populations in south Florida. Fla. Game and Fresh Water Fish Comm. Tech. Bull. No. 4. 64 pp.

Petrides, G. A. and R. B. Nestler. 1943. Age determination in juvenal bobwhite quail. Amer. Midl. Nat. 30(3): 774-782.

Pierce, R. A. 1951. Mississippi bobwhite study program on Henneberry Place. Miss. Game and Fish. 2 mimeo. p. (original not seen; cited in Kabat and Thompson).

Reeves, M. C. 1954. Bobwhite quail investigation. Ind. Dept. Consv. Div. Fish and Game, Final Report Pittman-Robertson Proj. W-2-R. 149 pp.

Rosene, W., Jr. 1957. A summer whistling cock count of bobwhite quail as an index to wintering populations. Jour. Wildl. Mgmt. 21(2): 153-158.

Shick, C. 1952. A study of pheasants on the 9,000-acre Prairie Farm, Saginaw County, Michigan. Mich. Dept. Consv. 134 pp.

Speake, D. W. and A. O. Haugen. 1960. Quail reproduction and weather in Alabama. Proc. 14th S. E. Assoc. Game and Fish Comm. 85-97.

Stoddard, H. L. 1931. The bobwhite quail, its habits, preservation and increase. Chas. Scribner's Sons, New York. 559 pp.

Stokes, A. W. 1954. Population studies of the ring-necked pheasant on Pelee Island, Ontario. Ont. Dept. Lands and Forests Tech. Bull. No. 4. 154 pp.

PROGRESS REPORT: PRODUCTIVITY STUDY OF WHISTLING SWANS WINTERING IN CHESAPEAKE BAY

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ABSTRACT

During the past four winters an effort has been made to devise a satisfactory method of estimating the percent of young among the whistling swan population wintering in the Chesapeake Bay. Work to date indicates that this can be done by use of well distributed 35-mm. aerial color slides. Combining photography with direct visual appraisal was tried in the winter of 1965. The tentative conclusion from this was that use of aerial photos for large, densely packed flocks and visual appraisal for widely dispersed flocks would give accurate results at somewhat less expense than using the photographic method exclusively. In addition to percent young, average brood and family size can also be determined by these methods. It was also noted that the percent of "gray" birds observed decreases steadily throughout the winter. Data from the 1964 breeding season indicate that cygnets from the western areas have a higher mortality rate than those from eastern areas.

INTRODUCTION

This paper is a progress report on a continuing study. It is hoped that this study can be completed during the winter of 1966-67. At that time a final report will be made. Until then any statements or conclusions are to be considered tentative and subject to revision.

Prior to 1962 the percent of young in the whistling swan population of the Chesapeake Bay area had been estimated by use of two aerial observers, one estimating total birds in flocks and the other estimating number of young in each flock. This method was not considered entirely satisfactory. Although the gray-headed young birds were readily observed from the air, recording the number present in large flocks became a tiring and time consuming process with accuracy varying among observers. With the same observer there was a tendency for accuracy to decline on long flights.

During the winter of 1962-63 this problem was discussed in considerable detail by personnel of the Migratory Bird Populations Station. These discussions resulted in the decision to attack the problem by using two methods:

1. By ground observations using binoculars and spotting scopes.

2. Aerial photography, using several different cameras and lenses, with both black-and-white and color film.

Discussion of Methods and Results:

During the winters of 1962-63 and 1963-64 several field trips were made by Station personnel and a considerable amount of data was accumulated from ground observations. These data nearly always resulted in a higher percent of young than was obtained from aerial surveys. This immediately cast suspicion on the accuracy of both the visual and photographic aspects of the aerial work. Study of the air and ground data for 1962-63 and 1963-64 showed why there was a discrepancy between the two methods.

It was found that the flocks available to ground observers were smaller and contained a higher number of family groups than most of the flocks observed from the air. Many of the larger flocks, containing relatively fewer young birds, were inaccessible to ground observers, either because of distance from shore or lack of suitable approach cover. These factors did not influence aerial observations. This characteristic was so well documented during the winters of 1962-63 and 1963-64 that no further attempts were made to determine productivity from ground observations. It should be noted that this characteristic may apply only to swans wintering in the Chesapeake Bay area. We have no direct knowledge of the flocking habits of swans wintering in other areas.

