UNITED STATES DEPARTMENT OF AGRICULTURE
MISCELLANEOUS PUBLICATION No. 58

WASHINGTON, D. C. NOVEMBER, 1929

MANUAL FOR BIRD BANDERS

By

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Associate Biologist, Division of Biological Investigations
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INTRODUCTION

The marking of birds with numbered bands and studies incident thereto constitute an important and an interesting field of ornithological research open to the student who has some leisure time. This method of investigation is fostered by the Bureau of Biological Survey—not to replace other existing forms, but rather to supplement them and permit attack upon ornithological problems from other angles.

At the end of 1928 more than 400,000 birds had been banded under permit in the United States and Canada by cooperators of the Biological Survey, and from these more than 19,000 usable return records had been reported to the bureau.

Bird banding properly done is neither cruel nor in any other way harmful. The weight of the bits of aluminum or copper from which the bands are made does not burden the birds, and if the bands are correctly placed there is slight danger of their becoming caught on twigs, thorns, or nesting material. The number of fatalities reported from this cause is so small as to be negligible.

As the bird-banding activities have advanced much experimental work has been done in developing suitable traps and other equipment. The great improvements thus far made in certain traps and the invention of others have reached a point where the information should be made available in a single publication for the use of bird-banding cooperators. During the period that bird banding has been a project of the Bureau of Biological Survey many types of traps have been figured and described in the mimeographed circulars Bird Banding Notes, issued to cooperators three or four times a year. The value of some of this equipment has been demonstrated, but other types and models require further testing before they can be definitely recommended.

Except as otherwise stated, the drawings, specifications, and other information included in this manual have been tested and can be followed without hesitation. Most of the traps are simple in construction, and anyone moderately skilled in the use of ordinary tools should be able to make his own equipment. This course is recommended, but for the benefit of those who prefer to purchase ready-made apparatus a list of dealers in banding equipment and supplies whose products have been successfully used has been prepared and will be furnished by the Bureau of Biological Survey on request.

Responsibility for success in developing bird-banding equipment rests not alone on the leaders but equally on the many careful and ingenious station operators who have given it attention. Grateful acknowledgment is here made by the authors for the cooperation and assistance rendered by these workers. In the preparation of this manual the plan has been to give each piece of equipment a name that is reasonably descriptive. In some cases, however, when a short, comprehensive name could not well be selected the trap or other device has been named for the person responsible for its invention or development.

Illustrations have been contributed from many stations. When the name of the photographer is not indicated the original is from either the files of the Biological Survey or the Baldwin Bird Research Laboratory.

HISTORICAL

Bird banding in America dates from the time of Audubon, who, about 1803, used silver wire to mark a brood of phoebes. He was rewarded in the following season by two of his marked birds returning to nest in the same vicinity. In the early part of the present century several banding or marking schemes were projected, one of which resulted in the organization in December, 1909, of the American Bird Banding Association. The work accomplished by that association, together with the development of the method of systematic trapping, demonstrated the possibilities of extensive banding operations. With a realization that the information obtained from banded migratory birds would be of great value in connection with the administration of the migratory-bird treaty act of July 3, 1918, the Biological Survey in 1920 took over the work of the American Bird Banding Association.

PRESENT BANDING METHODS

Under the direction of the Biological Survey, birds are obtained for banding mainly through the operation of approved traps. As many persons throughout the country regularly feed the birds in their vicinity, the establishment of trapping stations is comparatively simple, for a feeding station, whether on a window shelf or on the ground, may be transformed easily into a banding station. Productive stations frequently have consisted of nothing more than simple traps located on window feeding shelves. (Fig. 1.) Some cooperators have established stations with one or two traps in small yards, while others with larger grounds have been able to operate a

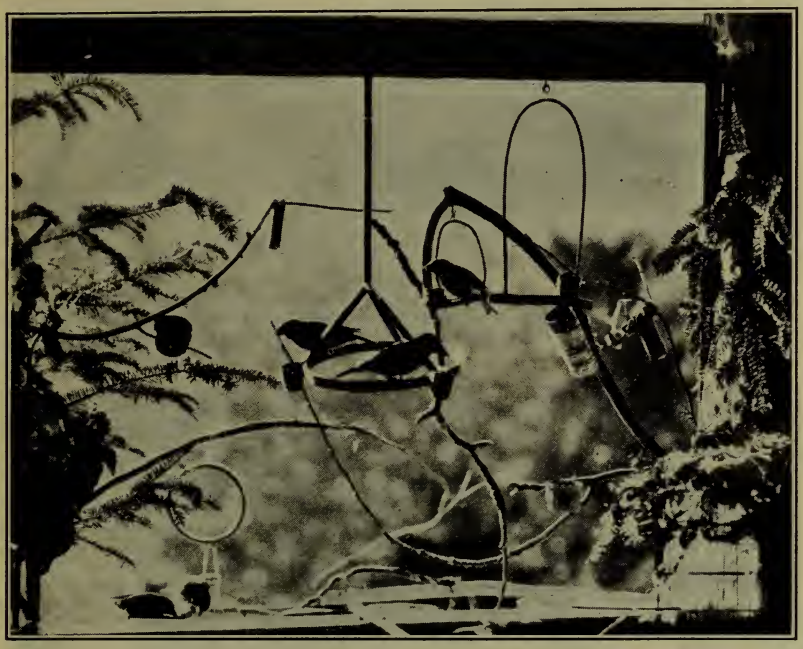

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FIGURE 1.—Window trapping station operated at Northeast Harbor, Me. The birds shown are purple finches; also a hummingbird at the extreme right. (Photo by the station operator, Mrs. Eleanora S. Morgan)

series of substations. (Fig. 2.) Such activities do not in any way detract from the value of these points as sources of food for birds. (Fig. 3.)

BANDING FLEDGLINGS

The banding of fledgling birds, except on the grounds of a trapping station, where the natural enemies of birds are usually kept under control, is not approved, and Federal permits will not be issued to persons who propose to engage in systematic nest hunting for this purpose. Experience has demonstrated that such work results in increased bird mortality, not because of injury to the young or through possible desertion by the parents, but because the human-

B3885M

FIGURE 2.—Trapping station operated in Frost Valley, Slide Mountain, near Oliverea, N. Y. A protected feeder is shown, with two drop traps, one on the ground and the other on a platform in the tree. (Photo by the station operator, Mrs. Florence K. Daley)

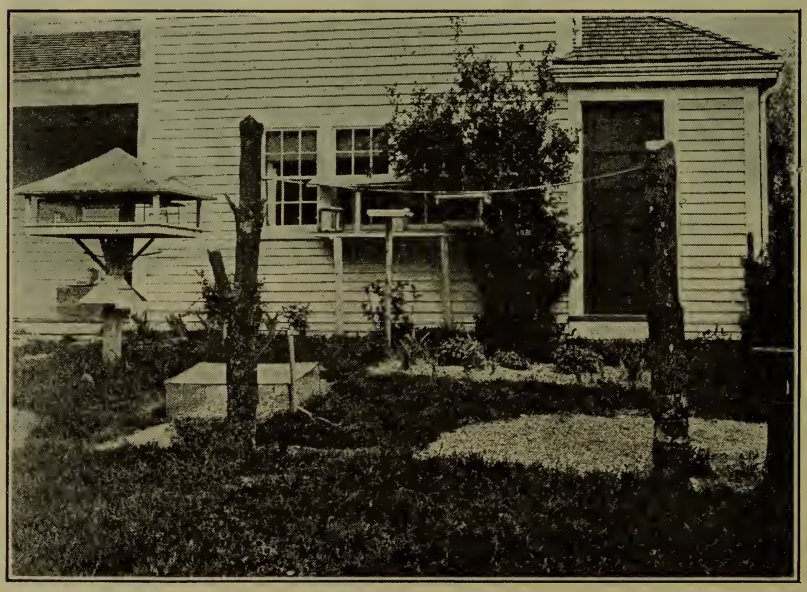

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FIGURE 3.—An efficient banding and feeding station in a small yard at Cohasset, Mass. From left to right, the equipment is: A "pagoda" weatherproof feeder, with zinc cat guard; on the ground, a collapsible drop trap (see fig. 8), operated from the window; on the window ledge, a 5-foot feeding shelf with a small trap; in front of the window, a feeding trap on a 4-foot pole; suspended between the two posts, another feeder hung on a wire; and at the extreme right, a 14-inch flowerpot saucer bath on a standard about 3 feet high. (Photo by the station operator, Charles L. Whittle)

scent trails unwittingly laid from nest to nest are afterwards followed by such small predatory mammals as house cats and weasels. Also, the returns obtained from banded fledglings are so few in number as to be of slight value. Ornithologists estimate that the normal mortality of young birds is about 50 per cent, so it is evident that if banding operations were confined to such birds, half the bands used would be wasted and half the original records would have no potential value.

On the other hand, data obtained from birds banded as fledglings have certain obvious values that are not represented in the records of those fully adult at the time of banding. For this reason nestling birds may be banded when the nests are so located as to be reasonably safe from further molestation. This, however, is to be considered purely a supplemental activity. The young of birds that breed in colonies, such as gulls, terns, cormorants, pelicans, and herons, also may be banded when such work can be undertaken by cooperators who understand the habits of these birds and will keep their welfare in mind.

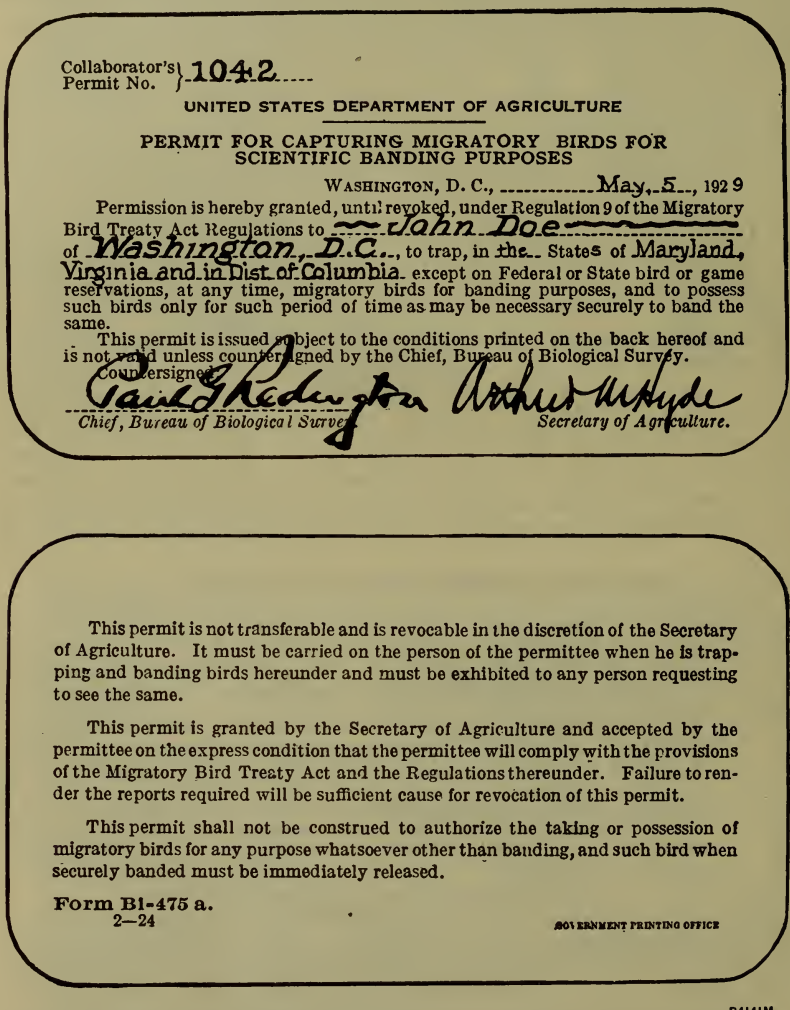
Young birds should not ordinarily be banded until after the feathers start to grow and they have reached nearly full body size. At this time the legs will be as large as those of the parents or even larger. Individual fledgling ducks, terns, and possibly others, will occasionally have very large tarsi when only 1 or 2 days old. Young birds should, however, be banded at least three days before they are ready to leave the nest, or before they have developed the sense of fear, so that they can be replaced in the nest without their attempting to escape.

STATION OPERATORS AND PERMITS

The method of marking native birds by means of numbered bands, and the studies thereby made possible, are scientific both in principle and in practice, a circumstance that makes it necessary for bird-banding cooperators to possess certain well-defined qualifications. The successful station operator is one who not only studies and bands a large number of birds, but also maintains his station as a refuge where birds are afforded every possible comfort and protection. He enlists the interest and support of his neighbors because of the obvious benefits accruing to birds through the presence of his station.

Under the migratory-bird treaty act, a Federal permit is required before one may engage in bird banding. (Fig. 4.) Application for such permit should be addressed to the Chief, Bureau of Biological Survey, United States Department of Agriculture, Washington, D. C. In giving consideration to each application the bureau, unless the applicant is already known, requires indorsement from other persons as to his general trustworthiness and ability to identify accurately local birds. This qualification is important, because banded birds are often reported by persons possessing little knowledge of birds, so that the value of the records rests entirely upon the identification of the cooperator who attached the band. The banding permits are valid until voluntarily surrendered or until revoked by the Secretary of Agriculture.

Some States also require an additional permit, while others recognize the Federal permit as sufficient authority for banding work. As each Federal banding permit is issued, appropriate notice is sent to the Federal game protector of the district in which the banding operations are to be conducted. The State game officials are also



Collaborator's Permit No. 1042

UNITED STATES DEPARTMENT OF AGRICULTURE

PERMIT FOR CAPTURING MIGRATORY BIRDS FOR SCIENTIFIC BANDING PURPOSES

WASHINGTON, D. C., May 5, 1929

Permission is hereby granted, until revoked, under Regulation 9 of the Migratory Bird Treaty Act Regulations to John Doe of Washington, D.C., to trap, in the States of Maryland, Virginia and in Dist of Columbia except on Federal or State bird or game reservations, at any time, migratory birds for banding purposes, and to possess such birds only for such period of time as may be necessary securely to band the same.

This permit is issued subject to the conditions printed on the back hereof and is not valid unless countersigned by the Chief, Bureau of Biological Survey.

Countersigned David Lesdernton Arthur M. Hyde

Chief, Bureau of Biological Survey. Secretary of Agriculture.

This permit is not transferable and is revocable in the discretion of the Secretary of Agriculture. It must be carried on the person of the permittee when he is trapping and banding birds hereunder and must be exhibited to any person requesting to see the same.

This permit is granted by the Secretary of Agriculture and accepted by the permittee on the express condition that the permittee will comply with the provisions of the Migratory Bird Treaty Act and the Regulations thereunder. Failure to render the reports required will be sufficient cause for revocation of this permit.

This permit shall not be construed to authorize the taking or possession of migratory birds for any purpose whatsoever other than banding, and such bird when securely banded must be immediately released.

Form B1-475 a.
2—24

GOVERNMENT PRINTING OFFICE

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FIGURE 4.—Face and back of Federal bird-banding permit. The permits issued to most cooperators are for taking nongame birds only, as few persons are so situated as to be able to trap migratory waterfowl and shore birds

notified. Permits in Canada are issued by the commissioner of the National Parks of Canada, Department of the Interior, Ottawa, Ontario.

SAFETY OF TRAPPED BIRDS

Bird-banding cooperators should always keep in mind the safety of captured birds. In order that proper interpretation may be made of banding records, it is important that the birds leave the hands of

the operator in as good condition as when they were trapped. Accidents may happen in spite of all precautions, and occasional injuries or fatalities are to be expected, but the protection from their enemies afforded birds that frequent a well-regulated trapping station will save the lives of a far greater number than are injured or killed through banding operations. Certain safeguards should be taken, however, to aid in reducing the number of such injuries or casualties.

Birds captured in cage traps, unless promptly removed, will sometimes injure themselves in their efforts to escape. The principal evidence of this is abrasions found at the base of the bill, caused by the bird repeatedly forcing it through the wire meshes. Although such injuries heal quickly and seem to have no harmful effect upon the bird, which may return to the trap in a few days with all signs of abrasion completely removed, nevertheless even the appearance of injury should be avoided. Automatic traps should not be kept set unless the operator can make regular visits to them not more than one or two hours apart. During the nesting season, when young are being fed in the nest, the visits should be more frequent. A blanket or other large covering thrown over the trap will prevent excessive fluttering, particularly when there are several birds in it.

Injury in cage traps usually can be prevented in various ways. A strip of copper mosquito netting 3 or 4 inches wide may be fastened on the inside of the sidewalls of the trap chambers. Another method is to cut out 2 or 3 inches of the horizontal wires and carefully smooth the vertical wires with emery cloth. Care must be taken not to remove the horizontal wires so high that the captured bird can easily spread apart the vertical wires and force its head between them. O. A. Stevens, of Fargo, N. Dak., reports some success in preventing the bruising of birds in traps by coating the wires with paraffin.

Cage traps for ducks, made entirely of ordinary 2-inch-mesh poultry wire, may cause injuries to captured birds left long in confinement. The most serious injury is caused by birds forcing their wings through the meshes of the wire netting, which will severely cut the web, or patagium, and injure the important flight feathers. These accidents may be easily avoided by attaching to the inside of the trap a piece of 2-foot rabbit or pigeon wire that will extend half above and half below the water line. Whenever possible traps for these birds should be placed so that they will have firm, hard bottoms. If this can not be done, they should be placed entirely in water not less than 8 or 10 inches deep. Traps should never be put in shallow water where there is a soft muddy bottom, for the captured birds will soon work the mud into a semiliquid condition, saturating their plumage and causing serious irritation or infection of the eyes, with possibly fatal results.

Guard fences are strongly recommended for the protection of small birds frequenting traps. A piece of ordinary 3-foot poultry wire or woven-wire fencing 60 feet in length is inexpensive and will inclose an area approximately 20 feet in diameter. (Fig. 5.) Such a fence will not actually keep dogs, cats, or other small mammals away from the traps but will prevent them from "rushing" birds that may be feeding around it. Dogs are not usually troublesome at trapping stations, but vagrant house cats are probably the worst menace there and should be disposed of as quickly as possible.

CATS

The cat trap shown in Figure 6 is simple in construction and efficient. It consists of a box, made from 7/8-inch lumber and about 12 inches square by 30 inches long; a false floor or treadle that rests on a fulcrum (a small piece of wood nailed across the floor of the trap); a trigger wire, connected by a loop to a screw eye at one side of the treadle in back of the fulcrum, carried to the top of the trap and passed through a second screw eye; and a vertically sliding door that is supported, when the trap is set, by the free end of the trigger wire. The door slides in grooves. The weight of the cat on the treadle beyond the fulcrum depresses that part of the treadle and pulls back the trigger wire, allowing the door to fall. In the back of

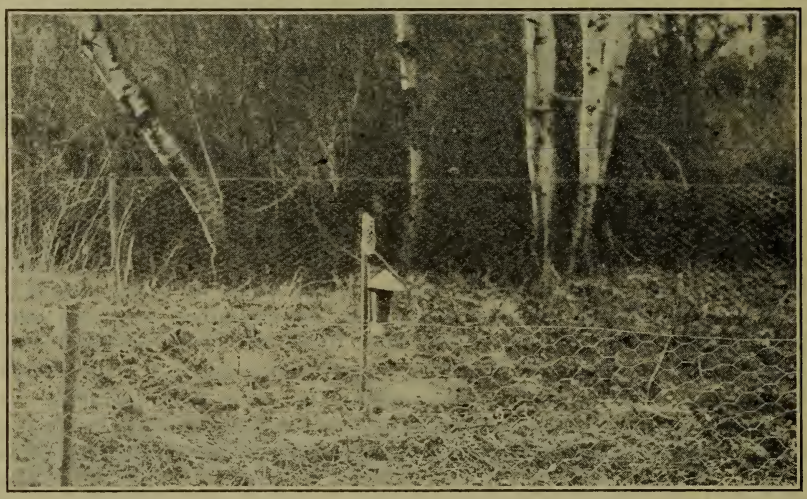

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FIGURE 5.—Trapping station protected by guard fence made from poultry wire. As this particular station is operated only on week-ends, an automatic food hopper is used to attract and hold birds during the intervals between trapping operations. (Photo by the station operator, Richard B. Harding)

the trap an opening about 3 inches square is covered on the inside with heavy wire netting and is provided with a tightly fitting door to permit examination of any captured animal and the introduction of fumigant for its disposal. The door should be open when the trap is set to provide ventilation. Bait (fish is probably the best) is placed well back in the trap. A little catnip will make it more enticing. When the captive is a vagrant cat or other animal that should be destroyed, an ounce of carbon disulphide may be poured onto a wad of cotton batting and inserted into the trap. This will produce fumes that will asphyxiate quickly and humanely. After carbon disulphide has been applied the trap should be kept tightly closed to confine the gas. *Carbon disulphide is highly inflammable and explosive, and its fumes are offensive and poisonous if inhaled in a closed place. It is therefore advisable to use it only in the open air.*

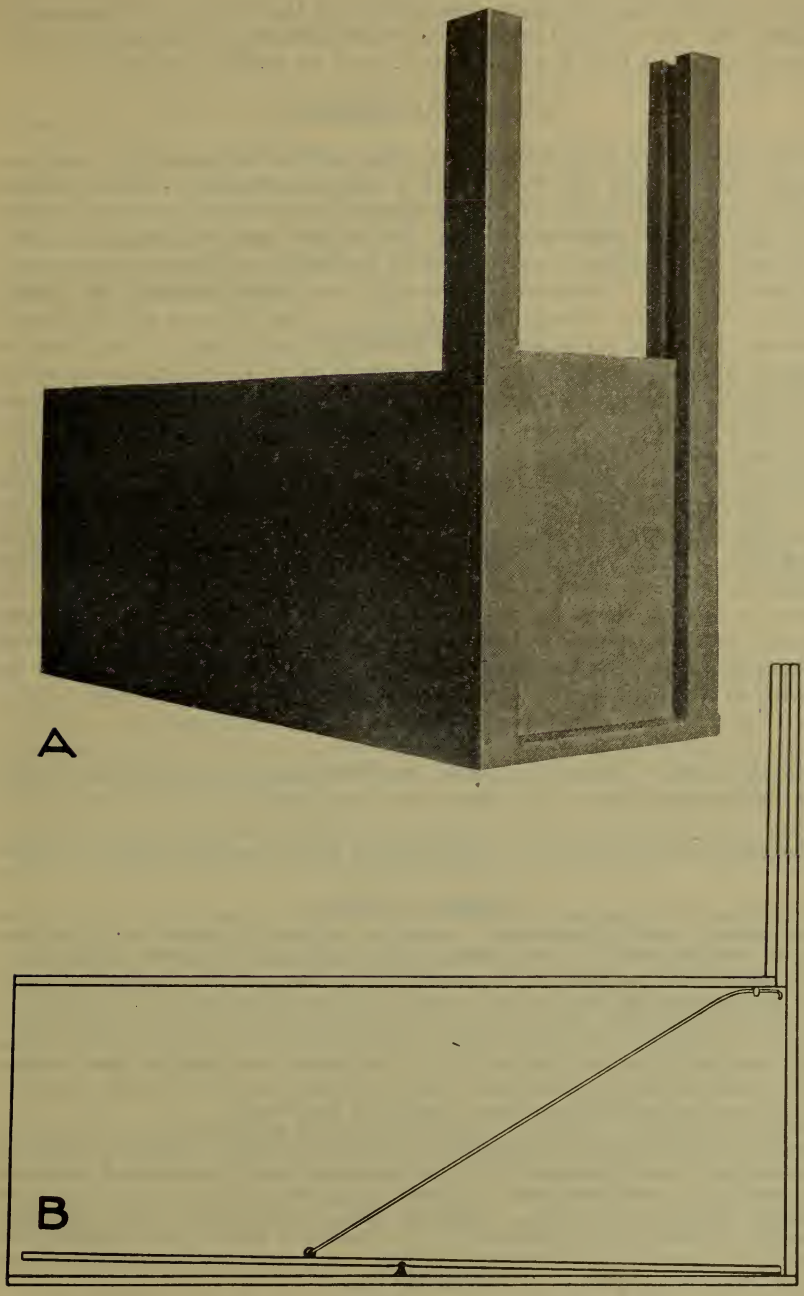

FIGURE 6.—A, Biological Survey cat trap. In the drawing B, the near side is removed to show the false floor or treadle resting upon the fulcrum; with the trigger wire extending from a screw eye placed on the treadle at a point in the rear of the fulcrum, to the screw-eye guide in the ceiling of the trap near the sliding door

A complete and detailed description of this trap is contained in Leaflet No. 50 of the United States Department of Agriculture on How to Make a Cat Trap.[1] Copies may be had on request.

OTHER SMALL MAMMALS

In addition to stray house cats, there are other mammals that can not be tolerated in the vicinity of a trapping station. Red squirrels are known to kill birds, and their gray relatives will do so sometimes. Chipmunks probably would not attack any but the smallest birds, but they nevertheless are a decided nuisance, as also are mice and pocket gophers. Sometimes, though not often, weasels or young skunks will enter a trap and kill birds. The Bureau of Biological Survey does not advocate the wholesale destruction of any native animal unless it is present in such numbers as to interfere seriously with agriculture or other activities. Many small mammals may be pests at bird-trapping stations, but to persons in other sections their presence may afford much pleasure. Trapping them with box traps and removing them to a region where their presence will not be objectionable is frequently a satisfactory means of solving the problem. It is occasionally advisable to operate a trap for small mammals near each bird trap. They usually may be caught in box or rat traps, care being taken to set them where they will not endanger birds. This may be done by setting them in pieces of draintile at least 3 feet in length placed under bushes or in other places where it is fairly dark. Birds generally avoid such tiles, whereas small mammals seem to be attracted by them.

SHRIKES

Under date of March 17, 1924, the Secretary of Agriculture issued the following order with reference to shrikes:

ORDER PERMITTING THE KILLING OF SHRIKES IN THE IMMEDIATE VICINITY OF BIRD-BANDING STATIONS

Information having been furnished the Secretary of Agriculture that shrikes have become, under extraordinary conditions, seriously injurious to and destructive of valuable birds in and around traps maintained by persons holding permits authorizing the capture of migratory birds for scientific banding purposes, and an investigation having been made to determine the nature and extent of the injury complained of, and whether the birds alleged to be doing the damage should be killed, and, if so, during what times and by what means, and it having been determined by the Secretary of Agriculture that shrikes have become, under extraordinary conditions, seriously injurious to bird life, and that such birds found committing the damage should be destroyed,

Now, therefore, I, Henry C. Wallace, Secretary of Agriculture, pursuant to authority in me vested by the Migratory Bird Treaty Act of July 3, 1918, and in conformity with Regulation 10 of the Migratory Bird Treaty Act Regulations approved and proclaimed July 31, 1918, do hereby order that the holders of Federal permits for capturing migratory birds for scientific banding purposes may kill shrikes in any manner, except by the use of poison, when found in the immediate vicinity of bird-banding stations, for the purpose of preventing them from killing other birds in or around the traps.

Every bird killed pursuant to the permission contained in this order, and every part thereof, shall be totally destroyed as promptly as possible, and shall not be possessed, transported, or shipped in any manner except for the purpose

[1] SILVER, J., and JARVIS, F. N. HOW TO MAKE A CAT TRAP. U. S. Dept. Agr. Leaflet 50, 4 p., illus. 1929.

of destruction in the immediate vicinity where the bird was killed. A record of the number of birds destroyed under this privilege must be kept and a report of operations made to the Department in conjunction with the report made of bird-banding operations.

This order does not authorize the killing of shrikes in violation of State law and a State permit, if any is required, must be obtained before operations are commenced under the Federal privilege.

This order does not mean that shrikes must be killed, but merely authorizes cooperators to take whatever means they consider necessary to protect their traps from depredations by these birds. When shrikes actually enter traps and thus are caught themselves, it is suggested that they be banded, removed to a distance from the station, and there released.

OTHER BIRDS OF PREY

Various other birds of prey at times may be exceedingly troublesome at a banding station and require drastic action on the part of the operator. Cooper's and sharp-shinned hawks are unquestionably the worst offenders, and when one of these birds learns that small birds congregate at a certain point, the operator will probably find it necessary to have recourse to a small rifle or shotgun. At times the otherwise beneficial sparrow hawk will be troublesome, but such cases are unusual and can be dealt with on their own merits.

CROWS

Crows are never troublesome at banding stations, but occasionally individual blue jays or grackles will show a disposition to kill small birds. A cooperator should not indulge in systematic control measures with such birds, as it is desirable to obtain information on all native species, regardless of their economic status. When an individual bird exhibits traits that are inimical to the interests of other birds frequenting the station, it usually will be found satisfactory to capture and remove it to a considerable distance before releasing it.

ENGLISH SPARROWS

English sparrows are generally considered detrimental to the welfare of small native species, and there is no question that they are a nuisance when present in numbers. It is advisable to keep their numbers reduced to a minimum about trapping stations, if for no other reason than to eliminate nonproductive bait consumers. Some useful and interesting native sparrows so closely resemble the English sparrow (particularly the females) that bird-banding cooperators should use care to see that native species are not destroyed by mistake. English sparrows should not be banded with Biological Survey bands, except by special permission from the bureau, which may be granted for the purpose of studying some particular problem.

STARLINGS

European starlings also might be in the class of troublesome species, but as their spread has been phenomenally rapid and as information is needed concerning their movements, the Biological Survey desires them to be banded. Data from banded starlings may be of

much value if extensive control measures become necessary. If it should become desirable to cease banding starlings, announcement will be made by the Survey.

SNAKES

The economic status of certain species of nonvenomous snakes is still somewhat undetermined, but the experience of bird students has shown that some of these reptiles are sometimes highly destructive of birds. Of these, the black snake is probably the worst, as it is an excellent climber and has no difficulty in ascending large trees to reach nests and secure the eggs or fledglings. In the West other members of the racer group of snakes, as well as the bull snake, share this fondness for birds. Here again, operators of trapping stations should bear in mind that it is usually unwise to attempt indiscriminate campaigns for the eradication of any native vertebrate animal. Cooperators should, however, maintain constant vigilance in keeping trapping-station grounds free of bird enemies.

TRAPS FOR SMALL-BIRD STATIONS

Several traps useful for the capture of various kinds of small birds have been described in previous publications of the Department of Agriculture.[2]

With the further development of the banding work and as a result of experiments carried on by the authors and many interested cooperators, important improvements in these traps have been made, and new types have been worked out. Various types of traps have been found suitable for the same kinds of birds, and it seems necessary to describe in detail only those that have been standardized through proved efficiency. On the other hand, station operators should bear in mind that a particular type of trap that gives excellent service in one locality may be a total failure in another. For example, the Cohasset warbler trap has been successfully used at several stations in New England, while at large stations in Michigan and Ohio it did not catch a single bird over a long period of constant experiment. Operators should study their local conditions and use traps that meet their particular needs.

The principle employed in the traps here described is frequently adaptable to others made in different dimensions and intended for different purposes. An example of this is the modified Government sparrow trap, which utilizes the funnel. A trap of this type with entrance funnels opening from both ends has been successfully used for the capture of shore birds, while the funnel is also the principle of the waterlily-leaf trap developed for securing ducks. Similarly, doors that slide vertically or drop through an arc of approximately 90° have wide adaptations that can be utilized by the ingenious station operator to fit peculiar conditions.

The devices described in the following pages have all been more or less thoroughly tested, although a few that are somewhat theo-

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[2] DEARBORN, N. THE ENGLISH SPARROW AS A PEST. U. S. Dept. Agr. Farmers' Bul. 493, 24 p., illus. 1912.
LINCOLN, F. C. INSTRUCTIONS FOR BIRD BANDING. U. S. Dept. Agr. Circ. 170, 19 p., illus. 1921.
——— INSTRUCTIONS FOR BANDING BIRDS. U. S. Dept. Agr. Misc. Circ. 18, 28 p., illus. 1924.

retical are included in order to provide a starting point for cooperators working on different groups of birds.

Traps used at small-bird stations should be painted, as painting preserves them by preventing rusting of metal parts and reducing excessive weathering of the wood. The important reason for painting, however, is to make the trap less conspicuous. The color to be used depends upon the location, but a leaf green or wood brown will usually be satisfactory. These colors are obviously intended for summer use, but they serve equally well in winter, as at that season there is little difficulty in attracting birds regardless of the color of the traps.

In the construction of traps it should be borne in mind constantly that the safety of captured birds is of paramount importance. A banded bird should always be released in as sound and healthy a condition as it was when trapped.

From the specifications here given, anyone moderately skillful in the use of simple tools (tin snips, pliers, files, hammer, and saw) can make an efficient trap in a few hours and at a moderate expense for material. The square-mesh wire netting generally used is known as No. 2 or No. 3 (two or three meshes to the inch) galvanized-wire hardware cloth, while other wire netting used is ordinary poultry netting of ¾-inch [3] or 2-inch hexagonal mesh.

GROUND TRAPS

DROP TRAP

The drop trap, frequently called "pull-string" trap, a device that is merely an adaptation of the old and well-known "sieve" trap, is easily made at little expense, and although not usually automatic in its operation it is probably the best trap for a new operator to use until he has acquired proficiency in handling birds. Such traps are particularly useful in summer, when, because natural food is abundant, birds are not so easily tempted to venture into the compartments of "cage" traps. Several types of the drop trap have been successfully used, from the wooden frame covered with wire or twine netting and the inverted wire-netting tray (fig. 7) to the collapsible, or beginner's, flat trap. (Fig. 8.)

TRAY TRAPS

Drop traps of the tray type should be made not less than 3 feet square (frequently 4 or 5 feet is more satisfactory) and from 6 to 10 inches high. They should have small knobs, such as wooden spools, attached to the corners to prevent the sides from touching the ground and possibly crushing a bird. Narrow curtains of canvas attached along the sides can fill the spaces between the knobs. Traps of this type, while highly efficient in taking many species of ground-feeding birds, must be used carefully, as there is always danger of injuring or killing a bird if it is not well in toward the center before the trap is sprung. A bird will detect the first movement of the trap,

[3] Occasionally some difficulty may be experienced in obtaining poultry netting of three-quarter-inch mesh. The Biological Survey has, however, been advised by two of the largest manufacturers of poultry wire that this is a standard product and should be available at any time. One-inch mesh can be used for larger birds, but it is too large for some of the smaller species.

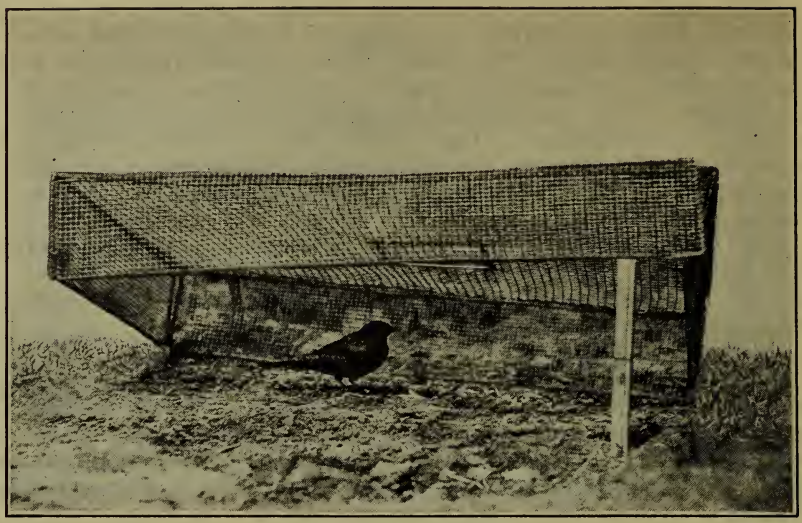

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FIGURE 7.—Drop trap made entirely from hardware cloth. (Photograph by the station operator, Paul W. Hoffman)

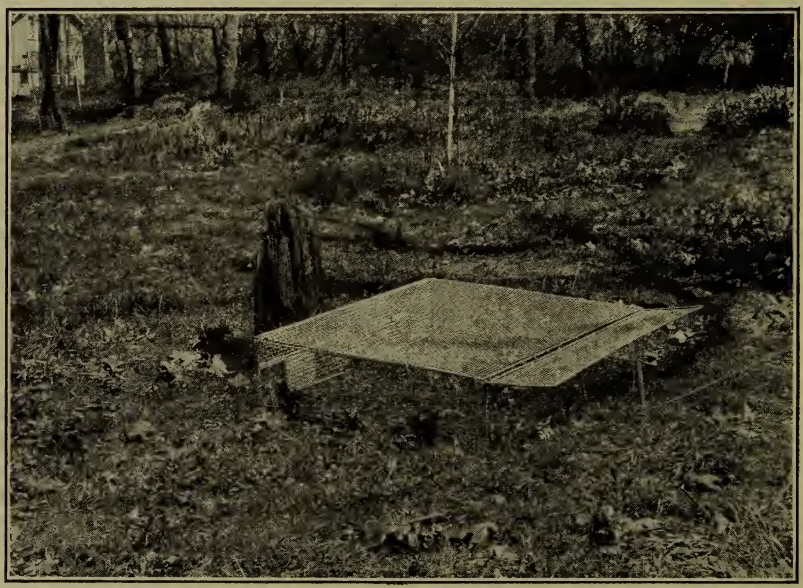

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FIGURE 8.—Beginner's flat trap. An excellent type for work with ground-feeding birds, which are rarely, if ever, injured by its operation

probably noting the shadow, and instantly spring into the air. As the descending trap may strike the bird as it is rising, the twine netting top is preferable to one of wire. It is best to spring the trap when the birds are headed inward rather than outward, as they are then less likely to be caught under the sides in attempting to escape.

