McCann (Aerial Color Photos) all flocks	11.0% Yg.
Martinson (Aerial Color Photos) all flocks	9.1% Yg.
Kaczynski (Aerial Color Photos) all flocks	7.6% Yg.

It should be pointed out that close agreement between the visual and photo methods on an individual flock basis is very unlikely, since it would be impossible to photograph exactly the same birds the aerial observer records.

Another interesting item was comparison of the young-per-group (or average brood) as determined by the two methods. For this, all of Lynch's Chesapeake Bay observations were used and all of the January photos. The tabulation looks like this:

	Group (Yg.)	No. Yg.	Av. Yg. / Gp.
Lynch	264	555	2.1
Photos	88	190	2.1

These figures agree quite well with other data on swan broods for that year. In August 1964 we recorded 2.63/brood on Mansel Island, NWT. Jim King, 1965 season, reported an average brood of 2.55 at Clarence Rhode NWR, Alaska (Lynch, personal correspondence). Lynch and Jensen recorded an average brood of 1.9 at Bear River in December, 1964, and Merrill Hammond, Souris NWR, fall 1964, average brood 1.85 (Lynch, personal correspondence). Using these data it is possible to calculate mortality of cygnets from time of hatching to December-January. Using King's 2.55 average brood in Alaska and the Lynch-Jensen average of 1.9 in December we got a cygnet mortality of 25.49 percent. The Chamberlain-Kaczynski average brood of 2.63 on Mansel Island and the Lynch-Smith-Chamberlain average of 2.15 in January gives 18.25 percent cygnet mortality. It thus appears that the 1964-hatched cygnets from the eastern part of the breeding range had better survival than those from the western part of the range.

Photo flights for this study are scheduled on a monthly basis, December through March. By late March spring migration is well under way and too few swans are present to justify an April photo flight. For various reasons the study has gone as planned only one season, although we came close to completion during the winter of 1965-66.

We plan to continue the photo coverage of wintering swans, making sure that we get a good sample early in December. Our experience to date indicates that we need at least four, and preferably five or six, 36-exposure rolls of film for each series of photos.

Coverage to date has been largely confined to the north-central portion of the wintering range. We think this should be extended, and hope eventually to limit the photo coverage to one extensive effort, with photos of portions of all the wintering flocks included.

MOURNING DOVE AND MIGRATORY WATERFOWL BANDING COSTS

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INTRODUCTION

Banding is recognized as one of the most useful tools for determining population characteristics, evaluating hunting regulations, and ascertaining other information needed to properly manage mourning doves, waterfowl, and other migratory birds. Since banding must be conducted as an annual program and is time-consuming and ex-

pensive when carried on at recommended levels, it is important to reduce program costs to a minimum.

In an effort to better understand banding cost relationships and pinpoint some of the factors influencing costs, the Bureau of Sport Fisheries and Wildlife conducted a study in the southeastern States to determine approximate costs for banding doves and waterfowl. This study was confined to banding accomplished by Bureau personnel in the Divisions of Management and Enforcement and Wildlife Refuges.

PROCEDURES

Forms were developed (copy attached) for recording cost data from all banding stations in a uniform manner. Costs were computed for labor, vehicle operations, trap depreciation, bait, and miscellaneous expenses. Separate forms were submitted for doves and waterfowl and for different capture techniques. Waterfowl capture methods included funnel (bait) traps, cannon nets, roost (drive) trapping to a very limited extent, retriever dogs, and hand-catching of locally-reared young. Doves were captured only by funnel traps and cannon nets. All labor costs were computed on the basis of regular duty time. Actually, nearly 50 percent of the banding was outside regular duty house and, thus, was accomplished by "donated" time.

PRESENTATION OF DATA AND DISCUSSION

Survey data included in this report cover the period January 15, 1965 through May 1966. During this period, reported costs covered banding of 62,925 waterfowl and 10,192 doves.

