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Propagation of Aquatic Game Birds

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Bureau of Biological Survey

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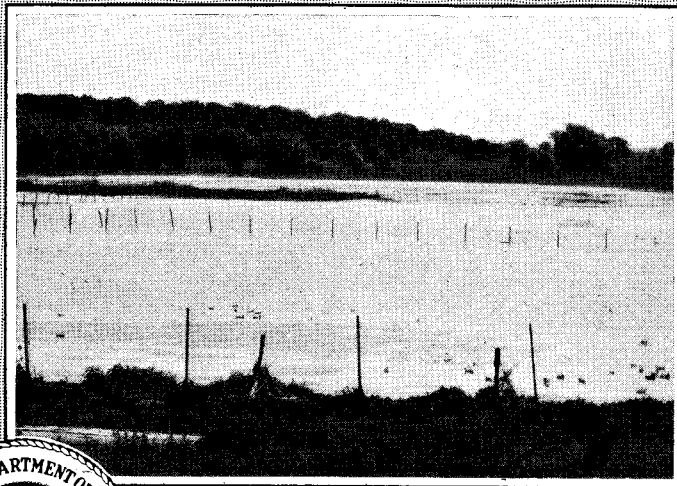
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U. S. DEPARTMENT OF
AGRICULTURE
FARMERS' BULLETIN No. 1612

PROPAGATION OF AQUATIC GAME BIRDS



THE PROPAGATION of aquatic game birds in the United States is a small but growing industry. Approximately 50,000 wild ducks and 5,000 wild geese constitute the present annual production. Some of these birds are bred by individual or organized sportsmen for their own use, some by fanciers because of their interest in the birds, and others by breeders for sale. The market for two species, the mallard duck and the Canada goose, demands birds for use in restocking, for decoys, and for food. Sale for food is the exception rather than the rule, and is to the better class of restaurants, hotels, and clubs, so that good prices are realized. Species other than the mallard and the Canada goose are produced only in small numbers and are sold to propagators and collectors of ornamental birds and to zoological gardens. The demand for all the species exceeds the supply, and for all but the two commonly bred kinds is sure to absorb all that are likely to be produced for a long time to come.

This bulletin, together with Farmers' Bulletin 1613, Propagation of Upland Game Birds, supersedes Farmers' Bulletin 1521, Propagation of Game Birds.

Game Forestation and Parks Commission

PROPAGATION OF AQUATIC GAME BIRDS¹

By W. L. MCATEE, *Senior Biologist, in Charge, Division of Food Habits Research
Bureau of Biological Survey*

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INTRODUCTION

AQUATIC GAME BIRDS, exclusive of the shore and marsh species, which have not yet proved adapted to artificial propagation, include in the United States only the family Anatidae, or ducks, geese, and swans. Of these birds, the wood duck and swans are now the beneficiaries of extended close seasons, so that they are not on the game-bird list. As these may be propagated in captivity, however, and are kept for ornamental purposes, directions for their care are given in this bulletin.

A surprisingly large number (nearly 50 species) of the ducks, geese, and swans of North America have been bred in captivity, most of them, however, upon only a small scale. About 20 species have been bred rather frequently either in this country or abroad, and at least one of them, the common mallard duck, can be propagated as readily as, if not more readily than, the ring-necked pheasant of the group of upland game birds. The directions for propagating here given apply primarily to the mallard and the Canada goose, the most frequently reared birds of their groups. These directions summarize the experience of the most successful breeders both in the United States and in Europe. Exceptional treatment found desirable in the care of other species is noted.

¹The following publications may be had free by applying to the United States Department of Agriculture, Washington, D. C.: MCATEE, W. L. PROPAGATION OF UPLAND GAME BIRDS. U. S. Dept. Agr. Farmers' Bul. 1613; PUBLICATIONS OF INTEREST TO GAME BREEDERS. U. S. Dept. Agr., Bur. Biol. Survey Leaflet Bi-203 [Mimeographed]; DEALERS IN GAME AND ORNAMENTAL BIRDS. U. S. Dept. Agr., Bur. Biol. Survey Leaflet Bi-458 [Mimeographed].

GENERAL CONSIDERATIONS

LICENSES

Most States have laws or regulations affecting the propagation of game birds and require game breeders to take out licenses. In addition, Federal permits are necessary to buy or sell migratory waterfowl, including wild ducks, geese, and swans, reared in captivity. Federal permits are obtainable through the Bureau of Biological Survey, United States Department of Agriculture, Washington, D. C., as are also copies of digests of State laws on game-bird propagation, and the addresses of officials to whom application should be made for State licenses and for the full text of State laws relating to the propagation of game birds.

SITE

POND

The usual basis of an establishment for rearing aquatic game birds is a shallow lake or pond (see illustration on title-page), preferably of not more than a few acres in extent and fed by running water. A considerable part, if not all, of the shore line should slope very gradually, so as to give the birds an approach to the water that will not require jumping or falling in.

Natural marshy growth for nesting cover about the margin of the pond is desirable, but other vegetation can be substituted for it artificially, as noted under directions for planting, page 20. If natural shelter against cold winds is lacking, either a high bank should be built on the proper side or dense shrubbery, preferably evergreen, should be planted, or both. To prevent escape of breeding stock and to keep out natural enemies, it is advisable to inclose the pond and all adjoining land to be used with woven-wire fence. Types of fencing are discussed on pages 6-8. The fence should be at a fair distance from the water at all points and should be screened with shrubbery or vines to prevent the birds from being disturbed by outside occurrences. There is a happy medium to be observed in locating the fence, however, for the larger the area inclosed the more difficult will be the task of finding nests and the greater the probability that some of them will entirely escape detection.

The usual duck pond is made by damming a small stream. A massive clay or clay-and-gravel dam holds small bodies of water satisfactorily, and such a dam, as well as an efficient water gate for it, can be homemade.² Local experience may be taken as a guide as to whether the soil is suitable for earthen reservoirs. Ground underlaid by porous limestone and loose soils in general are unsuitable. Under such conditions concrete basins should be made, shallow, well sloped toward the outlet, and designed in every way for easy draining and cleaning. For earthen dams a mixture of 1 part of clayey material to 2 or 3 parts of gritty material is best, combining weight, stability, and water-tightness. The dam should be three or four times as broad at the bottom as at the top; it should be level at the

² Full instructions for building dams are given in the following publications: LEWIS, M. R. RESERVOIRS FOR FARM USE. U. S. Dept. Agr., Farmers' Bul. 1703, 17 p., illus., 1933; and TALBOT, M. W. RANGE WATERING PLACES IN THE SOUTHWEST. U. S. Dept. Agr., Bul. 1358, 44 p., illus., 1926. Dept. Bul. 1358 is out of print, but may be consulted in libraries.

top and considerably wider when newly built than will be necessary later, as it will wash away to some extent. The outer side may be protected by turf and the inner by stones when practicable. The spillway for the water gate may be a concrete channel of appropriate dimensions, in the walls of which tapering slots are molded (Fig. 1.)³ The beveled ends of 1-inch flashboards, or heavier planks if necessary, fit in these, and between them clay is tamped. It is easy to raise or lower the level of the pond by adding or removing boards, or the whole gate may be pried up from the bottom to give an outlet.

Muskrats may become a pest by burrowing in earthen dams, but they do not burrow where the water level is always kept within about 6 inches of the top of the dam, so that there is no room for an air chamber that the water can not enter.

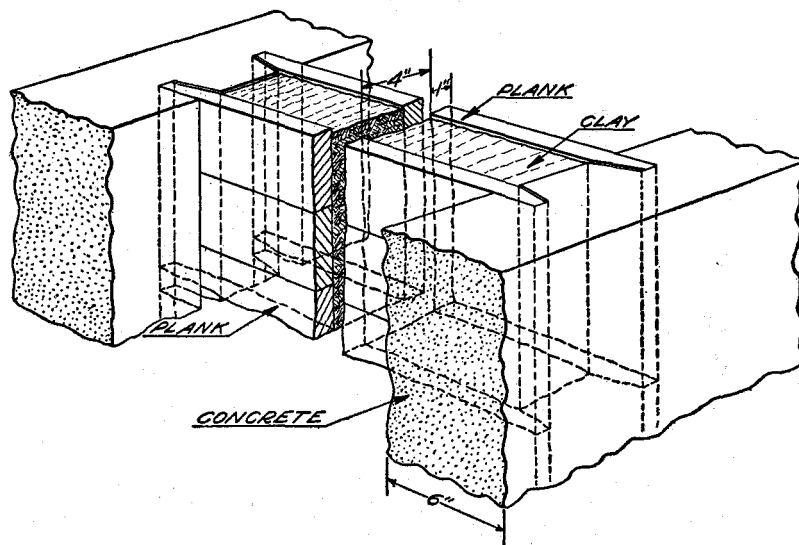


FIGURE 1.—Detail of water gate

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In laying out a small pond, care should be taken to provide a bottom that slopes evenly from all parts toward the outlet, so that it may be drained and cleaned from time to time when the condition of the water seems to indicate the necessity.

Two hundred breeding mallards have been satisfactorily handled in a 3-acre inclosure containing a pond of only 250 square feet. One authority advises 18 square feet of water for each duck, and another thinks that for mixed species of waterfowl it is best to provide about 50 square yards of water for each breeding pair.

REARING FIELD

Besides a pond a rearing field will be needed for the proper care of young birds. (Fig. 10.) In small-scale operations, a spacious lawn or grassy orchard may be made to serve, but when many water-

³ Of the illustrations in this bulletin, Figure 11 was contributed by the Kentucky Game and Fish Commission; Figures 13 to 15 by M. D. Phillips, and Figure 16 by the New York Conservation Commission.

fowl are to be reared, especially as a yearly program, more extensive accommodations must be prepared. The satisfactory rearing field should be on a sunny exposure, but with plenty of either natural or artificial provision for shade. The area should be moderately sloping or otherwise well drained and should be rather smoothly cultivated so as to give many more or less level spots for coops. The prime requirement in a rearing field is to have it covered, at the time needed, with a rich growth of mixed clover and grasses, which will supply not only ample green food for the young birds but also a plentiful supply of the small insects that breed upon such luxuriant and succulent vegetation. It is well to change from one rearing field to another from year to year, the vacant sites being renovated by plowing, fallowing, fertilizing, and rotating of crops. Spare rearing fields for emergency use, as in case of an outbreak of disease,



FIGURE 2.—Cornstalk and brush shelters for duck nests

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also are highly advisable, so that for continuing operations about four times as much land should be available as is required to care for the birds properly for a single year.

NESTING SITES

Tussocks and old logs and stumps in swamps, and litter from previous years' vegetation in marshes, furnish the usual nesting sites for most wild ducks. The nesting place is well screened as a rule by the growth of the year. Ducks in inclosures take to a variety of cover, and where there is not sufficient growing cover, shelters made of corn fodder or branches of evergreens (fig. 2) can be substituted. If, as is usual, the duck eggs are to be gathered for incubation under hens or otherwise, the area available to captive birds for nesting sites must be kept down to a reasonable minimum, or the difficulties of finding and regularly inspecting nests will become too great. Re-

striction of the area available to ducks for nesting is easily accomplished in parked surroundings by keeping the grass closely mowed except in small patches, preferably about shrubbery.

Islands are attractive as nesting sites, especially to deep-water ducks, but sometimes because of difficulty or neglect in inspecting them, they become harbors for vermin.

Wood ducks and a few other species that naturally nest in holes in trees will use nest boxes. These may be placed on trees or on posts within a few feet of the ground or water, along shore or on islands. Each should have an inside space measuring about a foot in each direction, with an opening 4 by 4½ inches in one side near the top. The roof should be sloped, projected well beyond the sides, and hinged to permit access to the interior. A cleated walk or slab with bark on it should be provided, leading to the entrance by an easy grade.

Sometimes species of ducks that do not naturally nest in holes will use nest boxes of the type described, and various species will lay in a simple box shelter on the ground. These may be from 1½ to 3 feet square and from 1 to 1½ feet high, without bottom, and may have one side half open for an entrance. Laid upon the ground and partially hidden by shrubs or herbs, they often prove attractive.

SANITATION

Birds are unable to tell of their discomfort, and often no difference in appearance or behavior can be noted before one is sick unto death. Treatment then is generally ineffectual. From every point of view the watchword should be "prevention." One cardinal rule for the game farm is to keep the living quarters of the indispensable poultry always entirely separated from those of the game birds. Domestic fowls have diseases to which they are more or less resistant but which may carry off captive game birds like a plague. It is well even for the sake of the poultry to change their quarters occasionally and to renovate the land; but under no circumstances should ground fouled by poultry be used for game birds until it has been baked by the summer sun, frozen by the winter cold, and plowed, fallowed, planted, and renovated to the last degree of thoroughness.

The prevention of disease depends to a great extent also on the policy followed in respect to the introduction of new stock on the game farm. On a going farm it pays to let well enough alone. The acquisition of fresh stock is fraught with such danger that it should not be undertaken except when the need is unmistakable. The fertile, well-managed game farm will have vigorous healthy stock, and once having it, a reasonable degree of selection being exercised, the owner need give no consideration to the bugaboo of inbreeding. When for some important reason it has been decided to bring in new birds, they should be held for observation for some time before they are allowed to mix with regular stock. For this quarantining, roomy and sanitary inclosures should be provided, since crowded quarters in themselves tend to promote disease.

