Pterostichus montanus population dinamics: the impact of climate and cyclicity in Northern Baikal

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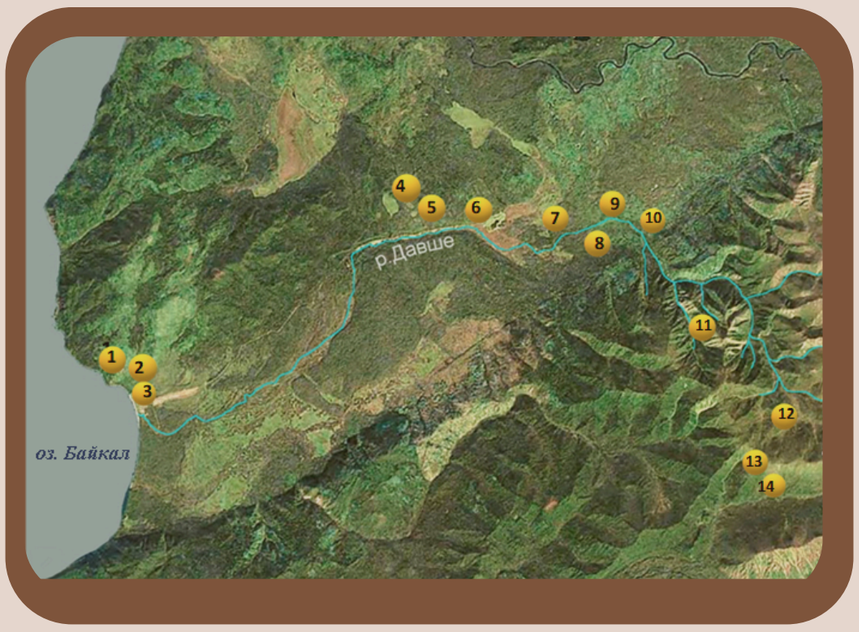
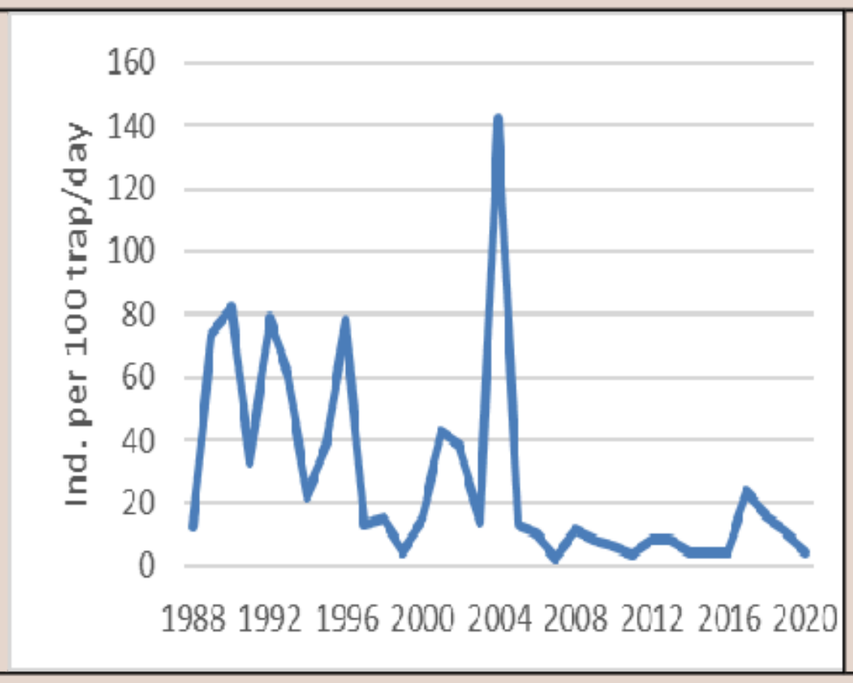
Our environment is a huge oscillating system with a set of various cycles. Cosmic and solar cycles, like a huge clockwork mechanism transfer energy to the atmosphere and further, affecting the population cycles of living beings, ensuring harmony and synchrony of the whole system of life on Earth. Thus, species adjust their internal cycles to external ones “along the chain”: cosmic - solar - atmospheric - climatic zonal - natural regional - population cycles. Deciphering the long-term cycles of natural processes is important for understanding the state of ecosystems and their conservation in the future.

