# BOOK REVIEW

## FISH AND FISH RESOURCES OF THE ANTARCTIC

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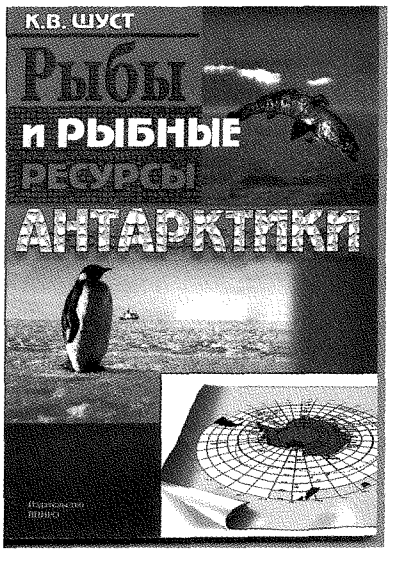


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This work by K.V. Shust (Doctor of Biological Sciences), published in 1998, remains fairly unknown beyond a Russian-speaking readership.

The book represents the first complete summary, prepared by a Russian author, of original material and published data describing commercial and potentially commercial Antarctic fish species. Moreover its value is enhanced by the author having participated in many fisheries research expeditions in Antarctica.

The introduction notes that until the 1960s Antarctic waters were still among the most poorly studied regions from the point of view of their fisheries potential. The USSR began regular, large-scale multidisciplinary studies here in the early 1960s.

Starting from the first South Atlantic expedition carried out by the research vessel *Akademik Knipovich* in 1964/65 and up until 1992, scientists from VNIRO and all of its regional branches carried out systematic research into Antarctic bioresources, especially fish. The mid-1970s saw other countries beginning to carry out research and commercial fishing in Antarctic waters. This led to international cooperation in the study of Antarctic bioresources, firstly by individual groups under the auspices of SCAR (Scientific Committee for Antarctic Research), and later, after the coming into force of the Convention on the Conservation of Antarctic Marine Living Resources, under the guidance of the intergovernmental Commission also known as CCAMLR.

The materials and scientific knowledge acquired by the author over a period of more than 30 years allowed him to analyse both the processes governing bioproductivity in various Antarctic ecosystems and the real opportunities that exist for the future harvesting of fish stocks based on the fisheries potential of areas with high productivity and the fish species which dominate them in terms of abundance and biomass. A significant addition to Russian research were the results of expeditions conducted by other countries in the 1970s and 80s under the BIOMASS Program and CCAMLR. Apart from general biological data and fisheries statistics, fish stock assessments were implemented using data and results of trawl-census and acoustic surveys carried out by Russian vessels and vessels of other countries.

While researching and writing the book the author identified dominant species whose populations have the highest abundance and biomass, as well as the most productive areas and their natural boundaries. He also determined the main characteristics of fish productivity in various areas depending on their ecological features.

This set the foundation for conducting quantitative geographic zonation of ichthyofauna of Antarctic waters, i.e. systematically describing the most productive subareas and identifying the dominant indicator species of these subareas. The comparison of research data and fisheries statistics made it possible to re-evaluate the current status of exploited fish populations, assess the actual potential for utilising fish stocks in general, and develop a broad strategy for the development of fisheries in Antarctic waters.

In describing the identified areas the author notes that the nature of Antarctic fish fauna, its distribution and ecology are determined by the unique characteristics of this geographically discrete, immense water basin.

According to recent data, the Antarctic bottom and near-bottom shelf fish fauna comprises slightly more than 200 species belonging to 28 families, while over the broad area of open Antarctic waters only just over 80 meso- and bathypelagic species (30 families) have been recorded. The distribution patterns of near-bottom shelf fish and those on the high seas are fairly distinct, although mesopelagic lantern fish (Myctophidae) are often found in island shelf waters and juveniles of many shelf fish and adults of some secondary-pelagic species (icefish – Channichthyidae), toothfish and Antarctic rockcods (Nototheniidae) regularly occur in pelagic waters over, and sometimes beyond, the shelf.

In Antarctic waters, where there is an abundant source of food in the form of copepods, euphausiids and hyperiids (especially in spring–summer), secondary pelagisation of bottom shelf fish, i.e. movement to pelagic waters, was one of the most successful adaptive qualities of these species. The range of these fish, limited for bottom and near-bottom fish by the boundaries of the narrow Antarctic shelf, has broadened due to immigration into the pelagic zone. Over the course of their lives almost all notothenioid fishes to some degree inhabit pelagic waters.

There are few specialised benthic-feeders among Antarctic fish. Some of these are: humped rockcod (*Gobionotothen gibberifrons*), some species of *Trematomus* and plunderfishes (Artedidraconidae). Many species of bottom-dwelling Antarctic fish should be classified as having mixed feeding patterns.

The bulk of pelagic fish fauna in the Antarctic and Southern Polar Front (SPF) region comprises deep-water species living in the meso- bathypelagic zone (200–3 000 m).

The author also analysed the zoogeographic zonation carried out in the 1960s and more fully described in papers by A.P. Andriashev. Dr Shust notes that results of research conducted by the USSR and other countries in the 1970s and 1980s revealed that the Antarctic fish fauna is much more diverse, and that the ranges of many species (including the most abundant) are much wider.

