Abramis sapa P. дене мүшелеріндегі бенз(а)пиреннің концентрациясын ШРК-мен салыстыра отырып еселік артуын анықтадық. Салыстыру үшін 0, 001 мг/кг тең, ет және балық өнімдері үшін арналған ШРК-ны қолдандық. Бенз(а)пирен бойынша барлық талдау жүргізген мүшелер ішінде ең жоғарғы жинақтау қасиет көрсеткен гонада болып шықты (ШРК-дан артқан еселілігі 42 есе). Ұқсас көрсеткіш бойынша екінші орында бүйрек тұр, содан соң бұлшық ет және желбезек. Барлық мүшелер бенз(а)пиренді нормадан жоғары жинақтаған. Ұлпалық деңгейдегі канцерогеннің ықпалын анықтау мақсатында жоғарыда аталған мүшелерге гистологиялық талдау жүргізілді.

Abramis sapa P. ішкі мүшелеріне микроскопиялық зерттеу жүргізу кезінде, бауыр құрылымында және желбезегінде өзгерістер анықталды. Бауырында циркуляторлық арнаның бұзылуы, тамыр маңындағы ісік және строманың ісігі байқалды. Желбезекке микроскопиялық зерттеу жүргізу, негізгі пластинкадағы эпителий ұлпасының ламеллаларында қабатталу түріндегі патологиялық өзгерістер барын, респираторлық жасушаларының некрозын, лейкоциттердің инфильтрациясын көрсетті.

Түр-индикатордың көзделген мүшелерінде сегіз ауыр металдың таңдамалы жинақталатындығы анықталды. Pb және Cd-дің мөлшері ШРК деңгейінен сәйкесінше 12 және 2 есе артық, ал мыс бойынша ШРК-дан асуы тек қана бауырда байқалды. Никельдің мөлшері түр-индикатордың барлық мүшелерінде ШРК деңгейінен асады, ал оның ең жоғары мөлшерде жинақталуы желбезекте екендігі және осы желбезекте тағы бір ауыр металл кобальттің (Co) жинақталатындығы анықталды. Мырыштың (Zn) және марганецтің (Mn) мөлшері түр-индикатордың барлық мүшелерінде ШРК-дан өте жоғары, ал темір бойынша ШРК деңгейінен артуы тек желбезекте ғана байқалады. Қорыта келгенде, жүргізілген зерттеулер көрсеткендей Abramis sapa P. түрі қоршаған ортаның мұнай өнімдері және ауыр металдармен ластануында түр-индикатор ретінде қолдану мүмкін екендігі көрсетілді.

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This paper describes a bioindicator for the northern part of Caspian Sea – Abramis sapa P. (Bream white eye), individuals who were caught and fixed in 10% formalin at a time in the near Atyrau Balykshy in August 2011. It is shown that the specie Abramis sapa P. can be used as an indicator species for environmental pollution by oil products and heavy metals. Indicator of nutritional status and security forage are not the only factors in Fulton and Clark, but the difference between them. In our case, the last increase compared with the tabulated data – a result of amplification of power and accumulation of cavitary fat that we found at the opening of the fish.

When comparing the concentration of benz(a)pyrene in the bodies of Abramis sapa P. with MAC calculated multiplicity excess. For comparison, we used the limit values for meat and fish, which is equal to 0.001 mg / kg. Of all the analyzed organs and tissues of the greatest cumulative properties of benz(a)pyrene found in gonads (multiple MPC excess of 42 times). The second place on the same index is the kidney, then muscle and gills. All organs accumulated benz(a)pyrene above normal. In order to detect the influence of a carcinogen at the tissue level was carried out histological analysis of the above bodies.

Microscopic examinations of internal organs were found Abramis sapa P. changes in liver and gills of fish. In the liver, circulatory disturbances observed bed, perivascular edema and swelling of the stroma. Microscopic examinations of gill lesions were detected in the form of delamination of lamellae, epithelial tissue from the basal plate, necrosis of respiratory cells, and infiltration of leukocytes.

