NEW DATA ON FISH COREGONUS PELED (GMELIN,1788) IN SOME WATERBODIES OF MONGOLIA

A.Dulmaa
(Institute Biology, MAS)

Abstract

In connection with the planned establishment of a coregonid fishery and the construction of a specialized hatchery in the area of Western Mongolia was organized with the task of studying some parts of the reproduction biology of Coregonus peled population inhabiting Lake Ulaagchnii Khar Nuur (Zavhan aimag). This species was introduced into this Mongolian lake, originally lacking any fish stock, in 1980 -1982. The samples of 11230 fish examined was collected during 1993 -1999, 2005-2011 and consisted partly of the fish originating from imported and introduced larvae and partly of the individuals belonging about 25th generating , already born in the lake studied. Most of parameters studied, such as absolute size, weight, the population dynamics, reproduction biology, of food analyses, and fatnes observed to the during vegetation period (November – December and first half of January), when the minimum daily waters temperature drops to 4^{0}centigrade or less. The sex ratio is fairly balanced if the total material from all fishings is considered. During this period of peak-spawning females predominate. The average individual standard length of spawners was 400 mm in males and 420 mm in females, the average weight 700 g in males and 900 g in females. Nevertheless, all parameters under study tend slightly to deteriorate in the course of time, which is obviously a result of the gradually increasing population density and of decreasing quantity of food available in the lake.

In Khuisiin Naiman Nuur (Uburchangajskij ajmag) sexually mature at the age of 2 + , exceptionally already at the age of 1 + , at the minimum total length of 323 mm and minimum weight 295 g. Gonadosomatic index of mature females ranged 9.0 to 25.0 %, mean absolute fecundity averaged 58.060 eggs.

Introduction.

With increasing fishing pressure has led in recent years to a decrease in density and production of valuable species, and demands for an improvement of fishery management, especially as regards the establishment of a coregonids fish culture. It was necessary to do basic ichthyological research on the population dynamics and reproduction biology of introduced Coregonus peled.

Coregonus *peled* is doubtless one of the most successful objects of acclimatization in fish management and at present is spread over numerous countries of Europe and Asia. In Mongolia introduction began only in 1978 (Dulmaa,1984; Anonymous, 1983) namely in the following waterbodies: lakes Shireet, Haliut and Muchar in 1978 and 1979 (the Lake-system Khuisiin Naiman Nuur Uburchangajskij ajmag, Lake Ulaagchnii Khar in 1980, 1982, 1986 (Zavhan aimag), Lake Khongor Ulen Nuur in 1981 (Bajan-Ulgij aimag).

The acclimatization of some coregonid fishes into certain lake systems of the Mongolia, aiming to intesify the natural fish production. All this was studied in the material from the Lake Ulaagchnii Khar and from some other lakes of the Khuisiin Naiman Nuur lake system [1].

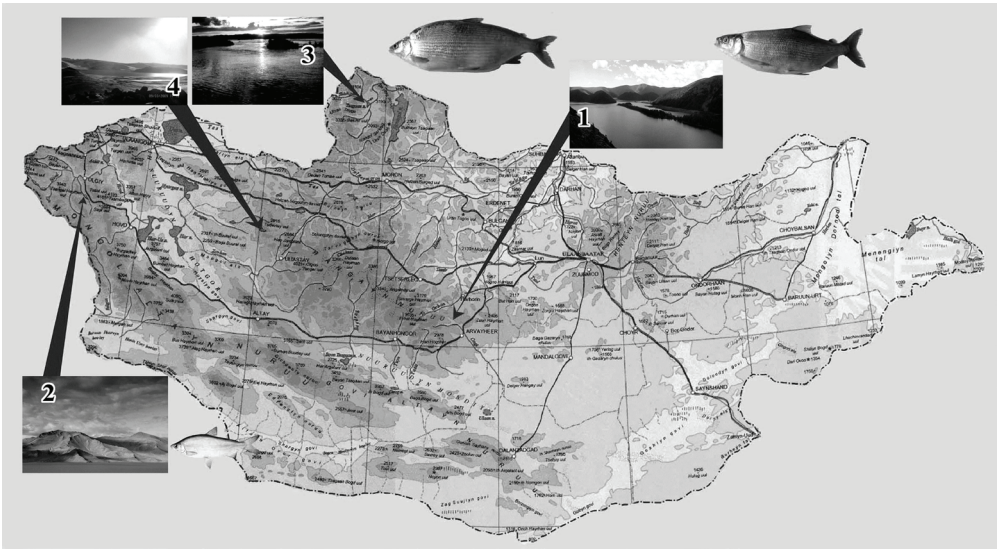

Fig.1. Distribution of Coregonus peled in Mongolia

1. Khusiin Naiman Nuur
2. Khongor-Ulen, Tolbo Nuur
3. Darhad Valey (Targan Nuur)
4. Ulaagchnii Khar Nuur

Material and Methods

We examined the material of fish collected at the 12 stations in the Lake Ulaagchnii Khar (n=11230) age classes 2+ to 13+ (Tab. 1). A set of 4 gillnets with a mesh size creasing from 35 to 60 mm and total length of 100-300 m was used for experimental fishing. The nets were usually laid on the bottom of the lake, both in pelagial and littoral parts. All length measurements (TL, SL, FL) were taken from the tip of the snout. Otherwise, the standard ichthyological procedures [5] were used in studying the reproductive properties, age composition, *etc.* The material of *Coregonus peled* larvae used for introduction in Mongolian lakes was imported from the Bolshrechnsky coregonid hatchery in Buryatya, Russia, near its mouth to Lake Baikal in 1980, 1982.

Table 1.

