

THE UNIVERSITY OF MANITOBA

AN ANALYSIS OF TOADS OF THE BUFO AMERICANUS GROUP  
IN A CONTACT ZONE IN CENTRAL NORTHERN NORTH AMERICA

by

FRANCIS RUSSELL COOK

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## ABSTRACT

Discriminant function analysis of 30 measured morphological characters was used to compare reference samples from Alberta to Prince Edward Island of 825 male Bufo americanus and 819 male B. hemiophrys and 59 female B. americanus and 118 female B. hemiophrys. Both analyses provided complete separation of the two taxa. When the resulting weights were applied to 2461 male and 225 female Bufo from southeastern Manitoba, an area excluded from reference samples, a relatively narrow zone of intermediate populations was defined. Separate analysis of three additional scored characters and of selected measured characters, alone or as ratios, followed the same pattern. Audiospectrograms of male breeding calls substantiated the presence of the intermediate populations and laboratory- and field-raised crosses between americanus, intermediate, and hemiophrys parents indicated some transformation success in all combinations.

Discriminant scores for B. woodhousei fowleri (19 males) and B. w. woodhousei (17 males) gave mean values different from the closest B. americanus or B. hemiophrys populations. Separate discriminant analysis comparing B. hemiophrys with B. cognatus (48 males) and B. boreas (60 males) showed complete separation of the taxa in areas of sympatry, and the morphological intermediacy of a single B. hemiophrys boreas field-identified hybrid was confirmed.

The taxa americanus and hemiophrys are conspecific and lack

apparent barriers to interbreeding. Because of the narrowness of the zone of intermediate populations, and the distinctiveness of these taxa outside of this zone, they can be considered megasubspecies: B. (americanus) americanus and B. (americanus) hemiophrys. Two previously recognized subspecies, B. a. copei (northern Ontario and Quebec) and B. h. baxteri (Wyoming) are not taxonomically distinct.

The intermediate zone between americanus and hemiophrys corresponds to the mid-point in transition between eastern and central herpetofaunas, elements of which are postulated to have been separated during a break in the trans-continental Boreal Forest during the Wisconsin, and perhaps earlier, glaciations.

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## INTRODUCTION

Five species of toads of the 187 (Gorham, 1974) recognized in the nearly cosmopolitan genus Bufo (Amphibia: Anura: Bufonidae) occur in northern North America (Canada and Alaska). Their geographical relationships may be summarized from Conant (1975) and Stebbins (1966). Three are broadly distributed: the American Toad, Bufo americanus, the Canadian Toad, B. hemiophrys, and the Northwestern Toad, B. boreas. These are largely allopatric and replace each other from east to west (Figure 1). North-south boundaries lie through eastern Manitoba and western Alberta. All are widespread in the boreal or montane forests which cover much of this region, but none invade tundra or true alpine conditions. Also, they are abundant in the deciduous forests of the east (americanus), the parkland and northern fringes of the grassland of the central portion (hemiophrys) and the arid interior valleys and coastal rainforest of the west (boreas). Two additional species invade or approach the southern fringes of the region. In the east, Fowler's Toad, B. woodhousei fowleri, reaches its northern limit along the sandy north shore of Lake Erie in southern Ontario. Here and south to the Atlantic coastal plain it is geographically sympatric with, but largely ecologically separated from, Bufo americanus. In the central portion of the continent Woodhouse's Toad, B. woodhousei woodhousei, is allopatric to Bufo hemiophrys



Figure 1. The geographic distribution of toads in northern North America based on Conant (1975), Stebbins (1966) with modifications and additions from National Museum of Natural Sciences (Herpetology Section) collections and Cook (1977).

Top: Bufo americanus, B. hemiophrys and B. boreas replace each other across the continent from east to west respectively. Note the narrow zone of sympatry between B. hemiophrys and B. boreas in central Alberta, and the disjunct population of B. hemiophrys in Wyoming (bottom of map, west of center).

Middle: The Bufo woodhousei complex: B. w. woodhousei in the west (hatched) and B. w. fowleri in the east (solid). Compare with the top map for area of sympatry between B. w. fowleri and B. americanus in the east, for allopatry between B. woodhousei and B. hemiophrys in the central portion and sympatry between B. woodhousei and B. boreas in the west. Ecological separation occurs within the areas of geographic overlap.

Bottom: Bufo cognatus. Compare with top and middle for areas of sympatry with B. hemiophrys and B. w. woodhousei. There is some ecological separation between B. cognatus and the other species within their overlapping ranges.