COLLAPSIBLE, OR BEGINNER'S, FLAT TRAP

The collapsible, or beginner's, flat trap (fig. 8) does not have disadvantages, and for most work it is a better trap. A good size for this trap, where used in a semipermanent position, is 34 by 34 by 8 inches; one, 16 by 12 by 7½ inches, can (if made collapsible) be readily carried from place to place in a suitcase. They should be made of No. 3 galvanized-wire, hardware cloth, and with the larger sizes, frames of No. 10 iron wire will be needed to give them proper strength. When made collapsible, the rectangular front, back, and side pieces are attached to the top with wire rings, and when in operation, the sides and back are fastened together with pieces of wire. The door for removing captured birds should be in the back.

INVERTED-V SUPPORT

Figure 9 shows an inverted-V trip-stick device used by A. W. Higgins, of Rock, Mass., with tray drop traps. It is made of two light strips of wood fastened together to form a letter V. About midway of the length of both legs, steel pins or small nails are driven in so as to project about half an inch. A small screw eye is fastened at the apex of the V on the other side. To this the pull string is attached. The principal advantage of a device of this kind is in the stability it gives to the trap, making it less likely to be sprung when the wind is blowing. The height at which the trap can be set can be varied merely by passing the projecting pins through the meshes of any desired course of the wire netting or, in the case of wooden-frame traps, into small holes drilled for the purpose.

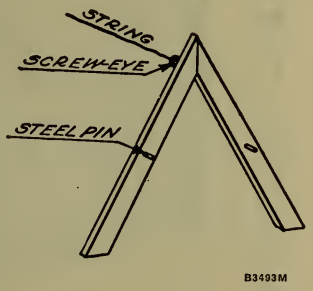

FIGURE 9.—Inverted-V device for use with trap drop traps. Two small nails or steel pins support the trap through the meshes of the netting. The pull string is attached to a screw eye at the apex on the other side

FOLDING TRIP STICK

In using a single-piece trip stick, as with the beginner's flat trap, more rapid action is provided by cutting the stick in two and fastening the pieces together with a small hinge. In use the hinge should be on the inside toward the trap. A light pull on the string will then collapse the stick and drop the trap instantly.

FIGURE-4 SUPPORT

Drop traps can readily be made automatic and thus serve a double purpose. For taking single birds, the well-known "figure-4" is satisfactory. (Fig. 10.) The horizontal member should be long

enough to serve as a perch and may be made from a natural branch, possibly with two or more side twigs, which will increase the chances of contact with the bird. A pull string attached to this member and carried to a convenient observation point will also enable the operator to spring the trap at will.

AUTOMATIC DROP TRAPS

Openings measuring 8 to 12 inches long and 4 to 6 inches high for automatic entrances, may be made on one or all sides of a tray drop trap. Two types of these have been successfully used, one (fig. 11, A) a frame with a series of guard wires projecting into the trap chamber, and the other (fig. 11, B) a half funnel made from hardware cloth, that is inserted in the opening. Either of these devices should be attached to hardware-cloth frames that will fit snugly against the

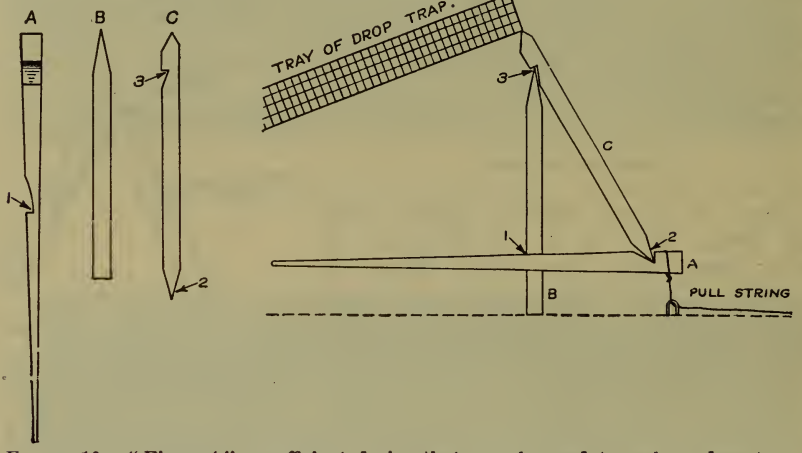

FIGURE 10.—"Figure-4," an efficient device that may be used to make a drop trap automatic in action. The sticks are about three-eighths of an inch square

openings. Pieces of hardware cloth may be used to close the openings when the trap is used only as a drop trap.

TRIPLEX TRAP

Another type of drop trap (fig. 12), developed by A. W. Higgins, of Rock, Mass., has the advantage of eliminating practically all sources of danger to the birds. He has named it the "Triplex" because of the three doors. The sample he sent to the Biological Survey is 30 inches long, 22 inches wide, and 7 inches high. No. 2 hardware cloth is used with light wooden strips for the bottom framework, door casings, and the front-door frame. The front door measures 15¾ by 6¼ inches (outside dimensions), while the two side doors are 6 inches wide and 5½ inches high. These last are made from fairly heavy sheet metal and slide in grooves cut in the door casings. Small screw eyes are inserted in the face of the front-door casing near each corner, and through these are passed vertically two pieces of heavy wire (about No. 12), which hold the front door in place but still permit it to be easily removed.

The two vertical strips forming the casings for each of the side doors are connected across their tops by pieces of wire (about No. 16) with loops or eyes in the middle. Pieces of cord passed through these

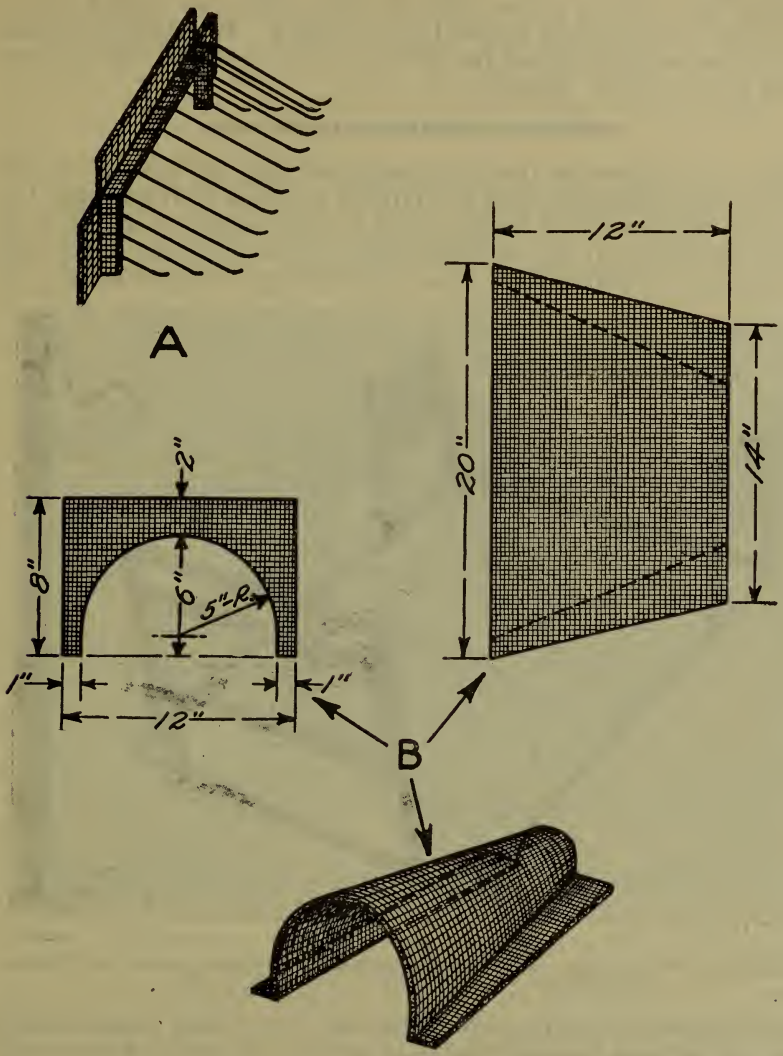

FIGURE 11.—Automatic attachments for drop traps. A, Attachment made by fastening to a hardware cloth frame a series of guard wires that will project into the trap chamber and that can be raised or lowered as desired (Northeastern Bird Banding Association type); B, half-funnel attachment, showing shape of the hardware-cloth arch to which it is attached, pattern for cutting the half-funnel, and the finished passage. (After G. D. Sprot)

eyes are fastened through holes in the tops of the doors. These cords are then carried to the front of the trap, passed through a small screw eye in the top of the front-door casing, and fastened to a small ring. Similarly, a piece of cord is attached to a screw eye in the top

of the front door and passed through the screw eye in the casing to the same ring. From this ring another cord is carried to the observation post.

When the cord is pulled taut all three doors are raised simultaneously, and when it is released all are closed. Mr. Higgins reports that he has actually raised the doors to admit another bird without losing those already captured.

MODIFIED GOVERNMENT SPARROW TRAP

The type of sparrow trap here described (fig. 13) is based on the extensive experimental work of William I. Lyon, of Waukegan, Ill., who has developed this apparatus to a high degree of efficiency, in which the safety of the captured birds has been a controlling consideration. As will be seen from the drawings and photograph, the

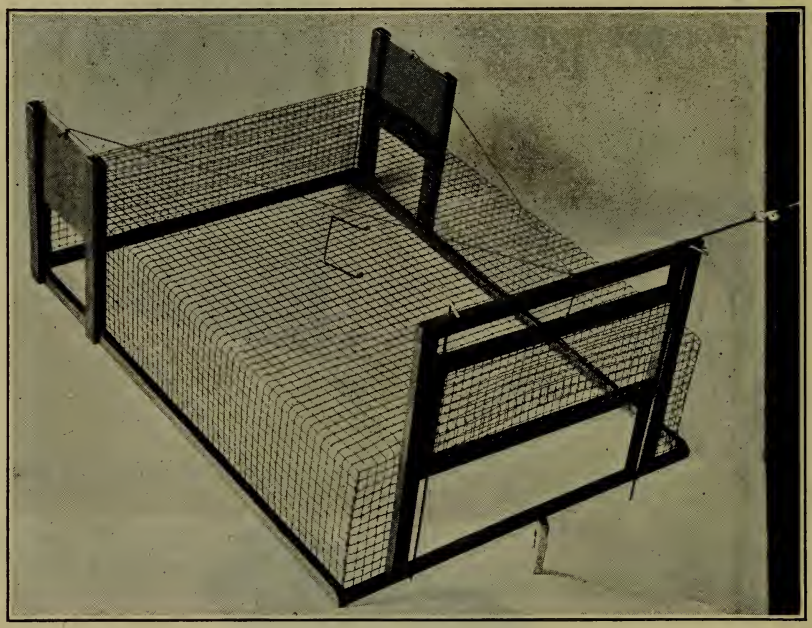

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FIGURE 12.—Triplex trap. The cords from all three doors come together at the ring. The vertical wire rods hold the front door in place

essential parts of this trap are as follows: (1) A half funnel leading into (2) an antechamber that ends in (3) a complete funnel, with outlet elevated to about the center of the trap and opening into (4) a second chamber, with (5) a number of blunt guard wires attached to the outlets of the funnels and projecting about 4 inches into the respective chambers.

The plans outlined are for a trap 35 by 20 by 16 inches, which is a good size for most work, as it is not cumbersome or heavy.[4] The

[4] Ordinarily, the trap here described gives excellent results. For some birds, such as quail, it is much too high, the explosive flight of these birds rendering them liable to injury by concussion against the wire top. If birds are being injured from this cause, make the trap lower and cover the top either with fine minnow seine or a piece of well-weathered canvas.

materials needed for construction are about 10 feet of No. 3 galvanized hardware cloth, 2 feet wide; 10 feet of ¾-inch-mesh poultry netting, 3 feet wide; and about 20 feet of No. 7 or No. 8 iron wire.

To construct this trap two rectangular wire frames are first bent into shape from the iron wire. One frame, which fits into the bottom of the trap, should be 35 by 20 inches, while the other one (used to reinforce the trap in the center) should measure 20 by 16 inches. It is best to solder the joints so that the frames will be rigid. A piece of No. 3 galvanized-wire hardware cloth 92 by 18 inches is bent to make the sides and back.

A simple way of making straight bends in wire netting is to place the netting on the floor, lay a board across it with one edge along the line where the bend is desired, stand on the board, and bend the netting up, tapping it lightly against the edge of the board with a hammer or mallet. This will give a straight, even, right-angle bend.

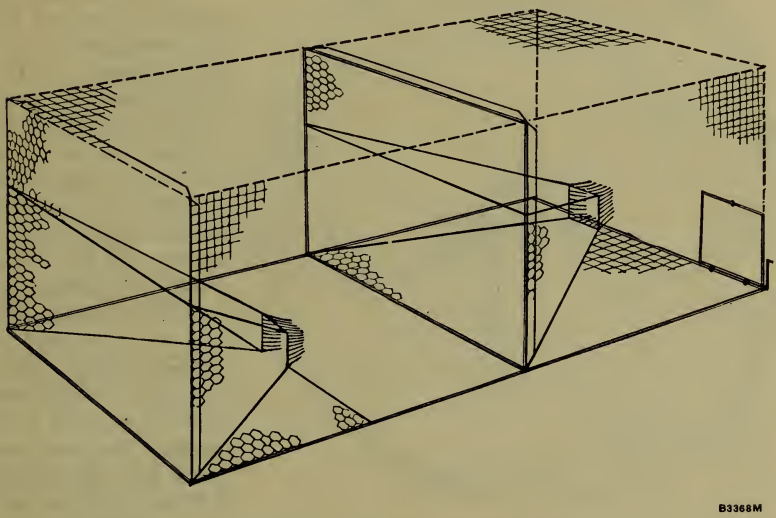

FIGURE 13.—Details of construction of modified Government sparrow trap. Relative position of funnels and door is shown

The top of the trap is made from a piece of ¾-inch-mesh pigeon or rabbit wire, which should be cut 36 by 22 inches. The finished trap is only 20 inches wide, but this piece of netting is cut to allow 1 inch on each side to be folded into a seam that incorporates 1 inch of the width of the sides and back. This seam may be made by folding together with a pair of pliers the two pieces of netting, and then with a mallet pounding it down flat on a block of wood. The finished seam will be about half an inch in width and by its own stiffness will eliminate need for additional strengthening of the top.

For the construction of the funnels paper patterns are first made as shown in Figures 14 and 15. For the front funnel (fig. 14) a horizontal line is ruled near one edge of the sheet of paper (a double newspaper sheet will answer), and from the middle of it a vertical line is drawn. The point where the perpendicular and horizontal lines meet will be the center of a 16-inch arc, and points for 17½ and

11½ inch arcs will be established on the perpendicular line by measuring up 1¾ and 2¾ inches, respectively. To draw the arcs, lay the paper on the floor and use a pencil and string, with a nail or thumb tack for a center. Then lay off the outline of the funnel, beginning with the longest line CD, which should be at right angles to the perpendicular line; and connect the points of the angles with the various centers from which the arcs were drawn. The section CKLD, which is for the front of the trap above the funnel proper, also may be drawn. The lines GH, HI, and IJ include the area that will be cut out to form the outlet from this funnel. On all outer lines add about 1-inch flaps, by which the funnel will be securely laced to the body of the trap.

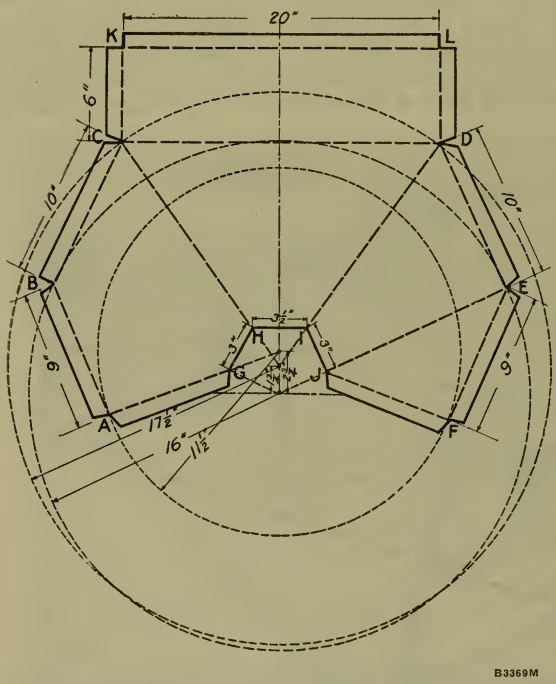

FIGURE 14.—Pattern for first funnel of trap shown in Figure 13

The pattern for the second funnel (fig. 15) is made in a similar manner. On a large sheet of paper, rule a horizontal line a few inches above the bottom and a perpendicular one 10¾ inches high from a central point. Draw a second perpendicular 8¾ inches high and seven-eighths of an inch to the right of the first. The points thus made will be the centers for two arcs. Next lay off the line AP at right angles to the perpendiculars, and follow with lines AB, BC, CD, DE, and EF, connecting the angles to the centers as was done with the first funnel. The section DKLE is added and the outlet GHIJF is drawn, while provision is made for 1-inch flaps of netting with which to fasten the funnel to the trap.

The front funnel should be placed first. See that the bends are true and then secure it to the trap chamber by folding in a seam from the sides and top. If this is done so as to take about 1 inch of netting, the total length of the trap will be 35 inches, the same as the length of the wire frame first made, which will be fastened to the bottom. Before this frame is attached, the second or rear funnel should be fastened in place at a point about 16 inches from the rear of the trap. Copper wire of about 20 or 22 gauge may be used to lace the parts of the trap securely together.

With the funnels in place and before the bottom is fastened to the second compartment (there is no bottom to the front compartment,

except for the small areas between the funnel and the outer corners)[5] the guard wires should be attached to the funnel entrances. The simplest way to make these is to take pieces of ½-inch-mesh hardware cloth 4 or 5 inches wide and 12 to 14 inches long and cut or melt out the long wires from 2½ or 3 inches on one side. One or two long wires also are removed from the opposite side of the strip, thus leaving three or four of these to hold the short wires together. The wires should then be carefully smoothed with sandpaper or emery cloth and the strip fastened to the funnel outlets by means of the short projecting wires, so that the long projecting wires will extend into the trap chambers. By spreading these wires, the entrance can be made large enough for blue jays, robins, and grackles, while bending them in will reduce the opening so that only the smaller birds will be admitted. Sharpening the wires is unnecessary and would be liable to injure the birds.

The bottom of the rear compartment, a piece of hardware cloth or ¾-inch netting about 18 by 22 inches in size, is then fastened in.

A door in the rear compartment should be provided through which captured birds can be removed. The best doors are made of sheet metal and slide vertically in grooves provided for the purpose, or they may be made of wire netting and be made to turn through an arc of 90°. (Fig. 13.) Doors of the latter type are easy to construct, as the only materials needed are a piece of hardware cloth of requisite size (doors 6 inches square are about the right size) and a piece of No. 8 or No. 10 wire for the frame. Such a door should be hinged at the bottom so as to drop against the floor of the trap, and the wire forming the bottom or axle should project about 2 inches beyond the side. This is then given two right-angle bends to form a crank, by means of which the door is lowered when a bird is to be transferred to the gathering cage. For the sake of neatness and to eliminate danger of scratching the hands of the operator, the doorway should have a frame made of the same heavy wire.

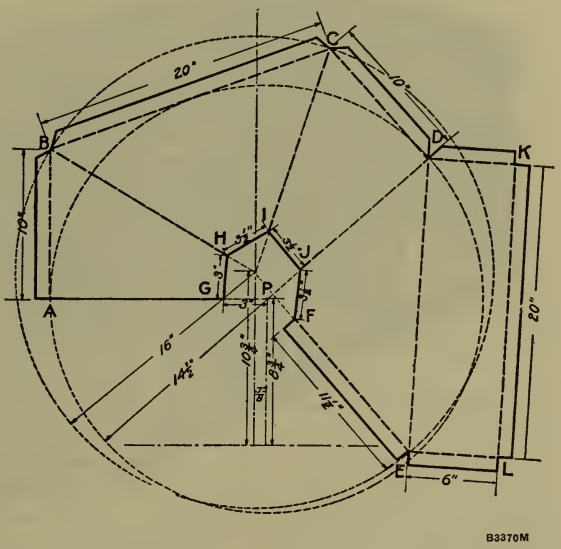

FIGURE 15.—Pattern for second funnel of trap shown in Figure 13

[5] In some localities, rats, mice, and other small mammals occasionally cause trouble by burrowing under and into the trap. These animals may even kill birds in the trap chambers. To prevent such annoyances, R. J. Middleton, of Norristown, Pa., puts a wire bottom over the entire trap, but in setting the trap takes care to see that the netting is buried below the surface of the ground, so that it is not visible to the birds.

For a sliding door, galvanized sheet iron is best. The door frame for such a door may be made of narrow strips of the same material doubled twice, one fold being pinched tightly around the edge of the wire netting and the second providing the channels in which the door will slide.

The trap is now complete and ready for painting, before which it should be given a careful inspection to see that all ends of wire or other projections are smoothed down to eliminate possible injury to captured birds. (See paragraphs on Safety of Trapped Birds, pp. 6–7.)

POTTER TRAP

The Potter trap is the most satisfactory of those that use a sliding door; and while usually made with two or four compartments, it also

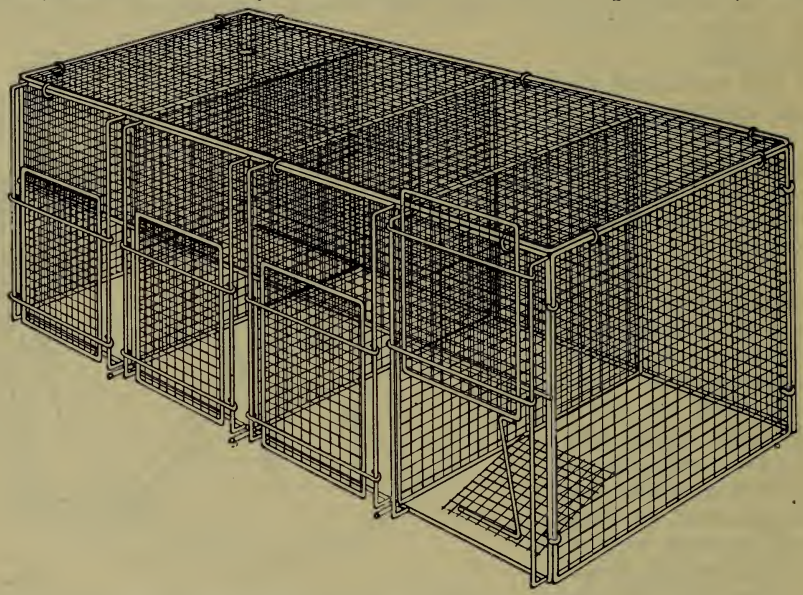

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FIGURE 16.—Details of 4-celled Potter trap, showing the projecting door frames, or slides, and the manner in which the doors are attached to them

can be employed as a single-chamber trap for use on a window feeding shelf. It was developed by Miss Jessica A. Potter and J. Eugene Law, of the Western Bird Banding Association, and has been widely used in California and other Western States. It can be made in sections, hinged together by simple wire rings, so that it can be folded up into a compact parcel. The 4-compartment trap measures 18 by 8 by 8 inches, and the only materials required are ¾-inch-mesh poultry-wire netting and a quantity of stiff wire (about No. 12) for the frames.

In constructing a 4-celled trap, three wire frames, 18 by 8 inches, are used for the front, back, and top (there is no bottom), and five frames, 8 by 8 inches, for the two ends and three partitions. (Fig. 16.) As this is a small trap, it is better to make all joints by soldering rather than by lap-twisting. Electric welding of the frames

would be still better. All the small frames and two of the large ones should be covered with wire netting. This can be stretched on and attached by lacing, but a better job will result if the netting is soldered. On the third large frame a piece of wire should be attached longitudinally 3½ inches from one side and the upper space filled in with wire netting; the remaining space (4½ inches wide) will be covered by the doors.

The frames, or slides for each door, should be 4 inches apart and 8 inches high, with half an inch between frames and a quarter of an inch at both ends; thus, the four frames 4 inches wide, three intervals of one-half inch each, and two intervals of one-fourth inch each make the 18 inches, the total length of the trap. Eight wires, each a little more than 9 inches in length, are used for these frames. Both ends of each wire are given right-angle bends, so that when they are soldered across the front frame they will project one-half inch.

The doors are made by covering wire frames 3½ inches wide by 5 inches high with netting. Two wires are soldered across each door, one being about half an inch from the bottom and the other about 1½ inches from the top. These wires should project on each side so that they may be bent into hooks that will go loosely around the door frames.

The triggers have been termed "trip-door-steps," a name that well describes them. One is needed for each compartment. A piece of either No. 2 or No. 3 hardware cloth 3½ by 2½ inches and a piece of wire 7¼ inches long are used for each. The wire is bent twice at right angles, crank-wise, the end bends measuring ½ and 2½ inches, respectively, and the middle section 4¼ inches. The 2½-inch end is woven into the meshes near one end of the piece of hardware cloth. The ½-inch end engages with the door when the trap is set.

In setting the trap the doors are raised and the trigger wire brought under the lower part of the frame, the piece of hardware cloth resting on the ground inside the compartment, and tilting up at a slight angle at the back. A bird that on entering the trap hops onto the netting exerts sufficient leverage to dislodge the trigger wire from its position against the bottom of the door, which is thus allowed to drop.

As the doors are very light, there is practically no danger of injury to birds and the trip-door-step triggers are sure to operate. These considerations, together with its lightness and compact nature, mark this trap as one of the best that has been developed for banding work. Obviously it can be made rigid instead of folding and the number of compartments increased to as many as desired.

RESETTING TRAP

The names "resetting" and "everset" have been applied to traps that employ a moving or tilting chamber that precipitates a bird into a larger chamber or cage. Actually, such traps are not perpetually set any more than is a Government sparrow trap or a flat trap with automatic attachment, but since the terms have come into general usage, it seems advisable to continue them. One of the first published accounts of a trap of this nature is that in Farmers' Bulletin 493,[6] where it was called the "Tesch nest-box trap."

[6] DEARBORN, N. Op. cit.

The trap shown in Figure 17 is the result of experimental work by William I. Lyon, of Waukegan, Ill., who has referred to it as a "top-entrance" trap. Its essential parts are (1) a receiving cage, entered through (2) a tilting chamber, that is flanked by (3) two trays or pans to contain bait, and (4) a wire-netting cover or superstructure that fits over the moving chamber and the bait pans.

The sample of this trap submitted by Mr. Lyon measured 15 by 12 by 12 inches, exclusive of the superstructure. The receiving cage is made by tacking wire netting over a wooden framework and providing a door at one end for the removal of captured birds. The bottom is made of wood, and the top also is covered over with a light board for a space of 6½ inches, an 8-inch opening thus being left across the entire width of the cage.

Two rectangular pans or trays 8 inches long, 3½ inches wide, and three-fourths of an inch deep are made from pieces of sheet iron and fitted against the sides of the opening left in the top, where they

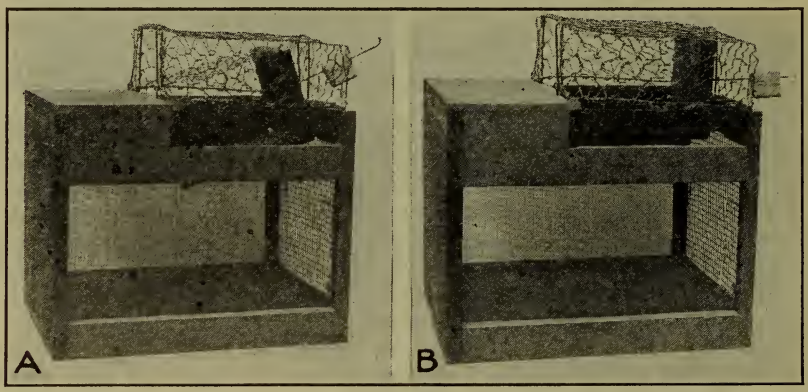

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FIGURE 17.—Resetting trap. A, Tilting chamber up; B, tilting chamber down. The bait pans do not show clearly, but they are located on either side of the moving chamber. The door for removing captured birds shows faintly in the lower right-hand corner. (Photos by William I. Lyon)

are attached with small nails or brads. A space about 5 inches wide will be left between the trays, and in this the tilting chamber is installed.

To make this chamber, nail together at right angles two pieces of light board, one measuring 7 by 4½ inches and the other 4½ by 4½ inches. These form the bottom and back. The top and sides are made from a piece of ¾-inch-mesh poultry wire, about 14½ by 6½ inches, which is bent at right angles 5 inches from each end and then tacked onto the bottom and back with small staples. At a point across the back of the chamber, 2 inches from the bottom, a piece of stiff wire (about No. 12 or 14) is stapled so that it will project about five-eighths of an inch on each side. This is the axle, and in order that the chamber may operate freely it is advisable to cut a groove in the back, in which the axle will fit flush with the surface. The counterweight should next be attached. One end of a piece of stiff wire 12 or 13 inches long is bent into a small ring, the other end being passed through a small hole drilled in the center of the back

of the chamber and securely clinched or fastened with staples. A piece of sheet lead about 6 inches long and three-fourths of an inch wide will serve for the counterweight. This may be doubled and bent over the projecting wire so that it will be free to move to any needed position to balance the moving chamber properly.

To attach the chamber to the trap, two pieces of wire about 2½ inches long are used. At one end of each, small rings are formed with a pair of pliers, and about seven-eighths of an inch beyond the rings, and in the same plane, the wires are bent at right angles. The free ends should be sharpened with a file so that they may be driven into the upper edge of the framework forming the back of the trap. The ringed ends will then project about 1 inch over the opening. The ends of the wire axle attached to the back of the chamber pass through these rings and by a little adjustment of the counterweight the chamber can be balanced so nicely that the weight of the lightest birds will be sufficient to move it.

A superstructure, or cover, to go over the bait trays and the tilting chamber is made from hardware cloth or ¾-inch-mesh poultry wire. Sections 3½ inches square are cut from the four corners of a piece of netting measuring 16 by 19 inches, and the sides thus formed are bent at right angles and fastened together by lacing with copper wire. The result will be a tray 3½ inches deep and 9 by 12 inches on its sides, which will be inverted over the parts mentioned. A cut 5½ inches long is then made at the bend in the middle of the front of the tray (a 12-inch side), and a piece 2 inches wide is cut entirely away. This will leave on each side of the opening thus formed sections of the front that will be 1¾ inches wide and that will be separated from the top. These are bent in at right angles to the front, making an opening 5½ inches wide, or 1 inch more than the width of the tilting chamber. It also will be necessary to make an opening or slit in the back large enough for the counterweight to pass through it. This cover should be attached to the trap by wire hooks in such way as to be easily removed when it is necessary to clean the bait pans.

In operation, one bait pan is kept filled with water and the other with food. A small quantity of bait also is scattered on the wooden part of the top, which is the landing or inspection platform of the trap. A bird in attempting to reach the bait in the trays enters the tilting chamber, which descends under its weight, thus preventing its escape through the entrance but permitting it to enter the receiving cage, after which the counterweight returns the tilting chamber to its original position.

HOUSE TRAP

The house trap (fig. 18) embodies several desirable features and is particularly adapted for trapping stations with premises large enough to permit more or less permanent trap locations. Its large size naturally limits its utility, but when its use is practicable it will generally be found to take a larger variety of birds. It consists of a large chamber entered through a vestibule and a single outer door and double inner doors, which are left ajar when the trap is set.

Select a location adjacent to trees or shrubbery and erect, of 2-inch uprights such as may be made by ripping 2 by 4 inch timbers, a framework about 5 feet square and 6 feet high. Three extra uprights will be needed to make a vestibule and casings for the doors,

(Fig. 19.) Cover this framework with woven-wire netting no larger than ¾-inch mesh. Stretch a piece of the netting between two extra uprights that are placed in one corner, 2 feet apart, and 18 inches from one side, thus making a vestibule or partial partition in the trap.

The outer door frame is made of light, narrow pieces of lumber, covered with wire netting, hinged to open into the vestibule. The inner opening is provided with two doors, of which only the tops and hinged sides are of wood. The other sides and the bottoms are formed by a heavy wire (or a ¼-inch soft-iron rod), which serves merely to stiffen the netting. This provides a minimum of visual obstruction to birds that may be entering. As it is obvious that the opening between the upper parts of the inner doors when in the "set" position is useless for admitting birds, and at the same time increases

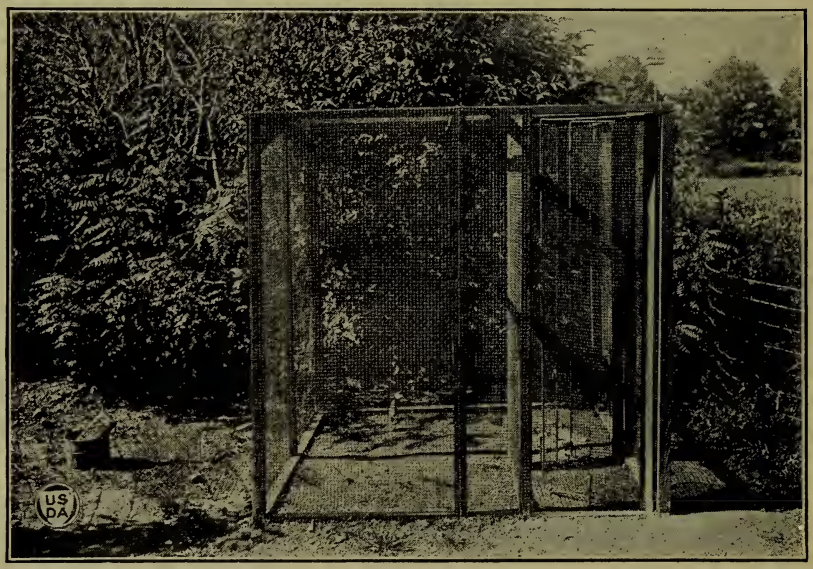

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FIGURE 18.—House trap—excellent for the permanent station

the chances for escape of those that have entered, it should be closed. This can be done by making the upper half of one door from 4 to 6 inches wider than the lower half so that when set the upper portion of the doors will be in actual contact. Do not place a threshold under the doors unless it can be set low enough to be covered with earth. Observation has shown that birds are reluctant to cross an obstruction of this kind.

In the large chamber several perches may be provided for the use of captured birds, which otherwise might be injured in their efforts to escape.

The trap can be operated in two ways, either of which is good, but for various reasons one method may give better results in one locality than in another. This problem can be readily solved by the station operator.

The first method is to lay a trail of fine bait from the outside through the vestibule into the trap chamber. The doors are left slightly ajar, the inner ones forming an effective funnel. The second method is the result of experiments by a British worker.[7] The outer door is kept closed, being used only by the operator, and an entrance into the vestibule 8 inches high and 6 inches wide is provided on the side around the corner from the outer door. This is best left without any framework, thus providing ready and uninterrupted entrance for the birds.

