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Microbiology

STUDIES ON THE QUANTITATIVE AND QUALITATIVE
COMPOSITION OF MICROFLORA IN ALIMENTARY CANALS
AT THE VARIOUS FISHES OF GDAŃSK BAY

BADANIA SKŁADU ILOŚCIOWEGO I JAKOŚCIOWEGO
MIKROFLORY PRZEWODÓW POKARMOWYCH RÓŻNYCH RYB
ZATOKI GDAŃSKIEJ

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Various quantitative and qualitative conditions of microflora in content of alimentary canal lengths were noted at cod, herring and sprat. The changes depended on season of a year. No bacteria was noted in stomach and middle intestine of cod during spawning season.

The upto now performed investigations on microflora in the alimentary canals content of fish, proved varying quantity of bacteria.

Shewan (1961), Scholes and Shewan (1964) ascertained in their works, that the quantity of bacteria in 1 ml of content oscillates between 10^3 and 10^8 . Similarly Kiser and Beckwith (1944), while examining the intestines of a mackerel, found in its content from 70 to 64×10^6 of bacteria.

Such changes of the bacteria quantity in a content of the fish alimentary canals are mainly caused by the various factors of an environment (Shewan, 1961).

This dependence is particularly distinct for the pelagic fish, in which the bacterial quantity in a content of the alimentary canals, is in a strict relation to the quantitative changes of plankton (Liston, 1956; Anonim, 1961).

An intensity of feeding of a fish-predator is, also dependent on the approaching season of spawning, when some species limit their feeding or do not feed at all.

Aschehoug and Vesterhus (1947) communicate, that Fellers and Blake, while investigating the alimentary canals of salmon migrating for spawning, did not found any presence of bacteria. According to Stry-

ż e w s k a (1962), a codfish is feeding 2-3 times less during the spawning-time than during the other months, and the quantity of bacteria was then decreased (F i s h e r, 1955).

Bacteria, the presence of which was noted in the fish alimentary canals, were assigned to the *Pseudomonas-Achromobacter* group (S h e w a n et al., 1960; S c h o l e s and S h e w a n, 1964). Present, were also the bacteria belonging to the *Micrococcus* and *Bacillus* species.

According to the accessible literature, the authors had investigated the quality and quantity of a bacteria in the fish alimentary canal, as a whole. Only, the investigations of A s c h e h o u g and V e s t e r h u s (1947) were related to the quantitative tests performed separately in stomach and intestine of herring. The present investigations are aimed to define the quantitative condition of the bacterial flora and qualitative relating to the *Pseudomonas-Achromobacter* group in the particular parts of alimentary canal of a codfish, herring and of sprat fished at Gdańsk Bay.

METHODS

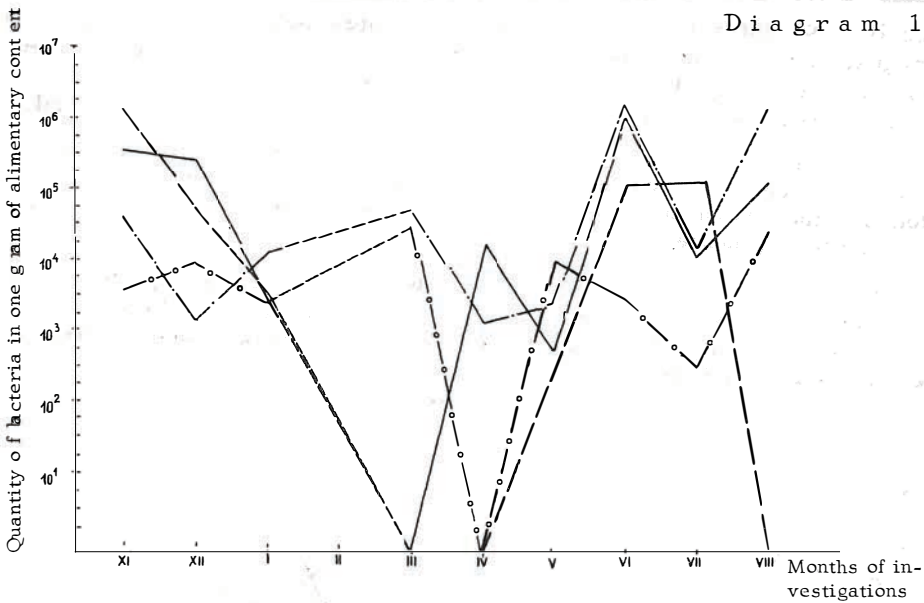
The fish was taken directly from fishing boats and transported to laboratory in thermoses cooled with ice. The analyses were performed directly after delivery of fish into the lab. The time elapsed from the moment of catching to testing did not exceed 12 hours.

