The recent occurrence of Garganey in North America and the Hawaiian Islands

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Photograph by Wayne Scott

THE GARGANEY (*ANAS QUERQUEDULA*) breeds between latitudes 40°–65°N, from the British Isles and France east across Eurasia to northern Japan and Sakhalin Island (Dement'ev and Gladkov 1976; Vaurie 1967; Kistchinski 1973; Cramp 1977; Figure 1, this paper). The species is not known to breed commonly in Kamchatka or on the Chukchi Peninsula (Kistchinski 1973; Portenko 1981). Garganey winter between latitudes 15°S and 35°N, from western Africa east to southern Japan and New Guinea, with stragglers to Australia and Micronesia (Marshall 1949; Delacour 1956; Dement'ev and Gladkov 1967; Vaurie 1967; Frith 1970).

Garganey begin fall migration in late August, with peak departure in September (Impekoven 1964; Dement'ev and Gladkov 1967; Cramp 1977). Some birds from northwestern Russia migrate westward to northern Europe, and then southward to Mediterranean wintering grounds. Others that breed in northern Russia, and winter in Africa, also fly considerable distances westward (Impekoven 1964, Dement'ev and Gladkov 1967, Cramp 1977). Still others breeding in central Russia winter in India (McClure 1974), and birds from northeastern Asia winter in China or Indochina (Dement'ev and Gladkov 1967).

Arrival on African wintering grounds begins in early September (Cramp 1977). Evidence suggests that Garganey migrating from Russia to western Africa fly great-circle routes (=shortest distance) over the Red Sea and the Sahara Desert (Moreau 1967). Moreau suggested that migrants from Europe fly at high altitudes and "not necessarily in touch with the Atlantic coast" of Africa.

The spring migration of the Garganey begins in late February to early March and peaks in March and April (Dement'ev and Gladkov 1967; Cramp 1977). Most arrive on their breeding grounds by May. Each year Garganey overshoot breeding areas and appear at higher latitudes.

Garganey have also been recorded in North America and the Hawaiian Islands consistently for more than 25 years. Yet, a comprehensive survey has not been made. Here we have compiled North American and Hawaii records through May 31, 1985, including seven previously unpublished. We discount the possibility that many records represent escaped captives (see below, and also McCaskie 1975; Paxton *et al.* 1976;