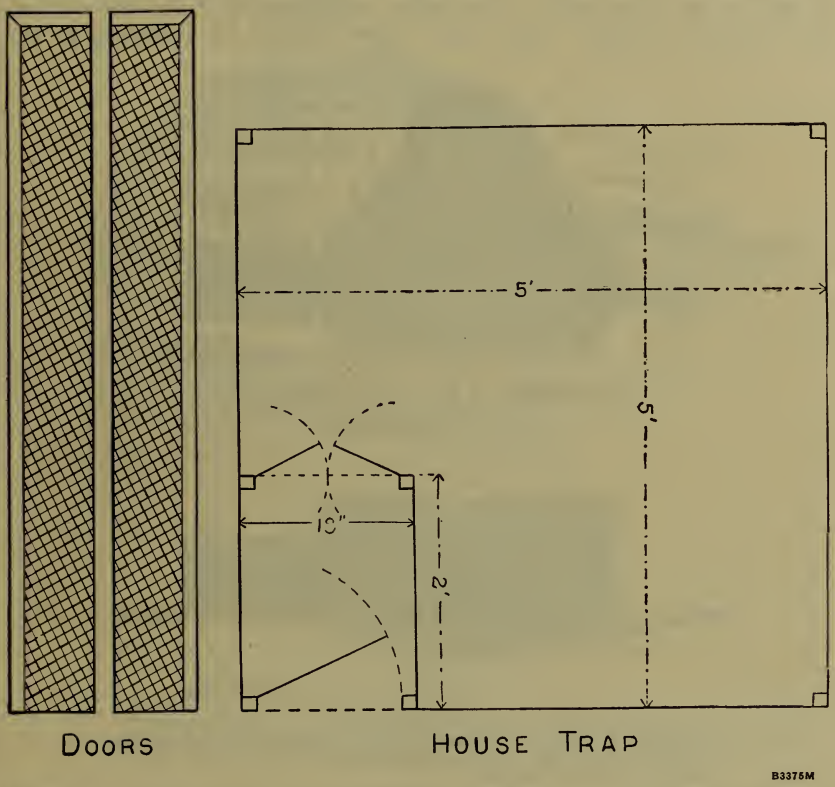

FIGURE 19.—Ground plan of house trap shown in Figure 18. The drawing shows the vestibule and the correct position of doors when the trap is set

These traps have been successfully operated by the authors and by others. They are generally satisfactory for the capture of orioles, thrushes, warblers, and other species that are reluctant to enter smaller traps. The usual run of ground-feeding birds are also taken.

THREE-LEAVED-CLOVER TRAP

The 3-leaved-clover trap was originally designed for the capture of mourning doves, but it has been found useful for taking almost

[7] NICHOLSON, E. M., and WILLSON, M. W. THE OXFORD TRAPPING STATION. Brit. Birds 21 : 290–294, illus. 1928.

any ground-feeding species. The trap is made on the funnel principle, and, as it is of simple construction, many banding stations have found it useful. One of its advantages is that three entrances are provided, permitting birds to approach an opening from any direction.

A trap of this type should be made of ¾-inch poultry wire in either 18-inch or 2-foot widths. Three pieces of netting, each about 4½ feet long, are used for the sides. As cut from a roll, they will have a tendency to remain in a more or less circular form, which is utilized to advantage. The pieces of netting are placed on edge on the ground (fig. 20) so that they will roughly form the outline of a 3-leaved clover. The lower edges should be fastened to the

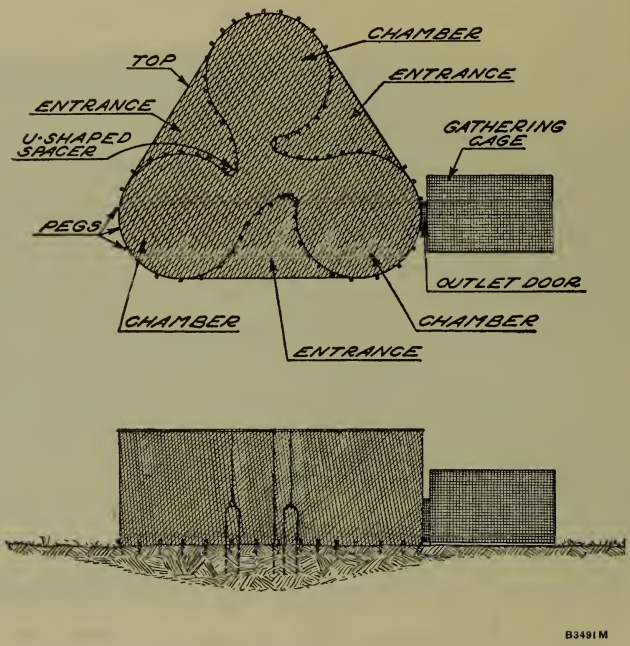

FIGURE 20.—Details of 3-leaved-clover trap. In the drawing, a connecting passage is shown between the trap and the gathering cage, but this is rarely needed, as the two doors may be placed in actual contact

ground by means of small pegs or of stakes notched near the upper end to engage with the netting. The ends of the netting should be from 1½ to 4 inches apart, depending upon the size of the birds that it is desired to capture. To maintain the openings at the proper size, inverted U-shaped pieces of wire may be woven into the netting and the ends forced into the ground. The ends of the netting above the U's should be fastened together. A top to the trap is made from the same kind of netting, and an outlet door is provided in one chamber for the removal of captured birds.

This trap is intended for a semipermanent location, but a portable trap of the same type, with smaller chambers, may easily be fashioned from hardware cloth. In such cases it is well to strengthen the netting by a framework of stiff wire.

O. A. Stevens, of Fargo, N. Dak., has made tests of this trap in comparison with the sparrow trap. He finds that more birds are likely to escape through the three openings, and, what is more serious, that cats appear able more easily to capture birds around and in it. The 3-leaved-clover trap is really a special, readily portable trap useful in certain situations, but it should be used with care and in every case protected by a guard fence.

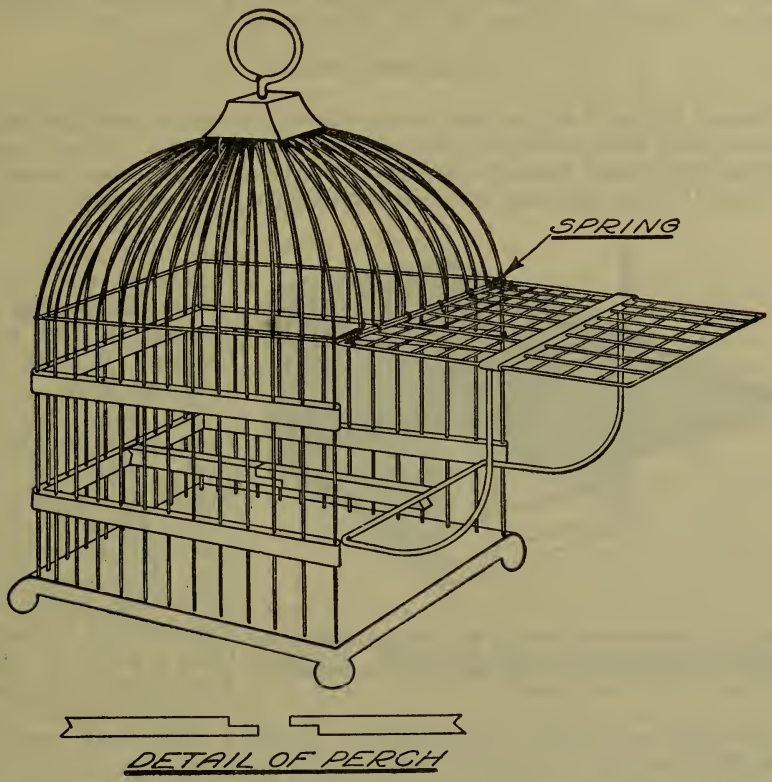

FIGURE 21.—Canary-cage trap. Simple in construction and admirably suited for window-feeding shelves

CANARY-CAGE TRAP

The canary-cage trap is a simple device peculiarly adapted for use on window feeding shelves or porch roofs, as well as at ground stations. As originally developed and used, a small square bird cage was employed (fig. 21), but it will be apparent that the cage can be readily constructed from hardware cloth. When made from a commercial bird cage, the back is cut out and replaced with a door made of a piece of hardware cloth hinged at the top. Light springs (rubber bands will answer) are attached to make it close more quickly. A wire loop is attached to the middle of the door, the two ends being fastened on opposite sides in such a way that when the door is open—that is, when it is in a horizontal position—this loop will project downward and curve in to the entrance of the cage, where it is sup-

ported by, and at the same time supports, a "broken perch." This perch, the length of which should be the same as the depth of the cage, is provided with a "half-lap" joint in the middle. By opening or closing this joint, the trap may be adjusted so delicately that the weight of birds as light as chickadees will cause the perch to "break," thus releasing the wire loop and permitting the door to shut.

The broken perch is the distinctive feature of this trap, but the same result can be obtained through the use of a vertically sliding door and the trip-door-step of the Potter trap.

FALSE-BOTTOM TRAP

Several types of traps that are operated through a movable false bottom have been used and are generally satisfactory. Many cooperators have found them useful, particularly since they can be made so small that several may be easily transported and operated in different situations. The one shown in Figure 22 was developed at the station of George, Harold, and Leonard Wing, of Jackson, Mich.

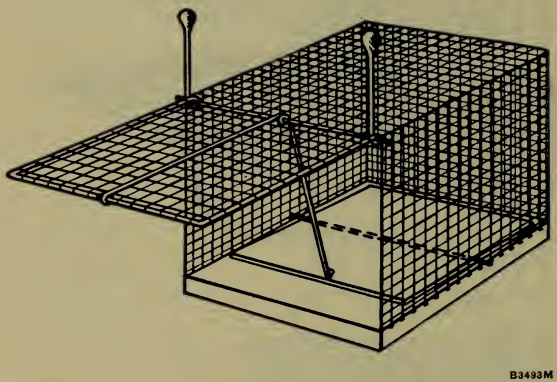

FIGURE 22.—False-bottom trap. The moving bottom, or treadle, is pivoted in two meshes of the sides. It engages with the trigger attached to the door, which is closed and held shut by the lead weights

The cage (made from No. 3 hardware cloth) may be as small as a 6-inch cube. The sides, top, and back are readily made from one piece of netting, while the true bottom is made from a piece of light wood about a half or three-quarters of an inch thick, to which the netting is fastened with small staples.

In making the door, use a single piece of about No. 12 wire to form the frame, the two ends projecting from the upper corners about 4 inches, to which are attached lead weights weighing about 1 ounce each. Small loops in the wire at the upper corners serve as bearings for the axle by which the door is attached to the cage.

The trigger, or trip wire, is made of a piece of wire attached first to the bottom of the door, extended across to the top, looped once loosely around the axle, and then bent at right angles to the plane of the door. The free end should be long enough to engage with the false bottom when the trap is set.

A piece of thin wood (such as a cigar-box cover) is used for the false bottom. It should fit loosely into the cage. A stiff wire axle is attached so that it will bear in opposite meshes of the side netting. When level the false bottom need not be more than half an inch from the true bottom of the trap. To engage with the trigger, the front of the false bottom may be cut away, leaving a middle projection

about half an inch wide, or a small tack or brad may be partially driven in near the edge.

When lead weights are used no other locking device is needed, but if desired a locking bail may be used instead of weights. A bail can readily be made from a piece of stiff wire (about No. 12 or 14) and a round wooden rod long enough to pass through the trap and project about half an inch on each side. A piece of ¼-inch dowel stick is excellent for this purpose, as it will turn freely in the meshes of No. 3 hardware cloth. The rod is placed about midway between the front and the back of the trap and about 2 inches from the top. The wire bail passes across the outside of the door, and then, by right-angle bends, along the sides to the rod, to which it is attached, either by sharpening the ends of the wire and driving them into the ends of the rod or by loops in the wire. In setting the trap the bail is lifted with the door, over which it falls when the trap is sprung. The bail locks the door merely by moving through a different arc.

HIGGINS AUTO-TRIP TRAP

The auto-trip trap, while essentially a one-bird trap designed by A. W. Higgins, of Rock, Mass., for use on window feeding shelves and ground locations, has also proved useful for the capture of squirrels, chipmunks, rats, and other station pests. It is somewhat similar to a 1-compartment Potter trap, in that it is closed by a vertically sliding door, but differs in the trigger arrangement, which is released from the rear instead of from the front of the trap.

A good size for a cage is 8 inches wide, 8 inches high, and 12 inches long, made by tacking hardware cloth over a wooden framework. It also is made with a framework covered with sheet metal, which is preferable when the trap is to be used for the capture of squirrels or other rodents. The bottom is of wood covered with a thin piece of sheet metal. The pieces forming the front corner posts should extend about 3 inches above the top and be grooved to carry the door. The tops of the door posts are connected with a piece of stiff wire having a central loop or eye through which passes the cord from the door to the trigger. The door may be made either of sheet metal or of a piece of hardware cloth with the edges bound with sheet metal. The latter is probably the better, as it presents less visual obstruction to birds. For this reason also it is well to keep the corner posts and other wooden parts as narrow as possible.

The trigger arrangement (fig. 23) consists of a shallow bait pan, about half an inch deep and 4 inches wide, extending across the trap chamber. This pan is hung on a wire axle, which passes longitudinally through it. Bearings are provided by small holes drilled through wooden blocks attached to opposite sides of the cage. The pan should be hung not more than 1 inch from the bottom of the cage, and it should have two or three small holes punched in the bottom to prevent rain water from gathering in it. A narrow strip of wood (the trigger holder), of the same height as the front corner posts, is fastened vertically to the center of the back of the trap, and through it about 2 inches from its base a ⅜ or ½ inch hole is bored. Through this hole is passed a piece of ½-inch dowel stick, which should just reach to the bottom of the pan. It should extend about 2 inches beyond the trigger holder and have a notch cut near the outer

end. A piece of soft but stout cord is next attached at the center of the top of the door, carried through the eye in the wire connecting the corner posts, and through a small screw eye on top of the trigger holder, after which it is attached to the middle of a piece of dowel stick about 2 inches long, both ends of which are beveled to a screwdriverlike edge. One end of this stick will fit into the notch cut in the end of the trigger stick, while the other should fit into a similar notch cut in the trigger holder, about an inch above the trigger-stick hole. The cord should be tightened so that when the trigger is set the door will be up, its weight holding the string tight and the trigger in position.

Bait is put in the pan, onto which a feeding bird is almost sure to hop, causing the pan to tilt forward, raising the trigger stick, which becomes disengaged from the small stick on the end of the cord,

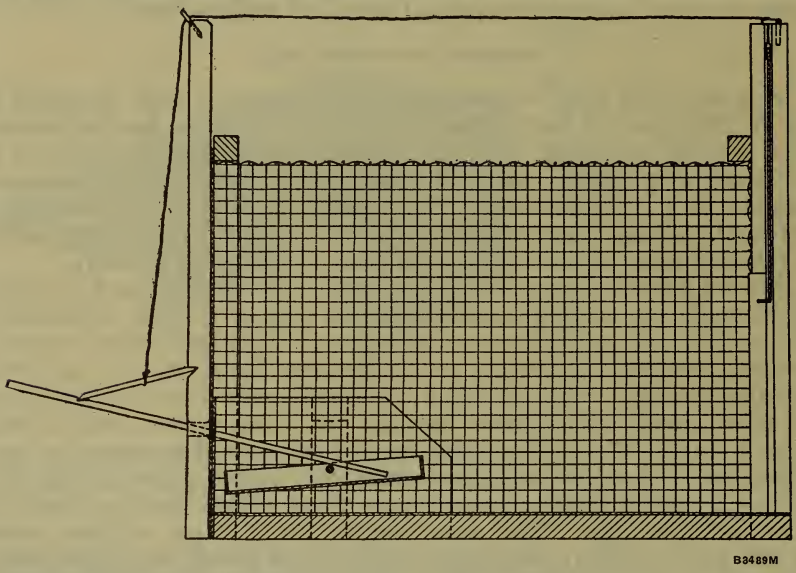

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FIGURE 23.—Details of Higgins auto-trip trap, showing bait pan and the figure-4 device used to release the door

allowing it to fly up and the door to descend of its own weight. As a bird must be in the rear of the trap in order to spring it, this trap is practically proof against injury to birds.

TWO-DOOR TRAP

The 2-door trap as originally designed by A. W. Higgins, of Rock, Mass., is nonautomatic, but experimental work by the late E. A. Everett, of Waseca, Minn., has resulted in the development of a simple automatic modification. Both types are shown and described, as each has its particular uses.

HIGGINS TYPE

The traps used by Mr. Higgins (fig. 24) measure either 18 inches wide, 22 inches long, and 7 inches high, or 21 inches wide, 30 inches

long, and 7 inches high and are made entirely of hardware cloth, which is cut and bent, and the abutting edges are fastened together by lacing with copper wire. A door for the removal of captured birds is provided in one corner. The entrance doors should be opposite each other and of fairly large size, possibly as long as the sides. As the doors are to be closed by a spring or elastic band, they should be reinforced with a heavy wire frame. By making each frame of two pieces of wire—long pieces for the sides and bottoms and shorter pieces for the tops—and allowing the two ends of the long pieces to extend about an inch beyond the upper corners, these projections can be bent into rings or eyelets and attached to the top of the trap, forming substantial and smooth-working hinges. The short wires forming the tops of the doorframes can be attached to

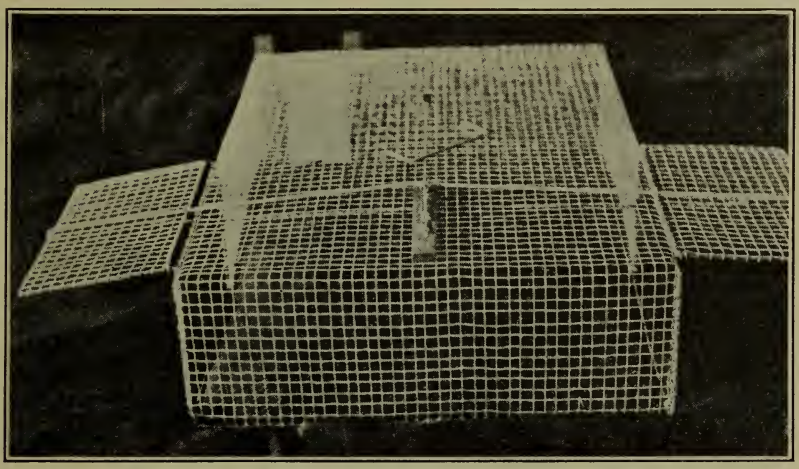

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FIGURE 24.—Two-door trap (Higgins type). The two doors are connected on the inside by a light spring (or an elastic band), and when set, the trigger wires lie on top of the cage, overlapping about an inch, and are held in place by the short trigger, which is jerked out when the trap is sprung. (Photograph by A. W. Higgins)

the sides of the frames in a similar manner, that is, by forming rings in their ends that can be fastened to the side wires.

Pieces of this same heavy wire should also be attached to the middle of the bottom of each door, extended vertically across them, and continued for a distance equivalent to a little more than half the width of the trap chamber. These are trigger wires, and when the trap is set, will lie on top of the cage, their free ends overlapping about an inch. On top of the cage and at right angles to the set position of the trigger wires, fasten a piece of wood 5 or 6 inches long, about an inch wide, and half an inch thick, placing it so that it will support the ends of the trigger wires when the trap is set. Two small screw eyes are driven into this piece about 3 inches apart, the eyes being parallel to the trigger wires. A trigger is made from a short piece of heavy wire, one end of which is formed into a ring for the purpose of attaching the pull string. This wire is passed through the screw eyes so that it projects over the trigger wires, thus hold-

ing them down and the doors open. A piece of screen-door spring or an elastic band connects the doors and supplies the motive power. The spring should, of course, be attached with the doors closed.

EVERETT TYPE

The automatic 2-door trap worked out by Mr. Everett (fig. 25) is operated by treadles releasing a figure-4. The floor of the trap is covered with two treadles—light platforms made either of netting or thin wood and pivoted by means of wire axles, bearing in the meshes of the sides.

In the middle of one side at the bottom is attached a piece of board 6 or 7 inches wide. A half-inch hole is bored through the center of this piece, care being taken that the hole is opposite a mesh of the netting, so that the trigger stick will pass through without difficulty. The trigger stick is actually the horizontal member of the figure-4.

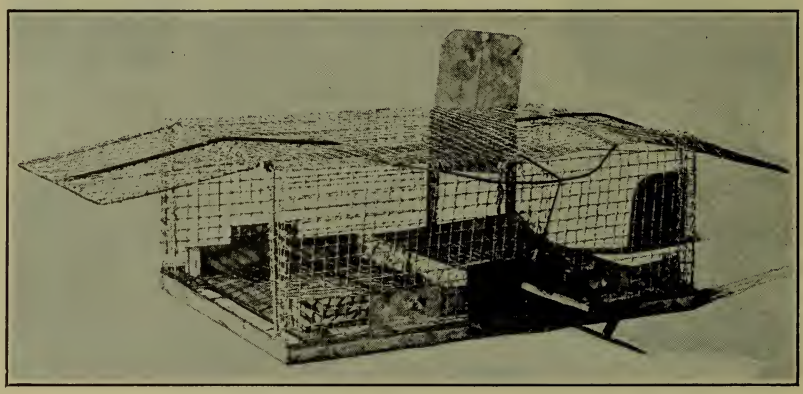

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FIGURE 25.—Two-door trap (automatic; Everett type). The trigger wires do not overlap, as in the Higgins type; and are held in place by a wire bail, which in turn is held by the trigger cord connecting to the figure-4 release. This last is operated by the movement of the pivoted treadles. The sliding door for the removal of captured birds is shown open. (Photograph by E. A. Everett)

This should be long enough to reach to the center of the trap, when its position will be directly above the line where the two treadles come together. A small but rather long wire nail should be driven through the inside end of the trigger stick so that it will project over both treadles. The outer end of the stick, which should project 3 or 4 inches beyond the side of the trap, should be notched.

Instead of having the trigger wires meet and overlap, as is done with the nonautomatic trap, they should in this trap extend when set only 5 or 6 inches onto the top, where they are held in place by a wire bail, which is attached loosely through the meshes of the top and which, in setting the trap, is brought over the trigger wires and secured by the trigger cord. This is a piece of soft but stout cord with one end firmly attached to the top of the trap above the trigger stick, while the other is attached to the middle of a light stick about 4½ inches long. One end of this stick is beveled to engage with the notch in the trigger stick while the other is notched to engage with the wire netting of the side of the trap.

When entering the trap from either side a bird will step on one of the treadles, causing the opposite side to rise and strike the nail driven through the trigger stick, which is thus dislodged, allowing the bail to fly up and the doors to be closed by the spring or elastic band that connects them.

Caution.—There is always a certain element of danger to birds from traps that are operated by springs, while the crash of the closing doors is frequently such a severe shock to such highly organ-

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FIGURE 26.—Lurvey combination trap. The top door is held open by the trigger post rising perpendicularly from the middle point of one side of a pivoted bait tray engaging with a trigger wire attached to the door. The secondary trigger wire (shown as a dotted line) is projected by opening the top door, so that the trigger hook on the front door may be engaged with it. This drawing shows the way in which the doors are pivoted, the springs attached, and also the figure-4 catch to lock the front door

ized animals that it will at times prevent repeat trappings. Operators should accordingly use discretion in work with these traps.

LURVEY COMBINATION TRAP

The Lurvey trap was developed by F. J. Lurvey, of Somerville, Mass., and, although not originally designated as a "combination" trap, it seems desirable so to define those that employ both top and end (or side) openings, the result being a combination of features of other traps. The method of release used on this trap is unique.

Figure 26 shows also another method of making traps in which wire netting has no part, but instead there is employed the brass wire construction extensively used in the manufacture of bird cages. Hardware cloth may be substituted, of course, if more convenient.

In the preparation of the drawing for Figure 26 and following specifications, the well-made sample submitted by Mr. Lurvey was used. It was found, however, after a thorough test, to be desirable to make certain modifications. This trap is well adapted for use on feeding shelves, as well as on the ground.

A good size for a trap of this type is 14 by 9 by 8½ inches. The framework, including the doors, may be made from soft wood half an inch square, fastened together with 1-inch brads or wire nails. The bottom part of the frame, however, should be about 1 inch wide. No. 16 brass wire is used for the bars, which should be not more than half an inch apart. The bottom can be of brass-wire construction (as shown), or it may be made of a light board.

For a trap of this size, the top door should be 7¾ inches square and the front door 6½ inches long by 5¼ inches high. These are outside measurements and in the case of lengths include the projecting parts by which the doors are attached to the cage and those at the opposite ends that are cut away to form half laps and that rest against bars of the cage when the doors are closed. The doors are pivoted by bars of brass wire passing through both their frames and that of the cage. To provide smooth-working bearings and to take up the space between the doors and the cage frame, one or two small metal washers should be inserted.

Each door is operated by a small brass coil spring, made from No. 26 or 28 wire, and should be long enough to reach both points of attachment with only slight tension. Elastic bands may be used in place of springs. To lock the front door when the trap is sprung a figure-4 catch, made from a narrow strip of thin sheet brass, or light brass wire, should be attached to the upper part of the frame.

The bait tray, made of light wood, and about 5 inches wide by half an inch deep, extends entirely across the trap and is pivoted to opposite bars by means of small screw eyes. The front of the tray should be not less than 4 inches from the front door, so that a bird will be well inside when it hops onto the tray.

The trigger consists of a perpendicular piece of brass wire driven into the middle of one side of the tray, which engages with a similar piece of wire attached at right angles to a rear corner of the top door. These trigger wires should be larger than the bars of the cage to facilitate setting adjustments. No. 10 or 12 wire is a good size. The lengths of these wires should be adjusted so that when they are in contact the top door will be held open at an angle of about 75°. The door need not stand vertically, as that would serve only to increase the force with which it closes when the trap is sprung.

To make the action of both doors simultaneous, a secondary trigger is installed, consisting of a piece of No. 16 brass wire, attached by a small screw eye to a rear corner (opposite the main trigger) of the top door, extending along the upper side and projected under the front part of the cage frame in back of the front door pivoting bar, where it is held in place by another small screw eye driven into the underside of the top frame. (In the drawing this wire is shown

as a dotted line behind the upper frame, on the near side.) It should reach about a quarter of an inch beyond the frame. To engage it with the front door, a small hook (bent acutely instead of at right angles) is attached by a screw eye to the upper rear corner of the door. This hook should be fashioned so that when the door is open it may be slipped over the end of the trigger wire. This will hold the front door open, but when the trap is sprung and the top door descends, the wire is drawn back through the hook, which slips off the end and permits the door to close. As the front door is closed entirely by the spring, while the top door is aided by gravity, the action of the latter is more rapid, but usually the difference is not sufficient to permit the escape of the bird springing the trap. To eliminate as much as possible the crash of the closing doors, it is well to glue small pads of felt or soft rubber into the laps where the doors strike the bars of the cage.

CHARDONNERET TRAP

Traps with top entrances, in which water is used for bait, have proved efficient in the capture of warblers, birds that as a rule will not enter traps with openings on the ground level. Other birds will, of course, also come to such traps and every well-equipped station should have at least one. The Chardonneret trap is typical and has given excellent service at many points. It is not limited to a water bait, as grain and bread may be placed on the triggers.

As ordinarily made, two cells or compartments are used (fig. 27), which may be approximately 12 or 15 inch cubes. The framework should be made of light wood, covered with No. 3 galvanized-wire hardware cloth, openings 6 inches square being provided in the top of each section. A strip of wood is fastened to the top through the center so that it will extend over each cell to the inner edge of the 6-inch opening. The doors are hinged to this piece. Four light strips of wood are required to make each door; three, measuring 6 inches in length, are for the sides and the hinged end, while the fourth, measuring 8 or 9 inches in length, is attached through the center of the door so that when it is open or in a vertical position, this fourth piece will project 4 or 5 inches into the compartment. The lower end of this piece should be beveled on the inside to a chisellike edge. The entire door framework is covered with a piece of wire netting.

A light metal rod or heavy wire to engage with the trigger sticks extends through the trap from top to bottom beside the partition separating the compartments. A small hole must be cut in the partition opposite this rod, so that both trigger sticks can engage with it.

The trigger sticks may be readily whittled out of pieces of soft wood about half an inch thick and 10 inches long (for a trap with 12-inch chambers). One end should be notched to engage with the central vertical rod, and the other end should be paddleshaped and hollowed out to form a little cup in which bait can be placed, if a pan of water is not placed on the floor. A notch is cut in each to engage with the chiselshaped ends of the centerpieces of the doors.

Motive power may be supplied as shown in Figure 27 with a light piece of steel, such as an old hack-saw blade, a piece of whalebone, or rubber bands. If a steel spring or whalebone is used, it should be fastened only to the piece to which the door is hinged, the other end

being free to move against the centerpiece of the door, where it is guided and kept in place by square wire staples.

In setting the trap the doors are raised to a vertical position, and the middle pieces are engaged with the trigger sticks, which in turn press against the vertical rod. The pressure of the springs against the middle strips of the doors maintains the trigger sticks in position. A very delicate adjustment may be made, so that the weight of the lightest bird in dropping from the top of the trap to one of the sticks will disengage it and allow it to fall, the spring then being free to act and close the door.

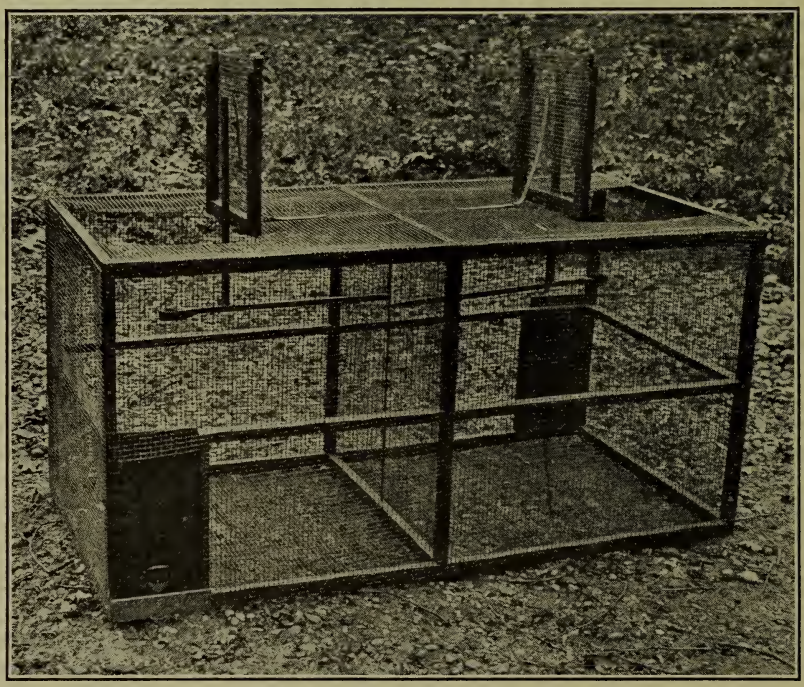

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FIGURE 27.—Chardonneret trap—an excellent top-opening type. Pressure of the door spring, transmitted through the centerpiece, holds the triggers in place against the vertical rod between the cells. A bird dropping onto the trigger dislodges it and allows the spring to close the door

MICHENER WATER TRAP

The Michener water trap (fig. 28) is the result of experimental work carried on by members of the Western Bird Banding Association. It has obvious advantages, the most notable being that the entire top opens, and since the framework is made merely of heavy wire, the trap is more likely to be entered by birds.

The trap is made in the form of a 12-inch cube, the sides covered with No. 3 galvanized-wire hardware cloth. One piece of netting 12 inches wide and 48 inches long will make all four sides, and the bottom may be attached either by soldering or lacing with copper wire. It is advisable to have the selvage of the netting at the top for the sake of smoothness. A quantity of heavy wire (No. 8 or 10) will be needed for the upper framework, door carriers, trigger, etc.

After the box or cage part of the trap is made, a heavy wire frame 12 inches square should be attached to the top of the cage so that it will stand about half an inch above it. To accomplish this, four pieces of heavy wire 12 inches long, bent in the middle to form right angles, are soldered into the four corners of the cage so that the bends will be about half an inch above the upper edge of the netting, the free legs extending out beyond the cage horizontally and parallel. These are the carriers on which the sliding doors will rest when open. The square frame, previously mentioned, should be soldered to the carriers at the bends, so that the carriers will be virtually extensions of two sides of the frame. The frame should be strengthened at the center of each side by pieces of wire soldered to it and to the netting below. Two of these pieces, on opposite sides, should be long enough to permit the free ends to be bent out at right angles to the frame and

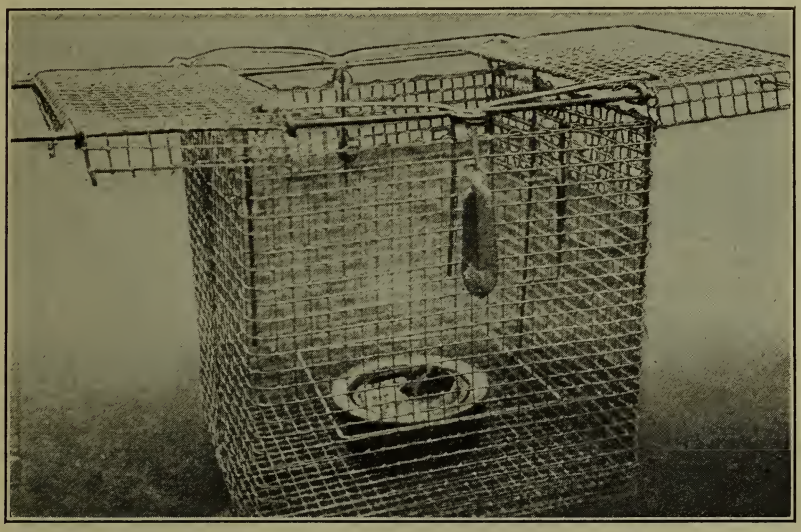

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FIGURE 28.—Michener water trap. When a bird touches the wire treadle around the drinking vessel, the trigger is released from the door to the right. This permits lead weights to close both doors. (Photograph by Harold Michener)

there shaped into horizontal rings about three-quarters of an inch in diameter. The operating cords from the doors to the weights pass through these rings.

On one of the other sides is attached the trigger apparatus. The trigger guide, which is soldered to the netting in the center of the trap wall, is made from a piece of wire 8 or 10 inches long, the ends being formed into rings about half an inch in diameter and then bent at right angles so that they will be opposite to each other. The trigger, which is supported and guided through these two rings, is merely a straight piece of heavy wire about 12 inches long that passes through the rings of the trigger guide, the lower end being attached (by a simple loop) to the treadle or trigger release, while the upper end engages with one of the doors (when the trap is set) through the meshes of the netting. The trigger release, or treadle, is made from a piece of wire about 27 inches long, bent twice at right angles to

form a U, the legs being 10 inches in length, and 7 inches apart. A piece of wire is soldered across the U so as to inclose a square 7 inches each way, and to this piece the trigger is attached. About 3 inches of the legs will project beyond this piece, and by means of simple loops these are attached to the netting of the cage under the trigger guide, and about 2 inches from the bottom.

Two doors are made from pieces of wire netting about 15 by 7½ inches. On two corners of each door sections 1½ inches by 1 inch are cut out (the 1½-inch cut being on the long or 15-inch side), and the side and two ends thus made are bent down approximately at right angles. These will form overhangs all around the cage when the trap is closed and will cover the space made by the elevation of the door carriers above the trap walls. Two pieces of heavy wire, 13½ or 14 inches long, are used to attach each door to the frame and carriers. Small loops or rings are formed on the ends of the wires, so that they will slide freely on the carriers, and they are then soldered to the undersides of the doors. The doors are operated by 2 half-pound weights (lead sinkers used by fishermen in casting heavy lines will serve), to which heavy but smooth cords are attached. The ends of the cords are carried through the wire rings on either side of the trap and are attached to the inner corners of the doors.

In operation the doors are spread apart and the treadle lifted until the trigger engages with one door through the meshes of the wire netting. The pull of the weights tending to close the doors will exert sufficient pressure against the trigger to hold it in place, although a very light weight on the treadle will dislodge it.

COHASSET WARBLER TRAP

The Cohasset warbler trap was developed by Richard B. Harding, of Brookline, Mass., and at some stations it has given exceptionally good results in capturing warblers. For these birds water dripping into a shallow dish or pan in the trap from a reservoir suspended overhead seems to be the best bait. Young birds also have been placed inside the trap, for the purpose of enticing their parents to enter.

The trap may be either circular or square, but the round type is preferable. As will be seen from Figure 29, it is of simple construction, being nothing more than a cage made from No. 3 galvanized-wire hardware cloth, 20 inches in diameter and 17 inches high, with a funnel, made of the same material, extending into the cage from the top. The opening from the funnel, about 3 inches in diameter, should be 5 or 6 inches above the bottom of the cage. A door for the removal of captured birds is provided near the top, as warblers seek an opening above the ground. A stand (as shown in the illustration) made of wood or sheet metal, may be provided to support the gathering cage.

