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DECLINE OF *GOMPHUS FRATERNUS FRATERNUS*
(ODONATA: GOMPHIDAE) IN LAKE ERIEPaul M. Catling¹

ABSTRACT

Collections and literature reports indicate that *Gomphus fraternus* was abundant on the shoreline of Lake Erie prior to 1960, and "tens of thousands" were reported at Long Point Bay. After 1960 there were no reports from the shoreline, although there have been a number of comprehensive studies that have included the shoreline area and a number of Odonata specialists have also visited the Lake Erie shoreline regularly. A survey of portions of the Lake Erie shoreline, including the Long Point Bay area in 1999 and 2000, during the established peak and late peak flight period in southwestern Ontario, did not result in any observations. It is concluded that *G. fraternus* has declined substantially in Lake Erie and is possibly extirpated from the lake. The decline appears to have occurred between 1950 and 1960, and thus approximates the mid-1950s decline of burrowing mayflies in Lake Erie, which has been associated with warm weather oxygen depletion and pollution. Although it may never be possible to precisely determine the cause of the decline of *G. fraternus*, it is likely that a number of factors are involved including climatic warming, pollution, changes to the shoreline, other effects of shoreline development, and introduced species.

A widespread dragonfly, the midland clubtail (*Gomphus fraternus fraternus* Say) occurs from southern Quebec to Manitoba, south to Texas and Virginia. In Ontario it occurs in four general regions: (1) the Carolinian zone north of Lake Erie and eastern Lake Ontario, (2) the Lake Simcoe/Georgian Bay area, (3) the Ottawa valley, and (4) in northwestern Ontario in the Lake of the Woods area (Walker 1941, 1958; Catling and Brownell 2000). The majority of the Ontario records are from the Carolinian region and within this region almost half of the records are for the Lake Erie shoreline (Walker 1941).

In 1941 Walker noted that *G. fraternus* was "abundant in Lake Erie", and he cited Point Pelee, Rondeau Park, Fisher's Glen, St. Williams, Long Point, Turkey Point, and Norfolk. In 1958 Walker indicated that in Canada *G. fraternus* was "abundant along the shore of Lake Erie, where it is sometimes found in vast numbers." Referring to the shoreline of the inner bay of Long Point, south of St. Williams, he noted that on 22 June 1934, he was "amazed to see the multitudes of of both sexes settling everywhere" along the beach and he reported seeing many pairs in copula. He also noted that along the shore the "exuviae were lying in tens of thousands". While compiling information for an assessment of dragonfly diversity in the Mixedwood Plains ecozone (Catling et al.1998), it was noticed that there were remarkably few, if

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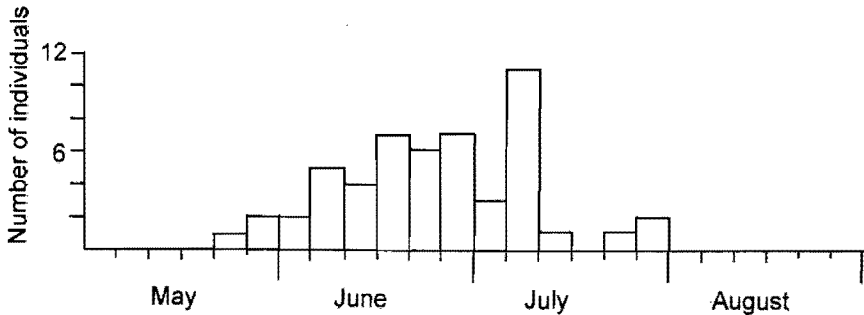


Figure 1. Flight period of *Gomphus fraternus fraternus* in southern Ontario based on 53 records.

any, recent records of *G. fraternus* for Lake Erie, which was surprising in the light of Walker's indications of abundance.

A decline is of interest with regard to the ecology of *G. fraternus*, but is also of interest with respect to the ecology of Lake Erie where fluctuation, decline and extirpation of native species (fish, molluscs, mayflies, etc.) is well documented but still not adequately understood. The purpose of the work reported here was to determine whether this apparent decline of *G. fraternus* can be supported by other evidence from recent observations and current field survey.

METHODS

Recent literature was gathered and examined for reports of *G. fraternus* from Lake Erie. Field biologists active in the Lake Erie region were questioned about occurrences of *G. fraternus*. To document the trend as accurately as possible material in collections was examined and only fully reliable reports from experienced observers were included on the map. Collections providing data included Agriculture Canada in Ottawa (CNC), Royal Ontario Museum (ROM) and the University of Guelph (UG). A distribution map was prepared from the resulting database showing reports up to and including 1960 and after 1960.

