

SARSIA



ON *LAMINARIA HYPERBOREA* (LAMINARIALES, PHAEOPHYCEAE) ON THE MURMAN COAST OF THE BARENTS SEA

ELENA V. SCHOSCHINA

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Laminaria hyperborea (GUNNERUS) FOSLIE forms a belt between depths of 3-5 m and 15 m in the outer area of the Dalnezelenetskaya Inlet. At one locality a biomass of 2.7-19.2 kg/m² and a density of 3-40 plants per m² were found. This species seems widespread along the Murman coast of the Barents Sea.

Шошина, Елена В. О *Laminaria hyperborea* (Laminariales, Phaeophyceae) на Мурманском побережье Баренцева моря. *Laminaria hyperborea* (Gunnerus) Foslie формирует пояс на глубине от 3-5 до 15 м в открытых частях губы Дальнезеленецкой. Отмечена биомасса 2.7-19.2 кг/м² и плотность 3-40 растений на м². По-видимому, данный вид имеет широкое распространение на Мурманском побережье Баренцева моря.

Dr. Elena V. Schoschina, Murmansk Marine Biological Institute of Russian Academy of Sciences, Vladimirskaaya 17, Murmansk 183010, Russia. E-mail: mmbi@mun.rospace.ru

INTRODUCTION

On the Murman coast the kelp belt is formed by *Laminaria saccharina*, *L. digitata*, *Alaria esculenta*, as well as *Saccorhiza dermatodea*. It is commonly assumed in the Russian literature that the eastern limit of *Laminaria hyperborea* is Varangerfjorden, Norway (BLINOVA 1965) and that it is not distributed further to the east on the Murman coast. Also, KAIN (1971) noted that *L. hyperborea* was distributed only a short distance into Russia. Along the Norwegian coast *L. hyperborea* is an abundant alga, forming an extensive sublittoral belt (SJØTUN & al. 1995). This species represents a main object of harvesting algae in Norway. The present study was carried out in order to examine the possible presence of *L. hyperborea* in the benthic flora on the Murman coast of the Barents Sea.

MATERIAL AND METHODS

Observations and sampling of *Laminaria hyperborea* were carried out by scuba diving in the Dalnezelenetskaya Inlet (69°07'N 36°04'E, East Murman, Barents Sea) in August

1995. The Dalnezelenetskaya Inlet is semi-closed and is subject to intense tidal water exchange with the adjacent coastal waters (the flushing time is less than a day). Water salinity is stable and varies between 33-34 psu. Mean monthly surface temperature changes from -0.5 °C in February up to about 9 °C in August (data from State Meteorological Station in Dalnie Zelentsy).

According to morphological features (KAIN 1971) adult plants of *L. hyperborea* and *L. digitata* from the Dalnezelenetskaya Inlet are clearly distinguished. Plants with terete, rugose and rigid stipe, decreasing upwards from holdfast and containing mucilage ducts were identified as *L. hyperborea*. Plants of *L. digitata* had flattened, smooth and flexuous stipe devoid of mucilage ducts. Young plants of *L. hyperborea* were distinguished from *L. digitata* by a narrowing in the transition zone.

The patterns of the distribution of *L. hyperborea* in the inlet were observed by divers at five localities. At one locality, where *L. hyperborea* was abundant, kelp was collected at 9 m depth in three samples of 1 m² each (Fig. 1). The length and wet weight of stipe, as well as the length, maximum width and wet weight of blade, and the diameter of stipe near rhizoids were measured in each plant in all three samples. The age of plants was determined by counting the dark rings in stipe near rhizoids (KAIN 1963).

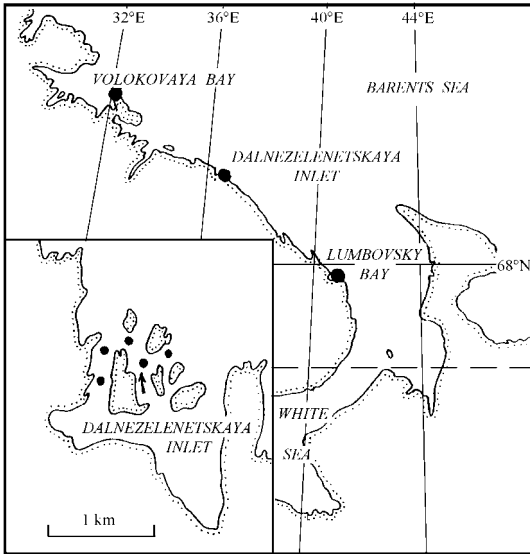


Fig. 1. Map of study area showing the localities (dark circles) where *Laminaria hyperborea* was found. The locality where samples were collected is marked with an arrow.

RESULTS AND DISCUSSION

Kelp plants from the Dalnezelenetskaya Inlet were positively identified as *Laminaria hyperborea* (Fig. 2). The plants had terete stipe along the entire length. The stipe tapered slightly from the holdfast to the transition zone and flattened suddenly in the transition zone (between stipe and blade). The surface of the stipe was rugose. The stipe was rigid, containing mucilage ducts. The blade was flat and very smooth, and divided into many fingers. The shape of blade base was slightly cordate. The

cone-shaped holdfast consisted of clearly formed vertical rows of rhizoids, situated very compactly; rhizoids were rigid, rugose, adhering firmly to the rock. Differences between youngest plants (0+) of *L. hyperborea* and *L. digitata* were less distinct (see KAIN 1971). Young plants (0+) of *L. hyperborea* were identified by a narrowing in the transition zone. At the sampling locality at 9 m, *L. digitata* was not found.