Under the sterile conditions, the alimentary canals were removed from 10 fishes; the canals were divided into pieces as follows: from herring and sprat were removed the esophagus, stomach and intestine, and from codfish - the esophagus, stomach, middle-intestine and back-intestine. The content was extruded from the particular lengths into the sterile, previously balanced flasks, and weighed.

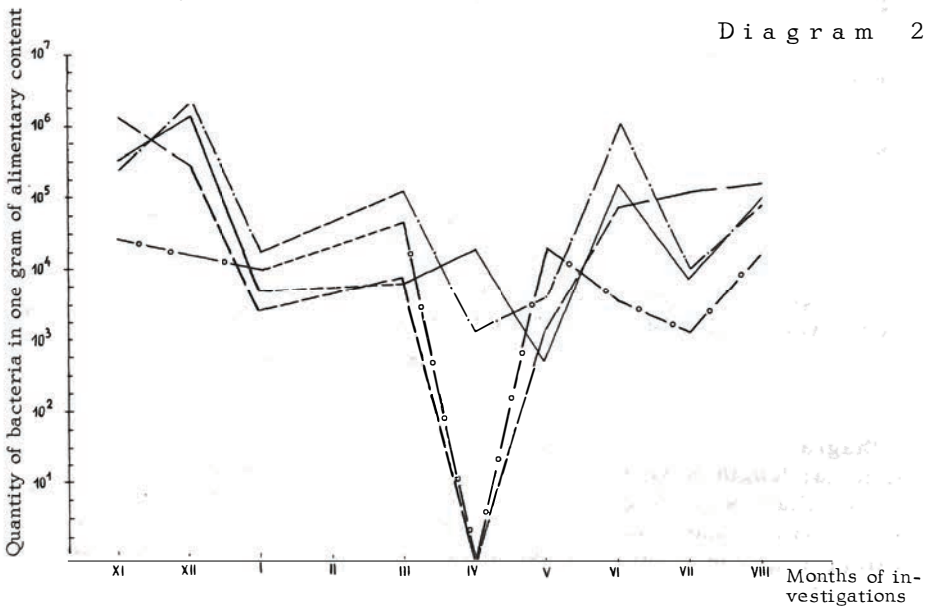
The quantity of bacteria was recorded from the count plates out of the tenfold-diluted content of the intestine lengths on 2.5 per cent agar medium and on 2.5 per cent agar medium prepared on sea water. Out of the cultured colonies, after inoculation the preparations were made and stained by Gram-method modified by Kopeloff and Beerman. The gram-negative bacteria were differentiated by the identification method applicable for bacteria of *Pseudomonas-Achromobacter* group and of relative groups, as processed by B u r z y ń s k a (1964).

