 1 |
| | F737 | (2) | 0 | 2 | 0 | 2 | 0 | 2 |
| | F742 | (4) | 3 | 1 | 1 | 1 | 1 | 1 |
| 1993 | F765 | (3) | 2 | 1 | 2 | 1 | 2 | 1 |
| | F769 | (2) | 1 | 0 | 0 | 0 | 0 | 0 |
| | Total | | 22 | 16 | 15 | 13 | 14 | 13 |
| | Means | | 2.71 | | 2.00 | | 1.93 | |
| | Loss between Intervals | | 26.2% | | 3.5% | | | |

[a]M = Male, F = Female.

cally different between two- and three-year-old mothers ($t = -0.94$, $P > 0.05$), mean litter size may be higher in older females. Mean litter sizes by female ages were as follows [$X \pm SD$ (n)]: 2 yrs., $2.4 \pm 0.8$ (7); 3 yrs., $2.8 \pm 0.8$ (6); and 4 yrs., 4.0 (1). Sex ratios of kits at birth did not differ from an expected 50:50 ratio ($\chi^2 = 0.95$, $P < 0.33$).

Fourteen of the 38 kits born died, and ten of these deaths occurred during the first week of life (Table 7). Almost all of the kit mortalities were associated with inadequate care from the mother and exposure (Table 8). Although the exposure deaths could also have been care related, we cannot be sure. We recorded nine additional mortalities of captive fishers, three as juveniles and six as either yearlings or adults (Table 8). Six animals died within a few

Table 8. Mortalities of fishers held in captivity at the University of Maine, 1990–1993.

| I.D. Number[a] | W/C[b] | Age at death[c] | Probable cause of death |
|---|---|---|---|
| M-1 | C | Kit (3 d) | Froze |
| M-2 | C | Kit (3 d) | Froze |
| F-3 | C | Kit (3 d) | Froze |
| M-4 | C | Kit (24 d) | Mother abandoned |
| M-5 | C | Kit (1 d) | Cannibalized |
| F-6 | C | Kit (1 d) | Cannibalized |
| M-7 | C | Kit (1 d) | Froze |
| M-8 | C | Kit (1 d) | Froze |
| M-9 | C | Kit (1 d) | Froze |
| F-10 | C | Kit (1 d) | Froze |
| M-11 | C | Kit (0 d) | Stillborn |
| F705 | W | Juv | Circulatory collapse, due to capture stress |
| F717 | W | Yrl | Stress due to capture, heat exhaustion |
| F723 | W | Yrl | Stress due to capture |
| F725 | C | Yrl (20 m) | Ulcers, gastric bleeding |
| M728 | C | Juv (10 m) | Malabsorption problem |
| M730 | C | Yrl (14 m) | Toxic insult |
| F744 | C | Kit (5 m) | Convulsions, anaphylactic reaction |
| M755 | C | Kit (68 d) | Cannibalized by mother |
| M757 | C | Kit (68 d) | Cannibalized by mother |
| F764 | W | Juv | Ulcers, dehydration |
| M766 | W | Yrl | Ulcers, gastric bleeding |
| M768 | W | Adt | Stress due to capture, dehydration |

[a]M = Male, F = Female.
[b]C = captive-born (conceived in the wild and born in captivity); W = wild-caught (taken directly from the wild). Because date of birth was unknown, age at death could not be calculated.
[c]Juvenile (Juv) = 6–11 months of age, yearling (Yrl) = 12–23 months, adults (Adt) ≥24 months. When known, age in days (d) or months (m) given in parentheses.

days of being brought into captivity, and necropsies suggested capture stress as the cause. The three juveniles (F725, M728, M730), all born in captivity, died at various times of the year from apparently unrelated causes (Table 8).

Thus, of the 23 mortalities recorded, 17 were of captive-born (14 as kits, three as juveniles), and 6 were of wild-caught animals (five yearlings, one adult) (Table 8). To keep mortalities of captive-

born fishers to a minimum, nest boxes should have some insulation and have extra bedding material. Wild-caught fishers should be given water immediately after capture and transported to their permanent cages as soon as possible.

