

Introduction and Dispersal of the Pacific Treefrog, *Hyla regilla*, on the Queen Charlotte Islands, British Columbia

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In about 1962, Pacific Treefrogs, *Hyla regilla*, from near Comox Lake, Vancouver Island, were transplanted to the Queen Charlotte Islands where the only native amphibian is the Western Toad *Bufo boreas*. The initial population of about six adults increased in numbers and expanded its range into a diversity of habitats. Secondary transplants have been made by local residents to other regions in the archipelago. Each of these has led to new dispersal fronts and currently the treefrog has a range of ca. 2600 km² (26% of the total area of the islands). Dispersal rate was estimated at about 2 km/y, but has been aided by secondary introductions.

Key Words: Pacific Treefrog, *Hyla regilla*, Western Toad, *Bufo boreas*, Queen Charlotte Islands, introduction, dispersal rate.

The Queen Charlotte Islands, British Columbia, have an impoverished native vertebrate fauna of which the amphibians are represented by a single species, the Western Toad, *Bufo boreas* (Foster 1965). In the 1930s and in the early 1960s, the Pacific Treefrog, *Hyla regilla*, common in southern regions of British Columbia (Carl 1966; Green and Campbell 1984), was introduced to the Queen Charlotte Islands and has now become widespread. Here, I provide a brief description of these introductions and the subsequent dispersal across the archipelago.

Since 1967, I have maintained site records (visual or acoustical) of treefrogs during biological surveys of lakes in the Queen Charlotte Islands. Historical information was collated from discussions with local residents. General physiography of the Queen Charlotte Islands are described in Calder and Taylor (1968).

Ranges of the treefrog on the Queen Charlotte Islands in 1970, 1979 and 1988 are summarized in Figure 1. The first introduction of treefrogs to the Queen Charlotte Islands allegedly occurred about 1933 when several adults, collected from Vancouver, British Columbia, were released on the north-eastern tip of Moresby Island (B. Mathers, personal communication). No treefrogs were observed in subsequent years and it is presumed that this introduction was unsuccessful. In summer of 1961 or 1962, D. Rennie (personal communication), collected approximately six adult treefrogs from near Como Lake, Vancouver Island, and transplanted these to his home at Port Clements, Graham Island. These individuals established a breeding population and within several years a chorus of adult treefrogs was common in roadside ditches within the town.

By 1970, treefrogs were heard in ponds up to 7 km north of the town (D. Rennie, personal communication; S. Simpson, personal

communication) but were absent further north (Figure 1a). By 1978, they had reached 25 km north of Port Clements but were still limited to a corridor adjacent to Masset Inlet since I did not observe individuals further inland during extensive ground surveys in 1979 (Figure 1b). By 1982, the corridor was approximately 6 km in width indicating gradual easterly dispersal into the *Sphagnum* lowlands. Much of the dispersal was likely terrestrial although the numerous small ponds would also allow aquatic dispersal of adults and larvae. Over this corridor, streams tend to flow in a westerly direction and would not have assisted northern dispersal. I did observe treefrogs at a single site 15 km further inland than the main dispersal front in 1979. This disjunct locality was close to one of the north-flowing rivers which dissect the central region of the lowlands, suggestive of downstream transport. In 1986, eastern dispersal from Masset Inlet extended 20 km across the lowlands.

Dispersal into the heavily forested habitats south of Port Clements is not as well documented; but by 1970 treefrogs were present up to 8 km from the town (D. Rennie, personal communication). In 1976, I observed them at an isolated lake 25 km to the southwest of Port Clements.

Secondary transplants of treefrogs have occurred in various localities on the islands, principally towns or small settlements (Figure 1c); in 1965, tadpoles from ditches in Port Clements were transplanted to a roadside pond 6 km southeast and to Mayer Lake, 10 km south-east of the town (D. Rennie, personal communication) where by 1967, adults were abundant (personal observation). The secondary introduction to Mayer Lake may comprise the source population for the major eastern and southern dispersal fronts on Graham Island; by 1970, treefrogs were

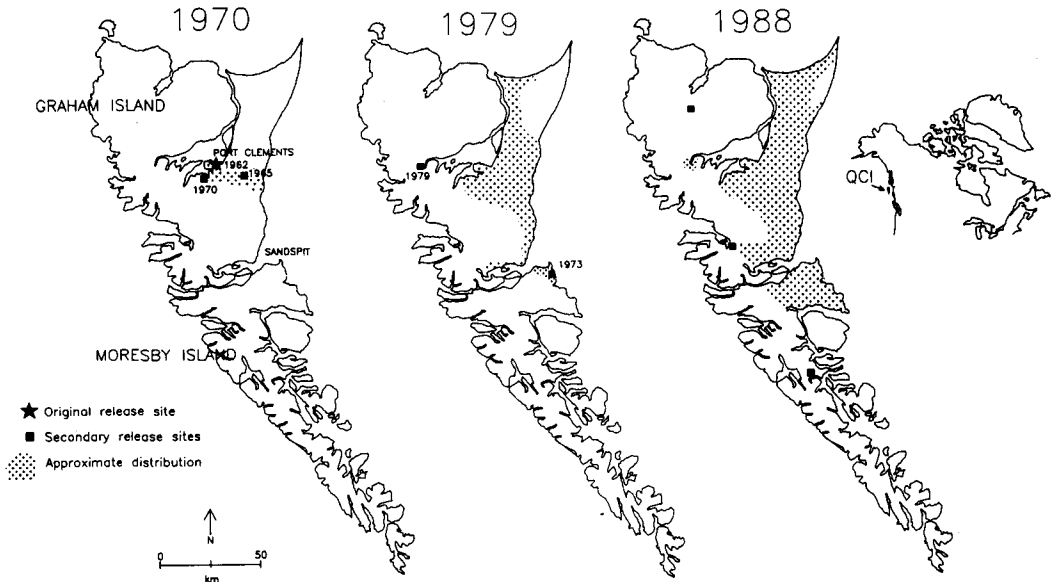


FIGURE 1. Geographical distribution of the Pacific Treefrog, *Hyla regilla*, on the Queen Charlotte Islands, British Columbia. Place names restricted to those used in the text.