Costs and pertinent comments are presented in the following tables:

TABLE I — BANDING COSTS BY METHODS USED

	WATERFOWL		DOVES	
METHOD USED	Cost Range per Bird	Avg. Cost	Cost Range per Bird	Avg. Cost
Funnel Traps	0.30- 39.60	1.26	0.19-26.20	1.43
Cannon Nets	0.30-120.89	1.51	1.21- 3.13	1.85
Dog Caught*	1.87 only	1.87	—	—
Night Drives*	1.95- 5.46	4.38	—	—

*Due to small samples, figures are not reliable. Night drives, in particular, should result in very low costs per bird banded when conditions are right and operations properly conducted.

Note that costs for dove banding are higher than for waterfowl. This was a surprise; however, we believe it was due, at least in part, to the majority of doves being banded by Refuge personnel whose interests and training in this activity are oriented towards waterfowl. Only recently have they become seriously involved in this effort.

Cannon net capture of doves is still largely experimental in the southeast, but bears promise of fruitful results where birds can be concentrated on bait.

In the "cost range" column, some of the figures appear to be—and are—abnormally high. These may be attributable but not necessarily restricted to such factors, or combinations thereof, as:

a. Small numbers of birds available
b. No previous history of banding at a particular station
c. Lack of adequate preparation; i.e., pre-baiting
d. Lack of experience in banding
e. Weather conditions
f. Lack of genuine interest in banding
g. Other pressing responsibilities

It was no surprise to find that bait (funnel) trapping costs were lower than cannon netting, since funnel traps are at work 24 hours per day, are much less expensive to build or purchase, and do not require long periods of surveillance. In addition, funnel traps are

more adaptable to different situations and require less site preparation. Cannon nets, however, are much more effective in the capture of geese; and though the study does not separate ducks and geese, by far the greatest number of geese was caught in cannon nets.

TABLE II — PERCENTAGE OF BANDING COSTS BY OPERATIONAL ACTIVITIES

Species and Methods	Labor	Vehicle Operation	Bait Cost	Trap Depreciation	Miscellaneous
Waterfowl					
Funnel trap	79	08	06	04	03
Cannon net	70	04	17	05	04
Doves					
Funnel trap	86	08	02	04	0
Cannon net	72	11	05	04	08

These figures show that labor is by far the item of greatest expense in banding operations of any kind, while costs for vehicle operation, traps, and bait are comparatively minor. Further, economy in the latter categories may result in higher labor costs and poorer results.

TABLE III — BANDING COSTS BY NUMERICAL CATEGORY, CY 1965

	WATERFOWL			DOVES		
Birds Banded (Numerical Category)	No. Stations	Total Waterfowl Banded	Average Cost	No. Stations	Total Doves Banded	Average Cost
01- 100	8	444	3.60	11	456	3.96
101- 300	10	1,881	2.55	7	1,515	2.47
301- 500	5	1,979	1.80	2	798	0.75
501-1,000	9	6,239	1.48	1	672	0.69
1,000 plus	9	19,274	0.88	2	3,283	0.89
Totals and Averages	41	29,817	1.21	23	6,724	1.42

As would be expected, reduction in cost-per-bird-banded is directly proportional to catch success. Banding of 56,221 waterfowl from January 15 through April 1966, and 10,429 doves from January 15 through August 31, 1966, resulted in similar findings, except that 1966 regional cost averages were lower than for 1965. Waterfowl costs dropped from $1.21 to $0.85 and doves from $1.42 to $1.04. It is believed this reduction is attributed to greater cost-awareness by field personnel, and espcially in the banding of doves, to proficiency as techniques are learned.

CONCLUSIONS

A number of valuable findings and interesting conclusions are derived from the study.

1. Since labor represents the greatest investment (70-86%), skimping on bait, traps, or to some extent vehicle operation, is poor economy. As many traps as possible should be operated. If needed, bait should be used generously.
2. Banding costs (per bird) are usually reduced in direct proportion to number captured.
3. Where large numbers of waterfowl were present, large walk-in traps (40′ x 50′ or larger) consistently caught numerous birds at very low cost per bird banded. This suggests that the larger the trap, the greater the catch and consequent cost reduction. This does not mean, however, that capturing waterfowl in small traps

is uneconomical in all situations. Small traps are adaptable to special situations and often are the only suitable means of capture. Certainly, large walk-in traps are not justified where small or scattered populations of birds are present.

