CALCULATING WATERFOWL ABUNDANCE ON THE BASIS OF BANDING RETURNS

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THE conservation and proper utilization of migratory waterfowl demand the fullest knowledge of their distribution, their habits, and their relative year-by-year abundance as influenced by many adverse factors. Their importance as a natural resource of recreational value is well illustrated by the fact that, with the possible exception of rabbits, there is no class of game that calls more citizens into the field every year for healthful sport and recreation. Moreover, the food value alone of the ducks and geese taken each year in the United States has been estimated to be at least $5,000,000, while probably a still greater sum is spent by the devotees of wildfowling in transportation, equipment, club fees, and other items. Few would deny the place of these birds as game, and everyone is vitally interested in knowing the effect of the annual toll taken by sportsmen through modern methods of hunting. In other words, it is a major problem to determine whether the annual kill represents the surplus, after deducting the losses from disease, natural enemies, and other causes, or whether hunters are also cutting into the breeding stock necessary for the perpetuation of these valuable and interesting species.

The many factors involved make the solution of the problem extremely difficult. For example, the disappearance of vast areas of marshland through drainage (frequently unproductive economically) is undoubtedly responsible for local concentrations that to the casual observer might well be considered to indicate an actual increase in the waterfowl population. Also the destruction of great numbers of ducks by alkali poisoning and possibly by other little-known diseases may decimate the birds of certain regions, so that, while their numerical strength is visibly decreased in those areas, the loss may be entirely local and of only minor significance in considering the entire waterfowl population of the continent. It will be apparent, therefore, that the mere opinion of any single observer or group of observers can be accorded little weight unless all pertinent factors are taken into account.

The important factors can probably be determined with reasonable accuracy, sufficient at least for practical purposes, and it is the intent of this article to suggest what seems to be a reliable method of calculating the annual fluctuations in the abundance of waterfowl. The basis of the suggested calculation is the relation that

appears to exist between the number of ducks banded and the number of these killed during the first succeeding hunting season. The figures used to demonstrate the method are as of January 31, 1927. The banding files of the Bureau of Biological Survey contain much additional information obtained during the shooting seasons of 1928 and 1929, but these data have not yet been analyzed. This preliminary statement, therefore, merely sets forth the proposed method, and the details are subject to change after further and more comprehensive studies have been made.

Briefly stated, the solution of the problem as here advanced is to be found in the following postulate:

Given a fairly accurate statement showing the number of wild ducks killed in North America in any one season, then the total number of ducks present on the continent for that season may be estimated by a percentage computation, based upon the relation that the total number of banded ducks killed during their first season as band carriers bears to the total number banded.
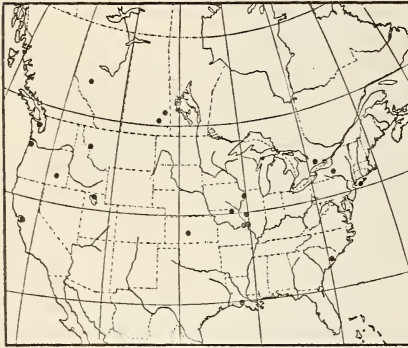
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FIGURE 1.—The distribution of stations where waterfowl have been banded in numbers sufficient to produce the percentages of returns used in this report

The banding of migratory wild fowl has been carried on at stations so well distributed over the entire country (fig. 1) that the results may well be considered as presenting a cross-section of the conditions affecting the whole country. These stations extend north to Alaska, south to Louisiana, east to New York and South Carolina, and west to British Columbia, Washington, Oregon, and California. For the purpose of computation, however, it is necessary that the banding be done on a scale large enough to yield data that may be considered as average. For this reason all groups of banded ducks from stations where less than 100 were banded have been excluded. Five hundred would be a better minimum, and effort is now being made to set a goal of not less than 1,000 for the season's work at each major station.

In calculating percentages it is to be noted that the data used include only those returns obtained during the first season after banding. Table 1 shows the total number of ducks banded in each of the seven years from 1920 to 1926, inclusive, the first-season returns from each lot, and the percentage. The small variation in the yearly percentages is impressive, but it is probable that this near uniformity will be even more significant when opportunity is afforded for increased bandings and further study. For example, it will be obvious that extensive banding operations conducted during the shooting season at a station located in a region of intensive hunting will result in a heavier percentage of first-season returns than would banding operations in the same area conducted after the close of the shooting season. This is illustrated in the case of the year 1922, when the grand total of banded birds was increased by 1,000 banded by the writer during the period October-December, at the Sanganois Club, near Browning, Ill., in the heart of one of the

country's most important shooting areas. The first-season returns from these birds amounted to more than 24 per cent, raising the percentage for the entire country to 15.16 per cent. For this reason further study of such data may result in a slight variation from the average here indicated.