Survey of Coregonus peled analized for age and size (1996-2011)

Age	n	Length, mm						Weight, g					
		M	±mM	SD	CV	Pt	±t $m_{M\ M}$	M	±mM	SD	CV	Pt	±t m_M
1+	11	271	7,915	13,75	5,035	2,9	15,545	320	7,19	12,5	4,065	2,34	14,125
2+	837	313,3	17,043	32,252	19,166	5,3812	35,078	449,77	25,757	157,62	28,103	4,4266	50,98
3+	1023	347,43	14,711	24,233	18,706	4,3846	29,06	641,36	37,632	159,23	20,835	8,8313	69,79
4+	616	381,19	18,338	38,804	22,157	4,5987	36,571	862,09	67,126	320	30,319	23,098	118,51
5+	793	399,94	12,172	17,724	5,7747	3,0078	27,473	959,35	48,532	133,75	12,857	17,734	87,576
6+	304	435,62	21,127	61,184	13,507	4,4116	41,283	1206	118,87	580,23	33,677	31,366	106,4
7+	287	449,61	18,625	53,533	11,884	3,8104	36,586	1471	125,9	495,97	21,177	25,815	228,65
8+	194	455,54	30,093	72,235	15,554	6,2981	58,782	1472,5	93,767	283,02	14,254	61,746	329,06
9+	150	465,52	25,39	44,13	8,5438	4,8944	49,883	1407,3	94,719	166,14	10,908	19,97	177,15
10+	50	475,75	37,45	65,721	12,473	7,1356	74,735	1744,9	96,742	178,38	9,7417	20,729	200,56
11+	25	537	62,077	109	19,787	11,263	121,63	2057,7	116,73	227,33	11,093	57,633	177,21
12+	12	581,33	51,433	90,267	16,117	9,14	100,4	2455	101,63	186,67	7,5167	84,207	118,22
13+	9	630	69,2	120	19	10,9	135	3100	57,5	100	3,22	1,86	113

Explanation: M – average, ±mM – error of average, SD – standard deviation, CV-coefficient variation, mCV-error of coefficient variation, Pt-accurary indicator, ±tm -confidential interval P_{005}

Study Sites

The main objects of introduction for our country are Coregonus peled. For experimental works were selected the following reservoirs, the ecological characteristics of some of them are given below.

A droup of flowless lakes is located in the north-western part of the Hangayn Platean of the Central Asian flowless basin, at the absolute height of 1700-2150 m a.s.l. Among them one of the largest is the Lake Ulaagchnii Khar and it is located on the territory of Zavhan aimag, NW from the district Uliastay, Erdenehairhan somon [4]. The lake is situated among the famous Mongolian great Sand Valley "Bor-Har", which stretch for 550 km. The lake has an ablong shape consists of several reaches with big bays and in the western part with two Islands with a height of 1980 m above the sea level.

Photo 1. Lake Ulaagchnii Khar Nuur

The territory of the Lake Ulaagchnii Khar is 84.5 sq. km., the lenght 36 km, maximum width 7 km and maximum depth of 50 m, average 25 m. The litoral zone, with a depth of 5 m, includes more than 15% of the total area. The zone limited by isobat of 10 m occupies 19% of the area, 12 m - 19%, 20-30 m 22%, over 30 m - 24%.

The lake"s bottom to a depth of about 5 m consist of gravel and sand, with clay existing exclusively at depths > 10 m. In its deepest parts the bottom is covered with a mixture of very fine clay and a high proportion of organic matter. The lake is almost completely isolated, with only a single periodic tributary, the Ulaagchnii Gol Creek, to the north. A small stream, Telj Creek flows out from the lake"s eastern part, however it disappears into the steppe after about 50 - 150 m. Spring of fresh water exist on several sites of the lake and thus create water circulation in the lake [3]. The banks of the lake are low, rocky, in some places the rocky mountains come abrupty into lake, where the substantial depth start.The W and NW banks are surrounded by sand dunes reaching sometimes a height of 200 m or even more.

The water in the Lake Ulaagchnii Khar is fresh, the total mineralisation is from 200 to 542.5 mg/1^{-1}. It is covered by ice in the end

of November beginning of December. The thickness of ice reaches 120-180 sm. The water temperature under ice is 1.0-2.0^{0}C, the transparency amounts to 7- 4 m. The ice in the lake is broken completely at the and of June. In summertime (July-August) water is heated at the surface up to 15-25^0 C, at the depth of 40-50 m 8 -12^0 C.

The oxygen concentration is 7.74-8.29 mg/l^{-1} and saturation up to 85.8 - 97.5%. Photosynthesis speed was in average 0.10 mgO_2/l^{-1} per day, with destruction 0.16 mgO_2/l^{-1} per day. The chlorophyll content ranged within 0.78 and 0.47 mg/m^3. The primary production is 105 mgC/m^2 or 115 kkal/year [2].

In the Lake Ulaagchnii Khar is inhabited by 43 species of zooplankton including *Copepoda - 11, Cladocera - 10, Rotatoria* -22 species. In the main forms are eurybiontic, with wide geographical spread. The prevailing complex of zooplankton during the year is *Rotatoria-Copepodian* with leading species of *Arctodiaptomus (Rhabdodiaptomus*) bacillifer, *Hirudinea* and *Chironomidae.* Their population reaches from 1.4 to 6.2 thousand/ m^3 *Mixodiaptomus incrassatus, Cyclops abyssorum, Daphnia (Daphnia) longispina, Keratella quadrata,* which are year round. In benthos dominating a*re Gammarus lacustris, Mollusca* with biomass from 200 to 570 kg/ ha^{-1} The most richly population zone is the zone of silted sands and silts with *Chara foetida* and *Fontinalis antipyretica,* which is strongly represented by *Gammarus lacustris* that occupies over the half of the total biomass weight. The most poorly population is the depth zone, where test samples give 15-75 kg/h^{-1}, exclusively of *Gammarus lacustris* and *Chironomidae,* from which mainly *Chironomus plumosus*. The biomass of the mentioned zone is probably higher, mainly due to the fact bottom drawer does not draw completely the *G. lacustris*.

The Lake Ulaagchny Khar.is a highly feed reservoir. In phytoplankton dominating are diatomic and blue-green ones. The zooplankton .biomass is sufficiently high, in summer it is 6.9 -10.1 g/m^3, in winter 1.26 - 3.05 g/m^3. .Considerable feed resources of the lake were not used because not was of fish in the lake. On the basis of theses biological data it was recommended to install into the lake larvae of Coregonus peled in 1980,1982 in total 100000 million larvae were released in to this lake [3].

Lake Khuisiin Naiman Nuur represented a system of eight consequently joined lakes (Shireet, Muchar, Halyut, Bugat, Haja, Shanaa, Doroo, Khuis) are situated in a valley of SE part of Hangai mountains, 120 km northerly the administrative centre Arvajheer, Uburchangajskij aimag.