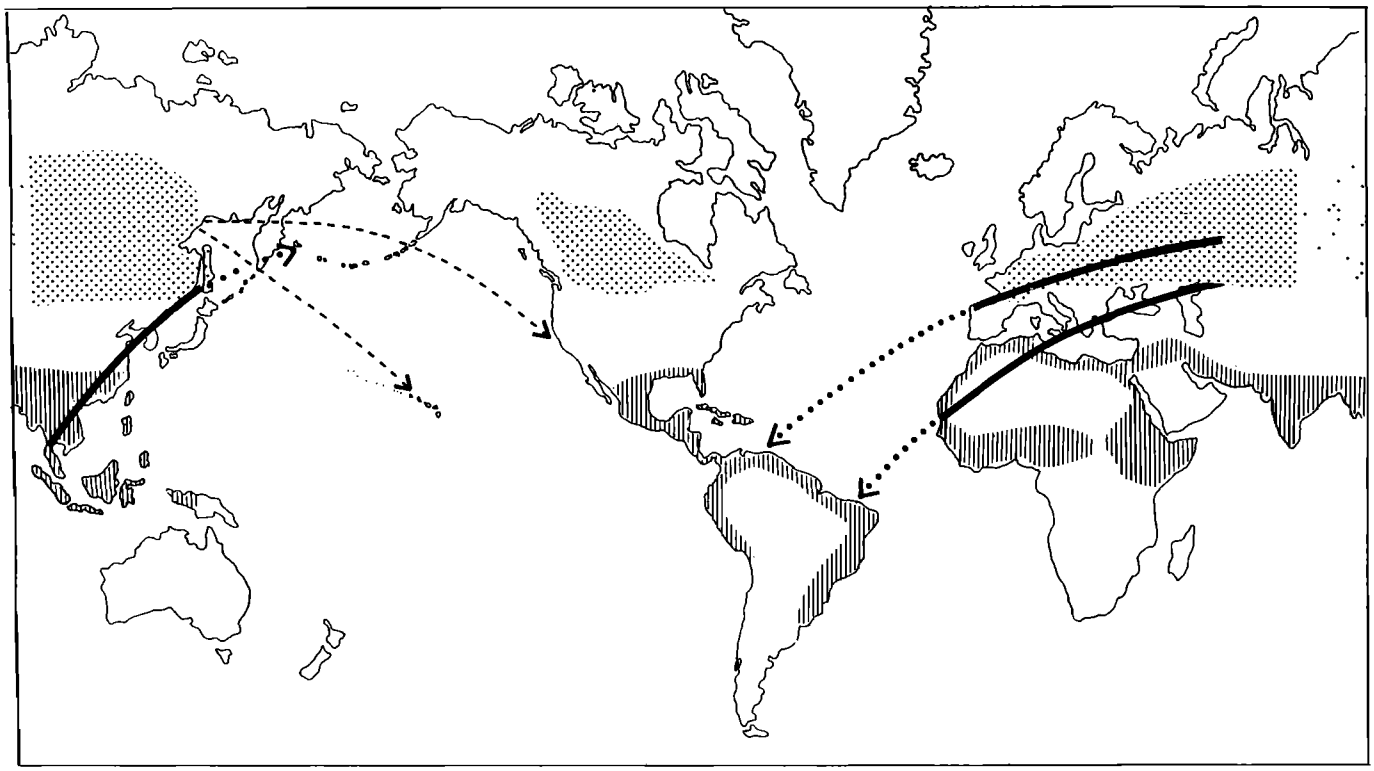

Figure 1. *Breeding ranges (dotted shading) and winter ranges (lined shading) of Garganey (Eastern Hemisphere) and Blue-winged Teal (Western Hemisphere). Also shown are suspected routes of overshooting (dotted lines) and misorientation (dashed lines) of Garganey. Solid lines denote "normal" routes of migrating Garganey. Lines are drawn as great-circle routes.*

Palmer 1976; Ryan 1980; Todd 1981; and Edgell 1984), and interpret occurrences in terms of dispersive behavior and influence by environmental factors.

Garganey occurrences in North America and Hawaii

We have found no record of a Garganey in North America or Hawaii before 1957, but since then at least 136 have been seen on 86 occasions through May 31, 1985 (Table 1). Regions and numbers of Garganey are: Alaska islands, 68; Hawaii, 28; North American Pacific coast, 12; North American interior, 13; North American Atlantic coast, Gulf of Mexico, and Caribbean islands, 15. No records are known from Central or South America (Meyer de Schauensee 1970; N.G. Smith and G. Stiles, pers. comm., 1985). A marked increase in sightings occurred after the early 1970's. Sightings in Alaska occurred in 13 of 16 years following the first in 1968. In Hawaii these teal were seen in four different years between 1961 and 1968, were not seen again until 1976, but have since been seen in seven of ten years. Similarly, Garganey were reported in continental North America and the Caribbean in only four years from 1957 to 1970, but have since been seen every year.

Records from Alaska are concentrated in May and June and from August through October, with only two records for July and one for November (Table 2). Hawaiian records are from September through April (Table 3). Except for one record in October, continental North American sightings are from March through June (Table 4), and, as noted by Roberson (1984), dates of sightings are later with increasing latitude ($r = 0.760$, $df = 33$, $P < 0.001$, Figure 2). Records from Barbados and Puerto Rico occurred in late summer or winter (Table 4).

Except for the fall record from British Columbia, each of the 36 from continental North America were of a single male in alternate (nuptial) plumage (Table 4). At least 56 percent were associated with Blue-winged Teal (*A. discors*) or Cinnamon Teal (*A. cyanoptera*), and on at least three occasions Garganey participated in courtship displays with Blue-winged Teal. Females of the North American species are difficult to distinguish from the female Garganey (Delacour 1956), and thus female Garganey may have gone unreported. Males seen in Washington and Prince Edward Island appeared to be paired with female blue-winged ducks that may also have been Garganey.

Lack of Garganey sightings from continental North America during late summer through winter may also have resulted from confusion with Blue-winged and Cinnamon teals, as not only female, but also juvenile and male Garganey in basic plumage are difficult to distinguish from these other species in corresponding plumages. Furthermore, male Garganey are in basic plumage for about nine months each year. They undergo prebasic molt between late May and late July, and do not complete prealternate molt until early March (Delacour 1956, Dement'ev and Gladkov 1967). Excluding alternate-plumaged males, Garganey differ from the two North American species only by the color of their upper wing coverts, brownish (juveniles) to grayish (adults) rather than bluish, a prominent white terminal border on the secondaries, a bolder facial pattern, gray instead of yellow legs, and a shorter bill (cf. Plate XVIII in Vol. 2 of Delacour 1956, Dement'ev and Gladkov 1967; Wallace and Ogilvie 1977). In Hawaii, where the Blue-winged Teal also occurs, the two facial stripes of female-plumaged Gar-

Table 1. Records of Garganey in North America and Hawaii through May 31, 1985.