The following precautions against disease may be specially suggested for aquatic game birds:

Never place the young where there is not plenty of shade. Adults also need shade, but they are not so susceptible to harm from the sun's rays as are the young.

Do not overcrowd.

See to it that young and old always have a perfectly dry place both for sleeping and for retreat in the daytime.

Remove all food not eaten by young birds and do not expose their drinking water to the sun.

Segregate sick birds at once and burn the bodies of all birds that die of disease. Spade and quicklime the pen in which they have been confined.

CONTROL OF ENEMIES

After disease, feathered and furred flesh eaters, popularly called "vermin," are the worst obstacles to success that the game farmer has to overcome. Among birds, the great horned owl is probably the most destructive where aquatic game birds are being reared.

Sometimes some of the larger hawks are tempted by the plentiful supply of food offered by a well-stocked game farm, but as these hawks are habitual mousers, warfare against them should be upon individual offenders and not upon the race. The smaller bird hawks, and owls other than the great horned, may take some young birds when opportunity affords, but crows are the worst flying enemies of both ducklings and eggs. Night herons occasionally prove troublesome.

Among mammals the most dangerous foes of birds on game farms are cats, free-roving dogs, rats, and weasels; of lesser importance are minks, foxes, badgers, skunks, opossums, and raccoons. Snakes sometimes figure prominently as egg thieves; and bullfrogs, snapping turtles, and such fish as pike, pickerel, and bass, if allowed to live in a duck pond, will seize and devour a great many ducklings and even attack adult birds.

These various animal pests find a center of attraction in game farms, and the necessity for their control in such places is freely admitted. Efforts along this line, however, are apt to vary widely. Some are well considered, selective, just, and sensible; others are blundering, indiscriminate, unnecessarily cruel, and fanatical.

FENCING

Usually the main dependence for predator control is appropriate fencing. The entire farm may be surrounded by a permanent vermin-proof fence; or the rearing or breeding fields may be guarded either by semipermanent fences, or even by temporary and easily movable fences that will exclude most natural enemies; or all such fencing may be dispensed with and only the bird pens themselves used to give protection. The pens are usually built so as to keep out both ground and winged enemies.

PERMANENT FENCE

Fencing of a type deserving to be called permanent is expensive—prohibitively so in most cases where profits are an object. Suggestions, however, as to the construction of such a fence may be in some demand, and hence are given here. The permanent fence should have concrete posts and a foundation of equal thickness, the latter

extending about a foot both above and below ground, and in the upper part of it the woven wire should be embedded. All mesh should be of the type galvanized after weaving. The lower course of 30 to 36 inches should be of $\frac{1}{2}$ -inch or $\frac{3}{4}$ -inch mesh and should have extending outward from its upper margin an overhang 1 foot wide of the same mesh. The upper part of the fence should be of not more than 2-inch mesh, and the top of it should be supported by a tightly strung barbed wire. Several other closely spaced strands of barbed wire or another overhang should form the top of the fence. The total height, excluding overhang, should be at least 8 feet. Modifications that may be made in this fence that will not seriously affect its permanency are the use of creosoted poles for all but corner and gate posts, and creosoted cypress (pecky for economy) planks, 1 by 6 inches, instead of the concrete base.

SEMI-PERMANENT FENCE

The ordinary semi-permanent fence (fig. 3), generally used where the degree of protection it affords is sufficient, departs from the ideal in several respects. However, wire galvanized after weaving is preferably used. The posts are all wood, creosoted at the base if possible; the mesh of the lower course is 1 inch, and about 6 inches of this width is buried in the ground. The overhang if placed at the top of this strip is of the same mesh, for it is wasteful to use for an overhang mesh smaller than that which it surmounts, because small climbing vermin will go through the first openings they find large enough.

The upper course of the ordinary fence is of the familiar poultry netting (2-inch mesh), and the overhang (1 to 3 feet wide) at the top is of the same material. The height should be 8 feet but sometimes is only 7. It is well to have a supporting strand of barbed wire along the top to keep the fence in better shape and especially to resist the weight put on the netting by sleet storms. It may be

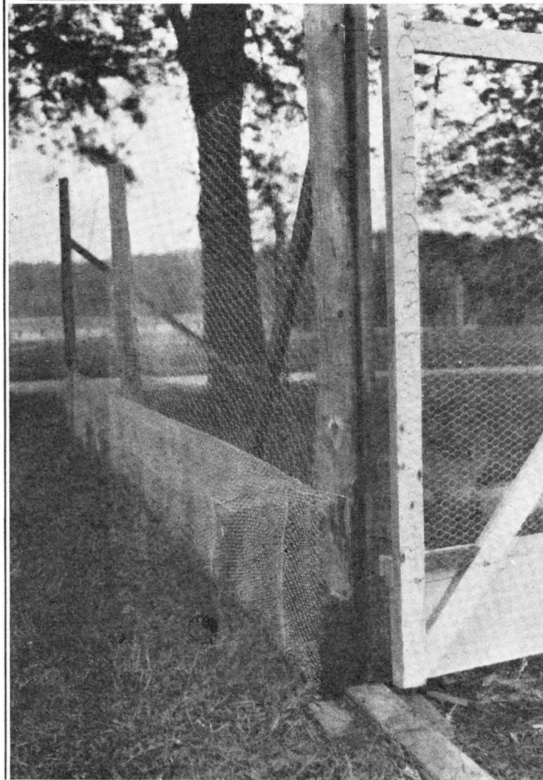
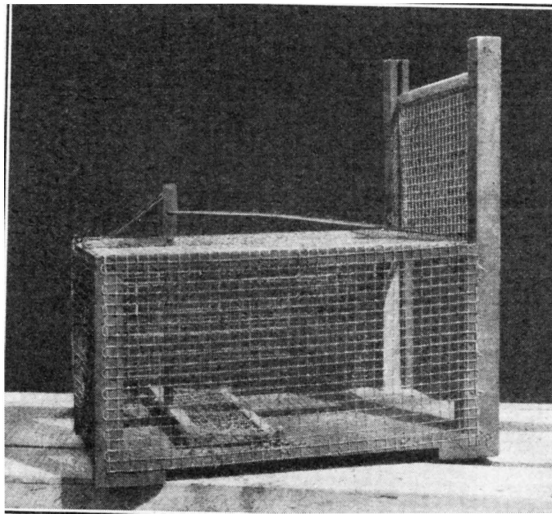


FIGURE 3.—Semipermanent vermin-repelling fence B26976

necessary also to reinforce a netting fence with barbed wire strung where horses, cattle, or hogs may come in contact with it.

TEMPORARY FENCE

Where the vermin problem is not serious or where general activity against predators keeps them under such control as not to involve too great risks, temporary or portable fencing is used to advantage. The supports for such fences are light poles put in holes made with a crowbar. The lower course (3 feet) of the fence is of 1-inch mesh (sometimes closer when it can be afforded) that has a single furrow



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FIGURE 4.—Evans vermin trap. This trap is 14 inches high, 17 inches wide, and 24 inches long. The front standards are 27 inches tall and contain a slot three-eighths of an inch wide and five-eighths of an inch deep. The door measures 15 by 12 inches. Door and treadle (6 inches wide) have the edges soldered in folded strips of heavy zinc. Mesh is five-eighths of an inch square, heavily galvanized. All screws are brass, the spring phosphor-bronze, and the levers iron. The corner posts are tinned inside and the whole trap dipped in paint. The small triangle of tin on the far standard falls across the slot when the door is down and prevents it from being raised.

turned over its base. The upper part (6 feet) is poultry wire without overhang. The two strips of mesh are pinned together with nails. This fence can be quickly and easily moved from one field to another and, on account of the frequent rolling and general wear and tear that it undergoes, for economy it is usually made of wire galvanized before weaving.

TRAPPING⁴

Theoretically, a vermin-proof fence should make trapping unnecessary. Unfortunately such fences rarely are entirely proof against natural enemies, and, if so at first, seldom

retain perfect effectiveness. Predators having once entered the game farm or subsidiary inclosure, it is necessary to combat them directly, and trapping is a favorite method. Traps are indispensable aids in controlling vermin, but their use is often turned to abuse. Care should be taken as to where and when they are set, and as to how long they remain set. A set trap is dangerous 24 hours a day every day, and will catch other creatures just as effectively as those particularly sought. It should not be placed, therefore, where it will be a menace

⁴The limits of this bulletin prevent giving specific instructions for trapping various kinds of animals. These may be found in general works on the subject of trapping, a list of which may be had upon application to the Bureau of Biological Survey, U. S. Department of Agriculture. State laws relating to the protection of fur-bearing animals, many of which are on the game breeders' list of vermin, are summarized in a Farmers' Bulletin that can be obtained from the U. S. Department of Agriculture.

to other than the offending animals. It should not remain set after danger has passed. While set it should be inspected at least once daily so as to shorten the period of the captive's sufferings and to permit release of innocent creatures. This last consideration makes traps that catch their victims alive and uninjured preferable to traps that kill or that cripple when they do not kill. A decided advantage of such traps is that stray game birds getting into them can be restored to stock.

TRAPS FOR GROUND ENEMIES

The Evans vermin trap illustrated in Figures 4 to 6 is ideal for ground enemies, since it can be built in any desired size and captures without injuring. Probably the best way of disposing of destructive animals caught in this trap is to shoot them with a small-caliber pistol, which can be carried in a

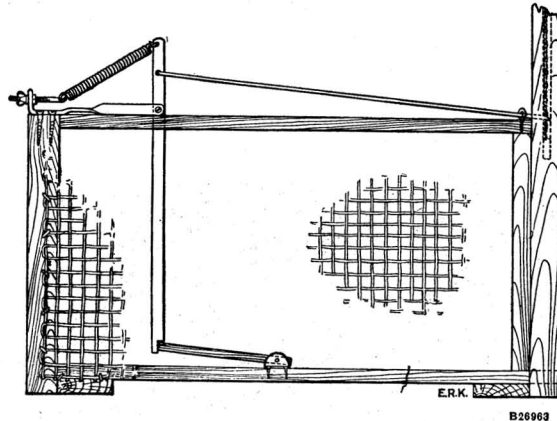


FIGURE 5.—Operating parts of Evans vermin trap



FIGURE 6.—Evans trap set along fence

pocket without inconvenience. Harmless snakes, frogs, toads, rabbits, and other innocuous animals caught in this trap can be released alive if inspections are made daily, as they should be.

The Evans trap is very effective when set with one side close against a fence. (Fig. 6.) Sometimes a stake is placed against the outer

frame of the door to hold the trap firmly against the fence and to support a short wing of wire netting flaring off to another stake to direct into the trap animals that might otherwise pass a few feet away. Sometimes the trap is set with the mouth against an opening in the fence, and so hooded over with wire netting that entrance into the trap is the only possible course. Ordinarily no bait is required, but should its use become desirable it can be wired to the back wall of the trap.

Other traps that capture animals alive are illustrated in Figures 7 and 8. The Melbrook trap is framed with channel iron, covered with wire mesh, and provided with a door and treadle of heavy-gauge sheet iron, thus being strongly constructed and all metal, an advan-

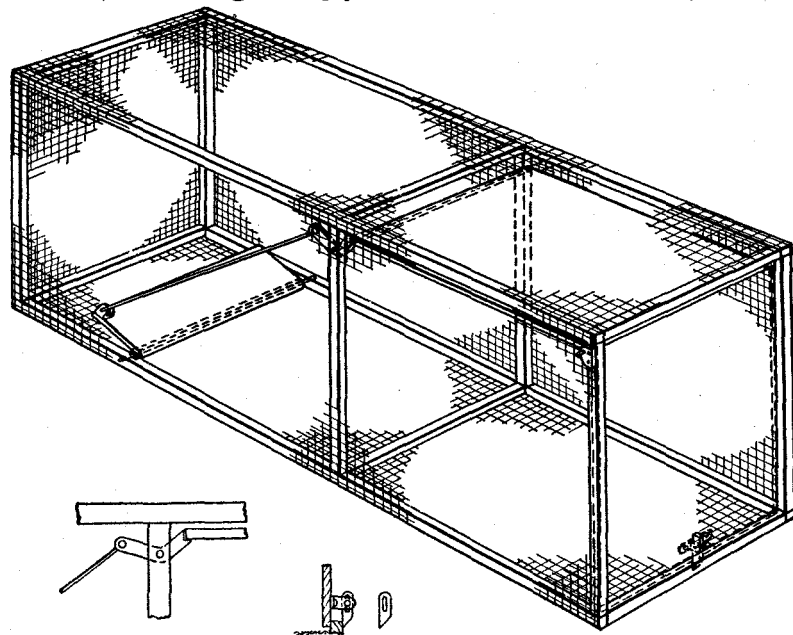


FIGURE 7.—Melbrook trap in set position; the door (under near half of top) falls when the treadle is depressed, releasing the trigger shown in separate outline drawing, and has a sliding bolt that catches on the frame and holds the door closed

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tage in preventing gnawing animals from getting out and in making the trap easy to clean. The Fooks trap (fig. 8), seen in Europe, is especially useful for setting along fences or in comparatively small spaces likely to be the runways of predators and is said to be most effective when covered with brush. It is a tunnellike box about 40 inches long and 8 inches square, which is always open at both ends and set except when it contains a captive. It contains two treadles each approximately half as long as the box, which are covered with sheet metal to prevent rats from gnawing out. The remainder of the inner surface also can be lined with sheet metal or wire mesh if necessary. The treadles are thin at the outer end and fit snugly against the floor in the set position. They pivot at about the middle, and an animal passing this point tips them up at the outer end, which

remains raised because of a wire wicket slung underneath, which catches on the floor and prevents the outer end of the treadle from coming down, and which in the fully vertical position holds the treadle firmly up against the top of the entrance. The treadle occupying the other half of the trap operates instantly as the captive passes the middle. A door on the top at the middle gives opportunity for inspection through the netting roof or lining.