The author indicates that, in the case of fish populations inhabiting the pelagic zone, the comparatively larger expanse of open sea in the Antarctic area is much more sparsely populated by meso- and bathypelagic fishes, however the species are more evenly distributed, differing in their habitats mainly according to latitude zonation.

The author compared the general zoogeographic diversity of fish and species having high abundance not only from the point of view of zoogeography, but also taking into account their population dynamics and geographical range. This helped to obtain a distribution pattern of areas with high fish productivity and to allocate areas according to the numerical dominance of species.

According to the author, most highly abundant, dominant fish species are distributed in island and continental shelf waters. Among fish inhabiting meso- and bathypelagic waters the number of highly abundant species is limited to a handful of lanternfish species. Representatives of other

meso- and bathypelagic families, Bathylagidae and Paralepididae, are highly numerous but have scattered populations which do not form concentrations.

Taking into account the research and fisheries data of the USSR and other countries, as well as CCAMLR sources, the author identified about 20 highly abundant species of neritic bottom and near-bottom notothenioid fish species, comprising only 10% of the 200 known highly abundant species of myctophids that form dense concentrations; this is approximately 4% of the 80 recorded meso- and bathypelagic species in Antarctic waters. Among neritic species with high abundance and population biomass are representatives of only two local families: Nototheniidae and Channichthyidae. Representatives of the remaining notothenioid families – Bathydraconidae, Harpagiferidae, Artedidraconidae, and also Rajidae, Macrouridae, Muraenolepididae, Moridae and Bothidae – are low in numbers despite their broad distribution.

The author concludes that the general geological and oceanographic features of the Antarctic area are responsible for the formation of variously sized biotope/ecosystems in which one can, based on the composition of fish fauna (especially of the most highly abundant species), identify ichthyogeographic zones (IZs).

It has been established that practically each type of biotope/ecosystem is characterised by the presence of one or more numerically dominant species, leading the author to term these species as 'indicator species' for various IZs.

Analysis of the distribution of indicator species, the geomorphologic and hydrological structure of the Antarctic area identified the following eight zones.

I. Circum-Antarctic – Southern Polar Front (SPF), including the SPF itself and the northern periphery of the Antarctic Circumpolar Current (ACC). Indicator species – *Electrona carlsbergi.*

II. South Georgia Shelf, including South Georgia and Shag Rocks shelf waters. Indicator species – *Notothenia rossii marmorata, Champsocephalus gunnari, Patagonotothen guntheri shagensis* and *Dissostichus eleginoides.*

III. Kerguelen Shelf, including Kerguelen, Heard and McDonald (and close lying banks) Island shelf waters. Indicator species – *Notothenia rossii rossii, Champsocephalus gunnari, Lepidonotothen squamifrons* and *Dissostichus eleginoides.*

IV. Ob and Lena underwater rises. Indicator species – *Lepidonotothen squamifrons.*

V. Transitional–South Antilles, including South Shetland and South Orkney shelf waters. Indicator species – *Notothenia rossii marmorata, Champsocephalus gunnari, Gobionotothen gibberifrons* and *Pleuragramma antarcticum.*

VI. West Antarctic Coastal, including shelf waters of the northern Antarctic Peninsula, Joinville and D'Urville Islands. Indicator species – *Chaenodraco wilsoni, Trematomus eulepidotus* and *Pleuragramma antarcticum.*

VII. Near-continental Deep-water (300–600 m), including the submerged shelf, island shelves, rises in near-continental seas. Indicator species – *Pleuragramma antarcticum, Chionodraco myersi* and *Dissostichus mawsoni.*

VIII. Near-continental Shallow-water (50–300 m), including inner-shelf rises. Indicator species – *Chaenodraco wilsoni, Trematomus newnesi* and *Trematomus eulepidotus.*

Scientific and commercial trawl data demonstrate that fish production in these IZs is governed by the high population abundance of indicator species, usually several numerous species such as *D. eleginoides* and large Channichthydae (zones II and III) and various *Trematomus* species (zones VI–VIII). It has been shown that zones I and VII, where the biomass of *E. carlsbergi* and *P. antarcticum* is estimated to be several million tonnes, have the highest absolute (summary) productivity, while zones II–V had (until the impact of fishing) very high relative (i.e. per unit of area) fish productivity due to the very large populations of notothenioid species. The overall potential fish productivity in zone VIII is unclear at this stage, largely because severe ice conditions often make research here difficult. Also unclear is the potential productivity of the largest high-latitude species, *D. mawsoni.* This species has a circumpolar distribution and is found on the continental shelf and mesopelagic waters of the high seas up to 56°S.

The author gives a detailed description of each of the IZs, including habitat conditions, biological features and abundance of fish species.

After examining catch data for the Southern Ocean in general, he concludes that the highest fish production occurs in the small shelf areas of islands and underwater rises. Moreover, fish productivity in the Atlantic sector – with the same composition of commercial indicator species – was approximately two times higher.

The author believes that the most promising areas for future fishing are the two largest zones in terms of area and distribution of indicator species, i.e. the Southern Polar Front (*E. carlsbergi*) and the continental shelf and slope (*P. antarcticum*).

As academic V.K. Zilanov notes in the book's introduction, this is a timely work which makes a significant contribution to knowledge about bio-productive processes in Antarctic waters and mankind's impact on this delicate environment.

The book is aimed at fishermen, fisheries managers, ecologists and biologists, and also those studying the World Ocean.

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