		Alaska Islands			*Continental North America*		
Year	*Total*	*Western Aleutians*	*Central Aleutians, Pribilofs, Middleton Is.*	*Hawaiian Islands*[a]	*Pacific Coast*	*Interior North America*	*Atlantic Coast*[b]
1957	1	—	—	—	—	—	1
1960	1	—	—	—	—	—	1
1961	3	—	—	1	1	1	—
1963	1	—	—	1	—	—	—
1967	1	—	—	1	—	—	—
1968	4	1	—	1	—	—	2
1970	1	—	1	—	—	—	
1971	2	—	1	—	—	1	—
1972	3	—	—	—	1	—	2
1973	1	—	—	—	1	—	—
1974	2	1	—	—	1	—	—
1975	3	1	1	—	1	—	—
1976	9	5	1	1	—	1	1
1977	8	5	—	—	1	2	—
1978	9	2	—	4	—	1	2
1979	7	1	—	2	2	1	1
1980	4	1	—	1	1	1	—
1981	4	—	—	2	—	2	—
1982	6	—	1	—	1	3	1
1983	7	2	1	3	—	—	1
1984	5	2	—	2	1	—	—
1985	4	—	—	1	1	—	2
Total	86	21	6	20	12	13	14

[a] *Sightings that occurred at the same location during a contiguous fall-spring period are counted only once.*
[b] *Includes Gulf of Mexico coast and Caribbean islands.*

ganey serve as a good field mark for distinguishing the two species (R.L. Pyle, pers. obs.; see also Wallace and Ogilvie 1977).

In Alaska and Hawaii, where other blue-winged ducks are as rare as or rarer than Garganey (Kessel and Gibson 1978; Pyle 1983), femalelike birds are more readily noticed than in continental North America. Fifteen of the 21 western Aleutian records were of groups (two or more), and often included female-plumaged birds (Table 2). The sex ratio of Garganey seen during the spring was even (n = 26). Six of the seven records from more eastern Alaska islands were of single birds, and 80 percent of the spring sightings were of males. Seventy percent of the records from Hawaii were of single Garganey (Table 3). Although 54 percent of the birds seen in Hawaii were female-plumaged, 68 percent of the Garganey sighted in spring (March–April; n = 16) and collected in fall (n = 3) were males.

The possibility of escape

Before treating Garganey from the North American continent as wild birds, we must examine the possibility that the birds had escaped from captivity. In western Canada, Sugden (1963) checked with zoos and aviaries and found that Garganey had not been in captivity there, and Macdonald (1978) reached similar conclusions. In Ontario, 20 Garganey escaped from a game farm in January 1983, but all except one (killed by a truck) were recaptured (N. North, Canadian Wildl. Serv., pers. comm.). F. Todd (pers. comm., 1978) was not aware of Garganey escapes on the U.S. West Coast and believed most captive waterfowl in the area were pinioned. In 1968, however, one may have escaped from a New Hampshire game farm (D.W. Finch and R.O. Paxton, pers. comm.). In summarizing the subject in continental North America, Ryan (1980) stated that "an unlikely 10% or more (of all captives in North America) would have had to escape, survive, and be seen to account for all the wild sightings."

Although the possibility of escapes cannot be discounted, the above information and the consistent temporal and spacial spread of sightings indicates that the majority were wild birds. In our interpretation of the data, we will not, however, place emphasis on one or two particular records from a given area.

The possibility of repeat sightings

Philopatry to wintering areas occurs in several anatid species (Mederios 1958; Bellrose and Crompton 1970; Raveling 1979; Limpert 1980). Even in Hawaii, banding studies revealed that Pintails (*A. acuta*) were not vagrants but were returning in subsequent years (Mederios 1958). Thus, some extralimital records of Garganey are suspect as repeat sightings of the same bird (Tables 2, 3, and 4). For example, the Long Beach, California, sightings occurred at the same location (G. McCaskie, pers. comm.). In addition, some Garganey records could be repeat sightings of the same bird in different places in the same year. In general, however, the spacial and temporal pattern of sightings indicate the involvement of many birds.