RESULTS

The average quantity of bacteria in one gram of content of the particular lengths in a codfish, obtained on 2.5 per cent agar medium, are presented on diagram 1. Diagram 2 illustrates the average quantity of bacteria obtained on 2.5 per cent agar medium prepared on sea-water. Comparing both diagrams, it may be ascertained, that in the esophagus and in the middle-intestine of a



Average quantity of bacteria in one gram of content of the particular alimentary canal length of codfish obtained on 2.5 per cent agar medium

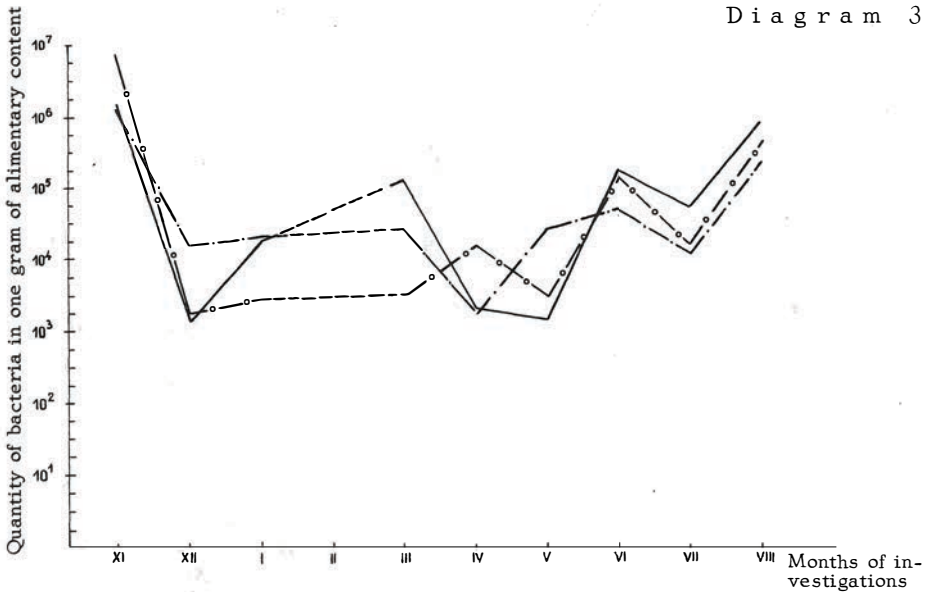


Average quantity of bacteria in one gram of content of the particular alimentary canal length of codfish obtained on 2.5 per cent agar medium prepared on sea water

codfish caught in March, and in the middle-intestine of a codfish caught in August, an increase of bacteria was noted on the 2.5 per cent agar medium of sea-water only. As it appears from both diagrams no bacteria was found in the stomach and middle-intestine content of a codfish caught in April.

To obtain on average quantity of bacteria in the content of a complete alimentary canal of codfish, herring and sprat, the quantities of bacteria found in the content of the particular lengths, were added and the result divided by the number of separated length.

The smallest average quantity of bacteria in one gram of content of the total alimentary canal at codfish, which amounted to about 10^3 was obtained in April and May. For the remaining months, the average quantity of bacteria was oscillating within 10^4 to 10^6 .



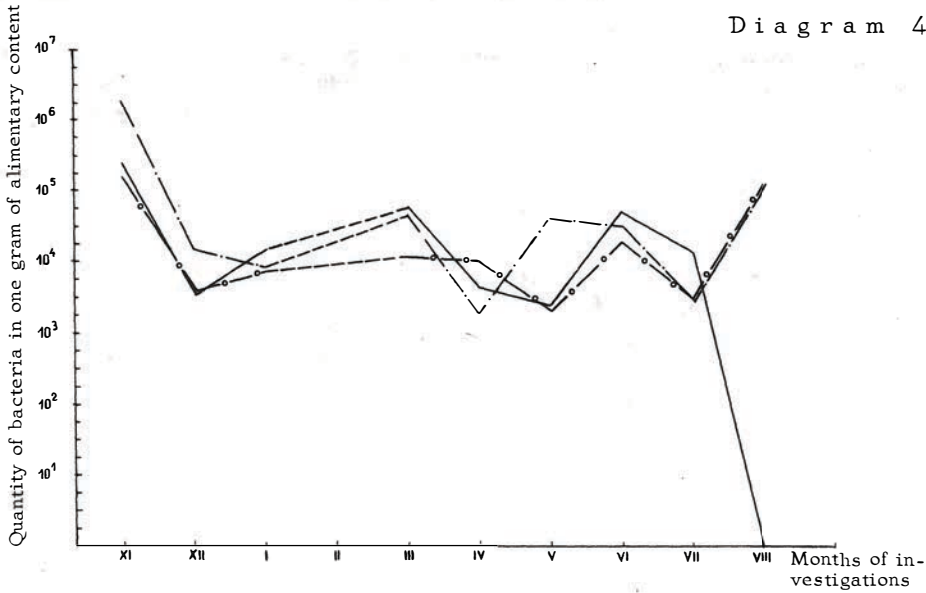
Average quantity of bacteria in one gram of content of the particular alimentary canal length of herring obtained on 2.5 per cent agar medium

