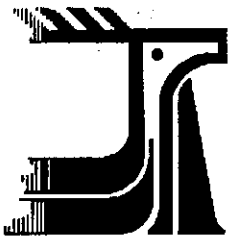


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Vol. 10

**STATUS REPORT ON THE CRICKET FROG  
*ACRIS CREPITANS*  
IN CANADA**

BY



**MICHAEL J. OLDHAM**

AND

**CRAIG A. CAMPBELL**

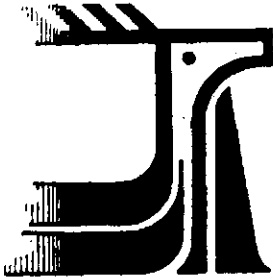
**STATUS ASSIGNED IN 1990  
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**REASON: APPARENTLY EXTIRPATED FROM SOLE ONTARIO  
MAINLAND AREA IN WHICH IT WAS RECORDED, AND NOW  
KNOWN IN CANADA ONLY FROM PELEE ISLAND WHERE IT  
WAS STILL WIDESPREAD IN THE 1970'S BUT RECENTLY  
ONLY VERIFIED FROM A SINGLE SITE.**

**OCCURRENCE: ONTARIO**

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JUNE 1990

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**STATUS REPORT ON THE CRICKET FROG  
*ACRIS CREPITANS***

**IN CANADA**

**BY**

**MICHAEL J. OLDHAM  
R.R. 31  
MOSSLEY, ONTARIO  
N0L 1V0**

**AND**

**CRAIG A. CAMPBELL  
194 ALBERT STREET  
WATERLOO, ONTARIO  
N2L 3T8**

**STATUS ASSIGNED IN 1990  
ENDANGERED**

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**Abstract.** — The genus *Acris* is endemic to eastern and central North America and *A. crepitans* is the most widely distributed of its two species. Blanchard's Cricket Frog, *A. c. blanchardi*, is the most western and northern of the two widespread races recognized for this species and is generally abundant throughout its range. In Canada, however, its occurrence has been verified only on Point Pelee and Pelee Island in extreme southwestern Ontario. Cricket Frogs are small frogs, adults range from 16 to 38 mm in snout-vent length. They are the most aquatic of the North American Hylidae ("treefrogs") and remain in the vicinity of permanent water throughout the year. In Canada, they are found along muddy and sandy shores and in emergent aquatic vegetation of ponds, marshes, and ditches. They call from early June to late July and each female may lay up to 400 eggs which hatch in three to four days. The tadpoles metamorphose in five to ten weeks. Metamorphosed *Acris* are opportunistic feeders, primarily on small arthropods. On Pelee Island, they probably breed the year following transformation, and the population turnover is likely close to 100% a year. Blanchard's Cricket Frog should be designated *Endangered* in Canada because of its very restricted range and low numbers (presently one known surviving population on Pelee Island), its disappearance from Point Pelee, and its documented decline on Pelee Island which is likely due, in part, to human alteration of its habitat.

#### Introduction

The Cricket Frog, *Acris crepitans*, is a small and semi-aquatic member of the family Hylidae ("treefrogs"). Adult snout-vent length equals 16 to 38 mm (Conant 1975) and if examined closely it is easy to identify. It is warty in appearance and has a pointed snout, relatively long hind legs, extensively webbed toes on the hind feet, and underdeveloped toe discs. Individuals are usually brown or grey, have a prominent V-shaped mark between the eyes, usually have faint dorsal markings, and are more rarely red or green than other *Acris*. There is a characteristic broad, ragged-edged dark stripe on the rear surface of the hind legs. The male breeding call sounds like pebbles being clicked together in rapid succession. *Acris crepitans* is active both day and night in and along the margins of permanent water, into which they rapidly take cover in a series of quick erratic hops (Conant 1975; Cook 1984).

An exhaustive account of the early literature (1825-1926) on *Acris* was presented by Wright (1932) along with original data from Georgia, but all the forms are treated as a single species. The Cricket Frog was first described as *Rana gryllus* by LeConte in 1825, and the genus *Acris* was created for it by Duméril and Bibron in 1841. *Acris crepitans* was described by Baird in 1853 and subsequently regarded as a subspecies of *A. gryllus* by Cope in 1875 (Schmidt 1953). Blanchard's Cricket Frog was first described as distinct by Harper (1947) as *Acris gryllus blanchardi*. Neil (1954) revised their taxonomy and regarded *A. gryllus* and *A. crepitans* as distinct species.

In Canada, the occurrence of *Acris crepitans* is verified only for Essex County, in extreme southwestern Ontario (Figs. 1, 2). Specimens have been collected at Point Pelee and Pelee Island. Early Ontario authors apparently confused the Chorus Frog, *Pseudacris triseriata*, (formerly called the Swamp Cricket Frog) with *Acris*. Garnier (1881) gave two forms: "*Acris Gryllus* var. *crepitans*. Cricket Frog. The most noisy of frogs for its size. Common." and "*A. gryllus* var. *gryllus*. A variety here of which I have two specimens I can only relegate to this. Taken near Lucknow, Co. Bruce, May 23, 1879." However he omitted Chorus Frogs from his list and it is likely that he actually observed this common species. Nash (1905) also listed "*Acris gryllus*" and remarked that "The Ontario form is *A. g. crepitans*. This can scarcely be considered a Tree Frog. Its home is in the high grasses surrounding the marsh where, if disturbed it can take refuge in the water." He does give the "Swamp Tree Frog" (as

*Chorophilus* [= *Pseudacris*] *nigritus*) with the comment "The variety here is *C. n. triseriatus*. It occurs on the north shore of Lake Superior and westward into Manitoba, but I have no records of its capture in any other part of Canada." The latter reference is clearly to the Boreal Chorus Frog, now *Pseudacris triseriata maculata*. He likely confused its common southern Ontario subspecies, now *P. t. triseriata*, which he omitted, with *Acris crepitans*. These records clearly cannot be interpreted as indicating a greater historic range for *A. crepitans* in Ontario (F. R. Cook, personal communication).

The first Canadian specimen of *A. crepitans* was apparently one taken in June 1913 by P. A. Taverner on a National Museum of Canada expedition to Point Pelee, Essex County (NMC 564). Although both Taverner (1914) and Patch (1919) published notes on the reptiles observed on this survey, neither included any amphibians and this specimen has been overlooked until now. Although somewhat shrivelled, its identity seems certain (F. R. Cook, personal communication).

The first verifiable published record for Ontario (Logier 1925) is based on a single calling male collected at Point Pelee on 15 July 1920. Logier (1937) included only this record. Logier and Toner (1942) listed the species without locality. Mills (1948) included northwestern Canada along with Logier's Point Pelee record. Dickerson (1906) had earlier indicated it occurred in the "northwest" and this was repeated in North American checklists [e.g. Stejneger and Barbour (1943)] as being the Canadian northwest but is likely that its basis was misidentified *Pseudacris* or an erroneous projection of expected range - even references as recent as Schmidt (1953) were still crediting *A. crepitans blanchardi* with a range "from South Dakota ... west to the Rockies" (F. R. Cook, personal communication). Logier (1952) and Logier and Toner (1955, 1961), however, discarded the northwest reference, citing only Point Pelee and a new addition, Pelee Island.

On Pelee Island (Fig. 3; Appendix 2), 17 specimens had been taken in 1950 by a Royal Ontario Museum field party and many more observed or heard (see Appendix 1). F. R. Cook and M. G. Foster collected one on the island 6 September, 1961 and FRC and J. C. Cook another 16 April, 1963 (National Museum of Natural Sciences 5789 and 6905). CAC and H. Hedges collected two 19 June, 1970 (NMC 14822), and CAC two 4 May 1971 (NMC 14825), and additional specimens the third week in October 1971 (NMC 14833), 14-18 September 1972 (NMC 14872; 14873-1,-2; 14874). Since 1979, however, it has been recorded only one location. We checked all known *Acris crepitans* sites on the island in 1982, and made additional surveys in 1983 and 1984 (Oldham and Sutherland 1986). No reports were received in 1985 or 1986 (Oldham 1988; Weller and Oldham 1988). However, Paul Pratt (personal communication), heard them at 1989 at the same location as our 1982 observation.