Waterfowl studies and observer effort

Several ornithologists were active in the western Aleutians during the 1950s and 1960s (Gabrielson and Lincoln 1959; Kenyon 1961; Williamson 1969), but investigations peaked between 1974 and 1978 with activities of the Outer Continental Shelf Environmental Assessment Program.

Table 2. Garganey records from Alaska islands through May 31, 1985.

Region/ Location	*Month/Date*	*Year*	*Number*	*(Sex)*[b]	*Source*
Western Aleutians					
Shemya	May 10–31	1977	3 (at least)		*AB*[a] 31:1036, Gibson 1981 and (*pers. comm.*)
Amchitka	May 13	1968	2	(1m, 1f)	Williamson 1969
Buldir	May 14–June 3; one male through June 16	1974	up to 5	(2m, 3f); (1m; UAM 2709)+	*AB* 28:838, 935, Byrd *et al.* 1978, Gibson (*pers. comm.*)
Amchitka	May 17–18	1977	1	(m)	Kessel and Gibson (unpubl.)
Shemya	May 17–30	1976	6	(3m, 3f); (1m; UAM 3448)+	*AB* 30:877, Byrd *et al.* 1978, Gibson 1971 and (*pers. comm.*)
Amchitka	May 18–June 21; one male through July 2	1976	3	(2m, 1f); (1m; UAM 3544)+	*AB* 30:877, Byrd *et al.* 1978, Kessel and Gibson (unpubl.)
Shemya	May 20–22	1975	2	(1m, 1f)	*AB* 29:895, Byrd *et al.* 1976
Attu	May 20–31	1980	3		*AB* 34:806
Buldir	May 20–July 11	1976	1–4		*AB* 30:877, Byrd *et al.* 1976
Attu	May 21–26	1977	2	(1m, 1f)	*AB* 31:1036, Gibson (*pers. comm*)
Attu	May 23	1984	1	(f)	Kessel and Gibson (unpubl.)
Agattu	May 28	1983	2	(1m, 1f)	Kessel and Gibson (unpubl.)
Agattu	June 13	1976	2	(1m, 1f)	Byrd *et al.* 1978
Buldir	August 30–September 24	1976	1	(f)	*AB* 31:211, Byrd *et al.* 1978
Shemya	August 31–October 3	1977	1–8	(f); (1f; UAM 3607)+	*AB* 32:244, Kessel and Gibson 1978
Agattu	September 1	1978	1		*AB* 33:205
Shemya	September 5–October 13	1978	up to 3(f)/day		*AB* 33:205, Gibson 1981, and (*pers comm.*)
Amchitka	September 10–October 4	1977	6	(f; all banded)	*AB* 32:244, Kessel and Gibson 1978
Attu	September 11–26	1979	up to 4/day		*AB* 34:190, Gibson (*pers. comm*)
Attu	September 12–19; then at intervals through November 3	1983	1(f)/day		*AB* 38:235, Gibson (*pers. comm*)
Shemya	September 20–22	1984	1	(f)	*AB* 39:91
Central Aleutians, Pribilofs, Middleton					
Adak	May 1–5	1983	2	(1m, 1f)	*AB* 37:902
Adak	May 20	1971	1	(m)	*AB* 25:785, Byrd *et al.* 1974
Adak	May 29	1970	1	(m)	*AFN*[a] 24:634, Byrd *et al.* 1974
Adak	May 31–June 12	1976	1	(m)	*AB* 30:877, Byrd *et al.* 1978
Saint Paul	August 28	1975	1	(f)	*AB* 30:110
Middleton	September 29	1982	1	(f)	*AB* 37:213

[a] AB = American Birds; AFN = Audubon Field Notes.

