Range expansion and population increase of the Gadwall in eastern North America

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In this era when papers discussing extinction rates and endangered species seem to be the norm, it is somewhat refreshing to report on a species that has extended its range and increased in numbers. Such is the case with the Gadwall *Anas strepera* in the northeastern United States. This paper documents and discusses the range expansion of the Gadwall breeding population in the northern portion of the Atlantic Flyway (whose boundary is shown in Figure 1) and the resultant increase of Gadwall harvested by hunters.

Figure 1. Gadwall breeding sites in eastern North America. 1, Walpole Island; 2, Magee Marsh WMA; Luther Marsh WMA; 4, Presqu'ile Point; 5, Iroquios NWR; 6, Montezuma NWA; 7, Howlands Island, WMA; 8, Wilson Hill WMA; 9, Parker River NWR; 10, Great Meadows NWR; 11, Long Island; 12, Great Swamp NWR; 13, Brigantine NWR; 14, Bombay Hook NWR; 15, Egg Island WMA; 16, Little Creek WMA; 17, Blackwater NWR; 18, Prime Hook NWR; 19, Deal Island WMA; 20, Chincoteague NWR; 21, Martin NWR; 22, Wallop's Island NASA; 23, Fisherman's Island NWR; 24, Plum Tree Island NWR; 25, Back Bay NWR; 26, Bodie Island NS; 27, Pea Island NWR; 28, Swanquarter NWR; 29, Pamlico Point WMA; 30, Cape Romain NWR. ●—●, Flyway boundary.

Fifty years ago the Gadwall, as a breeding bird in North America, was restricted to the west and midwest. Phillips (1923) stated that the species did not nest east of Lake Michigan, although Bent (1923) added that it had formerly nested in Ohio and was a casual breeder on Anticosti Island, Gulf of St. Lawrence. However, Godfrey (1966) questions the validity of the latter record, which was based on a half-grown young.

Range expansion eastward was first recorded in 1939 (Grey, 1940), when a brood was seen at Pea Island National Wildlife Refuge (NWR) in North Carolina (see Figure 1 for locations). A brood was also seen in 1939 at Bombay Hook NWR in Delaware (Griffith, 1946). Sedwitz, Alperin & Jacobson (1948) reported the species first nesting on Long Island in 1947, and Springer & Stewart (1950) reported seven pairs nesting in Maryland in 1948. Bull (1962) indicated that sixty to eighty young had been produced on Long Island in 1947, 118 in 1950, and ninety-three in 1952. According to Parnell & Quay (1962) nesting had begun on Bodie Island (National Seashore), North Carolina, after 1954, and production at Pea Island National Wildlife Refuge had increased to an average of about 540 per year between 1950 and 1958. They also reported sixty-three pairs of Gadwall at Egg Island Wildlife Management Area (WMA), New Jersey, in 1959. By the 1960s the species was reported nesting at several other locations along the Atlantic coast, including Bull's Island (Cape Romain NWR), South Carolina (Chamberlain, 1960), and Pamlico Point WMA, North Carolina (Lewis, 1970).

Materials and methods

A high percentage of the Gadwall nesting records was from National Wildlife Refuges established in the Atlantic Flyway during the 1930s and 1940s or from more recent state-owned Wildlife Management Areas. Although Griffith (1946) discussed data from refuge narrative reports through the mid-1940s, information from refuges and WMAs