Photo 2. Lake Khuisiin Naiman Nuur

Its elevation is 2450 m.s.l., the water area varies from 100 to 325 hectares, the maximum depth occurring in the SE part of the lake 17-25 m, the most frequent depths are 5-10 m.The bottom relief is saucer-like.The lake is closed. No streams flow into or from it. There water collection is carried out through atmosphere precipitation, inflow of high flood waters and ground nutrition. All lakes have similar hydrobiological, hydrochimical and hydrological features. The transparency of water varies from 2.5 to 4.5 m the surface water temperature reaches maximally 15—18 °C during summer. As regards water chemistry, the lake is of the hydro-carbonate type and according to the degree of mineralization the "ultra-fresh" type, the total amount of salts being 58.1 to 69 mg/l^{-1}. The oxygen content is very suitable reaching 7.41—8.91 mgO_2/l^{-1} (107.2-112.4% saturation) during May and July, 9.60 mgO_2/l^{-1} (101.5 % saturation in October. Under the ice (February-March) the surface concentration of O_2 changed from 7.2 to 8.0 mgO_2/l^{-1} (saturation 69-74.2%). Daytime oxygen concentrations showed some oversaturation at the surface, but no other remarkable signs of eutrophication were observed. Photosynthesis speed was in average 0.63 mgO_2/l per day, with destruction 0.37 mgO_2/l per day. pH-value range 6.97-7.20. Chlorophyll a concentration of Lake Shireet and Muhar were from 3.25 to 5.96 mg/m^3, phytoplankton biomass 3.91-1.49 g/m^3 and primary production is 605 mgC/m^2 or 730 kkal/m^2 during the year.This lakes may be considered as mesotrophic.

Phytoplankton of the lakes presented in 33 species and ultraspecific taxon of algae belonding to 5 groups. At the head was *Chlorophyta – 13 species, then following Bacillariophyta -11, Cyanopyta -7, Pyrrophyta -1, Euglenophyta* – 1 species. Among the five phytoplankton taxa, dominant algae were *Cyclotella comta* (37.3 mg/m^3), *Oocystis submarina* (0.25 mg/m^3), *Synedra ulna* (200 mg/m^3), *Melosira islandica* (250 mg/m^3), *Scenedesmus quadricauda* - 0.11 mg/m^3.

The benthic vegetation is well developed, with up to 40% of the bottom supporting macrophytic growth. The mesotrophic lakes of Khusiin Naiman nuur shows a rich developed submerged vegetation with well developed under water meadows of varies *Chara vulgaris* and *Fontinalis antipyretica.* The following macrophytes were identified: *Ceratophyllum demersum, Lemna minor, L.trisulca, Myriophyllum spicatum, Polygonium hydropiper, Phragmites australis, Spirogira sp.,Zygnema sp.* In shallow of Lake Shireet the dominant species were*: Myriophyllum verticillatum, Ranunculus aquaticus, Polygonium amphibium, Potamogeton pectinatus, P.praelongus, P.lucens.Helophytes* were sparse but diverse, mostly *Eleocharis palustris, Scirpus lacustris, Alisma lanceolata, Juncus bufonius.*

Lakes Khuisiin Naiman Nuur have the highest quantity of food among the water bodies on the Hangai mountain Lake Plateau [1]. The zooplankton is composed of 20 species: *Arctodiaptomus denticornis, Cyclops lacustris, Daphnia longispina, Kellicottia longispina, Conochilus unicornis* are abundant of them. The biomass of zooplankton, excluding sufficiently abundant gammarids, varied 1.0 – 2.3 (x= 1.28) g/m^3 in the period prior to stocking of peled larvae into the lakes during the summer season and 0.7-1.0 (x=0.81) g/m^3 during winter. The abundant trophical sources were not formerly utilized due to the complete absence of the fish, particularly the planktonophages. The seasonal productivity of crustaceo plankton reashed 73 kkal/m^{-2}.

The benthic invertebrates include planktonic crustacean, most *Gammaridae*, and *Ostracoda.* Lake insects are also numerous. Many nektonic *Heteroptera* and *Coleoptera* feed on the bottom and

breathe at the surface, mostly in the shallow water near shores. The planktonic larvae and nymphs of mosquitoes thrive in these lakes. In the macrophyte belts above muddy bottoms lives a rich and diverse animal benthos comprising *Hydracarina, Mollusks (Lymnaea peregra, Planorbis planorbis, Gyraulus sp., Physa acuta, Radix ovata, Valvata and Pisidium casertanum*. Among the insects, mostly *Chironimidae* with biomass 0.05-0.71 g dry weight per/m^{-2} (*Mictopsetra, Polypedilum brevianteunatum, Microtendipes, Tanytarsus, Chironomus salinaius)* dragonflies and some mayflies are adapted to muddy subsrata but caddisflies are restricted to hard subsrata as are the stoneflies. Muddy bottoms are also occupied by numerous mollusks (0.12-0.48 g dry weigth per/m^{-2}) such as *Lemnaea, Planorbis and Pisidium*. Benthic animal biomass in lakes Shireet 5.2, in Muchar 0.62-5.30 dry g/m^{-2}. The potential commercial productivity of fish was estimated to be 10-20 kg/ha^{-1}. There are also vast suitable spawning sites on sandy or gravel banks.

On the basis of these biological data it was recommended to stock into lakes Schireet, Muchar, Chaljut, Khuis and Bugat larvae of Coregonus peled in a quantity 1 500 individuals per hectare. In May 1978 into the system of lakes Khuissin Najman Nuur were brought in 50 thousand, and in 1979, 100 thousand larvae of Coregonus peled.

Into Altaj reservoirs of the Khongor-Ulen system in Bayan-Ulgii a/mag /Har, Toson, Khongor/ and Tolbo Nuur with exclusively poor ichtyofauna the Coregonus peled was introduced in mid-May 1981. In summer of the same year the individuals reached up to 50 g.

Photo 3. Lake Tolbo Nuur

Coregonus peled /Gmelin, 1778/ owing to ecological plasticity it has inhabited far beyond the limits of its areal, in reservoirs of the Central Asia. In Mongolia introduction began only in 1978 [2]. At present Coregonus peled has acclimatized well and settled all over the Lake Ulaagchnii Khar. In the beginning of October-November starts a spawning migration toward the lake side areas of the resejrvoir. ln winter the fish goes into deeper parts. O+ yearlings weight from 75 to 120 g.