Revealed the differential accumulation of eight heavy metals in target organs of the form of the indicator. The content of Pb and Cd exceed the MPC by 12 and 2 times respectively, and the excess copper is observed only in the liver. The nickel content in all organs of the form of the indicator exceeds the MCL, but his maximum accumulation is observed in the gills, which accumulates and other heavy metals – Co (cobalt). Of zinc (Zn) and manganese (Mn) in all studied organs of the form of the indicator is much higher than the MAC, and of iron a clear excess is observed only in the gills. Thus, studies have shown that the species Abramis sapa P. can be used as an indicator species for environmental pollution by oil products and heavy metals.

УДК 550.7:574.2:911.5/7(043.3) (574.2)

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RADIOBIOGEOCHEMICAL ASSESSMENT OF NATURAL AND MAN-MADE ECOSYSTEMS IN THE ISSYK-KUL REGION

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The results of measurements of natural radiation level was researched the concentration of natural and artificial radionuclides of soils in cultivated and wild plants of Issyk-Kul region natural and technoetnic ecosystems .

Issyk-Kul basin is a unique natural complex, with peculiar climatic conditions and rich biodiversity of flora and fauna. Research V.V. Kowalski was found that physical and geographical location and geological structure of the basin is largely define it

as a province with a high level of natural uranium, formed due to the scattering of uranium from weathered rocks and granites, and its accumulation in sedimentary rocks. The outputs of granites, the presence of carbonaceous-siliceous shales enriched uranium – define high concentration of uranium and other natural radionuclides in the environment /1/. Ionizing radiation in the biosphere, the origin of which is associated with natural radioactive elements, is one of the most important components in a complex set of factors that continually impacts on living organisms and their communities, which is characteristic for the conditions of the region. Our research has shown that the power of natural background radiation of gamma rays in the region ranged from 13 to 23 mR / h in some places up to 40 mR / h. Observed that as the distance from the lake to the mountains, its level rises, but not significantly. For example, if in areas of the lake it varies from 13-15 mR / h, then at a distance of about 5-6 km in the mountains, its level increases to 40 mR / h, especially in some mountainous areas, canyons, coastal wetlands. Probably, the variation of natural background radiation associated with a nonuniform distribution of heavy natural radionuclides in the crust [2, 3, 4].

Concentrations of natural radionuclides in the soil. For Issyk-Kul basin is characterized by diversity of soil cover, which is caused by a variety of sedimentary rocks that line the valley, the peculiarities of climate, the difference in hydrothermal conditions altitudinal and latitudinal belts, as well as the nature of the vegetation of slopes of ridges, foothills and piedmont plains [2, 3, 4].

Uranium. Our results has shown that the depending on the type of soil the uranium concentration flactuates from 2,8 to 12,7×10^{-4} % in the region. According to the A.P.Vinogradov the soil of the former Soviet Union provide are 1,9-9,3×10^{-5} % in an average. For example, the chernozem in Kursk Reserve which is considered the reference soils contain an average of 7,4×10^{-5} % [5]. If we compare with the benchmark, then the uranium concentration in the soils of the region are in 3,8-17,2 times greater than in the chernozem soils of Russia. The specific activity of the isotope uranium-234 in soil ranged from 42.3 to 106,6 Bq/kg, which is above clarke flactuates (25 Bq/kg) in 1,7- 4,3 times.

Thorium. Research has shown the average concentration of thorium in the out layer of the earth's crust more three times than the concentration of uranium. Results of Vinogradov in the soils of the Russian Plain thorium concentrated close to the geochemical background and is 6,0-8,0 × 10^{-5} % /5/. The results of our analysis have shown that the thorium concentration flactuates 11,7-84,1 × 10^{-4} % in the soils of the region, its highest concentration found in the plow horizon of light – and dark chest nut soils and in soils of mountain chernozem. The degree of enrichment of thorium is about 2,0-10,5 times in the soil of the region, it compared with conventional geochemical background.

Radium. In nature, radium is in dispersed form. It is not included in the composition of individual minerals, and is widely distributed in the form of inclusions in many formations. Clarke concentration of radium in the earth's crust is 1 × 10^{-11} %, and in soils – 8 × 10^{-11} % /5/. In soils of radium has the highest migration ability in comparison with other heavy natural radionuclides. According to our data, the concentration of radium in soils of the region flactuates from 9,4-43,0 × 10^{-11} %, which is higher than clarke about 1,2-5,4 times. Maximum concentrations of radium were found in light-soils. The specific activity of radium-226 in soil fluctuated from 59,4 to 111,7 Bq/kg, which is higher than world average values (29,2 Bq/kg) in 2-3,8 times.