The only report from Point Pelee subsequent to Logier (1925) was that of a single individual calling 22 May, 1972 by Don Rivard (Rivard and Smith 1973). However, Rivard had no previous first hand experience with the call of the species, the calling date is remarkably early for this species in Canada, and no substantiated records have been made since, either by the naturalists employed at the Point Pelee Park nor during searches by both the present authors and by P. D. Pratt, all who made trips there specifically to search for it at optimum times for the species to be heard. Cook (1984) suggested that its continued existence at Point Pelee is doubtful and we agree.

No other substantiated records exist for Ontario, although there are a scattering of sightings or calls tentatively reported from the southwestern mainland (see Fig. 2). In Essex County, during 1979 and 1980 CAC and David Perrin observed what they thought was this species near Lighthouse Cove, Essex County, but none could be captured; in 1981 CAC and Paul Pratt heard what they identified to be *A. crepitans* calls at the mouth of the Canard River, but site surveys in 1982, 1983, and 1984 had negative results; in 1985, a report of a single *A. crepitans* heard on 18 June at the Combar Sewage Lagoon was sent to the Ontario Herpetofaunal Summary but no details were provided. In Haldimand-Norfolk Regional Municipality, one heard 15 July 1976 at Big Creek Marsh by P. S. Taylor of the Canadian Wildlife Service (Bradstreet 1977), one heard near the base of Long Point on 19 April 1984

(Oldham and Sutherland 1986), and several heard in the Turkey Point Marsh by George North (Gartshore et al. 1985) have been reported. Although all the observers are credible and often experienced, there is nothing in any of these reports to clearly rule out confusion with other superficially similar small frogs, particularly *Pseudacris triseriata*. Calls of unseen individuals in isolation are often capable of fooling the best trained ear and sight observations of frogs are rarely reliable for small individuals without the close examination possible with the animal in hand. These reports are all most striking for the failure of observers to provide any subsequent confirmation despite the great interest in discovering a more extensive range for the species in Ontario. At present they can only serve to encourage further searches and to emphasize the necessity of documentation by verifiable photographs, specimens or tape recordings.

### Distribution

Blanchard's Cricket Frog, *Acris crepitans blanchardi*, is widely distributed in the United States (Fig. 1), extending from extreme southwestern Ontario to the Rio Sabinas Valley in Coahuila, Mexico (Conant 1975). A single specimen from 1905 may be evidence of its former occurrence in Arizona but it is now thought to be extirpated there due to increasing aridity in the collection area (Frost 1983).

The only other race recognized for the species, the Northern Cricket Frog, *Acris c. crepitans*, ranges to the south and east of Blanchard's Cricket Frog, occurring from Long Island, New York, to the Florida panhandle and west to eastern Texas (Fig. 1). A second species, *Acris gryllus*, has two subspecies: *A. g. gryllus*, the Southern Cricket Frog, ranges from southeastern Virginia to the Gulf Coast and Mississippi River; *A. g. dorsalis*, the Florida Cricket Frog, occurs in southeastern and extreme southwestern Georgia to the southern tip of Florida (Conant 1975).

In Canada, Blanchard's Cricket Frog occurs at the southern tip of the Carolinian life zone in Ontario (personal communication, J. A. MacLean). However, it should be noted that the Carolinian designation is not very useful in this context because in its broadest sense it embraces much of eastern North America. As it is generally used, it implies to the public mind an eastern deciduous forest habitat, whereas *A. crepitans* has affinities with a mid-continental, more "western", moderately arid-adapted, fauna with a distribution centre in and to the west of the Mississippi drainage basin (Bleakney 1958; Fig. 1), rather than of the eastern forest habitat. This, and some other amphibians and reptiles restricted to southwestern Ontario, probably spread into the province at a time of more arid conditions that at present and some may have thrived particularly well during the presence of the edge of the prairie peninsula effect some 5000 to 7000 years ago (personal communication, F. R. Cook; see also Bleakney 1958)

### Protection

Currently, Blanchard's Cricket Frog is not protected under Ontario's Endangered Species Act (Ontario 1971), although it has often been included in discussions of rare, threatened, or endangered species in the province (Cook 1964, 1970, 1977; Campbell 1969, 1977; Stewart 1974; Parsons 1976; Bowman 1978). In the United States, only New York and Wisconsin list *Acris crepitans* under their Endangered and Threatened Species laws. New York considers *A. crepitans*, to be threatened and requires a permit and prior approval for investigations of the species (Anonymous 1982). Wisconsin added *A. crepitans blanchardi* to its list of endangered species on 1 December 1982 (Wisconsin Department of Natural Resources, 1985).

Land owned by the Ontario Ministry of Natural Resources on Pelee Island has the last confirmed population of *Acris crepitans* in Ontario. By virtue of the site's status as a Provincial Nature Reserve, the *A. crepitans* population is legally protected there. However, the site is seldom patrolled and has not been managed with *A. crepitans* in mind.

Historic *Acris crepitans* populations on Pelee Island were mainly on private land and very vulnerable to drainage and other changes in land use. *Acris crepitans* has also disappeared from protected areas: one provincial nature reserve on Pelee Island and Point Pelee National Park.

#### Population Size and Trend

On Pelee Island, *Acris crepitans* might have been widespread and abundant in the former large interior marsh (Campbell 1971) which comprised most of Pelee Island prior to dyking and draining in the 1880s and 1890s (Hooper 1967). No documentation of numbers was made, however, until 1950 (Appendix 1). During the 1970s, one of us (CAC) recorded populations at twenty sites around the Island, with high numbers for an individual year being twelve sites in 1972 and 15 sites in 1976 (Appendix 2). Apparently the populations were decimated in 1977-78. Since one of us (MJO) began visiting the Island in 1979, *Acris crepitans* have only been recorded one locality, despite several searches of all previously known sites. At this single remaining site the highest recent estimate of individuals calling was about 30 on 8 June 1984 by Al Sandilands (Oldham and Sutherland 1986). No records were reported to the Ontario Herpetofaunal Summary in 1985 or 1986 (Oldham 1988; Weller and Oldham 1988). In 1988, James Kamstra spent much of the summer on Pelee Island and, although primarily engaged in a botanical survey, he had ample opportunity to make herpetological observations, but did not hear or see any *Acris*. However, in 1989 Paul Pratt reported hearing two calling at Fox Pond, establishing the continued existence of the species there.

In most states within its range, *Acris crepitans blanchardi* is common and widespread. Population declines and concern for this species have been mentioned in several states at the northern limits of the species range. Although not officially recognized as a threatened or endangered species in Michigan, Harding (1978) considered the species "seemingly uncommon" in Michigan. In Wisconsin, *A. crepitans* was once very common, but during the late 1970s they diminished rapidly and are now extremely rare in the state for reasons that are unknown (Vogt 1981). In 1982, Blanchard's Cricket Frog was added to the Wisconsin Endangered and Threatened Species List under the endangered category (Wisconsin Department of Natural Resources, 1985). New York considers *A. crepitans* a threatened species (Anonymous, 1982); in Minnesota, it has been considered peripheral and is not currently protected but populations are thought to be stable (Ashton, 1976). *Acris crepitans* occur on the Ohio islands south of Pelee Island (Langois 1964) but the present numbers are unknown.