Table 1. Nesting Gadwall on National Wildlife Refuges in the Atlantic Flyway*

Year	Bombay Hook	Pea Island†	Montezuma	Blackwater	Chincoteague	Brigantine	Prime Hook	Great Meadows	Parker River	Great Swamp	Iroquois	Total
1972	300	217	300	10	89	190	55	2	32	10	14	1219
1971	300	363	500	0	283	270	50	0	24	5	6	2803
1970	200	293	280	0	400	600	25	2	20	6	0	1826
1969	200	137	510	0	400	400	25	4	10	0	0	1686
1968	100	97	520	0	100	50	20	4	4	0	0	895
1967	100	50	205	0	50	120	5	4	0	0	0	534
1966	50	53	185	5	50	150	12	0	0	0	0	505
1965	150	47	350	0	25	70	8	2	0	0	0	652
1964	50	83	300§	0	50	75	12	0	0	0	0	570
1963	25	97	250	0	15	2		0	0	0	0	389
1962	75	90	110	0	28	12		0	0	0	0	315
1961	70	170	130	0	30	6		0	0	0	0	406
1960	40	220	75	0	10	0		0	0		0	345
1959	10	170	60	0	20	0		0	0		0	260
1958	8	243	50	0	25	0		0	0		0	326
1957	15	180	150	0	12	0		0	0			357
1956	15	127	80	0	10	0		0	0			232
1955	10	310	20	4	2	0		0	0			346
1954	70	237	10	0	0	0		0	0			317
1953	130	293	12	0	4	0		0	0			439
1952	–‡	317	10	0	0	0		0	0			318**
1951	70	257	6	0	0	0		0	0			333
1950	–	203	10	0	0	0		0	0			213**
1949	–	147	0	0	0	0		0	0			147**
1948	–	30	0	0	0	0		0	0			30**
1947	–	100	0	0	0	0		0	0			100**
1946	–	70§	0	0	0	0		0	0			70**
1945	–	40	0	0	0	0		0	0			40**
1944	–	27	0	0	0	0			0			27**
1943	–	27	0	0	0	0			0			27**
1942	–	8	0	0		0			0			8**
1941	18	15	0	0		0						33
1940	2	23	0	0		0						25
1939	2	3	0	0								5
1938	0	0		0								0
1937	0			0								0
Year Established	1937	1938	1938	1931	1943	1939	1963	1944	1941	1960	1957	

*Data for earlier years at Back Bay NWR were not available; however, at least 8 pairs have nested on the refuge since 1969. Five pairs have nested at both Martin NWR, and Swanquarter NWR since 1969, and at least 1 pair at Cape Romain NWR in 1960.

†Index to breeding population was obtained by assuming that all broods were counted and that 60% of the breeding pairs produced broods.

‡(–) no data.

§Data not available (assumed average of 2 nearest years).

**May have been Gadwall nesting at Bombay Hook, but no counts were made.

has not been intensively reviewed during the last 25 years. We therefore examined refuge narrative reports and contacted state waterfowl biologists. The US Bureau of Sport Fisheries and Wildlife's Harvest Survey data for the Atlantic Flyway enabled us to obtain an estimate of the number of Gadwall harvested each year. Banding records from Manitoba and Minnesota allowed some insight into the contribution of birds produced in the Canadian prairies and the north central States to the harvest taken in the northern portion of the Atlantic Flyway.

Eastward range expansion

Gadwall have nested on fifteen National Wildlife Refuges in the Atlantic Flyway in recent years (Table 1), with the majority on five refuges: Montezuma NWR, New York; Bombay Hook NWR, Delaware; Pea Island NWR, North Carolina; Chincoteague NWR, Virginia; and Brigantine NWR, New Jersey.

The recent observance of large summer flocks of Gadwall at Bombay Hook NWR is indicative of further population growth. Peak August populations on a freshwater impoundment there have been 800, 700, and 1,200 in 1970, 1971 and 1972 respectively. These figures suggest that a considerable number of birds may also be nesting in the vicinity of refuges.

Range expansion and population growth in southern Virginia and northern North Carolina has also been apparent (*in litt.* O. Florschutz, Jr.). Since 1969 Florschutz has recorded a total of eight pairs at Back Bay NWR, five pairs at Martin NWR, and five pairs at Swanquarter NWR. During the last 2 years he also surveyed Wallops Island, Fisherman's Island, and Plum Tree Island, the latter two being satellites of Back Bay NWR. He recorded eight pairs, six pairs, and two pairs, respectively, on these areas.