— esophagus, —○— stomach, —·— intestine

Diagrams 3 and 4 represent the average quantity of bacteria found in the particular length of alimentary canal of herring. The diagrams appear to be very similar, with exception of August, when no increase of bacteria was noted from the inoculations on 2.5 per cent agar medium prepared on sea-water, while the quantity of bacteria amounted to 10^6 on the 2.5 per cent agar medium.

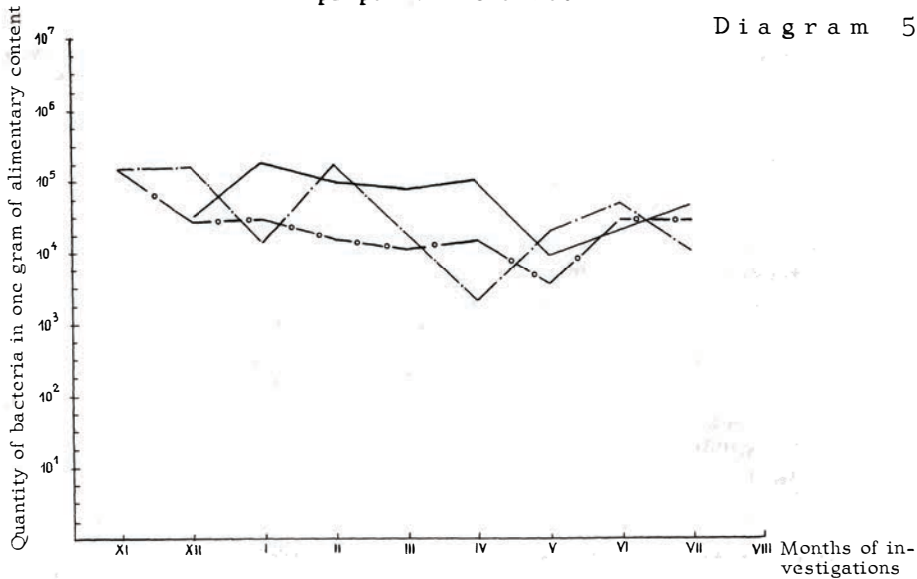
The average quantity of bacteria in alimentary canal of herring in particular months amounted from 10^4 to 10^5 with exception of December and April, when the average amounted to 10^3 and of November, with the average of 10^6 in one gram of the content.

Diagram 4



Average quantity of bacteria in one gram of content of the particular alimentary canal length of herring obtained on 2.5 per cent agar medium prepared on sea water