[b] *(m) = male-plumaged; (f) = female-plumaged; (+) = specimen collected and sexed internally. UAM = University of Alaska Museum.*

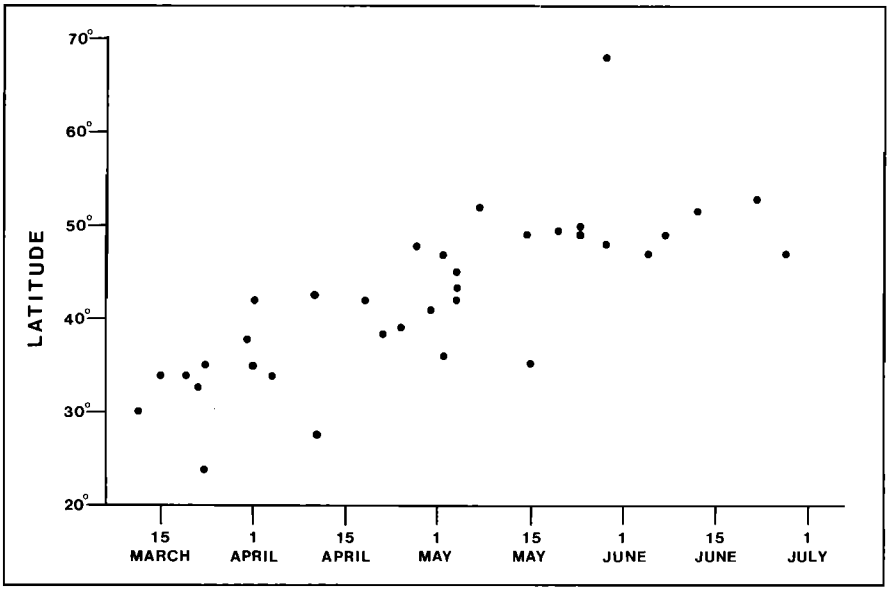

Figure 2. *Sightings of Garganey during spring/summer in the North American continent: sighting dates are plotted relative to latitude of respective sightings. Dates of sightings that occurred over a period of days are set at the first day.*

In Hawaii, waterfowl have been studied extensively since the early 1900s. The most thorough investigation was probably a banding and censusing study in 1949–1955; no small blue-winged ducks were seen (Mederios 1958). The first Gaganey record resulted from activities of several birders who observed water birds consistently beginning about 1957 (Walker 1961) Other records during 1963–1968 came from the Smithsonian Institution's Pacific Ocean Biological Survey Program (Clapp and Pyle 1968). Effort in observing water birds in Hawaii then waned until 1975, but has increased to a new high because the activities of birders and an expanded U.S. Fish and Wildlife Service staff, supplemented by acquisition of water-bird habitat for refuges.

There is little doubt that observer effort in the continental North America

Table 3. Garganey records from Hawaiian Islands through May 31, 1985.

Island (Location)	*Month/Date*	*Year*	*No.*	*(Sex)*[b]	*Source*
Oahu (Waipio)	September 12, 16	1981	1	(f)	*AB*[a] 36:222
Midway (Sand Island)	September 17	1963	2	(juvs., 1m, 1f; USNM 493451, 453452)+	Clapp and Woodward 1968
Kure (Green Island)	September 30	1983	1	(juv. f; BPBM 159738)+	*AB* 38:250, P. Pyle (unpubl data)
Oahu (Kii Pond)[c]	October 22	1983	1	(f)	*AB* 38:360, 967, R. Pyle (unpubl. data)
	February 12, 23	1984	2	(1m, 1f)	
	March 10	1984			
	April 16	1984	1	(m)	
Oahu (Waipio)[c]	November 4, 5, 15, 27	1979	2–4	(2m, 2f)	*AB* 34:204, 309, 818, R. Pyle (unpubl. data)
	December 2	1979			
	March 17, 22	1980			
	April 2, 4	1980			
Midway (Sand Island)	November 1	1984	1	(f)	*AB* 39:106
Hawaii (Waiakea Pond)[c]	November 8, 19, 23	1978	1	(f)	*AB* 33:219, Pyle 1979
	January 27	1979			*AB* 33:317, Pyle 1979
Oahu (Waipio)	November 18	1978	1	(f)	*AB* 33:219, Pyle 1979
Kauai (Hanalei Refuge)	November 24–December 1	1976	1	(f)	*AB* 31:376, Zeillemaker 1977
Oahu (Waipio)	December 13, 20	1980	1	(f)	Stemmermann 1981, R. Pyle (unpubl. data)
Oahu (Kii Pond)	January 5	1985	1	(m)	*AB* 39:213
	February 17		3	(1m, 2f)	
Oahu (Waipio)	January 7	1978	1	(m)	*AB* 32:402–403, 1058
	March 12–13				
Hawaii (Hilo)	February 28	1961	1	(m)	Clapp and Pyle (1968)
	March 20				
Maui (Kealia Pond)	March 1	1983	1	(m)	*AB* 37:341, R. Pyle (unpubl data)
Oahu (Waipio)	March 3	1968	1	(m)	Clapp and Pyle 1968
Oahu (Kakuku)	March 12, 23	1967	1	(m)	Gauthey 1967, Clapp and Pyle 1968
Maui (Kanaha Pond)	March 20	1981	2	(1m, 1f)	*AB* 35:865, R. Pyle (unpubl data)
Oahu (Kii Pond)	March 28	1979	1	(m)	*AB* 33:808
Molokai (Kakahaia N.W.R.)	April 12	1978	2	(m)	*AB* 32:1058

[a] AB = American Birds.