Information obtained from state waterfowl biologists in Maryland, Delaware, New Jersey, and New York suggests that the breeding population on state wildlife areas is also increasing and expanding in range. At the Little Creek Wildlife Area in Delaware an estimated 173 young were produced in 1962, 272 in 1969, 307 in 1970, 648 in 1971 and 310 in 1972 (*in litt.* T. W. Whittendale, Jr.). V. D. Stotts (*in litt.*) indicated that aerial surveys of Maryland Wildlife Management Areas in late April during the period 1967–1972 gave estimated number of pairs for the respective years: twenty, thirty, forty-six, fifty-eight, forty-two and 132. The trend of singles and group birds recorded showed a similar pattern of increase. The majority of breeders in Maryland were reported from Deal Island WMA (an impounded area), although pairs were seen at Fishing Bay, Fairmont, Ellis Bay, Cedar Island, and Taylors Island Wildlife Management Areas. The Long Island breeding population spread to eight breeding locations by 1968 from Jamaica Bay to Gardiner's Island, about 130 miles ENE (*in litt.* S. Browne). In upstate New York, aside from the federal refuges, Browne indicated that an occasional brood was reported from Howlands Island WMA since the late 1960s and one from Wilson Hill WMA in 1970. Ferrigno (*in litt.*) established indexes for the major types of marshes in New Jersey and projected a total estimate of 3,000 Gadwall pairs. He indicated that 'the mixed *Spartina patens–Spartina alterniflora* marshes of Delaware Bay have always been ideal nesting areas for Gadwall. Gadwall are practically absent from the Atlantic coastal marshes except where impoundments were constructed: the Barnegat Bay Area and Hackensack Meadows.' Locations of all known Gadwall breeding records in the northeast are shown in Figure 1.

Boyer & Devitt (1961) reported Gadwall nesting on an impounded area in southern Ontario (Luther Marsh), and Bednarik (in Campbell, 1968), on another impounded area in Ohio (Magee Marsh). Godfrey (1966) states that the species also breeds very locally at Walpole Island in Lake St. Clair, Ontario. In 1971 and again in 1972, a Gadwall hen and brood of ducklings was seen by Charles Barwell (Ontario Ministry of Natural Resources) and Henny at Presqu'ile Point, Ontario. Further recent evidence of movement into eastern Canada is provided by band recoveries there of Gadwall produced in New York, New Jersey, Delaware, Maryland, and Massachusetts. These have been in southern Ontario (nine) and Quebec (six).

Transplant experiments

Borden & Hochbaum (1966) reported the first successful transplant experiment in the northern portion of the Atlantic Flyway. In late August and early September 1957, twenty-four Gadwall, hatched and captive-reared at Delta, Manitoba, were released at Great Meadows Ponds adjacent to the National Wildlife Refuge of that name in Massachusetts. A first brood was seen in 1961 and another in 1962, but no nests or broods in 1963. One nest, destroyed by a predator, was found in 1964. Another fifty-two Gadwall were released into the area in

April 1965. Twenty-one pairs were recorded in the area in 1965, as far as 5 miles from the release site.

No sightings of Gadwall at Great Swamp NWR, New Jersey, were reported prior to 1969. Fifty-five ducklings transplanted there in 1969 from Brigantine NWR, also in New Jersey, attained Class III size (see Gollop & Marshall, 1954). One hundred reached the same size from a transplant experiment in 1970. Breeding birds were seen on the refuge in 1970, 1971, and 1972, but no production was noted. Young produced in 1971 and 1972 on Iroquois NWR, in upstate New York, were the result of class II and class III ducklings captured at nearby Montezuma NWR and released at Iroquois, twelve in 1969, nine in 1970, and sixty-two in 1971. Table 1 indicates that these transplants have not yet led to an upsurge in local populations.

Harvest in northern portion of Atlantic Flyway

Gadwall were taken in all twelve states in the northern portion of the Atlantic Flyway (above Virginia) during the hunting seasons of 1961 through 1970. Most of the harvest occurred in Maryland (42%), New York (22%), New Jersey (14%), Pennsylvania (10%), and Delaware (8%). The remaining 4% was taken in the following states in descending order: Connecticut, West Virginia, Maine, Rhode Island, Massachusetts, Vermont, and New Hampshire.

Table 2. A comparison of the Gadwall breeding population on National Wildlife Refuges (from Table 1) with the numbers harvested in the northern portion of Atlantic Flyway. Data for 2-year periods are pooled together

Years	Breeding population	Harvest
1971–72	4,022	–*
1969–70	3,512	13,902
1967–68	1,429	10,817
1965–66	1,157	10,753
1963–64	959	4,087
1961–62	721	1,248
1959–60	605	–
1957–58	683	–
1955–56	578	–
1953–54	756	–
1951–52	651†	–
1949–50	360†	–
1947–48	130†	–
1945–46	110†	–
1943–44	54†	–
1941–42	41†	–
1939–40	30	–
1937–38	0	–

*(–) Not available.