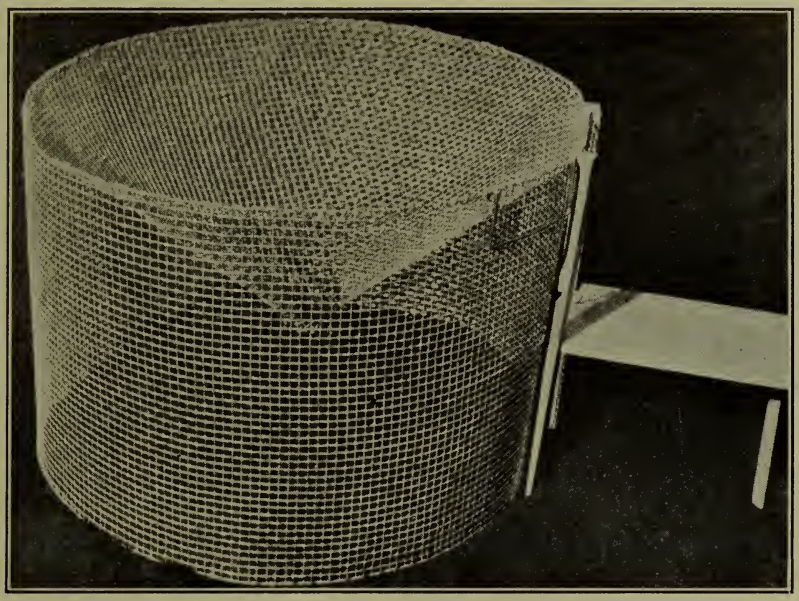
TREE-TRUNK TRAPS

Traps for the capture of tree-climbing species are necessarily specialized, but they need not be of complicated construction. As woodpeckers and other birds that obtain their food in this manner are among the most interesting species, every well-organized station should have at least one trap in its equipment for their capture. In using tree-trunk traps attention should be given to the kinds of birds for which they are intended and the method of approach of each.

For example, creepers and nuthatches usually start low on a tree and work up, and so would enter a trap at the bottom, while some woodpeckers, as the downy and hairy, may back in from the top.

BASKET TRAP

A simple and inexpensive trap for the capture of these birds can be readily made from a wire basket, such as is used for desk papers or for draining dishes. (Fig. 30.) A board somewhat larger than the basket is used for the base. This should have a hook or screw eye at one end so that it may be hung on a nail driven into the trunk of the tree. The basket is attached to the board simply by driving two or three staples over its rim at the top (one end) and into the board.



B3466M

FIGURE 29.—Cohasset warbler trap. As the door for removal of captured birds is placed near the top, a stand is provided to support the gathering cage. Photograph by A. W. Higgins)

It is well to fasten a weight on the other end of the basket to help hold it down after the trap has been sprung. This may be accomplished also by attaching a light catch and running rubber bands from the basket to the baseboard, or the lower end of the board may be inclined from the trunk an inch or two, in order that the basket may not hang perpendicular and slightly open at the bottom when sprung. A trip stick about 1 foot long is used, one end engaging with the lower rim of the basket and the other resting on the head of a nail driven into the trunk of the tree, about 10 inches below. This arrangement permits a more direct pull when the trap is sprung.

BALDWIN WOODPECKER TRAP

As with traps of other kinds, an automatic trap is frequently desirable for the capture of woodpeckers. The Baldwin woodpecker trap has proved satisfactory for birds of this group, including those

the size of the flicker. As shown in Figure 31, it consists of a rectangular cage 8 inches square and 20 inches long, made from either No. 2 or No. 3 galvanized-wire hardware cloth. It is open at the back, where it is fitted against the trunk of a tree. A piece of netting 24 inches long and 20 inches wide will make the sides and front. The top and bottom should be finished by the installation of wire frames securely fastened to the netting and with the ends at the back corners bent out at right angles and formed into eyes or rings, through which nails or screws may be driven in to attach the trap to the tree. The top and bottom (of wire netting) also should be mounted on wire frames. The top may be rigidly attached to the cage by lacing with copper wire, but it is better to have it hinged with wire rings so as to serve as a second door, which, as previously stated, may be needed in capturing certain kinds of birds. If the latter course is adopted a light piece of strap iron or a piece of stiff wire should be fastened across the door and project beyond the sides of the trap to prevent the door from falling inside the trap chamber.

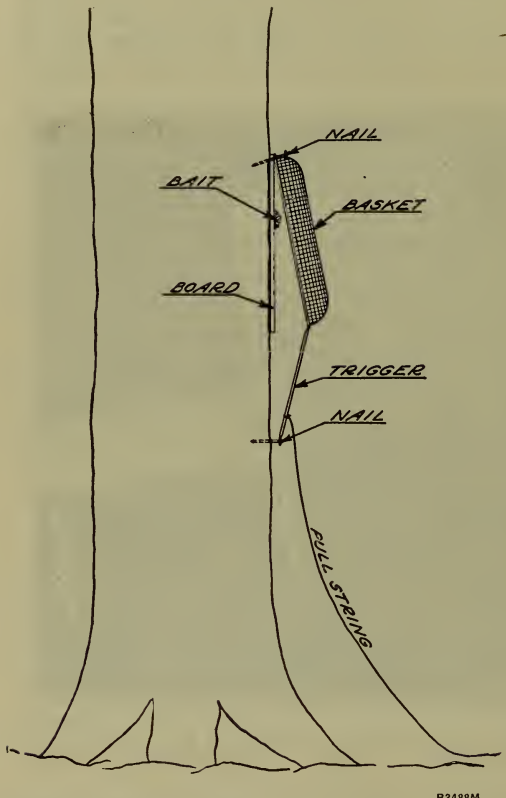


FIGURE 30.—Basket trap. A wire letter basket is attached loosely by staples to a board that may be hung on a tree trunk. A pull string is attached to a light stick, one end of which rests on a nail driven into the tree, while the other end props the lower end of the basket away from the board

The bottom door opens inwardly, standing vertically against the front of the cage when the trap is set. On the lower frame, stops made of short pieces of stiff wire should be attached, to prevent the door from falling outside the chamber when the trap is sprung.

The trigger is made from a piece of No. 14 gauge wire, about 25 inches long. Beginning at one end, double the wire back on itself to form the letter T, the two arms each measuring about 3 inches in length. At a point 5 inches below the arms, bend the wire down at a right angle, and 6 inches below that fashion it into a W-shaped hook to engage with the frame of the bottom door, when the trap is set. This hook is shown in Figure 31. Care should be taken not to make it too deep and thus obviate unnecessary movement of the trigger. A little experimenting will be required to adjust the trigger

so that it will engage lightly with the door. The trigger is attached to the trap by soldering a crossbar at the upper bend and pivoting it through the meshes of the sides of the trap chamber. This is best done before final adjustments are made on the trigger hook.

This same trap may be readily used as a 2-door pull-string trap, the upper door to open up and the lower door to drop down outside the trap when it is set. The stops for the lower door should be removed and a simple catch attached to hold the door up when the cord is pulled. By adjusting the cranks of the doors they may be connected to one string and so closed simultaneously. (Fig. 32.)

In using any trap for woodpeckers it is advisable to ascertain, if possible, which trees at the station seem specially favored by these birds. The automatic trap should have a piece of suet or other bait fastened on the tree trunk opposite the trigger crossbar, which a feeding bird will be likely to strike and slightly raise, thus releasing the door.

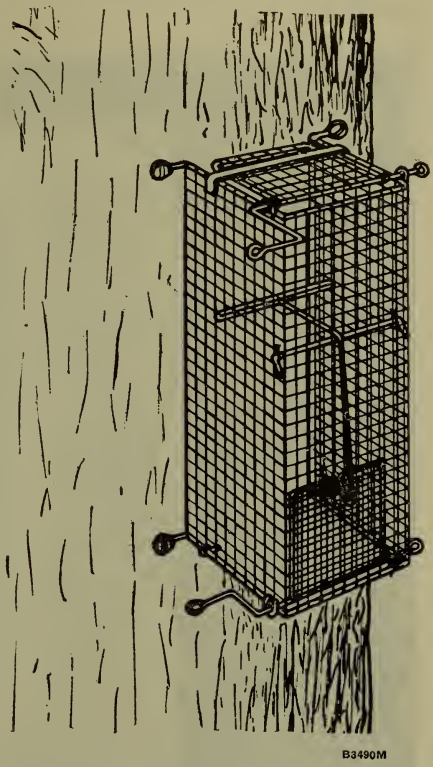


FIGURE 31.—Baldwin woodpecker trap. A bird entering the trap from below climbs up the tree trunk to get the bait placed just above the cross-arms of the trigger. These are naturally touched and lifted enough to release the lower door from the W-shaped hook on the lower end of the trigger

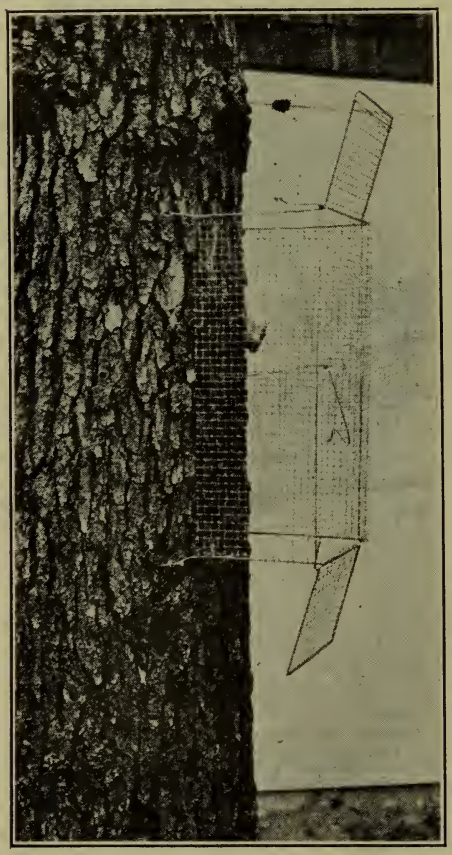
INLAND CREEPER TRAP

The inland creeper trap is the result of the experimental work of William I. Lyon, of Waukegan, Ill., to perfect a trap for the capture of the smaller tree-climbing species, such as creepers and black and white warblers. Its plan usually lends itself to semipermanent location, although Mr. Lyon reports that the standard type here described can be placed on tree trunks of various sizes. (Fig. 33, A.) The essential parts are (1) an outer chamber, entered through a funnel that is approached by leads of wire netting tacked spirally around the trunk of the tree, and (2) an inner chamber that is entered through a chute from the outer chamber. As the construction of such a trap might well vary to fit existing conditions, the principle employed is explained without minute details. The following description and measurements were taken from a sample supplied by Mr. Lyon:

The outer chamber is a cage open at the back, which fits against the trunk of the tree. It is made from ¾-inch poultry netting and measures about 12 by 12 by 15 inches. The bottom is worked into a funnel, similar to the one in the outer chamber of the Government

sparrow trap (fig. 13), the mouth being protected by guard wires. The back part of the funnel and the rear edge of the top should be cut out semicircularly so that the cage will fit snugly against the tree trunk. By bending outward the last course of the meshes of the wire netting, it will be possible to fasten the cage to the tree trunk with small staples.

On one side of the cage at the top is attached a horizontal framework made from strips of wood three-fourths of an inch square and measuring about 11¼ by 5¾ inches. The frame is fastened to the netting with small staples and the inclosed netting cut out. This forms the entrance to the second chamber. As the second chamber is hung on this frame, it must support considerable weight and accordingly should be braced by a piece of wood (triangular in cross section) attached to the frame on the back and extending the full height of the cage. The wire netting should be fastened to the brace with staples.



B4144M

FIGURE 32.—Baldwin woodpecker trap used with a pull string. The cranks on both doors are connected so that the doors will close simultaneously

The outside dimensions of the inner chamber (fig. 33, B), which is virtually a receiving cage, are width, 11¼ inches; depth, 10½ inches; and height, 15 inches. Four pieces of ¾-inch wood, 15 inches long, form the corner posts, which are attached to a wooden bottom. At a point 5 inches below their tops a second floor is added. In the center of this is made a rectangular opening 3 inches wide and 8½ inches long. The chute is attached in this opening, extending about 5 inches into the space between the floors. A piece of sheet iron 5 inches wide and 14½ inches long will make the sides and front of the chute. It should be fastened with small brads flush with the surface of the upper floor. The back of the chute is made of a pane of glass 8½ inches wide and 12 inches long, which should extend above the upper floor to the level of the tops of the corner posts. It may be held in place by small clamps or sockets made of sheet iron. Small pieces of metal should be left at the bottom of the sides of the chute, which may be bent into sockets for this purpose.

The walls of the second chamber below the second floor may be made of ordinary window screen. In the sample supplied by Mr. Lyon, the sides and back are of window screen, while the front is of sheet iron. A door for the removal of captured birds should be provided. The top and the sides above the second floor should be covered with ¾-inch poultry netting, and the two front corner posts in front of the chute should be connected at the top by a piece of ¾-inch wood. Square hooks made of heavy wire (preferably galvanized) should be attached to the inside of these posts so that they will project a little more than three-fourths of an inch. By means of these hooks this chamber is attached to the ¾-inch framework of the outer chamber. When so attached the two openings will coincide, leaving an apparent exit for birds that have entered the outer chamber, but whose attempts to escape are blocked by the pane

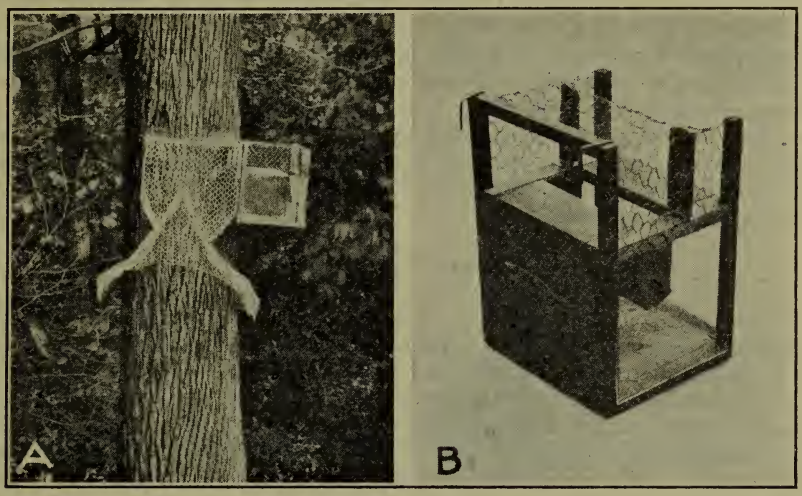


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FIGURE 33.—Inland creeper trap. A, Trap in place showing outer chamber with leads of wire netting below the funnel and the inner chamber attached; B, inner chamber, which is attached to the outer by the hooks on the corner posts. A chute extending into the space between the floors is shown. (Photographs by William I. Lyon)

of glass against which they will fly and so fall through the chute into the lower part of the second chamber. No injury to birds is caused by striking the glass as there is not sufficient space for them to gain momentum.

In order that the progress of the climbing birds may be directed toward the funnel, long strips of ¾-inch netting, 6 or 8 inches wide, should be attached to the tree below the funnel, extending down and back around the trunk. This trap should be painted dark brown or gray to render it less conspicuous.

NEST TRAPS

The use of traps at nests for the purpose of obtaining parent birds for banding must be undertaken with great care. The belief that has long prevailed that wild birds will desert their nests if they are

interfered with in any way has been disproved in many cases, but sufficient data are not yet available to warrant definite advice. Bird-banding cooperators accordingly should exercise caution and discretion in their work with nestling birds. It is seldom wise to attempt the capture of adults while incubation is in progress, as desertion of the nest may follow. Incubating or brooding birds of many species, however, if approached quietly, without sudden movement, will become so accustomed to the presence of the operator that they may be captured and banded without causing undue disturbance.

In adjusting nest traps, advantage may be taken of the usual habit of many birds of approaching their nests by the same route, so that a few minutes' observation will show which way the door of the trap should face.

A few suggestions as developed from trapping robins may be applicable to other species that do not readily tolerate interference at the nest. The best time for such work is about a week after the young have hatched. It is also desirable not to try to capture both adults on the same day but to allow two or three days between captures, as this will give time for the bird first taken to resume its normal behavior. This is aided by the other adult, which unalarmed will continue with the nesting activities. Then when both have resumed their duties the other bird may be caught. Nest traps never should be made automatic.

TRAPDOOR PERCH

For species that regularly nest in boxes or natural cavities, the trapdoor perch can be employed to advantage and may be the means for detailed studies of individual birds during the nesting period.

The simplest type of trapdoor perch is made from a small block of wood, large enough to cover the entrance hole. To this a piece of stiff wire is attached by means of staples and extended on either side as an axle. One end of the wire is given a right-angle bend and provided with a small loop or ring to which the pull string is attached. The perch is fastened to the nest box or tree trunk with small staples, which serve as bearings.

A more substantial type is made entirely of metal. Two or three inches from one end the wire axle is bent into a loop, and on this a piece of sheet iron, zinc, or tin is bent so that when the loop is held vertically a piece of the sheet metal will project horizontally and form the platform and door to close the nest opening. The loop serves as a bracket against the tree or nest box and keeps the platform in a horizontal position when open.

Nest boxes on which the device is used should be constructed so that the front may be opened for the purpose of removing captured birds and for cleaning. This is easily accomplished by rounding off the edges of the top of the front, which is then pivoted on two nails driven in through the sides near the top. (Fig. 34.) A small hand net, with a hoop 4 or 5 inches in diameter and a bag made from mosquito netting, is frequently all that is needed to secure the bird.

The net is placed over the entrance and the trapdoor lowered. Usually the bird will fly at once into the net, but occasionally a little tapping on the box may be necessary to bring it out. Some birds,

however, are reluctant to come out, and should it be necessary to open the door carefully and slide the hand into the box, it is well to cover the hand with a piece of soft cotton mosquito netting.

NEBBA NESTING-BOX TRAP

Nest boxes also may be converted into efficient traps by the use of a metal or wooden shutter, arranged to fall or to be pulled across the opening when the bird has entered. One of the most satisfactory traps equipped in this manner is the so-called Nebba trap, which has found favor with cooperators in New England and was developed by A. W. Higgins, of Rock, Mass.

The shutter is made from a piece of galvanized sheet iron cut in the shape shown in Figure 35, with an aperture corresponding in size to the hole in the box. A small hole is punched in the lower left-hand corner, and through it a screw is driven for a pivot. In order that the shutter may fit snugly against the box a guide is made from a piece of fairly stiff wire (about No. 14), the ends being bent at

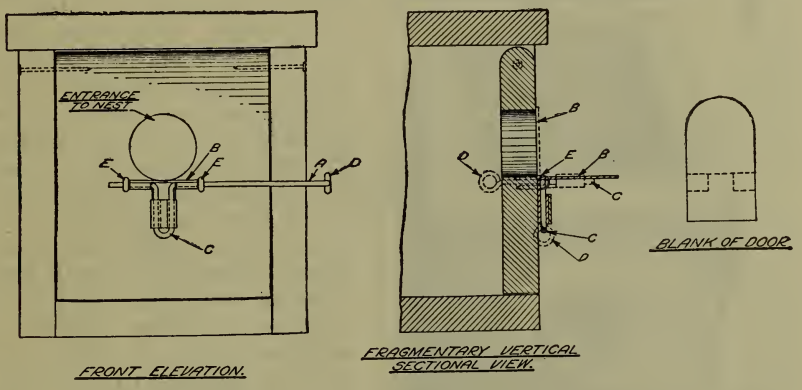

FIGURE 34.—Details of construction of nest-box trap

right angles and sharpened so that the guide can be driven into the front of the box like a wide staple. The upper right-hand corner of the shutter is so cut out as to form an angle for holding it in place by a catch. This is merely a straight hook, the short arm of which fits into a small hole drilled part way into the trap front under the point of the angle of the shutter. The long end of the hook terminates in a ring or eye, to which the pull string is attached. By means of a small staple the catch is attached to the front of the trap with the ringed end projecting beyond the right edge. The staple should not be driven down tight, but left so as to act as a bearing for the catch.

In operation the pull string is carried from the catch through a small screw eye in the back part of the right side. The shutter is raised, and the short arm of the catch is inserted into the hole and in this position supports the shutter. A sharp jerk on the string will pull the catch loose and allow the shutter to fall of its own weight. A small screw or nail should be driven into the box to stop the shutter when it has fallen far enough to close the entrance.

A little care is required in the operation of this trap, as the shutter might be released just as the bird starts to leave. The shutter is light, however, and so far as known no birds have ever been injured through its use.

LURVEY TRAP NO. 3

The Lurvey trap No. 3 was designed by F. J. Lurvey, of Somerville, Mass., and at the few stations where it has been tested it has received high indorsement. Being automatic, it is not intended as a nest box, but it is useful in taking such birds as bluebirds, starlings, house wrens, nuthatches, and chickadees when they are prospecting for nest sites.

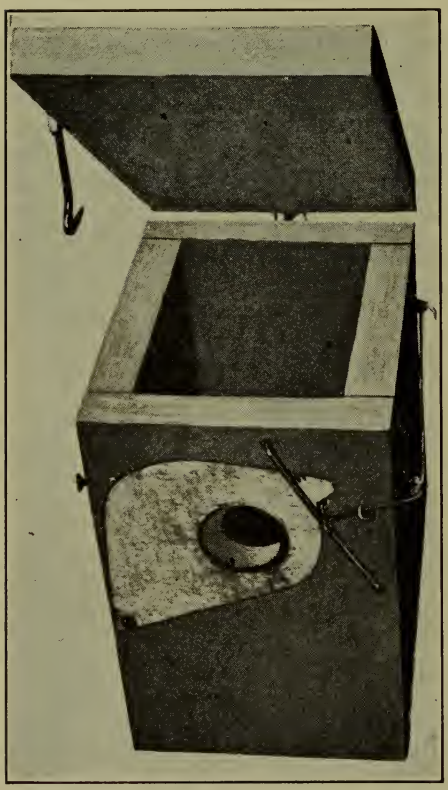

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FIGURE 35.—Nebba nesting-box trap. (Photograph by A. W. Higgins)

Figure 36 illustrates a sample trap submitted by Mr. Lurvey, which consists of a box made from 3/8-inch poplar, the base 6 inches square, the front 7 inches high, and the back 10 inches high. The board forming the back may be about 13 inches long to provide extensions above and below for attaching to a tree or building. The top is hinged at the back and projects about half an inch on the front and sides as a protection against the weather, and is kept closed by a small brass hook on one side. To provide ventilation, holes should be bored through the sides near the top. Instead of a true bottom the trap has small wooden cleats about half an inch square nailed around the inner lower edges of the box. These prevent the treadle from moving more than enough to release the shutter.

The entrance hole measures 1¾ inches in diameter and is closed by a wooden shutter, attached by one corner to the front of the box, above and to the left of the hole. A perch for an entering bird serves as a stop for the shutter. Diagonally across from the point of attachment to the trap a small brass screw eye is driven into the shutter, the eye being on the same plane as the face of the shutter.

A shallow wooden tray, A, about 5 inches square is pivoted in the bottom of the box about an eighth of an inch above the cleats. A small brad or nail may be inserted for the left-hand pivot, but the one on the right, B, should be made from a piece of No. 16 brass

wire about 7 inches long. Outside the box this wire should be bent up at a right angle for about 5 inches, and then given a second right angle bend forming a short horizontal leg about a quarter of an inch long.

The trigger, C, is made from another piece of No. 16 brass wire about 5 inches long. By twisting this in the middle into two or three complete loops, through which a screw can be driven, it becomes a

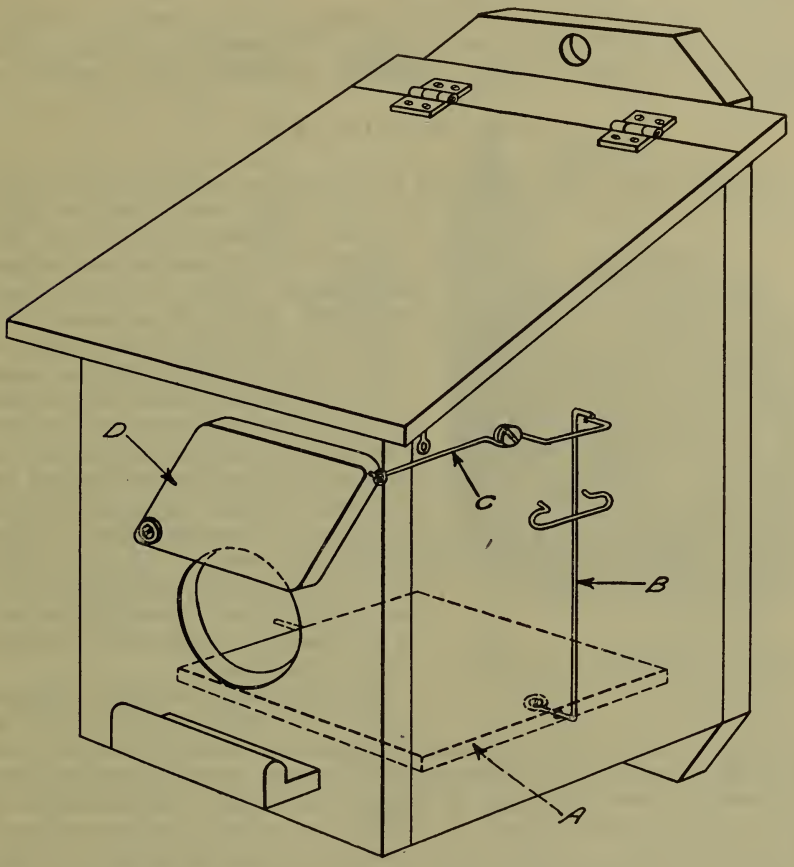

FIGURE 36.—Lurvey trap No. 3. A bird entering the box through the hole provided hops onto the tilting treadle A, which moves the lever B, disengaging the pivoted trigger C, and allowing the shutter D to descend of its own weight and close the opening

bearing for the trigger. The front end should be left straight and should project about three-eighths of an inch beyond the front of the trap. The rear part should first be bent out, then continued parallel to the side of the trap, and finally have the end bent in at a right angle, making a horizontal leg about one-fourth of an inch long to engage on the underside of the similar leg on the operating lever. It is well to flatten the contact surfaces with a fine file; otherwise the set will be so sensitive that it will be sprung by any slight jar.

A brass-wire guide or broad staple to inclose the lever may be fastened to the side of the trap, as shown in Figure 36.

To operate, the shutter is raised to clear the opening, and the straight end of the trigger is passed through the screw eye. The lever is then brought over and engaged with the trigger, the weight of the shutter exerting sufficient pressure to maintain the contact. A very light weight on the treadle will be sufficient to disengage the trigger and thus let the door close.

Sunflower seeds or suet may be placed on the treadle, so that it can be used as any other baited trap. The sample sent in by Mr. Lurvey has a suet container, made of hardware cloth, attached to the back.

BANK-SWALLOW TRAP

Banding work with bank and rough-winged swallows has shown interesting possibilities, and the equipment used involves little expense. Clarence S. Jung, of Milwaukee, Wis., developed the following simple device that has been successful at several colonies:

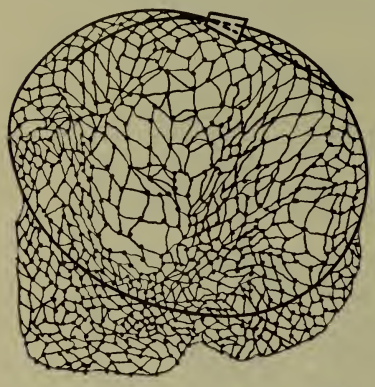

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FIGURE 37.—Bank-swallow trap made from a cap hair net, a basket reed, and a cork

Several cap hair nets, pieces of either No. 1 or No. 2 basket reeds 2½ to 3 feet long, and some 1-inch corks are the only materials needed. The pieces of reed are woven in and out between the meshes of the nets and the ends fastened by forcing them through holes drilled through the corks. (Fig. 37.) The size of the opening to the nets may be regulated by drawing the ends of the reeds through the corks any desired distance.

Equipped with a supply of these nets, it is relatively easy for an operator to take a large number of swallows. When a bird has been observed to enter a nest hole, one of these nets is placed quickly over the entrance and fastened in place with a few forked twigs or U-shaped pieces of wire, which are stuck into the earth over the reed. If the bird does not immediately come out it usually may be forced to do so by flashing a flashlight into the hole or by pounding on the ground above the nest. Captured birds should be removed immediately, but by exercising a little care it will not be necessary to tear the nets.

DUER NEST TRAP

A useful nest trap, developed by Harry E. Duer, of North Olmsted, Ohio, has taken warblers, goldfinches, waxwings, and doves. (Fig. 38.) A cylindrical net made of green mosquito netting is held in shape by two rings, about 10 inches in diameter, made of No. 9 wire. The diameter of the trap may be much less if it is to be used only for species that build small nests. One of these rings is sewed at the bottom of the net cylinder and the other is fastened inside

about 15 inches above the bottom. Above the upper ring the netting is gathered together and tied.

The net is suspended above the nest, a space of at least 3 inches (depending more or less upon the size of the bird) being allowed between the top of the nest and the bottom of the trap. An elastic band should be inserted in the suspending cord and obstructing limbs and twigs should be carefully trimmed back from the nest. Four pieces of black linen thread, equally spaced, are attached to the lower ring, and after being carried well below the nest are joined together and attached to the pull string. The string is then passed over a crotched branch or through a wire loop on the ground and carried to the observation post of the operator. To prevent the bird from escaping below the net a ring of grass is placed concentrically around the nest, so that the combined diameter of nest and ring will approximate that of the trap. When the bird has settled on the nest the net is pulled down over it, and the pull string is tied to a branch or other convenient object to prevent the net from being lifted by the elastic band.

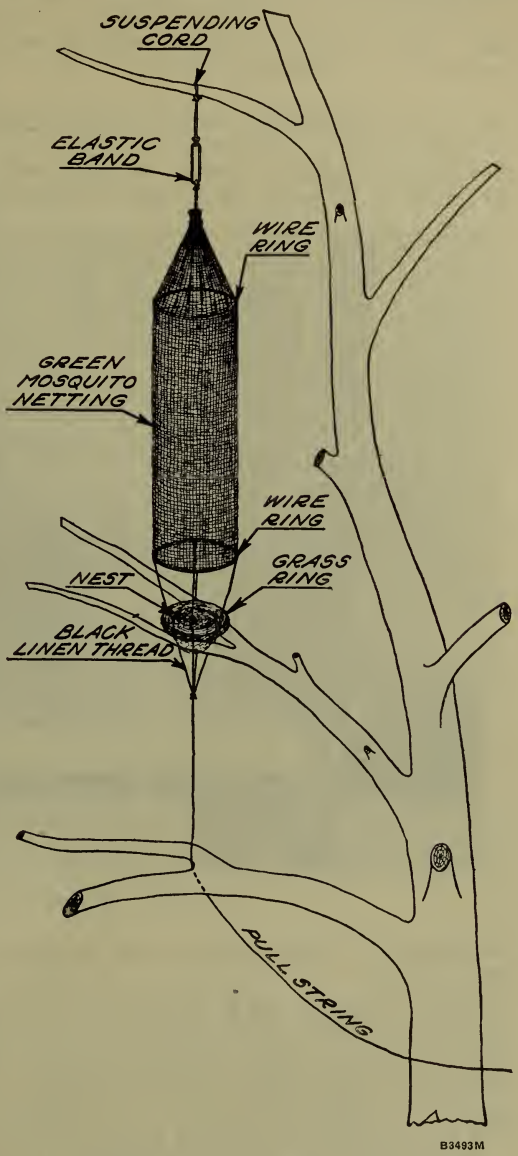


FIGURE 38.—Details of Duer nest trap

KENDEIGH NEST TRAP

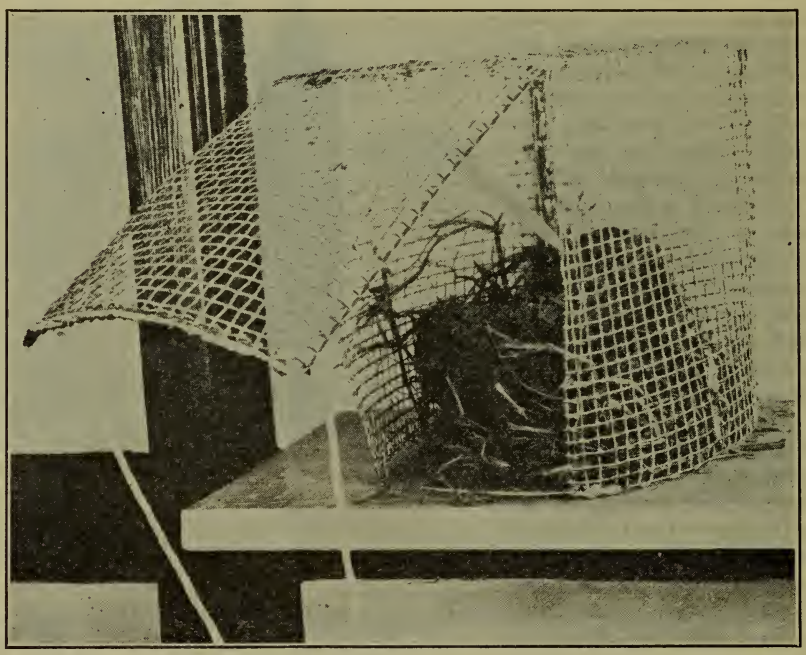
A simple type of nest trap has been successfully used by S. Charles Kendeigh at the Baldwin Bird Research Laboratory in capturing adult robins at the nest. (Fig. 39.) The trap is in the form of a box open at the bottom, made from No. 4 galvanized-wire hardware cloth. The front is a door hinged at the top. In operation this door is held horizontally by a trip-stick to which a pull string is attached. The open bottom permits placing the trap over a nest in almost any sort

of location. As the hardware cloth is readily bent at the bottom edges, the trap may be fitted to nests of irregular outline. The adult birds quickly learn to enter the cage through the open door, where they may be caught by pulling the string that releases the supporting trip stick.

For robins a trap approximately 7 inches on a side is of sufficient size. For smaller or larger nests of other species, dimensions may be adapted accordingly.

BALDWIN NESTING BOX AND NEST TRAP

The nesting box is merely an open-end box about 8 inches square. (Fig. 40.) A series of such boxes may be attached to the sides of



B4i07M

FIGURE 39.—Kendeigh nest trap

buildings or under eaves for the occupancy of such birds as robins and phoebes.

The trap cage is made of hardware cloth and should be of sufficient size to slip readily over the front of the nest box. A vertically sliding door is provided, which should be as large as possible. (See description of Potter trap for method of attaching sliding doors, p. 23.) A thin board, such as a shingle, should be attached to the box and project out in front as a landing platform for the bird.

The trap attachment should not be put on the box until the young birds are 3 or 4 days old, and even then it is not advisable to attempt to trap the parents at once. The best way is to fasten the door open and thus allow the birds to go in and out freely for a day or two, when the door may be lightly supported by a trip stick with pull string attached.

In addition these traps may be employed to capture parent birds on nests that they have previously made. For such work the box should be nailed up close to the nest, and after a day or two allowed for the birds to become accustomed to its presence the nest is lifted intact and placed inside the box, after which the operator proceeds in the usual manner.

TRAPS FOR GROUND-NESTING BIRDS

A simple method of capturing ground and marsh nesting birds for banding is to place a piece of No. 2 hardware cloth completely around the nest inclosing an area 2 to 3 feet in diameter (depending upon the size of the bird and its nest). The netting need not be high; in fact, it is preferable that it be made as low as possible. Usually 6 inches to 1 foot will be about the right height. This should be left a few days until the incubating bird becomes accustomed to its presence, when a circular cover made from a piece of

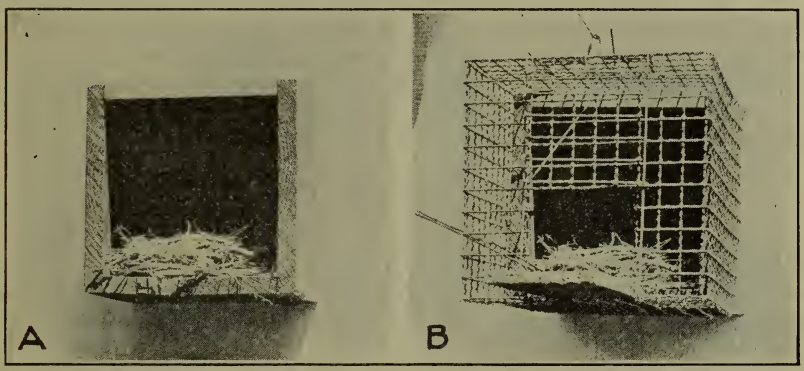


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FIGURE 40.—Baldwin nesting box and nest trap. A, The box occupied by a robin's nest; B, the box with the trap in place and the door open, showing the outside platform

netting may be attached by means of a wire ring and held up by a short stick with a pull string attached. It is best to defer operations of this nature until incubation of the eggs is well advanced, or, better still, until after they have hatched.

SPECIAL TRAPS AND METHODS

The traps thus far described are those used for general or routine work at small-bird stations, and a large variety of birds may be taken with such equipment. It is desirable, however, to bring additional species under investigation by the banding method, for no North American bird is excluded from possible banding work, and many more species may reward station operators with ingenuity in trap development. The traps and methods described in this section are illustrative of the field that awaits the attention of the inventive cooperator. Those described may be useful for birds other than the species for which designed and, furthermore, the principles employed may be applicable to special traps of different patterns.