4. Examination of detailed data (not included herein) revealed nothing of significance in regard to pre- and post-season banding costs. Some stations banded more economically in pre-season efforts, while others were more successful during post-season periods. In-season banding at some stations resulted in the most economical operation. We hasten to add that in-season banding is discouraged except in special cases, as the information obtainable is of less value and because of potential conflicts with current baiting regulations.
5. Detailed data indicate that seasonal differences in habitat may have a significant influence at any given banding station. Good success one year should not be used as a measure for future programs at that location.
6. Trapping and banding success is directly proportional to the interest and enthusiasm of the bander—all other factors being equal.
7. Cost of banding can be reduced by employing the cheapest labor available; however, as costs are reduced in this manner, quality of information obtained probably will go down. Accuracy in identification, sexing, aging, and in record-keeping requires technical experience and training unavailable at cheap wage rates. Thus, objectives of a banding program may be sacrificed by overemphasizing economic considerations.

BANDING COST RECORD

Month of _____, 196__

1. Number and type of traps used: _____ bait, _____ cannon nets, mist nets, _____ night drives, _____ other (describe) _____

* * * * *

2. Number and species of waterfowl captured _____ _____, _____ _____, _____ _____. Doves _____.
3. Total man/hours spent on banding ___hours @___ $_____
4. Vehicle miles driven on banding ___miles @___¢ $_____
5. Bait used ___lbs., bu. @___ $_____
6. Misc. other costs _____ $_____
7. Depreciation on traps used (see instructions) $_____
8. Total man/hours contributed by State, private or other cooperators _____ hours.

Total cost this month $_____

* * * * *

Remarks: _____

_____

_____

_____
Bander Permit No.

(See over for instructions)

INSTRUCTIONS FOR PREPARATION

A report, in single copy, for each method of trapping is to be prepared for each month of activity and mailed to the regional office, along with copies of banding schedules showing the birds banded. When no birds are captured (as in the case of prebaiting, trap construction activity or unsuccessful efforts) cost record should be forwarded at the end of the month without copies of banding schedules.

When two or more trapping methods are used simultaneously costs should be recorded as accurately as possible for each.

Several species of waterfowl captured by any one method during the month may be shown on one report. Doves should always be shown on one report. Doves should always be shown on a separate report even though they may have been banded as part of a combined trapping effort.

Labor costs are to be calculated on the basis of hourly rates applicable to the personnel doing the trapping and banding. Be sure that labor charges accurately reflect the actual time spent on banding. Do *not* lump the entire day's time as banding simply because that was the activity calling for the major effort of that time period.

Vehicle operation costs per mile may be obtained from operation reports in your files.

Trap and cannon net costs are to be figured on a depreciation basis using costs of materials and labor to build. For example, a dove trap costing $5.00 ($1.50 for materials and $3.50 for labor to construct) will operate an estimated five years. Thus, the yearly depreciation is $1.00 and, if operated 2 months each year the monthly depreciation is 50¢. Since conditions and equipment vary, you are to use your own judgment in this matter.

Refuges, in figuring costs on bait produced on the refuge, may show estimated production costs; or if obtained as part of a share cropper rental payment, the costs of harvesting (if by refuge personnel) and moving to the trapping area are to be considered.

A SURVEY OF PRIVATE AND COMMERCIAL SHOOTING PRESERVES IN TENNESSEE

By CHESTER A. MCCONNELL, *Research Biologist*
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INTRODUCTION

Future recreational needs will be tremendous and administrators in the recreation field, including game and fish commissions, are planning for these needs. Experts predict a United States population of 230 million persons by 1975 and 350 million by the year two thousand. Seventy-three percent of the people are expected to live in metropolitan areas. The population of Tennessee is expected to increase from 3.5 million in 1960 to about 4.3 million in 1975 (Anonymous, 1961). Based on recent trends, these people will be making more money and have more leisure time.

Planning for future hunting needs will require consideration of questions like the following. How much wildlife habitat will be diverted to intensively managed agricultural areas to produce food for our increasing population? How can we use the available land to provide more quality hunting and fishing? How much can commercial and private shooting preserves reduce hunting pressure on game species produced by nature?

The search has begun for answers to these and other questions. One step taken by the Tennessee Game and Fish Commission was a