

Study of residual radioactivity in fish and fishery products imported into Bulgaria from China, Vietnam, Japan and Norway

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In the last few years - 2012 - 2014, in Bulgaria, fish and fish products are massively imported from the regions of China, Vietnam, Japan and Norway. As we know in these areas, especially in the zone 61, which is adjacent to the nuclear power plant Fukushima, where there was a global nature disaster in 2011 (7 degrees on the scale of INES), there was mass infection with radioactive substances of the Pacific water, plankton, algae and fish. Contamination of the Pacific water with radioactive substances. It was extremely dangerous in the initial period after the accident, but after this as well, mainly after 2015.

Keywords: fish, radioactive, Fukushima, Pacific water, Strontium-90, plankton, nuclear reactors.

INTRODUCTION

In the last few years - 2012 - 2014, in Bulgaria, mass imported fish and fish products from the regions of China, Vietnam, Japan and Norway. As we know in these areas, especially in the zone 61, which is adjacent to the nuclear power plant Fukushima, where there was a global emergency in 2011 (7 degrees on the scale of INES), there was mass infection with radioactive substances of the Pacific water, plankton, algae and fish. Contamination came from the Pacific water with radioactive substances. It was extremely dangerous, during the initial period after the accident, but also and after this, especially in 2015 years.

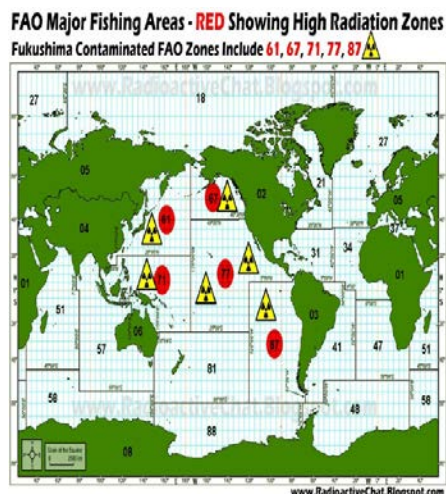


Fig.1. Fishing zone 61

The characteristic features of the three main species of fish that are widely imported into Bulgaria are the following:

Scomber (*Scomber scombrus*) is one of the most widely consumed fish in the world. In our country it

is widespread and popular because it is at a very affordable price, especially frozen, imported from China. Mackerel is a marine fish of aerodynamic shape, the most widespread in the Atlantic Ocean and its associated seas - the Baltic Sea, the Mediterranean and others.



Fig.2. **Scomber** (*Scomber scombrus*)

The Black Sea mackerel spends the winter in the Sea of Marmara, and it can be seen in Bulgaria Black sea in the period April- September. It is known as chirz and is back in September-January. This fish is more fed and with a higher quality. In Bulgaria, mackerel is available in any state - from freshly caught to frozen, whole, cleaned, without heads, only fillets; Smoked, salted, preserved in vegetable fat or tomato sauce "Breakfast" and "Ropotamo". Mackerel has great health benefits and beneficial properties. First of all, we must note that this type of fish contains in significant quantities the mineral substances - potassium, phosphorus, fluorine, sulfur, zinc, chlorine, sodium, as well as the whole spectrum of vitamins B, omega-3 fatty acids. The condition of the skin, the work of the heart, the brain, and the nervous system. As a powerful antioxidant, Omega-3 helps to strengthen membranes of the body's cells at the expense of neutralizing free electrons. These are radicals that can break the walls of the cells and

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disrupt their activity, resulting in a number of diseases.

Pangasius (*Pangasius*) is a silver-plated fish with a flat head and a horizontal mouth, often referred to as a silver shark. Adult specimens are quite impressive in size, reaching up to 1.5 m in length. The natural range of the species is the Indo-Kid's pools of Mekong, Chao Praia and Meklong, where this fish is a very important fishery resource.



