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## Original article

## The comparative statuses of the Far Eastern seas and the northwestern Pacific Ocean based on the range of integral characteristics of pelagic and bottom trawl macrofauna



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## ABSTRACT

Comparison of the pelagic and benthic of the Far Eastern seas (mainly within the borders of the Russian EEZ) and the contiguous part of the Pacific Ocean according to the macrofauna population density, species richness, evenness and diversity, and average individual weight of animals, is provided on the basis of the results of multiannual broad-scale pelagic and bottom trawl surveys carried out in 1977–2010.

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## Introduction

As can be determined from the title of this article, the topic is macrofauna (all animals with a body size  $\geq 1$  cm) of the northwestern Pacific. However, according to the data available to me, more or less complete information will be provided here not for the entire northwestern quarter of the Pacific Ocean, but only for the Russian EEZ with the adjacent neutral waters and a part of the economic zones of Japan and the Democratic People's Republic of Korea where, in accordance with intergovernmental agreements, works with involvement of Russian scientists were carried out (Figure 1). These are mainly the subarctic ocean waters, the northwestern third part of the East Sea, the western part of the Bering Sea (also nearly one-third of the water body's area) and so on, but for the sake of brevity in this article these will be referred to as the Pacific Ocean (or simply Ocean), the East Sea, the Sea of Okhotsk, the Bering Sea and the northwestern Pacific (or the whole region). One more preliminary specification is connected with the method of basic data collection: *the pelagic macrofauna* in this article refers to the animals caught in the process of pelagic

trawling into the midwater trawl with a fine-mesh insertion of 10–12 mm webbing, sewn into its cod end over the length of the last 12–15 m, and the benthic or bottom-dwelling macrofauna stands for the animals, caught into bottom trawls also equipped with a fine-mesh insertion (Table 1).

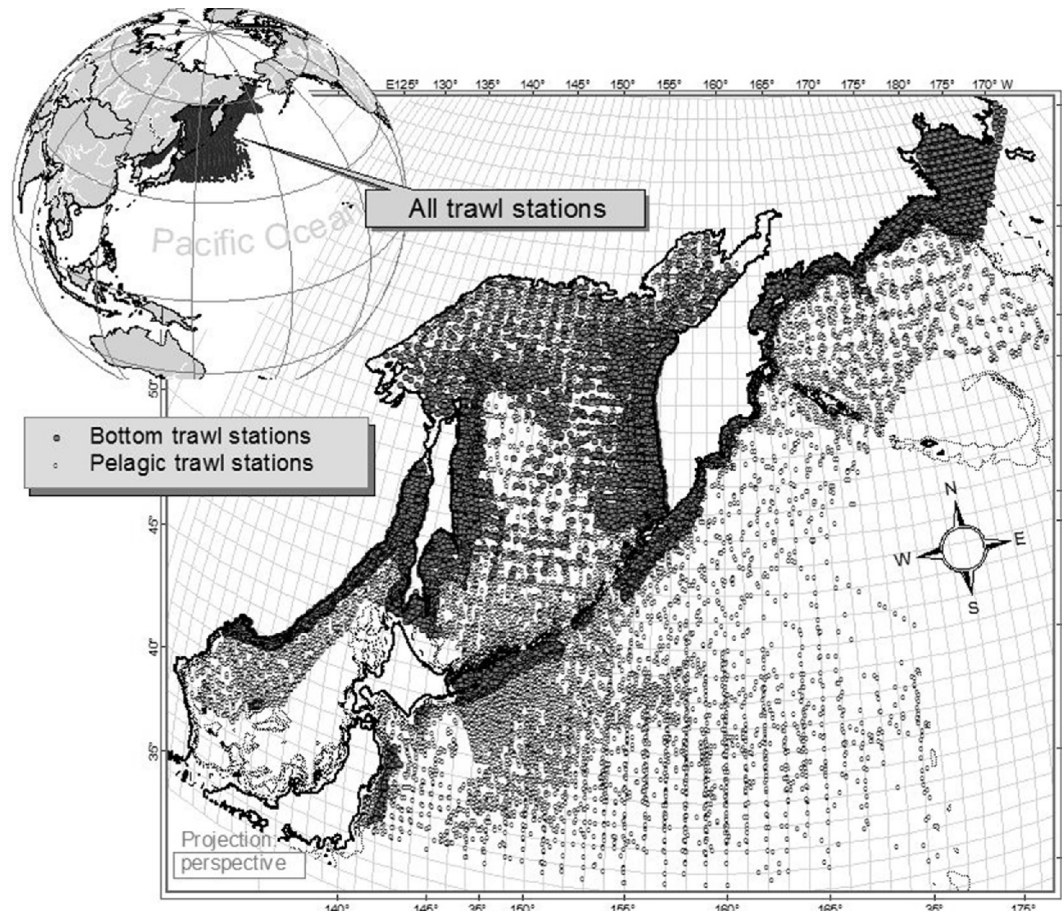
The subject of comparison is six emergent integral properties of macrofauna, characterizing it as a whole:

- (1) and (2) The total number  $N$  (ind./km<sup>2</sup>) and biomass  $M$  (kg/km<sup>2</sup>) of all the specimens – measures of abundance, population density, reflecting the potential reserve of renewable biological resources, productivity of the ecosystem, which provides their reproduction, as well as the intensity of the biogeochemical cycle and the realized ecological environmental capacity in the area of location of this system;
- (3) The average weight of individual  $W$  (kg/ind.) – characteristic of average size, mean metabolic rate of the animals, quantity of the resources consumed by them, power and mobility of the individuals, and size of their feeding area, as well as share of carnivores among them;
- (4) Species richness  $S$  (number of species) – measure of the taxonomic diversity and of the number of realized ecological niches;

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**Figure 1.** Location of the trawl stations on the explored water areas of the four water bodies, for which the integral properties of macrofauna were calculated.

(5) Evenness of species abundances according to [Pielou \(1966\) \*J\*](#) (unit fraction) – index of equitability of specimens to species, synonym of “polydominance” of biocenotic assemblages, the value inversely proportional to the expressiveness of dominance of the dominant species over the others (“monodominance” or “oligomixity”), characteristic of homogeneity of the structure and the complexity of the community’s architecture;

(6) Species diversity according to [Shannon \(1948\) \*H\*](#) (bit/ind.) – measure of uncertainty – ambiguity of belonging of a randomly chosen specimen to a certain species, index of suitability of a certain water area for monospecific or multispecific fishery.

The same water areas have already been compared between one another 5 years ago according to the six aforementioned properties

**Table 1.** Composition of the studied macrofauna (number of species in brackets).<sup>a</sup>

Habitat group	Ecological forms	Taxonomic groups	
Pelagial population (825)	Nekton (790)	Fish and cyclostomes (677)	Vertebrates (677)
	Plankton (35)	Cephalopods (75)	Invertebrates (148)
		Prawns and shrimps (38)	Jellyfishes and ctenophores (27)
Benthic population (1306)	Nektobenthos (819)	Others (8)	
		Fish and cyclostomes (693)	Vertebrates (693)
	Benthos (468)	Cephalopods (57)	Invertebrates (613)
		Prawns and shrimps (69)	
		Gastropods (123)	
Plankton (19)	Bivalves (71)		
	Crabs (38)		
	Sea urchins (8)		
	Holothurians (14)		
	Others (214)		
	Jellyfishes and ctenophores (19)		

<sup>a</sup> This Table gives only the lower limits of species richness of the listed groups of hydrobionts, because not all the individuals are identified to species. Comprehensive checklists of species are published ([Pelagic macrofauna, 2012a–c](#), [Benthic macrofauna, 2014a–e](#)).

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