Potassium. Considerable variations in levels of radioactivity can also occur with various concentrations of potassium-40 in rocks and soils. In present work, we introduce a special notion of «potash background», reflecting the contribution of potassium-40 in the total content of radionuclides /5/. The results of our tests have shown that the concentration of potassium-40 is uniform and 0,68-2,47 × 10^{-11} % in the soils of the region, the maximum concentrations detected in the light chestnut soils. The specific activity of potassium-40 are ranged from 861 to 1012 Bq/kg in soil, which is higher clarke values (370 Bq/kg) in 2,3 – 2,7 times.

Concentration of natural radionuclides in plants. Pathway of natural radionuclides in plants is very complex and depends on a number of interrelated factors. Our results have shown that the most migration- the ability of natural radionuclides in soil-plant chain are radium and uranium, thorium and the least. Found that in vegetative organs and roots of radionuclides accumulated significantly more than in the reproductive parts of plants (flowers, buds, seeds). The concentration of uranium are in wild plants for different areas of the region flactuetes from 3,7 × 10^{-6} % to 5,1 × 10^{-4} %. Individual plant species, such as *Orostachys thyrsiflora, Astragalus Borodinii, Oxythopis nutans, Caragana leucophloea, Lagochilus diacanthophyllus, Ephedra intermedia, Peganum harmala* able to concentrate uranium from 3,6×10^{-5} % to 2,1×10^{-4} %.

Concentration of natural radionuclides in the water. According to different authors, the amount

of uranium in the waters of the rivers of the Issyk-Kul is $n\times10^{-6}$ g/l. In many rivers of the region it flactuates, depending on season and place of test, from $2,8\times10^{-6}$ to 1×10^{-5} g/l, they contain 10, and in some cases 100 times more uranium than water areas of chernozem and black soil zones of Russia. The water of the lake Issyk-Kul is contained $3,0\times10^{-6}$ % the uranium on average. It is an order more than the uranium concentration in sea water (10^{-7} %) and one – two orders more than the average concentration of uranium in rivers and freshwater lakes (from $n\times10^{-8}$ to $n\times10^{-7}$ %). A high level of uranium is not something unique in the lake of the Issyk-Kul. For example, in the Aral and Caspian Seas – continental water bodies located in an area with a dry climate, there are similar concentrations of uranium in water. Different zones of lake Issyk-Kul have different concentration of uranium in water, due to uneven evaporation and desalination, occurring in coastal areas of the lake. The average water of Issyk-Kul contain $3,0\times10^{-6}$ % uranium. This is an order more than the uranium concentration in seawater ($n\times10^{-7}$ %) and one – two orders more than the average concentration of uranium in rivers and freshwater lakes (from $n \times 10^{-8}$ to $n\times10^{-7}$ %). The concentration of uranium in the sediments of lake Issyk-Kul at 1,5-2 order exceeds clarke concentrations. The high levels of uranium is connected the direct adsorption of complexes of uranium with organic matter. The among of algaes are most concentrated uranium algae from the family *Stoneworts*, on the dry matter of which have 1000 times more uranium than it is contained in the underlying sediments. Among the more bentonosnyh organisms accumulate uranium shells. In general, organisms bentonosa and plankton contain an order less uranium than the algae, as in animal organisms the accumulation of uranium occurs indirectly – through food. There are differences in the uranium concentration in the same species of fish taken in the same biogeocenoses. Observed the concentration of uranium in organisms and silt, depending on its content in the water. Commercial fish species of Lake Issyk-Kul contain an average of four biogeocoenose the following amounts of uranium in dry matter: *Leuciscus bergi* – $3,4 \times 10^{-5}$ %), *Leuciscus Schmidt* – $2,7 \times 10^{-5}$ %. Common normality for all the fish – is even less concentration of uranium in comparison with bentonos organisms. With the lengthening of the food chain increases sifting uranium – decreases the gradient of its accumulation.