In certain cases it is necessary to vary the method of trapping, and then ordinary steel traps can be used. These are probably the best devices for use against rats⁵ under buildings and other structures. Great care must be taken, however, to set these traps where game birds can not get into them. In burrows under objects and in holes where the birds can not go the trap may be set without special protection. Elsewhere it may be put under a box with a notch cut

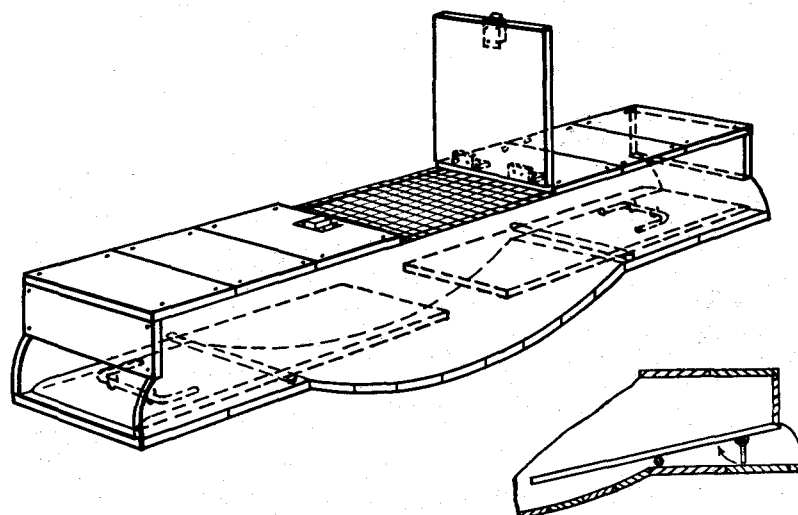


FIGURE 8.—Fooks trap. The middle section of the bottom need not be round, but can be broadly V-shaped

in the edge, under a troughlike shelter made of three boards, or under a cover improvised from wire netting, in each case, however, with the entrance to the trap so small that the birds can not get in. All such sets are best made along fences where ground vermin are prone to run. Ground traps of all kinds should be kept out of rearing fields where there are small game birds.

TRAPS FOR BIRDS OF PREY

Winged enemies also have been combated chiefly by use of traps. The most common device is an ordinary steel or jump trap set on the flat top of a post or pole and fastened to it by the chain of the trap. These traps instantly kill small birds getting into them and usually are the cause of lingering death to larger species, which in

⁵ Full information on the control of rats is contained in the following publication: SILVER, J. RAT CONTROL. U. S. Dept. Agr. Farmers' Bul. 1533, 21 p., illus. 1927.

their struggles fall with the trap from the top of the pole and hang head down until death ensues. Birds that do retain their perch on the top of the pole usually have one or both legs injured so that it is necessary to kill them. These troubles can be obviated in part by having the chain of the trap attached to a large ring around the pole or a smaller one on a wire that will slide to the ground when the trap is moved from the top. This permits the release alive of any useful bird that has not been crippled by the first grip of the trap.

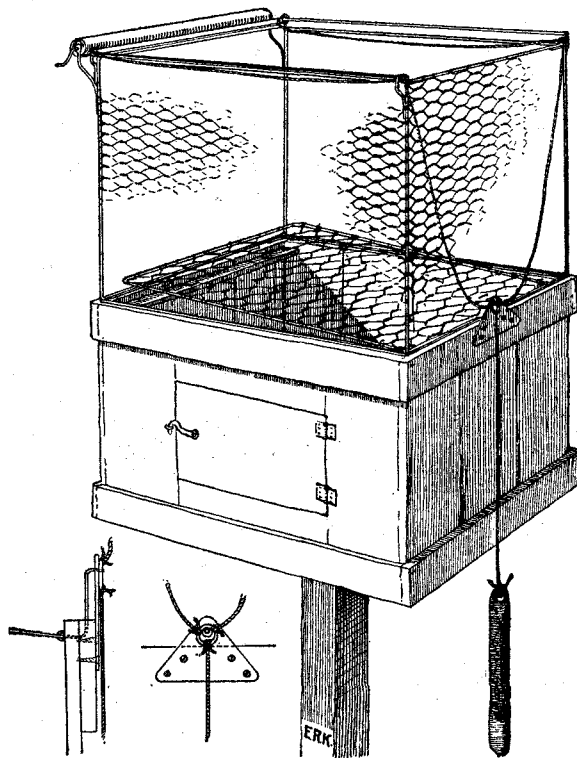


FIGURE 9.—Basket trap for hawks. A live chicken or pigeon is kept in the lower part of the trap for bait. A hawk endeavoring to strike the fowl depresses the wire netting floor of the upper part of the trap, releasing the weight, which pulls over the top of the trap the rolled curtain shown at the left.

As ordinarily used pole traps are objectionable in several respects. Not only should the number be reduced to the minimum but also the objectionable features of those kept in use should be lessened. Breaking the legs of larger birds can be prevented by wrapping the jaws of the trap near the ends with hard cord of sufficient diameter to keep the jaws well apart when sprung. This will hold the larger birds but will permit the escape of such smaller ones as are not disabled or killed when struck by the jaws of the trap.

The indiscriminate killing of various small birds is the greatest fault of pole traps. If the traps are kept set at

all times, a number of small birds will be killed to every hawk captured. It is a painful experience to make the rounds of a game farm and find flickers, red-headed woodpeckers, kingbirds, and bluebirds dead in the pole traps. Such destruction of innocent birds not only constitutes unnecessary cruelty but is also wasteful of these useful birds' lives and in most cases is a violation of Federal or State law. The killing of small birds by pole traps can be obviated, in part, by setting traps too heavy for such birds to spring them. Another device is to put a pad of cotton under the pan that will compress under the weight of a larger but not under that of a smaller bird. Both

legal and humanitarian considerations require that the use of pole traps be carefully regulated. If moderation in using them is not observed, legislation entirely forbidding their use may be expected.⁶

Devices that make it possible greatly to reduce the number of pole traps and at the same time to retain the effectiveness of those used against predatory birds are (1) tapering the tops of most of the fence posts to a point, and (2) guarding flat-topped posts by inserting in each an erect, slender wire to prevent large birds from perching upon them. If all the ordinary fence posts are so treated and only selected posts or poles provided with traps, the large birds will be driven to the latter when they seek to alight. Some hawks habitually perch to watch for prey, and while these are the species least destructive to birds, they are the very ones that are most frequently caught in pole traps. The bold, dashing bird hawks are more apt to come skimming over the tops of fences and pounce without a pause upon the first victim that offers.

Because of their selective destruction of the less harmful hawks, and of their danger to bird life in general, pole traps should be abolished as rapidly as practicable. Traps that capture birds alive should be substituted for them, so that harmless species can be released. Suggestions for such a trap are given in Figure 9. A cage with live hawks or owls in it attracts other birds of these kinds, and may be placed near a pole or basket trap to decoy such visitors to the farm.

SHOOTING AND OTHER METHODS

The patrolling of the game farm by an armed man with a well-trained dog is probably as satisfactory a method for the control of diurnal enemies as can be had. This conclusion rests on the supposition, however, that the man knows his business and does not blaze away at everything alive on the place except the game birds. The man can be and should be selective in his war on enemies. His presence, together with an occasional shot from his gun, should have a strongly deterrent effect on the visits of winged predators, and his watchfulness and activity should strictly limit depredations by ground enemies. More crows and hawks can be killed by using an owl decoy and by shooting from a blind or cover than by other methods.

Where patrolling is carried on, scarecrows (fig. 10) may have some value. When manlike figures are always stationary, birds become accustomed to them, but when there is also some patrol work, with moving about and shooting, the warning effect of the stationary figures is much greater.

The Clove Valley (N. Y.) Rod and Gun Club has found that it pays to keep a good stock of cottontail rabbits as a first line of defense against enemies on areas stocked with game birds. Foxes, weasels, and certain other predators seem to prefer the rabbits or find them easier to catch; accordingly rabbits are imported into the preserve every year.

CONTROL OF CROWS

Crows are combated by poisoning or shooting. An egg into which powdered strychnine has been stirred through a small hole, after-

⁶ They are now outlawed in New Jersey.

wards pasted over with paper, is put near a nest that crows have found, provided always that this bait is out of the reach of children or domestic animals that might eat it. Another device is to put out a false nest with a few hen eggs and surround it with several steel traps concealed in loose litter. With a blind and crow call, and especially with a decoy owl in addition, crows can be lured within gunshot, and sometimes many of them disposed of in a short while.⁷

CONTROL OF SNAPPING TURTLES

It is best to eradicate snapping turtles from a body of water before using it for rearing wild fowl. Seining with a net having a well-weighted lower edge is the best method of removing the turtles wholesale and is most effective in the spring before vegetation has become so dense as to interfere with dragging the seine. So far as possible snags and other obstacles should be removed beforehand.

In a large pond where seining may be impracticable, or in special cases, other means of dealing with snapping turtles may be needed.

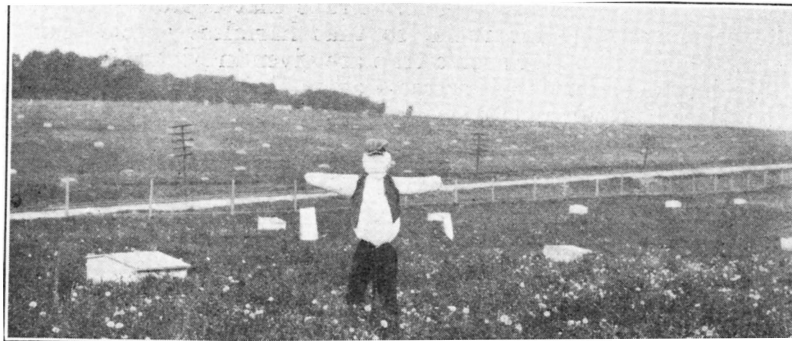


FIGURE 10.—Scarecrow in rearing field. The inner support is a crosslike frame. An outer stake is inserted in head. Bright sheets of tin, so arranged as to turn with every breeze, are suspended from ends of arms

As these animals take bait readily, set lines kept in constant operation will help to reduce their number. Each set line may be prepared as follows: Anchor with weight and line a well-stoppered empty bottle that will make an easily observed float. To the bottle attach a large fishhook on a wire of sufficient length to keep the bait out of reach of the waterfowl and bait the hook with tough meat. By keeping a number of such set lines working and inspecting them regularly the number of turtles can be greatly reduced.

An effective turtle trap may be constructed as follows: Place a slab or plank 6 or more inches wide and several feet long in water frequented by the turtles, preferably near shore, so that the lower end touches the bottom and the upper extends 1 or 2 feet above the surface, providing a gradual slope up which the turtles may crawl for sunning themselves. A pound net should be built under the exposed upper end, the walls projecting above the surface of the water

⁷ Further information on means of controlling crows may be found in the following: KALMBACH, E. R. THE CROW IN ITS RELATION TO AGRICULTURE. U. S. Dept. Agr. Farmers' Bul. 1102, 20 p., illus. 1920.

and made of such material and construction that the turtles can not escape from it. When suddenly alarmed, turtles on the plank will drop off into the pound where they can be captured with a dip net. Another form of turtle trap is illustrated in Figure 11.

