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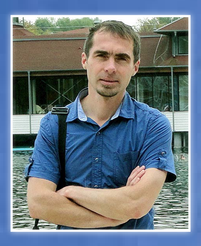
LUMPFISH AS MAIN CONSUMER OF NORTHERN COMB JELLY AND EFFECTIVE TOOL OF ITS RESEARCH



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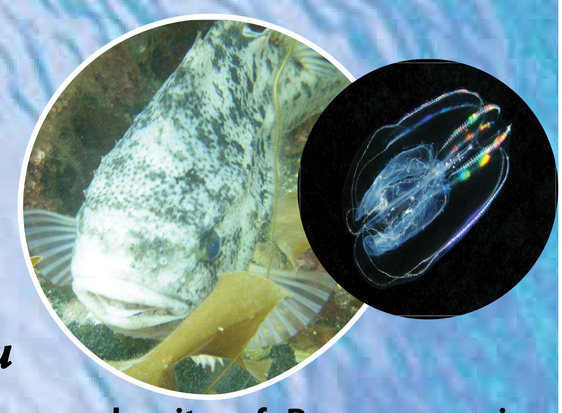

INTRODUCTION

Comb jellies are difficult to catch with standard planktonic nets due to hydrodynamic features that misrepresent distribution pattern of the species. Therefore, feeding habits of fish consuming jellyfish in high amounts might be used for estimating comb jelly abundances. In the case of lumpfish *Cyclopterus lumpus*, 60-95% of their diet consists of the northern comb jelly *Beroe cucumis*.

In the Barents Sea, apart from a lumpfish, cod and haddock consume comb jellies as well. Their proportion in annual diet of cod and haddock does not exceed 5% (Novikova, 1970).

MATERIAL & METHODS

Data were sampled by researchers of PINRO during annual trawl surveys focussing on the assessments of the Barents Sea in 1998-2010 (analysis of 810 stomach contents).

The analysis of lumpfish stomach contents was performed according to degree of digestion of comb jellies. Lengths of non-digested ctenophores were measured. Experiments on compulsory feeding of lumpfish were conducted in the cage to study the speed of prey digestion.

RESULTS

Lumpfish conduct feeding migrations from coast to the central part of the Barents Sea where the Polar front creates favorable conditions for dense comb jellyfish aggregations (Rusyaev, Trofimov, 2004). Occurrence and mean size of comb jellies increase in the frontal area.

The density of fish aggregations increases in the area of Polar front during the period of feeding migrations. The number of comb jellies consumed increases as well that might be demonstrated by well pronounced relationship (fig. 1).

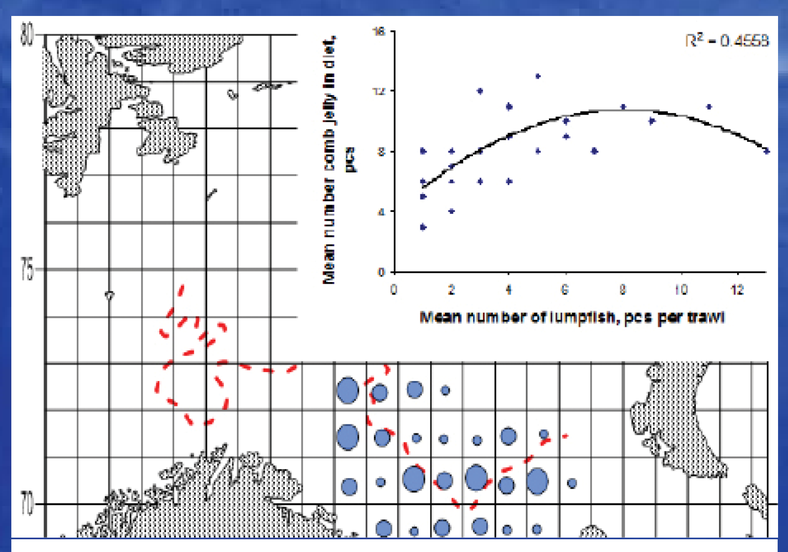

Fig.1. The distribution of filling the stomachs of females lumpfish relatively Polar front (line) and the dependence of the number of comb jelly in the stomachs - density of lumpfish (pcs. per trawl)

During nighttime (18-06 h), feeding intensity of lumpfish decreased. According to these data (fig. 2), the smallest number of fish with fresh food falls to the night period.