Fig.2. Coregonus peled from Lake Ulaagchnii Khar

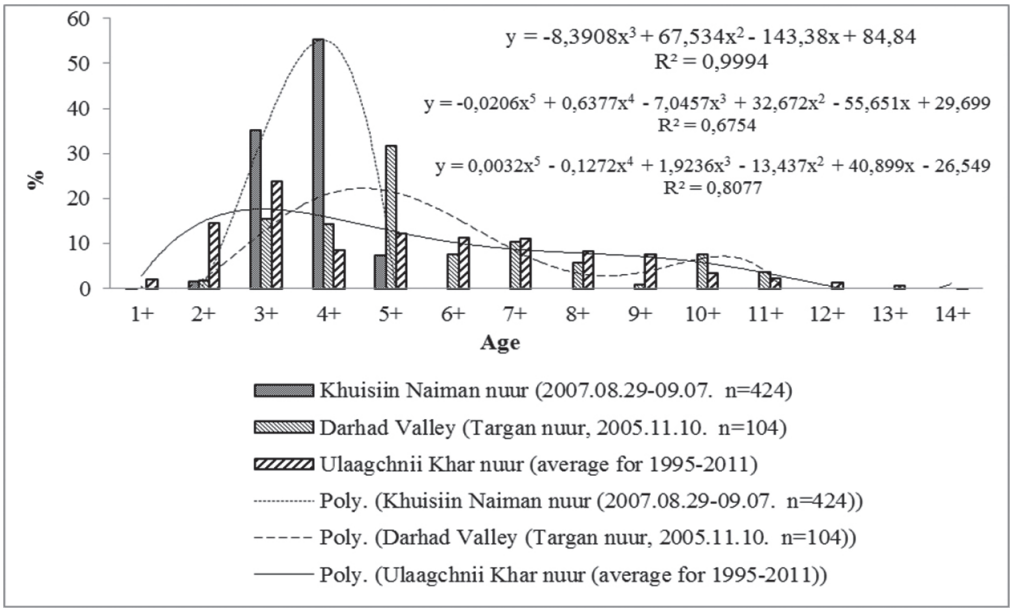

Fig. 3. Age composition of Coregonus peled

The age captured Coregonus peled was from 1+ to 14+ groups, the major part of the stock consisted of individuals 2+ to 10+ age in Lake Ulaagchnii Khar Nuur, in Khuisiin Naiman Nuur individuals of peled captured from 3+ to 5+ years old. In waterbodies of the Darhad valley peled have a age composition from 3+ to 11+ years, in the stocks dominate 5+ year old.The grown-up fish weight varies from 350 to 3620 g are found at the age of 1+ up to 14+, but dominating are 3+ - 5+ (87.1%) age. Coregonus peled under the conditions of sharply continental climate matures rather early on the second life year, in some cases at the age of 1+ with achieving minimum length of 323 mm end minimum weight of 295 g .

In Khuisiin Naiman Nuur yearling C.peled weight 120 g, adult fish of 1+ - 5+ ages weighted between 230 and 335 g, corresponding to a length of 214 and 341.2 mm, respectively. In the Darhad valley for summer 3+ - 9+ old individuals of C.peled had a body length of 245-450 mm, weighted 330-1200 g. In lake Ulaagchnii Khar Nuur the individuals of 3+ to 9+ age were in average 323-520 mm and 397-2560 g.

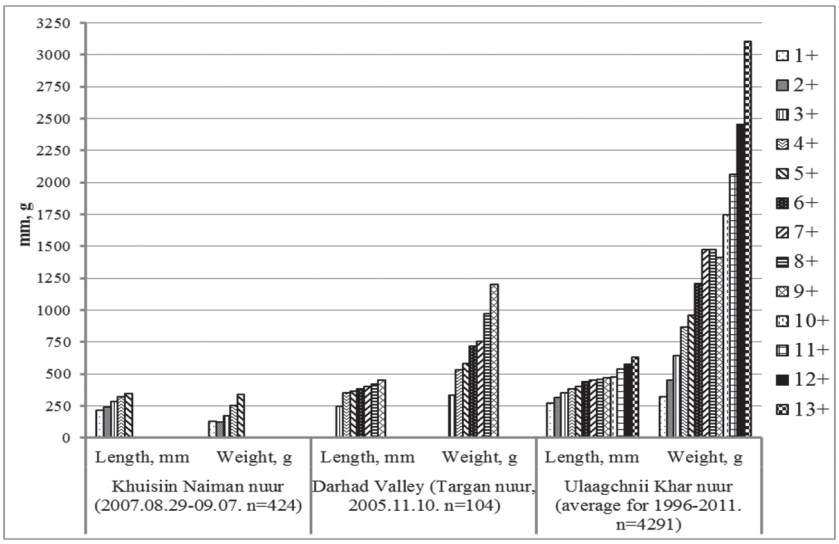

Fig.4.The size and weight of Coregonus peled in different ages

The rate of growth of peled whitefish population-acclimatizants is high and is closely related to temperature and feeding features of reservoir. According to available data, the comparatively intensive growth is noticed with peled whitefish in the system of Khuisiin Naiman Nuur, Ulaagchny Khar and Baga Nuur. When comparing the figures of growth of peled whitefish from Mongolian lakes and several reservoirs of Siberia, one can easily see that the growth rate of fishes of population-acclimatizants is rather high. The increase of the growth rate of Coregonus peled in the first years of acclimatization in reservoirs outside the natural areal, under the condition of good supply of feed, has been mentioned numerously in the literature [4].

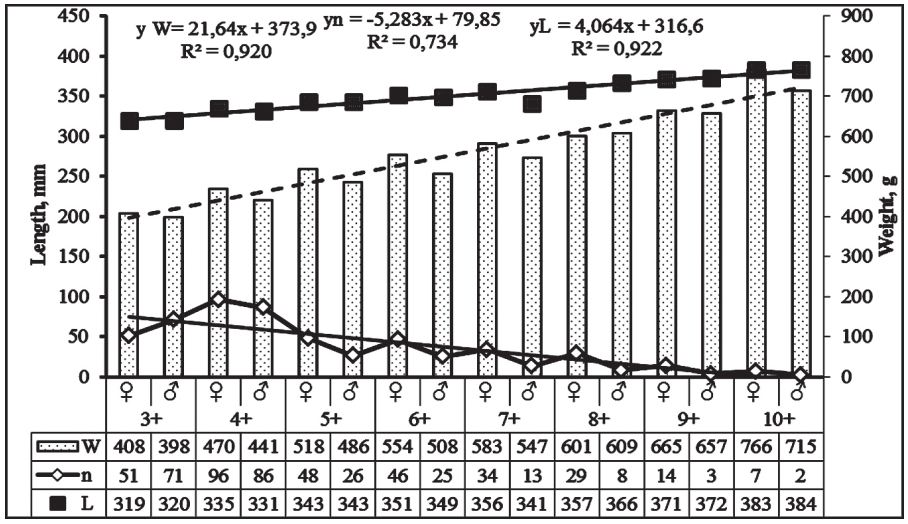

Fig.5. Growth of the female and male of C. peled in Lake Ulaagchnii Khar

To a temporary increase in C.peled catches due the overexplotation of it. The effort resulted in extra catch about 20000 - 50000 t in period 2010-2012 years. Perhaps , this may result to decrease of the size, weigh and in changing age composition Coregonus peled in the Lake Ulaagchnii Khar and Khuisiin Naiman Nuur, with comparision in 2009 year.