Diagram 5



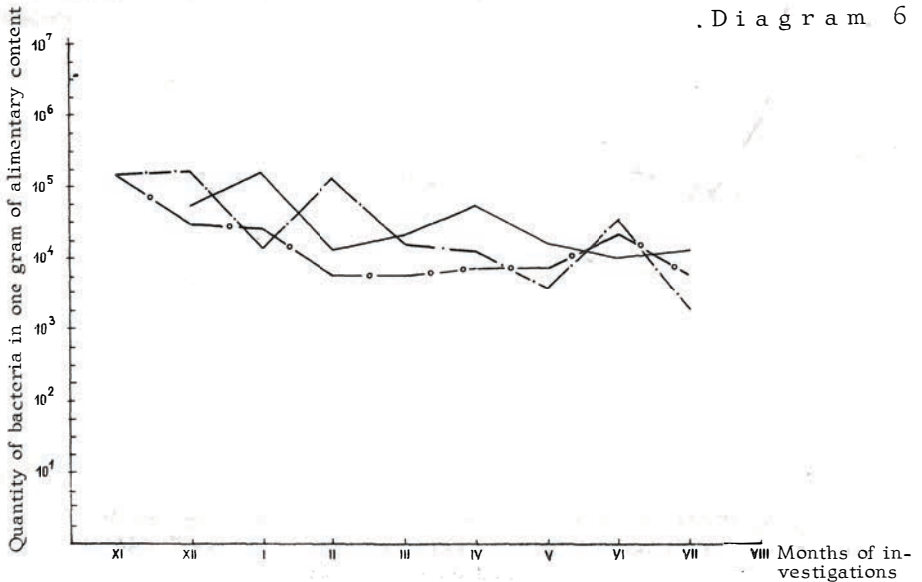
Average quantity of bacteria in one gram of content of the particular alimentary canal length of sprat obtained on 2.5 per cent agar medium

— esophagus, —○— stomach, —●— intestine

The diagram 5 illustrates the average quantity of bacteria in esophagus and intestine of a sprat obtained from the inoculations on 2.5 per cent agar

medium. Diagram 6 represents the data obtained from inoculations on 2.5 per cent agar medium prepared on sea-water. No principal differences in quantity of bacteria are noted when comparing both diagrams for both mediums.

. Diagram 6



Average quantity of bacteria in one gram of content of the particular alimentary canal length of sprat obtained on 2.5 per cent agar medium prepared on sea-water

The average quantity of bacteria in one gram of alimentary canal content for November, December, January and February amounted to 10^5 , while for March, April, May, June and July, the average amounted to 10^4 .

The per cent participation of the bacteria of Pseudomonas-Achromobacter group separated within the alimentary canal lengths of a codfish, herring and sprat represents the 10 diagrams. In the present work, only one diagram is enclosed as exemplary. It represents the per cent participation of bacteria of Pseudomonas-Achromobacter group and of the gram-positive bacteria contained in the herring intestinal content. This is justified, as no schematic quantitative changes of such microbes are noted within the particular lengths of alimentary canals, what is revealed by the enclosed diagram and the remaining diagrams.

The content of alimentary canal of a codfish was considered as a whole; most frequently were appearing the bacteria of Vibrio and Achromobacter species. Present were also the bacteria of Alcaligenes and Flavobacterium group, of Pseudomonas, Aeromonas, Xanthomonas species and of Enterobacteriaceae family; Anitratum was noted in one case only.

Within the alimentary canal of a herring, the most frequent were noted the bacteria of Vibrio, Achromobacter and Alcaligenes species and of Enterobacteriaceae family. Noted were also the bacterie of Anitratum, Aeromonas, Pseudomonas, Flavobacterium and Xanthomonas species.

the prevailing temperatures and the quantities of plankton, seen to be very important, particularly when considering the fish feeding on plankton.

The presented investigations of microflora contained in the alimentary canal of herring and sprat proved the seasonal quantitative changes of bacteria particularly distinct in a case of herring. The quantity of bacteria at herring was also increasing during the Summer months, what complies with the investigations performed on the Norwegian herring (Anonim, 1961). In that investigations it was proved, that the quantity of microbes was increasing in relation to population of fitoplankton. No distinct differences were noted during the investigations performed on the particular lengths of herring and of sprat.

Such differences were, appeared at the codfish, in which during April i.e. spawning season, noted complete lack of bacteria in stomach and in middle-intestine; the bacteria were, however, present within the esophagus and back-intestine. It may be assumed, that such phenomenon is caused by the strong digestive enzymes, the activity of which kills the bacteria in the stomach and middle-intestine at the shortage of food. This is common for the carnivorous and all-eating mammals.