SHIPPING AQUATIC GAME BIRDS

Ducks, geese, and swans are constituted sufficiently different from typical upland game birds to make it desirable that the containers for shipping them differ in important particulars. As these birds do not jump against the top of a crate, a fender is not needed. It will do no harm, however, to have the top lined with burlap, and a crate with only burlap for a top has been used successfully. Aquatic game birds make much more use of water than do the upland species,

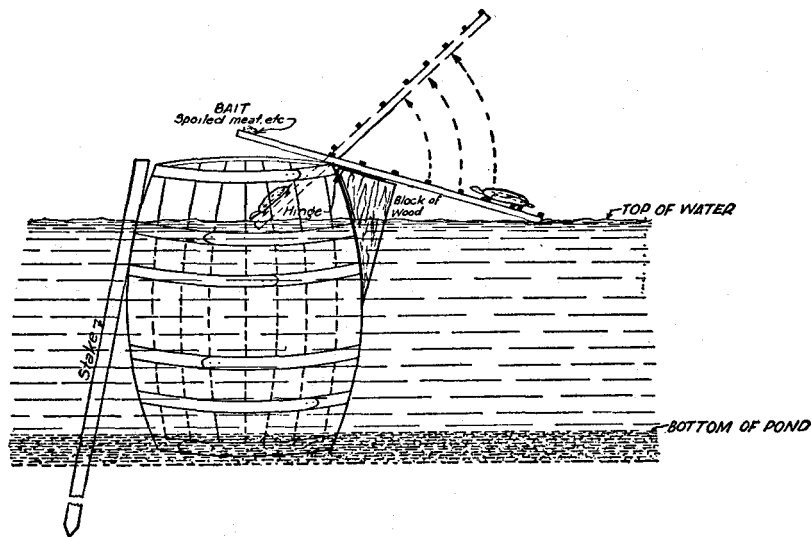


FIGURE 11.—Turtle trap. The board should be attached to the barrel by a free-working strap hinge, and almost on a balance. Cleats on the tilting board make the trap more effective

and this need must be provided for. The feces of these birds are copious and moist, and objectionable fouling of containers is sure to occur unless it is guarded against.

A basket or hamper may be used for shipping a few individuals of some of the smaller aquatic game birds for short distances. The climax or market-basket type, of which large and strongly built models can be had, is convenient. Such a container is light, and the prominent upstanding handle reduces the chances of its being thrown about and also prevents piling other objects on top of it. The basket can have holes to admit air and light, but these should be so small that the birds can not possibly stick their heads through them. The top should be close-fitting and firmly fastened.

Mallards, the most commonly propagated aquatic game birds, have been shipped in ordinary poultry crates, but with the added protection of a burlap lining and straw bedding. In general, propagated

birds are too valuable to take undue chances on during shipment, and it will pay to construct for them well-adapted and substantial shipping containers. Correct shipping methods are especially necessary for aquatic game birds, as their general tendency to delay breeding after any change in environment may be made worse by terrifying experiences in transit.

A type of shipping container successfully used by a game farm that has shipped aquatic game birds to practically all parts of the world is illustrated in Figure 12. This crate made on the same pattern for all birds, but varying in size for the different species, is made of $\frac{1}{2}$ -inch lumber; the front is covered with $\frac{1}{2}$ -inch-mesh wire netting, and the top with strong burlap. Numerous quarter-inch holes are bored in the ends for ventilation, and in the bottom for drainage. Drainage is further facilitated by placing four cleats of $\frac{3}{4}$ -inch material across the bottom, thus holding it clear of the supporting surface. The problem of drainage has been solved in another way also, by making the bottom of strong wire cloth of $\frac{1}{4}$ -inch mesh. Two zinc trays (6 by 8 inches and 2 inches deep) are

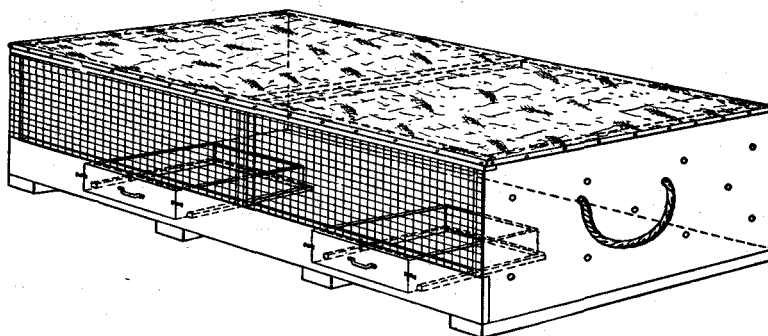


FIGURE 12.—Crate for shipping aquatic game birds

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fitted to slide in guides from the front where each is fastened in by three door buttons. These are used for food and water, and the edges of the water tray are turned over a quarter of an inch inside to check spilling. In an extemporized shipping box for short transport a spittoon wired into the corner makes a good nonslopping water container, and an ordinary poultry food hopper firmly fastened in, and charged with enough food and grit for the trip, will take care of the birds' needs in these respects.

Sizes of the crate described as suitable for small, medium, and large birds are as follows: (1) 30 inches long, 18 inches wide, and 10 inches high; (2) 36 inches long, 24 inches wide, and 15 inches high; and (3) 48 inches long, 36 inches wide, and 24 inches high. Whatever sort of shipping container is adopted or improvised, a few general principles should be observed. The container should be so built that it will have a definite and easily recognized top side or even so that it can not possibly be set on that side, in order to minimize the risk of overturning. Also the top should be distinctly marked: "This side up," "Handle with care," "Do not delay," "Live birds, rush," "Keep in a cool dry place," "Please water," or with similar conspicuous signs. Light should be admitted to the container, but

there should be no holes through which the birds can put their heads and no openings about the lower sides or bottom through which their feet might slip. The inside should be high enough to permit the birds to stand fully erect. The floor should be thickly covered with some form of absorbent litter (dry peat moss, straw, shavings, excelsior, or the like) and a supply sent along for renewal on long trips.

The food ordinarily given to the species concerned should be used, although for birds in transit it is better to err on the side of bulky rather than of concentrated foods. Grit is a necessary and charcoal a desirable element to include for traveling waterfowl. Oats, bran, and chopped hay are good bulky foods for geese and other large waterfowl. Small grains and green foods should be given the smaller ones. Chopped roots, vegetables, and firm fruits may be substituted for green foods. Full instructions for feeding, watering, and other care of the birds should accompany the shipment, when

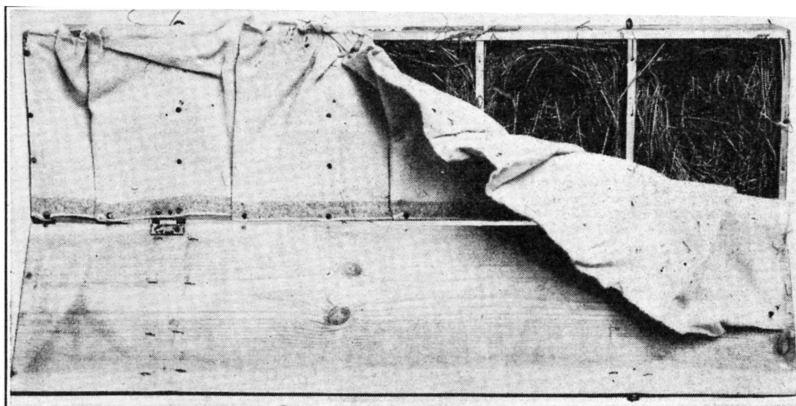


FIGURE 13.—Shipping box for day-old ducklings. Dimensions: 28 by 7 by 4½ inches. The flannelette is tacked down and screw eyes are wired together before shipment

uninitiated persons must be depended upon for these duties. Aquatic game birds require a fresh supply of water as often as feasible, and green foods should be given to all the vegetarian species whenever available. Special foods for the largely or wholly carnivorous species will have to be provided as a rule entirely in advance.

Large lots of birds on an extended trip, or other especially valuable shipments, should have a caretaker traveling with them. In other cases arrangements for their care can be made with transportation companies, and advance notice of shipment should be given by mail or telegraph. Different species of birds or different sizes of young should not be mixed in the same crate, as the larger birds may fight and injure the smaller. Quarrelsome individuals and geese and swans in general, except mated pairs, are best shipped singly, in separate compartments or crates.

Day-old ducklings are sometimes shipped to points that they will reach in 24 hours; the container used is like that for day-old pheasants (fig. 13), except that not nearly so much hay packing is put in each compartment.

SHIPPING EGGS AND YOUNG

Duck eggs as a rule do not travel very well. When shipped, each egg should have an individual wrapping. Some shippers wrap the eggs in two long strips of newspaper, one applied at right angles to the other; others twist them up tightly in wisps of hay. The outer packing for these individual eggs may be shavings, excelsior, hay, or similar shock-absorbing material. Mallard eggs are sometimes shipped in poultry-egg crates, but the best containers are baskets of the oblong grape-basket or the round peach-basket types. Both are light and suggest careful handling, and neither can readily be stacked with heavier objects.

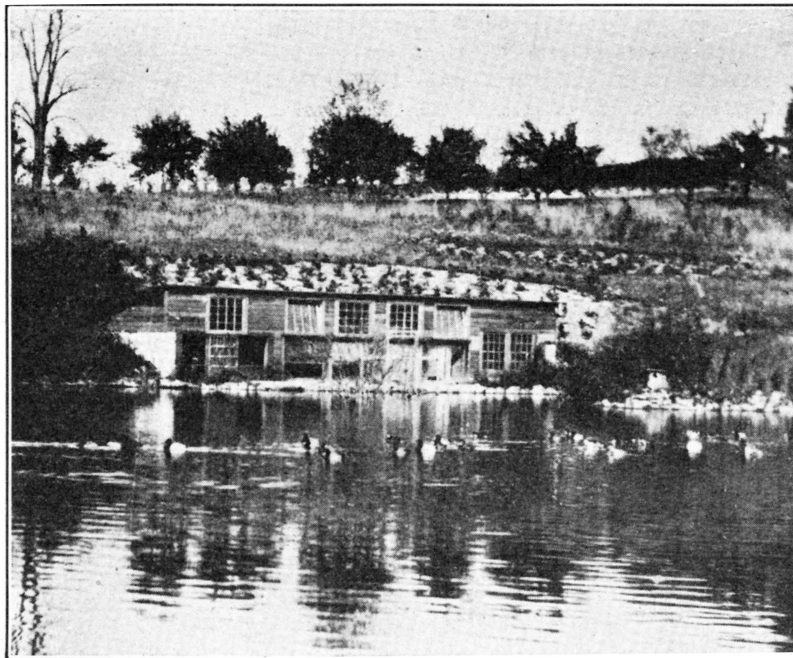


FIGURE 14.—Wintering house for aquatic game birds

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WINTER SHELTER

Shelter for the birds in severe winter weather is desirable in most places and essential in the North. Where only occasionally needed, it may consist of low, thatched hutches with abundant dry litter on the ground underneath. These should be closed on three sides to keep out snow, and the birds may be trained to use them by having feed scattered inside. Ducks usually will succeed in keeping part at least of the water available to them from freezing by their constant swimming, but where this is not easily done, it is better to provide a house of one of the types described below that inclose a pool for the birds.

In climates with moderately cold winter weather the shelter problem may be solved by building a house in the water, the under-water portion of wire cloth of mesh too small for ducks to get their heads

through, and the above-water part of frame construction with plenty of south-facing windows to let in the sun. Water seldom freezes in such houses, and the ducks winter perfectly in them. It is best to have one end of these houses extend upon land, where dry quarters

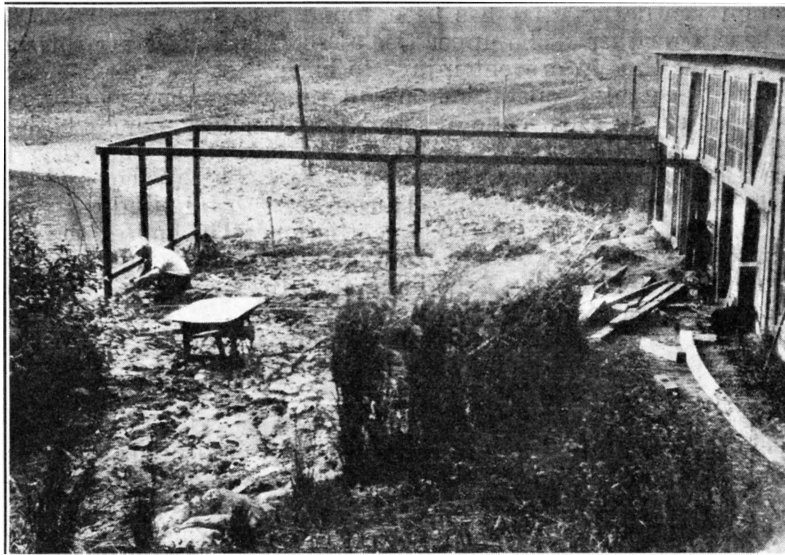


FIGURE 15.—Wintering house for aquatic game birds. Construction of the outdoor swimming inclosure B30899

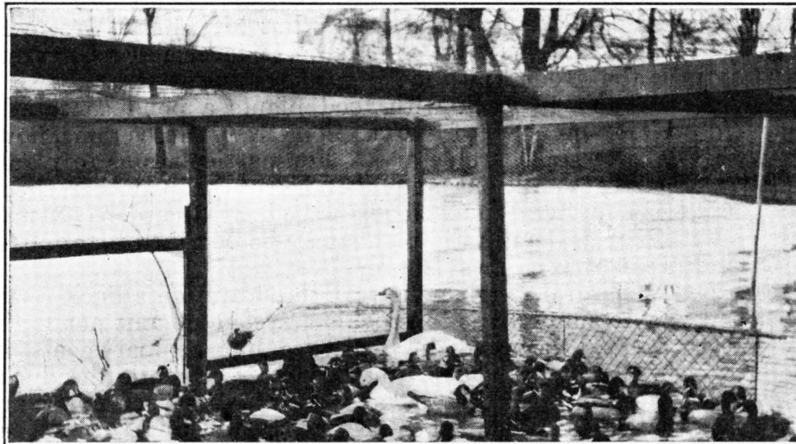


FIGURE 16.—Wintering house for aquatic game birds. Outdoor swimming inclosure in use B30898

will be available to the birds when needed. Windows only on the south side are the rule in all duck houses, but ventilation is a necessity except in the severest weather.