Historically, *A. crepitans* was known in New York from Long Island, Staten Island, and the Shawangunk-Hudson Highlands area of southeastern New York. Loss of habitat has led to the extirpation of all or most of the *Acris* populations on Long Island. Loss of habitat has also been a major factor causing the decline of *Acris* on Staten Island but there are thought to be a few local populations still extant. Although there is still apparently much suitable habitat available in Orange, Rockland, Ulster and Westchester Counties, there have been few records in recent years and the extent and reasons for the decline of *Acris* in this portion of New York is unknown (A. Breisch, personal communication).

#### Habitat

Blanchard's Cricket Frog occurs in a variety of habitats: along lakes, ponds, rivers, streams, occasionally at temporary ponds or rain pools, and even at relatively dry stretches of intermittent streams (Burkett 1984). Throughout most of its range *A. crepitans blanchardi* is a common and conspicuous small frog. It is generally more aquatic than most hylids, and is most aquatic of the hylids in North America (Ralin and Rogers 1972). They do not leave the vicinity of water after the breeding season but remain throughout the summer and fall along the margins of permanent ponds and streams.

It has been suggested (Fitch 1956; Brattstrom 1963) that during periods of falling air temperatures in the evening, *A. crepitans* make periodic trips to the water both for rehydration and for



additional warmth. In the daytime, however, the high body temperature of the frogs suggest that a return to the water is for cooling and replenishing water for subsequent evaporative cooling. Heat gain mechanisms for *A. crepitans* potentially include basking in direct sunlight and, perhaps, direct contact with sunlit water. Heat loss mechanisms may include evaporative cooling, body pressing against cool surfaces, and shade seeking. Prevention of heat loss (but not necessarily heat gain) may also be accomplished through the utilization of cracks and depressions to minimize evaporative cooling (Anderson 1983). Dunlap (1969b) presented evidence for a daily rhythm of heat resistance in *A. crepitans*.

Typically, Cricket frogs is found on muddy shores and among the emergent aquatic plants of the shallows; in ponds where floating aquatic plants are abundant it may venture far out from shore (Walker, 1946). Occasionally *Acris* may be encountered in temporary pools, but generally where these are located near some permanent water. In central and western Ohio, Walker (1946) reports that *A. crepitans* is common along the smaller and more sluggish streams, especially where they flow through open country. Also in Ohio, these frogs are often seen in the thick mat of green algae that covers pasture ponds and old quarry pools (Walker 1946). Minton (1972) also mentions populations being found in water-filled quarries in Indiana. However, on Pelee Island where there are a number of flooded, abandoned quarries, *A. crepitans* has not been seen in this habitat. Cricket Frogs are rarely or never encountered in dense forest or in small pools which are heavily shaded (Walker 1946).

In northeastern Kansas, where *A. c. blanchardi* was studied intensively by Burkett (1969), the preferred habitat is muddy, beach-like edges of small, shallow streams and ponds. He observed that this frog avoided deep water. Irwin (1980) found a single adult of this species near the twilight zone of a cave in Kansas in late December. Most authors (e.g. Walker 1946; Logier 1952; Vogt 1981) indicate that *A. crepitans* seldom wander far from permanent water, except sometimes during rainy weather. In contrast, Collins (1982) suggests that Blanchard's Cricket Frog evidently wanders great distances from water during both dry and wet weather, and Fitch (1958) stated that many die during these wanderings, thus keeping populations at an optimal level. Pyburn (1958) studied a Texas population and found that during dry periods frogs were restricted to the edge of the pond and were seldom seen more than a few feet out in the water. Periods of precipitation, however, not only allowed extensive movements, but apparently furnished the stimulus for them.

### General Biology

Over its extensive geographic range, the breeding season of *Acris crepitans* varies greatly with latitude. Near Austin, Texas, periods of calling have been reported as early as 30 January and as late as 10 September (Blair, 1961). In another Texas study, Pyburn (1958) first heard calling on 5 February, with peak breeding in April and May, and calling tapering off through June. Large choruses were heard as early as late April in Kansas, and had ceased by the last week in July (Burkett 1984). In Illinois, Smith (1961) states that calling occurs from late April until late summer. In Ohio, *Acris* choruses are noted from early May through June and into July (Walker 1946). Iowa *Acris crepitans*, according to Johnson and Christiansen (1976), call from mid-May to late July. In Wisconsin, Vogt (1981) reports calling from late May through July. Frogs begin calling each year in the daytime; but later, as temperature increases, calling also occurs at night (Blair 1961; Burkett 1984). Pelee Island *A. crepitans* have been heard calling between 5 June and 28 July (Appendix 1 and 2). At Point Pelee, the single confirmed *Acris* calling was on 15 July 1920 (Logier 1925).

Warm temperatures in spring instigate reproductive behaviour. Minton (1972) noted that males in a shallow stock pool began calling several days before males in a nearby but deeper and colder quarry. Pyburn (1959) found his first calling Cricket Frog of the year on 5 February at a water temperature of 21°C and an air temperature of 22.2°C. The lowest daytime calling temperature

measured by Blair (1961) was 23°C on 18 March. The lowest temperature that night calling was heard was 24.6°C on 17 March. With the latter exception, all night calls were heard at temperatures of 29.7°C or above. In Texas populations of *A. crepitans* the call was not affected by changes in relative humidity but there was a relationship between rate and atmospheric temperature (Jackson 1952). Perrill and Shepherd (1989) concluded that males modify their calls in response to calls of conspecifics and that these interactions serve as signals to space individuals in a chorus.

Chorusing in *A. crepitans* does not always indicate that egg-laying is taking, or will take, place. This frog is said to maintain choruses for other, unknown, reasons (Collins 1982). Weather conditions can apparently initiate calling that is not followed by breeding. For example, in Indiana a late chorus was heard on 21 August following a thunderstorm (Minton 1972). However, in Texas, Blair (1961) mentions that heavy rain in August, September and October failed to stimulate calling.

Pyburn (1956, 1958) found that in Texas young-of-the-year from the early breeding may themselves breed the season they transform with the first females with eggs collected on 23 July and the last on 15 September. In Kansas, they do not form a second breeding chorus the year they transform (Burkett 1984). The first females with developed eggs were taken by about mid-April but spent females were noted from 31 May to 29 June (varying with year and locations). By 13 July, although some females were still fully gravid, most had only a few eggs. One of the latter was found as late as 3 August, leading to the suggestion that either some eggs were never laid or that females may mate and lay eggs twice during the breeding season. Dates of amplexus observed for Ohio *Acris crepitans* were from 7 May to 24 June (Walker 1946). In Canada, with a much shorter season, females probably breed only once a year and do not reproduce the year they transform.

The eggs are attached singly or in very small clusters to vegetation or other objects beneath the surface in shallow water (Wright and Wright 1949). Vogt (1981) reported that in Wisconsin the eggs are attached to vegetation in flowing water in a surface cluster of 10 to 15 eggs. Livezey (1950) described *Acris* eggs in detail. Individual females may lay up to 400 eggs (Collins 1982). The eggs hatch in three to four days into rather secretive bottom-dwelling tadpoles. These often have black-tipped tails in pond habitats and Cadwell (1982) hypothesized that this functions to divert attacks of large dragonfly larvae away from the more vulnerable head and body. Tadpoles metamorphose in 5 to 10 weeks (Burkett 1969) at a length of 10 to 15 mm (Walker 1946; Minton 1972). In Indiana, Minton (1972) found the greatest number of newly transformed during July and August. Walker (1946) recorded Ohio transformations between 24 July and 8 September. Of three *Acris* taken on Pelee Island 16 September, 1962, one had a tail stub indicating recent transformation.

In northern Texas young males had motile sperm in early September and in Kansas nearly all males had well-formed sperm by early October; a few males also developed chin spotting in the fall, but the vocal pouch was not formed until late March or April (Burkett 1984). In contrast (Brenner 1969) concluded that *Acris* must overwinter before attaining sexual maturity. A male collected on Pelee Island on 15 or 16 May, 1972 (National Museum of Canada 14873) had small testes and appeared to be immature (F.R. Cook, personal communication).