It should be noted that there are man-made places in the region which requires special attention. One of man-caused uranium province is Kadji-Sai /8,9/. Mining Enterprise of the Ministry of Medium Machine Building of the Soviet Union for processing uranium ore was in operation from 1948 to 1969, later it was transformed into electro-technical plant. In this province, uranium oxide is extracted is not the traditional way, from the ashes of brown coals Sogutinskogo uranium-containing deposit. Coal produced at a local coal mine underground, pre-burned with concurrent production of electricity, and then the uranium oxide was extracted by acid leaching of ash. Waste and industrial equipment have been buried, forming a deposit pond, with a total volume of uranium waste 400 thousand m^3. Currently, the deposits and the dike under the influence of natural and anthropogenic influences gradually eroded, exposing erosion floods and mudflows, which lead to the removal of radioactive materials on the surface. In some areas the destruction of the insulating layer and the deposit dam background radiation reaches up to 1300 mR/h, which requires special attention, since subsequent mudflow phenomena will lead to a washout of radioactive particles in the waters of the unique high-mountain lake Issyk-Kul. In samples of the soil the concentration of uranium flactuates from 1,1 to $2,6 \times 10^{-3}$ g/kg in the deposit, with depth, its concentration increases slightly to $3,0\times10^{-3}$ g/kg. In the analysis also found other natural radioactive elements with high specific activity present in table 1.

Table 1

Isotope concentration of the ground of depository place in Kadji-Sai the technogeny uranium province

Specific activities of radionuclide, Bq/kg						
U-238	**Ra-226**	**Pb-214**	**Bi-214**	**Pb-210**		**U-235**
851,6±9,2	3789,6±2	2946,1±7	2675,8±6	3337,2±16		39,5±0,9
Th-227	**Ac-228**	**Ra-224**	**Pb-212**	**Bi-212**	**Tl-208**	**K-40**
162,9±2,9	39,5±0,9	146,2±12	109,4±1,0	87,4±5,5	97,9±1,9	890±11

The territory is fenced deposit reinforced concrete fence, however, public access and cattle remains an open question. A serious problem can be spray radioactive material with an open surface of the deposit and its transfer to the nearby territory. The percentage of uranium in plants technological province is from 0,17 to $4{,}0\times10^{-4}$%, that is, they have a higher concentrations of uranium in comparison with other areas of the Issyk-Kul region. Plant growth in an environment with high concentrations of uranium, not only accompanied by changes in their biological productivity, but also causes morphological variability in particular: a) in *Astragalus Borodinii* revealed splitting of the leaf blade, b) the flowers *Peganum harmala* instead of the usual five petals, it was noted 6-7 and part of their split (fig. 1), c) the *Orostachys thyrsiflora* there are significant morphological changes – low-growing form with branched inflorescences instead of straight single arrows (fig. 2, 3).

Another area which has also man-made – Factory № 7. On the shore of lake Issyk-Kul in the picturesque bay koltsovki was built in 1955, scientific proivodstvenny factory number 7 on the production of uranium from water. The choice was not accidental. Preliminary researchs have found that in the gulf there are powerful undercurrents. The idea of getting uranium out of the water was very tempting. The factory includes two-departments in addision the laboratory building and office buildings there are large and volume pools which is connected by a complex underground utilities.. Technology of obtaining uranium from Issyk-Kul water was very simple – the injected pump Issyk-Kul water in swimming pools, mixed with various reagents, which precipitated the uranium from the water, and then using a special filter obtained uranium concentrate. But not everything went so smoothly, the factory № 7 was received very little concentrations of uranium, and also concentrate had a high cost due to the large consumption of expensive copper hydrate and electricity. From this technology was abandoned. From 1956 to 1957 to replace the old technology, chemical precipitation of uranium from the water came a new technology based on ion exchange using ion exchange resins. But she has also undergone changes. From 1957 until the closure of the technology was worked out already selective extraction of uranium from the water, also using the new modifications of synthetic resins. The new set of resins required thorough the research of their selective properties of uranium. To do this in a metal container, wire mesh and placed the modification of resins, a metal container on a rope attached to the stern of the boat. Boat moving through the lagoon, has contributed more active sorbirovaiiyu uranium resins. In this case, many parameters were researched, the saturation time resin with uranium, the equilibrium concentration of uranium in water – uranium in synthetic resin, etc. Still, industrial plant for uranium mining in the lake Issyk-Kul and did not take place. This prevented the opening of several major uranium deposits in the USSR, as well as high costs derived from the Issyk-Kul water uranium concentrate. No less important has been taken into account and unpredictable environmental consequences that inevitably would occur in the project. All this is to tip the scales in favor of uranium mining companies. In 1982, the factory number 7 was closed. Low-level radioactive sludge (50 mR / hr) was taken at Kadji-Sai deposit [9]. Present work have shown that the object from the viewpoint of radiation safety is not a natural environment potentially dangerous.