observed up to 10 km south of Mayer Lake (L. Rennie, personal communication) and by 1978, occurred an additional 30 km to the south. By 1986, I observed them in all of the major watersheds of central and mid-eastern Graham Island. Dispersal from Mayer Lake also occurred to the east. In 1986, individuals were observed in a narrow corridor up the eastern side of Graham Island, probably as a consequence of access to north-flowing drainage. Presumably, this secondary northerly dispersal from Mayer Lake will merge with the easterly front that dispersed north and west from Port Clements (see Figure 1c).

Between 1975 and 1977, treefrogs were transplanted from roadside ponds in the southeastern region of Graham Island to Queen Charlotte City at the southern edge of Graham Island (K. Moore, personal communication) and by 1986, were heard in roadside ponds up to 30 km northwest. In 1980 or 1981, treefrogs were transplanted (probably from the Port Clements area) to a logging camp near the south-western head of Masset Inlet on Graham Island (M. Dunderdale, personal communication). This population expanded and recently (May 1989) individuals have been observed in sub-alpine ponds 6 km to the west of release site (C. Williamson, personal communication), representing the first sighting of treefrogs on the western slopes of the archipelago.

In 1973, five adult treefrogs collected from Port Clements were transplanted to the north-eastern

corner of Moresby Island near Sandspit (N. Blount, personal communication). These individuals formed a successful breeding population and have greatly expanded their range, occurring over a 525 km² region by 1988. Additional transplants appear to have occurred to the central Moresby Region since in 1982, an adult treefrog was observed in a mountain valley 60 km south of Sandspit (K. Moore, personal communication).

Current distribution and summary of suspected dispersal routes are shown in Figure 1c. Total area currently occupied by the treefrogs is about 2600 km² comprising 26% of the surface area. The numerous secondary transplants during the last two decades, of which only some are known, confound any rigorous efforts to examine the dispersal rate. However, compilation of the records where presence/absence information is available for a series of years and where secondary introductions can be excluded yields an average dispersal rate of 1.9 km/y, range 1.1 - 2.5 (Table 1). These data are derived principally from the low elevation terrain (< 100 m) in eastern Graham Island which is characterized by thousands of ponds (Douglas and Reimchen 1988) and where, presumably, the habitat is conducive for rapid dispersal and colonization. Moresby Island is mountainous throughout its length with deeply indented coastlines and, as such, dispersal will be much slower. General dispersal rates of toads and frogs are quite variable. American Toad (*Bufo americanus*) spread at an average rate of ca.

TABLE 1. Estimated dispersal rate of Pacific Treefrog on the Queen Charlotte Islands. Localities where secondary transplants are suspected are excluded.

Source-Date	Locality ¹ -Date	Distance (km)	Dispersal (km/y)
Port Clements-1963	L#32: 1970	8	1.1
Port Clements-1963	Sheila Lake: 1976	25	1.9
Port Clements-1963	Drizzle Lake: 1977	30	2.1
Port Clements-1963	L#1041: 1979	40	2.5 ²
Port Clements-1963	L#115: 1986	30	1.3 ²
Port Clements-1963	L#1800: 1986	25	1.9
Mayer Lake-1966	Tlell: 1970	10	2.5
			$\bar{x} = 1.9$

¹Locations (#) designated from District Lot Number.

²Adjacent stream may have accentuated downstream dispersal.

0.3 km/yr (maximum 1 km/yr) following their introduction to Newfoundland (Maunder 1983) while *Rana berlandieri* spread via water courses at a rate of 6-16 km/yr across Arizona (Platz et al. 1990).

The introduction of the treefrog on the Queen Charlotte Islands parallels the frequent and global pattern of exotic introductions into archipelagoes (Simberloff 1988). The ecological effect on the native biota of this introduction will be difficult to ascertain since a diversity of confounding factors are operating. This is only one of twelve vertebrate species to have been introduced to the archipelago within the last 80 years, some of which have greatly influenced the native species (Reimchen, Douglas and Moore, unpublished data). The expanding treefrog populations could, through trophic interactions, or competition for breeding habitat, adversely affect the native toad, some populations of which have already been depleted from predation by the recently introduced Raccoon (*Procyon lotor*) (personal observation). Finally, one of the more fundamental changes to the natural habitat of the Queen Charlotte Islands resulting from this introduction is the diurnal and nocturnal vocal chorus which now dominates the bioacoustical environment in spring. Whether this interferes with communication of other taxa is unknown. Substantial opportunities for ecological, genetical and evolutionary investigations are possible as this species continues to expand its range and colonize a diversity of habitats in the archipelago.

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