## SUMMARY AND CONCLUSIONS

Anyone planning a study that requires capturing fishers should carefully consider the number of animals needed to obtain the study objective(s). Using experienced trappers to obtain fishers from the wild, it took 11,347 trap-nights to capture 77 fishers, or an average of 147 trap-nights per animal. Using this capture rate, and the mean age-sex composition of fishers trapped in Maine, we present a method for estimating the effort needed to capture a specified number by age-sex class of wild fishers.

We observed that wild-caught fishers retained their fear of people and were easy to move into a nest box or squeeze cage for examination or immobilization. Wild-caught fishers also appeared to adapt to captivity easily, needing a minimal amount of space. In contrast, captive-born animals apparently did not develop a fear of people, and thus were difficult to move into nest boxes or squeeze cages. Special attention had to be given while feeding or cleaning cages of captive-born fishers to ensure they did not escape. Captive-born fishers, however, could make excellent animals for facilities wanting to exhibit fishers, because they spend more time out of their nest boxes and exhibited little stress in the presence of people compared to wild-caught fishers.

While there is some information on the design of housing facilities for fishers written by zookeepers and fur-breeders, information is sketchy. Thus, we present descriptions and pictures of holding cages, nest boxes, and squeeze cages we used to maintain and handle fishers in captivity.

Regular cleaning of holding cages and nest boxes, and locating cages within a fenced area is critical to disease prevention. Individual fishers need to be monitored so they do not become overweight. Guidelines are presented on feeding and watering regimes.

Fishers can be easily confined in a nest box, moved to a squeeze cage, and immobilized for safe handling. We found a 10:1 mixture of ketamine hydrochloride and acepromazine maleate to be effective in anesthetizing fishers. Repeated immobilization of animals (n = 955) had no apparent behavioral effects, and no animals died because of sedation. This report presents data on drug dosage rates, induction times, and body temperature.

Of the 82 fishers (44 wild-caught, 38 captive-born) we handled between October 1990 and October 1993, 23 died in captivity. Eighty-seven percent of these deaths were either kits (n = 14) or older animals dying within a few days after being brought into captivity (n = 6). Mortality of wild-caught fishers can be minimized by administration of water and transporting them to their permanent location immediately after capture. Captive-born mortality can be minimized by using insulated nest boxes and providing extra bedding material.

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# APPENDIX A— INVENTORY OF WILD-CAUGHT FISHERS MAINTAINED IN CAPTIVITY AT THE UNIVERSITY OF MAINE, 1990–1993.