Figure 1. The flowers Peganum harmala instead of the usual five petals, it was noted 6-7 and part of their split

Figure. 2. The Orostachys thyrsiflora there are significant morphological changes – low-growing form with branched inflorescences instead of straight single arrows

Figure. 3. Colour mosaic of leaves of Iris songarica Schrenk

Small areas with high level of natural background radiation:

- Unusual place in terms of radio-ecological researches are thorium in the sands of the beach in village Jenish, located on the south shore of Lake Issyk-Kul. The radioactivity of 30 – 60 mR / h, less at some points reaches up to 420 mR / hr. The results showed the presence in samples of sand following radionuclides specific activity was: radium-228 – 4173,3 ± 72,1 Bq / kg, thorium-228 – 4087 ± 87,9 Bq / kg, uranium-238 – 425 Bq / kg , radium-226 – 296 ± 16,0 Bq / kg. The level of total activity of alpha and beta emitting radionuclides was on alpha – 88700 ± 9200 Bq / kg, beta – 14700 ± 1500 Bq / kg.
- Small areas of lake Issyk-Kul the coastal zone, giving an increased radiation background. These sites can be attributed to the bank v.Tosor – 40-50 mR / h, the west coast 10 km. v.Kaji-Say – 38-40 mR / h, the coast around with v. Toru Aygyr – 30 mR / h, the coast around with v. Tamchi – 40-50 mR / h.
- Mountainous terrain gorges which are based on granite, rocky soil, and red sand giving high natural background radiation from 25-40 mR / h. These caves are: Chichkan, Kurgan-Sai, Kurga, Ak-Terek, Chong-Jargylchak, Sutu-Bulak, Tosor, Jon-Bulak, Kekilik, Tong, Chok-Tal, Baktuu-Dolonotu, Sogotu.

Given the fact that lake Issyk-Kul basin is the natural uranium biogeochemical provinces in the region need to conduct sresearches to determine radiobiogeohimical radionuclides manmade objects in the environment.