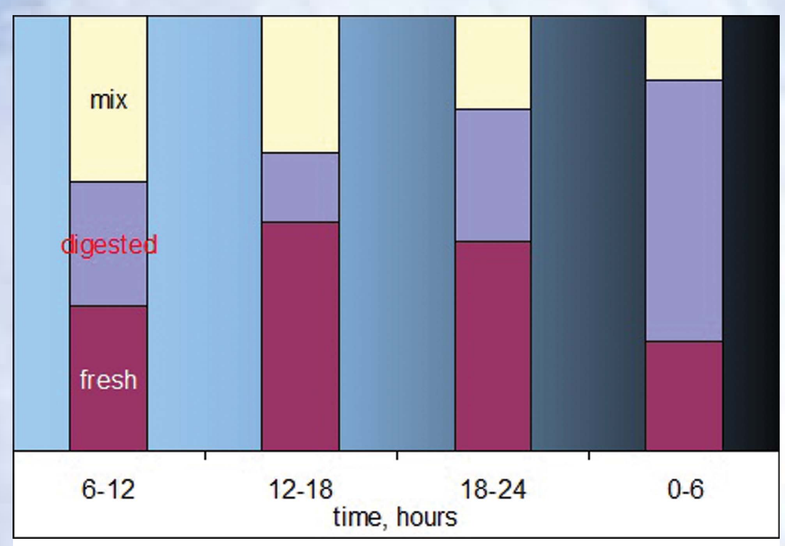

Fig. 2. The feeding of females of lumpfish a comb jelly on the time of day

This might be associated with vertical migrations of comb jellies to surface layers and adaptive diurnal rhythm of lumpfish.

Taking into account results of experiment (duration of complete evacuation of comb jellies from stomachs 5±1 h), lumpfish probably performs about 3 feeding cycles per day. Night time is likely feeding break since proportion of lumpfish in trawl catches is the same during both day and night periods that testifies to lack of vertical diurnal migrations in female lumpfish.

Distribution of lumpfish within entire depth range of the Barents Sea (fig. 3.) allows lumpfish to effectively consume comb jellies with wide size range (from small to large). The size structure of ctenophores caught by traditional fishing gears is less representative (Søreide et al, 2003).

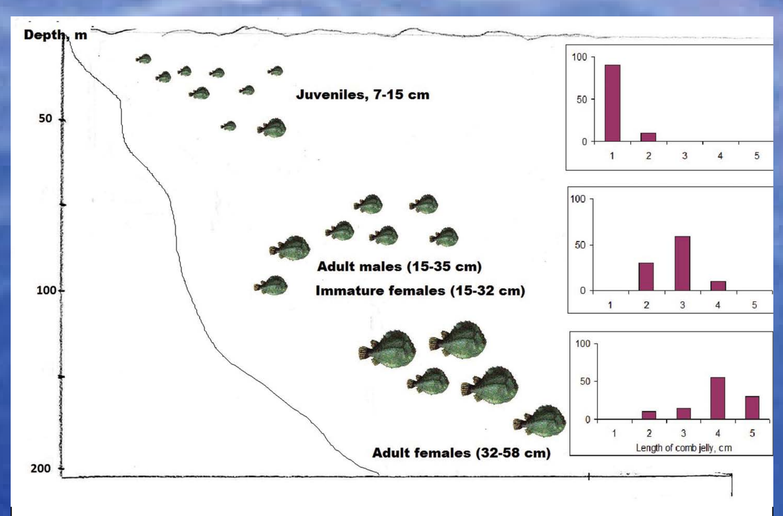

Fig. 3. Vertical distribution of lumpfish and the size structure of the victims-combjelly

Taking into account data on lumpfish abundance in the southern Barents Sea (Rusyaev, 2011), frequency of feeding cycles and average number of fresh prey items in stomachs (10-15 spec.), annual volume of consumption of comb jellies may reach 0,25 million t.