BARN-SWALLOW TRAP

As a case in point, the experience of Miss Helen J. Robinson, of Brewer, Me., in trapping adult barn swallows may be cited. Following specifications furnished by A. W. Higgins, of Rock, Mass., a light cage about 4 feet square and 2 feet wide was made from strips of pine lumber and covered with light twine minnow seine. At one end two doors opening inward were hinged and fixed so that they could be closed by a pull string. In the floor was a manhole with a trapdoor to admit the operator.

In the evening, after the swallows had gone to roost in the barn, the large sliding doors through which they had entered were closed. On the following morning the trap with doors open was placed on supports (trestles or boxes) close against the barn doors, blankets were hung above and below, and the barn doors carefully opened for a distance about equal to the width of the trap (2 feet). The operator then took the pull string, entered the barn, and selecting a place where the opening could be kept under observation yet far enough away from it to cause the birds no alarm, waited quietly. As the barn was in semidarkness the birds soon flew toward the light coming through the trap, entered it, and were secured by the operator closing the trap doors by means of the pull string. Miss Robinson reported taking 15 swallows the first morning the trap was operated.

CHIMNEY-SWIFT TRAP

As its name indicates, the chimney-swift trap has been designed for the sole purpose of capturing chimney swifts at their roosting or nesting chimneys. Charles O. Handley, of Richmond, Va., is responsible for its invention and perfection, but it also has been successfully used by banders at other points.

Since the shape and size of the trap would necessarily vary, depending upon the chimney for which intended, it is impracticable to give detailed specifications. Figures 41 and 42 will assist in construction and operation. Because of the physical difficulties and dangers that may attend such work, the trap should be made as light as possible, and the various parts should be connected by hooks.

The trap chamber is made of strips of poplar or other light wood; the sides are covered with white muslin, which is better for the purpose if somewhat soiled or dingy; and the top is covered with ½-inch-mesh twine netting. The sample submitted by Mr. Handley was 54 inches long, 15 inches wide, and 18 inches high at the exit. About a foot from the apex of the base of the chamber (the left-hand end in fig. 41) a light vertical partition, about 2 or 3 inches wide, is inserted to prevent birds from wedging themselves into the far corners. The bottom is partially covered with muslin, the area covered depending upon the size of the chimney to be worked. On one side a flap about 7 inches square is provided, so that the operator's hand may be inserted when necessary. This flap may be held shut with a couple of thumb tacks. On both sides are tacked pieces of pigeon wire about 18 inches wide with light strips of wood running lengthwise through the free sides, to fasten the trap in position, which is done by lowering them over the sides of the chimney and tying with a rope or stout cord. When the trap is being taken

to the top of a chimney, the flaps are best tied up (as in fig. 41) so they will not be in the way of the operator.

The chute, or hopper, is made of sheet iron (base sections of stovepipe frequently may be modified for this purpose) with a vertical panel to close the end of the trap chamber, made of celluloid such as that used in automobile curtains. Sheet-iron side braces help support the panel, and on the inner edge of the chute is soldered a piece

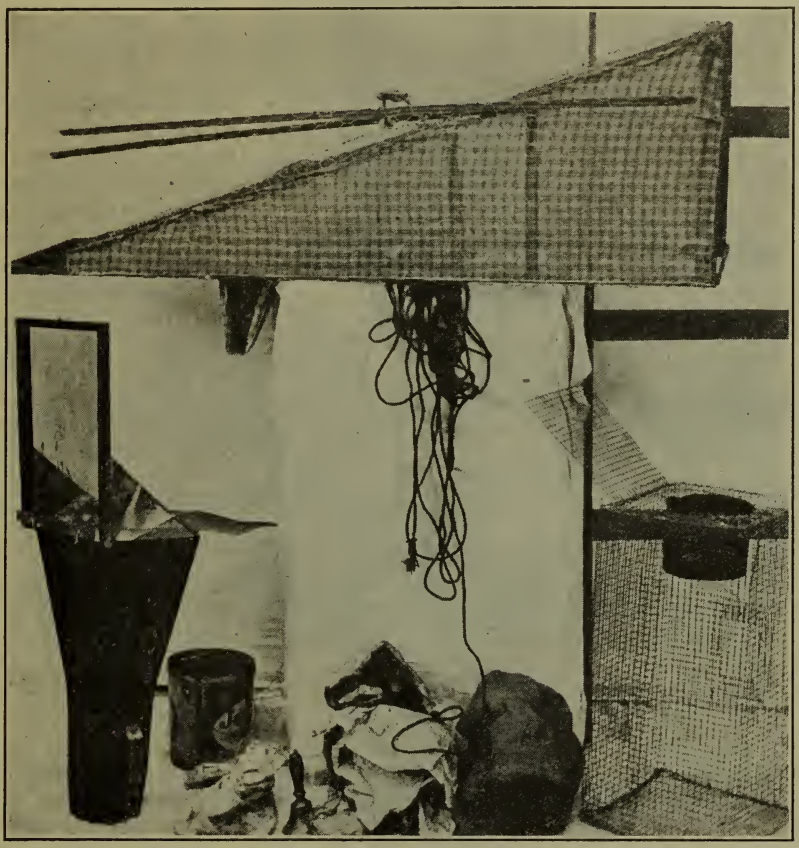

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FIGURE 41.—Chimney-swift trap. Above is the trap chamber, made of light poplar strips, the sides covered with muslin and the top with ½-inch-mesh twine netting, and with flaps of pigeon wire for attaching to chimney; at the left is a celluloid panel attached to the chute; in the lower right-hand corner is a gathering cage with safety door raised; and in the center are various implements, a pail, bell, burlap sack, roll of newspaper, etc., that can be lowered into the chimney to start the birds. (Photograph by Charles O. Handley)

of tin or sheet iron, running the full width and bent so as to slope inward and up. This actually forms a continuation of the inner wall of the chute and serves to catch birds striking the celluloid panel and helps to direct them into the chute. The mouth of the chute, 6 or 8 inches across, is the full width of the trap chamber and is attached to the trap chamber by means of hooks and screw eyes.

Gathering cages should be about 2 feet high and at least 1 foot square. They may be made entirely of No. 2 hardware cloth, without

reinforcing frames. A 5 or 6 inch section of stovepipe is inserted into the top and securely wired in place, and a piece of hardware cloth is attached to the top of the cage to cover this opening when it is removed (filled) from the trap. It is also desirable to provide a door on one side for convenience in removing birds. Two stout wire hooks are used to fasten the cage to the chute.

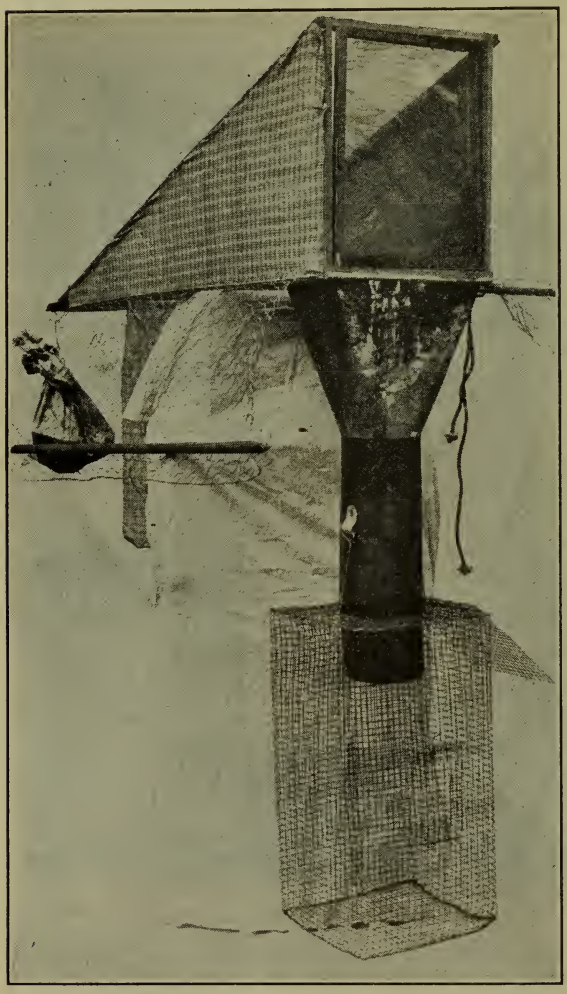

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FIGURE 42.—Chimney-swift trap assembled. The chute is attached to the trap chamber with small hooks and screw eyes, and the gathering cage is attached to the chute by means of two wire hooks fastened opposite each other on the pipe of the chute. (Photograph by Charles O. Handley)

In operation, the trap chamber is placed on top of the chimney early in the morning or in the evening after the swifts have entered. After the trap is securely tied in place and all possible exits eliminated except the end, the chute is attached. If the chimney is a high one, the chute may be extended by sections of stovepipe to the gathering cage on the roof below. With low chimneys, it is more convenient to suspend the cage to the chute by hooks. The swifts upon emerging from the chimney strike against the celluloid panel, lose their equilibrium, fall into the chute, and then into the gathering cage.

If the birds are slow to start, a bell, a roll of newspapers, a pail, or some similar object may be lowered down the chimney with a cord and raised by short jerks, the object being to produce a noise or disturbance below them. *Never, under any conditions, should fire be introduced at the base of the chimney for the purpose of starting the birds.* When once started, the swifts will come out rapidly, so that two or more gathering cages should be in readiness. Guard carefully against overcrowding in the cages, as this may smother many birds.

Work with chimney swifts should be thoroughly planned and organized in advance of actual operations. The permission of the chimney owner should be obtained, and one or two assistants should be fully instructed in the parts of the work they are to do.

The trap described is intended for taking large numbers of birds during migration, when several hundred will congregate in a single large chimney. A smaller trap can be used to take the pairs that usually are found in smaller chimneys during the breeding season. Such work is well worth while, as the operator has an excellent opportunity to recapture swifts that have been banded while on migration, thus establishing two definite points in the travels of individual birds.

MINER CROW TRAP

During the winter of 1925–26, Jack Miner, of Kingsville, Ontario, constructed a large trap that was so successful in the capture of crows

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FIGURE 43.—Miner crow trap. A photograph of the original trap at Kingsville, Ontario. End view. At the time this picture was taken the trap held 100 crows

that the senior author visited Kingsville to obtain first-hand information concerning its construction. Although designed solely for the control of crows, the trap is also adaptable in trapping some other birds, such as gulls and geese, which are not readily taken in smaller traps.

As will be seen from Figures 43 and 44, the Miner trap is a large structure and somewhat expensive to build. Mr. Miner estimated that his trap cost about $100, but this cost could be greatly reduced by use of second-hand material. The specifications here given conform closely to the original trap, which was 73 to 75 feet long, 6 feet high, 20 feet wide at the bottom, and 12 feet wide at the top.

MATERIALS

The materials used in the construction of the Miner crow trap of this size are 14 heavy posts (about 8 feet long and 6 or 8 inches in diameter); 2 posts about the same size, but about 11 feet long; 2 smaller posts, about 11 feet long; 412 feet of 1½-inch iron pipe,

with elbows and T joints; 12 posts about 2 by 2 inches and 7½ feet long; 340 feet of 2-inch-mesh galvanized poultry wire, 6 feet wide; 150 feet of 2-inch-mesh galvanized poultry wire, 1 foot wide; 10 pieces of ¼-inch flat iron, about 1 inch wide and 18 inches long; 10 pieces of ¼-inch flat iron, 1 inch wide and 10 inches long; 10 pieces of ½-inch iron rod about 3 inches long; 12 flat or strap hinges about 2 inches wide; about 300 feet of heavy galvanized-iron wire; a quantity of old lumber to complete the framework of the trap; and the necessary tools for pipe fitting, forging, and carpentry.

CONSTRUCTION

After the site has been selected the 14 heavy posts are set in the ground in two parallel lines 12 feet apart, so as to inclose a rectangle

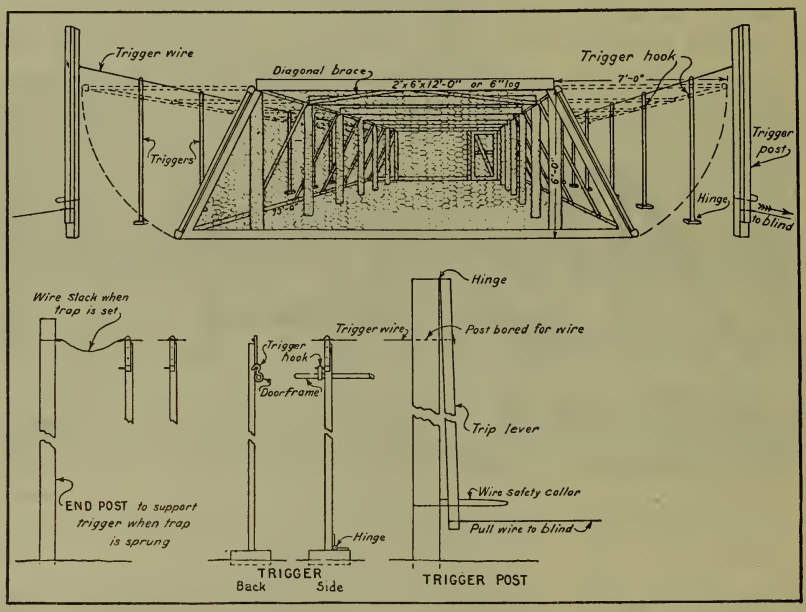

FIGURE 44.—Details of Miner crow trap. The trap is built on heavy posts, with scantlings, ordinary 2-inch-mesh poultry wire, and 1½-inch iron-pipe doors. Traps of this same type have been successfully used to capture geese for banding

about 75 feet long and 12 feet wide. The posts can best be set by the use of a regular post-hole digger and should project 6 feet above the ground. The opposite posts in the two lines are then joined together by heavy timbers (timber 2 by 6 inches were used by Mr. Miner) and cross bracing added where necessary. The ends of these timbers should not extend entirely across the tops of the posts, but a space of about 3 inches should be left, which will be necessary in attaching the doors. Two pieces of 6-foot wire netting will be used to cover the top. The details of the ends are best left until the doors are in place.

DOORS

The doors are merely frames, made from 1½-inch iron pipe and 75 by 7 feet in size. Six pieces of pipe are used as cross braces, parallel

to the ends. Joints should be made with the usual T, or, at the corners, elbow joints. When the frames are completed two pieces of netting, one 6 feet wide and the other 1 foot wide, are used to cover them, the netting being laced together and to the frame as tightly as possible with copper wire. The doors may now be set up against the posts, to which they are hinged by heavy spikes driven into the tops of the posts and bent over the upper pipes of the frames.

With the doors in place the ends may be completed on board frames nailed to the end posts. They also should be covered with wire netting, and a door should be provided to admit the operator.

TRIGGERS

By pulling each door out and up until horizontal the place for the line of the triggers can be determined. On each of these lines five blocks are placed equally spaced. (Short sections of 4 by 4 inch timbers set in the ground will do.) These should be so set as to project an inch or two above the ground. To these the triggers are hinged. The triggers are 2 by 2 inch posts 7½ feet long (2 by 4 timbers, ripped longitudinally will make satisfactory triggers), to the tops of which are bolted pieces of ¼-inch flat iron about 18 inches long. These irons must be drilled for screws or bolts before they can be attached, and there should also be a ¼-inch hole near one end; the opposite end is forged around a piece of ½-inch iron rod so that the latter will project at a right angle about 2 inches, as a pin. As great strain will come on this ironwork the pins must be firm. In attaching the irons to the posts the perforated end should extend several inches beyond the wood, and when held vertically the ½-inch iron pins should be approximately at the height of the doors when open (6 feet from the ground). The triggers are fastened to the ground blocks by strap hinges placed on the side toward the blind that will conceal the operator.

At the ends of each of the lines of triggers and about 4 feet beyond, posts are set firmly in the ground. The end posts need not be large, but the trigger posts, which carry the operating levers, should be 6 or 8 inches in diameter. Also the end posts need be only a few inches higher than the triggers, while the trigger posts should be 2 or 3 feet higher. At the height of the tops of the triggers a hole is bored through the trigger posts, and through each is passed a piece of heavy wire, which connects the triggers by means of the holes in the iron work, where a loop is made, and is finally fastened to the end post. Each wire should be taut from the trigger post to the last trigger but should have a few inches of slack between the last trigger and the end post. This is to prevent the triggers from falling too far forward.

On each trigger post a trip lever (of the same material as the triggers) is attached by hinges across the tops. These levers should extend within about a foot of the ground, and to each is attached the ends of the trigger wires that pass through the trigger posts. To prevent the levers from being pulled too far, wire safety collars are attached to the trigger posts a few inches above the lower ends of the levers. These should allow the lower ends of the levers to move about 2 feet. The pull wires are attached to the lower ends of the

two levers, and after extending about 50 feet they may be joined together and continued to the blind as a single wire.

TRIGGER HOOKS

At points on the bottoms of the door frames corresponding to the position of the triggers, the trigger hooks are attached. These are made from pieces of ¼-inch flat iron about 1 inch wide and are forged so that one end may be curled tightly around the pipe of the door frame, while the other end is formed into a hook that will rest over the pins on the triggers.

OPERATION

The doors are very heavy, and it will likely require the services of three men to set them. They are pulled out and up to the horizontal position and the triggers moved so that the hooks on the door frames rest over the trigger pins. It is well to attach the blind end of the pull wire to a short stick (such as a section of broomstick), so that it may be better grasped with both hands. A sharp jerk on this will pull the trigger wires in the same direction 2 or 3 inches. As these wires are attached to all triggers, the action is simultaneous. The upper ends of the triggers move toward the operator, drawing the pins through the trigger hooks and allowing the doors to fall.

TRAPS FOR HAWKS AND OWLS

The capture of adult birds of prey for banding purposes is a field in which further experimental work is necessary. Up to the present time the majority of the birds of this class that have been banded were marked as fledglings. In addition, there have been taken for this purpose a small number of adult birds by means of small steel traps set on posts or poles. Such traps must be used with the greatest care. It is first necessary to wrap the jaws of the traps with several thicknesses of soft cloth, such as Canton flannel. A piece of strong wire should then be passed through the eyes of the spring and twisted tightly so that the spring can not entirely close the trap jaws. Thus, when the trap is sprung by a hawk or owl lighting on the treadle, the closing jaws will grip the bird's leg but will not break or bruise it. Also, when these traps are set on top of poles, they should have rings large enough to enable them, when the traps are sprung and the birds leap into the air, to slide freely to the base of the pole and so prevent the captured birds from being suspended in mid-air. Traps with single springs, and not larger than size 1, should be used for this work.

Frequently, when on tramps through the woods and at other places, cooperators may have opportunity to band fully fledged young owls. Although such birds may be able to fly, they occasionally may be closely approached. When this is possible, the method used by F. W. Rapp, of Vicksburg, Mich., may obtain additional birds for banding. Mr. Rapp uses a large but soft cord, such as a window-sash cord, with slip noose at one end, which is kept spread by means of a long slender stick ending in a crotch. The tips of the crotch are split or deeply notched so they will hold the cord. The cord from the noose follows on down the stick and is held by the operator.

When a young owl is located, the operator approaches quietly with the loop-carrying stick upraised to slip the noose over the bird's head. If he is successful, the owl will fly, of course, but the operator drops the stick and by retaining hold of the cord easily guides his captive to the ground, where it is secured and banded in the usual manner. There is no cruelty or danger of injuring the bird if a large cord is used.

JACK LIGHTS

The well-known effect of light upon most kinds of wild animals may be taken advantage of in bird-banding work. This method has been used by only a few cooperators, although practically all of these report success. By means of lights, small birds roosting in shrubbery or trees and incubating birds on their nests may readily be taken. It is frequently possible by this method to remove a bird from its nest with no other help than the bare hand. After it is banded, the bird should be returned to the nest and held there while the light is again turned into its eyes. The hand should then be slowly removed, and the operator back away for several feet before extinguishing the light. If these directions are followed, the bird will rarely flush. There is a peculiar fascination in working with birds at night, and it is believed that lights might be more extensively used. If properly done, there is no danger of causing injury to the birds.

The selection of a proper light is of much importance. It should be as nearly white as possible and thrown by a reflector that concentrates the rays. The lights found satisfactory for this work are the focusing flash lights with parabola reflectors and operated with three to five small dry cells. The ordinary bulls-eye flash light usually is unsuited for these operations, as it permits too much diffusion of light upon the operator. A more powerful electric light can be made by preparing an automobile focusing spot light, so that it can be readily carried in the hand, the current being supplied from a 10-volt storage battery that can be carried in a knapsack on the back. Herbert L. Stoddard, of the Biological Survey, has successfully used a light of the latter type, although he states that the battery is heavy and rather awkward to carry. By this means and with the aid of a small dip net, he has captured a large number of small sandpipers, plovers, and even pied-billed grebes. Other cooperators also have been successful in work with shore birds. During the season of 1927, Edward S. Thomas, of Columbus, Ohio, found that a focusing flash light was useful in capturing fully fledged common terns, while success in taking swallows, robins, phoebes, and other small perching birds has been reported by other operators.

Lights burning acetylene probably will be found more satisfactory, as the light is brilliant and exceptionally white. A light of this character equipped with a parabola reflector should render excellent service, particularly in taking adult birds at breeding colonies.

In working with adult birds a dark night is essential. Moonlight or strong starlight is frequently sufficient to enable birds to see the operator back of the light, and even under the most favorable circumstances failure may sometimes result. It is, however, interesting work and well worth the effort required.

AERIAL CLAP NETS

The apparatus described as an aerial clap net is much different from the clap nets used for the capture of birds in European countries. So far as known, aerial clap nets were first used in this country by Herbert L. Stoddard, who employed them to capture robins, cowbirds, and bronzed grackles from a large roost in Milwaukee, Wis., and later to capture quail at Beachton, Ga. The net is shown in Figure 45. The size of the net will necessarily depend upon the roost to be worked and the strength and ability of the operator.

To construct a net of this type, three bamboo poles, 18 to 20 feet long, and a quantity of ½-inch square-mesh thread or light twine netting are required. The small ends of the poles are tied with stout

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FIGURE 45.—Aerial clap net. The net is held open on one side of the tree, while an assistant startles the birds from the other. As the birds fly out and strike the net, the two side poles are clapped together in front of the operator. (Photograph from Milwaukee Public Museum)

cord into a permanent bow or curve, after which the tips of all three are fastened together with a hinge made of buckskin or other soft leather. This permits the tips to be moved freely in any direction. The upper 12 feet of the poles is then covered with netting so that when elevated and spread a net bag at least 6 feet wide (narrowing, of course, at top and bottom) will result. It is desirable to stain the poles and net light green. If it is necessary to work a higher tree, extension poles may be attached with metal tubing sockets, but ordinarily about 25 feet is all that can be used satisfactorily.

To handle such a net the operator wears a heavy leather belt having leather or wire sockets on the sides and back as supports for the butts of the poles. The belt should be wide to prevent binding or chafing. When up and extended the center pole is behind the operator, while the side poles are grasped, one in each hand, and clapped together

when birds have flown into the net. The center pole makes the net bag properly when open. The net is held up by the operator, over the bushes or at one side of the tree used as a roost, while one or two assistants take positions on the opposite side and endeavor to startle the birds into flight by waving white cloths on the ends of poles. Mr. Stoddard reports that stormy evenings seem to be the best time for this work, and he has found that if a roost is not worked too persistently, the birds will not desert it. He has taken a large number of birds by this method and states that he has never in any way injured one. To facilitate removal of captured birds an assistant should be designated to take the birds from the net, band, and release them. By merely stooping over, the operator can bring the net within reach of the bander without the necessity of removing the poles from the belt sockets.

In many communities martins, blackbirds, robins, and other birds gather in large roosts late in the summer before starting their fall migration, and at such points bird-banding cooperators might do much good work by the use of an aerial clap net.

CAPTURING COLONIAL BIRDS

The excellent opportunities for banding work in breeding colonies of pelicans, cormorants, herons, gulls, and terns, and other species that have the communal habit, have been appreciated from the start by bird-banding cooperators. The possibilities of intimate studies of life histories, carried on through the banding method, are almost unlimited. In addition to the comparatively simple task of banding partly fledged young, adults also may be taken if attention is given to a study of their habits. From present knowledge it is not possible to do more than suggest methods for capturing such birds, but the successful means will not be a complicated one. To illustrate, the case of the common tern may be cited.

Previous to 1928 several thousand young common terns had been banded, but attempts to capture the adults had resulted in complete failure. During the summer of 1928, while working at Tern Island, near Chatham, Mass., Charles B. Floyd was able to take more than 100 adult common and roseate terns by means of simple drop traps. The traps were merely trays about 2 feet square and 8 to 10 inches deep, made of 1-inch-mesh poultry netting. A battery of 10 traps was used, set over nests containing eggs, with trip cords converging to one point where the operator could keep all under observation. No blind was necessary, and frequently a trap would be tripped without even alarming the sitting birds, which continued to incubate. The secret of this success was the simple (almost crude) form of traps, which were made without any framework or reinforcing of any kind.

On dark nights flash lights and a hoop net might be used to advantage with these and other species.

Many of the largest colonies are located on either Federal or State reservations, and the permit usually issued for banding work (see fig. 3) specifically excepts such reservations from the authority granted. Cooperators wishing to undertake such operations accordingly should communicate with the Bureau of Biological Survey or

the proper State authorities and outline the work contemplated. If, in the opinion of the officials charged with the care of the reservation, the cooperator is properly qualified, and there are no other factors that would cause banding activities to have a bad effect on the birds concerned, a special permit may be issued.

A few general instructions will be found useful for work in bird colonies. Such operations should not be made the occasion for a picnic, with children and other uninterested persons in the party. If assistants are used, the operator should see that they are fully informed, that they handle birds carefully, and that bands are properly attached and recorded. Properly qualified persons can render important help in such work.

Good days should be selected when the absence of the parent birds for a somewhat longer time than usual will have no injurious effect upon eggs or young. Cold, rainy days are not suited for banding activities, as they are disastrous to the welfare of colonial birds. Similarly, very hot days demand the shelter of the adult birds for eggs and young.

For the same reasons visits to breeding colonies should not be prolonged, particularly if there are several members in the banding party. Conclude the banding expeditiously and leave, so that the parent birds may resume their duties. Some special study may demand a longer stay, but when this is necessary the operator usually can work alone, and by moving slowly and as infrequently as possible, reduce to a minimum the disturbance caused by his presence.

In work at a large colony composed of a single species, it is possible to simplify the field records merely by using the bands in rotation, noting the number of the first and last used. If part of the banding is delegated to assistants, the operator should maintain a careful check on their activities and see not only that bands are properly attached but also that they are so used that there will be no confusion in handling the records. William I. Lyon, of Waukegan, Ill., has had much experience in this type of work and his method is recommended. The bands are broken up into strings of 50 each and are threaded on insulated copper wire, each string carrying a tag showing inclusive numbers, on the reverse of which the name of the assistant is noted. Upon arrival at a colony, each assistant is furnished with one or more strings of bands for which he is held accountable. The operator keeps in his notebook a record of each string and to whom it is issued. At the conclusion of the work each assistant is called upon to produce all empty or partially empty wires with tags attached, and from these the operator prepares his record of the birds banded. If some such system as this is not followed, trouble is almost sure to develop, with resulting confusion in the records. Figure 46 shows two strings of bands, one of No. 6 and the other of No. 3 bands, together with two types of sheaths for pliers that Mr. Lyon has found highly satisfactory. The type of sheath shown at the left is recommended, and to safeguard further against possible loss of this essential tool, it is suggested that a small hole be drilled through the end of one of the handles, by means of which the pliers can be attached to the sheath by a cord long enough to allow easy handling.

TRAPS FOR WATERFOWL STATIONS

The banding of migratory waterfowl offers an attractive field of study and investigation, not only because these birds are of relatively great importance, but also because there is assurance of an early solution of some of their migration and life-history problems, because of the many returns sure to be received. Return records of waterfowl almost always come from dead birds, in contrast with the numerous returns that may result from a single individual of a nongame species through the continuous operation of a small-bird trapping station. This, however, is largely offset by the greater proportion of returns from the birds hunted for sport, which, during the first season, has already in some cases exceeded 15 per cent of the total number banded. With the systematic trapping of birds of these groups at a large number of stations, the number of returns obtained will, of course, be correspondingly increased. These stations will be particularly valuable during the spring migration, since the Federal law protecting migratory birds has abolished spring shooting, for which period carefully operated trapping stations may be expected to supply many of the data. Ideal sites for such stations are duck clubs having resident superintendents. Bird-banding cooperators desiring to work with these birds, but who do not belong to a club or have other facilities, may usually obtain permission to operate on the grounds of a duck club, after the close of the shooting season.

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FIGURE 46.—No. 6 and No. 3 bands strung in lots of 50 on insulated copper wire for use in colony work. Two types of sheaths are shown for pliers to be carried on the belt while so engaged

Under these circumstances, knowledge of the best methods of obtaining waterfowl for banding becomes of much importance. In the following pages traps that have been successfully used are described in detail.

Traps for waterfowl, as for land species, include both those that are automatic and those that are sprung by the bird-banding operator. The former secure the birds without the presence of the operator; whereas the latter are more or less under continuous obser-

vation and are manipulated by a watcher from a point of concealment, or blind. When traps can be visited regularly, the automatic kinds are preferred. This is particularly true when ducks are feeding at night, as is generally the case when the moon is full.

The principle of most automatic traps is that of confusion, effected either by obstructing wings or by an adaptation of the funnel successfully employed in the Government sparrow trap and its modifications.

Thus far the surface-feeding or river ducks (Anatinae) have received more attention than the deep-water, or sea, ducks (Fuligulinae), which obtain their food by deep diving. Consequently, most of the traps here described have been developed for use with the shoal-water species. It is important that this discrimination be

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FIGURE 47.—Waterlily-leaf trap operated on the grounds of the Sanganois Club in the marshes of the Illinois River, near Browning, Ill. When the photograph was taken there were about 100 mallards, black ducks, and pintails in the trap

overcome as soon as possible, for there is as much or even more to be learned regarding the migrations and habits of the diving ducks.

WATERLILY-LEAF TRAP

The waterlily-leaf trap (figs. 47 and 48) was developed during field work in the marshes of the Illinois River in March, 1922. Two traps were used at that time and five others during the ensuing fall, with exceptionally fine results, the total catch being about 2,000 mallards, black ducks, pintails, and wood ducks. Such traps have since been successfully used at other points. They are readily constructed and at slight expense where light saplings of willow or cottonwood are available.

Nine saplings, 10 or 12 feet long, are cut and set firmly in the mud, forming an outline roughly similar to a water-lily leaf or a deeply indented heart. (Fig. 48.) About 4 feet above the water the

poles are bent in sharply toward the center and their ends firmly wired together. This forms a framework similar to that of the hut dwellings used by some of the Indian tribes of the Southwest. The two poles that mark the identation, or funnel, should be about 1½ or 2 feet apart. From these points the wire netting is continued toward the center of the trap until the two ends are not more than 4 or 5 inches apart. If necessary, these portions of the netting may be stiffened by weaving light willows through the meshes and forcing them deep into the mud. The ends are then laced together to within

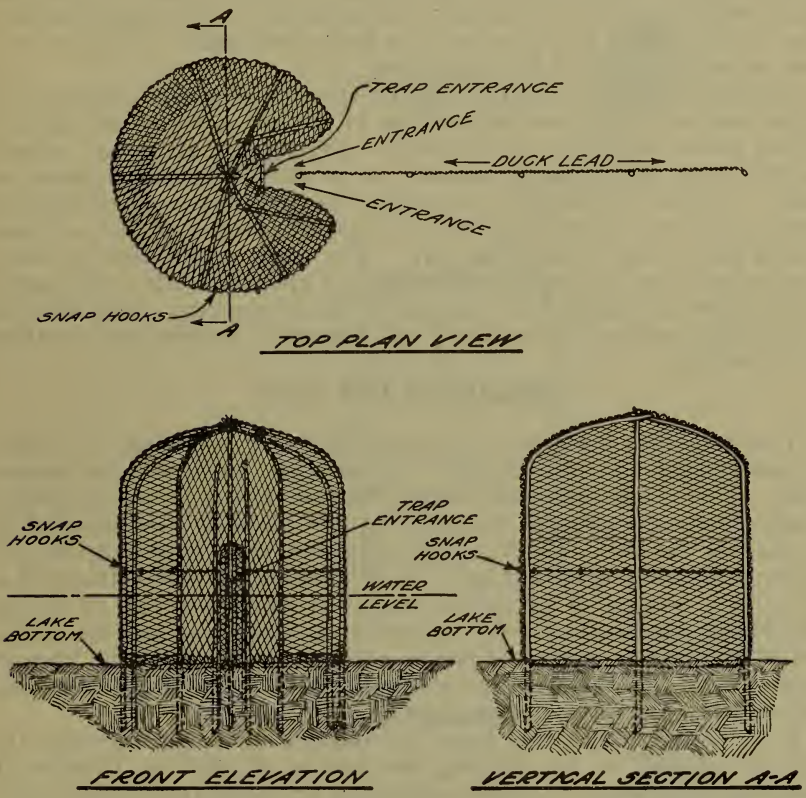

FIGURE 48.—Details of waterlily-leaf trap. An apron of netting extending onto the bottom from the sides prevents captured birds from diving under the side walls and escaping

a foot of the water, the opening being reinforced by an inverted U-shaped piece of stiff, heavy wire. If the wire netting is stiff enough to hold up properly, this wire may be omitted. A good size for a trap of this kind is about 5 feet in diameter, so that a piece of wire netting, 18 or 19 feet long, will make the circuit. Two short pieces are usually required to complete the top covering.

By working out the mud captured ducks will soon deepen the water in the trap chamber so that they can escape by diving under the netting, unless means are taken to prevent them. To do this the netting of the side walls is pulled out onto the floor of the trap

for 18 inches or 2 feet and tramped into the mud, forming an apron that will prevent escapes of this nature. Forked stakes may be driven deep into the mud, to fasten the netting in place. Such stakes should be fairly close together to give the necessary strength, as the rushes of the birds will put the entire structure to a severe strain.

For convenience in removing captured ducks it is preferable to have the back of the trap chamber on a bank and the opening in the water about 8 or 10 inches deep. The entire trap, however, may be constructed in water up to 2 feet deep, but in any case the operator must be prepared for a wetting when he enters the trap chamber. An oilskin jacket and trousers, the latter left outside of hip boots, are necessary parts of his equipment.

Entrance for the operator may be through one side, between the lower course of wire netting and one of the pieces that form the top. These pieces should be securely wired together at all points, except on this side, where small harness snaps should be used instead of wire. A lead, or fence of wire netting, for guiding the feeding birds toward the trap runs from the center of the funnel 25 feet or more out in the area in front of the trap. The single lead is fully as effective as two that are widely diverging. Captured birds will concentrate either in the back of the trap or in the pockets at the sides of the funnel, and only rarely will one escape by accidentally locating the opening.

McILHENNY PEN TRAP

The principal involved in the waterlily-leaf trap can, of course, be considerably extended where it is possible to construct a permanent trap. This is only advisable where the general conditions, including water level and natural food supply, are more or less constant in succeeding seasons. Figure 49 is a diagram of a large trap of this type, successfully operated by E. A. McIlhenny, of Avery Island, La. This trap, because of its size, is relatively expensive, but by its use Mr. McIlhenny has succeeded in capturing both river and sea ducks, while in January, 1929, the senior author, operating at the Paul J. Rainey wild-life refuge in Louisiana, used it successfully in taking canvasbacks and several other species.

It is believed that this trap has important possibilities for the capture of such birds. During the winter of 1927–28, Charles O. Handley and James S. Mason, operating a trap of this general type, built in about 3 feet of water, in a lake near Beachton, Ga., captured and banded 430 ring-necked ducks.

The trap consists of a large outer chamber with two entrance funnels, which are approached by leads, and two receiving chambers, entered from the outer chamber by long funnels. When the trap is set, the funnel openings into the outer chamber should be so constructed that they may be readily moved by pulling up the stakes at the apexes in order that one side may be swung back against the front of the trap while each of the other sides is employed to close the passage leading to a receiving cage. This should be the condition of the trap when not in operation, since it will permit the birds to have free access to the outer chamber without confining them. To set the trap it is only necessary to swing the wings of the funnels into position and to bait. With the receiving chambers roofed over, pro-

vision should be made for the entrance of the operator either at one side or at the back. (See the method described in connection with the waterlily-leaf trap.)