| Animal number[a] | Capture date | Age at capture[b] | Capture location | Disposition and date[c] | | Days in captivity |
|---|---|---|---|---|---|---|
| F705 | 4 Nov 90 | Juv | Grand Falls | Died | 6 Nov 90 | 2 |
| F706[d] | 16 Oct 90 | Juv | Monroe | Rel | 10 Aug 92 | 664 |
| F707[d] | 16 Oct 90 | Juv | Frankfort | Rel | 27 Apr 91 | 193 |
| F708[d] | 18 Oct 90 | Juv | Winterport | Rel | 15 Mar 91 | 148 |
| F709 | 29 Oct 90 | Juv | Charleston | Rel | 15 Mar 91 | 137 |
| F710 | 4 Nov 90 | Yrl | E. Corinth | Rel | 10 Aug 92 | 645 |
| F710 | 5 Nov 92[e] | Adt | Charleston | Rel | 23 Jun 93 | 230 |
| F711 | 6 Nov 90 | Adt | Orient | Rel | 10 Aug 92 | 643 |
| F712 | 6 Nov 90 | Yrl | Amity | Sac | 23 Dec 91 | 412 |
| F713 | 9 Nov 90 | Yrl | Levant | Sac | 14 Dec 91 | 400 |
| F714 | 9 Nov 90 | Juv | Orient | Rel | 15 Mar 91 | 126 |
| F715 | 23 Nov 90 | Adt | Amity | Sac | 14 Dec 91 | 386 |
| F716 | 29 Nov 90 | Yrl | Amity | Sac | 23 Dec 91 | 389 |
| F717 | 2 Dec 90 | Juv | Charleston | Rel | 15 Mar 91 | 103 |
| F717 | 11 Jun 91[e] | Yrl | Atkinson | Died | 12 Jun 91 | 1 |
| M718 | 2 Dec 90 | Juv | Charleston | Rel | 19 Jul 91 | 229 |
| M719 | 2 Dec 90 | Juv | Jackson | Rel | 19 Jul 91 | 229 |
| M720 | 9 Dec 90 | Adt | Orient | Rel | 21 Jun 93 | 925 |
| F721 | 10 Dec 90 | Juv | Orient | Rel | 15 Mar 91 | 95 |
| M722 | 9 Dec 90 | Adt | Amity | Rel | 23 Jun 93 | 927 |
| F723 | 10 Dec 90 | Yrl | Atkinson | Died | 17 Dec 90 | 7 |
| F731 | 9 Nov 91 | Juv | Charleston | Rel | 30 Nov 92 | 387 |
| F732 | 9 Nov 91 | Adt | Atkinson | Rel | 27 Aug 93 | 657 |
| F733 | 11 Nov 91 | Adt | Amity | Rel | 30 Nov 92 | 385 |
| F734 | 11 Nov 91 | Adt | Amity | Rel | 30 Nov 92 | 385 |
| F735 | 13 Nov 91 | Adt | Atkinson | Rel | 10 Aug 92 | 271 |
| F736 | 15 Nov 91 | Adt | Cary | Rel | 13 Aug 92 | 272 |
| F737 | 17 Nov 91 | Adt | Brooks | Esc | 26 May 92 | 191 |
| F738 | 30 Nov 91 | Juv | Amity | Rel | 23 Jun 93 | 571 |
| F739 | 21 Dec 91 | Juv | Orient | Rel | 10 Aug 92 | 233 |
| F740 | 17 Dec 91 | Juv | Amity | Esc | 9 Sep 92 | 267 |
| F741 | 15 Dec 91 | Juv | Cary | Rel | 21 Jun 93 | 554 |
| F742 | 25 Dec 91 | Adt | Amity | Sac | 14 Dec 92 | 355 |
| F743 | 26 Dec 91 | Juv | Amity | Esc | 24 May 92 | 150 |
| F761 | 3 Nov 92 | Juv | Amity | Rel | 19 Jun 93 | 228 |
| M762 | 13 Nov 92 | Adt | Topsfield | Rel | 19 Jun 93 | 218 |
| F763 | 19 Nov 92 | Juv | Amity | Rel | 19 Jun 93 | 212 |
| F764 | 21 Nov 92 | Juv | Atkinson | Died | 2 Dec 92 | 11 |

Appendix A. Continued.

| Animal number[a] | Capture date | Age at capture[b] | Capture location | Disposition and date[c] | | Days in captivity |
|---|---|---|---|---|---|---|
| F765 | 26 Nov 92 | Adt | Kossuth | Rel | 27 Aug 93 | 274 |
| M766 | 27 Nov 92 | Yrl | Cary | Died | 21 Dec 92 | 24 |
| F767 | 29 Nov 92 | Juv | Amity | Rel | 27 Aug 93 | 271 |
| M768 | 3 Dec 92 | Adt | Orneville | Died | 13 Dec 92 | 10 |
| F769 | 20 Nov 92 | Adt | Amity | Rel | 27 Aug 93 | 280 |
| F770 | 1 Dec 92 | Juv | Amity | Rel | 27 Aug 93 | 269 |
| F771 | 1 Dec 92 | Juv | Amity | Rel | 21 Jun 93 | 202 |

[a]M = male, F = female.
[b]Age classes: Juvenile (Juv) = 6–11 months, Yearlings (Yrl) = 12–23 months, Adults (Adt) ≥24 months.
[c]Disposition: Rel = released; Sac = sacrificed; Esc = escaped.
[d]Fisher caught by Maine Cooperative Fish and Wildlife Research Unit personnel. These individuals were not included in the capture rate analysis.
[e]Recaptured.