TABLE 1.—*Percentages of returns throughout the country of banded ducks and geese during the shooting season immediately following their banding, 1920–1926*

Year	Banded	Returns	Percentage	Year	Banded	Returns	Percentage
1920	238	31	13.03	1925	1,795	214	11.92
1921	382	52	13.61	1926	4,891	444	9.08
1922	3,774	572	15.16				
1923	4,103	438	10.68	Total or average	17,449	2,083	11.94
1924	2,266	332	14.65				

This matter is further exemplified by a study of the returns from ducks banded in some other shooting centers where wild fowl are much concentrated. This is illustrated in Table 2.

TABLE 2.—*Percentages of returns of ducks during the open season immediately following their banding at 10 shooting centers, 1920–1926*

Station	1920			1921			1922			1923		
	Banded	Returns	Per cent	Banded	Returns	Per cent	Banded	Returns	Per cent	Banded	Returns	Per cent
Cayuga Lake, N. Y.							50	2	4.0	154	19	12.34
Lake Scugog, Ontario	238	31	13.03	382	52	13.61	1,002	139	13.87	1,075	150	13.95
Browning, Ill.							1,338	324	24.22			
Cuivre Island, Mo.							260	38	14.62	1,456	173	11.88
Portage des Sioux, Mo.										618	64	10.36
Oakville, Iowa										94	12	12.77
Total or average	238	31	13.03	382	52	13.61	2,650	503	18.98	3,397	418	12.30

Station	1924			1925			1926			Totals, 1920–1926		Average percentage
	Banded	Returns	Per cent	Banded	Returns	Per cent	Banded	Returns	Per cent	Banded	Returns	
Cayuga Lake, N. Y.	60	2	3.33	26	5	19.23	59	4	6.78	349	32	9.17
Lake Scugog, Ontario	896	127	14.17	572	84	14.68	882	82	9.30	5,047	665	13.18
Browning, Ill.										1,338	324	24.22
Cuivre Island, Mo.	529	91	17.20	114	6	5.26				2,359	308	13.06
Portage des Sioux, Mo.	265	36	13.58	138	24	17.39	105	9	8.57	1,126	133	11.81
Scobey Lake, Mo.	13	2	15.38	110	15	13.64	86	11	12.79	209	28	13.40
Oakville, Iowa										94	12	12.77
Bear River marshes, Utah							969	83	8.57	969	83	8.57
Moiese, Mont.							385	63	16.36	385	63	16.36
Oakland, Calif.							243	27	11.11	243	27	11.11
Total or average	1,763	258	14.63	960	134	13.96	2,729	279	10.22	12,119	1,675	13.82

The case of the birds banded at Browning, Ill., has previously been mentioned. The situation in the vicinity of the National Bison Range, maintained by the Biological Survey at Moiese, Mont., is apparently quite similar. As at Browning, Ill., the banding work was done during the shooting season rather than before or after its close, with an increased percentage of first-season return records.

Also, in most seasons, there has been a high percentage of return records resulting from the banding work at Lake Scugog, Ontario, although there the banding was done both before and during the shooting season, and it is reasonable to believe that many of those banded early had scattered or even left the vicinity before shooting began. To demonstrate, however, the full import of these data, the figures for Browning, Ill., and Moiese, Mont., may be omitted from the total shown in Table 2, and the general average then made from the work of the remaining eight stations. The resulting percentage, 12.39, is most significant when compared with the country-wide average of Table 1, that is, 11.94 per cent, or a difference of less than 0.5 per cent.

In order to test the theory here set forth, it would be necessary to obtain the whole-hearted cooperation of clubs and individual sportsmen in reporting their annual bags. It is realized that such figures never would be complete, as large numbers of birds would be killed and not reported for one reason or another, but, as a compensating factor, many banded ducks are doubtless killed that are not recovered or for various reasons are not reported. If these two missing factors may be considered to balance each other, the figures obtained would be sufficiently accurate, for practical purposes, to determine the approximate annual fluctuation in the numerical strength of North American waterfowl due to shooting.

To assume a case: If in one season 5,000 ducks were banded and yielded 600 first-season returns, or 12 per cent, and if during that same season the total number of ducks killed and reported by sportsmen was about 5,000,000, then this number would be equivalent to approximately 12 per cent of the waterfowl population for that year, which would be about 42,000,000. To assume further: If during the following season, another 5,000 ducks are banded, which also yielded about 600 first-season return records, while the total kill is 500,000 birds less, then the total duck population for that year would be about 37,500,000, or an indicated decrease of 4,500,000 in the continental waterfowl population.

Such figures could be considered only as approximations, but they would at least have the merit of being based on factors that appear to have a definite relationship. And with the continuance of the banding work and the resulting increase in comparable data, it should be possible ultimately to arrive at an average percentage to serve as a standard, in which the margin of error would be reduced to a negligible quantity.

American sportsmen who are vitally interested in the perpetuation of an abundant stock of wild fowl and in the American sport of free shooting should be willing to do all in their power to see that all banded birds are reported to the Bureau of Biological Survey and to furnish reports concerning their seasonal bags, and other information, when requested to do so. With their active cooperation and interest in all phases of the waterfowl problem, a solution can ultimately be reached that should guarantee both effective conservation and satisfactory sport.