The concentration level of artificial radionuclides in the soil. The specific activity of strontium-90 amounted to 2,1-4,1 Bq/kg with an average of 3,2 Bq/kg (RC – 9 Bq / kg, NRB-99) in the soil. The specific activity of cesium-137 ranged from 3,8-7,9 Bq / kg, with an average 6,1 Bq/kg (RC – 15 Bq/kg, NRB-99). We believe that their nature is connected with the processes of global fallout, as the range of concentrations of artificial radionuclides from global fallout in the northern hemisphere are on the strontium-90 and cesium-137 to 30 Bq/kg /11/. The concentration of artificial radionuclides in plants. When you receive data from the radionuclides in soil of cereal crops is noted more intense their accumulation in vegetative plant parts as compared to reproductive organs. Amount of strontium-90 in winter wheat grain was 0,15 – 0,26 Bq/kg in the straw from 2,45 to 3,12 Bq/kg. Levels of cesium-137 in wheat grain varied from 0,10 to 0,23 Bq/kg and in straw 2,05 – 2,56 Bq /kg. The observed variations of the specific activity of strontium-90 and cesium-137 are related to differences in physical, chemical and agronomic properties of soils, with flactuating the concentration of radionuclides by the data as well as varietal characteristics of wheat. A similar accumulation of radionuclides typical of spring barley, as in vegetative and reproductive parts of plants. The concentrations of strontium-90 and cesium-137 in leguminous plants – sainfoin, alfalfa higher by about two orders of magnitude than in cereal crops. Lower concentrations of radionuclide observed in corn cobs. For potato accumulation of radionuclides in the economic valuable part of the crop (tubers) are 3-4 times lower than their accumulation in the leaves. The concentration of strontium-90 in wild plant species (*Artemisia tianschanica, Festuca valesiaca, Traxacum sp., Plantago lanceolata, Peganum harmala, Achnatherum splendens, Caragana leucophloea, Ephedra intermedia, Phragmites communis, Glycyrrhiza glabra, Phleum phleoides, Stipa capillata*) flactuated between 2,1-3,1 Bq/kg, with an average 2,6 Bq/kg. acceptable levels of specific activity of strontium-90 is 111 Bq/kg (NRB-99) in wild vegetation. Levels of cesium-137 in these kinds of wild plants Issyk-Kul region amounted to 1,9-2,8 Bq/kg, an average of 2,3 Bq/kg, with acceptable levels of specific activity of cesium-137 in wild vegetation-74 Bq/kg (NRB-99). The concenration of artificial radionuclides in the water. Results of radiochemical analysis of water samples of Lake Issyk-Kul have shown that the specific activity of artificial radionuclides below the radiation safety standards. The specific activity of strontium-90 in water ranges from 0,015 to 0,036 Bq/l, compared to a standard – 5 Bq/l (NRB-99). The specific activity of cesium-137 in water ranges from 0,043-0,065 Bq/l, with NRB-99 – 11 Bq/liter. In the bottom sediments were also found low concentrations of these radionuclides. Thus, the results of our investigations have not revealed the presence of anthropogenic contamination of Issyk-Kul region artificial radionuclides (strontium-90 and cesium-137). Their specific activity in the objects

of the natural environment of the region is within background values.

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Жұмыста табиғи радиацияның деңгейін зерттеу нәтижелері келтірілген, деме техногендік және табиғи радионуклидтердің Ыстықкөл аймағындағы табиғи-техногендік экожүйелердегі мәдени және жабайы өсімдіктерде мөлшері анықталған.

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В работе представлены результаты измерений природного радиационного фона, исследовано содержание естественных и искусственных радионуклидов в почвах, культурных и дикорастущих растениях природно-техногенных экосистем Прииссыккулья.

УДК 591.8

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МОРФОЛОГИЧЕСКОЕ ИССЛЕДОВАНИЕ ВНУТРЕННИХ ОРГАНОВ ОТДЕЛЬНЫХ ВИДОВ РЫБ, ОБИТАЮЩИХ В РЕКЕ ИЛЕ В РАЙОНЕ ПЛОТИНЫ

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Проведено патоморфологическое исследование органов желудочно-кишечного тракта, печени, жабр, половых желез у особей жереха, судака, сазана, обитавших в реке Иле в районе плотины Капчагайской ГЭС. У всех исследованных особей были выявлены морфологические изменения компенсаторно-приспособительного характера, выраженные в большей степени в печени и жабрах. Они выражались в увеличении количества слизистых и палочковых клеток в эпителии жаберных лепестков, появлении слизистых клеток в эпителии лепесточков, явлениях отека в эпителии жаберных лепестков и ламелл, явлениях отека в периваскулярных пространствах печени, моноцитарной и лимфоцитарной инфильтрации периваскулярных пространств печени, лимфоцитарной инфильтрации эпителия кишечника. У особей сазана в печени, жабрах, яичниках были отмечены морфологические изменения деструктивного характера. Они выражались в деструкции сосудистого слоя отдельных жаберных ламелл с явлениями гемостаза, обширных воспалительных процессах и некротических изменениях ткани печени, нарушениях сосудистого русла (кровоизлияния, отеки, тромбозы печеночных артерий) и желчевыводящих путей печени, разрастаниях соединительной ткани стромы печени, дегенеративных изменениях ооцитов в яичниках. Выраженные патоморфологические изменения у изученных особей сазана могут быть объяснены тем, что сазан как бентофаг в большей степени подвергается воздействию загрязняющих веществ, которые приводят к патологическим изменениям органов.