The sex ratio of newly metamorphosed Kansas *Acris* was four females per male but in frogs over three months old males usually predominated; the overall percentage of males was 57.6 in 2131 frogs (Burkett 1984). In Texas, Pyburn (1958) found a ration near 1:1 in a sample of 152.

Growth in *Acris* is rapid from metamorphosis to maturity. Texas *A. crepitans* grew in snout-vent length from approximately 0.1 mm/d from 7.0 to 21 mm, after which the rate of increase declined (Bayless 1969a).

In Kansas, Burkett (1984) found an almost complete turnover in his study population in one year. Johnson and Christiansen (1976) also reported an annual population turnover in Iowa. Adult mortality is high during the latter portion of the breeding season. During the period of metamorphosis

the change from a population of adults to one almost entirely composed of juveniles occurs in less than a month. Approximately half the frogs alive in early September die before mid-October. Almost 95 percent do not survive the winter, and the survivors are further reduced through the breeding season. Less than 0.1 percent are alive in the following September or October (Burkett 1984). In southern Louisiana, however, some adults have been found to survive through two breeding seasons (Bayless 1969b).

The observations of *Acris* wintering sites are few and fragmentary. In the southern part of its range, eg. Texas, *A. crepitans* can be active all year (Pope 1919, Jameson 1950, Pyburn 1958, 1961). Bayless (1966) suggested that they may regularly overwinter terrestrially and published observations substantiate this view except where springs modify winter temperatures. In Louisiana Walker (1963) found them under debris in the winter and in Oklahoma Blair (1951) found fifteen under large rocks near a spring in January. Linsdale found them in warm springs throughout the winter in Kansas. In west-central Indiana Blatchly (1892) collected them in December and February. In southern Illinois, Gray (1971b) collected individuals in December, January, February, and March in and around a spring where the water temperature was 12.5°C and the air varied from -4 to 12°C. At a spring in central Illinois five were collected when the water was 2°C and the air 8°C. Pope (1964) reported "hibernating" individuals among leaves and water weeds and under logs in winter near Chicago. Walker (1946) found some hibernating in Ohio under a mass of cattails and rushes near a lake and others buried 8 to 14 inches in gravelly soil. The latter site was under some willow trees at the edge of a small pond on Middle Bass Island (about 10 km southwest of Pelee Island) on 6 December.

In McLean County, Illinois, Gray (1971b) observed that during the fall, as average temperatures and day length decreased, *Acris* moved progressively further up the bank away from ponds. By 23 October, frogs were no longer on the surface but located in cracks produced in the banks through a combination of freezing, drying and contraction of the mud surface. Temperatures in these cracks averaged 1.5 to 2 °C above air temperatures. Experiments confirmed that northern *Acris* do not enter water or burrow when environmental temperatures fall, but they utilize natural depressions, holes and cracks away from surface water. In the spring, Cricket Frogs become active a month or more before the first choruses are heard. In Ohio, Walker found them active as early as 14 February, but choruses are not heard there until early May through June and into early July.

The call consists of a series of sharp, clicking notes which have been aptly compared to the sound produced by striking two pebbles or marbles together. The first notes typically are given rather slowly; the later ones more rapidly and often in groups of two or three. At close range the call sounds loud, but it has far less carrying power than that of the Spring Peeper, *Pseudacris crucifer*, or the Chorus Frog, *P. triseriata* (Walker 1946).

*Acris* are largely opportunistic feeders, primarily on small arthropods. Garman (1892) first reported on their diet and stated that it consisted largely of aquatic insects. Jameson (1947) reported stomach contents of 94 individuals collected in Kansas and Nebraska. Two series were similar with about 50% beetles, mainly aquatic larvae of *Dytiscus*. Small spiders made up almost 25%. Third in importance were Diptera, mainly the larvae of midges (Chironomidae) and muscids (Myodaria). Hemiptera present were mostly water-boatmen (Corixidae). Springtails (Collembolans) occurred in only three stomachs but one frog had eaten more than 200 of them. All Collembolans eaten were species that live on the surface of the water. Johnson and Christiansen (1976), Labanick (1976) and Burkett (1984) have also reported *Acris* feeding on Collembolans. Jameson (1947) concluded that most of the animals he studied were feeding in the water, both at the surface and on the bottom.

Other investigations have documented a more terrestrial diet. Hartman (1906) reported that in the stomachs of seven *Acris* he found "ants, a caterpillar, lady-bugs, snapping beetles, a spider, one small crayfish, and small beetles unidentified". Gelbach and Collette (1959) reported that in eight *A. c.*

*blanchardi* examined "two contained carabids, two had pyralid larvae, and one each contained mirids and small spiders". Dulleman and Schwartz (1958) summarized the stomach contents of 36 *A. gryllus dorsalis* from Florida and found mostly beetles and ants. Johnson and Christiansen (1976) examined the contents of 218 stomachs of *A. c. blanchardi* in Iowa and found a mostly terrestrial diet. Of the 214 that had feed, arthropods comprised 97.6% by volume, with insects at 85.7%. Diptera (20.2%), Coleoptera (11.9%), and Homoptera (10.5%) were the orders most commonly represented. Their study concluded that food consumption was greater in larger frogs, frogs with small fat bodies, female frogs, and frogs caught in June and July. They determined that the stomach was emptied every 8 hours. *Acris crepitans* were found to feed both day and night, and an estimated 4800 food items could be consumed per frog per year in a population where the active season was 1 April to 1 November.

#### Limiting Factors

The entire interior (about 2800 ha) of Pelee Island was once a single marsh which might have supported a larger *Acris* population. It was drained before the turn of the century. Whatever the original numbers of Cricket Frogs, there were many populations in 1950 when their occurrence there was first documented (Appendix 1). A subsequent decline resulted in almost total obliteration of the species on the island in the late 1970s (see Appendix 2).

Drought has been implicated in the disappearance of a Michigan *Acris crepitans* population (Collins 1975; Collins and Wilbur 1979). Dredging and draw-down of the many canals on Pelee Island to remove silt and aquatic vegetation almost certainly adversely affected Cricket Frogs there. Artificial drainage and landfill can be directly related to the elimination of the sizable population formerly present at the South Bay Marina Marsh (Curry Marsh).

Fluctuating water levels in Lake Erie have caused flooding and scouring of shoreline lagoons and the breaching of pools has allowed Carp (*Cyprinus carpio*) access to *A. crepitans* breeding areas. Natural flooding is implicated in the disappearance of populations at one site. None have been heard there since the major floods that occurred in November 1972 and March 1973 breached dykes and flooded many hectares of agricultural land to create Lake Henry. Other *A. crepitans* sites around the periphery of the island may have been affected by these storms as well.

Predation by man is probably not a significant limiting factor now because frogs are not abundant enough for it to be worth the time for fisherman to collect them as bait. Road mortality should not be especially high as this species stays close to the water all year, but one was collected by F.R. Cook in 1961 on a road.

Predation by waterbirds may have contributed to the decline of the species on Pelee Island. Campbell (1976) speculated that the shifting of a large heronry from a woods site to the lagoon may have altered *A. crepitans* numbers at the remaining site. In 1981 the heronry again relocated, this time to nearby Middle Island; however, the herons still fed at the *A. crepitans* locality, though in lesser numbers. Logier (1952) noted *Acris crepitans* in the stomachs of American Bitterns (*Botaurus lentiginosus*) taken on nearby North Bass Island, and it is probable that the large numbers of Black-crowned Night Herons (*Nycticorax nycticorax*) which feed on Pelee Island are preying to some extent on Cricket Frogs. Fitch (1958) observed both Great Blue Herons (*Ardes herodias*) Green-backed Herons (*Butorides striatus*) feeding on *Acris* in Kansas.