At the end of July sexual products of female Coregonus peled are at the II - IIIrd stage of maturity, in August at the III-IYth, in September at the IYth, in October - November at the IY-Yth, by the and of Desember and the beginning of January there are found individuals with gonads at Y-YIth stages. The gonadosomatic coefficient before spawning of female of age 2+ varies from 9.1 to 20.0%. At the end of October-mid-November some female individuals have the maximum coefficient of maturity - 25%, and the minimum was in February - 0.8%.

The spawning happens in November-December during the period of getting ice-bound or after it. Spawners starts at the temperature of water 2.5-1.8^{o} C and the height falls on the period with water temperature of 1.5-1.0^{o} C under ice. Coregonus peled spawns at the depth of 1.5-4.0 m on sandy or pebbly-sandy grounds. The sex ratio of Coregonus peled among same age producers in selected waterbodies is close 1:1 (Fig.6).

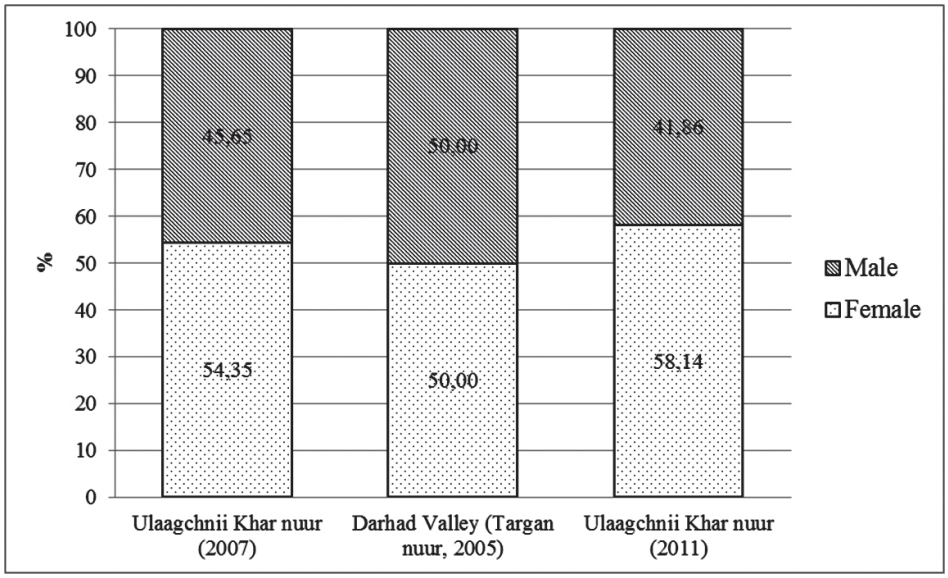

Fig. 6. Proportion of the male and female in waterbodies of Mongolia

The fluctuation level of fecundity depends rather not only the age, but the producers sizes. The growth of length and weight of fish leads to the increase of absolute fecundity (fable 2). The absolute fecundity of two yearslings fluctuates within 5.6 - 62.5 thousand eggs, of three-year-lings 7.4-77.6 thousand eggs, four-yearlings 10.8-92.2 thousand eggs, and five-yearlings 18.6 – 120.0 thousand eggs. The number of eggs accounting per 1 gramm of testicle depending on the level of mature of gonads, age and mass of fishes fluctuates within 300 to 1325 eggs. The eggs is yellowish - orange, the sperm is thick consistence and of white colour. The average diameter of unswell eggs is 1.5 mm and of the ripened eggs reached - 2.0 mm.The absolute fecundity of naturalized Coregonus peled varies strongly from 4.4 to 120 thousand eggs with average of 59.0 thousand.

Table 2. Absolute fecundity in long standing date of Coregonus peled from Ulaagchnii Khar lakes depending of the length and weight

Age	n	L,mm	W, g	Absolute fecundity				Relative fecundity				Coefficient fecundity				Gonadosomatic index,%			
				M	±mM	SD	CV	M	±mM	SD	CV	M	±mM	SD	CV	M	±mM	SD	CV
1996.11.2 - 12.28																			
1+	2	234	160	5379	613	1225	22.77	3.68	0,183	0.37	1.09	0.69	0.04	0.07	3.5	10.25	0.439	0.88	8.556
2+	9	302	280	14146	1110	4708	33.28	51,02	3,764	16	31,3	0,64	0,04	0,18	2	17,98	1,729	7,33	4,79
3+	21	336	470	21435	993	6433	30.01	45,99	1,233	7,99	17,4	0,75	0,02	0,16	0,76	15,81	0,458	2,97	18,77
4+	7	362	580	22748	2130	7971	35.04	38,65	2,214	8,28	21,4	0,97	0,5	0,18	2,57	14,85	1,239	4,64	31,23
5+	3	401	740	30594	3796	9299	30.39	41,1	4,523	11,1	27	1,02	0,11	0,27	9	14,29	1,689	4,14	28,94
6+	5	451	950	34102	5578	17638	51,72	34,57	2,951	9,33	27	1,37	0,1	0,31	6,2	12,61	1,334	4,22	33,46
7+	5	457	1130	49727	4608	14572	29.3	39,56	2,065	6,53	16,5	1,18	0,06	0,19	3,8	13,92	0,767	2,42	17,41
8+	6	483	1270	45522	3682	12755	28.02	36,1	3,054	10,6	29,3	1,43	0,11	0,37	6,17	13,45	0,774	2,68	19,93
9+	9	502	1290	447804	4680	19855	41.53	36,47	2,843	12,1	33,1	1,51	0,11	0,46	5,11	13,08	0,873	3,7	28,32
10+	6	519	1470	58925	5084	17612	29.89	39,7	2,979	10,3	26	1,4	0,12	0,42	7	13,74	0,908	3,5	22,89
11+	8	540	1680	55164	5000	19999	36.25	33,7	3,393	13,6	40,3	1,93	0,26	1,04	13	11,77	1,128	4,51	38,32
12+	1	587	1800	61456				34,14				1,72				11,11			
15+	1	620	2600	65487				25,19				2,46				8,462			
2005.12.2 - 12.16																			
3+	29	334	492	24298	1620	8630	35,5	48,75	2,35	12,67	26					18,01	0,67	3,6	20
4+	14	367	656	38502	4975	18618	48,3	56,98	5,29	19,79	34,7					19,61	1,34	5,02	25,6
5+	2	385	787	40527	12122	17143	42,3	51,23	14,58	20,62	40,3					16,79	1,96	2,77	16,5
2+	3	286	286	13110	413	715	5,46	45,95	2,69	4,66	10,2					17,52	1,29	2,23	12,7
3+	25	349	562	26423	2010	10053	38,05	46,57	2,41	12,04	25,9					18,56	0,78	3,92	21,1
4+	9	361	626	36002	4401	13205	36,68	56,93	4,19	11,57	22,1					2,7	1,34	4,01	19,4
5+	1	353	620	35140				56,68								22,6			
6+	1	465	1475	112200				76,07								29,83			
3+	26	342	521	24172	1467	7884	30,96	46,09	2,01	10,26	22,3					17,39	0,65	3,44	19,5
4+	9	371	652	34623	2685	8056	23,27	53,02	3,55	10,64	20,1					20,97	1,25	3,76	17,9
5+	2	397	755	42490	5635	7969	18,76	58,78	16,42	23,22	39,5					21,4	5,09	8,34	30,9
2007.9.12 - 10.4																			
4+	2	368	600	40100	14500	20506	51,1	66,8	24,2	34,2	51,2	6,36	2,3	3,32	52,3	11,6	5	7,07	60,9
5+	13	376	778	35696	2717	9796	27,4	44,3	4,67	16,7	37,8	9,9	0,94	3,39	34,2	13,37	4,03	14,53	108
6+	11	431	1177	62085	2501	7543	40,2	52,4	5,25	14,7	33,2	8,95	0,71	2,38	26,6	10,5	0,87	2,88	27,4
7+	13	469	1664	98584	6034	21765	22	57,9	2,26	8,15	14	8,98	0,36	1,32	14,7	12,9	0,77	2,78	21,5
8+	16	480	1834	121152	4811	19244	15,8	66,2	2,45	9,82	18,8	7,39	0,27	1,09	14,7	14,1	0,58	2,33	16,5