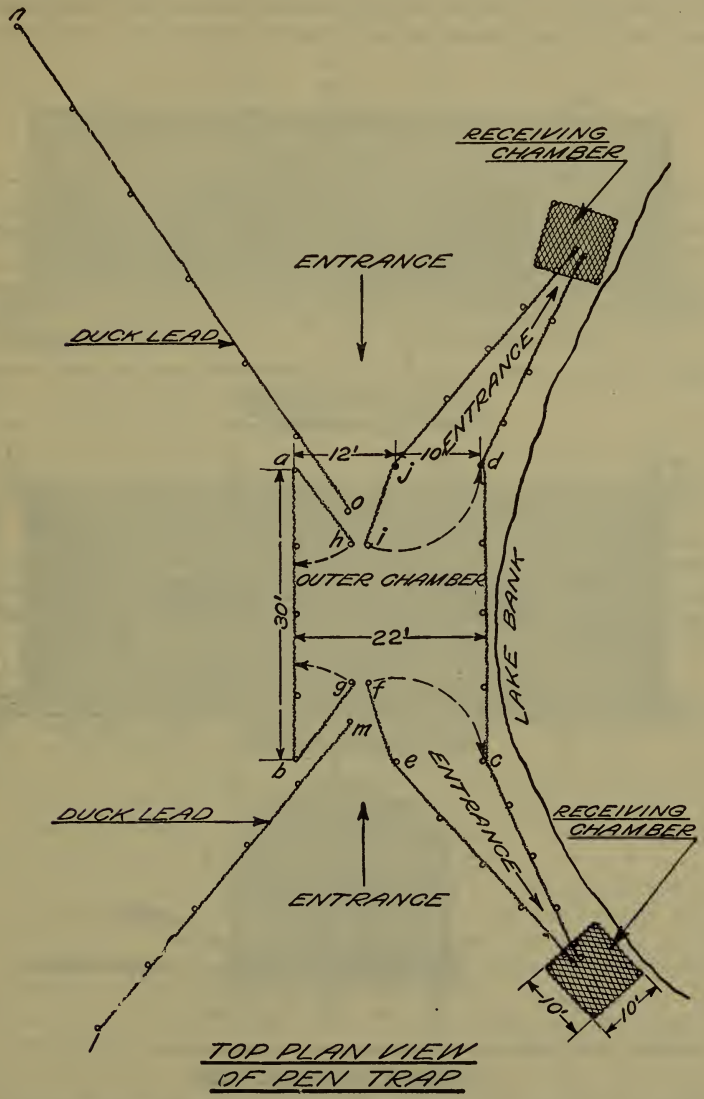

FIGURE 49.—Details of McIlhenny pen trap. The large outer chamber (*a, b, c, d*) is provided with large funnels (*a, h, i, j* and *b, g, f, e*), which are approached by leads (*l, m* and *n, o*). Funnel-shaped passages lead from the outer chamber to the receiving chambers, which are entered by funnels 4 to 6 inches wide. When the trap is not in operation, entrance to the receiving chambers is blocked by moving the funnel wings (*i, j* and *e, f*) to the positions *d, j* and *c, e*, the opposite wings (*a, h* and *b, g*) being moved against the front of the outer chamber

RAFT TRAP

The first raft trap that came to the attention of the Biological Survey was developed and used at Lake Scugog, Ontario, by H. S.

Osler, of Toronto. (Fig. 50.) This trap is about 36 feet long, 12 feet wide, and high enough to permit the operator to stand erect and move about while collecting captured birds. It is made of ordinary hexagonal, 2-inch mesh, galvanized poultry wire stretched over a framework of galvanized-iron pipe, *b*, secured to a raft made by

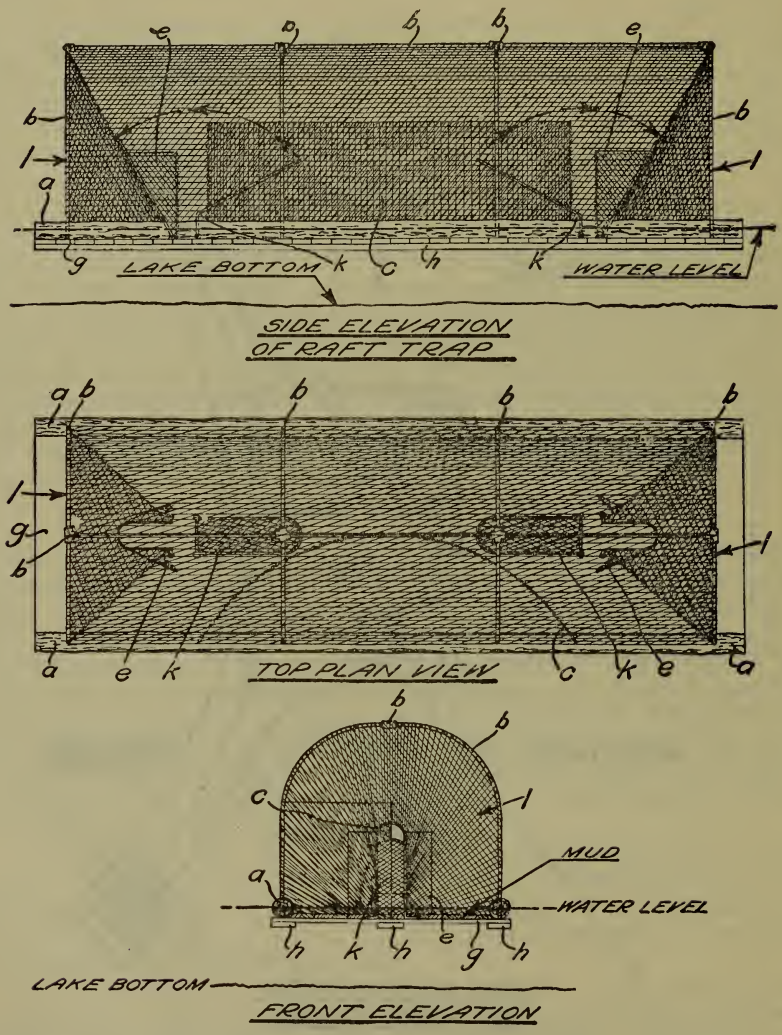

FIGURE 50.—Details of raft trap. The framework of galvanized-iron pipe (*b*) is secured to the raft made by bolting planks (*g*, *h*) to two 40-foot logs (*a*). The funnels (*l*) terminate in entrances that may be closed by doors (*k*) hinged to the raft or platform. Short deflecting wings (*e*) will turn captured birds away from the entrance. A semicircular pen (*c*) confines a few live decoys

bolting planks, *g*, *h*, to two 40-foot cedar logs, *a*. Two funnel-shaped entrances, *l*, are provided, one at each end, and each is fitted with short wings, *e*, which serve to deflect any captured birds that try to go out the way they came in. The large openings permit unobstructed entrance. During the operation of removing the birds,

they are closed by doors, *k*, hinged to the bottom. Inside the trap, on one side, is a semicircular pen, *c*, for confining a few live decoys.

This rather elaborate trap is towed into position in a natural feeding ground and submerged by piling mud on the floor. Being mounted on a movable platform this apparatus may be towed to any point where ducks are known to be congregating, a feature of obvious importance when operations extend over a large feeding area. The main disadvantage is in the expense of construction.

SPRING-POLE TRAP

Where ducks may be baited onto the shore a trap that throws a net is satisfactory. One of this kind has been used by Joseph Pulitzer at his stations at Bar Harbor, Me., and Cuivre Island, Mo. (fig. 51), and also by the authors at other points. Traps of this type may be strong enough to throw a net 40 or 50 feet square, but such large traps are difficult and dangerous for one man to operate alone. The one described here is for a net 20 feet square, which will be large enough for general use.

Two straight poles (oak, hickory, or ash preferred), about 40 feet long and 5 or 6 inches across the butts, are set firmly in the ground 60 to 75 feet apart at right angles to the shore line and back from it about 40 feet. (Fig. 51.) The tips, which reach practically to the shore line, should be elevated 3 or 4 feet by resting the poles about midway of their length on forked posts set firmly in the ground. These posts will also act as fulcrums when the poles are bent in setting the trap. The tips of the poles are connected with a piece of heavy iron wire called the "throw wire," about 75 feet long, midway of which one side of the net is attached.

The ground to be covered by the net should be thoroughly cleaned of all rubbish, rocks, and roots, as any held in the ground will be sure to catch and cause bad tears in the net.

With one side attached to the throw wire, the net should be spread out carefully and the opposite side secured to the ground. This is best done by weaving a light rod through the meshes and driving several forked stakes over it.

The next step is to install the triggers, two of which are needed. The accompanying illustrations (fig. 51) show how these are built. A board about 3 feet long and 5 or 6 inches wide is fitted at one end with a small stop block and at the other with a projecting cleat (catch block) to secure the upper end of the trigger pole. Broomsticks make excellent trigger poles, the rounded ends resting against the stop blocks, and about 3 or 4 inches from the other ends are cut notches which will hold the throw wire when the trap is set. The back part of the trigger boards should be elevated about 6 inches and firmly staked down about a foot beyond the sides of the net and 8 or 10 inches in front of the line where it is fastened to the ground. It is important that the catch blocks on the trigger boards both open in the same direction, which will be toward the blind concealing the operator. A piece of wire (baling wire will do) is attached to one trigger pole just above the notch and extended to the blind. This is the trigger wire by which the trap is sprung.

To set the trap, the throw wire is pulled back and caught in the notch of one trigger pole, which is then put in place on the trigger board, *where it is tied fast with a piece of stout cord or wire.* This is for the protection of the operator until the other trigger is set and the tension on the spring poles equalized. When the throw wire has been similarly pulled back to the opposite trigger, the pull of the spring poles may be adjusted by sliding the throw wire in either

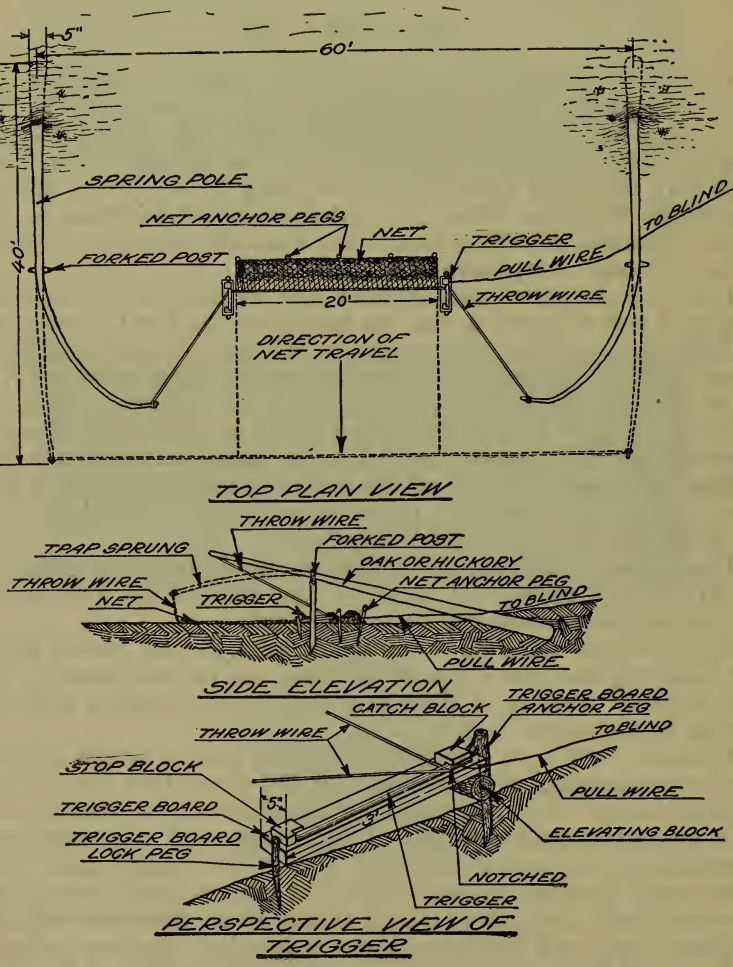

FIGURE 51.—Details of spring-pole trap with net 20 feet square

direction until the tension is equalized, as shown by the fact that the trigger poles do not tend to slip from under the catch blocks. The net should then be pulled back and arranged in a long pile behind the wire, the operator taking care to see that it is not caught on any of the stakes holding the edge of the net to the ground. Bait should be scattered thinly over the area to be covered by the front of the net and more thickly to the rear. As a trap of even this size is

capable of inflicting serious injury upon the operator, he should never work in front of the throw wire unless one trigger is tied fast.

The safety cord may now be removed from the trigger that was first set. A sharp jerk on the trigger wire will pull both trigger poles from under the catch blocks, and the poles, no longer held in place, then rise vertically against the stop blocks at the foot of the trigger boards. The throw wire slips off and shoots forward carrying the net with it. With powerful poles the action is so quick that birds feeding on the bait have no time to escape.

This trap may also be successfully used for land birds that feed in flocks on the ground, such as mourning doves, blackbirds, horned larks, and sparrows. Spring-pole traps may be made small enough to throw nets not over 4 or 5 feet square.

MINER TRAP

In this connection the possibilities for taking waterfowl with the Miner crow trap may be mentioned. (For description, see pages 57–60.) In fact, it is with a trap of this type that Mr. Miner has captured a large number of Canada geese. If the trap is to be used in this way, it might be necessary carefully to bait the birds for several days, making no attempt to pull the trap until a sufficiently large flock has congregated. After one capture the operation would probably again require patient baiting to effect another concentration. If the trap is made large (as it should be for geese), a gathering chamber, 6 or 8 feet square, should be provided at one end, into which a part of the birds may be driven from the trap chamber, to facilitate handling. Use of such a chamber also will reduce confusion and eliminate all possible chances of injuring the birds, which might result if attempts were made to capture them in the large area of the trap chamber.

A similar trap might be made on a small scale, such as a cage 10 or 12 feet long, 6 or 8 feet high and about the same in width, and with a door hung at one end that might be released by a cord when ducks have been enticed into the chamber. A pen in the rear confining a few live decoy ducks will increase the efficiency of such a trap. One of this type, constructed by the senior author at Ray Lake, Iowa, was successfully operated for several seasons by Allen Green.

PEN TRAP FOR DIVING DUCKS

Diving ducks present a field for interesting experimental work, and it is important that a satisfactory automatic trap be developed. In its construction it is to be borne in mind that these ducks may dive when alarmed, and a trap made from wire netting should have the meshes small enough to prevent the birds from getting their heads and necks through them. Unless this precaution is taken, there is a real danger of the birds drowning. Another point of which advantage may be taken is that deep-water ducks are unable to make the almost vertical rise from the water that characterizes the take-off of the shoal-water species. Instead, they require a long start across the water to gain sufficient speed to lift them much above the surface. For this reason it is unnecessary to have a top to the pen, and this has an added advantage in that these birds being

reluctant to swim under anything, are more likely to enter an inclosure without a roof.

The most satisfactory trap for diving ducks that has been brought to the attention of the Bureau of Biological Survey is the one used by A. A. Allen, of Cornell University. It consists of a 3-sided pen, 8 feet on a side, erected in water about 3 feet deep, in a natural feeding area where by baiting a still greater concentration of birds can be brought about. The fourth side of the pen is closed by a door that swings upward from the bottom either as the operator pulls a cord extended to a blind or as a counterweight is released by him. There is little gained, however, by use of the weight, for since this must be released by pulling a trigger cord, the operator may as well continue

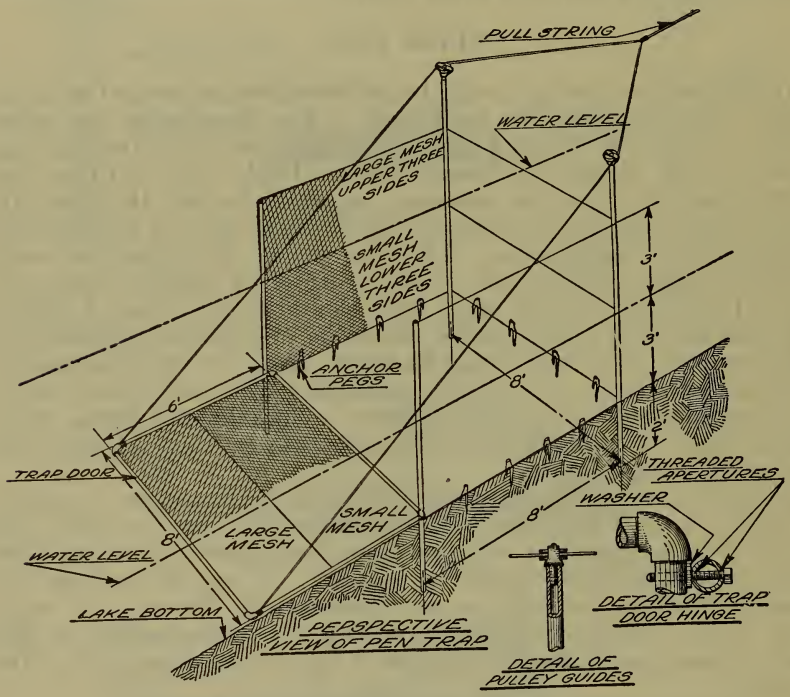

FIGURE 52.—Details of pen trap for diving ducks

to pull and raise the door. The drawing shows a trap equipped with a pull cord. (Fig. 52.)

Four pieces of galvanized-iron 1-inch pipe are used for the corner posts.[8] Two of these should be about 8 feet long to allow about 2 feet to be driven firmly into the bottom, and the other two pieces should be about 9 feet long. The 8-foot sections are used for the front posts and should have holes drilled about 25 inches from one end, corresponding holes being drilled through opposite sides of the door, as close as possible to the corners, in order that small bolts may be passed through to serve as hinges.

[8] The galvanized-iron fence posts now available in various lengths are supplied with a row of projections or hooks for attaching the wire fencing and are excellent for this purpose. The hooks can be utilized to advantage, saving considerable work.

The doorframe, 6 by 8 feet in size, is best made from four pieces of small galvanized-iron pipe, threaded so as to form the corners by use of elbow joints. Over the frame wire netting is stretched. The door should be attached to the 8-foot posts before they are driven into the bottom. By fastening the door upright between them it is possible to drive the posts so that they will be nearly perpendicular and parallel to each other as well as to the door when closed. They may be wired to the door until set in position. The two 9-foot posts are then similarly set so they will project 4 feet above the surface. A course of 3-foot rabbit wire (about 1-inch mesh) is fastened around the three open sides and secured firmly to the bottom with forked stakes. These stakes can easily be driven by means of a section of a tree trunk, 4 or 5 inches in diameter, used as a pile driver. The top of this course of netting should come just about to the surface of the water, and the walls of the inclosure may be completed by a course of ordinary 2-inch-mesh, 3-foot poultry wire. When this is securely laced to the lower course with copper or galvanized-iron wire the trap pen is complete.

Two small pulleys should be fastened to the tops of the rear posts and threaded with strong cords carried to the upper corners of the door. A short distance beyond the pulleys these cords are united and continued as a single pull string to the blind. (Fig. 52.)

S. M. Batterson, of Mohler, Oreg., has been successful in trapping large numbers of scaup and other ducks with a trap similar to the one above described, except that he makes it much larger and covers the top with wire netting. The trap he describes is 40 feet long, 20 feet wide, and 6 feet high, with a small gate (to admit the operator) on the shore end, and a full-end gate in front. Three-quarter-inch galvanized pipe is used for the framework including the door, which measures 20 by 6 feet and which lies flat on the bottom when the trap is set. The front of the trap is placed in not less than 16 inches of water, while the back is on the shore. Mr. Batterson states that when the trap is set in tidewater he gets the ducks either upon the rise or fall of the tide when the water is the right depth. He has taken as many as 70 at one time.

During the season of 1927, H. S. Osler, of Toronto, Ontario, constructed a large trap for diving ducks. Although conditions then prevented a thorough test, it will doubtless prove entirely successful; a general account is therefore given here for the benefit of those wishing to experiment.

The trap is built upon a wooden platform about 24 feet long and 12 feet wide, galvanized-iron pipe being used for the framework. The front end is made square but is sloped inward toward the top, so that a duck can swim up to the entrance without feeling that there is anything overhead. By weighting the platform with stones, the trap is sunk to a depth of about 15 inches and rested upon piles driven for the purpose, which prevent it from sinking farther. These piles also stabilize the trap when the operator is moving about inside. There is no visible opening, but the netting at the front does not extend entirely to the platform but ends about 1 foot above, thus leaving an opening 1 foot high and 12 feet wide. When the trap is sunk as above described, the top of the opening is about 3 inches below the surface of the water.

The cage does not cover the entire platform, which extends about 3 feet beyond the front. Bait is placed sparingly on this end platform and more abundantly in the trap chamber. The theory (which has been at least partially confirmed) is that the ducks dive for the feed, move about under water, and come up inside the trap. Observation has shown that when the birds find themselves inside the trap they may not dive to get out but instead are likely to swim persistently about the walls searching for an exit. If the operator approaches the trap from the front it will not be necessary to provide any means of closing the entrance, as the ducks will crowd to the back of the chamber where they may be caught either by hand or with a dip net. A small entrance door for the operator may be provided on one side near the front.

OTHER TRAPPING EQUIPMENT

GATHERING CAGES

Traps with small compartments, such as feeding-shelf traps and the Potter trap, can be safely operated without gathering cages, but traps having chambers as large as those in the Government sparrow trap or larger should be operated with gathering cages. Unless it is absolutely necessary no attempt should be made to seize a bird in the trap chamber. The preferred method is to use a small gathering cage into which the bird may be gently driven, and from which it can be taken without the excessive fluttering and struggling sure to occur in the larger areas of the trap.

A satisfactory gathering cage, 12 inches long, 6 inches wide, and 6 inches high (the usual size of doorways in small cage traps) can be readily constructed from a piece of hardware cloth, 1 foot wide and 2 feet long. A piece of netting is laced in to form the back, while the door is made by attaching a piece of netting to a stiff wire frame, which is then hinged so that it will drop inward and lie flat on the bottom when the cage is open. It is advisable to have one end of the wire frame of the door project beyond the side of the cage and end in a small crank handle by which it can be opened or closed. A more elaborate gathering cage can be made by fitting a wooden framework to the front with a vertically sliding door made of sheet iron. A cord from the door to the operator can hold the door up until the bird enters the cage.

Some cooperators have reported success with gathering cages made of small wooden boxes with the ends covered with wire netting; others, including Ernest W. Vickers, of Berlin Center, Ohio, recommend cylindrical cages. As will be observed, a cage of this type is easily made. The one used by Mr. Vickers is merely a cylinder of No. 2 hardware cloth, 6 inches long and 4½ inches in diameter, fastened to a piece of board by way of a base. One end is closed, and the other has a door that slides upward in a square frame of a size similar to that of the removing door of the traps. Mr. Vickers reports that birds are easily secured when in this cage, and because of its shape they are less likely to injure themselves than in rectangular cages. When several birds are driven into the gathering cage at the same time, it is advisable to have a piece of black cloth 3 or 4

feet square with which to cover the cage while the birds are being banded. Covering the cage in this manner will stop the birds from fluttering.

Some small birds are very active and may escape from the gathering cage in spite of all precautions. To reduce the number of such escapes the following method has been successfully used by Henry P. Baily, of Philadelphia, Pa., and others: A short sleeve is made of dark-colored cloth, the opening at one end being large enough to go over the end of the gathering cage, and the other large enough easily to admit the operator's hand while still fitting snugly about the wrist. (Fig. 53.) Elastic bands are sewed into both ends. The birds in the cage can not possibly get away until the sleeve has been removed, and at the same time there is free access for the operator's hand, the sleeve not interfering in any way.

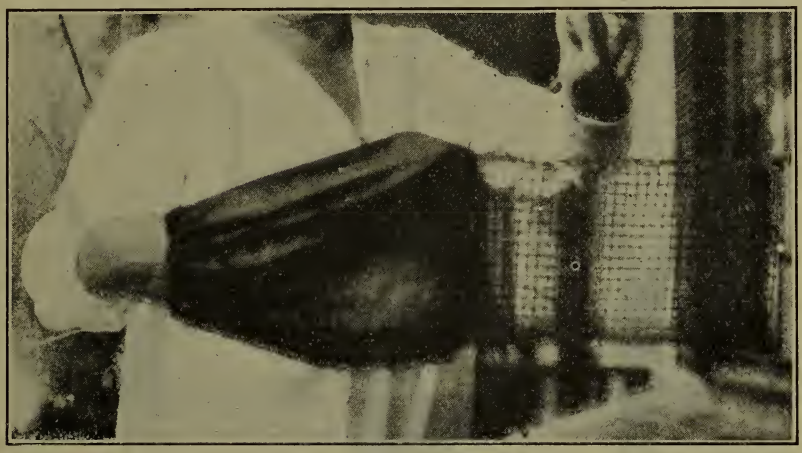

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FIGURE 53.—A sleeve is sometimes useful to assist in removing small birds from a gathering cage. Elastic bands are sewed into both ends, one of which fits over the cage while the other fits snugly about the wrist of the operator. (Photograph by Henry P. Baily)

TOOLS

The tools needed in the operation of a trapping station, aside from those used for the construction of traps, are few in number. (Fig. 54.) One or two pairs of suitable pliers, an instrument for opening bands, and a pocket magnifying glass are all that are needed.

A small ice pick can be successfully used to open bands, but a more satisfactory tool for this can be made from a metal embroidery stiletto set in a hardwood handle. Small bands may also be opened satisfactorily with a small pair of scissors having rather slender blades. The points are inserted in the band and then opened carefully, the leverage being sufficient to open the band.

The selection of suitable pliers for attaching bands is of great importance. In spite of repeated warnings, cooperators have in the past attempted to attach bands to small birds by means of their unaided fingers. With the stiff metal now employed in the manufacture of bands *it is impossible properly to close one of them without*

the use of pliers, and a band improperly closed is a constant source of danger to the bird that carries it. For operators working with small birds only, a pair of small pointed pliers, with the inner surface of the jaws ground or filed smooth, is an excellent tool. The type used by opticians is probably the best. Such pliers also may be used to attach lock bands, but greater speed is frequently possible when pliers with longer jaws are used. For such work jaws 2 inches long and one-eighth of an inch across the tips have been found satisfactory.

Fred H. Kennard, of Newton Center, Mass., worked out the pliers shown in Figure 55, which have proved an excellent tool for banding. It does not seem practical to make pliers for all sizes of bands, and

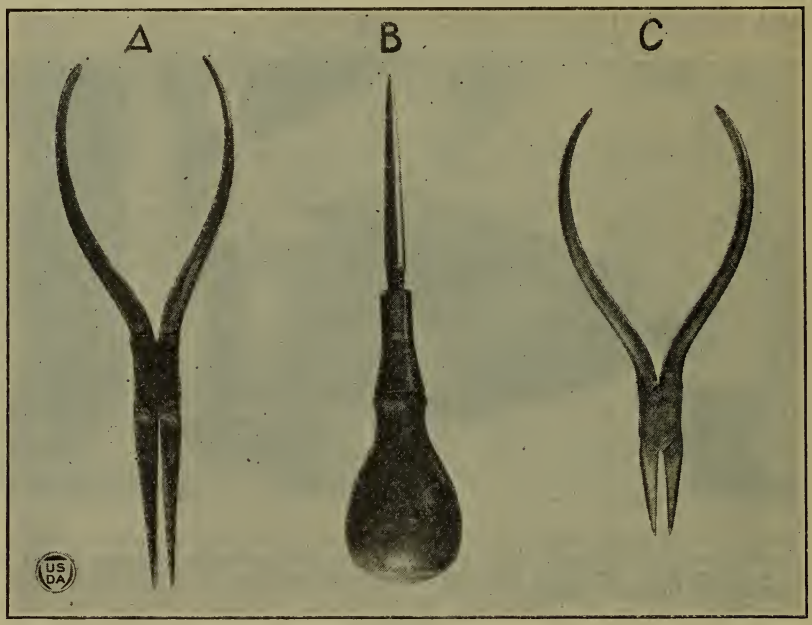

FIGURE 54.—Tools used for attaching bands: A, Pair of pliers with 2-inch jaws about one-eighth of an inch across the tips, used to attach lock bands; B, stiletto set in a hardwood handle and used to open small ring bands; C, good type of pliers for closing the smaller bands; they have smooth pointed jaws and may be obtained from dealers in optician's supplies

as Nos. 1 to 3 are those used in largest numbers two pairs of pliers will be ample, one to close No. 1 and No. 1A bands and the other to close Nos. 2 and 3. A pair of pliers 4½ inches long is best for the smaller sizes and a pair 5 inches long for the larger. The holes should be drilled accurately and smoothly at a machine shop. Also the jaws of the pliers should be machined or ground down until they are not thicker than the width of the bands, or about three-sixteenths of an inch, so that the band can be held by the fingers while it is placed in the pliers for closing. After the holes are drilled the grooves made in each jaw of the pliers should be carefully smoothed and polished with fine emery cloth or an oilstone, particular attention being given the corners where the jaws separate so that they will not mar the band.

The authors have thoroughly tested samples of these pliers and do not hesitate to recommend them, as bands closed by their use will be perfect rings with the ends so tightly pressed together that it will be impossible for this joint to catch on any foreign material. Only one caution need be given: When actually closing a band care must be taken not to relax the hold upon the bird, as a broken leg would almost invariably result.

A pair of dentist's extracting forceps also makes a good tool for closing bands. A pocket hand lens will be useful in making certain the reading of band numbers that may be obscured or badly worn. As the band number is the key to the record, no pains should be spared to make the reading accurate. In operating a banding station many of the birds that learn to frequent the traps will, of course, soon carry bands, and will be "repeats"; but if a number as read does not seem familiar, and is not of the series then in use by the operator, the band should be given a thorough examination before the bird is released. If possible, ask another person to check the reading, using the magnifying glass to insure accuracy. Also, care should be taken to see that no inaccuracy is caused by wear or lapping of the band, which might obscure one or more of the figures. An unusual number is likely to be from another station and so calls for unusual care in reading.

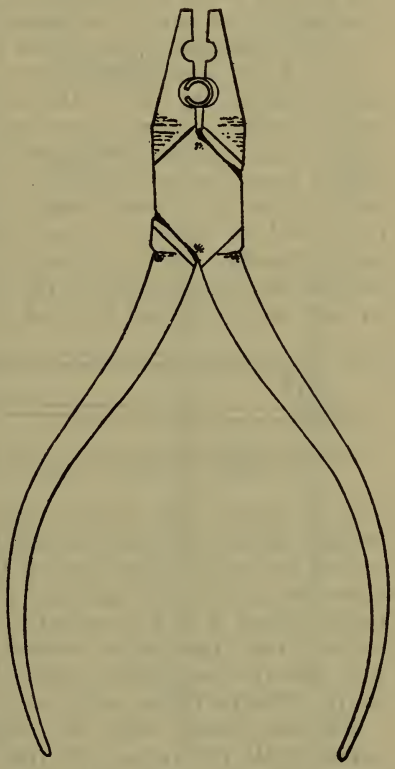

FIGURE 55.—Kennard banding pliers. Well-made pliers of this type insure perfectly closed bands

BAND HOLDERS

It is a distinct advantage to have the bands arranged on a holder in numerical order. As the bands come from the Bureau of Biological Survey they are strung on cord or copper wire. With the larger sizes it may be desirable to leave them on the original carrier, but with the smaller sizes, particularly Nos. 1, 1A, and 2, a stiff holder will be more convenient. Each cooperator can work out the scheme that seems to fit best his particular requirements, but the safety-pin holder is the most satisfactory type that has thus far been devised. (Fig. 56.) This is simply a large blunt-pointed safety pin, and is easily made from a piece of galvanized-iron wire (about No. 14). A similar device, made to hold stitches when knitting, can be purchased from stores that handle such supplies, or the large safety pins commonly used on horse blankets can be used.

Another method, employing different sizes of nails, and suggested by A. W. Higgins, of Rock, Mass., has proved satisfactory. A common eightpenny, or 2½-inch, nail will hold 10 No. 1 bands, which when forced on the nail will be opened ready for use. A tenpenny, or 3-inch, nail will carry 10 1A bands; a twentypenny, or 4-inch, nail will carry 15 No. 2 bands; and a thirtypenny, or 5-inch, nail will hold 20 No. 3 bands. It is advisable to polish the nails with fine sandpaper or emery cloth to smooth off abrasions that might mar the bands. The points of the nails may be pushed into corks to prevent the bands from slipping off or becoming lost. When removing a band from such a holder the thumb should be placed over the opening in the band, for unless this is done the band may be closed as it slips off the point of the nail.

For No. 6 and other large ring bands used on waterfowl, the holder suggested by W. Bruce Large, of Rochester, N. Y., is excellent. As shown in the drawing (fig. 57), it is made of 10-gauge wire (preferably galvanized), and measures 32 inches long. About 5 inches from one end, which is pointed, two circular twists are put in the wire to prevent bands from falling below that point. The other end of the wire is bent into a loop about the size of an umbrella handle. The end at the loop should project about an inch beyond the vertical part of the holder, and be turned slightly upward so that bands will not slide off when the holder is in use. The bands

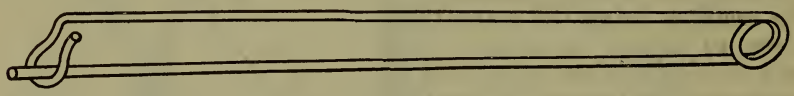

FIGURE 56.—Safety-pin holder for ring bands. Made of galvanized-iron wire and long enough to hold at least 25 of the smaller bands (about 6 inches)

are, of course, put on in reverse order, the highest number at the bottom and so on until the shaft of the holder is covered. The loop end of the wire is then pulled back and allowed to spring in on the opposite side of the shaft and in contact with it, thereby locking the holder when it is not actually in use. When ready to band (as at a duck trap) the holder is stuck into the ground in an upright position and the loop point pulled back and to the opposite side of the shaft. Such a holder will carry 100 No. 6 bands.

Various means may be worked out for conveniently carrying bands while visiting a trap line. Figures 58 and 59 show two satisfactory types of pocket band kits, one that can be rolled up and the other closed like a book. The first was designed by Herbert L. Stoddard and consists of a strip of light duck, canvas, or other strong cloth, with a series of pockets of suitable size to carry several safety-pin band holders, a fountain pen or pencil, a pair of pliers, and a notebook. Such a kit may be rolled up and easily carried in a coat pocket.

The book-like case was worked out by A. W. Higgins, of Rock, Mass., and is made of the covers of an old book about 1 inch thick. Two frames made from ½-inch white pine are hinged together and fitted into the covers so that when closed they just replace the leaves of the book. If an old book is not available the frames may be

covered with light sole leather or stout cardboard and shellacked thoroughly. Twelve needles, or band carriers, an eighth of an inch longer than the inside of the frames, are made from No. 14 galvanized wire. One end of these should be sharpened and the other bent into a small ring or eye by which they can be attached loosely with small staples on the inside at one end of the frames. The free pointed ends are stuck into the opposite ends of the frames, effectually preventing bands from coming off. The magnifying glass is placed under two of the needles, the band opener, or expander, and pencil are between two others, while the "day card" fits in on top. Such a case may be made attractive and efficient.

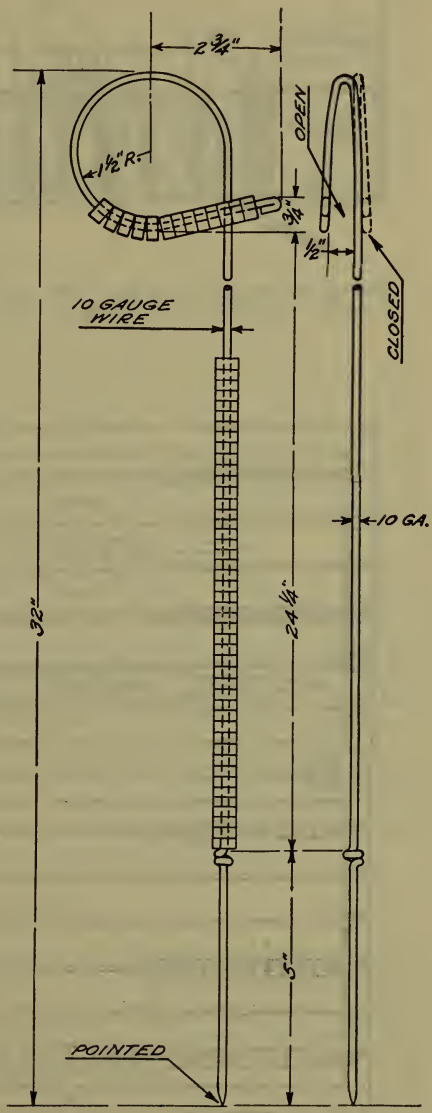

FIGURE 57.—Holder for large bands

BAIT

The problem of a bait suitable for birds is not so serious as might be supposed, as a simple bait like bread crumbs is almost always effective. In fact, crumbled bread is probably taken by a larger variety of birds than any other bait that has been tried. An active station should, however, make every attempt to bring a constantly increasing number of species to the traps, and should experiment constantly with different kinds of baits used in combination with different types of traps. Attention to this matter is of particular importance during the migratory season, when a greater number of species will be found in the vicinity of the station, than during the periods when birds are more or less sedentary.