[b] *(m) = male-plumaged; (f) = female-plumaged; + = specimen collected and sexed internally.*
USNM = U.S. National Museum, BPBM = Bernice P. Bishop Museum.

[c] *Birds sighted in fall are presumed to be same birds sighted in winter and spring.*

has increased several times over during the past two decades. In addition, observer effectiveness has increased in all areas because of better field guides, better access to rural areas, and better optics including especially the spotting scope.

Great-circle routes, overshooting, and misorientation

Overshooting of breeding grounds may explain spring occurrences of Garganey in the Aleutian Islands (Figure 1). The Near Islands may also provide an annual landfall for small numbers migrating between southeastern and northeastern Asia (Gibson 1981), or even small groups returning from islands in the Central Pacific Ocean. The temporal pattern of Garganey records in the Aleutians and Hawaii suggests fall and spring movements. Movement between Central Pacific islands and northeastern Asia, via the Near Islands, would not be surprising; this route is used by other Palearctic species (Baker 1953; Mayr 1953; Gibson 1981) that also fly great circle courses (Cramp 1983).

The pattern of Garganey sightings in continental North America suggests northward spring migration of birds that arrived in the Western Hemisphere in fall or winter and became incorporated into North American flyways. Evidence includes fall records from the Gulf of Alaska, British Columbia, and Caribbean islands, and the preponderance of males, which tend to be the predominant dispersing sex among Anatidae (see review by Greenwood 1980). Although frequent occurrences of females with males in spring are well documented in the western Aleutians, the complete absence of records of females in continental North America in spring suggests that males are *not* arriving from normal wintering grounds, but instead are coming from extralimital wintering grounds where they have not had an opportunity to pair. If Garganey arrived in spring after pairing on or enroute from normal wintering grounds, one would expect that females accompanying them would be detected occasionally.

Some Garganey have probably arrived in continental North America via trans-Atlantic flight (see discussion below), however, fall records from the Gulf of Alaska and British Columbia suggest that some also arrive in continental North America via a Pacific route. The eastward movement of storm fronts over eastern Asia and the North Pacific in fall (Miles *et al.* 1981) could facilitate this. Diversion by weather should, however, result in records of

Table 4. Garganey records from continental North America and Caribbean islands through May 31, 1985.