9+	8	493	1912	127212	9262	26198	20,59	64,9	4,5	12,8	19,7	7,66	0,54	1,53	20,3	12,9	0,89	2,52	19,5
10+	7	501	2044	134170	15640	41381	30,8	67,1	8,74	23,1	34,4	8,1	0,68	1,82	22,4	14	0,79	2,09	14,9
11+	3	507	2250	122710	10795	23468	19,1	54,3	3,61	8	14,8	9,5	0,66	1,47	15,5	13,5	1,05	2,36	17,4
12+	3	529	2633	164932	20323	35210	21,3	70,6	4,7	8,1	11,5	8,66	1	1,89	21,8	15,7	0,75	1,3	8,25
2008.10.26-12.27																			
2+	37	358	669	33088	14588	88732	268,2	49,9	19,8	121	242	8,99	3,51	21,4	238	9,6	2,2	13	136
4+	20	450	1582	107073	88181	394356	368,3	67,4	59,4	266	394	8,01	52,3	234	2920	17	29	129	748
5+	231	476	2026	155487	68058		666,7	76,9	33,6	511	665	8,25	23,4	356	4320	20,3	21,5	327	1610
6+	43	477	2043	177382	70751	463943	261,5	87,9	28,5	187	212	6,87	5,3	35	509	20,8	3,7	24,3	116
7+	13	465	1947	163527	73205	263946	161,4	82,5	131	473	574	6,5	150	542	8337	22	146	526	2392
10+	3	527	2913	220568	12295	21296	9,65	76,5	7,29	12,6	16,5	7,02	0,89	1,53	21,9	24	4,7	8,2	34
2009.09.02-2010.01.27																			
2+	26	343	569	19640	9830	50123	255,2	34,1	14,8	75,6	221,6	13,2	8,1	41,2	312,6	8,92	3,44	17,5	196,6
3+	495	436	1342	85682	23873	89725	215,5	46,7	15,6	267,2	256,4	10,5	7,1	36,5	286,4	15,8	4,92	28,6	136,8
4+	13	435	1374	72581	28203	101687	140,1	52,5	138	497,6	947,8	9,1	150	539	5957	17	147,3	531,2	3117
5+	29	488	2179	121387	41225	222004	182,9	55,6	16,9	91,3	164,2	9,94	3,92	21,1	212	20,6	5,69	30,6	149,1
6+	154	504	2501	145083	50004	620527	427,7	58,1	17,6	218,5	375,9	10,3	6,2	77	747	20,4	6,18	76,8	375,8
7+	47	500	2617	156478	53567	367239	234,7	59,4	15,6	106,8	179,8	9,8	3,04	20,8	212,5	20,6	5,26	36,03	174,8
8+	10	504	2596	147134	20886	66047	44,9	58	11,4	36,1	62,1	9,12	2,23	7,04	77,2	23,1	4,76	15,05	65,2
9+	2	503	2460	99290	24530	34691	34,9	40,2	9,3	13,2	32,8	13,2	3,12	4,4	33,3	14	2,42	3,4	24,4
10+	2	473	2130	130680	12680	17932	13.7	61,3	0,48	0,68	1,1	7,71	0,26	0,36	4,72	22,4	1,76	2,49	11,12
2010.06.17 – 2010.12.22.																			
2+	12	349,4	532,1	47625	21853	75701	158,9	94,3	47,3	163,8	173,7	2,37	0,62	2,18	92	22,9	7,52	26,1	113,3
3+	93	430,5	1195	63370	2411,2	23254	36,7	52,9	1,78	17,2	32,5	7,06	0,32	3,15	44,6	13,3	0,51	4,89	36,7
4+	37	486,2	1883	119543	7013,1	42659	35,7	60,6	3,06	18,6	30,8	5,85	0,51	3,05	5,86	18,7	1,05	6,39	34,1
6+	7	498,7	2197	181087	32132	85015	46,9	79,4	2,7	26,1	32,9	7,13	0,29	2,82	39,5	23,8	1,63	4,32	18,1
7+	20	529,1	2579	201400	5270	23571	11,7	79,8	2,35	10,5	13,2	5,45	0,21	0,91	16,6	23,3	1,31	5,87	25,2
8+	4	512.3	2775	231155	51810.2	103620	44.8	84.5	18.2	36.4	43.1	6.2	1.76	3.51	56.5	26.3	5.15	10.3	39.1
2011.06.11 – 2012.01.16.																			
3+	10	319	408	28836	4426.5	13.998	48.542	68.61	7.777	24.592	35.8	16.13	1.262	3.99	24.75	5.66	0.87	2.74	48.38
4+	12	334	470	20707	2161.0	7485.9	36.152	47.77	4.283	14.836	31.1	12.95	1.199	4.15	32.07	7.82	0.76	2.64	33.82
5+	12	343	518	27761	2135.3	7399.1	26.653	58.12	4.289	14.859	25.6	15.48	0.899	3.12	20.12.	6.62	0.84	2.92	44.09
6+	16	350	554	33056	2533.0	1013.2	30.651	61.94	3.305	13.221	21.3	17.01	0.787	3.15	18.51	6.01	0.33	1.31	21.77
7+	21	355	582	32469	1973.7	9044.6	27.856	59.21	2.910	13.337	22.5	16.44	0.789	3.62	22.0	6.42	0.35	1.58	24.66
8+	28	356	600	42251	2679.2	14.177	33.554	71.66	4.331	22.918	32.0	17.50	0.205	1.09	6.21	5.68	0.37	1.96	34.53
9+	43	370	665	47862	1936	12696	26.525	73.48	2.782	18.242	24.80	17.31	0.577	3.79	21.87	5.64	0.34	2.21	39.18