The house illustrated in Figures 14 to 16 will provide adequate shelter for wild fowl in regions where real winter is the rule. It is

built wholly on shore, with a netting-inclosed extension into the water at one end. The shed on shore is much on the plan of a poultry house, with the floor and lower walls of concrete. The south side consists chiefly of windows, while the others are almost solidly inclosed. There is a small window in each end, however, to aid in the thorough ventilation that has been found necessary in all but the most severe weather. The upper tier of south windows are screened with wire netting to prevent injury to birds that may dash against them while catching operations are in progress. The windows of the lower tier are each made of two hinged sections, one or both of which can be folded up and fastened for ventilation when desired. These sections contain wire netting (no glass), which is covered both outside and inside with burlap. Thus even with all windows closed there is some of the indispensable ventilation. The end of the floor adjoining the outside extension is occupied by a swimming pool fed by running water. Exit to the outer pen, the mesh sides of which are flared outwardly at the bottom and weighted with stones, is through sliding windows. The door for the use of the keeper is in front between the pool and the floored section of the house.

PLANTING

Planting is of importance in relation to the vital needs of shelter, nesting sites, and food. Fences may be covered with Japanese honeysuckle, bittersweet, or woodbine, or may be screened with hemlock or arborvitae; the latter plants are excellent also for a wind-break along shore. Marsh valuable for summer shelter and nesting sites can be made by planting cat-tails, but plants producing some duck food should be preferred, as bulrushes and other sedges, wild rice, wild millet, and other grasses. Cover for nests on shore can be furnished by any tall grasses and weeds, but low shrubs are more desirable, as broom and waxmyrtle. Trumpetreeper and other vines sprawling over the ground also make good nesting cover.

It is impracticable to stock with food plants a pond constantly frequented by large numbers of ducks. Something can be done, however, with a lake of considerable area. For particulars as to plants adapted to various conditions and methods of propagating them, consult bulletins on wild-duck foods issued by the department.⁸ These and a list of dealers in the plants may be obtained by application to the Bureau of Biological Survey.

Green food or natural roughage is very important on a duck farm, and a good way to supply it is to provide a system of unit ponds; in other words, a canal or broad ditch divided into compartments, in some of which plants can be growing under screen while the ducks are allowed to feed in the others. The best plants for such ponds are water cress, waterweed, coon tail, duckweeds, and musk grass (described in Department Bulletin 205).

BREEDING STOCK

The United States Department of Agriculture has no game birds or their eggs at its disposal, and notwithstanding press notices to

⁸ See U. S. Dept. Agr. Tech. Bul., No. 634, FOOD OF GAME DUCKS IN THE UNITED STATES AND CANADA.

the contrary never has distributed any of them. Some of the State game departments from time to time distribute certain game birds or their eggs, but the regular sources of supply are game farms and commercial dealers. Addresses of these can be obtained from the Bureau of Biological Survey, United States Department of Agriculture, Washington, D. C.

To obtain initial stock of aquatic game birds from the wild, it is necessary to have permit from the Bureau of Biological Survey for capturing the birds. (See paragraph on Licenses, p. 2.) Beginning with wild stock involves delays while the birds are becoming accustomed to restraint, which can be avoided by using propagated stock.

Breeding stock should be obtained in the fall, so that the birds may be settled in their quarters before the breeding season, which comes rather early in the spring. Even if they do not then breed, the owner should not be unduly disappointed but should remember that not all birds will breed during the first year of life or of captivity.

Birds received after a long trip should not be allowed to visit the pond, as their plumage will not be oiled and in good order and they will get water-soaked. If feathers of newly arrived ducks seem to be dirty, give the birds a pan of tepid water on a sunshiny morning; when they have again gotten their plumage in good order they may be liberated to visit the water. Feed the birds with especially nourishing food until they recover from the hardships of travel.

The production of fertile eggs is the basis of success in breeding any game bird, and difficulty in this respect has been the greatest obstacle in the case of all but a few species of wild fowl. Success with species usually slow to breed seems to depend on keeping birds, if of wild stock, long enough for them to become reconciled to their loss of freedom, and whether of wild or propagated stock, on giving the birds ample space for them to pair naturally and find suitable cover for their nests, and on allowing the necessary degree of isolation in a sufficiently natural environment. Endless patience is essential.

Hand-reared stock is a universal desideratum, and duck breeders can save one another tedious and disappointing delays by cooperating in sharing such stock.

PINIONING AND WING-CLIPPING

Stock purchased from dealers will arrive either pinioned or wing-clipped, and usually it is necessary to perform one or the other of these operations on all birds intended to be kept as breeding stock. Wing-clipping simply means shearing off the principal flight feathers, or primaries, well away from the flesh of the wing, and it is necessary to repeat the operation at least annually after the regular molt in midsummer. Pinioning means cutting off the last section (the fingers) of the wing to which the long flight feathers are attached.

To pinion an adult bird, raise the thumb of the wing (at base of last joint) and tie a cord tightly around the last joint well up under the thumb. (Fig. 17.) Have ready some tannic acid in powdered form. With a pair of strong sharp scissors or pruners,

or with a knife, block, and mallet, clip off the joint close below the cord, removing all or nearly all the long flight feathers or primary quills. At once take a pinch of tannic acid and press it firmly into the wound to check bleeding. Glycerite of tannic acid (liquid tannic acid, 1 part; glycerine, 4 parts) also is used for the purpose. This seals the wound and gives good results. The cord should be removed a few days later when the wound is healing. Pinioning should never be done shortly before the breeding season. If full-winged birds must be rendered flightless at this time, merely clip the primaries of one wing.

Pinioning ducklings is very simple. Operate when the birds are 4 to 7 days old, if in good condition, snipping off the last joint with

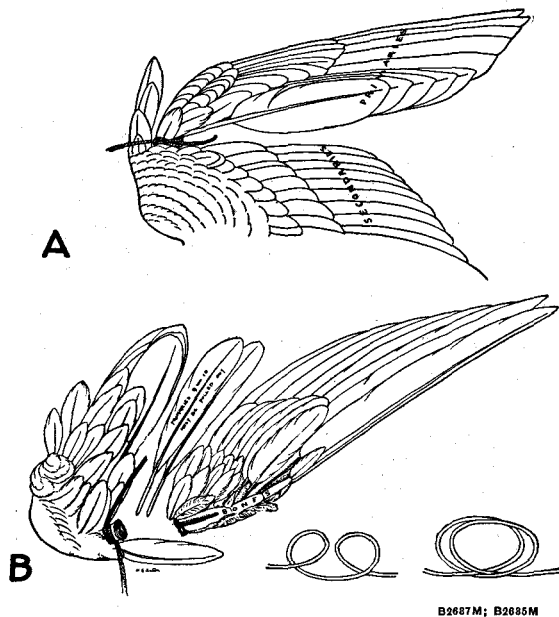


FIGURE 17.—Method of pinioning. A, Upper side of wing showing flight feathers separated from secondaries, and tied just within point of amputation; B, underside, showing place of amputation and form of knot used

scissors and dipping the stump into tannic acid. Bear in mind that a pinioned bird never can fly; so if flight is likely to be desired at any time, it is better to continue the clipping of flight feathers.

Only one wing should be pinioned or clipped.

MALLARD DUCKS

The mallard, sometimes called stock duck, because it is the source of most domesticated varieties, is reared as a wild duck also in larger numbers than any other species. The bird occurs naturally almost throughout the

Northern Hemisphere, and its tolerance of a wide range of conditions no doubt is one of the principal factors in its superior adaptation to domestication. It quickly becomes accustomed to captivity and is a persistent and successful breeder. These qualities, together with the wider market for this popular species, easily give it first rank among artificially reared aquatic game birds.

REARING METHODS

The rearing methods here described may be applied on either a large or small scale, but they are of the type found suitable for quantity production. They involve proper domiciling of the breeding stock (see sections on pond, rearing field, nesting sites, etc., pp. 2-5), so as to insure maximum egg production, collection of all eggs, hatching them usually under hens, sometimes in incubators, and

growing the young on rearing fields (pp. 3-4) until they are large enough to be liberated on the same general pond with the adults. This is the standard method, but mallards may also be reared "dry" exactly like pheasants. The dry system is little used, however, on account of the greater difficulty experienced in keeping the birds near the wild conformation. Mallards are prone anyway to degenerate into the barnyard type, and avoidance of overfeeding and careful selection of breeders must constantly be practiced.

FEEDING ADULTS

The first information needed by the prospective duck farmer who has the necessary ponds, shelters, and other features mentioned under "General Considerations" (pp. 2-5), and who has obtained initial stock, is on how to feed his birds.

The staple food for adult wild ducks on game farms is whole oats and mixed small grains, as wheat, barley, buckwheat, scratch feeds, and mill wastes. A mixture of weed seeds and broken rice, which can be obtained from rice mills, has been used with satisfactory results, and waste from other types of mills no doubt will serve. Little corn is fed, as a rule, and that chiefly in winter; when corn is used it should be cracked. When the weather permits, scatter the food in water, as this gives the birds their natural feeding conditions and leaves no food where it is likely to attract rats. With proper feeding, however, little or no food should be left over.

The ducks are fed twice a day, morning and evening. Forcing foods are universally used for some time before and during the breeding season; the same rich foods also are often used in winter and in special cases for birds weakened by exposure or other cause. The special rich foods are given in the form of a scalded mash, the bulk of which may consist of alfalfa meal, bran, middlings, barley meal, ground corn or oats, with a liberal addition of beef or fish scrap. Feed the mashes only crumbly moist and no more of it than the birds will consume at once. The same mixture dry, however, may be kept available to the birds throughout the breeding season, being put in a trough or hopper sheltered from rain. Good results have been obtained also by using chopped fresh fish or live minnows as a forcing food.

Roughage is desirable at all times, the best being aquatic plants, which may be grown in sufficient quantities in the pond most frequented by the birds if it is large enough; otherwise the system of unit ponds mentioned under planting (p. 20) may be used. Aquatic plants also may be gathered from any convenient source and thrown into the feeding pond. In the total absence of such plants, chopped-up grass, weeds, lettuce, or spinach, or even chopped roots and vegetables, may be used. Plenty of coarse, sharp grit should always be accessible to the birds, and it is well also to keep before them a mixture of ground-up oyster shells and charcoal.

CARE OF EGGS

Eggs are sometimes purchased when duck breeding is started, but they do not always bear shipment well. Better results are obtained from hatching the eggs of a well-acclimated stock of adult breeding birds, preferably individuals themselves reared in captivity.

Wild ducks lay early, and it is necessary to be prepared to care for the eggs in March and April. When the eggs are collected regularly, mallards will lay from 25 to 40 eggs each breeding season. Striving for maximum egg production involves the necessity of careful selection of breeders and keeping their average age at about 2 or 3 years.

Ducks are likely to lay early in the morning, and it is well to make the daily search for eggs by 9 a. m., so that the eggs will not long be exposed to possible attacks by vermin. Considerable skill developed by experience is necessary to find all the nests, some of which may be very cleverly concealed. To keep the duck laying in the same nest, substitute eggs of various types are kept in the nest until the bird ceases to lay. Some breeders substitute hen eggs, on the theory that since there usually would be more hen eggs than duck eggs in the nests, they would bear the brunt of any attacks by vermin. Others have found that if even a hen egg is eaten in a nest the duck will desert, and have resorted to wooden eggs of approximately the same size and color as those natural to the nest.

In gathering eggs, baskets and buckets are the usual containers, and when all the eggs are collected they are taken direct to a store-room, where tables with a thick layer of sand, oats, bran, or other poor conductor of heat await them. It has been stated that sawdust, shavings, and excelsior are undesirable for this purpose, as they contain some oily matter, which may clog some of the pores of the eggs and interfere with respiration of the embryo. The eggs are placed on the tables in rows touching one another and are turned twice daily, morning and evening. In order that the handler may know which eggs have been turned, the more pointed ends of all should be placed in the same direction the first day.

A dry, cool cellar is an ideal storage place for eggs, and when the temperature ranges from 40° to 50° F. they may be kept safely for a fortnight before setting. When a cellar is not available the storage room used should be dry, and sunlight should be largely excluded.

Putting all eggs through this curing process and not setting them direct from the breeding cages, except in an emergency, contributes to uniform hatching. Time and energy will be saved, as a rule, by allowing eggs to accumulate until enough are on hand to set all the available hens. When there are more hens than are needed for one rearing field, set only enough to produce young birds up to the full capacity of that field. Eggs abnormal in any way should be rejected. It is customary also to reject a few of the earliest as well as of the latest eggs laid by each individual bird, as they are likely to prove infertile. Rejected eggs may be sold or used in food mixtures.

HATCHING COOPS

Hatching coops for duck eggs may be the same in every respect as those used for pheasants. A few types are described here, but the styles used are almost as numerous as the game farms using them.