State—Province (Location)	*Month/Date*	*Year*	*No.*	*(Sex)*[b]	*Source*
Pacific Coast					
California (Long Beach)	March 15	1972	1	(m)#	*AB*[a] 28:852
	April 4	1974	1	(m)#	*AB* 28:851–852
	March 19	1975	1	(m)*,#	*AB* 29:741, McCaskie (*pers. comm.*)
California (Lake Elsinore)	March 21–April 4	1979	1	(m)*,#	*AB* 33:805, McCaskie (*pers. comm.*)
Sinaloa, Mexico (Escuinapa Lagoons)	March 22	1973	1	(m)*,#	*AB* 30:819, Alden (*pers. comm.*)
California (Modoc N.W.R.)	April 10–28	1985	1	(m)	*AB* 39:345
Washington (Mount Vernon)	April 27–30	1961	1	(m, f?)*,+ (UCDWM 1119)	unpubl.[c]
California (Lower Klamath N.W.R.)	April 29	1982	1	(m)#	*AB* 36:889
British Columbia (Sea and Iona Islands)	May 14–31	1977	1	(m)*,#	*AB* 31:1038, Macdonald 1978
British Columbia (Penticton)	May 23–24	1984	1	(m)	*AB* 38:881, 937
British Columbia (Iona Is.)	June 8–12	1979	1	(m)	*AB* 33:891
British Columbia (Port Alberni, Vancouver Is.)	October 12	1980	1	(f)	unpubl.[d]
Interior					
Kansas (Newton)	March 29	1981	1	(m)	Thompson *et al.* 1983
Tennessee (Memphis)	April 1–5	1978	1	(m)	*AB* 32:1018
Illinois (DuPage County)	April 18–23	1982	1	(m)*	*AB* 36:858, Peterjohn (*pers. comm.*)
Kansas (Oxford)	April 21–May 1	1982	1	(m)	Thompson *et al.* 1983
Oklahoma (Roger Mills Co.)	May 2	1979	1	(m)*	Ross 1982
Colorado (Waterton)	May 4	1980	1	(m)*	*AB* 34:801, Justice (*pers. comm.*)[e]
Alberta (Galahad)	May 7	1977	1	(m)*	Poll 1977
Oklahoma (Washita N.W.R.)	May 15–18	1981	1	(m)*	Klett 1982
Manitoba (St. Ambroise)	May 23	1971	1	(m)*	*AB* 25:759, Koes 1971
Yukon (Old Crow Flats)	May 27	1976	1	(m)	Mossop 1976 (*pers. comm.*)
Montana (Benton Lake N.W.R.)	May 27	1977	1	(m)	*AB* 31:1014
Alberta (Strathmore)	June 12–15	1982	1	(m)*	*AB* 36:989[f]
Alberta (Two Hills)	June 22–24	1961	1	(m)*	Sugden 1963
Atlantic Coast, Caribbean islands, Gulf of Mexico					
Puerto Rico (Roosevelt Roads Naval Res.)	January–March	1978	1		Raffaele 1983, Wiley (*pers. comm.*)
	January–March	1982	2		unpubl.[g]
Alabama (Gulf Shores)	March 11, 19	1968	1	(m)*	*AB* 31:1011
North Carolina (Cape Hatteras)	March 25, 30–31	1957	1	(m)*	*AFN*[a] 11:334, Chamberlain 1957
Massachusetts (Marshfield)	April 1–18	1978	1	(m)	*AB* 32:978
Texas (Riviera)	April 11–May 17	1985	1	(m)*	*AB* 39:323
Delaware (Bombay Hook N.W.R.)	April 24–May 5	1976	1	(m)	*AB* 30:819
Quebec (Bergeronnes–Trois Pistoles)	May 2, 4–6	1983	1	(m)	*AB* 37:849, Gosselin (*pers. comm.*)
Massachusetts (Plum Island)	May 4–25	1968	1	(m)	*AB* 30:819, Paxton (*pers. comm.*)
	May 11–17	1985	1	(m)	*AB* 39:270
New Brunswick (St. John)	May 4–19	1979	1	(m)	*AB* 33:752
Prince Edward Island (Indian River)	June (early), and June 14, 22	1972	1	(m, f?)*	*AB* 30:819, Guignion (*pers. comm.*)
Quebec (Isle Verte Bay)	June 28	1972	1	(m)	unpubl.[h]
West Indies (Barbados)	August 29	1960	1	(f)+ (ANSP 169852)	Bond 1965, Hutt & Robbins (*pers comm.*)

[a] AB = American Birds; AFN = Audubon Field Notes.

[b] *(m) = male-plumaged; (f) = female plumaged; + = sex confirmed by examination of specimen; (f?) = male accompanied by female blue-winged duck; * = with Blue-winged Teal; # = with Cinnamon Teal, ANSP = Academy of Natural Sciences, Philadelphia, UCDWM = University of California (Davis) Wildlife Museum.*

[c] *When Spear initially sighted this bird it swam with 12–16 Blue-winged Teal on a pond in a dairy pasture 5 km west of Mount Vernon. During the next few days it was seen on three different ponds within a radius of 2 km and was accompanied by a female blue-winged duck on each occasion. Spear thought the duck was a hybrid and collected, skinned and preserved it on April 30, 1961. In 1978 it was identified.*

[d] *Shot by hunter; wing sent to Canadian Wing Bee (analysis of samples provided by Canadian hunters) and subsequently identified by Pierre Dupuis, CWS, Quebec Region The wing was of a juvenile (tertials and tertial coverts not yet replaced) showing smooth feather tips and no evidence of unusual wear from incidental break-off in pen-reared birds (P. Dupuis,* pers. comm.*).*

[e] *This Garganey courting a female blue-winged duck. A male Blue-winged Teal accompanied the two but did not court the female (F. Justice,* pers. comm.*).*

[f] *Exhibited courtship displays (burping, backward head-stretch, and ratsche-call; see Lorenz 1971) including a courtship flight while associated with eight male and one female Blue-winged Teal (Lewis, pers obs.)*