Explanation: M – average, ±mM – error of average, SD – standard deviation, CV-coefficient variation

The relative fecundity of peled whitefish ranges from 25.2 to 95.0 eggs per 1 gramm of body weight without viscera (sculled weight). The minimum indicator was observed in July – 10.6 and the maximum in October-November up to 95 eggs. With the increasing sizes and mass there is observed its natural decrease. Therefore, the absolute fecundity of the peled whitefish under conditions of the lake system of Mongolia has a comparatively high figure.

In the Khuissin Naiman Nuur C.peled spawns in November-December. Fecundity is from 8795 to 24781 eggs. In the Darhad valley females produce between 23999 and 75113 eggs. The spawning season C.peled in Lake Ulaagchnii Khar Nuur takes place in December January, under water temperature descends to 1.8 – 2.1^0 C, spawn peaks in 1.5-1.0^0 C. Female produce 28836 to 58453 eggs. Fecundity increases with the length, weight and age (Fig.7.)

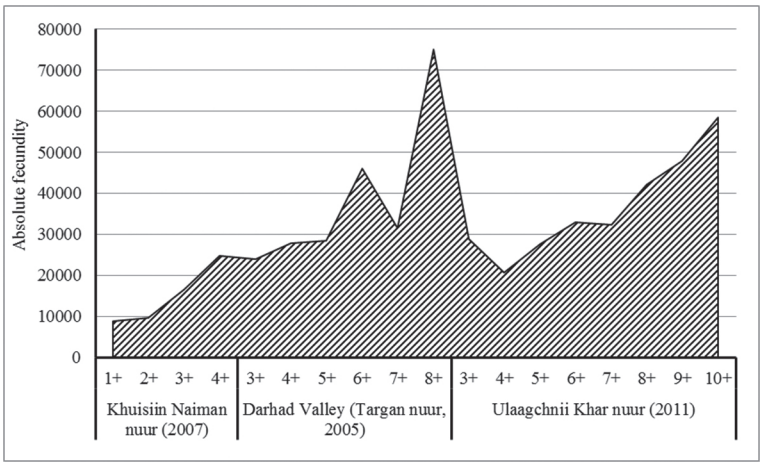

Fig.7. Fecundity of C. peled in waterbodies of Mongolia

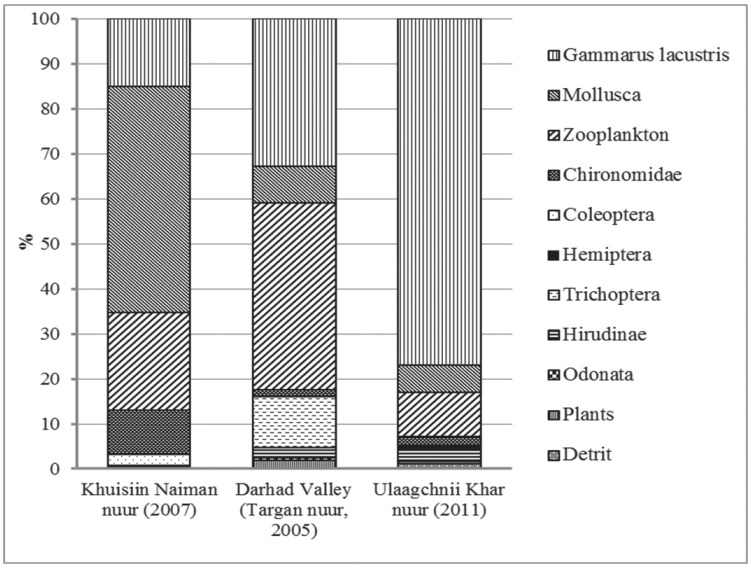

Fig. 8. Food components of Coregonus peled

In Mongolian lakes Coregonus peled feeds year-round. The main food is planktonic crustaceans, planktonic gammarids, chironomidae and molluscs. The oldest C.peled of rivers and lakes in selected reservoirs feed mostly on benthic organisms. Plankton is the major source of food for young fish up to years old. Some of 20 species of food organisms have been identified as food items of C.peled from the Khuisiin Naiman Nuur, Darhad valley and basin of Lake Ulaagchnii Khar Nuur. The index of stomach fulness ranges from 10 to 75 o/ooo.

The fatnes coefficient by Clark is rather high and ranges within 1.4-2.67. The fatnes coefficient of mature peled whitefish in places of its natural areal varies within 1.1-1.8.