Plants of *L. hyperborea* were found to form a belt between 3-5 and 15 m at all localities examined in the Dalnezelenetskaya Inlet. The densest part of the *L. hyperborea* zone was found at 9 m. In the deep (> 15 m) and central parts of the inlet there was a scarce population of *L. hyperborea*. In the outer part *L. digitata* and *Alaria esculenta* grew in the shallow areas from the intertidal zone down to 3-5 m, and *L. hyperborea* occupied the subtidal below. *L. digitata* and *L. saccharina* dominated in the subtidal algal vegetation of the inner part of the inlet.

The samples of *L. hyperborea* collected at 9 m depth at one station in the Dalnezelenetskaya Inlet showed the biomass values between 2.7 and 19.2 kg/m² and densities between 3 and 40 plants per m². The largest plant found had a stipe of 122 cm, a blade of 115 cm in length and wet weight of the whole plant was 2625 g; the oldest plant was 12 years (Table 1). All plants of *L. hyperborea* found in August were sterile, while adult specimens of *L. digitata* were mainly sporogenous at this time (pers. data).

Observations of *L. hyperborea* have recently also been made at other sites along the Murman coast. During an expedition in October 1995 *L. hyperborea* was found in both the Lumbovskiy Bay (67°50'N 40°24'E, White Sea, Kola Peninsula) and Volokovaya Bay (Varangerfjorden) (Makarov, V.N., pers. comm) (Fig. 1). In the Lumbovskiy Bay (exposed site, 4.5 m depth) the

Table 1. Mean \pm SE of size parameters and wet weight of different age plants of *Laminaria hyperborea* in the Dalnezelenetskaya Inlet (Barents Sea, August 1995)

Age (yrs)	n	Stipe length (cm)	Stipe diameter (cm)	Blade length (cm)	Blade width (cm)	Blade weight (g)	Stipe weight (g)	Plant weight (g)
0+	25	4 \pm 0.5	0.2 \pm 0.02	8 \pm 0.9	3 \pm 0.4	0.3 \pm 0.1	0.8 \pm 0.2	1.5 \pm 0.3
1+	5	15 \pm 2.9	0.7 \pm 0.5	19 \pm 4.9	11 \pm 2.6	6 \pm 2.2	9 \pm 4.3	18 \pm 5.9
5+	3	89 \pm 4.6	2.8 \pm 0.2	73 \pm 5.9	132 \pm 14	415 \pm 61	369 \pm 26	892 \pm 90
6+?	1	102	3.2	65	79	508	210	1035
7+	2	105	3.65	100	199	671	1020	1993
8+	3	103 \pm 13	3.2 \pm 0.1	89 \pm 5	265 \pm 26	673 \pm 68	985 \pm 115	2031 \pm 114
9+	3	110 \pm 2	3.6 \pm 0.3	105 \pm 6	230 \pm 44	773 \pm 42	1222 \pm 157	2212 \pm 241
12+	1	117	4.0	110	360	1035	1382	2527

largest plant collected was 7 years old with a stipe of 187 cm and a blade of 182 cm, the wet weight of the whole plant was 2744 g. Thus, the size of *L. hyperborea* plants from the Murman coast is quite comparable with that of plants from the Norwegian coast (SJØTUN & al. 1995).

The present data show that *L. hyperborea* is a typical species of wave-exposed habitats of the Murman coast, contrary to what has been assumed earlier (ZINOVA 1953; KAIN 1971). In the earlier reports (MAKAROV & SCHOSCHINA 1993) it is quite possible that *L. hyperborea* has been incorrectly identified as *L. digitata* in some open habitats. The question why this species until now has not been reported from the northern Russian seas, is difficult to explain properly. It is quite possible that this is a consequence of two facts. This species is absent in 'Guide to the brown algae of the northern seas of the USSR' (ZINOVA 1953), the only guide which has been used up to present days. In addition the research usually accompanying the commercial harvesting of laminarian algae (*L. saccharina* is the main object) was carried out mostly in the inner parts of bays but not in their open stretches on the Murman coast. Therefore, in order to find the real distribution of *L. hyperborea* in the southern parts of the Barents Sea further studies are needed.

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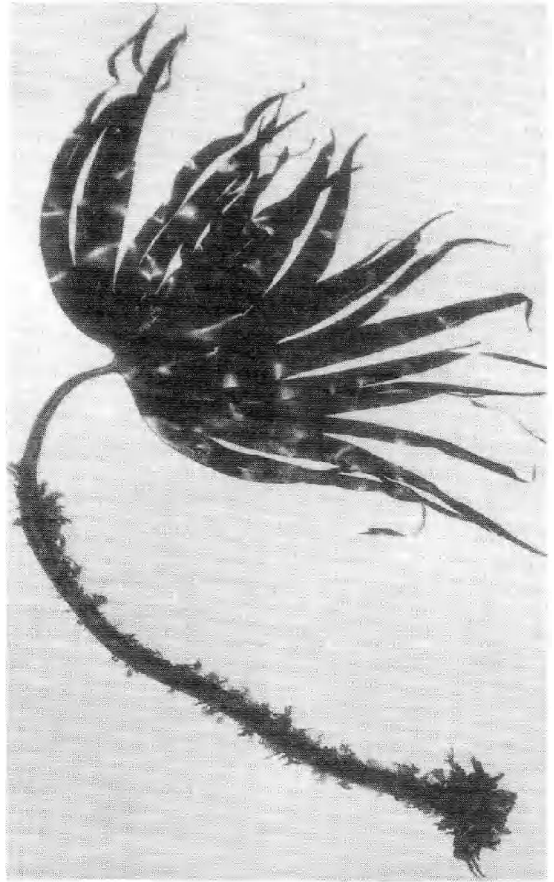


Fig. 2. *Laminaria hyperborea* from the Dalnezelenetskaya Inlet (Barents Sea, August 1995).

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