Portions of the Lake Erie shore were searched in 1998 and 1999. To ensure that the timing of the field survey was appropriate to record presence or absence, southern Ontario reports of *G. fraternus* were plotted as number of individuals in six date divisions of months (1–5, 6–10, 11–15, 16–20, 21–25, 26–30). Areas surveyed between 4 and 11 July in 1999 were Cedar Springs (42.2711° N, 82.0361° W) on 4 July, Willowood (42.1111° N, 83.0828° W) on 5 July, Big Creek (42.0662° N, 83.0765° W) on 5 July, Wheatley Park (42.088° N, 82.445° W) on 6 July, base of Long Point at provincial park (42.6597° N, 80.4070° W) on 11 July, Port Burwell Provincial Park (42.6496° N, 80.8243° W) on 10 July, and Long Point Bay south of St. Williams (42.6597° N, 80.4070° W) on 11 July. The latter location was the place where Walker reported "vast numbers and "tens of thousands". In 2000 this latter location was visited again on 30 June, and on 6 July Port Royal (42.6017° N, 80.4880° W) was visited. At least two hours was spent at each site. At Long Point Bay on each occasion approx. one hour was spent on each of three searches: (1) exuviae

were searched for on shorelines, (2) sand, aquatic vegetation and debris were dredged for nymphs, and (3) adults were searched for on sandy roads, trails, woodland clearings, along the shore and over water.

RESULTS

Literature and communications. *Gomphus fraternalis* has not been observed along the shore of Lake Erie since 1960. Falls (1996) did not report it on Long Point based on observations made between 1991 and 1995, despite the earlier records from there. Stewart and Carmichael (1993) in four seasons of collecting in Elgin County (1989–92) reported it only from Big Otter Creek at the inland location of Philmore bridge, and I. Carmichael (pers. comm.) provided one additional record from the inland area of Sparta 3 miles N of the Lake Erie shore. P. Pratt (pers. comm.) reported seeing *G. fraternalis* many times over the past 20 years on the Sydenham River, Thames River and smaller streams such as the Canard River in Essex Co., but never on the Erie Islands or along the Lake Erie shoreline.

Gomphus fraternalis is either not reported or listed as rare on the U.S. shore of the lake. Masteller's (1993) potentially useful synopsis for example, covering a period of 90 years, makes no mention of *G. fraternalis*. Kennedy (1922) found it to be rare on the Bass Islands of western Lake Erie. Thus the centre of abundance appears to have been the sandy areas of the north shoreline.

There are no reports directly from the Lake Erie shore of Ohio over the past 10 years (B. Glotzhober, pers. comm.). The records from lakeshore counties are from inland locations, but this could be a result of where surveys were done. C. E. Trisler (pers. comm.) who has collected dragonflies at the Stone lab on Kelly Island over several years reports old records from the lab collection but none seen over the past decade. Thus a decline is suggested on the Ohio shore, although *G. fraternalis* may never have been common there.

Collections. Walker made collections (ROM) at the inner bay south of St. Williams in 1934 at the time of his observations of large numbers. Other collections of *G. fraternalis* in the Long Point area were made by G. Walley in 1931 (UG), F. P. Ide in 1934 (ROM), S. J. Thompson in 1940 (ROM), J. B. Falls in 1950 (pers. comm.), and lastly by M. Landon in 1960 (ROM). Prior to 1960, collections were made from other parts of the Canadian shore of Lake Erie (Figure 2), but particularly notable was a series of males, females and exuviae from Pelee Island collected by V. Kohler in June and early July 1950 (ROM), a series from Rondeau collected in the early 1920s by E. M. Walker (ROM) and Baker (UG). Thus support for presence and statements of abundance in Lake Erie is well established with voucher material. After 1960 there were no more collections or observations from the Lake Erie shore, but only from inland sites (Figure 3).

Field survey. The flight period of *G. fraternalis* in Ontario is mostly from mid-June to early July with a peak in early July based on 52 individuals (Figure 1). In Ohio the flight period is from late May to late July with a peak in mid-June based on 223 records (Glotzhober 2000). Walker's observations were made on 22 June 1934 (Walker 1958, vouchers at ROM). Thus the late June and early July surveys were on appropriate dates.