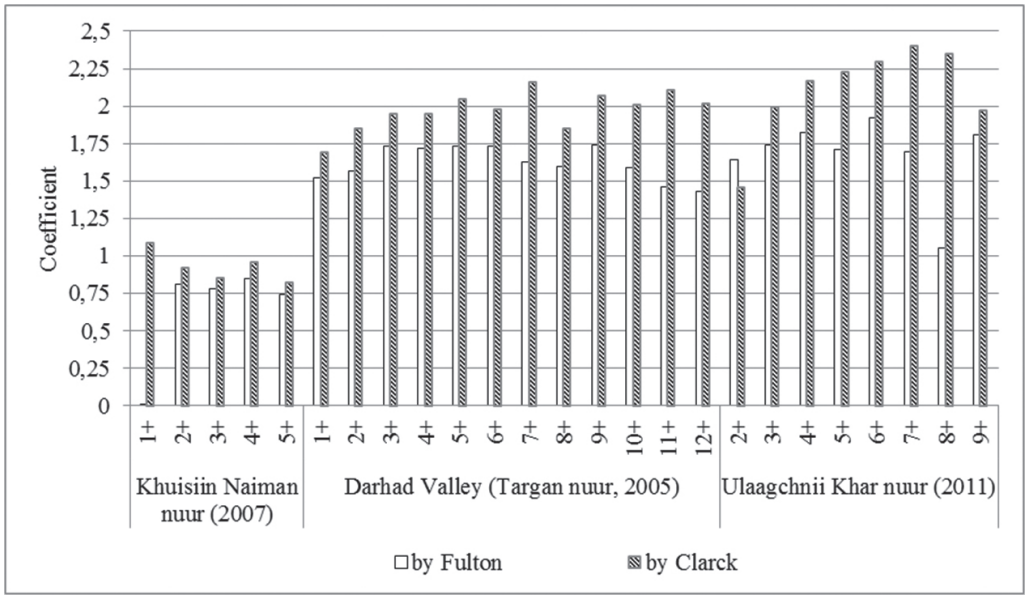

Fig.9. Coefficient fatnes of Coregonus peled

The coefficient fatnes of Coregonus peled in selected lakes very different. Lower coefficient fatnes of C.peled observed in lakes Khuissin Naiman Nuur (0.85 - 1.15), in Darhad valley 1.40-2.25 by Fulton. The highest coefficient fatnes are found in C.peled from waterbodies Ulaagchnii Khar Nuur (1.65-2.4 by Fulton). Fig.9.

Conclusion.

At present Coregonus peled has naturalized in Mongolia. Thus, in the reservoirs in fact has appeared an additional trophic chain - consuments of first and second sequence. Based on the experience of acclimatization works, an outlook of changes in the population of Coregonus peled can be made. Its number is substantially increasing on the account of natural reproduction and fishes are growing well. In all lakes there has been formed with concentration sufficient for fishery the parent herd and introduction material for installing fish into other reservoirs of Mongolia. In the future the population is likely to grow steadity and after achieving the certain level, will stabilise. lt is more likely, with growing population the Coregonus peled growth rate will slow down due to the competition of food, but no seems it for the present time in Mongolia.

Table 3. Coefficient of fatnes of Coregonus peled from Lake Ulaagchnii Khar Nuur

Age	n	Sex	By Fulton							By Clark						
			M	±mM	SD	CV	mCV	Pt	±t mM	M	±mM	SD	CV	mCV	Pt	±t mM
2+	186	♀	1,72	0,08	1,16	67,3	3,49	4,94	0,16	1,19	0,02	0,32	16,9	0,81	1,24	0,04
	80	♂	1,57	0,02	0,2	12,8	1,01	1,43	0,04	1,72	0,03	0,24	13,7	1,08	1,53	0,05
3+	118	♀	1,8	0,02	0,22	12,3	0,8	1,14	0,04	2,15	0,02	0,26	12,3	0,8	1,14	0,04
	104	♂	1,68	0,02	0,23	13,8	0,95	1,35	0,04	1,84	0,02	0,27	14,6	1,01	1,43	0,05
4+	42	♀	1,82	0,03	0,19	10,6	1,16	1,65	0,05	2,34	0,03	0,24	10,5	1,14	1,61	0,07
	45	♂	1,83	0,03	0,19	10,5	1,11	1,57	0,05	1,99	0,03	0,21	10,8	1,1	1,6	0,06
5+	6	♀	2,15	0,09	0,23	11,1	3,2	4,53	0,25	2,44	0,09	0,22	9,25	2,67	3,78	0,26
	10	♂	1,27	0,06	0,21	16,7	3,73	5,27	0,13	2,02	0,06	0,2	9,76	2,18	3,08	0,12
6+	11	♀	1,86	0,08	0,28	15,3	3,26	4,61	0,16	2,38	0,09	0,32	13,7	2,92	4,14	0,19
	15	♂	1,98	0,04	0,17	8,47	1,54	2,18	0,08	2,21	0,06	0,25	11,5	2,1	2,97	0,13
7+	26	♀	1,93	0,03	0,19	10,2	1,41	2	0,07	2,58	0,04	0,23	8,96	1,24	1,75	0,08
	16	♂	1,46	0,14	0,58	39,9	7,07	9,99	0,28	2,23	0,04	0,17	7,71	1,36	1,92	0,08
8+	14	♀	0,93	0,16	0,6	64,2	12,1	17,1	0,31	2,61	0,11	0,42	16,1	3,04	4,3	0,22
	8	♂	1,18	0,07	0,22	18,6	4,65	6,58	0,15	2,09	0,06	0,19	8,99	2,25	3,18	0,13

While organizing the industrial exploitation of peled whitefish it is more reasonable to orient the fishery to the fishing of fishes under three- six year age, as growth during this period is most intensive. Taking into account the high growth rate of Coregonus peled during the first - five years of life, the fishery is planned to be organized by the pasture fishery type, where by the reproduction process is carried out artificially and the younglings released into the reservoir, is cached already in 1-2 years time.

In lake Naiman Nuur all individuals became sexually mature at the age of 2 + exceptionally already at the age of 1 + , at the minimum total length of 214 mm and minimum weight 295 g.Gonadosomatic index of mature females ranged 9 to 25 %, mean absolute fecundity averaged 58.060 eggs.

The first spawning of C. *peled* after its introduction in the Najman Nuur Lake system was observed in 1980, *i.e.,* in the age 2+. During the autumn excursions carried out in following years 1981—1983 it was found that all 2+ years and exceptionally also 1+ old individuals were mature and ready to take part in the following spawning (gonads occurred in the maturity stage IV—V according to Nikolskij). This early sexual maturation, both of the males and females, seems to be normal in the majority of acclimatized and fast growing populations [6.7].The earlier maturation is rather a consequence of plentiful food resources than of geographical latitude. The gonadosomatic index of mature females varied in the range 9-20 and in extreme cases reached 25 % at an absolute weight of gonads of 160 to 250 g. The size (total length) of spawners ranged 323—560 mm and their weight 295—1 700 g. The absolute fecundity varied in the range 23 920 to 98 160 eggs *(x* = 58 060), the relative fecundity ranged 35200-81800 eggs/ kg^{-1}. The average diameter of the ripened eggs reached 1.3—2.0 mm. In 1982, an abundant spawning shoal formed and the first spawning took place of the offspring already born in the Najman Nuur lakes.

Coregonus peled valuable commercial target. It is relatively expensive. In the 1995-2005 catches varied from 3.5 to 50 tons a year. By the end of 2005, the abundance of C.peled significantly decreased to 25 tons a year. An annual ban on fishing was instituted during spawning period and is considered a sufficient conservation measure.

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