The following tabulation shows the information obtained during the past two winters.

Percent Young, Wintering Swans Chesapeake Bay

	December	January	February	March
1964-65	10.36	13.9	12.19	9.46
1965-66	10.64	12.1* (No Photos)	9.72	8.22

* J. Lynch, Air Visual Estimate

It was originally assumed that by mid-December all of the wintering swans had arrived. However, as shown in the tabulation above, in two consecutive winters, more young birds were present in January than in December. This sent us back to the files for a check on total numbers which resulted in the following tabulation.

December/January Whistling Swan Population, Chesapeake Bay

Month and Year	Number observed (to nearest 100)	December observations in percent of January observations	Three year average December: January
December 62	24,900	57%	Total Dec. 93,200
January 63	43,400		Total Jan. 126,100
December 63	32,800	88%	
January 64	37,300		93,200
December 64	35,500	78%	——— = 74%
January 65	45,400		126,100

This tabulation shows that, in the three winters for which we have December counts, we had substantially fewer swans in December than in January. Since there are fewer swans, both in total and in percent of young, present in December than in January it appears that a fairly substantial proportion (about 25 percent on the average) of the total wintering swans arrive about a month later than the main flock. These late arrivals increase the percent of young in the total count, indicating that this segment of the population is composed largely of family groups, probably late-hatched broods. This, plus the likelihood that most of the non-breeders are among the earlier arrivals, would account for the increase in percent of young in January.

Aerial estimates have been confined to total numbers, with one exception, which will be discussed later. Aerial photography was started at the same time as ground observations. Several different cameras were used, with a variety of lenses and films. The first series of photos showed that the 35-mm. camera would probably be the best for this work, that black-and-white film would not do the job, and that a powerful telephoto lens was not satisfactory, since the increased magnification resulted in too few birds per slide and too many slides unusable because of camera motion. A single-len reflex 35-mm. camera with a 105-mm. telephoto lens using either Kodachrome-X or high speed Ektachrome film has given the best results. (There is a possibility that a 135-mm. lens would be better. We have not had one available for trial.)

Optimum flight altitude has been found to be 200-250 feet, with air speed as slow as is consistent with safety. This, of course, will vary with the type of aircraft used. Most of our work has been done with a Grumman Goose, which is a little too fast for best results. Better results were obtained using a Beaver. With about ¼ flaps and reduced power it is possible to cruise over flocks of swans at 70-75 knots indicated air speed. This yields slides of somewhat better quality and makes it possible to get about 1/3 more slides per flock.

One aspect of this work has turned out to be slightly unusual. Because of the work load of Station personnel there has seldom been anyone available to use the camera when photo missions were scheduled. Therefore, this has been, in the main, a one-man operation, with the pilot doubling as photographer and has proven to be completely satisfactory.

It was noted earlier that air-visual observations have been generally confined to estimates of total numbers. The one exception to this was in January 1965 when a combined photo-visual effort was tried. Mort Smith piloted N709, a Cessna 180, with John Lynch doing the visual observations and tape-recording them as young, families and non-productive adult-plumaged birds, while Chamberlain photographed birds out of a number of flocks designated as "photo-flocks." For these "photo-flocks" Lynch maintained separate recordings for later comparison of direct visual versus photo observations. There were nine photo-flocks in all, but the photos from No. 7 were poor and were not used. The figures from the eight remaining sets of photos showed several interesting things.

For some time it had been suspected that group analysis of the photos was giving different data than would result from each observer arriving at a figure independently. The first reading of the slides from the "photo-flocks" was by three observers who discussed each slide and arrived at agreed figures for both total swans and number of young per slide. Some time later a second session was set up using the same observers and slides, but this time having no discussion. Each man recorded his count independently. Results of the second session were an increase in percent of young in five flocks, no change in one flock and a decrease in two flocks. This raised the percent young for all flocks from 9.4 to 10.2. Adding two more observers again raised the percent of young to 10.7 There was no agreement between Lynch and any of the photo observers on a "photo-flock" basis, but overall the figures look quite good:

Lynch (Direct-visual, air) all flocks	12.0% Yg.
Chamberlain (Aerial Color Photos) all flocks	12.1% Yg.
Smith (Aerial Color Photos) all flocks	11.7% Yg.

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-