For convenience and economy hatching coops are so planned that they can be used not only for housing the hens while they are incubating but also later when they are moved to the rearing fields

to brood the young birds. The hatching coop illustrated in Figure 18 is 2 feet square, 23 inches high in front, and 12 inches at the back. The slatted door (1 foot high) is so constructed as to close, or, if slid to one side, to expose all openings between the slats forming the front of the coop. These slats are spaced so that the ducklings can run freely in and out of the coop, but so as to confine the hen. When it is desired to release her the sliding door shown at the left of the picture is raised.

The roof of the coop is 30 inches wide and 31 inches long and is provided with cleats on the lower side about 4 inches from each end that fit inside the walls of the coop and hold it in place. It should be nearly or quite rain-proof. The coop is made of $\frac{7}{8}$ -inch material and may look clumsy and heavy, but there is good reason for this construction. Storms do not easily unroof or overturn the

coops and they stand wear and tear better. The roof should be weighted if necessary to prevent strong winds blowing it off. The advantage of its being rain proof and wind proof are obtained also by pyramidal construction of coops; or sometimes fibro-cement slabs are used for tops.

In the view showing the interior of the hatching coop (fig. 19) is the nest holder, a frame 5 or 6 inches high and 16 inches square. One

of these frames is used to hold the nest in shape, and a second is placed on top of the other at hatching time to prevent the tiny young from scrambling away from the warmth and shelter of the hen, which are so necessary to them at first. The hole in the upper front of the coop shown in Figure 19 is for administering sprays.

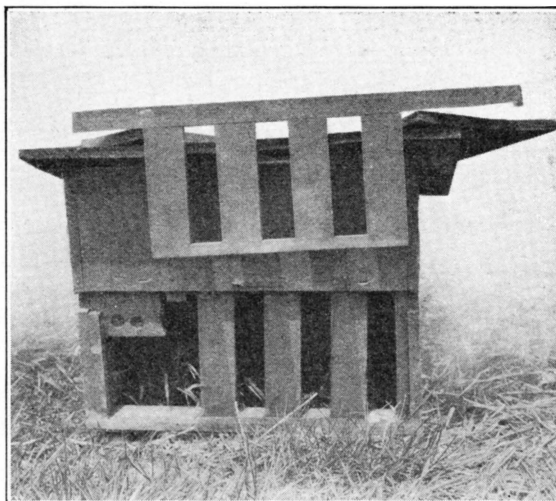


FIGURE 18.—Hatching and brooding coop ^{B26969}

EXERCISING RUNS

For convenience and economy of time the hatching coops are arranged in rows with space at the sides about equal to their own width, and sufficient in the other direction to allow for a path and to accommodate the exercising runs. (Fig. 20.) These runs are simple frames, 36 inches long, 27 inches wide, and 23 inches high, covered with chicken wire on top and with 1-inch-mesh netting on two sides and one end. The top is removable, and the drinking cup is attached to the frame. These runs fit the front of the hatching coops and

provide a place where the hen can exercise, be fed and watered, or confined whenever it is desirable to exclude her from the hatching coop. A similar coop and run are illustrated in Figure 23 also.

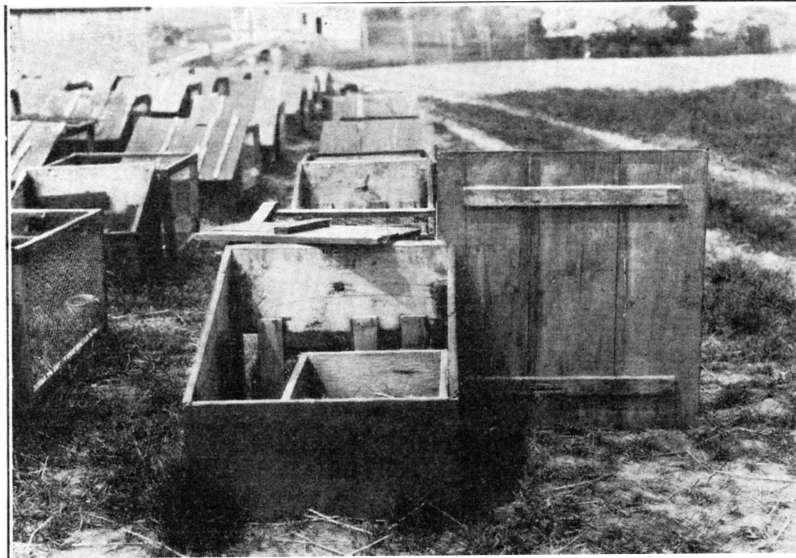


FIGURE 19.—Interior of hatching coop

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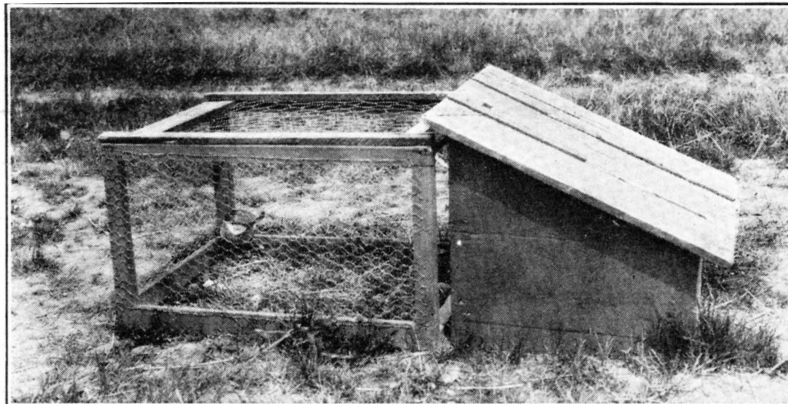


FIGURE 20.—Hatching coop with exercising run

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COMBINATION COOP

A combination hatching coop and exercising run is illustrated in Figures 21 and 22. The body of this is 30 inches square and is provided with two cleats on each side, so placed that a partition slid in them will divide the interior into two approximately equal compart-

ments. The corner posts are $1\frac{1}{2}$ inches square and the cleats of $\frac{7}{8}$ -inch and the walls of $\frac{1}{2}$ -inch material. The door on the side, 8 inches square, is hinged at the bottom and fastens with a button at the top.

The front of the combination coop is of 1-inch mesh, with a 3-inch slat across the bottom hinged to open upward, thus providing a place for the young birds to pass through. The button mounted on the block at the left side (fig. 22) holds the slat in position when fully opened. The coop is 18 inches high in front, 20 inches at the middle, and 15 inches at the rear.

The roof overhangs all around, and the back section is hinged and strengthened beneath by three cleats cut so as to hold it firmly in place when closed, the upper two fitting inside the body of the coop, and the lower one outside. The front half of the

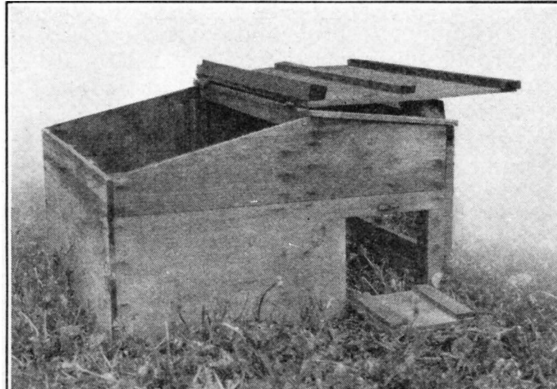


FIGURE 21.—Combination hatching and brooding coop (side)

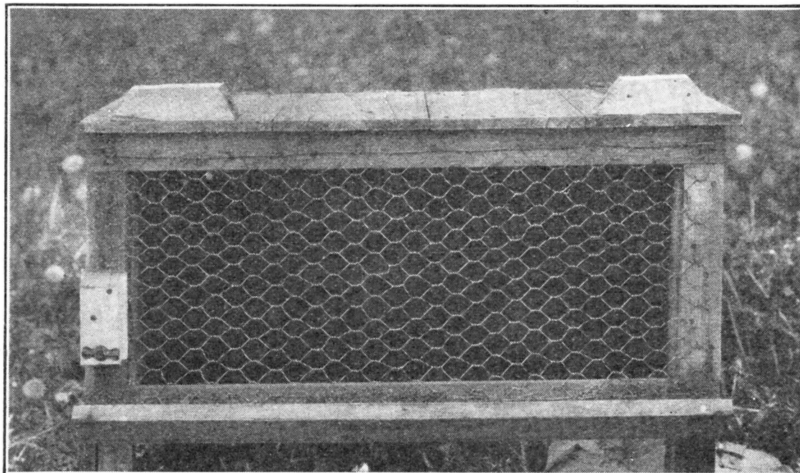


FIGURE 22.—Combination hatching and brooding coop (front)

roof is provided with two blocks upon which the rear half rests when open. This prevents undue strain on the hinges, and makes a level surface on which the caretaker may place anything he may wish to set down for a moment.

Setting boxes instead of hatching coops are used by some breeders and usually are built according to the battery system. In the simplest

form nesting boxes are built in units of six compartments each, which have ventilating holes on three sides and a door in the other. Small feeding boxes in a series built to correspond are placed against the hatching boxes and the hens transferred to them for feeding and watering. The feeding boxes have a slatted front and a trough along it for the reception of food. Hatching coops can be kept out of doors without other shelter, in which case the eggs usually do not need to be sprinkled with water. At one game farm it was found that a common feeding and exercising run for the hens was best, as the birds thus mingled were placed on different nests from day to day, and the effect of differences in their body heat thus being equalized, a more even hatch was obtained.

Aggregations of these hatching boxes are sometimes placed in a hatching shed that has removable sides, so that it may be kept cool. For the same reason the floor of the shed, the hatching coops, and other things in the shed are sprinkled daily in hot weather. The turf or peat used for the foundations of the nest in the boxes is saturated with water at the time of building the nest, and in unusually hot weather the eggs are sprinkled occasionally.

An item of equipment sometimes accompanying the batteries of hatching and feeding boxes is a box of six compartments, each with a sliding top, which, loosely filled with straw, is used in transferring the young from the hatching shed to the rearing field.

MAKING THE NESTS

After the hatching coops or boxes have been disinfected by being dipped in an antiseptic solution, as of carbolic acid or creosote, or by thorough spraying with a commercial louse killer, a square of sod should be taken up and some of the soil removed from the under side so as to permit formation of a slight depression. This sod should be thoroughly drenched with water and placed on that where the coop is situated, giving enough elevation to assure that no damage will be done by heavy rainfall running in. Over the sod a smooth nest of straw or hay should be formed, dusted well with pyrethrum powder, and lined with grass clippings well worked in. Care should be taken to see that the nest is still well formed and smooth a day or two before hatching time.

INCUBATING

Preferences vary as to the type of hen to use for incubating eggs, but in general unfeathered legs, small size, and quiet disposition are desirable qualities. Hens obviously affected by scaly leg or any other fowl malady should not be used. With suitable broody hens on hand, it is well to accustom one for a few days to each hatching coop that it is planned to use. Putting in a few hen eggs may persuade her to adopt the nest, but these should not be replaced with duck eggs until the hen seems well settled down to her task. When satisfied regarding this requisite, place the eggs in a single layer in the nest, 8 or 12 of them according to the size of the hen, dust the hen thoroughly with pyrethrum powder, and allow her to return to the nest. Inspection in a short time will reveal whether she has properly adopted the eggs; and if so, she may be left in peace. If the hen

does not promise to be a good close sitter, the eggs should be given to another at once.

During the 23 to 29 days' (average 26) incubation period, the hen should be carefully removed from the eggs and liberated in the exercising run once daily at a regular time, fed sparingly, and watered. Boiled whole corn, or scratch feed, grit, and charcoal should be her ration. If the day is warm she may remain off the eggs for an hour perhaps, but if cold or wet, the period should be decidedly reduced. The nest should be inspected daily for the purpose of removing broken eggs, washing soiled ones (in tepid water without soap), or rearranging the nest and eggs if not in the smooth and orderly condition necessary to get best results from the body warmth of the hen. It may be necessary also to turn the eggs, as not all hens attend to this necessary detail. The eggs should be sprinkled daily with tepid water. Hatching coops on the ground have an advantage in relation to moisture for the eggs. Care should be taken to keep close watch for lice, for if these become numerous they will annoy the hen so that she may give up brooding. In such case the coop should be disinfected, the nest renovated and powdered, and a new hen put on the eggs as soon as practicable. Meanwhile the eggs may be temporarily cared for in an incubator or in a flannel-lined basket by the kitchen stove. As a matter of routine, the hen should be dusted with pyrethrum after about 10 days of incubation, and again a few days before hatching time. Pure pyrethrum powder is insisted upon because some of the louse-preventive compounds contain ingredients that have been found injurious to young birds.

When incubators are to be used, larger numbers of eggs should be accumulated. The incubator should be run at a temperature of 103° F. and carried to 104° during hatching. The eggs should be turned, aired, and sprinkled with tepid water daily, and the air in the incubator should be kept moist by the evaporation of a never-failing water supply. Incubators are sometimes used to hatch eggs incubated under hens to prevent loss of ducklings by trampling.

Young hatched in incubators, as soon as dry, should be put under broody hens so that they may learn to nestle before being placed on the rearing field.