Although the collections prior to 1960 (Figure 2) suggest general occurrence along the Lake Erie shoreline, and Walker (1941) noted that it was "abundant on Lake Erie", the general survey of localities on the Lake Erie shoreline in 1999 and 2000 did not reveal a single occurrence. The only individuals seen near Lake Erie were five on Big Otter Creek near Straffordville,

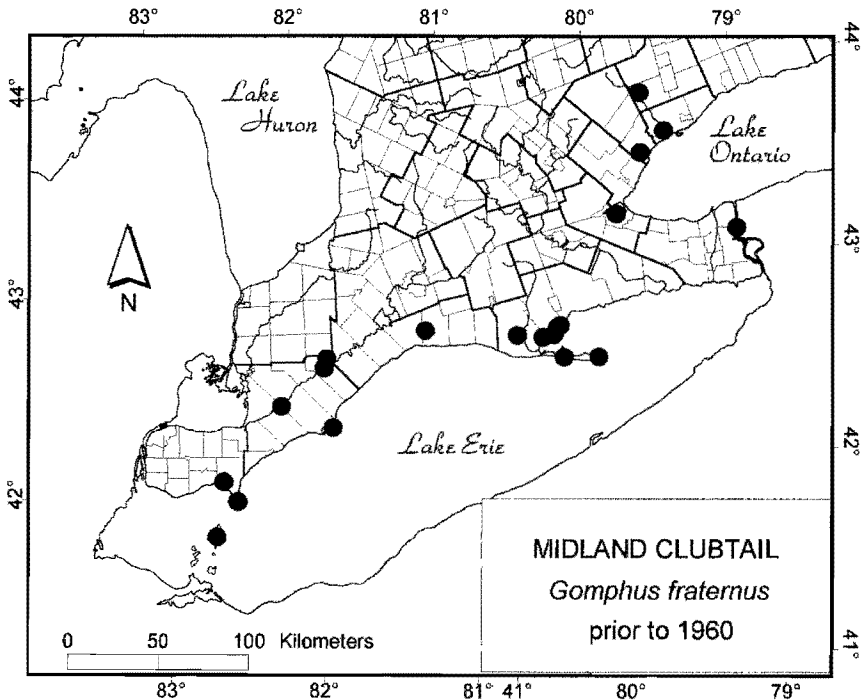


Figure 2. Southern Ontario distribution of *Gomphus fraternus fraternus* based on records prior to 1960.

8 km north of the Lake Erie shoreline on 6 July 2000, and they were either on the creek or on an adjacent sandy trail within 50 m of the creek.

Walker's observations were evidently made at the foot of the road to St. Williams based on his reference to the shore bluff and marsh, and relationship to the hamlet of St. Williams. This location is at 42.659° N, 80.407° W in Charlotteville Tp., Regional Municipality of Haldimand-Norfolk.

On 11 July 1999 no adults of *G. fraternus* could be found after an hour of searching the shore at the foot of the road to St. Williams and no nymphs or exuviae could be found after 30 minutes of sifting sand and aquatic vegetation and shoreline debris. Dragonfly adults seen included *Enallagma carunculatum*, *Enallagma signatum*, and *Ischnura verticalis*. The only exuviae found in the shore drift were those of *Epiptera princeps*. The weather was mild and variably cloudy.

On 30 June 2000, a sunny and warm day, we again surveyed the shoreline of Long Point Bay south of St. Williams. The only adult dragonflies seen were *Pantala hymenaea* (6 seen), *Enallagma carunculatum* (60 seen), *Enallagma signatum* (30 seen), and *Ischnura verticalis* (30 seen). In addition over 500 exuviae of *Epiptera princeps* were found on emergent *Scirpus* spp. and *Pontederia cordata* along 30 m of shoreline at the foot of the road that leads up the shore bluff to St. Williams. Although dragonflies were still present, not a single adult, nymph, or exuvium of *G. fraternus* was seen where Walker