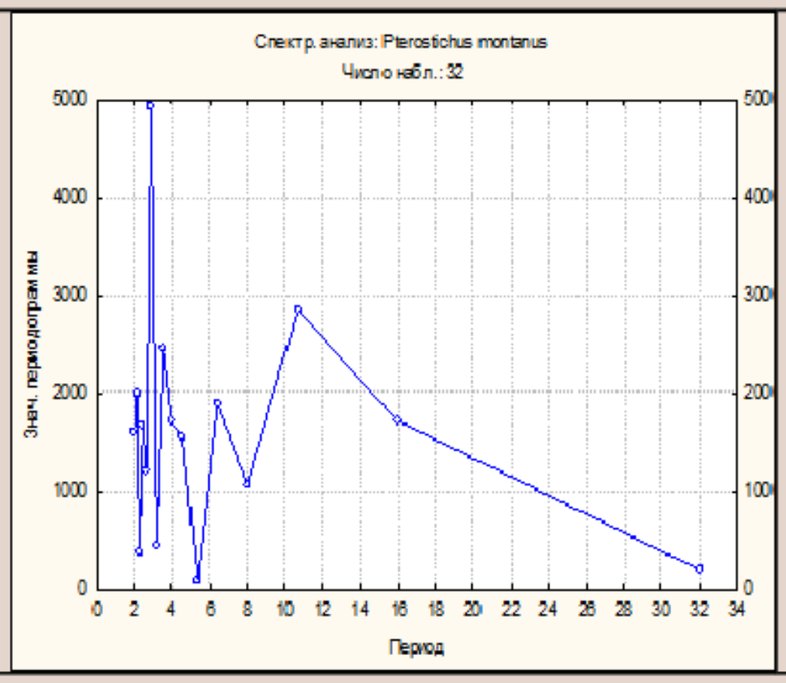
For this and other purposes, we carried out quantitative surveys of herpetobiont insect species in the high-altitude transect of the Barguzin range (Lake Baikal) in 1988-2020.

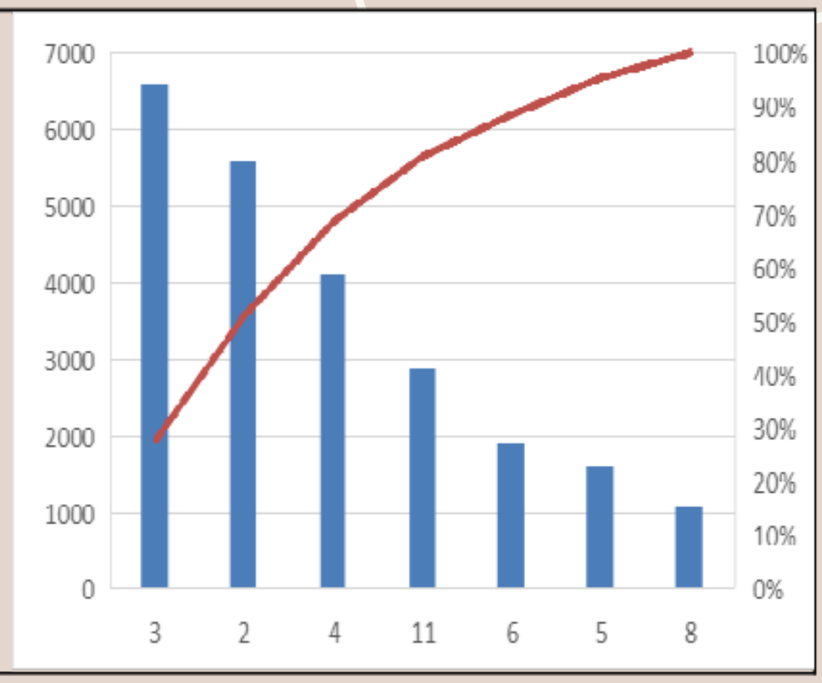


As a model species, we chose the mass species of beetle Pterostichus montanus Motsch. 1844 (Carabidae, Coleoptera).

Long-term series were subjected to Fourier spectral analysis. To determine cyclicity, the elements of the Pareto 80/20 fractal histogram were used. Long time numerical series (A), Fourier spectral analysis (B), Pareto histogram (C), Bergenia aspen biotope is presented as an example, Fig.5.







Transformation of the long-term Pt. montanus series during analysis, Bergenia aspen forest

№ SITE	BIOTOPE	H M.A.S.L.	IND. PER 100 TRAPS/DAY	SUMMER MIN T°C THE SOIL	MAIN PARETO CYCLES
1	Blueberry cedar	460	9.2	5.8	7
2	Birch pine forest	480	10.8	6.0	7
3	Larch rosemary	458	2.9	4.1	3
4	Meadow with mixed grasses	517	6.6	6.4	2, 3
5	Larch blueberry	518	16.1	8.9	2, 3
6	Sedge spruce forest	517	1.9	6.3	2, 11
7	Lingonberry pine forest	535	4.8	13.2	2
8	Bergenia cedar	635	38.2	11.4	2
9	Bergenia aspen	721	28.5	10.8	2
10	Siberian dwarf pine	1004	6.8	8.1	2, 3, 4
11	Blueberry fir	1278	28.1	7.2	2
12	Park birch forest	1004	27.6	5.9	2
13	Blueberry tundra	1278	4.6	5.8	6
14	Lichen tundra	1004	5.8	5.3	3

Thus, in the long-term Pt. montanus series, 7different power cycles are encountered.

The most pronounced were 2-year cycles, correlated (Spirmen) by the cyclicity of atmospheric precipitation (p = 0.001) and 3-year cycles, determined by the temperature regime of habitats (p = 0.001). The 11-year cycle is of secondary (p = 0.01).

Biotopic conditions are the main key factor determining the abundance of the ground beetle population.