It was suggested by Oldham (1981) that the disappearance of breeding herons from the last occurrence site for *Acris crepitans* might allow a resurgence of Cricket Frog numbers there. However, it appears that the highly predacious Bullfrog (*Rana catesbeiana*) has benefited instead, perhaps to the detriment of *Acris*. In eight years of visits (1979 to 1986), of of us (MJO) has noted a dramatic increase in Bullfrogs to several hundred adults and several thousand larvae at the remaining *Acris crepitans* site. It has been long known that a Bullfrog "will eat almost any moving object that it can swallow or

partially swallow" (Dickerson 1906) and frogs and tadpoles are recorded food items in almost all studies of Bullfrog food habits (eg. Frost 1935; Kirn 1949; Korschgen and Moyle 1955; Cohen and Howard 1958; Korschgen and Baskett 1963; Fulk and Whitaker 1969; Taylor and Michael 1971; Bruggers 1973; Moyle 1973; see Burry and Whelen 1984 for a more comprehensive list). Smith (1977) reported that 80% by volume of the food of large frogs at the University of Kansas Natural History Reservation (and other nearby ponds) consisted of small frogs. Blanchard's Cricket Frog is a known food item of the Bullfrog (Lewis 1962; Tyler 1978). Burkett (1984) stated that the presence of a large Bullfrog population at his study ponds "undoubtedly accounted for much of the predation of *Acris*". Bullfrog tadpoles are also known to consume the eggs and tadpoles of other species (Erlich 1979).

Potential mammalian predators on *Acris*, such as Raccoons, skunks, and Opossums, are scarce or absent on Pelee Island. However, two natricine snakes, the Island Water Snake, *Nerodia sipedon insularum*, and the Common Garter Snake, *Thamnophis sirtalis sirtalis*, are common to abundant, and both feed extensively on frogs (Carpenter 1952; Wright and Wright 1957; Fitch 1965). The efficiency of some natricine snakes in capturing *Acris* (1 frog in 4.5 minutes) was documented in *Thamnophis proximus* by Wendelken (1978). Other potential predators of perhaps lesser importance include large aquatic spiders (eg. *Dolomedes sexpunctatus*: Burkett 1984), predacious fish (Grubb 1972; Burkett 1984) [although the latter do not normally occur in the same habitats as Cricket Frogs on Pelee Island], dragonfly larvae (preying on tadpoles: cf. Savage 1962), leeches (Savage 1962); turtles (such as *Chelydra serpentina*, *Emydoidea blandingi*, and *Chrysemys picta*, all present on Pelee Island), and certain other birds (e.g., Killdeer, Herring and Ring-billed gulls, Red-winged Blackbird, Common Grackle: Beaseley and Carothers 1974; Burkett 1984).

There are a number of references to parasites in *Acris crepitans*: two species of nematodes in northwestern Ohio (Ashton and Rablais 1978); trematodes (Brooks 1979); cestodes in 15.4% of 26 frogs in Iowa (Ulmer and James 1976); a tymbicid mite in Nebraska (Tyser 1972); large numbers of fluke metacercariae, probably *Zeugorchis megacystis*, in 97.5% of abdominal cavities (Stewart 1960).

Pelee Island is largely agricultural. Minton (1972) mentioned that the species was intolerant of pollution. Campbell (1975) reported high applications of pesticides and fertilizers there. Runoff into the drainage canals, formerly used by *A. crepitans* may have contributed to their disappearance. Birge et al. (1980) found that aquatic or moist terrestrial habitat amphibians were most sensitive to organic pollutants. Hall and Kolbe (1980) determined that tadpoles concentrate pesticides up to 60 times the level in the water they are in. Minton (1972) stated that Cricket Frogs seem highly sensitive to pesticides and pollution. Flickinger et al. (1980) found paralysed Cricket Frogs 15 minutes after treatment of Texas rice fields with Furadan 3G. Flemming et al. (1982) exposed *A. crepitans* to varying concentrations of parathion in water and found frogs from 1.0 and 10 ppm groups accumulated 0.08 and 4.6 ppm parathion, respectively. One of four American Kestrels (*Falco sparverius*) fed frogs from the 10 ppm group died from organophosphate poisoning less than 3 hours after consuming five frogs. There was no Kestrel mortality however in groups from lower treatments and these represent levels more likely to be encountered. However, for *A. crepitans* and *A. gryllus* in Mississippi, Ferguson (1963a) and Boyd et al. (1963) found that mortality was lower where their had been previous exposure. Vinson et al. (1963) found that in areas previously treated with DDT, toxaphene, methyl parathion, and endrin, frogs had lower subsequent mortality to aldrin treatments. Campbell (1978) reported analysis of 7 Pelee Island *Acris* which showed residues (in ppm) of 0.02 Heptachlor Epoxide, 0.02 dieldrin, 0.00 DDT, 0.12 to 0.17 DDE, 0.10 to 0.16 PCBs (1254/1260), and 0.04 to 0.05 mercury. The DDE and PCB levels were considered high, while the mercury was considered low.

A flooded quarry on Pelee Island has been used as a dump site for old implements, cans, drums, bottles, and garbage. Prior to the mid 1970s diesel fuel was dumped into it every year to kill snakes (T. Beech, personal communication). Cricket Frogs formerly breed there (about 24 males calling

in 6 June 1974: Campbell 1975) but have vanished, although salamanders (*Ambystoma* sp.) and snakes (*Nerodia*, *Storeria*, and *Thamnophis*) are still common.

Although acid precipitation has been implicated in amphibian population declines elsewhere (e.g., Pough 1976; Pough and Wilson 1977; Hagstrom 1980; Dunson and Connel 1982; Cook 1983), the calcareous bedrock on Pelee Island may buffer its potential effects there.

#### Special Significance of the Species

Taxonomy and comparative ecology of the two species of *Acris* have been studied by Dunn (1938), Harper (1947), Neil (1954), Mecham (1964), Bayless (1966, 1969b) and Blem et al. (1978). Although *Acris* has traditionally been placed in the family Hylidae, *A. crepitans* has 22 chromosomes (Bushnell et al. 1939; Duellman and Cole 1965; Cole 1966; Nur and Nevo 1969; Bogart 1973) and the karyotype is very similar to some species of *Leptodactylus* which has led to one suggestion that it could be allied to the family Leptodactylidae (Bogart 1973). Gaudin (1974) found *Acris* more closely related to *Pseudacris* than to *Hyla* in a phenetic comparison of 20 osteological characters, but Hedges (1986), in an electrophoretic analysis of holarctic hylid evolution, found its systematic position to be unclear.

*Acris crepitans* exhibits a heritable stripe colour polymorphism in which green is dominant to non-green and red is dominant to gray (Pyburn 1961a, 1961b). It has received wide attention for genetic (Pyburn 1956; Wendelken 1968; Isaacs 1971; Gray 1971a, 1972, 1977, 1978, 1983, 1984; Nevo 1973a; Milstead et al. 1974) and geographic (Dessauer and Nevo 1969; Salthe and Nevo 1969; Dunlap 1972, 1973; Capranica et al. 1973; Guttman 1973; Nevo 1973) analyses.

*Acris crepitans* has little or no direct economic significance to humans and the degree of public interest in them is negligible. *Acris crepitans blanchardi* is widespread over much of eastern and central North America and is not considered rare, threatened, or endangered over the vast majority of its range. However, the last known Canadian population represents the subspecies at the northern extremity of its adaptive ability and is a unique part of the original Canadian herpetofauna, especially so because it is one of a small group of amphibians and reptiles that either occur, or now mainly survive, in Canada only on Pelee Island (i.e. *Nerodia sipedon insularum*, the Island Water Snake; *Ambystoma texanum*, the Smallmouth Salamander; *A. texanum* × *laterale*, a hybrid in which individuals can be diploid, triploid, or tetraploid; and *Coluber constrictor foxi*, the Blue Racer. As well, melanistic individuals of *Thamnophis sirtalis*, the Eastern Garter Snake, occur here and only at a few other places in Ontario, mainly Point Pelee and Long Point.