†May have been nesting at Bombay Hook NWR, but no counts made.

The Gadwall harvest for 2-year periods is shown in Table 2 and compared with the size of the breeding populations on National Wildlife Refuges. It is readily apparent that the increase in harvest parallels the increase in the breeding population. However, the estimated harvest is much larger than the breeding population on the refuges could sustain. Therefore, a portion of the birds must be derived from other breeding sites. State Wildlife Management Areas within the flyway undoubtedly produce many birds, as do areas which are unsurveyed. Another source seems to be eastern Canada and adjacent states.

Our conclusion, that the breeding population of Gadwall in the Atlantic Flyway is larger than our observations can indicate, is borne out by the fact that birds banded in the eastern extreme of main breeding range are very seldom recovered in the portion of the Atlantic Flyway under study (Figure 2). Gadwall banded in Minnesota have yielded 135 recoveries, but only one in Maryland and one in New Jersey. Similarly, of 292 recoveries from Gadwall banded in Manitoba, only three were found in Maryland, one in New Jersey, one in New York, and one in Pennsylvania.

Discussion and conclusions

Phillips (1923) indicated that the Gadwall was extremely rare on the Atlantic coast from Chesapeake Bay north through New Jersey and all of New England. Furthermore, Stone's (1937) intensive observations yielded only five Gadwall in New Jersey during migration. In the next few years, however, band recoveries made it apparent that a few Gadwall from the main breeding range were in fact migrating into the northern portion of the Atlantic Flyway (Figure 2). The stock for the colonizing effort was believed to be a small percentage of birds from the 'prairie pothole' region of Canada and the United States.

Impounding of water on federal refuges and state Wildlife Management Areas seems to have provided a suitable nesting habitat for the species. Such impoundment has been a part of development plans in the east since 1935, and totalled approximately 2,000 acres by 1940, 4,000 acres by 1950, 7,000 acres by

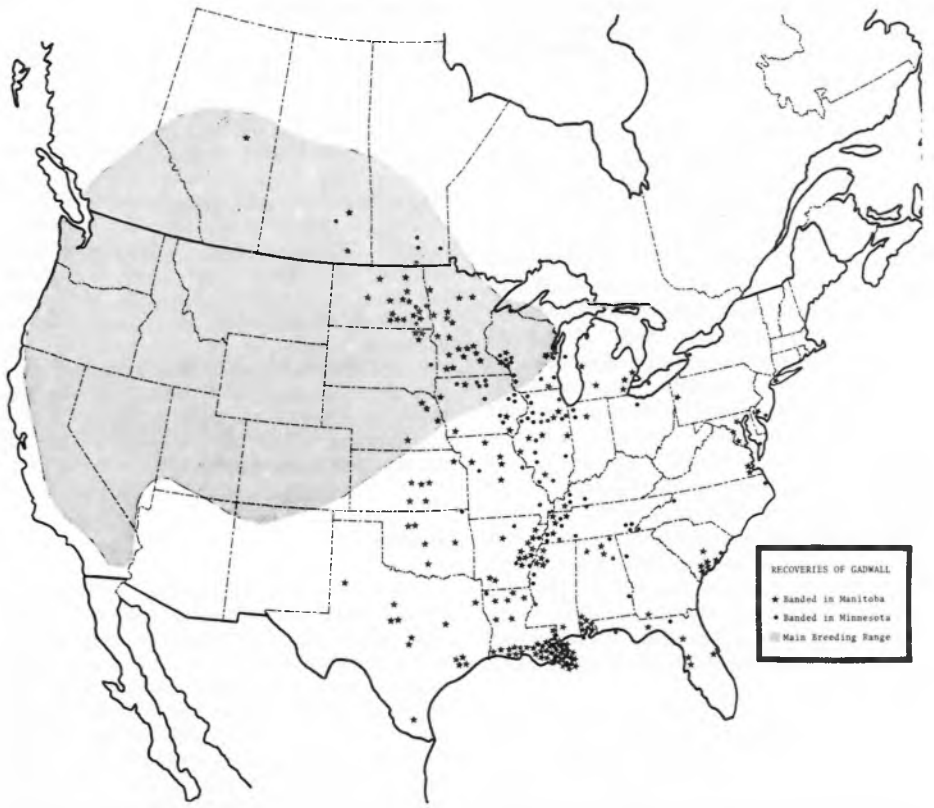

Figure 2. Main breeding range of Gadwall in North America (after Phillips, 1923), and the distribution of recoveries from bandings in Manitoba and Minnesota. Recoveries from within the State or Province where banded were omitted. Also, two recoveries in Mexico (Vera Cruz and Michoacan) were not plotted.