HATCHING

As the day approaches when hatching may be expected, the first signs of pipping should be watched for. From this time until the young birds are all hatched and thoroughly dry, the hen usually will stay continuously on the nest and should not be disturbed. The second story of the nest frame described in the section on "Hatching Coops" (p. 25) should be placed about her; this will prevent the tiny young from scrambling away from the hen, when they may perish from cold. Until the hen leaves the nest voluntarily after hatching she should not be fed or removed for any reason. She should have full charge of the young for 24 hours after hatching is completed. They do not need food at this time.

REARING

Shortly before the rearing field is needed for use single swaths should be cut in it from 50 to 100 feet apart. The hatching coops

should be spaced 50 to 80 feet apart in the swaths, so as to allow for moving them 3 or 4 or more feet daily for 8 to 10 days. The shorter grass in the swaths makes the work of the keepers in moving coops, watering, and feeding far easier and renders it less disagreeable on dewy mornings. The coops can be kept close to the uncut grass, so that the ducklings can easily reach it when taking cover. A little banking of soil around the coop is sometimes necessary to prevent water from draining into it. The coops should be placed on the rearing field a few days before needed, and in fine weather, so that the ground under them will be dry.

After the 24-hour drying period, the hen should be removed with her brood (the hen in a sack, the young in a covered basket well filled with straw) to a coop in the rearing field. The hen is then confined to the coop, which for the first three days should be provided with a small run made of three boards a foot wide to keep the young from straying. The lower edges of these boards and the walls of the coop should fit the ground closely and have no holes through which the ducklings can escape. The runs should be covered also with wire netting and either set in partial shade or provided with screen (small homemade "tables," 4 by 6 feet with 18-inch legs, are good) against the strong, direct rays of the sun, exposure to which will quickly kill the young birds.

Confining the young for three days gives them a chance to get well acquainted with their foster mother, and what is especially important, to learn her calls. Some breeders maintain that this can be accomplished by shutting up the birds for a few hours with the hen in the rearing coop. After the fourth day the board run should be removed and the position of the coop changed a few feet every day.

Hens seem prone to scratch more than usual after the irksome confinement of the incubation period, and scratching in the rearing coop is dangerous to the young birds. Some breeders prevent it by setting unfloored coops on burlap bags for the first few days, while others floor the coops with wire netting or even boards.

The hens are confined to the coops at all times on the rearing field and fed whole corn (best boiled), grit, and charcoal. The young are weaned from them at the end of three weeks and placed in subdivisions of the rearing field with plenty of shade available.

Contrary to popular impression, ducklings when brooded by hens do best if kept away from water until their bodies are well feathered; that is, until they are about 8 weeks old. When brooded by ducks their plumage is kept oiled, and wetting does not hurt them. At earlier stages whenever their plumage begins to be fouled let them bathe in shallow pans of tepid water for a short time on warm, bright mornings.

The regular supply of water may be furnished safely in good-sized baking pans lined with green turf that is then barely covered with water. This prevents the ducklings from getting their backs wet (thus guarding against chilling and more serious disorders) and gives them employment probing mud and nibbling grass. The water should be shaded, and frequently and completely renewed to keep it cool and wholesome.

At 8 weeks of age all ducklings may be allowed to run together, a warm morning being chosen for their introduction to the pond where

they are to mature. For the first few days they should not be allowed to stay in too long, but should be driven into the dry compartment of an inclosure consisting of a wire cage in the water and a shed on shore. This should be their permanent feeding and roosting place, where they can be penned whenever wanted.

FEEDING DUCKLINGS

Fine grit, mixed with a little ground charcoal, should be before ducklings from the very first, as well as water in drinking fonts in which they can dip only their bills. The first feeding, when they are a day old, may be finely ground hard-boiled egg mixed with cracker crumbs or rolled oats, and a little sand, the mixture being no more than crumbly moist. The foster mother should be fed with grain to prevent her taking all the ducklings' food. For the same reason, as soon as the ducklings have learned to eat, it is better to feed them outside the coop.

Feeding at first should be in small quantities and as often as five times a day. In a few days the meals can be cut down to four and later to three. After the first day a good feed is 3 parts oatmeal and 1 part commercial duck meal, scalded and fed only crumbly moist. Sprinkle in this mixture somewhat less than a tenth its bulk of coarse sharp sand and about a quarter by bulk of hard-boiled eggs, ground shell and all.

After one week the base of the food may be varied with barley meal, bran, and middlings. Continue this a week, then gradually reduce the egg until at three weeks none is given. At this time add good beef scrap until it forms 10 to 15 per cent of the food, and begin giving in the mash small mixed grains, which can be increased in quantity and size as the ducklings grow. Little corn is given until the birds are practically grown. Abundant chopped green food, as grass, lettuce, and rape should be given from the first; nothing is better for the purpose than water plants, especially duckweeds.

OTHER DUCKS

No fewer than 27 species of North American ducks have been bred from captive parents, and several others have been reared in captivity from eggs or young taken in the wild. Some have been bred only a few times and with difficulty, but gradual increase in knowledge of how to handle the birds indicates that a number of the species can eventually be bred as extensively as desired. The great desideratum in all cases is establishment of a breeding nucleus of hand-reared birds. Possessing such a stock the experienced breeder will hardly admit that there are any further serious obstacles to success with most of the species.

The rearing methods outlined for the mallard (pp. 22-31) are best for quantity production. In most respects they can be adapted to rearing small numbers of ducks, but it is possible in the latter endeavor to adopt refinements of method and special treatment for individual species that have been found helpful in efforts to breed them.

PENS

When it is desired to keep a variety of species of waterfowl breeding true, or if the collection includes birds of markedly different sizes (the larger of which are invariably, and even dangerously aggressive), separate inclosures should be constructed for the different kinds or at least sizes, each containing both land and water. It is well to have more of these fenced areas than will be actually in use at one time, so that empty ones can be renovated and a growth of grass or other green food restored. It is an advantage to have the subdivisions screened by dense hedges, and if space permits shrubbery should be included in each to provide the shade and cover the birds so evidently appreciate.

CONTROL OF ENEMIES

With smaller numbers of birds greater precautions for the control of enemies can be taken because of the usually smaller areas involved, and such precautions are often highly desirable also on account of the much greater value of the stock. On the farm where mixed species of valuable waterfowl are being reared, a vermin-proof outer inclosure should be regarded as of first importance. Inner partitions and pens should also be vermin-repelling, and traps of the type taking live captures should be constantly set, and, be it not forgotten, constantly inspected to permit the release alive of game birds or other innocent victims. Hatching boxes without bottoms may be guarded by being put in an inclosure of vermin-proof fencing, which for greater safety should have a complete floor of wire mesh buried in the earth. Hatching and rearing coops also may have a solid board floor and substantial door, so that they may be entirely closed at night. When such hatching boxes are used greater care will have to be taken to give the eggs plenty of moisture.

How the point of view alters cases is shown by the fact that the mallard, the principal object of production on most aquatic game-bird farms, is classed as vermin by breeders of fancy ducks. The mallard is freely polygamous, and its tendencies in this respect have to be strictly controlled on game farms where the production of other species in pure strains is desired. In fact, at establishments specializing in the production of a wide variety of duck species, mallards, because of their promiscuousness, are regarded as a pest and so far as possible excluded.

CARE OF EGGS

One point to watch in egg production from especially valuable birds or those from which eggs are desired the following year is not to drain the female completely by continued removal of eggs from the nest. Her cycle of egg laying can be terminated by giving her a setting of mallard or even hen eggs, and if this is done, she is likely to produce normally the next season.

Frequently ducks being raised in small numbers are allowed to complete their first clutch and hatch and rear their own young. Under this system not so many eggs are laid, and while the method may serve in some cases, in general it is risky. Accidents of various kinds often cause considerable losses; the young may die from in-

sufficient nourishment or from too much bedraggling; in a word, they are less under control and can not be so well tended as those that are penned with hens. Some breeders compromise and allow ducks to incubate their eggs up to near hatching time, when they are removed and put under hens.

The period of incubation of some of the commoner American ducks has been reported as follows: Black duck, 26 to 28 days; teals, 21 to 23 days; pintail, 22 to 23 days; wood duck, 28 to 30 days; redhead, 22 to 24 days; canvasback, 28 days; and goldeneye, 20 days.

CARE OF YOUNG

In general, the care and incubation of eggs are the same as described for the mallard. In the case of the young, smaller inclosures are the rule, and it is seldom that the typical rearing-field

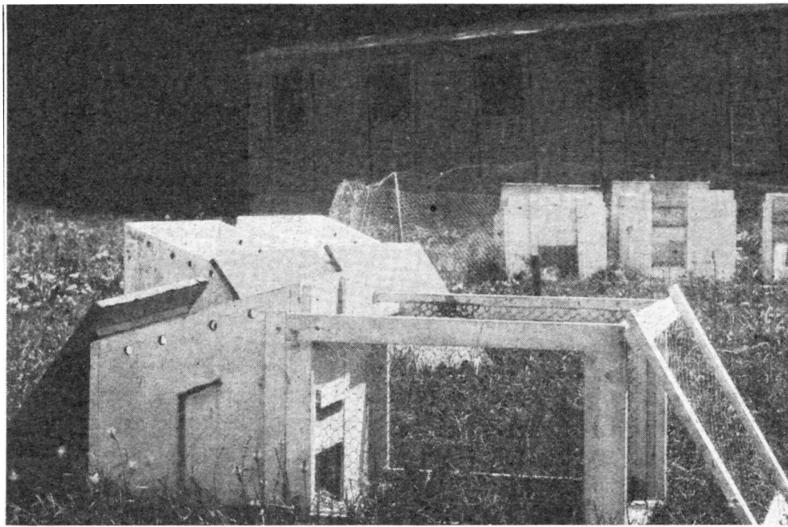
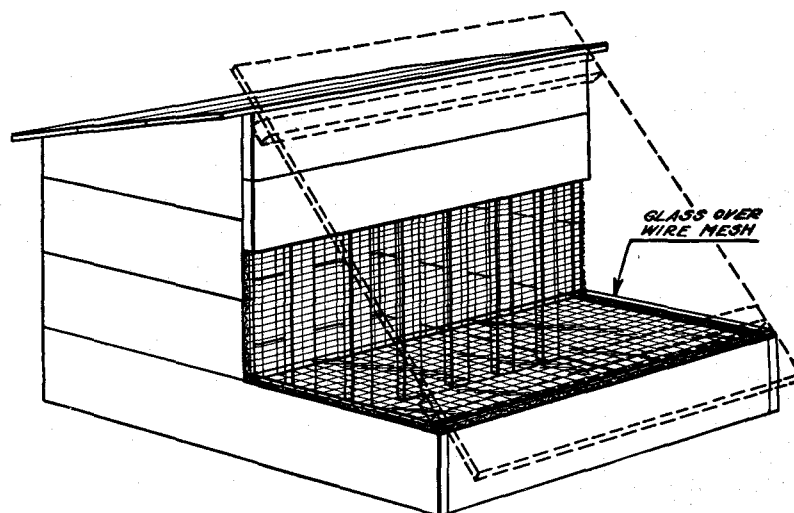


FIGURE 23.—Coop that can be used both for hatching and rearing; heavy construction makes for durability, coolness, and stability in windy weather. The small run in front of the coop may be used as an exercising range for a sitting hen or for ducklings their first few days; in the rear are coops in a temporary run of wire netting, and in the background a shed housing hatching boxes

system can be used, because young birds of different species, and even of distinct sizes of the same species, must be kept in separate pens on account of the tendency of hens to peck at and even kill young differing noticeably from the brood they have at the time.

The use of small inclosures hastily improvised is illustrated in Figure 23, as is also a somewhat different type of hatching and rearing coop and portable range from those figured in the account of the mallard. (Fig. 19.) A rearing coop adapted for use in cool climates is shown in Figure 24. A good type of small pen including grassy range, bathing pool, rearing coop, and small range is illustrated in Figure 25. The shallow concrete basin is especially commendable, as it is easily swept out and scrubbed clean.

Practice varies in respect to admitting ducklings to water from the first or at some more advanced age, and success has been obtained in both ways. When ducklings, especially small ones, are allowed access to water, however, there is added responsibility for seeing that their plumage does not become water-soaked, and greater care is necessary in cool or rainy weather. It may be necessary at any time to gather up a bedraggled brood, tuck them cozily in flannel, and warm them by the kitchen stove. A precaution that can be taken against wetting is setting unfloored rearing coops on burlap bags that will absorb moisture, and changing the bags each day. It has been found also that clipping off the tail feathers of ducklings greatly reduces the quantity of water they carry into the coop and thus keeps the hen drier in brooding them. This tail clipping is done at the



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FIGURE 24.—Rearing coop for cool climates. The roof (screen shown in outline) and two similar pieces (not shown) are of identical construction and are used for shade, shelter against winds, and otherwise as needed. The wire-topped runway is covered with heavy glass during cold or rainy weather. A glass plate can be used also to close the slat-and-mesh portion of the front above the top of the run

same time as pinioning and serves for some time as a convenient means of telling which birds have been pinioned.

Even when ducklings are put on water from the first, it is usual to provide only a small and shallow pool to start with, and to transfer them as they grow successively to larger pens with larger and deeper pools.