#### Evaluation

Although documented to have had an extensive distribution on Pelee Island until recently, *Acris crepitans* have been recorded there in the last decade only at a single locality. At Point Pelee, the only substantiated locality for mainland Ontario, there has been no confirmed presence in the past 70 years. (One was collected there in 1913 and a second in 1920).

The decline of *Acris crepitans* on Pelee Island seems linked to habitat alternation either as a primary or secondary cause. Even though the single remaining population is in an Ontario Provincial Nature Reserve, no special measures for its conservation are currently taken, and the last report of calling was of only two individuals. Because it has typically a annual turnover of close to 100% in detailed studies elsewhere, one year of reproductive failure could eradicate it. The status for this species in Canada clearly fits the COSEWIC definition of *Endangered*.

Its general abundance and widespread distribution in the United States has no bearing on the Canadian designation which must reflect its status here. However, the reports of declines in numbers in some states at the northern edge of its range may indicate that the potential for recolonization from the south is receding.

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*Explanatory Note* - The Ontario Ministry of Natural Resources has requested the clarification that none of its staff were responsible for the preparation of this report. M.J. Oldham, although now currently employed by the Ministry at its Aylmer Region Office as a District Ecologist, was not an employee at the time (1986) he wrote and submitted the original report but was then employed by the Essex Region Conservation Authority. Craig A. Campbell has never been a Ministry employee, but is a free-lance natural history consultant and a research associate of the Royal Ontario Museum. Current (1990) home addresses are used for both authors to prevent further confusion.

Identification of localities and landowners on Pelee Island have been removed on request as "In order to help ensure the protection of endangered species in Ontario, the Ministry of Natural Resources does not itself publish specific site locations" (letter, dated 16 March, 1990 from J.A. MacLean, Director, Wildlife Branch, Ontario Ministry of Natural Resources).

Francis R. Cook  
2 April 1990

(Editors of this report: Francis R. Cook and David M. Green)

Fig. 1. North American distribution of *Acris crepitans* (based on Conant (1975)).

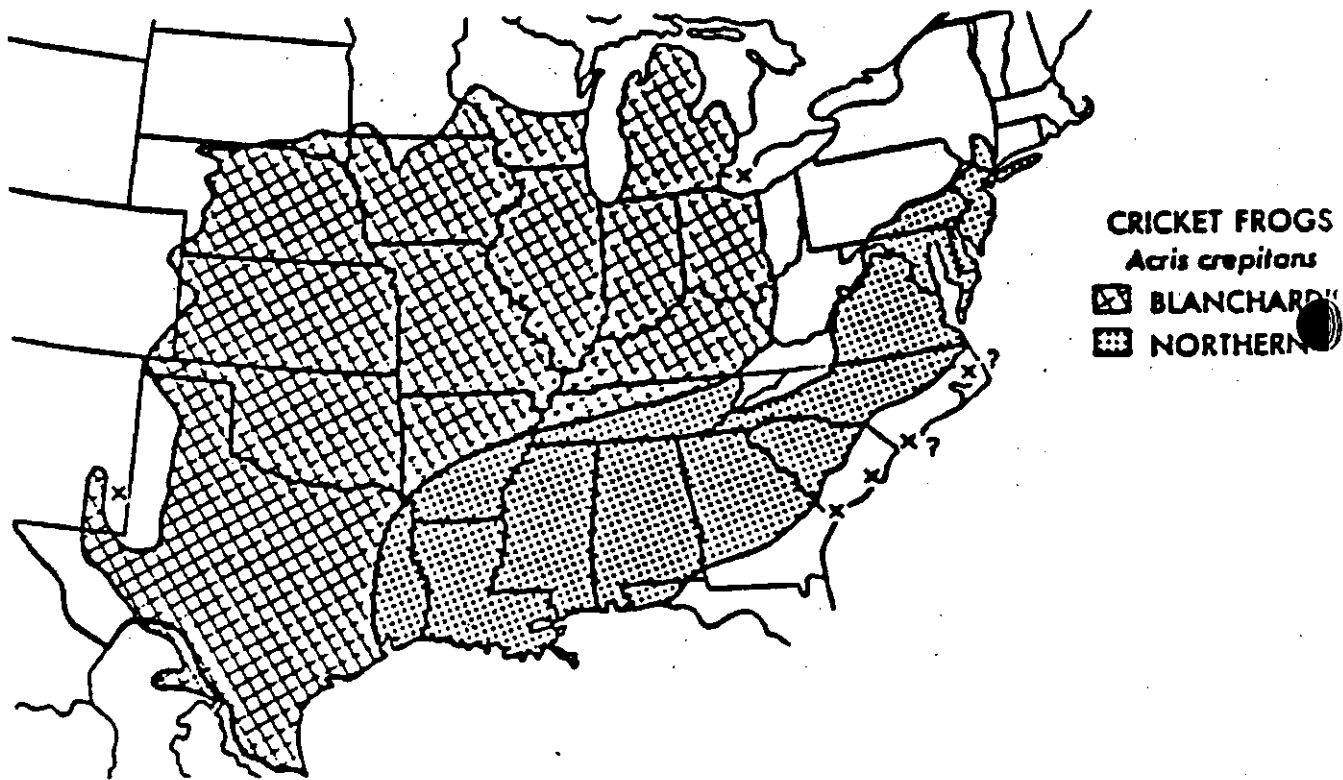


Fig. 2. Canadian distribution of *Acris crepitans*.