In the southeastern Barents Sea (31°-50°E), estimated annual consumption of comb jellies by lumpfish made up no less than 0.25 million tons (updated information).

Published data on density of Beroe cucumis in Arctic seas (Siferd, Conover, 1992) allows us to estimate its biomass in study area as 2±1 million t (updated information), thus lumpfish consumes here 3-6% of total comb jelly's biomass.

We conclude that the biomass of comb jellies is the most important factor for the stability of lumpfish abundances -and that the chain from comb jelly – to lumpfish – to humans, which transports produced carbon from sea to shore and from lower to higher trophic levels, is rapid and effective.

Speed of carbon transportation in this chain takes about 1 year. Considering an annual gain of lumpfish production in this area (about 1-2 thousand t), assimilation of production in the chain «comb jelly-lumpfish» makes up about 0,1-0,5% that is more than 10 times lower than theoretical values of biomass assimilation between trophic levels in ecosystem.

Total consumption of comb jellies by lumpfish, the transport of carbon from surface to deep layers and the simplicity of sampling with this new technique allows to estimate biomass of comb jellies in the Barents Sea that might be helpful for ecosystem simulations under different climate change scenarios (fig. 4).

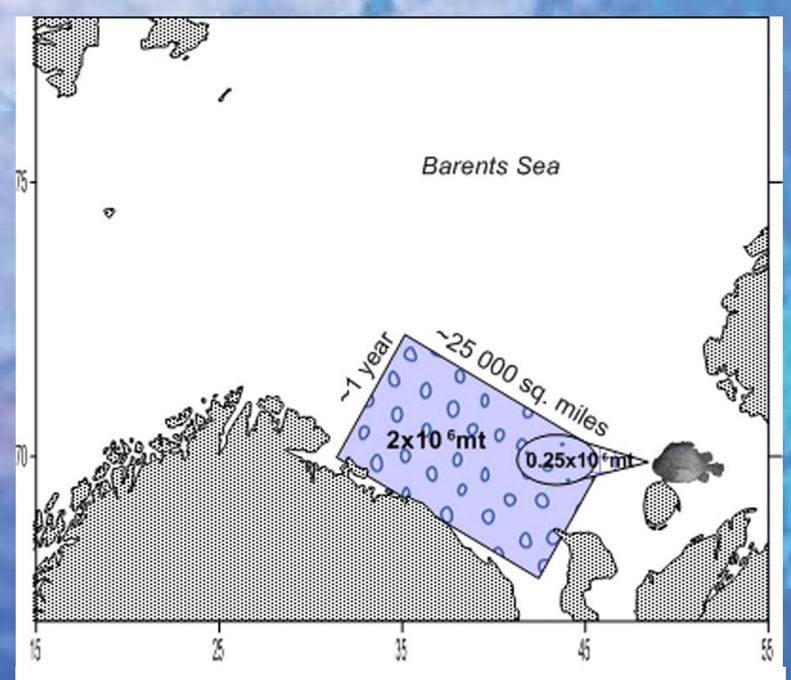

Fig. 4. Some parameters of the trophic chain: lumpfish-plankton in the south Barents sea

CONCLUSION

1 . Vertical distribution of lampfish and feeding peculiarities allow to consider this fish as the best tool for the study of *Beroe cucumis*.

2 . The total consumption of ctenophores by lumpfish in the southern part of the Barents Sea only makes up to 0,25 million t. That possibly composes 10% of total comb jelly's biomass in this area.

3 . Speed of carbon transition from plankton to the human in this trophic web makes 1 year that possibly is a superefficient case in boreal seas.

4 . Assimilation of organic production by lumpfish feeding on ctenophores composes less than 1% that is probably associated with a low nutrition value of prey.

SOURSE

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