Fig.3. Pangasius (*Pangasius*)

Since its cultivation is relatively easy, and the ever-increasing world demand for fish products makes it a major export commodity for Vietnam. Which is also the world's largest producer of pangasius with over 3500 tons a day. Production rates are steadily rising and this raises concerns about the emergence of different environmental and social problems. From a culinary point of view, the Pangasius is considered part of the so-called white fish group. It is a pronounced freshwater species that is also evident in its chemical composition - the notorious polyunsaturated omega 3 fatty acids are many times less. Otherwise, his meat is white, tender, slightly grainy and has a sweet and fine taste. Pangasius in Bulgaria and worldwide is sold exclusively in the form of frozen fillets without skin.

Salmo (*Salmo salar*) Salmon is born in freshwater, and when young salmon are big enough to cope with the salinity of the sea, they migrate. The so-called alpine salmon occupies the northern Atlantic and the rivers that flow into it.



Fig.4. Salmo (*Salmo salar*)

Different Pacific salmon live mainly in the Northern Pacific Ocean and its associated rivers. In 1960, Norway created the first marine farms, which

are floating cells in the fjords. The salmon that grows here takes about 2 years. This is the time it takes to reach the market size (about 2 pounds). Since it is a carnivorous fish, salmon feeds on fishmeal and butter (50%), and contains other ingredients such as plant meals and extracts (cereals, legumes, soybeans), vitamins, mineral salts as well as astaxanthin (a natural or synthetic pigment) vital to her health, which gives her the distinctive character color. The color of salmon changes with age due to hormonal influences. Salmon grows up to a maximum length of 1.50 meters and can weigh up to 35 kg.

Salmon, which is grown in the kennels, can be known on its characteristic spine fins, which are curved, unlike the normally developed wild salmon fins. The most distinctive feature of salmon is the color of the meat, which is light red to pink. In commercial chains, the salmon fillet is sold either without head or packed in vacuum packs. Today, the main salmon producing countries in these methods are Norway, Chile, and Canada. Norway's fish catches \$ 4 billion a year and is second only to oil.

Salmon is a rich source of healthy proteins. Omega-3 fatty acids are beneficial to heart health. They prevent blood clotting, irregular heart rhythm and lipid profile by increasing the level of good cholesterol and lowering blood triglycerides. Salmon is also rich in vitamin B12 and niacin. Niacin helps to lower cholesterol levels and B12 favors the work of the heart. Salmon maize is able to reduce the inflammation and pain associated with osteoporosis and arthritis.

EXPERIMENTAL

When severe accidents occur in energy or experimental nuclear reactors, large amounts of radioactive isotopes, such as iodine - 131, cesium - 137, strontium - 90, and so on, are extremely dangerous to humans. Although iodine - 131 has a relatively short decay period (about 8 days), it accumulates significantly in algae, plankton, sea and ocean waters and their inhabitants. Strontium - 90 has a half-life of 28 years and, as an analogue of calcium, mainly accumulates in the bones of the animal organisms where it resides for a long time. Cesium - 137 has a half-life of 30 years and mainly accumulates in the blood and soft tissues of seafood and ocean occupants. The present study aims to establish the presence of radioactive substances in fish and fishery products imported in Bulgaria in excess of the limit values from the fishing and breeding areas of China, Japan, Vietnam and Norway. About six months ago, various samples of fish mackerel, pangasius, salmon and fish canned from mackerel "Breakfast."

The samples were purchased from the retail chains located in the region of Blagoevgrad and tested in the laboratory "Environmental Radiation Analyzes" y Spectrometer - 20 050



Fig. 5. Spectrometer radiometric analyzes 20 050.

The results of these studies are as follows:

Table 1. Specific activity of the samples in November 2016.