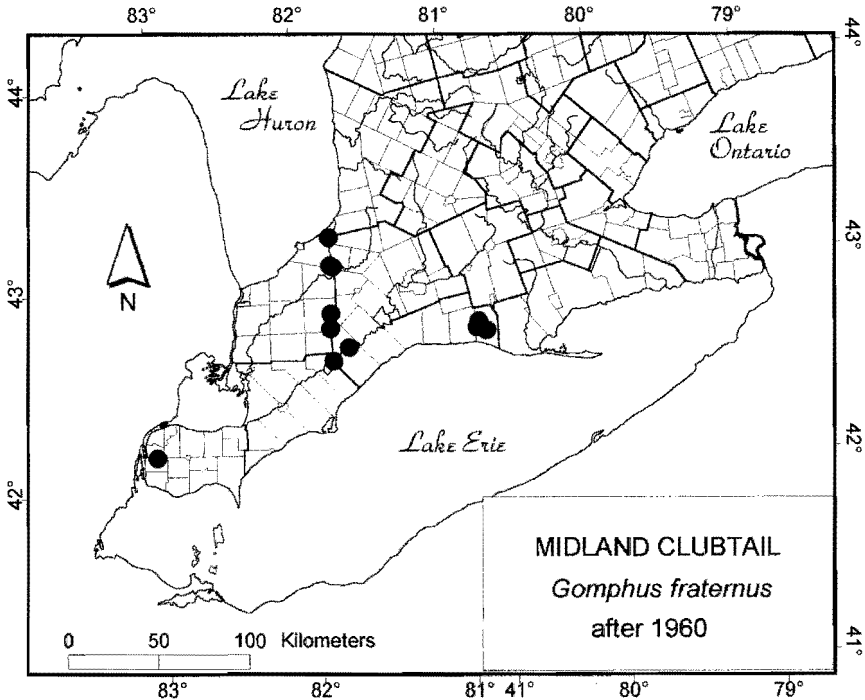


Figure 3. Southern Ontario distribution of *Gomphus fraternus fraternus* based on records after 1960.

had seen “tens of thousands”. The latter phrase may describe *Epitheca princeps* in Long Point Bay, but a more accurate census would be necessary, to be timed on the few days of emergence, probably during the second or third week of June. Clearly the dragonfly fauna of this part of Lake Erie has undergone a major change in composition since 1934.

DISCUSSION

What happened to the “multitudes” and “tens of thousands”? The shoreline of the inner bay of Long Point and that of the rest of Lake Erie has changed appreciably. At the inner bay what was once a sandy beach, possibly with sparse local growth of *Scirpus* spp., and essentially continuous shoreline with longshore currents, is now concrete fill with trailer parks and marinas beyond which are beds of emergent and submersed aquatics including *Scirpus* spp., *Pontederia cordata*, *Typha latifolia*, and submersed *Najas flexilis*, *Ceratophyllum demersum* and *Vallisneria americana*. The shoreline is irregular due to rock and concrete breakwalls protecting marinas, and fill accommodating boathouses. The sandy beach has gone completely and gravel roads have been built along the shore in both directions. A large trailer park has also been developed at the base of the shore bluff. All the developments

extend into the deeper water so that there is no longer a gradual slope to dry land. Coves accumulate organic debris including dead fish and plant material which would have otherwise been washed ashore. Although there is still a firm sandy bottom offshore, the longshore current and wave actions have evidently been stopped or altered. Nutrient input has probably greatly increased leading to increased aquatic macrophyte growth. Emerging dragonflies would encounter a large number of new impacts such as waves from boats and numbers of purple martins using nest boxes in the trailer park. Of course numerous other changes have occurred in Lake Erie since the 1930s. The fish community has changed and numerous alien species have been introduced (Mills et al. 1993). The decline of *Gomphus fraternus* appears to have occurred between 1950 and 1960, and thus approximates the mid-1950s decline of Burrowing Mayflies (*Hexagenia* spp.) in Lake Erie, which has been associated with warm weather oxygen depletion (Britt 1955) and pollution (Krieger 2001). Mayflies were abundant in the western basin of Lake Erie for centuries prior to the 1950s (Krieger 1999, 2001a, 2001b, Krieger et al. 1996, Reynoldson and Hamilton 1993). Since the dragonfly nymphs may occur in coarser sediments than the mayflies, a direct relationship is not necessarily implied. Although it may never be possible to precisely determine the cause of the decline of *Gomphus fraternus* in Lake Erie, it seems most likely that a number of factors are involved including climatic warming, pollution, changes to the shoreline, other effects of shoreline development, and introduced species. Pollution in Lake Erie has been gradually reduced through international initiatives and various pollution abatement programs as well as invasion of mussels (*Dreissena* spp.), and "mayfly storms" returned to the western basin during the 1990s (Krieger 1999, 2001a, 2001b, Krieger et al. 1996, Reynoldson and Hamilton 1993). Whether or not there will be a recovery of *Gomphus fraternus* is unclear because of the multiple factors likely involved in its decline.

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