FOOD

Feeding may be more easily diversified for small than for large numbers of ducks, and it is more expedient to use commercial preparations. Mixed flocks of fancy ducks as a rule are fed richer foods than are the birds on a strictly mallard farm. The older ducklings and adults before and during the breeding season are given a mash rich in meat scrap or the like, according to some breeders the richer the better, expense being the check upon the quantity of ani-

mal matter in the food rather than any necessity for restriction so far as the welfare of the birds is concerned.

Animal food used includes meat scrap, both commercial and home-made from various sources, cooked liver, fish meal, chopped raw fish, ground raw or cooked rabbit, and even the bodies of birds and mammals killed as vermin. Ducklings are given such special foods as cleansed and scalded maggots, meal worms, and chopped earthworms. Duck farmers seem unanimous as to the great value of duckweeds for ducklings, and it is well to have at hand sources of an almost unlimited quantity of these. It has been found that grass clippings are a good substitute for duckweeds, and growing grass should always be available to ducklings.

In small-scale operations, commercial drinking-water fountains and hoppers for any dry foods given are being used more extensively. Fountains should always be shaded.

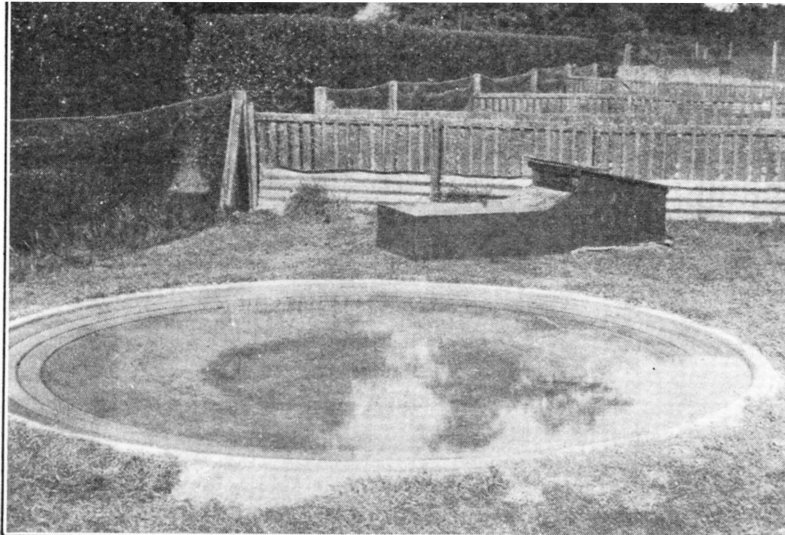


FIGURE 25.—Rearing coop and pool for ducklings in a small pen

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When the birds have plenty of range they will obtain a great deal of natural food and may require artificial feeding but once a day, except when being prepared for, and while actually engaged in, producing eggs and rearing young, and in winter.

NOTES ON SPECIAL GROUPS OF DUCKS

MERGANSERS

There appear to be no records of the breeding of mergansers in captivity. Probably the difficulty of providing their chief natural food, namely living fishes, is the chief obstacle to success with the fish ducks.

BLACK DUCK

The black duck, often called the black mallard or dusky duck, is of a more wary and nervous disposition than the common mallard,

but nevertheless has been bred in large numbers in confinement. Once a breeding stock of captive-reared birds is available, the black duck seems no more difficult to rear than the mallard.

WOOD DUCK

The beautiful wood duck is hardy in confinement and thrives even in small inclosures. At all ages wood ducks have surprising climbing abilities, which make it difficult to limit their movements. They are particularly inclined to roam at the approach of the nesting season, and for this reason unpinioned birds have an advantage, as they are better able to escape danger when roaming and can get back home more readily. Full-winged birds, if not disabled, may be depended upon to return to the place where they have been reared, and they are said to breed better than pinioned ones. Wood ducks usually breed only in nest boxes, which have already been described (p. 5). The ducklings are rather delicate at first and sometimes slow about starting to feed. It seems easiest to get them interested in something alive and moving, as fresh-water shrimp; in the absence of these, meal worms or scoured maggots might be tried if the mash continues to be ignored.

OTHER SHOAL-WATER, OR RIVER, DUCKS

In general, the shoal-water ducks are easier to keep and have bred much more freely in confinement than the deep-water species. The various teals and widgeons have been bred on every game farm that has had even a modicum of success, and the gadwall and pintail do well in captivity. The shoveler is said to require more animal food than the other species and probably prefers it in a finely divided form.

DEEP-WATER, OR DIVING, DUCKS

In a state of nature the deep-water ducks inhabit deeper water and partake more extensively of animal food than the shoal-water species. A number of the species have been bred in captivity, but on the whole they are much more difficult to rear than are the river ducks.

Conditions satisfactory enough to induce redheads and canvasbacks to lay at an Ohio establishment were afforded by half an acre of springy, flooded woodland, containing stumps, logs, tussocks, bushes, and an abundance of duckweed. The pond was inclosed by vermin-repelling netting and partitioned to separate the different species. Young redheads hatched under hens and reared with them for some weeks were returned to the pond and added to a brood reared by a female redhead, which adopted the newcomers without delay. This female redhead kept her own young away from the water for two days after hatching. It was necessary to trap owls about the woodland pond, and hawks were kept away by hanging up brightly colored papers.

Ducks of the scaup or bluebill group have been very resistant to efforts to breed them. Goldeneyes have been bred; they nest in boxes like the wood duck, and thrive if given plenty of ground fresh fish. The common eider seems to have tendencies toward domestication, evidenced by its nesting in dooryards and permitting handling in countries where its down and first clutches of eggs are harvested.

These birds have been bred by keeping them on a salt-water pond and feeding them entirely animal food, cooked or raw rabbit to the adults and chopped earthworms to the ducklings.

TREE DUCKS

Jean Delacour⁹ gives the following brief summary of his experience with tree ducks:

In very cold places they feel hard frost and it is wise to shut them up for the winter; but in the milder parts of France and England they may stay out all the year round except in unusually cold weather. Being as a rule very tame and non-migratory, they may usually be left full-winged and will not abuse the privilege. I must say that all those which I have kept full-winged for years, though they sometimes take flight, never stray away.

Imported birds (and almost all are imported birds) do not breed readily, but once young can be obtained in confinement, they reproduce themselves abundantly; each female lays about thirty eggs between April and August. The young are rather delicate and grow slowly. Both adults and young are fed like other ducks. They do not go into eclipse plumage and the sexes are identical and impossible to distinguish. As a rule they are inoffensive birds, but a few males may turn bully, which may be tiresome, but is not dangerous.

CANADA GEESE

The Canada goose is rather easily reared from pairs reconciled to captivity; the birds ordinarily are allowed to hatch their eggs and rear the young, which they do with an amazingly high percentage of success.

RANGE

Geese need room, and the ideal range should include a pond or a section of lake or sound shore, together with ample pasturage and some shade. Shelters other than natural cover are not required. Pinioned birds (and the primary stock of most breeders will be pinioned) need protection, especially from dogs. A dog-proof fence is needed about the breeding area at least, and if the goslings are to be protected from small vermin the lower 2 feet of the fence should consist of 1-inch-mesh wire netting or of boards, in either case with an overhang at the top of this section.

BREEDING STOCK

Propagated geese are more desirable as breeders than birds captured in the wild, for the latter may not mate and settle down to breeding for several years, whereas reared birds sometimes breed when 1 year old. Geese must be allowed to select their own mates. They remain mated for life, and it is advisable to handle them in mated pairs and not attempt to break or mix pairs. These birds live to a considerable age (50 years or more) and are better breeders in late than in early life. It is well to have room enough for the pairs to be well separated during the mating season, and other birds on the farm, especially young, should be kept away from the geese, which may attack them.

In localities where geese can easily glean a living in winter, it has been found that propagated birds will remain about their home, even if not pinioned. In most cases, however, it will no doubt prove

⁹ DELACOUR, J. *Avicultural Mag.* (4) 6 (2) : 43-44. 1928.

desirable to render the birds incapable of flight. Directions for pinioning are given on pages 21-22. (Fig. 17.) Family loyalty is so strong among geese, however, that usually all will remain if only one or two of each family are incapable of flight.

NESTING

Geese are somewhat temperamental about their first nest and should be left entirely undisturbed when mating and selecting their first nesting site. In succeeding years they more boldly select and hold their chosen home, resorting when possible to the site of former years. If the range has tussocks of grass, no nesting material need be furnished; in their absence it is advisable to supply hay or straw. Nesting takes place early in spring, and the number of eggs varies from 4 to 7, the usual number being 5. The female sits very close, and the gander zealously guards the nesting site. The incubation period is 28 to 30 days. During this time the birds must be fed and watered near the nest. Intensive breeding methods also have been successfully tried with Canada geese, two and three clutches of eggs being obtained from each pair. The extra eggs are hatched under hens.

CARE OF YOUNG

If on good pasture, where they can get all the green food they want, the goslings require little care other than that given by their parents. It has been found best to prevent them from getting into water until they are about 10 days old. During this period drinking water should be supplied in fountains in which they can dip their bills only. The water should be renewed frequently and kept in the shade. Shade is necessary also for protection of the goslings from heat.

FOOD

Geese are primarily grazers and can live indefinitely on pasture that will support cattle. Rye furnishes good winter pasture, and millet or mixed grasses satisfactory summer range. Before and during the breeding season, it is advisable to feed grain. Almost any kind will be eaten, but a mixture of 75 per cent whole oats and 25 per cent corn is recommended before egg laying, and just the reverse of these proportions during the incubation period. Oats and a little corn are fed regularly in winter, especially when pasturage is not available, and at this season cabbage, apples, turnips, and the like can take the place of green feed. Ground hay and alfalfa also are good.

Goslings as well as the adults can subsist wholly upon green food, but some breeders advise feeding them lettuce and stale bread moistened with sweet milk. This is laid on a board where it will dry up rather than sour, if not eaten. When the young are 10 days old and browsing actively, a supplementary ration of soaked oats, cracked corn, or scratch feed may be given. When they are growing their feathers, feed whole wheat. Keep a plentiful supply of ground oyster shells and clean gravel always available.

OTHER GEESE

All the North American species of geese, except the sea brant, have been bred in captivity. No special directions are necessary for the

care of these species except the emperor goose. As this northern bird can not stand heat, it does best in cool, humid localities provided with running water. The young must have plenty of cool water and shade. The emperor goose requires animal food, and the most successful breeder has used dried shrimps for the purpose. No corn is given.

SWANS

Although swans are classed as migratory game birds, there is no open season on them anywhere in the United States. One of our two native species, the trumpeter swan, is so rare that no permits are issued for trapping any swans in the region—British Columbia, Alberta, and Montana—where small flocks of trumpeters are still known to exist.

STOCK

Breeding stock of several species of swans may be obtained from dealers, a list of whom will be furnished if a request is addressed to the Bureau of Biological Survey. Swans are slow to mate and remain mated permanently. The only satisfactory way to buy them, therefore, is in guaranteed mated pairs. Under normal circumstances never separate the birds of a pair. It is necessary to pinion swans, as the birds are not sure to return home if allowed to fly. Directions for pinioning are given on pages 21-22. (Fig. 17.)

RANGE

Swans are large and aggressive birds and must be given plenty of space. If the available range is not large enough for the pairs to separate when they choose, thus preventing constant fighting, an ample pen should be wired off for each pair. The birds can not keep in good condition without access to water, and if a body of water is available large enough to maintain plant growth for natural roughage, so much the better.

FEEDING

Swans graze, but not so extensively as do geese. Grass, clover, and especially alfalfa are suitable green foods, and it helps a great deal if a growth of water plants is available to the birds. If not directly accessible, some of these plants should be gathered occasionally and fed, or such plants as lettuce, kale, and spinach can be substituted. Water plants are a very necessary element of food for the cygnets, or young. In addition to roughage, swans must have grain, and this is usually thrown in the water for them; any small grains will serve. Grain given to cygnets should be soaked over night; but oatmeal is preferable for them. In winter, clover and alfalfa hay, chopped roots, bran, oats, and a little whole corn may be fed. Bread and root vegetables cut in sizes convenient for swallowing also are sometimes given to them. Plenty of grit and clean water should always be available. Swans are slow feeders and should be fed apart from ducks, geese, or chickens. If this is not feasible, place their food in a pail on a box and wet it thoroughly.

BREEDING

Swans, like wild geese, are allowed entire charge of family affairs. They pair very deliberately, but for life. They are particular about nesting sites and are said to take most readily to small islands. If natural conditions do not permit thorough separation of the pairs, fences must be used. Adults not only fight among themselves, but will kill the young of other pairs. The incubation period of the whistling swan is 35 to 40 days.

WINTERING

Swans can winter in the Northern States in a shelter partially open to the south and deeply littered with hay or straw to protect their feet. Where their swimming pool does not freeze over, no winter shelter is required.

OTHER AQUATIC AND SEMIAQUATIC GAME BIRDS

Some species of rails, coots, and shore birds have been propagated in captivity but as yet scarcely on a scale interesting to the game breeder. The Bureau of Biological Survey, however, will gladly aid inquirers to get in touch with existing information on the subject.

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