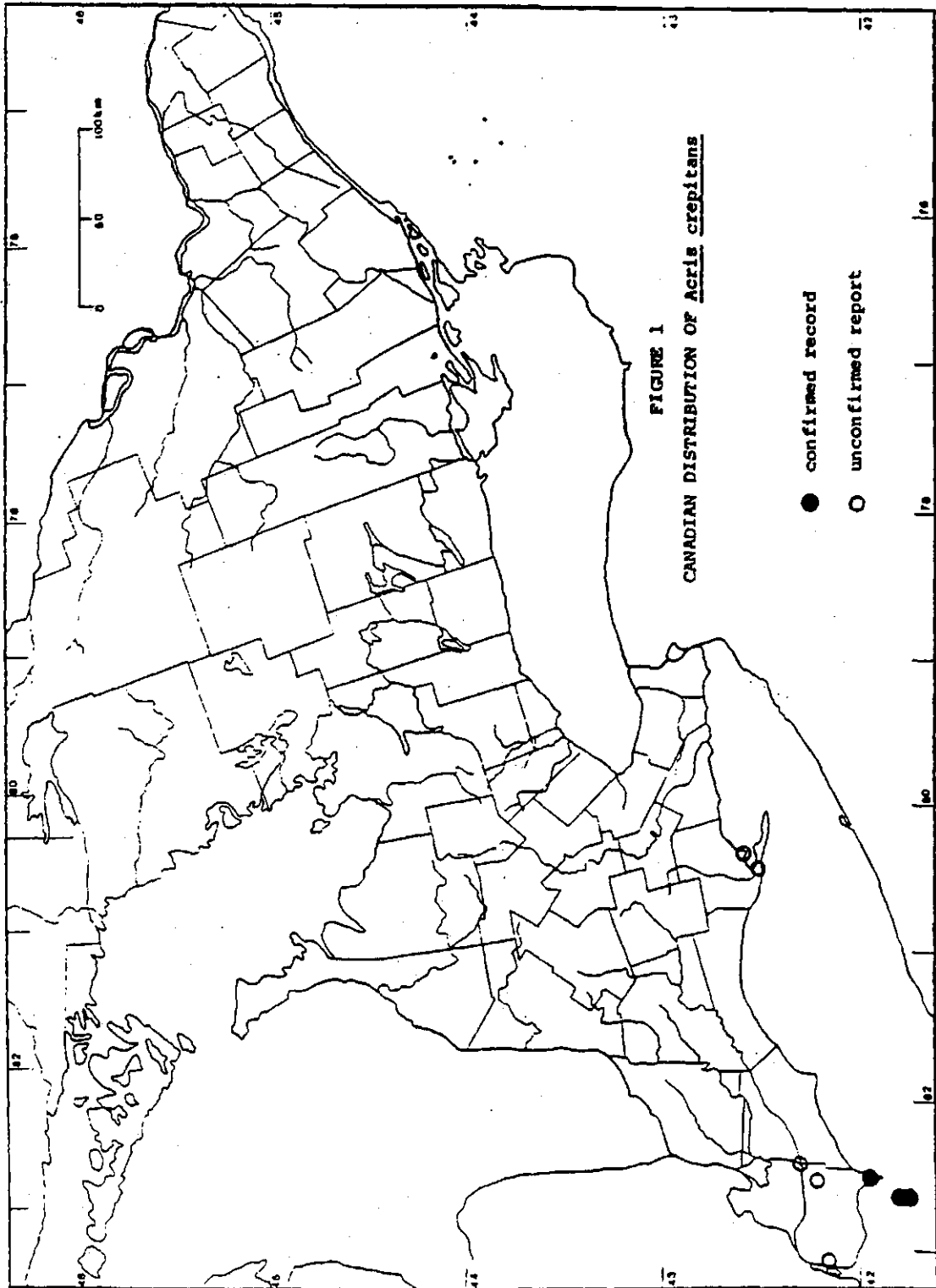




Fig. 3. Pelee Island *Acris crepitans* sites.

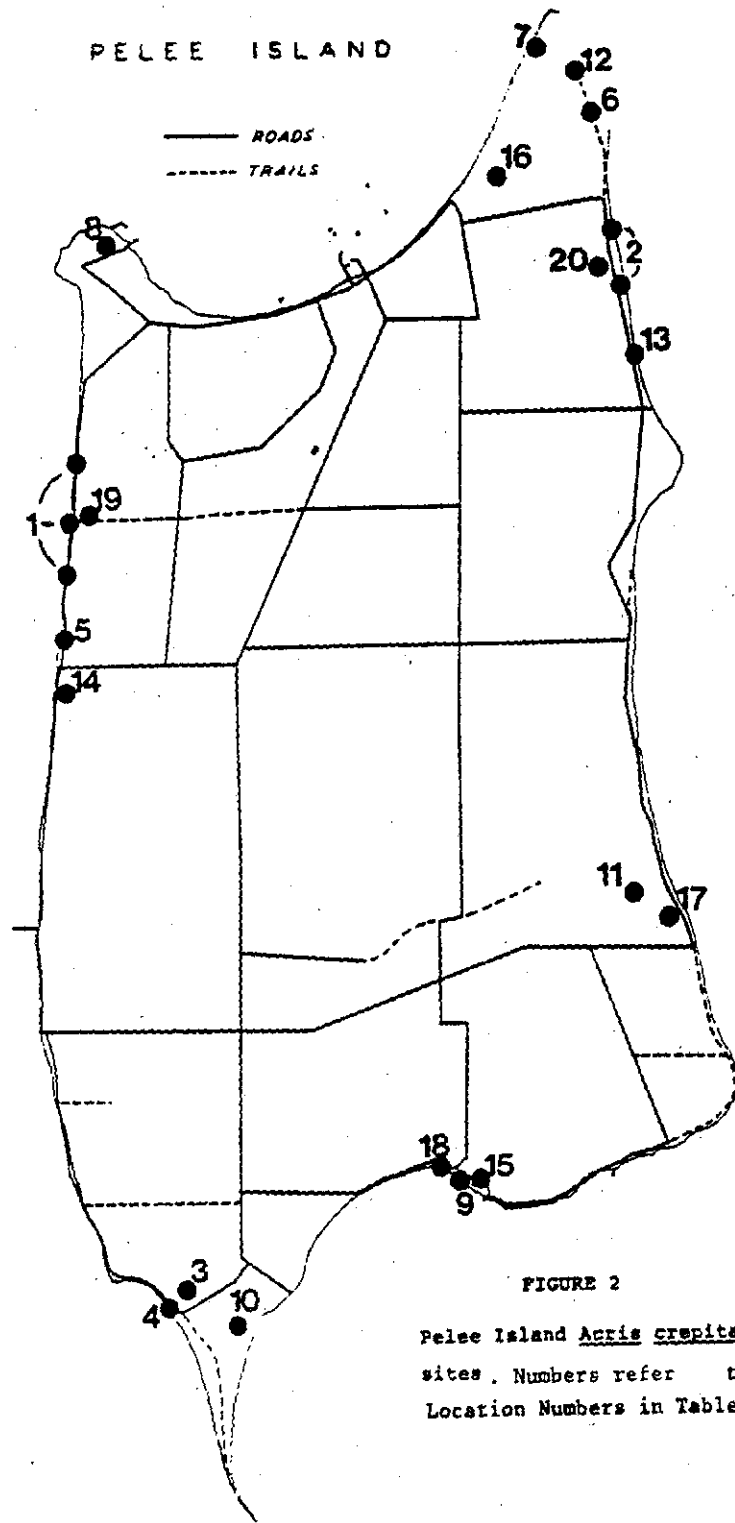


FIGURE 2  
Pelee Island *Acris crepitans*  
sites. Numbers refer to  
Location Numbers in Table 2.

Appendix 1. J. L. Baillie's 1950 observations of *Acris* on Pelee Island (extracted from his journals housed at the Royal Ontario Museum).

Date	Time	Habitat	Numbers	Behaviour
June 5		remnant marsh on east shore	1 caught, 100's heard	
June 7			several	singing
June 13	22:05 - 24:00 hrs		1 heard	
June 14	24:00 hrs		many	singing
June 14			several caught	
June 15	22:00 hrs		some	
June 18	21:45 - 30:00 hrs		some heard	singing
June 19	21:00 - 21:45 hrs		some heard	singing
June 20	08:20 - 11:00 hrs		few heard	singing
June 24	08:20 - 11:00 hrs		few heard	singing
June 29			?	singing
July 1			?	singing
July 4-6			?	singing
July 7			a few	singing
July 12			several, 2 caught, 1 kept	transforming
July 19	a.m.		1 or 2 heard	
July 24	10:00 - 12:30 hrs	marsh	1	singing
July 25			1	singing
July 27			1	singing
July 28			1	singing

Appendix 2. *Acris* on Pelee Island 1970-1984.