# APPENDIX B— INVENTORY OF CAPTIVE-BORN FISHERS MAINTAINED IN CAPTIVITY AT THE UNIVERSITY OF MAINE, 1990–1993.

| Animal number[a] | Birth date | Mother's Id. No. | Disposition and date[b] | Days in captivity |
|---|---|---|---|---|
| M-1 | 4 Mar 91 | F713 | Died 7 Mar 91 | 3 |
| M-2 | 4 Mar 91 | F713 | Died 7 Mar 91 | 3 |
| F-3 | 4 Mar 91 | F713 | Died 7 Mar 91 | 3 |
| M-4 | 22 Mar 91 | F712 | Died 15 Apr 91 | 24 |
| M-5 | 22 Mar 91 | F712 | Died 23 Mar 91 | 1 |
| F-6 | 22 Mar 91 | F712 | Died 23 Mar 91 | 1 |
| F724 | 23 Mar 91 | F715 | Esc 18 Oct91 | 209 |
| F725 | 23 Mar 91 | F715 | Died 10 Nov 92 | 598 |
| F726 | 26 Mar 91 | F716 | Gray 1 Oct 93 | 920 |
| M727 | 26 Mar 91 | F716 | Gray 1 Sep 93 | 890 |
| M728 | 28 Mar 91 | F711 | Died 12 Jan 92 | 290 |
| M729 | 28 Mar 91 | F711 | Rel 1 Oct 93 | 918 |
| M730 | 28 Mar 91 | F711 | Died 28 May 92 | 427 |
| F744 | 18 Mar 92 | F737 | Died 5 Aug 92 | 140 |
| F745 | 18 Mar 92 | F737 | Esc 30 Aug 92 | 165 |
| M746 | 21 Mar 92 | F732 | Gray 1 Sep 93 | 529 |
| M747 | 21 Mar 92 | F732 | HWR 22 Jun 93 | 458 |
| M748 | 25 Mar 92 | F733 | Gray 29 Jun 93 | 461 |
| F749 | 25 Mar 92 | F733 | Rel 30 Nov 92 | 250 |
| F750 | 25 Mar 92 | F733 | Rel 30 Nov 92 | 250 |
| F751 | 26 Mar 92 | F734 | Gray 29 Jun 93 | 460 |
| F752 | 26 Mar 92 | F734 | Gray 4 Dec 92 | 253 |
| F753 | 26 Mar 92 | F734 | Gray 4 Dec 92 | 253 |
| F754 | 27 Mar 92 | F736 | Acad 7 Sep 93 | 529 |
| M755 | 27 Mar 92 | F736 | Died 3 Jun 92 | 68 |
| M756 | 27 Mar 92 | F736 | Rel 13 Aug 92 | 139 |
| M757 | 27 Mar 92 | F736 | Died 3 Jun 92 | 68 |
| M758 | 28 Mar 92 | F742 | Esc 25 Sep 92 | 181 |
| F759 | 28 Mar 92 | F742 | HWR 22 Jun 93 | 451 |

Appendix B Continued.

| Animal number[a] | Birth date | Mother's Id. No. | Disposition and date[b] | Days in captivity |
|---|---|---|---|---|
| M-7 | 28 Mar 92 | F742 | Died 29 Mar 92 | 1 |
| M-8 | 28 Mar 92 | F742 | Died 29 Mar 92 | 1 |
| M760 | 31 Mar 92 | F735 | Rel 10 Aug 92 | 132 |
| M-9 | 31 Mar 92 | F735 | Died 1 Apr 92 | 1 |
| F-10 | 31 Mar 92 | F735 | Died 1 Apr 92 | 1 |
| M-11 | 24 Mar 93 | F769 | Died 24 Mar 93 | 0 |
| M772 | 1 Apr 93 | F765 | Gray 1 Oct 93 | 183 |
| M773 | 1 Apr 93 | F765 | Acad 7 Sep 93 | 159 |
| F774 | 1 Apr 93 | F765 | Gray 1 Sep 93 | 153 |

[a]M = male, F = female

[b]Disposition: Rel = released; Sac = sacrificed; Esc = escaped; Gray = Given to Maine Department of Inland Fisheries and Wildlife game farm in Gray, ME; Acad = given to Acadia Zoological Park, Trenton, ME; HWR = given to A.E. Howell Wildlife Refuge, Amity, ME.