The following information relative to baits has been taken largely from trapping-station reports and has the value of actual experiment. Birds' tastes vary, so it should be remembered that a bait that is eagerly taken by any particular species at one season in one part of the country may be entirely ignored by the same species at another season in some other region.

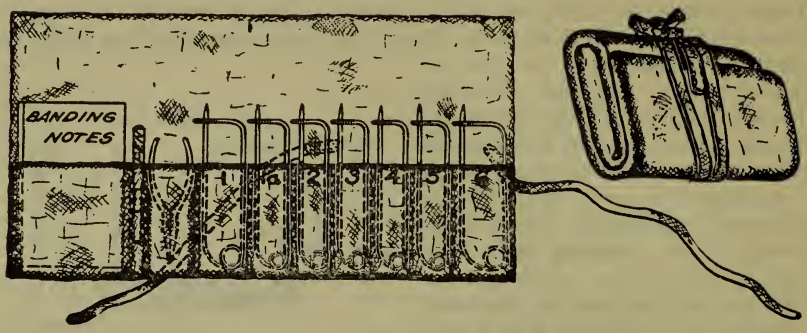

FIGURE 58.—Pocket band kit. The case is made of light canvas or other strong cloth, with pockets for safety-pin holders, pen or pencil, pliers, and notebook

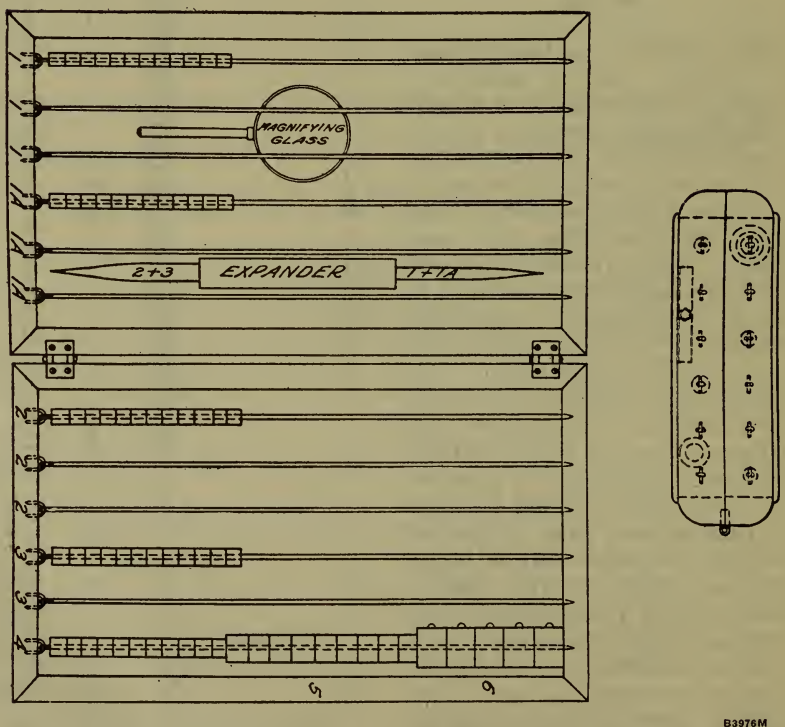

FIGURE 59.—Pocket band kit. Light frames made from wood half an inch square and backed with light sole leather or stout cardboard are hinged together to make a book-like case. The bands are carried on galvanized-wire needles, pointed at one end and with small rings in the other, by means of which they are attached loosely to the frames by small staples

BAIT FOR LAND BIRDS

BREAD

It is generally advisable to add crumbled bread to any seed combination that may be used for ground-feeding birds, such as most of the sparrows and finches, catbirds, brown thrashers, blackbirds, jays, and even occasionally robins. Cake and cheese crumbs also come in this category, while some breakfast foods have likewise been successfully used. Baking-powder biscuits, made so short that they will crumble easily, have been eagerly taken by robins and bluebirds. Some stations keep on hand a supply of biscuits made up for this purpose.

SEEDS

The majority of the birds banded at the average small-bird station are seed eaters, members of the family Fringillidae, which includes the great hosts of sparrows and finches. Seeds (including cereals) are accordingly important items in the bait supply.

Finely cracked corn or wheat, of the type known as baby-chick feed, is a staple that has given universal success. Millet, hemp, canary seed, and rape are excellent additions. Canary seed will be taken by horned larks, goldfinches, purple finches, and siskins, while hempseed has been found to be especially favored by Harris's sparrows and is also readily taken by others. White-crowned sparrows have been observed to be fond of rice.

Sunflower seeds are always good and at times make a successful bait when all others fail, particularly in summer. They are favored by jays, cardinals, blackbirds, nuthatches, titmice, purple finches, song sparrows, and grosbeaks. Pumpkin seeds run through the largest cutter of a food chopper are taken by chickadees and juncos.

Hay seed, such as may be swept up from the floor of a hay loft, and weed-seed cleanings from elevators and flour mills are easily obtained and make excellent bait for many ground-feeding birds.

Whole wheat, rice, and sunflower seeds are enjoyed by quail and doves. Red-winged blackbirds and grackles have been taken by the use of whole or cracked corn and oats, while chopped oats have been successfully used for white-throated sparrows and towhees.

NUT MEATS

For many species of birds nut meats are attractive, particularly in winter, the high oil content probably affording a heating element that they appreciate. Chopped peanuts (including peanut butter) and walnuts are generally used, but others will serve the same purpose. Jays, woodpeckers, purple finches, chickadees and other titmice, and nuthatches are notoriously fond of this food. Where suet containers are furnished for the birds, either in or out of the traps, nut meats may be ground in with the suet.

FRUITS

While the use of a fruit bait requires close attention to replace any that shows evidence of spoiling, many birds can be enticed into traps by this means. Wild fruits are generally preferable. The

hawthorn or thorn apple (Crataegus) and Oregon grape (*Berberis nervosa*) have been successfully used for the capture of robins and bluebirds, the latter also showing a fondness for bayberries. Elderberries, pokeberries, wintergreen berries, blackberries, wild cherries, and other small wild fruits have made trapping stations more attractive for myrtle warblers, waxwings, and hermit thrushes.

The fruit of the ornamental Russian-olive is sometimes eaten in large quantities by waxwings, while the small pie cherries and grapes make excellent substitutes for wild fruit. Pieces of apple are relished by robins, especially in spring, while this same fruit baked is another good bait for waxwings.

Raisins are probably the most convenient fruit to use, and they are occasionally sought by catbirds, thrushes, robins, jays, towhees, and others. In winter cranberries are attractive in a trap when it is set on snow-covered ground, although it is not definitely known that they are actually eaten by small birds.

VEGETABLES

Vegetables do not yield many attractive baits, but in spring lettuce can occasionally be used to advantage for goldfinches, purple finches, and others. To keep it fresh and crisp as long as possible it should be placed in the trap in a shallow pan or dish of water. Boiled potatoes have been used successfully as a bait for grackles, jays, and robins.

SUET

Beef suet is a general-utility bait during the winter months, particularly for woodpeckers, titmice, and nuthatches, with which it is a special favorite, though it is taken also by juncos, tree sparrows, cardinals and other grosbeaks, catbirds, jays, and others, including bobwhites. If used in a coconut shell or other cavity feeder, the suet should be passed through a food chopper, and nut meats may be advantageously added. The suet is then packed tightly into the feeder with a spoon or stick.

INSECTS

The use of adult insects, their larvae, or other live-animal bait is somewhat difficult but may be resorted to on occasion. The most satisfactory bait of this type is meal worms, which may be raised by the operator for the purpose. The following directions for raising these insects will be of assistance.

Meal worms are single brooded; that is, an entire season is required to make complete growth. The beetles may be found laying eggs from May until freezing weather in fall. The early eggs will produce larvae that will be full grown by September or October of the same year, but larvae from late eggs will not attain full growth until about midsummer of the following year. A female beetle will lay from 20 to 50 eggs. While practically any farinaceous material, as corn meal, ground feed, cracker crumbs, or bread crusts, is suitable as a propagation ground, experiments have demonstrated that best results are obtained from some form of wheat. A tight box or earthen jar should be filled half full of the food material, with some scraps of old leather, covered with woolen cloths, and fitted with

a lid of wire screen. A few hundred larvae or adult beetles should be put into the receptacle and left undisturbed, except for the insertion of a raw potato from time to time. If this is done in April, a good supply of larvae will be available for use in the following fall, winter, or spring. The initial stock may be obtained from a dealer in aviary equipment.

In using meal worms as bait they may be placed in glass or porcelain dishes with vertical sides to prevent them from getting out, or they may be pinned to the feed boards.

Earthworms make good bait for robins, which are notoriously fond of them, and they also are taken by other thrushes. If several worms are tied together on a string, the birds will endeavor to pick them off.

Fly maggots may likewise be used if the operator is willing to undertake the disagreeable task of raising them.

As a suggestion for capturing flycatchers, artificial trout flies with the hook cut off, may be suspended by very light threads under drop traps. A couple of small feathers tied together and so suspended, has resulted in the capture of phoebes.

SALT AND OTHER MINERALS

The taste that birds occasionally show for materials that are apparently entirely lacking in food value is not thoroughly understood. In fact, the statement is frequently made that salt will kill birds. Possibly this is true for some species, but doves and pigeons, as well as crossbills and some grosbeaks, are fond of it. On a few occasions fairly large numbers of such birds have been trapped for banding by cooperators who have taken advantage of congregations of birds at points where salt was available. Earth impregnated with salt may be preferred to the ordinary table or rock material.

Writing in the Condor, T. T. McCabe[9] makes the following important contribution to the subject of baits:

> The [pine] grosbeaks are eager for exposed unfrozen earth in winter, and find it most often at the mouths of sheltered burrows among the roots of forest trees (braving, not always with impunity, the lurking weasels), or under the eaves of trappers' cabins. The siskins, in spring and early summer, have a passion for a certain type of sandy yellow clay (not gravel), when fresh dug, in spots of which they will pick for hours in large numbers, neglecting quantities of apparently similar material, as well as baits of salt or ashes placed alongside. Failing this, at the same season, they are eager for ashes, and will brave the smoke and heat of a dying campfire in efforts to obtain them. * * * As many as 125 siskins were trapped at such spots last spring, and a few pine grosbeaks in midwinter.

These observations were made at Barkerville, British Columbia, so possibly this habit is peculiar to northern latitudes.

WATER

For summer trapping water has been found to be one of the best baits, particularly for thrushes, warblers, and vireos. Even in midwinter birds appreciate a supply of clean drinking water and at times will bathe when the temperature is so low that frequent replenishment of the supply is necessary because of freezing.

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[9] McCABE, T. T. BIRD BANDING NEAR BARKERVILLE, BRITISH COLUMBIA. Condor 29 : 206–207. 1927.

Shallow receptacles, such as pottery flowerpot saucers, are excellent, particularly when used in Chardonneret or Cohasset warbler traps. In trapping birds with a water bait, the secret of success usually is *keep the water "alive" or constantly agitated.* To accomplish this,

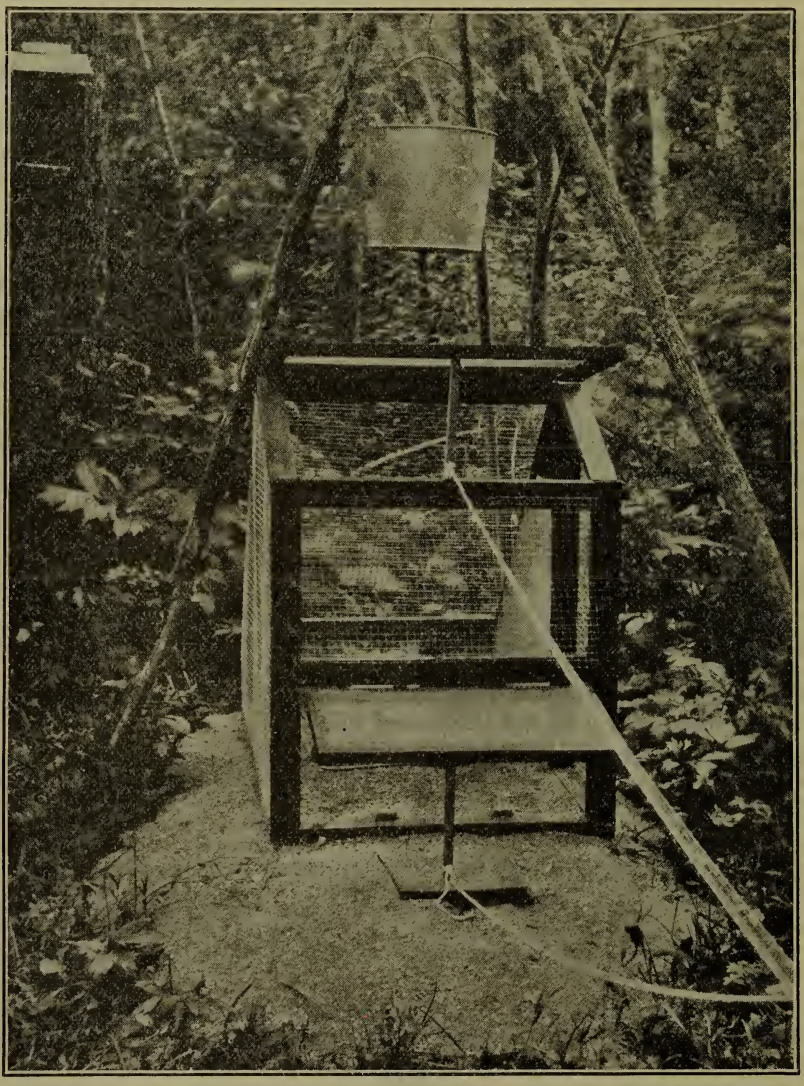

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FIGURE 60.—Combination trap baited with water, showing a method of suspending the storage reservoir over the trap. The basin is almost concealed by the lower door. (Photograph by Karl Christofferson)

a pail or can holding 2 to 5 gallons should be suspended over the trap from a convenient limb of a tree or by means of a tripod erected for the purpose. (Fig. 60.) A nail hole near the bottom may be plugged with a soft stick so as to permit about a drop a second to

fall into the receptacle in the trap. This will keep the water moving and add wonderfully to its attractiveness.

NESTING MATERIALS

Considerable success has attended baiting orioles, kingbirds, and robins with nesting materials. Common wrapping twine cut into 12 or 18 inch lengths, yarn, and narrow strips of cloth are desirable to these birds for their nests. A box of feathers and broken straw may likewise be used. Robins, barn swallows, and cliff swallows may be taken with a drop trap set over their supply of mud.

FLEDGLING BIRDS

The use of fledglings by a careful and conscientious operator as bait to trap parent birds is altogether proper. Such is frequently the means of obtaining important genealogical and other data.

Operations of this character should not be started until the young are well fledged and about ready to leave the nest. None of the automatic traps is suited for this work, as the operator should remain with his trap until the work is completed. A simple drop trap, or a Chardonneret trap with the door held open by a light stick, is the best equipment. The young birds may be placed in the trap in an old felt hat or a shallow box. Sometimes it is possible to lift the entire nest from its original site and place it in the trap, but this should not be done unless the operator is sure that it can be returned and securely fastened to its former base. The trap always should be placed as close to the nest site as possible.

Young birds require frequent feeding, and if the parents (one or both) are not obtained and banded usually within 15 or 20 minutes, the young should be returned to the nest for food. After a few feedings it may be possible to renew the experiment. As in all other phases of bird banding the operator should make every effort to see that his banded birds are released unharmed.

BAIT FOR WATERFOWL

In trapping ducks and geese, cereal bait is almost always the best, and of the different grains corn is the most satisfactory. It is eagerly taken by both shoal-water and diving ducks, as well as by geese, and may be used on the cob, shelled, or cracked. A few ears with the shelled kernels make a good combination for use. Wheat, barley, and rice also are good, while some success has been attained with oats. For teal, kafir corn or milo maize is good, and as these grains are so small it is preferable to bait with the unthreshed heads.

Chopped fish or shellfish may prove a good bait for some of the deep-water ducks, but no definite recommendations can as yet be given.

OPERATION OF TRAPS

The successful trap operator is the one who makes a close study of the birds that he attracts, noting their reactions to traps of different types, baits, and preferences for certain localities.

Some traps will give excellent results at one station and be a total failure for the same kinds of birds at another because of slight differ-

ences in the general environment. Some species are readily attracted to a station, but others must be sought out. An excellent example of this is shown in the banding of more than 75 ovenbirds during the spring of 1928 by C. E. Holcombe, of Zion, Ill., who considered that bait and traps had little to do with his success, but that the location of the traps among evergreens and shrubbery on a south slope was the all-important feature.

At some stations light board platforms placed under the traps have proved useful to eliminate the annoyance caused by rats, mice, moles, and other animals that burrow into the chambers. Generally speaking, wooden floors are not entirely satisfactory, but when trouble is experienced from small burrowing mammals, such expedients may be resorted to.

Stations operating during the winter in northern latitudes will find that the size of their catch is increased if their traps are protected from snow. Low shelters made of old lumber and ordinary roofing paper, with a southern exposure, will be quickly discovered by the birds, and traps so placed will be well used.

For general operation, traps at a small-bird station should be set on open ground close to trees or shrubbery. When feeding, birds like to have a readily accessible means of escape from possible enemies, and observation will show that frequent "repeaters" nearly always approach the trap by the same route through trees or thickets.

Scatter bait thinly on the ground around the trap and more plentifully at the entrances and in the chambers. It is well to place crusts of bread or other large pieces well inside the trap. Most birds appear to have a piggish habit, particularly if other birds are around, and will rush in to seize a large piece, when an equivalent or larger quantity may be readily available in smaller pieces outside the trap. It is, in fact, well to bait for a week or 10 days in anticipation of trap operation at any point, thus getting a group of birds accustomed to coming to that spot for food.

After a station has become well established it is frequently possible to omit most or all of the bait outside of the trap, although it is usually well to scatter at least a little in the way of an appetizer. In some regions, however, or when birds are unusually wary, it may be best to trap on alternate days and give the birds free access to the bait at all other times. When this is necessary automatic traps should have the exits left open or should be turned on their sides beside the baited area. Do not remove the traps entirely, as it is desirable to accustom the birds to their presence, but it is important that they be left in such manner that there will be no danger of birds becoming caught during the absence of the operator.

Frequent visits to automatic traps are essential. (See section on "Safety of trapped birds," pp. 6–12.) Be particularly careful to visit all such traps before dark to see that no birds are confined overnight. Birds should not be released after dark, as they will not have proper opportunity to find a suitable roosting place, and in consequence are likely to fall easy prey to cats, weasels, owls, or other predatory animals. Because of the fact that unforeseen circumstances will at times keep an operator away from his traps until after dark, it is advisable for every station to have a few storage cages available. These are best made from wooden boxes (about 8 inches square and twice that

long), provided with one or two simple perches, and with the front covered with ordinary window screen. Two or three small birds may be placed in such a cage, and if supplied with food and water may be safely kept overnight. The cages should be stored in a place where there is little light, such as a cool cellar or basement. Do not leave them outdoors and never include in one cage more than a few individuals of a single species. If two or more species are put together some or all are likely to be injured or killed. Figure 61 shows a series of these cages as used by William I. Lyon, of Wau-

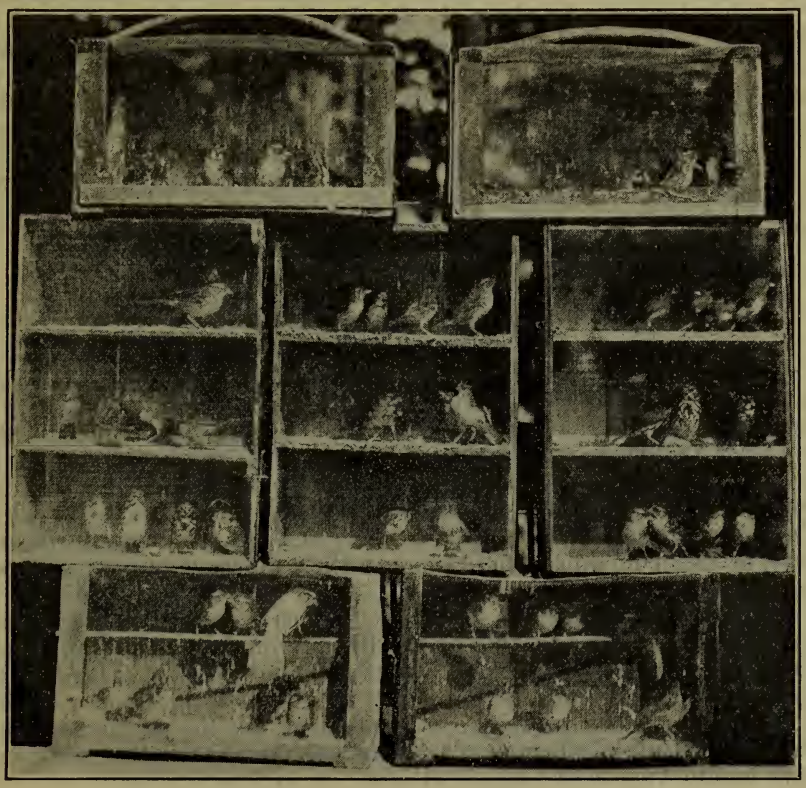

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FIGURE 61.—Storage cages for keeping small birds overnight. (Photograph by William I. Lyon)

kegan, Ill., who operates one of the largest stations in the country. The birds so confined should be promptly released in the morning.

If the operator expects to be absent from the station for a period longer than the customary period of trap visitation, the area should be abundantly baited, and automatic traps should be adjusted so that they will not capture birds.

In using a gathering cage when a trap contains both large and small birds, as grackles and song sparrows, remove one or the other first. Do not drive both into the cage at once, as the larger individuals are likely to injure the smaller. If a hand net is used (as may be necessary in a house trap), force the bird quietly into a corner and slip

the net over it without undue haste. Never attempt to capture a bird as it flies across the trap as the chances of breaking a wing or otherwise injuring the bird are great.

In preparing for duck trapping, a natural feeding ground should be selected if possible and baited abundantly until a flock of ducks works regularly in the vicinity. As soon as this occurs the trap may be constructed, but it is occasionally desirable to continue baiting for a few days before opening the entrance. This affords the birds an opportunity to become familiar with the superstructure of the trap.

Live decoy ducks, not confined in a special compartment of the trap chamber, may be given the freedom of an area 50 or 75 feet in diameter, surrounded with a fence of wire netting. The trap should be close to the decoy pen, but not actually inside it. This method of keeping decoys in pens is practiced extensively at shooting clubs, and such places as are selected for shooting stands make the best trap sites. By making arrangements with the proper officers of a club, a cooperator can, at the close of the shooting season, usually avail himself of the excellent opportunities that are presented on such properties.

HANDLING CAPTURED BIRDS

HOLDING SMALL BIRDS

The utmost care must be exercised in handling small birds, for they must be in perfect condition when liberated. Almost without exception small birds are highly nervous, and a quick pressure by the operator following some spasmodic struggle of the bird may kill it, or so seriously injure it as to make killing necessary. If the information to be obtained from the banding of birds is to be of value, the carriers must be strong and healthy and not handicapped in any way, as under no other conditions can their movements be considered as normal.

With this precautionary statement, the beginner may be put at ease by knowing that the technic of handling living birds is by no means complicated and that it is an unusual occurrence for a bird to be injured or killed while in the hands of a station operator. A bird may actually die from fright or excitement, but the number of such cases is negligible, when compared with the thousands that are every year handled again and again without the slightest injury.

It is expected that every operator will adopt the manner of handling birds that seems to fit best his own case, but the following method has been found satisfactory for the majority of persons, and it is accordingly recommended as a starting point for every new bird-banding cooperator.

To remove a bird from the gathering cage for banding, reach into the cage, blocking the opening around the arm with the other hand (unless a sleeve is used, as in Fig. 53), and work the bird into a corner. It is almost certain to be facing away from the operator. Grasp it so as to pinion its neck between the index and second fingers, and the wing tips, tail, and feet by the little finger closed against the palm. In this position the bird can be held quietly without using undue force. Strangely enough, securing the bird's head or neck will almost invariably cause it to cease struggling.

If the bird is already banded, and only a simple examination is necessary, this position need not be changed, as the band may be readily turned with the free hand and the number read. Or the bird may be allowed to perch on the little finger, the neck secured between two fingers, as before. Most birds will rest quietly in this position, which has the advantage of permitting an examination of the entire body. (Fig. 62.)

To place a bird in position for banding, remove it from the hand in which first held by grasping its head lightly but securely with the thumb and the index and second fingers of the other hand; release all other hold (fig. 63) and by quickly reversing the position of the bird draw it through the free hand with its back against the palm.

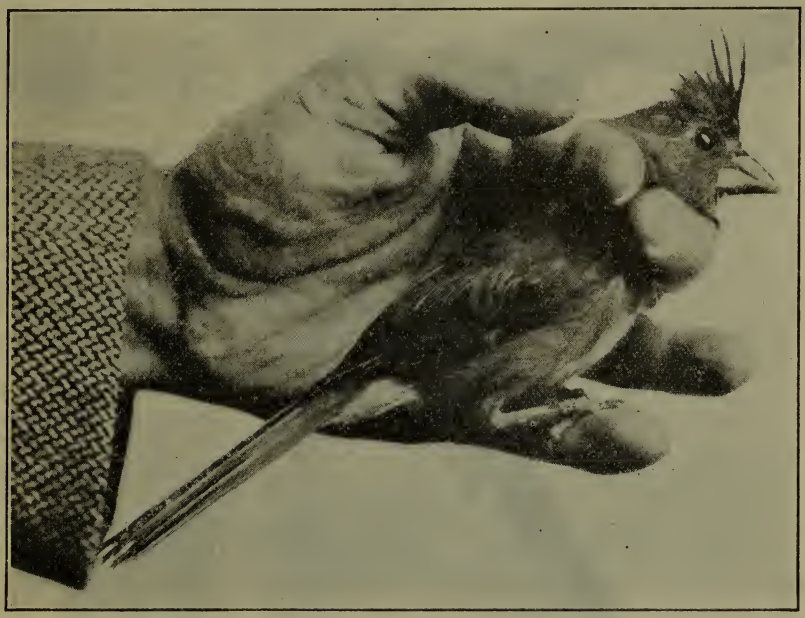

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FIGURE 62.—Manner of holding a bird when removing it from a trap or a gathering cage. If the bird is already banded and it is necessary only to examine the band to obtain the number, this position need not be changed. See also Figures 63, 64, and 65

close the little finger over the neck, and the other fingers around the body. This position is exactly the reverse of the original one in that the bird's feet, wings, and tail are now held by the second finger, whereas in the other case this was accomplished by the little finger against the palm. The thumb and index fingers are now free to hold the tarsus while attaching the band. (Fig. 64.)

This system of handling small birds has been found entirely satisfactory if the fingers of the operator are long and slender, but operators who have short, stocky hands will do well to learn the method indicated in Figure 65. According to this method the bird is taken from the gathering cage in the same manner as before, except that the bird's neck is secured between the thumb and index finger, and instead of pinioning the feet, the right foot is grasped between the thumb

and second finger, the other fingers being closed around the bird's body. In this way, the bird's wings are held against the palm of the hand, the only part left free being the left foot, and with this foot the bird will usually grasp the little finger if permitted to do so.

B3968M

FIGURE 63.—Changing a bird to banding position. There is practically no danger of injury in this method of handling, as the bird will not struggle while so held

HOLDING DUCKS AND GEESE

Most ducks are remarkably gentle when they realize that they are helpless, even during the height of the shooting season. When the operator approaches a cage trap, however, the captured birds will naturally plunge around in great confusion, frequently putting the entire structure of the trap to a severe strain. The careful operator will reduce this commotion as much as possible by removing the birds rapidly and placing them in burlap sacks. An assistant will materially expedite this part of the work, but his help is not absolutely necessary.

When the trap is set entirely in water it should be visited with a boat, which should be tied broadside to the trap at the point where the operator will enter. On entering the trap the operator closes the funnel or other entrance and attaches an empty sack over the side opening through which he came. If an assistant remains in the boat, this last will not be necessary, and as he will handle the sacks the process of emptying the trap should take only a few minutes. Care should be taken to keep the sacks as dry as possible, for if they become wet the body heat from the birds will produce steam and cause the otherwise waterproof plumage to become soaked and in cold weather probably result in injury to the birds. Care should be taken also to avoid crowding in the sacks.

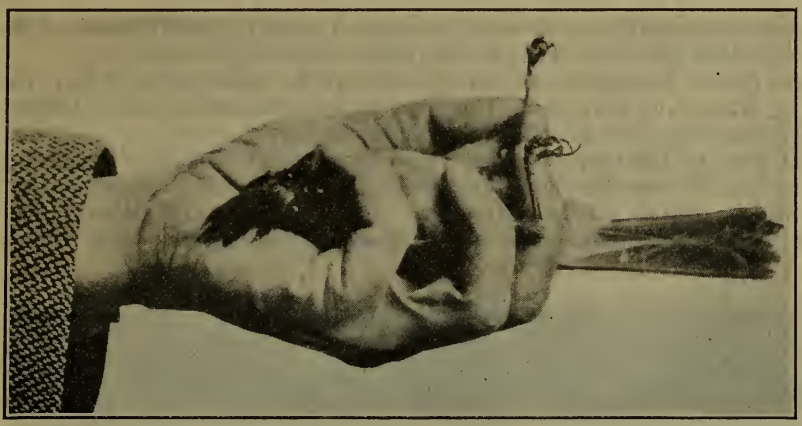

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FIGURE 64.—Manner of holding a small bird for banding. The little finger held lightly over the bird's neck prevents struggling and leaves the thumb and index finger free to hold the bird's tarsus while attaching the band. See also Figures 62, 63, and 65

B1959M

FIGURE 65.—Manner of holding small birds for banding. Suitable for persons with stocky hands. (Photograph by William I. Lyon)

Large coffee sacks will hold comfortably 10 or 12 birds of the size of mallards, but the smaller grain sacks only 6 or 8 birds each. As soon as each sack is filled it is securely tied and placed on the bottom of the boat so that the birds will have as much room as possible.

As it will be almost impossible to keep the sacks entirely dry, the birds from each trap should be banded and released at once, preferably from the boat as it lies alongside the trap.

If part of the trap chamber is on dry land, the task of removing the birds is considerably simplified. To stop their struggling they should be driven gently to the back of the chamber and either placed temporarily in sacks or the entire mass covered lightly with a piece of burlap or light tarpaulin.

B24897

FIGURE 66.—Manner of holding ducks for banding. Birds of this family are usually remarkably gentle when they realize that they are prisoners

In holding for banding, the operator may hold the body of the duck against his own body by light pressure from his forearm, with the duck's head and neck either free or held against the operator's body by his upper arm. Figure 66 shows a mallard drake held in this way, the only part actually grasped being the leg on which the band is placed.

Because of their large size geese can not be held in the same manner as ducks, and unless an assistant is available to hold the bird, the operator had best kneel and hold the goose against his knees by pressure of one forearm, thus leaving both hands free to attach the band.

HOLDING HERONS

Great care must be exercised in working with the larger herons, as these birds strike with snakelike rapidity, and the blow is likely to be toward the eyes, because of their brightness. Hold the bird's

neck securely during the entire banding operation, preferably close to the head. Another method that will facilitate banding when an operator is working without assistance is to cover the bird's entire body (including the head and neck) with a sack or old coat. In either event the heron's head should be kept secured until the operator has completed his work.

Other water birds, as gulls, cormorants, gannets, and puffins, can inflict severe and sometimes dangerous wounds with their powerful beaks, so in operations involving them the neck hold should be practiced.

HOLDING HAWKS AND OWLS

The weapons of defense of birds of prey are their powerful feet and claws, and these must be watched. The bill usually may be disregarded. These birds generally throw themselves on their backs with feet drawn up ready to strike. When they are in this position a stout stick may be inserted between the bird's feet and its body, and

B3967M

FIGURE 67.—Releasing a banded bird. Frequently birds will remain in this position for several minutes before taking flight

by a steady outward and downward pressure the feet forced out straight along the bird's tail. Then hold the stick in position by the shin of one leg (do not kneel on it, or the bird's legs may be broken) or by the instep, and grasp both feet firmly while the band is attached. A hawk or owl has practically no ability to grasp when its legs are straightened out. An assistant can render material help with such birds.

RELEASING

The simplest way to release a banded small bird is merely to open the hand and permit it to take flight at will. After banding such a bird it will likely be on its back in the operator's hand, and individuals of many species will frequently lie quietly in this position, even permitting gentle stroking or the spreading of a wing, not seeming to realize that they are free. (Fig. 67.) Suddenly they will roll over and flash into flight.

Never throw a bird into the air or otherwise frighten it into flight, as this will only add to the difficulties of recapture, and it should be remembered that frequent repeaters furnish much useful information.

BANDS

DESCRIPTION

Several sizes of bands are issued by the Bureau of Biological Survey, the smallest (size 1) having an inside diameter of three-thirty-seconds of an inch. The bands are of two types, split ring and lock, and in the manufacture of small sizes pure aluminum is used. In the manufacture of the larger sizes both aluminum and copper are used. Salt water has an action on aluminum that is comparable to the action of an acid upon zinc or copper, so that bands carried by birds that spend a part or all of their time in salt or alkaline waters will have a longer life if made of copper. Other metals, such as the alloy known as Monel metal, may at times be used for some of the largest sizes. Cooperators contemplating special work should furnish the Survey with a complete outline of their plans, so that the bureau can give them intelligent advice concerning the bands that should be used.

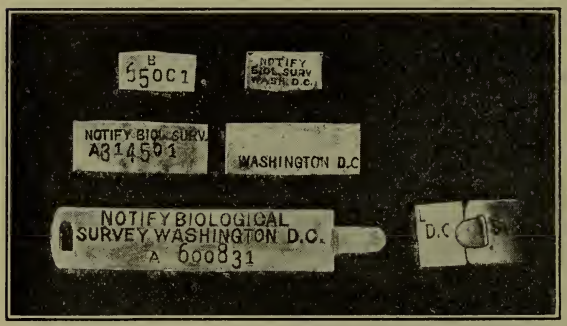


FIGURE 68.—Types of bands. Upper figures, No. 1 band straightened out, showing both faces. Middle figures, No. 3 band straightened out, showing both faces. Lower figures, No. 6 band, at left, straightened out with full legend; at right, closed and properly locked

All bands carry a serial number, which on size No. 1 has not more than five figures. All other sizes (1A, 2, 3, 4, 5, 6, and X) carry numbers of six figures. The number also has a series designation, such as a letter. This is an important part of the number and always should be given, as B58429. On all sizes, except No. 1, the first figure of the number designates the size. For example, band No. B127436 is size 1A; and No. B592261 is size 5. On the smaller sizes the entire legend is carried on the inner surface, while on the intermediate sizes part of the legend is placed on the outside above the number. It is possible only on the largest size to give the complete, unabbreviated legend "Notify Biological Survey, Washington, D. C.," on the outer surface. (Fig. 68.) The Post Office Department, however, has been fully advised concerning the abbreviations used, so that letters reporting return records that have to be addressed merely "Bi. Surv., Wash. D. C.," will be delivered to the Bureau of Biological Survey.

The bands are made by machinery, and while imperfections in shaping or in numbering are rare, they sometimes occur. Effort is made constantly to detect these at the Washington office, but should any imperfect bands be received at a trapping station, they should be returned to the Survey.

On new bands it may be a little difficult to read the numbers, but this will rarely be the case with bands carried by repeating or returning birds, as the impressed surface oxidizes at a different rate from

that of the flat surface, and it also will have a tendency to pick up dirt.

To bring out the numbers on new bands, a little black oil paint (artists' tube colors) or paste shoe blacking may be rubbed over them while on the cord or wire, and the excess wiped off with a cloth. This will leave a deposit of color in the numbers and legend, causing them to show up so clearly that there will be no difficulty in reading them. This procedure is strongly recommended for every operator who has any difficulty in reading the numbers, as it will serve to eliminate mistakes. The bands used in the photograph (fig. 68) were treated in this way.

ATTACHING

Always select the smallest-sized band that will close around the tarsus, or bare part of a bird's leg immediately above its toes, without binding or chafing. Table 1, below, gives an idea of the comparative sizes of birds and the bands adapted to them, but operators should feel free to exercise independent judgment in this matter. A band correctly selected and attached should move freely up and down the bird's tarsus and turn easily and smoothly, but it should not fit loosely like a bracelet, as with small perching birds there is danger that twigs or thorns will catch in it. When it is considered absolutely necessary, the size of the band may be slightly reduced by lapping the ends, but care must be exercised to see that the edges of the lap are made smooth. Projecting edges are likely to catch in nesting material. If a band is lapped too much, there is danger of pinching the bird's foot and ultimately causing paralysis of the member. It is never safe to lap a band on powerfully billed birds, such as grackles and grosbeaks, as the lap reduces its strength and makes it more easily crushed. For some of the smaller birds the junior author favors using bands a size smaller than the Nos. 1A, 2, or 3 here indicated.

