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Use of parasite tags in delineating stocks of white hake (*Urophycis tenuis*) from the southern Gulf of St. Lawrence and Cape Breton Shelf

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Abstract

Protozoan and metazoan parasites were inventoried in 396 white hake (*Urophycis tenuis*), 40–60 cm in length, collected from the southern Gulf of St. Lawrence (NAFO division 4T) and Cape Breton Shelf (NAFO subdivision 4Vn) between August 2001 and May 2003. Discriminant function analysis (DFA) of parasite abundances revealed that cysts of unknown etiology ("CUE") in the gill filaments, and three species of parasitic helminth, the monogenean, *Diclidophoroides maccallumi*, and the nematodes, *Capillaria gracilis* and *Hysterothylacium aduncum*, were useful as markers for discriminating 4T hake found at depths of >100 m along the southern slope of the Laurentian Channel and in the Cape Breton Trough from those found in the shallower (<50 m) waters of St. Georges Bay in the southeastern Gulf. DFA of the southern Gulf samples yielded an overall correct classification rate of 78%, thereby supporting earlier tagging, meristic and morphometric studies which indicated that 4T hake are comprised of distinct deep-water (Channel) and shallow-water (Strait) stock components. DFA of all 4TVn samples, with the inclusion of a fifth marker, the acanthocephalan *Echinorhynchus gadi*, yielded correct classification rates of 66 and 76% for "channel" and "strait" hake, respectively, and 76% for 4Vn hake from Laurentian slope waters of the Cape Breton Shelf. Hence, parasite tags could be applied, together with other biological and/or genetic markers, in studies of migration and possible mixing of 4TVn stock components over-wintering in Laurentian slope waters.

Keywords: Parasite; Biological tags; Stock structure; White hake; *Urophycis tenuis*

1. Introduction

White hake (*Urophycis tenuis*) are demersal fish, inhabiting the continental shelf and upper continental slope waters from southern Labrador to northern Florida, and favoring soft bottoms and temperatures of 5–11 °C (Musick, 1974). In the southern Gulf of St.

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Lawrence, the greatest concentrations of larger hake are found in cooler water (2–4 °C) (Clay, 1991). They are among the most fertile of commercial demersal fish, and a single female may produce several million eggs each spawning (Musick, 1974). Historically, the fishery for white hake was the third or fourth most important groundfish fishery in the southern Gulf of St. Lawrence (NAFO division 4T), with annual landings averaging 5675 t from 1960 to 1994 (DFO, 2004). This fishery has been under moratorium since 1995, following its collapse in the early 1990s, and there have been no signs of stock recovery. The indices of biomass and abundance in 2002 were the lowest on record.

The critically low abundance of white hake throughout the Gulf of St. Lawrence (4RST) and on the Cape Breton and Scotian shelves (4VWX), and the fact that *U. tenuis* is being considered for species at risk status in these areas by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) underscores the importance of understanding the structure of these populations (www.cosewic.gc.ca/eng/sct3) (Fig. 1). Hurlbut and Clay (1998), who used meristics and morphometrics, to confirm an earlier hypothesis that white hake in the southern Gulf are composed of separate deep-water (Channel) and shallow-water (Strait) stock components, proposed a reevaluation of the management of 4T hake. The Channel component occurs in deep water (depths >200 m) along the southern slope of the Laurentian Channel and in the adjoining Cape Breton Trough throughout most of the year. The distribution of the Strait component is now confined to shallow waters (<100 m) of the southeastern Gulf, with the greatest concentrations being found in St. Georges Bay through the summer and fall. Both components are thought to over-winter in the deep (>200 m) relatively warm (4–5 °C) waters of the Laurentian Channel, where their distributions are continuous with 4Vn white hake on the adjacent slopes of the Cape Breton Shelf (Morin and Hurlbut, 1994; Hurlbut et al., 1996).

Use of parasites as "biological tags" has often proven advantageous over traditional mark-recapture methods for studies of fish stock structure and migration (Williams et al., 1992). It is especially appropriate for delicate, deep water species (MacKenzie and Abaunza, 1998). This approach, aside from being less costly, avoids the trauma associated with traditional tagging. Parasite markers have frequently been used for studying structures of hake (primarily *Merluccius*

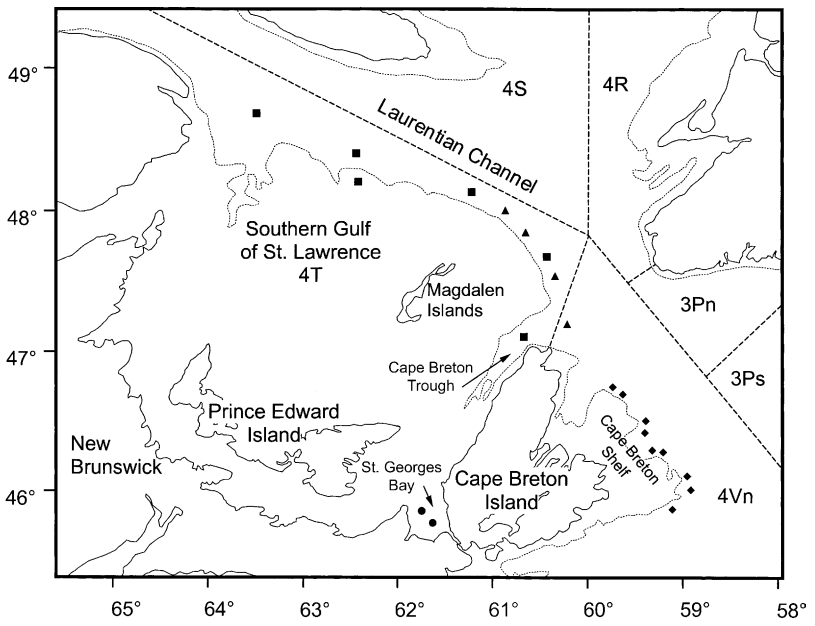

Fig. 1. Plot of the southern Gulf of St. Lawrence and Cape Breton Shelf indicating white hake sampling locations: St. Georges Bay (Strait), August 2001 and September 2002 (●); southern Laurentian slope (Channel), September 2001 (▲) and September 2002 (■); Cape Breton Shelf (Shelf), May 2003 (♦). Depth contour (. . .) = 100 m.