No of the sample	Date of sampling and analysis	Type (name) of the sample	Sample activity - Bq / kg
1.	November 2016	Mackerel from China	580
2.	November 2016	Pangasius from Vietnam	460
3.	November 2016	Salmon from Norway	412
4.	November 2016	Canned "Breakfast"	390

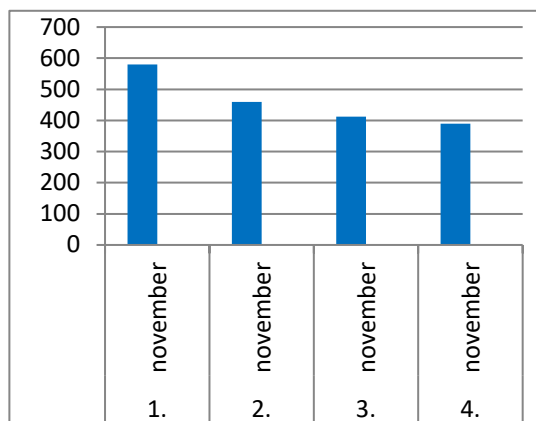


Fig. 6. Specific activity of the samples in November 2016.

Table 2. Specific activity of the samples in February 2017.

No of the sample	Date of sampling and analysis	Type (name) of the sample	Sample activity - Bq / kg
1.	February 2017	Mackerel from China	529
2.	February 2017	Pangasius from Vietnam	587
3.	February 2017	Salmon from Norway	492
4.	February 2017	Canned "Breakfast"	410

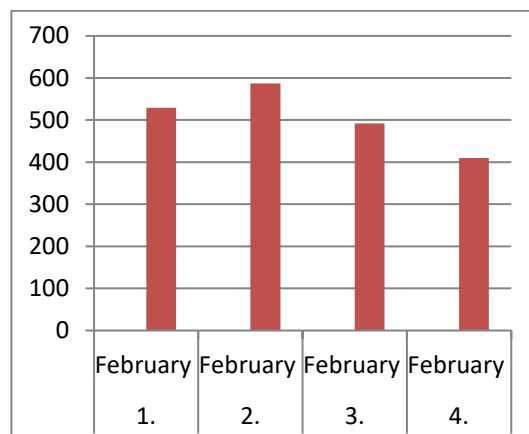


Fig. 7. Specific activity of the samples in February 2017.

Table 3. Specific activity of the samples in April 2017.

No of the sample	Date of sampling and analysis	Type (name) of the sample	Sample activity - Bq / kg
1.	April 2017	Mackerel from China	556
2.	April 2017	Pangasius from Vietnam	527
3.	April 2017	Salmon from Norway	462
4.	April 2017	Canned "Breakfast"	431

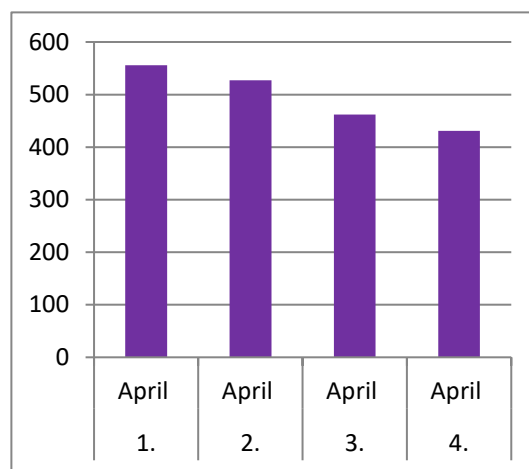


Fig.8. Specific activity of the samples in April 2017.

CONCLUSIONS

1. The results obtained show that in analyzed samples of fish and fishery products, none of them have activity above the limit values.

2. The activity closest to the limit values is the activity in mackerel samples taken in a fishing zone 61 close to the Japanese Fukushima nuclear power plant in which a global accident occurred in 2011.

3. Since radioactive substances with relatively longer half-lives are accumulated in the waters and underwater plants in this Pacific region, periodic radiological analyzes should be carried out after catches of fish and other ocean and seafarers.

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