# APPENDIX C

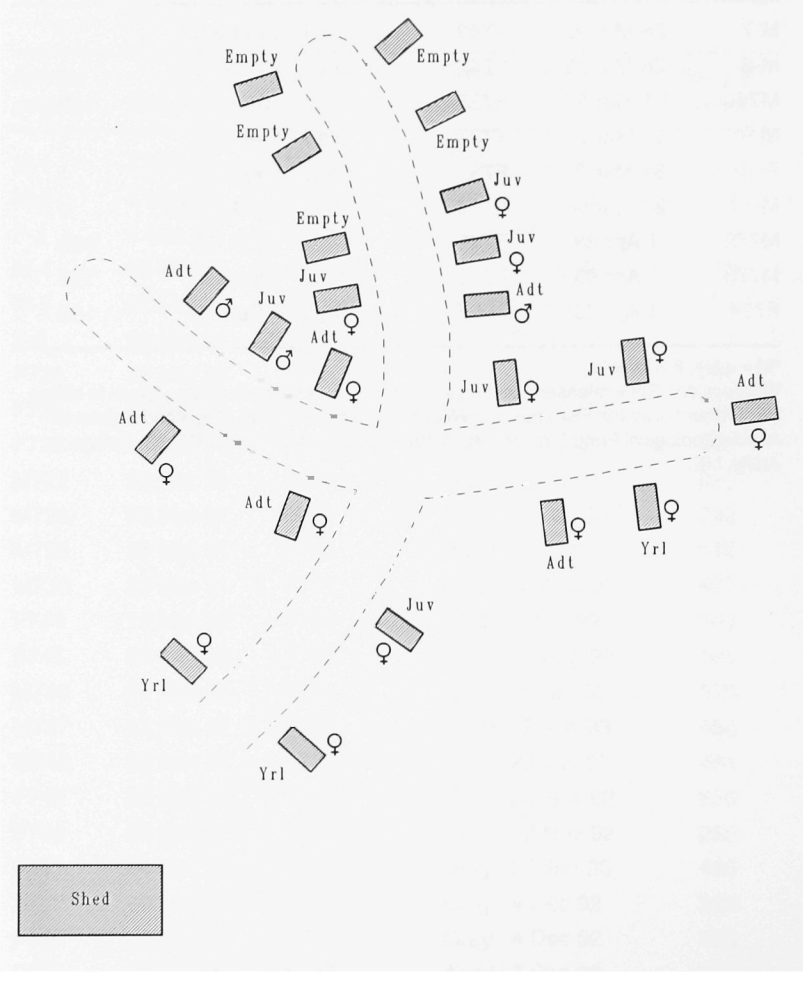


*Diagram of the arrangement of the fisher holding cages as of January 1, 1991. Cages were spaced approximately 5–10 meters apart. Fishers were within sight of neighboring cages.*