[g] *Observed and identified by James W. Wiley (J. W. Wiley,* pers. comm.*).*

[h] *Detailed field notes by Austin Reed, Canadian Wildlife Service, Quebec (A. Reed,* pers. comm.*).*

groups because Garganey generally migrate in flocks (two or more; Dement'ev and Gladkov 1967). Furthermore, while storms might divert them temporarily, these strong fliers would probably not be diverted as far as North America or Hawaii if they were following the correct orientation (Lack 1969; Bergman and Donner 1971; Richardson 1976; Bingman *et al.* 1982; Wege and Raveling 1984). Another possible mechanism for arrival in continental North America is "normal" immigration from eastern Asia (as in the Pintail, see Henny 1973), but again, group sightings could be expected.

The lack of sightings of groups suggests misorientation, the inability of an individual to follow the correct orientation (DeSante 1983). Two forms of misorientation, either "180° reverse misorientation" or "mirror image misorientation", were proposed as causing fall vagrancy by eastern North American species to western North America (DeSante 1983), and vagrancy by several Asian species, also during fall (P. Pyle *et al.* 1983; Wingate 1983). It follows that a Gaganey beginning fall migration, on a great-circle route oriented 180° in reverse of that required to take it from eastern Asia to India, would be enroute to the Aleutian Islands or the West Coast of North America (Figure 1). Mirror image misorientation could explain Hawaii sightings.

The evidence suggests that after Garganey arrive in continental North America they often migrate with Blue-winged or Cinnamon teals, of which the breeding and wintering areas are of similar latitudes to those of Garganey (Bellrose 1976; Figure 1, this paper). There is little available information on spring migration routes of Blue-winged Teal, but fall migration routes are well described (Bellrose 1976). Blue-winged Teal from as far west as Alberta move east to Atlantic maritime states and provinces. Their course then becomes south southeast across the western Atlantic Ocean to wintering grounds on Caribbean islands and in South America Others moving from the interior of North America fly south to winter on the Pacific slope from southern Mexico to Peru. Because anatids exhibit well-developed homing to natal areas and previous breeding locations (reviewed by Alison 1977; Blohm 1978; Greenwood 1980; Savard 1985), many Blue-winged Teal could be expected to return to respective areas in spring. Therefore, if Garganey were incorporated into North American flyways, then those sighted in the interior of the continent could have wintered on either the Pacific or Atlantic slopes, and Garganey sighted along the Atlantic coast of North America likely wintered on the Atlantic slope after arrival via trans-Atlantic flight (Figure 1). Among shorebirds, trans-Atlantic flight is most frequent in species that, like the Garganey, have a strong east-west component in fall migration (Nisbet 1959). These birds apparently overshoot the coasts of Europe and Africa and, helped by easterly winds, make a landfall in the Americas (Nisbet 1959; Eisenmann 1960). The bird collected in late summer in the West Indies and those seen in Puerto Rico may have made similar flights.

Factors affecting the frequency of extralimital Garganey records

The effect of a vast increase in observer effort and expertise was quite evident in temporal patterns of extralimital Garganey sightings after the late 1960s. The total absence of sightings prior to 1957 is puzzling, however, because there was a good deal of previous activity. This was especially true in Hawaii, where waterfowl habitat is not extensive. We wonder if recent changes in Eurasian breeding grounds might also be a factor. A northern expansion of the Garganey's breeding range could result in increased extralimital flights *via* mechanisms discussed above.

Historically, the breeding range of the Garganey has fluctuated considerably, with range contraction or expansion in northern areas lasting from one to several decades (Voous 1960; Dement'ev and Gladkov 1967; Bauer and Glutz von Blotzheim 1968; Parslow 1973; Cramp 1977). Explanations include displacement by drought from southern breeding areas (Cramp 1977), and a cessation of spring hunting that allowed more birds to make breeding attempts (Parslow 1973). A ban on spring hunting did, in fact, go into effect in the Amur region of eastern Asia in 1969 (Kistchinski 1973). Kistchinski also notes serious destruction of dabbling duck habitat on Sakhalin Island during the same period. An even more fundamental factor, warming during the current glacial period, was postulated as responsible for northern range expansion of the Tufted Duck (*Athya fuligula,* see Palmer 1976). Any or all of these factors might have affected the Garganey in ways that would lead to increased dispersion to the Western Hemisphere.

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