TABLE 1.—*Comparative sizes of birds and bands*[1]

Species	Size	Species	Size
Grebes	6	Mallard	6
Great black-backed gull	6	Black duck	6
Herring gull	6	Baldpate	6
California gull	6	Teals	5
Ring-billed gull	5	Pintail	6
Laughing gull	5	Wood duck	5
Franklin's gull	5	Redhead	6
Bonaparte's gull	4	Canvasback	6
Caspian tern	5	Scaup ducks	6
Royal tern	5	Ruddy duck	6
Cabot's tern	4	Geese	[2] X
Forster's tern	3	Ibises	6
Common tern	3	Bittern	6
Roseate tern	3	Least bittern	4
Least tern	1A	Great blue heron	6
Black tern	2	Egret	6
Black skimmer	4	Snowy egret	5
Petrels	2	Louisiana heron	5
Cormorants	[2] X	Little blue heron	5
Pelicans	[2] X	Green heron	4
Mergansers	6	Black-crowned night heron	6

[1] The birds listed are in A. O. U. Check List (1910) order and represent every group or size taking bands from size 1 to size X.

[2] Size X bands are special lock bands needed only for the largest birds. The Survey always endeavors to obtain the best band of this type, but as the style may be changed as improved types are placed on the market, it is not expedient to attempt a description in this publication. Details relative to the band in use can be obtained by writing to the Biological Survey.

TABLE 1.—*Comparative sizes of birds and bands*—Continued

Species	Size	Species	Size
King rail	4	Evening grosbeak	2
Virginia rail	3	Pine grosbeak	2
Sora	3	Purple finch	1A
Gallinules	6	House finch	1
Coot	6	Crossbill	1A
Phalaropes	1A	Redpoll	1
Avocet	4	Goldfinch	1
Woodcock	4	Pine siskin	1
Wilson's snipe	3	Vesper sparrow	1A
Dowitcher	3	Savannah sparrow	1
Knot	3	Grasshopper sparrow	1
Pectoral sandpiper	2	Lark sparrow	1A
Semipalmated sandpiper	1A	Harris's sparrow	1A
Sanderling	2	White-crowned sparrow	1A
Godwits	4	Golden-crowned sparrow	1A
Yellowlegs	3	White-throated sparrow	1A
Willet	4	Tree sparrow	1A
Upland plover	3	Chipping sparrow	1
Spotted sandpiper	1A	Junco	1
Curlews	4	Song sparrow	1A
Black-bellied plover	3	Swamp sparrow	1
Killdeer	3	Fox sparrow	1A
Semipalmated plover	2	Towhee	2
Piping plover	2	Cardinal	2
Mountain plover	3	Rose-breasted grosbeak	2
Turnstones	2	Indigo bunting	1A
Oyster catcher	5	Scarlet tanager	2
Quail	4	Purple martin	2
Grouse	6	Cliff swallow	1
Mourning dove	3	Barn swallow	1
Marsh hawk	6	Tree swallow	1
Sharp-shinned hawk	4	Bank swallow	1
Cooper's hawk	5	Cedar waxwing	1A
Goshawk	6	Northern shrike	2
Red-tailed hawk	6	Loggerhead shrike	2
Eagles	[2] X	Red-eyed vireo	1
Duck hawk	6	Warbling vireo	1
Pigeon hawk	4	Black and white warbler	1
Sparrow hawk	3	Blue-winged warbler	1
Barn owl	6	Virginia warbler	1
Long-eared owl	6	Parula warbler	1
Screech owl	6	Yellow warbler	1
Burrowing owl	5	Myrtle warbler	1
Cuckoos	3	Ovenbird	1A
Belted kingfisher	4	Kentucky warbler	1A
Hairy woodpecker	3	Connecticut warbler	1
Downy woodpecker	2	Maryland yellowthroat	1
Sapsuckers	2	Yellow-breasted chat	1A
Red-headed woodpecker	3	Canada warbler	1
Flickers	3	Redstart	1
Nighthawk	2	Mockingbird	2
Chimney swift	1A	Catbird	2
Kingbird	2	Brown thrasher	2
Crested flycatcher	1A	Cactus wren	1A
Phoebe	1A	Rock wren	1A
Wood pewee	1	Carolina wren	1A
Horned lark	1A	House wren	1
Magpie	3	Brown creeper	1
Blue jay	3	White-breasted nuthatch	1A
Raven	6	Red-breasted nuthatch	1
Crow	5	Tufted titmouse	1A
Starling	2	Chickadee	1
Cowbird	2	Bush tit	1
Yellow-headed blackbird	2	Wren tit	1
Red-winged blackbird	2	Golden-crowned kinglet	1
Meadowlark	3	Blue-gray gnatcatcher	1
Orchard oriole	2	Wood thrush	2
Baltimore oriole	2	Hermit thrush	1A
Brewer's blackbird	2	Robin	3
Bronzed grackle	3	Bluebird	1A

[2] Size X bands are special lock bands needed only for the largest birds. The Survey always endeavors to obtain the best band of this type, but as the style may be changed as improved types are placed on the market, it is not expedient to attempt a description in this publication. Details relative to the band in use can be obtained by writing to the Biological Survey.

Never under any circumstances attempt to close any band with the unaided fingers. In spite of repeated warnings some operators have persisted in attaching bands without the aid of pliers. *No*

band of any size can be properly closed by the fingers alone. The metal used in band manufacture is purposely tempered as hard as possible, and this gives them a certain springiness. A pair of pliers is an indispensable tool. (Figs. 54, C and 55.) A little practice with this instrument will give such skill that bands can be placed accurately and rapidly. After the band has been closed (if pointed pliers are used), crush it slightly with one jaw of the pliers directly on the joint of the band in order to bring the edges tightly together and definitely eliminate any danger of foreign substances becoming caught at that point. With pliers of the type shown in Figure 55 this is not necessary.

Caution.—If a bird, while in the hand, should take advantage of a momentary relaxation of the fingers and get loose, do not attempt to grasp it from the air, but let it escape quietly and trust to recapturing it. The desire to seize an escaping bird is almost instinctive, and it requires thorough muscular control to refrain. No matter how quick the lunge toward an escaping bird, it will generally net nothing more than a handful of feathers, usually the tail, while the chances of breaking a wing or otherwise injuring the bird by a sudden grasp are great.

Lock bands, equipped with special devices to prevent removal, obviously require a little more time to attach. Figure 68 shows a No. 6 band opened out flat and also properly locked. Pliers with longer jaws are a decided convenience when working with such bands. (Fig. 54, A.)

REMOVING

Removing bands from small birds is at best a delicate operation and should not be attempted unless absolutely necessary. An assistant should be at hand to hold the bird during the process.

When, for one reason or another, it becomes necessary to remove a band, great care should be exercised to see that *all leverage is exerted directly on the band and not upon the leg of the bird.* To start an opening, a pair of small but stout-bladed scissors is useful. By placing the points at opposite sides of the band at the joint, and closing the scissors slowly, the ends of the band will be forced apart sufficiently to admit the tips of the pliers. These can then be inserted and opened slowly, opening the band far enough to permit its removal. Be careful to see that none of the tools come in contact with the bird's leg, and during the entire operation see that the band is held securely.

When a band is removed because of wear or imperfections it should be destroyed. Never, under any circumstances, should a band already reported as used be placed on another bird. Were this done, much confusion would result in the records at the central office.

RECORDS

The Bureau of Biological Survey is the central agency for the bird-banding work, and all cooperators are expected to comply with the simple regulations prescribed. Such rules as are in effect or may be formulated from time to time are for the best interests of the banding work through obtaining standardization. So far as records

are concerned these apply only to the reports rendered to the central office, for the survey has no intention of interfering with such other details as may interest station operators. Rather it is the desire to render all possible assistance to the end that the best results may be obtained. Cooperative regional associations are rendering efficient assistance by coordinating the activities of station operators in different geographical areas, and it may be the desire of their officers to have members render certain reports to the local headquarters. There is no objection to this, provided that such reports are made supplementary to the ones forwarded to the central office.

TERMINOLOGY

Certain terms that have peculiar fitness have come into use in the bird-banding work, and in order to avoid confusion these should be standardized. In preparing for publication reports based upon the results of banding operations, additional terms are likely to be necessary, especially when an analysis of data forms the subject matter of the text. This will be due to the diverse character of the returns, since records of banded birds reported from localities other than those of banding may admit of interpretations different from those obtained at the original trapping station. The consideration of these matters need not, however, enter into the system here treated, which is concerned only with methods of obtaining birds for banding, and the proper preparation and filing of the resulting data.

In rendering their reports to the Biological Survey, cooperators are accordingly requested to employ terms and names as herein used. Adherence to these will be of service not only in central-office records but also to other cooperators and other interested persons, who will thus be able to make intelligent statements or requests, knowing that the terms employed by them will be in conformity with current usage and not susceptible of misinterpretation.

A clear understanding of the distinction between repeats and returns, for instance, is of first importance. The following definitions are more or less arbitrary, and, as above stated, additional classifications may be necessary by any worker who undertakes to digest and interpret the records for any particular species, but for the purpose of properly recording and filing the information obtained, the two classes of records have been found adequate. Every cooperator is expected to adhere to these definitions in so far as the reports transmitted to the Biological Survey are concerned.

REPEATS

The term "repeat" is used to designate a short-time return of a live bird at the original station and is used to indicate recoveries of banded birds that have apparently not been absent from the neighborhood since the time they were last handled. In other words, repeats are records of banded birds that it is assumed have not migrated and have not been otherwise absent since last recorded. Some birds acquire the trap habit, and repeat frequently, while others may be taken only at intervals of a month or more. Such records, when pertaining to migratory species, may provide exact information regarding the time that migration commences. Sedentary species may

perhaps repeat continuously throughout the year. Every repeat should be recorded.

RETURNS

The term " return " is used to designate a recovery from the same or any other station during or following a migration period, and also for all banded birds meeting death at or near the station where banded. If known, the cause of death should be given. Returns recorded at the original station, after migration, are usually banded birds that have come back to the neighborhood where they were in a previous season. As it may at times be difficult to distinguish definitely returns of this class from repeats, a time limit of three months has been arbitrarily adopted. Hence, if a banded bird is recaptured three months or more after the time of its last capture at the station it should be listed as a return. Stations also may obtain returns of birds banded at some other point. Thus far there have not been many of this class, but they are likely to increase with a greater number of trapping stations in operation and the constant increase in the number of banded birds.

Banded birds killed or found dead by persons other than cooperators are naturally reported direct to the Biological Survey, as requested on the bands, but the information is forwarded by the bureau to the person responsible for banding.

CENTRAL OFFICE RECORDS

The following information is furnished cooperators so that they may know how their work fits into the general scheme:

COOPERATOR'S RECORD

In the bird-banding office of the Bureau of Biological Survey in Washington each cooperator is represented in three card files. One of these is merely an alphabetical list, being a duplicate of the mailing list used for mailing Bird Banding Notes and other literature. The second card file groups cooperators alphabetically by States and shows at a glance the history and activities of each person holding a Federal banding permit. On the face of each card, in addition to his name and address, is the history of his permit and other pertinent information, while on the reverse is noted the number of birds he has reported banding. The third file shows the bands issued to each station operator, giving the sizes, quantities of each, numbers, and date issued. Bands not used or returned for any reason are credited on these cards in red ink.

ISSUE INDEX

In addition to the issue record, an issue index is maintained on cards. One of these cards is prepared for each block of bands issued, and they are arranged in numerical sequence. With the present system of handling banding records, this issue index is of great importance, as is shown under " Foreign returns," page 105.

SCHEDULES

The schedules, constituting the reports of cooperators, are filed in the order of the check list of the American Ornithologists' Union, in

jackets or folders, the records from each cooperator being kept together in a folder bearing his name. The folders are arranged alphabetically.

When schedules are received from a banding station they are first stamped with the date of receipt, after which a post card is sent the cooperator to inform him that his records have been safely received. The schedules are then examined for records of newly banded birds, the total of which is entered upon the operator's permit card previously mentioned. The number of newly banded birds of each species also is noted on an index of birds banded, another card file from which it is possible to determine the total number of banded birds for any particular species. This index does not give the band numbers, for such an index would require the copying of almost every record, a procedure that would make the cost of assembling such information prohibitive.

After the totals of new birds are noted, the schedules are reexamined for returns, the numbers of which are required to be encircled or underscored by the station operator with colored ink or pencil. All such records are copied on special cards, punched for the sorting machine, and placed in the return file. The schedules are then filed in proper order in the folders.

RETURN FILE

The return file is probably the most valuable part of the entire series of records. The face of each card used is divided into two parts, one of which gives the complete written record while the other duplicates this information by a series of holes punched in appropriate columns, a method that makes it possible to arrange the cards for any particular class of data by means of an electrically operated sorting machine. The cards are normally arranged chronologically under species guide cards in the order of the American Ornithologists' Union check list. This is a thoroughly up-to-date business system and permits the preparation of reports at a minimum expenditure of time and labor.

STATION REPORTS

Under the system placed in operation January 1, 1926, bird-banding cooperators now forward their station records to the Bureau of Biological Survey only once or twice a year, instead of at more frequent intervals as formerly required. Exceptions to this rule are records for game birds banded during open hunting seasons and for colony-breeding species, the banding of which is generally a special activity. Records of such bandings should be sent in promptly, as return information usually is reported by persons without official connection with the bureau, and it is highly desirable that their communications be answered without delay, a procedure that is possible only when the cooperators responsible for the banding are prompt in transmitting the original records.

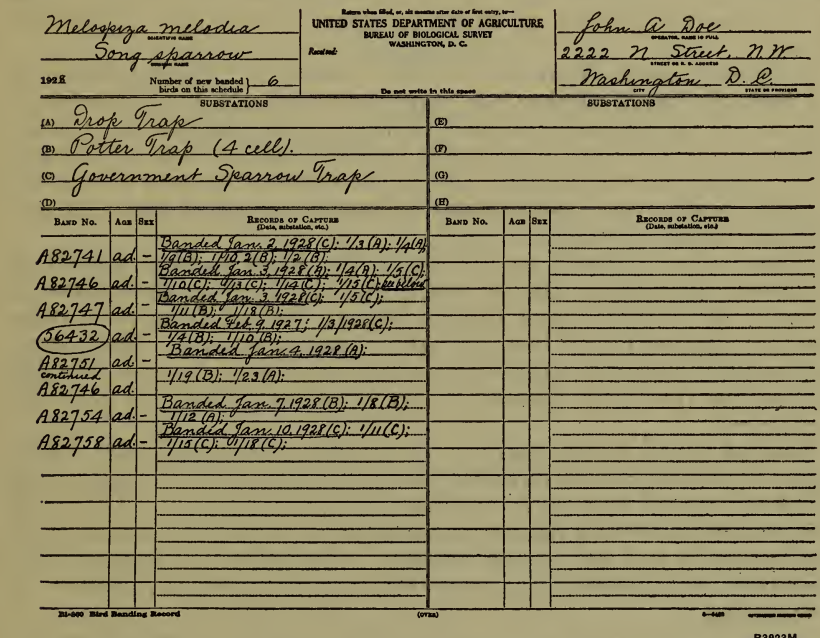
General station reports, *including original banding records, repeats, and returns, should be compiled on schedules* and forwarded for the particular species involved at the end of their season at that station. For example, a schedule containing the data for a series of juncos should not be sent in during December or January, while these

same birds are still in the vicinity of the station and repeating regularly. In other words, when a schedule is mailed it should carry a complete record for the individual birds for the season covered.

The schedule blanks are furnished by the Biological Survey, several being sent at the time each order for bands is filled. Additional ones will be forwarded upon request.

In preparing these reports (fig. 69) it is essential that records for *one species only* be listed on each sheet. Each schedule has room for the records of 60 banded birds, unless the number of repeats (for some individuals) causes them to occupy greater space. Also, schedules should be filled in with pen and ink. Lead pencil is not satisfactory.

The upper left-hand block is for (1) the name of the bird, which



Melospiza melodia
Song sparrow
1928 Number of new banded birds on this schedule 6

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF BIOLOGICAL SURVEY
WASHINGTON, D. C.
Do not write in this space

John A Doe
2222 N Street NW
Washington D. C.

SUBSTATIONS
(A) Drop Trap
(B) Potter Trap (4 cell).
(C) Government Sparrow Trap
(D)

SUBSTATIONS
(E)
(F)
(G)
(H)

Band No.	Age	Sex	Records of Capture (Date, substation, etc.)
A82741	ad.	-	Banded Jan. 2, 1928(C): 1/3(A); 1/4(A); 1/9(B); 1/10, 2(B); 1/12(B).
A82746	ad.	-	Banded Jan. 3, 1928(B); 1/4(B); 1/6(C); 1/10(C); 1/11(C); 1/14(C); 1/15(C); 1/16(C); 1/18(C); 1/23(C).
A82747	ad.	-	Banded Jan. 3, 1928(C); 1/11(B); 1/18(B).
56432	ad.	-	Banded Feb. 4, 1927; 1/3/1928(C); 1/4(B); 1/10(B).
A82751	ad.	-	Banded Jan. 4, 1928(B); 1/19(B); 1/23(A).
A82746	ad.		Banded Jan. 7, 1928(B); 1/18(B); 1/12(A).
A82754	ad.	-	Banded Jan. 10, 1928(C); 1/11(C); 1/15(C); 1/18(C).
A82758	ad.	-	

21-500 Bird Banding Record (OVER) B3923M

FIGURE 69.—Properly prepared schedule of banding records. The one return has the number encircled and the banding date repeated. The series of repeat records for the bird listed as No. A82746 are entered as "continued"

may be either the common or the scientific name, or both; (2) the year, which usually permits omission of this item in the body of the report; and (3) the total number of new banded birds for which data are furnished on the schedule. This total should not include any repeats or returns for which the original banding record has been already reported. This information is used for statistical purposes and to make it possible to know at any time the total number of birds of any species that have been banded; it is useful also in computing the total number of birds of all species that are banded in any one year. The upper middle block should be left blank by the cooperator, as this space is reserved for the receiving stamp of the Bureau of Biological Survey, from which information can be furnished concerning the date of receipt of any particular record or series of

records. The upper right-hand block is for the name and address of the cooperator. Care should be taken to see that this is entered on every schedule.

Under the heading "Substations," station operators should list the traps instrumental in effecting the captures represented on each schedule. It is not necessary to note on each sheet all traps that may be in operation at a station, but only those whose captures are thereon recorded. In listing traps, the names used should be those employed in this publication for the different types. If records are listed for banding work done at two or more localities during the period covered, each locality should be listed as a substation, giving the geographic location. Unless such notations appear in the substation section, the assumption will be that all banding was done at the regular station, the locality of which is given in the upper right-hand block.

Four columns are provided for such record of a banded bird. In the first, the band number (be careful to note serial designation, if any, as "A," etc.); in the second, the age, as ad. (adult), im. (immature), or juv. (juvenile or nestling); in the third, the sex (if known), as ♂ (male) or ♀ (female); and in the fourth, the date of original banding *underscored*, other dates of capture (repeats and returns), and substation references.

When return records are obtained, the band number should be encircled with colored ink or pencil and the banding date given, if known. If it should be a foreign return, that is, from some other banding station, note "foreign" after date of capture. The Survey will supply details of banding when the schedule is sent in and also will advise the other operator as to where and when his bird was recaptured.

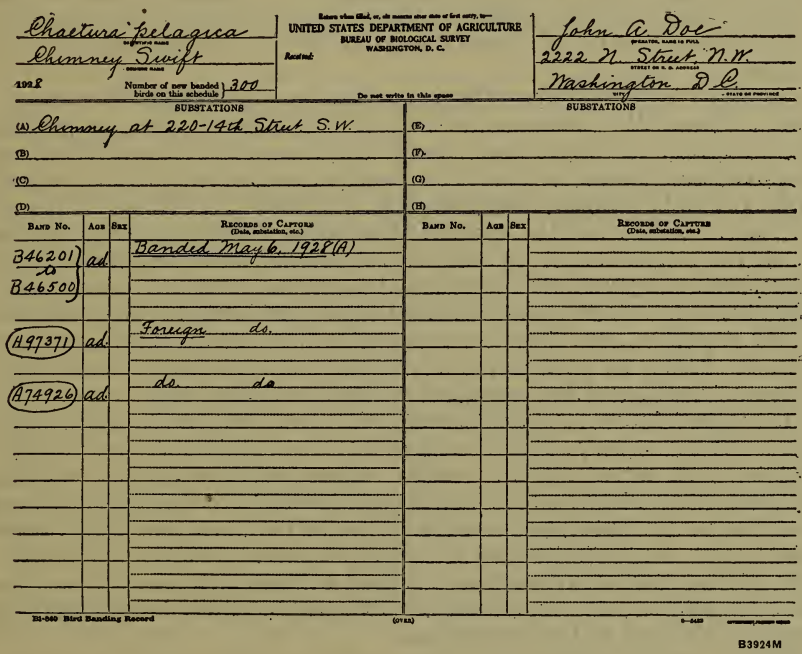
Banded birds found dead at the station, or accidentally killed, either in the traps or in handling, should be reported as returns, with full details given relative to the cause of death, if known. This is important, as the Survey desires to maintain a complete record of banding casualties and the causes therefor. Operators are expected and cautioned to be careful, but accidents are to be expected, despite all precautions.

At the bottom of the reverse side of the schedules, space is provided for "Remarks," where notations can be made concerning weather conditions, bait used, actions of certain birds, or other pertinent information.

The manner of preparing schedules above described applies to the usual operations of a trapping station. When large numbers of a species are captured and banded on one day, the record may be greatly simplified, provided the bands are used in proper sequence. Figure 70 shows a schedule that is properly prepared for a large number of birds of the same species, banded on one day. Schedules prepared in this manner have given on a few lines the data of more than 1,000 birds and obviously are a great saving in time to all concerned. This method may be employed when work is done with gulls, terns, cormorants, ducks, swifts, swallows, starlings, blackbirds, and others.

FOREIGN RETURNS

When return information is received at the Survey for a bird not banded at the point where recovered, the first item to be ascertained is the cooperator charged with the band. This is done by reference to the issue index. With this information the folder of that operator is opened and the schedules scanned for the original record of banding. If found, the banding record and return information are copied on a card, the card is punched, and the cooperator and person rendering the return report are notified on special forms of the information of particular interest to them. Should the original record not appear on the schedules in the cooperator's folder, a post card with reply card attached (Form Bi–666) is sent to the operator



Chaetura pelagica
Chimney Swift
1928
Number of new banded birds on this schedule 300

Return when filled, or, six months after date of first entry, to—
UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF BIOLOGICAL SURVEY
WASHINGTON, D. C.
Restrict
Do not write in this space

John A. Doe
2222 N. Street N.W.
Washington D.C.

SUBSTATIONS
(A) Chimney at 220-14th Street S.W.
(B)
(C)
(D)

SUBSTATIONS
(E)
(F)
(G)
(H)

Band No.	Age	Sex	Records of Captures (Date, substation, etc.)
B46201 to B46500	ad.		Banded May 6. 1928 (A)
A97371	ad.		Foreign do.
A74926	ad.		do. do.

Bi-560 Bird Banding Record (OVER)

B3924M

FIGURE 70.—Properly prepared schedule for a large number of birds of the same species banded on one day. Applicable to ducks, gulls, terns, cormorants, swifts, swallows, and others

requesting the banding data for that particular number. Prompt attention always should be given such requests, as replies to correspondence may be delayed while awaiting the report from the banding station.

STATION RECORDS

Satisfactory methods to be used by cooperators in the handling of their permanent station records must necessarily depend upon the nature of the work that is carried on. If systematic investigations on definite ornithological problems are to be advanced, a duplex system will be necessary.

A method that has been successfully employed by the junior author is simple and efficient. Sheets of paper, foolscap size, are used, and

upon them are entered the date, temperature, and weather conditions. The records for each new bird banded on that day, together with returns from previous seasons, are then entered in the regular order in which the birds are captured. It is well to have the band numbers set off to the left as in a column, indenting the balance of the record. Entries on these sheets may be made direct from a day card or the notebook carried to and from the traps. Repeats, appearing on the day card, should be carried back to the sheet on which appears the original record, or (if a return) the first recapture for the season. In this way the complete record is kept in one place for that bird for the season. The day card is merely a card that is carried from trap to trap and on which is noted the band number, kind of bird, trap (substation), and other pertinent data. One card is used each day, and after posting into the permanent record these original card records are filed in chronological order, thus providing a convenient means of illustrating the day-by-day activities of the station.

Another method of handling the data at the time of banding is that of Frank W. Commons, of Crystal Bay, Minn., who uses manila envelopes 2½ by 4¼ inches in size. The faces of these are ruled into five vertical columns with 12 crossrules, exclusive of the heading. The vertical columns are headed "Number," "Bird," "Date," "Time," and "Trap," the width of the columns being ⅝, 1, ¼, ¼, and ¼ inches, respectively. In each envelope are placed 12 bands of one size, already opened and threaded in sequence on cotton rug yarn. The numbers are previously entered in the proper spaces on the face of the envelope, and the remaining data are supplied as each band is used. When an envelope is empty, the data are posted in the permanent record, and the envelope is filed as a day card.

The card system is widely used, and when kept up to date is the most effective means of quick reference to any particular set of data. Repeats may be entered in regular sequence following the banding record, while returns may be similarly recorded and the card rendered conspicuous by attaching to it a small index tab, or signal. This same system also may be developed through the use of loose-leaf notebooks. The records may be arranged according to band numbers without regard to species, or numerically under species, whichever method is most satisfactory to the cooperator.

Where special studies are being made, as of the development of plumage colors and markings, the record is best supplemented by a loose-leaf book in which there will be ample space to enter minute details.

In the operation of a station many birds will be retaken again and again as repeats. The band numbers always should be examined and recorded, and if a banded bird is not recognized as one recently banded at the station, it should be held until the operator has searched the records of his station to make sure of the previous record and of the accuracy in transcribing the band number.

If the original banding record is not found in the previous files of the station, the return must be a foreign one, and as such is of exceptional interest. To take every precaution against error, the operator should fully identify the bird, if possible, and have the band number carefully read through a magnifying glass by other persons.

PROBLEMS THAT TRAPPING-STATION OPERATORS MAY SOLVE

The solution of problems concerned with the distribution and migration of North American birds is the primary object of bird banding, from the viewpoint of the Bureau of Biological Survey, and in this every station operator is a potential factor. As this subject may require a knowedge of conditions over the entire continent and the correlation of data obtained from widely scattered sources, individual station operators may not be in a position to undertake the solution of more than one or two phases.

A great many problems, however, are ready at hand for the attention of each cooperator, any one of which, when worked out to a logical conclusion, may furnish the basis for an important contribution to ornithological science. When possible, two or more operators should undertake the solution of the same problem for the same species, as only by so doing will definite and dependable conclusions be drawn relative to the general application of the data in question. The appearance in print of a report from one station setting forth certain conclusions based upon information obtained at that point should not discourage other cooperators from repeating the work at their stations. Their results may be entirely different, and a check-up at these and other stations may demonstrate that one of the reports was based upon exceptional data.

The questions given below may suggest possible fields of investigation for individual station operators or for two or more stations operating in the same general region. Other problems will continually come to attention. The Survey will always be glad to advise cooperators relative to problems engaging their attention and to assist in establishing contacts between operators working along similar lines. The Survey maintains a collection of published pamphlets relating to banding work. The value and usefulness of this file can be greatly increased if authors will cooperate by sending in two or three copies of each of their papers as printed.

Migration.—What are the arriving and leaving times? How long will individuals of different species remain at the station? Is departure before or after a storm? What is the effect of weather on daily movements? Is the same route followed in successive seasons? Is the same route followed in spring and fall flights? Is travel continued daily or only when weather conditions are favorable? Do males, females, and young travel together, or if separately, which comes or goes first? Is there much return to the same nest or nesting locality? Is there much return to the same winter quarters? What proportion of adults and young return, regardless of seasons? Are the same stopovers made in succeeding seasons? Do some individuals of a species remain sedentary while others of the same species pass over them in migration? Do adults or young make any postnuptial migrations to the north before starting south?

Territory.—What is the range limit during breeding, winter, or other seasons? What are the territorial limits about nests? Do both birds defend the territory?

Dispersal.—What are the facts in connection with dispersal of young that do not return to area where they were hatched? (This

may have to do with extension of range locally or on a large scale.) What proportion of males and females return to the same nesting sites? When leaving the nest do the parents keep the young in the nesting locality or lead them into adjacent territory? How strong is the homing instinct of different species? (Test by experiment.)

Ecological preferences.—What are the reasons for preference of different types of environment, and can different species be attracted away from the preferred type? Is the preferred habitat valley, upland, mountain, marsh, shore, etc.? What appears to be the effect of changes in temperature, moisture, vegetative covering, etc.? What species are adaptable to changes in environment; that is, are plastic?

Family groups.—What is the length of time that the unity of the family is preserved? Are these groups the family parties from a neighborhood? If not, are they grouped by age or sex?

Permanent residents.—Are so-called "permanent residents" the same individuals or is there a movement of greater or lesser extent in such species?

Mating activities.—What are the facts relative to permanence of matings? Does polygamy, polyandry, or inbreeding take place? In case of death of one of a mated pair, will the other obtain a new mate? What is the number of broods per season? What part is taken by both sexes in nest building and care of the young? Is the first nest used for a second brood? What species breed their first year, i. e., when 1 year old? Are eggs laid at the rate of one a day; and if so, at about what hour? When is incubation begun, and do eggs hatch in the order in which they were laid? Do both sexes participate in incubation; and if so, what is the regular period of duty for each? During incubation (when by one bird only), how much time is taken and when for feeding, or is food supplied by the mate?

Plumage.—What is the sequence of plumage changes by fading, wear, and molt? How does the development of feather tracts, feather colors, and patterns from fledgling to adult take place? Are there detectable differences in sex in species where male and female are similarly colored and marked? Is there any variation in the color of the iris, bill, and feet among individuals of a single species? How does the plumage develop on young birds from the first down to the fully formed feather? Are there any differences in the development within one brood?

Weights and measurements.—What is the ratio of weight variability at different times of day, and what is the ratio of growth shown by young birds as revealed by regularly taken weights? (This should be correlated with studies of food brought to the young and its relationship to variations in temperature or other climatic changes. By careful measurement the rate of growth of the body as a whole and also of different parts thereof may be noted.)

Temperatures.—Is there any particular variation in temperature at different times of day; and if so, is it related to different types of foods, weather conditions, etc.? Do young of different species have a definite temperature control?

Parasites and diseases.—What is the effect of different kinds of external parasites? What is the nature of different diseases of birds,

and how do they affect the individual? (This may be of great importance, but because of its nature the assistance of a trained pathologist or biologist may be necessary.)

Longevity.—What is the normal length of life of different species as shown by yearly return records?

Personality.—Do individual birds have peculiarities in appearance, habits and manners? (Banded birds are individuals and should be studied as such. Some will be wild, others tame and gentle; some will always fight, others will scold or squeal; some will exhibit courage or daring, others will show fear; some will give characteristic notes or even sing under stress of excitement. All of these and many other items have a bearing upon bird psychology, and should be watched for and carefully investigated.)

APPENDICES

APPENDIX 1. LITERATURE

BIBLIOGRAPHY ON BANDING

A bibliography of bird banding in America for the period up to and including the year 1927 was published as a special supplement to the Auk for October, 1928. The Survey has a limited supply of these for distribution upon request. Copies also may be consulted in many libraries, or the number containing the article may be obtained by purchase from the treasurer of the American Ornithologists' Union, 200 Cedar Street, Cherrydale, Va.

HANDBOOKS FOR IDENTIFICATION

Every station operator should have at least one handbook for use in the identification of birds. The following works are authoritative and convenient, and are recommended for this purpose:

Bailey, F. M. Handbook of Birds of the Western United States. Houghton, Mifflin & Co., Boston, Mass.

Chapman, F. M. Handbook of Birds of Eastern North America. D. Appleton & Co., New York, N. Y.

Hoffmann, R. A Guide to the Birds of New England and Eastern New York. Houghton Mifflin & Co., Boston, Mass.

Wyman, L. E., and Burnell, E. F. Field Book of the Birds of the Southwestern United States. Houghton Mifflin & Co., Boston, Mass.

COLORED PICTURES

For those desiring colored pictures of birds, the following are inexpensive and convenient:

Henshaw, H. W. The Book of Birds. Common birds of town and country and American game birds. National Geographic Society, Washington, D. C.

Portfolio of plates from Eaton's Birds of New York, drawn by Louis Agassiz Fuertes. New York State Museum, Albany, N. Y.

Pearson, T. G. (Editor). Portraits and Habits of Our Birds, 2 v., illus. Text by various authors. Issued by the National Association of Audubon Societies, New York City.

Horsfall, R. Bruce. Bird and Animal Paintings. American Nature Association, 1214 Sixteenth Street NW., Washington, D. C.

Reed, C. A. Bird Guide. Part I. Water and Game Birds; Birds of Prey East of the Rockies. Part II, Land Birds East of the Rockies. Doubleday, Doran & Co., Garden City, N. Y.

Reed, C. K. Western Bird Guide; Birds of the Rockies and West to the Pacific. Doubleday, Doran & Co., Garden City, N. Y.

GENERAL WORKS

Station operators pursuing technical investigations should have available general works on birds. The following will be useful:

ALLEN, G. M. Birds and Their Attributes. Marshall Jones Co., Boston, Mass.
DWIGHT, J., Jr. The Sequence of Plumages and Moults of the Passerine Birds of New York. Ann. N. Y. Acad. Sci. 13: 73–360, illus. 1900.
HEILMANN, G. The Origin of Birds. D. Appleton & Co., New York, N. Y.
HENDERSON, J. The Practical Value of Birds. The Macmillan Co., New York, N. Y.
RIDGWAY, R. Color Standards and Color Nomenclature. Published by the Author, Washington, D. C.
THOMSON, A. L. Problems of Bird-Migration. Houghton, Mifflin & Co., Boston, Mass.
THOMSON, J. A. The Biology of Birds. The Macmillan Co., New York, N. Y.
WEED, C. M., and DEARBORN, N. Birds in Their Relation to Man. Ed. 3. J. B. Lippincott Co., Philadelphia, Pa.
WETMORE, A. The Migrations of Birds. Harvard University Press, Cambridge, Mass.

APPENDIX 2. ORNITHOLOGICAL ORGANIZATIONS

BANDING

With the approval and help of the Bureau of Biological Survey bird-banding cooperators have been organized into regional associations for the purpose of obtaining better coordination and contact both among themselves and with the Survey. Membership in a regional association is not in any way obligatory, but the active cooperator will find many benefits from membership in the organization covering his territory. The annual dues for active members are small, and in return the operator usually receives bulletins or news letters (made possible through the dues of members) that contain useful information, frequently of importance to his own work. As the officers of these associations are likely to change yearly they are not listed, but their names will be furnished by the Biological Survey upon request.

Northeastern Bird Banding Association.—Assigned the following States and Provinces: Connecticut, Rhode Island, Massachusetts, New Hampshire, Vermont, Maine, Quebec, New Brunswick, Nova Scotia, and Prince Edward Island. Publishes a quarterly bulletin with the cooperation of other regional associations.

Eastern Bird Banding Association.—Assigned the following States and Province: New York, New Jersey, Delaware, Pennsylvania, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, and Ontario.

Inland Bird Banding Association.—Assigned the following States and Provinces: Michigan, Ohio, Indiana, Kentucky, Tennessee, Alabama, Mississippi, Wisconsin, Illinois, Minnesota, Iowa, Missouri, Arkansas, Louisiana, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Texas, Mackenzie, Alberta, Saskatchewan, and Manitoba.

Western Bird Banding Association.—Assigned the following States, Provinces, and Territories: Montana, Wyoming, Colorado, New Mexico, Idaho, Utah, Arizona, Washington, Oregon, Nevada, California, British Columbia, Yukon, and Alaska. Issues a quarterly news letter, News from the Bird Banders.

GENERAL ORGANIZATIONS

Membership in any or all of the following organizations will give bird-banding cooperators contact with leading ornithologists of the country and a familiarity with all phases of ornithological science:

American Ornithologists' Union.—Publishes The Auk, quarterly.
Cooper Ornithological Club.—Publishes The Condor bimonthly.
Wilson Ornithological Club.—Publishes The Wilson Bulletin, quarterly.
National Association of Audubon Societies.—Publishes Bird-Lore, bimonthly.

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