The “Arctic Stamp”, its imprint on an endangered marine flora – the Arctic benthic algal flora and its environment seen from 65 years of Arctic research

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With 8 figures and 3 tables

Abstract: The pan-Arctic attached algal flora, its character and composition is identified. It is currently best represented in the Beaufort Sea, the Canadian archipelago, N Baffin Island, NW and NE Greenland N-NE, Svalbard, the N Laptev Sea, and the Russian coasts including the W coast of the Bering Strait. This description of Arctic littoral and sublittoral marine ecosystems includes a comprehensive inventory of their florae and identifies mechanical and physiological stresses. Character and biogeography of the Arctic marine flora reflect the abiotic characteristics of the environment. Long dark periods and continuous sub-zero to near zero temperatures are barriers to northward migration of sub-Arctic and Boreal species. Arctic species diversity, biomass, many morphologies are distinct from these features in sub-Arctic species. The imprint of the environment, its affects on the flora are termed the “Arctic stamp”. The flora contains 161 species, many cyanobacteria, 2 identified, 48 Chlorophyta, 58 Phaeophyta, 46 Rhodophyta, 1 Dinophyta, 2 Chrysophyta, 1 Xanthophyta. The flora contains 66 species also present in the NW Pacific Ocean and or the Bering Sea. Twenty one species (12 brown, 8 red algal-45 taxa, 1 green alga) are considered Arctic endemics. This floristic and ecological information reflects pre-19th century Arctic marine floras, a recognizable basis of identity that permits predictions of change in the macroalgal Arctic flora as the result of seawater warming and sea ice attenuation.

Keywords: The marine “Arctic Stamp”, Arctic, sub-Arctic benthic algae, marine environments, stress, survivor species, climate change

Introduction

The pan-Arctic benthic algal flora is identified on the basis research in excess of five decades that reveals both the composition and the character of that flora. It forms a baseline description of that Arctic marine flora as it was in the mid-20th century, likely a close approximation of the post-Pleistocene Arctic marine flora and its environment. Arctic phytoplankton and sea grasses are not discussed; the latter are not present in areas cited as Arctic. Marine phytoplankton is beyond the scope of this investigation. Reference is made to the floristic studies of Kjellman 1877, 1883; Rosenvinge 1893; Collins 1927; Zinova 1953, 1955, 1957; Lund 1959; Lee 1973, 1980; Vinogradova 1986, 1990, 1995 a, b; Averintsev & Perestenko 1994; Mathieson et al. 2010, and others. Each study broadened and contributed to the scope of this thesis.

It is particularly apparent to those who have lived and studied in the Arctic that terrestrial and marine environments and their biota are undergoing quantifiable changes (Cattel & Crossley 1996; Hinzman et al. 2005; Barnes & Kaiser 2007; Overland & Wang 2007; Comiso et al. 2008; Walsh 2008; Zachar et al. 2009; Brown et al. 2011; Wassmann et al. 2011; Weslawski et al. 2015; Marbà et al. 2016). Owing to current climate change, and earlier, the Arctic marine environment in the future is likely, mostly no longer present in many former areas (Burrows 2003; Polyakov 2005; Krause-Jensen & Duarte 2014; Wilce, unpub. obs.). Where the Arctic environment remains, its considerable influence on the biota, accompanied by the absence of many sub-Arctic and Boreal species is its principal defining features. Identities are provided of the Arctic algal species and importantly, questions that when answered lead to further knowledge of this flora, its character and limits of the Arctic environment.

The “Arctic experience” for many has been limited to summer visits to several marine sites in the sub-Arctic, erroneously