Date	Time	Location Number	Habitat	Numbers	Behaviour
June 21, 1970	ca. 2330 hrs	1	floating wood	7 in 70 yds, 5 in 5 yds, as close as 10 ft apart	several taped while singing, one fed twice on flies. 2 males call.
June 21, 1970		20		a few frogs	
June 21, 1970		3	flooded field in algae water	1 adult ♀ cap., about 1 oz. males singing.	
June 21, 1970		4	pool	some found	
June 21, 1970		5		strong chorus	
June 21, 1970		6	ribbon marsh between beach and road, over grown canal	some	
June 21, 1970	1415hrs	7	pickerel weed, water lily, fairly steep shrubby banks	chorus; 2-3 seen, 3 separate choruses	singing
June 21, 1970		8	flooded and abandoned shrubgrown	0	
June 21, 1970		9	overgrown open meadow & wooded road edge	some	singing in places
June 21, 1970		1	Bladderwort, duckweed, fringe of caitail and open water	75 singing (conservative estimate) in 200 yards	
May 4, 1971		10	ribbon marsh	3 caught, 1 photographed	none calling

## COSEWIC

May 5-11, 1971		Surveys of all areas each night with none found			
October, 1971		One immature Cricket frog caught on island and sent to NMC			
June 6, 1972		11	overgrown meadows	0	
June 7, 1972		11	meadow	0	
June 5, 1972	20:55 hrs	9	open tall-grass marsh pH:7.2-7.6	many	singing
June 5, 1972	21:00 hrs	2	narrow strip of marsh and dunal pools	moderate numbers	singing
June 6, 1972		2	open pools	many	singing
June 6, 1972	21:20 hrs	12	canals and marshy lagoons. pH on west side 7.6-8.0 pH on east side 7.0-7.2	?	Singing
June 7, 1972	10:30 hrs	5	beach pool with duckweed and trash. pH: 7.0	?	singing (very wary)
June 7, 1972	16:20 hrs	2	roadside lagoon PH: 6.8- 7.0	low	
June 6, 1972	22:30-23:30 hrs	13	shallow oozy-bottomed pool pH:7.0	many	singing
June 7, 1972	20:15 hrs	12	lagoon and canals	many	singing
June 7, 1972	22:10 hrs	8	pH:7.6	many	singing
June 8, 1972	21:00 hrs	8		many	singing
June 8, 1972	21:30 hrs	4	beach pool and flooded canal. pH:7.0-7.2	0	

June 7-8, 1972	21:30-22:00 hrs	5	canal-open, wide, shallow with clumps of emergents	strongest chorus yet	singing
June 8, 1972	21:30-22:00 hrs	1	floating aquatics, bare sand, trash covered bank, brush and cattails	many	singing
Sept. 15, 1972	09:30-10:45 hrs	3	grassed waterway, flooded woods edge, bean and fallow fields	0	
Sept. 15, 1972	11:15-11:30 hrs	2	edges	0	
Sept. 15, 1972	15:40-16:00 hrs	15	mudflats, grassy banks and treed cottage lots	2 caught	
Sept. 15, 1972	15:15-15:30 hrs	3	grassed waterway, flooded woods edge, bean and fallow fields	0	
Sept. 15, 1972	19:25-19:55 hrs	1	open sandbars and duckweed mat	3 - 5	sitting on bank
Sept. 16, 1972	12:00-12:15 hrs	15	mudflats and marsh	8 - 9 (three caught, one with tail-bud present).	Leaping into pond and burying themselves
Sept. 16, 1972	11:00-11:30 hrs	1	damp sand	2 caught and third seen	"skittering" on algal mat
Sept. 16, 1972	14:15 hrs	1	damp sand	one re-found	
Sept. 16, 1972	13:30-14:30 hrs	1	under ash trees on soggy sand and gravel	8 (4 caught and released)	basking
Sept. 16, 1972	14:40 hrs	1	algal mat	9 - 12	basking then skittering on surface and diving
Sept. 17, 1972	19:00-20:00 hrs	10	mud flats and sand on east side of little lagoon	caught one reddish-brown, saw one greyish green	sitting by water near thin vegetative zone

## COSEWIC

Sept. 18, 1972	19:00-20:00 hrs	1	pool edge	2 seen, very active	dived in
Sept. 18, 1972	14:10 hrs	2	lagoon edge. (coarse grass and cattails, fallen logs, trash).	2	Sitting on wet bark
Sept. 18, 1972	ca. 18:00 hrs	10	duckweed pH: 7.0-7.2	0	
Sept. 18, 1972		9	millet, dock, mud plantain and sedges	4	diving in
Sept. 18, 1972	ca. 17:35 hrs	1	algal mat and bark chips	12 caught, 5 seen. L-4 recaptured. All released.	sitting on bark and skittering on mat
Sept. 15, 1973	midday	10	dry sandbars	2+	skittering on aquatic mat
Sept. 15, 1973	a.m.	9	cottage lawns	0	
Sept. 12, 1973		1	mostly destroyed	0	
Sept. 12, 1973		9	intact	0	
Sept. 12, 1973		7	partially intact	0	
Sept. 12, 1973		10	intact	0	
Sept. 12, 1973		4	pool open to lake and partially filled with sand	0	
Sept. 12, 1973		8	intact	0	
Sept. 12, 1973		3	bean and fallow fields, habitat intact	0	
Sept. 12, 1973		2	some obliteration of pools and some breaching	0	
June 6, 1974	ca. 20:00 hrs	11	intact	0	

June 7, 1974	21:00 hrs	8		24 max. heard in total	singing (very wary)
June 7, 1974	09:05 hrs	9	shoreline	few dozen (none collected)	singing
Aug. 8, 1974	09:30 hrs	10	middle of lagoon	few dozen	singing intermitten
Aug. 8, 1974	14:15 hrs	2	canal being redredged. open to lake, many shrubs dead, much scouring & rock, lack of floating and emergent vegetation	0	
Sept. 3, 1974	late afternoon	9	Bonnet's lawn, pond beside house. (very warm air).	7 caught, 9 others seen. 16 within 4.6 meters	
		3	flooded field	0	
Sept. 3, 1974	evening	16	inner mudflats	1 seen ?	
Sept. 4, 1974	noon	7	sand spits	0	
Sept. 4, 1974	afternoon	10	sand spits	0	
Sept. 5, 1974		9	arrowhead and duckweed zone	4 seen (all brown)	dove in
May, 1976		10	sand and mud edges	0	
May, 1976	evening	16	shallows	0	
June 8, 1976	22:00 hrs	16		moderate chorus	singing
June 8, 1976	22:35 hrs	7	shoreline	moderate chorus	singing
June 8, 1976	22:45 hrs	2	roadside	0	
June 8, 1976	22:50 hrs	11	meadow	0	
June 8, 1976	23:00 hrs	17	flooded field	0	

## COSEWIC

June 8, 1976	23:30 hrs	9	marsh almost dry	small chorus (handful of males).	singing
June 8, 1976	23:30 hrs	15		some	singing
June 8, 1976		18		some	singing
June 8, 1976	23:50 hrs	9		stronger chorus	singing
June 9, 1976	00:10 hrs	3	flooded field	0	
June 9, 1976	00:10 hrs	4	pool open to lake	0	
June 9, 1976	00:20 hrs	1	roadside canal edge	fairly strong chorus	singing
June 9, 1976	00:35 hrs	8		0	
June 10, 1976	evening	5		0 (many in previous years)	
June 9, 1976	22:00-22:15 hrs	8		0	
June 9, 1976	22:20 hrs	19		?	singing
June 9, 1976	22:20 hrs	3	field	0	
June 9, 1976	23:05 hrs	17	field	0	
June 12, 1976	14:45 hrs	19		?	singing
		1			
June 12, 1976	08:45 hrs	9	pH: 6.7-6.8 marsh being drained	weak chorus	singing
July 18, 1976	22:00 hrs	9	marsh dry and mowed	1	
July 18, 1976	22:00 hrs	9		1	singing
July 8, 1976	23:00 hrs	19	lily pads	2 - 3 dozen calling. 1 caught (to M.N.R.)	



summer, 1977		11	flooded field	0	
summer, 1977	noon	17	field flooded and worked	a few heard ?	
summer, 1977	a.m.	9	water back, some fill	moderate chorus	
summer, 1977	15:00 hrs	19		few singing	
June 13, 1977	11:30 hrs	9		few	singing
June 10, 1977	22:30-22:45 hrs	8		0	
July 24, 1977	21:30 hrs	10	edge of water lilies	?	singing
July 24, 1977	16:00 hrs	10	centre of pond	ca. 2	calling weakly
July 24, 1977	21:30-22:30 hrs	10	centre of pond	10 to 20	calling
July 24, 1977	sundown	10	centre of pond	fewer than 20 singing males	intermittent not a true chorus

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