Thus, the results of the present investigations prove, that the alimentary canal of a spawning cod-fish should not be considered from the microbiologic aspect as a unity.

Shewan (1961) communicates, that the flora of a fresh codfish is dependent from such factors, as time and place of catching, the technics of investigation, the applied medium and the temperature of incubation. Liston (1957) ascertained, that the obtained quantitative and qualitative various results from investigation of the sea fish, depend on the fact whether the medium is prepared on a sea-water or on fresh-water.

The present investigations did not reveal, with minor exceptions, any distinct quantitative and qualitative differences of microflora cultured on the plain agar medium of sea-water medium. This may be due to the fact, that the fish subjected to this investigation were caught at the Gdańsk Bay, where the waters are considerably freshened. Beside freshening the waters of Gdańsk Bay are characteristic for a considerable contamination what, in turn, could bear on such frequent appearance of bacteria of Enterobacteriaceae group.

CONCLUSIONS

1. The seasonal oscillation of the bacteria quantity was proved within the content of the alimentary canal lengths of herring and sprat.

2. Within the content of the particular lengths of a codfish, the smallest quantity of bacteria was noted at spawning season; at this time, the bacteria did not appear in the stomach and in middle-intestine.

3. No schematic quantitative changes of Pseudomonas-Achromobacter group bacteria were observed within the content of the alimentary canal

lengths of the cod-fish, herring and sprat, in the course of these investigations.

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BADANIA SKŁADU ILOŚCIOWEGO I JAKOŚCIOWEGO MIKROFLORY PRZEWODÓW POKARMOWYCH ROŻNYCH RYB ZATOKI GDAŃSKIEJ

S t r e s z c z e n i e

Badania ilościowe i jakościowe dotyczyły treści odcinków przewodów pokarmowych. U dorsza badano przełyk, żołądek, jelito środkowe i tylne, u śledzia i szprota przełyk, żołądek i jelito.

W okresie tarłowym dorsza stwierdzono w jego jelicie tylnym najmniejszą ilość bakterii, w tym samym czasie żołądek i jelito środkowe były jał-

we. W pozostałych badaniach treści odcinków przewodu pokarmowego dorsza jak też we wszystkich badaniach szprota i śledzia stwierdzono wahania ilościowe bakterii.

Mikroflora treści odcinków przewodu pokarmowego dorsza, śledzia i szprota wykazywała w trakcie badań stałą zmienność składu jakościowego drobnoustrojów z grupy *Pseudomonas-Achromobacter* oraz bakterii gram-dodatnich i z rodziny *Enterobacteriaceae*. Wyniki badań jakościowych nie pozwalają na wyprowadzenie jakichkolwiek zależności.

ИЗУЧЕНИЕ КОЛИЧЕСТВЕННОГО И КАЧЕСТВЕННОГО СОСТАВА МИКРОФЛОРЫ КИШЕЧНИКОВ РАЗНЫХ РЫБ ИЗ ГДАНЬСКОЙ БУХТЫ

Р е з ю м е

Количественные и качественные исследования касались содержимого участков кишечника, и так: у трески изучались: глотка, желудок, средняя и прямая кишки; у сельдя и шпрота – глотка, желудок и кишечник.

В нерестовый период трески, найдено в её прямой кишке крайне невеликое количество бактерий, в то время как желудок и середина кишечника были стерильными. В другое время в содержимом желудка и кишечника трески, а также во всех пробах проведённых у шпрота и сельдя, нашли количественные колебания бактерий.

Микрофлора содержимого участков пищеварительных трактов трески, сельдя и шпрота показывает значительную изменчивость качественного состава микроорганизмов из группы *Pseudomonas Achromobacter* а также других бактерий. Результаты качественного анализа не позволяют вывести никаких закономерностей.

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