# APPENDIX D

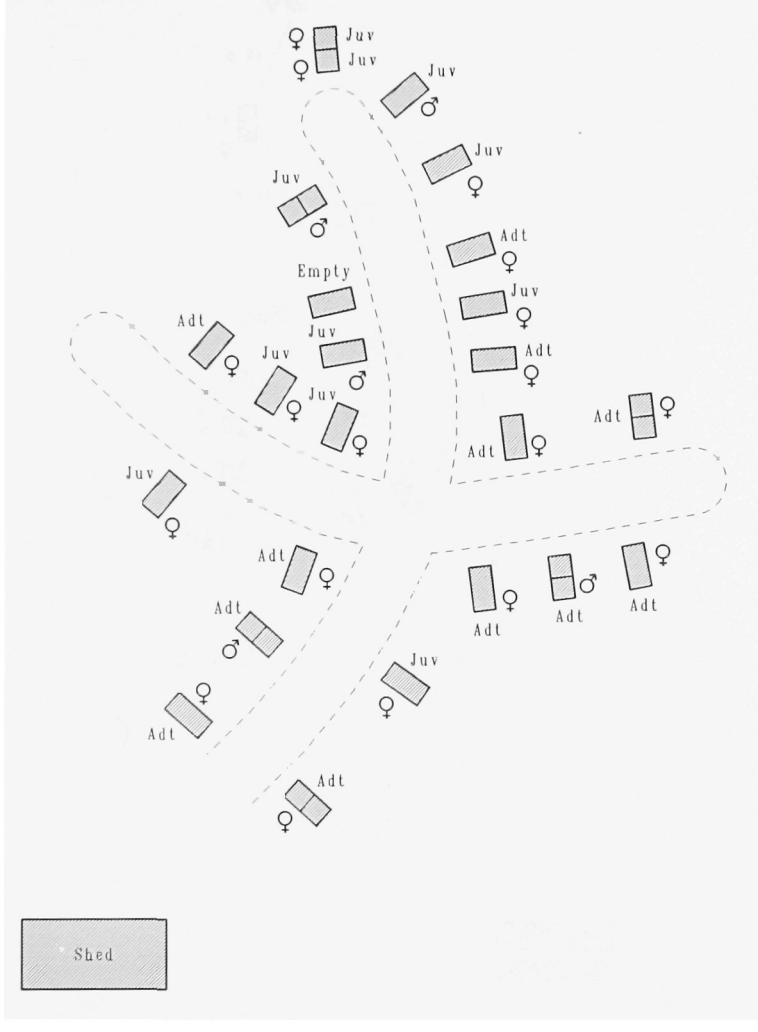


*Diagram of the arrangement of the fisher holding cages as of January 1, 1992. Cages were spaced approximately 5–10 meters apart. Fishers were within sight of neighboring cages. Cages with lines through them indicate the double or breeding cages referred to in the text and Figure 4.*

# APPENDIX E

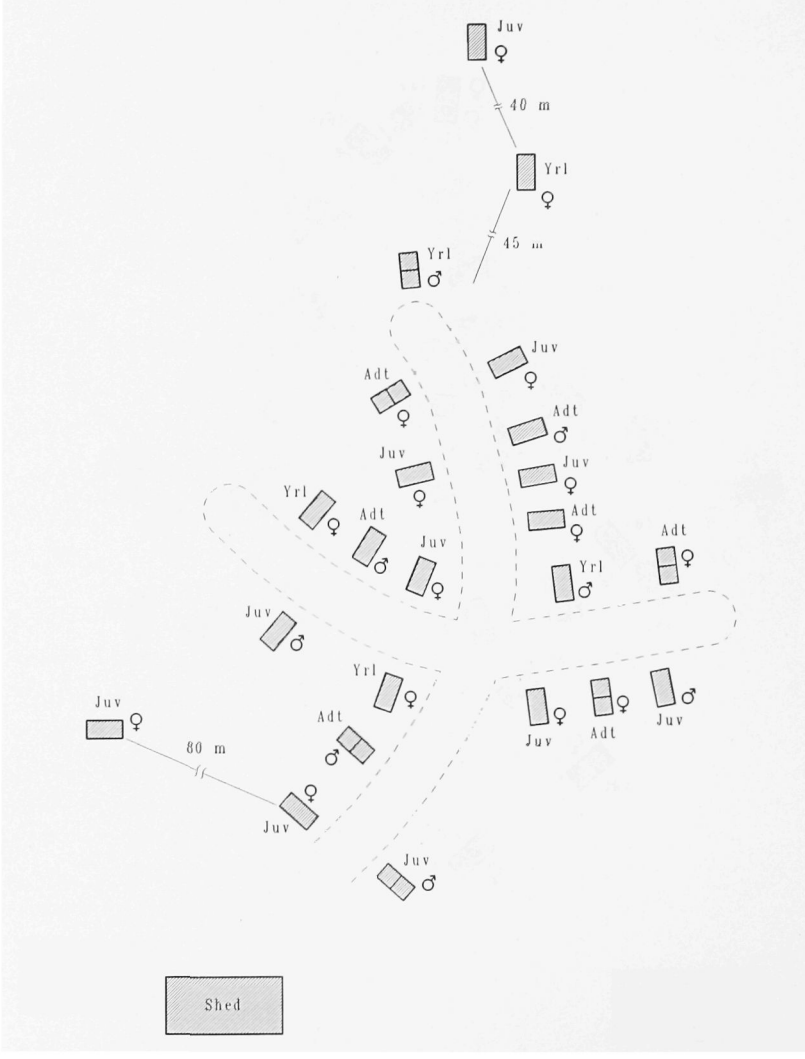


*Diagram of the arrangement of the fisher holding cages as of January 1, 1993. Cages were spaced approximately 5–10 meters apart unless otherwise noted. Three fishers were visually isolated from other fishers. All other animals were within sight of neighboring cages. Cages with lines through them indicate the double or breeding cages referred to in the text Figure 4.*