1960, and 12,000 acres by 1970. Colonization took place soon after the impoundments were completed and they act as focal points for nesting activities. Parnell & Quay (1962) indicated that at Egg Island, New Jersey, a definite preference for non-tidal ponds is exhibited by older broods, whereas at Pea Island the impoundments are used for the entire rearing period. Gadwall do not utilize wetlands with as much emergent vegetation cover as do other dabblers. They prefer deep open water, much like diving ducks, and the ducklings will escape by diving.

Stewart & Kantrud (1973) indicated that Gadwall in the 'prairie pothole' region of North Dakota were found in relatively greater numbers on semi-permanent ponds and lakes, reservoirs, and large impoundments. Duebbert (1966, p. 16) discussed a large impoundment island nesting situation in North Dakota and indicated that 'in late April and early May pairs frequented open shorelines ... broken marsh and small water areas, but many pairs occupied open-water loafing sites ... spent long periods of time (up to 3 to 4 hours) on open water ...' Possible explanations for the correlation between impoundments and breeding Gadwall in eastern North America include: (1) the non-tidal water which is used for courtship activities, nesting and brood rearing; (2) the lower salinity which may be necessary for ducklings with poorly developed salt glands; (3) the food sources which are similar to those found in the main breeding range.

Water impoundments along the northern portion of the Atlantic coast produce dense stands of succulent submergent vegetation. Plant species found in abundance include Widgeongrass *Ruppia maritima*, Muskgrass *Chara* spp., Horned Pondweed *Zannichellia palustris*, Southern Naiad *Najas guadalupensis*, Redhead-Grass *Potamogeton perfoliatus* Var. *bupleuroides*. Adult Gadwall feed mainly on succulent vegetation rather than seeds (Martin, Zim & Nelson, 1951). However, recent work in North Dakota by Serie & Swanson (1972) reveals a markedly

greater consumption of invertebrates for the species than previously described, particularly during the laying period. Invertebrate populations in coastal impoundments have not been studied.

Parnell & Quay (1962) compared the eastern coastal marshes with the inland western marshes. For example, Bear River Marsh, Utah, provides near-optimum breeding conditions for Gadwall, according to Williams & Marshall (1938). Parnell and Quay reported that the vegetation at Pea Island and Bear River was directly comparable in many instances. Sago Pondweed *Potamogeton pectinatus* was abundant in the ponds of both refuges. Large amounts of submergent plants, *Potamogeton* spp. primarily, were present in the non-tidal ponds at Bombay Hook, Egg Island, and Pea Island and these plants provided a food supply similar to that on western marshes. They concluded that controlled water levels and protection of nesting birds might allow substantial increases in nesting populations of Gadwall and other species of ducks on the eastern coastal marshes. Such a population increase of Gadwall has indeed taken place during the last decade.

The process may have been accelerated to some extent in recent years through transplant activities, both from within and without the Atlantic Flyway. Nevertheless, we believe that the inadvertent provision, by impoundments, of suitable production habitat for Gadwall is more important. The species responded immediately to the available habitat by extending its breeding range and increasing in numbers. The population is still increasing in the northeast, while the size of the population in the main breeding range has fluctuated since 1955 with no apparent trend.

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Summary

A disjunct breeding population of Gadwall in eastern North America was first recorded in 1939. This population has extended its range during recent years to the point where it is now found breeding in more than thirty locations (primarily National Wildlife Refuges and Wildlife Management Areas). These are 1,600–2,000 km (1,000–1,200 miles) from the main breeding range in the west and midwest. The number of breeding birds and the harvest have both increased during the last decade. Approximately 40,000 Gadwall were harvested in the northern portion of the Atlantic Flyway between 1961 and 1970. The impoundment of water seems to be responsible for the increase, providing focal points for nesting activities.

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