

## **Appendix 5A**

### **Caspian Seals Report**

# **Status Report for Seismic Project SWAP**

**T.M.Eybatov, Zardabi Natural History Museum**

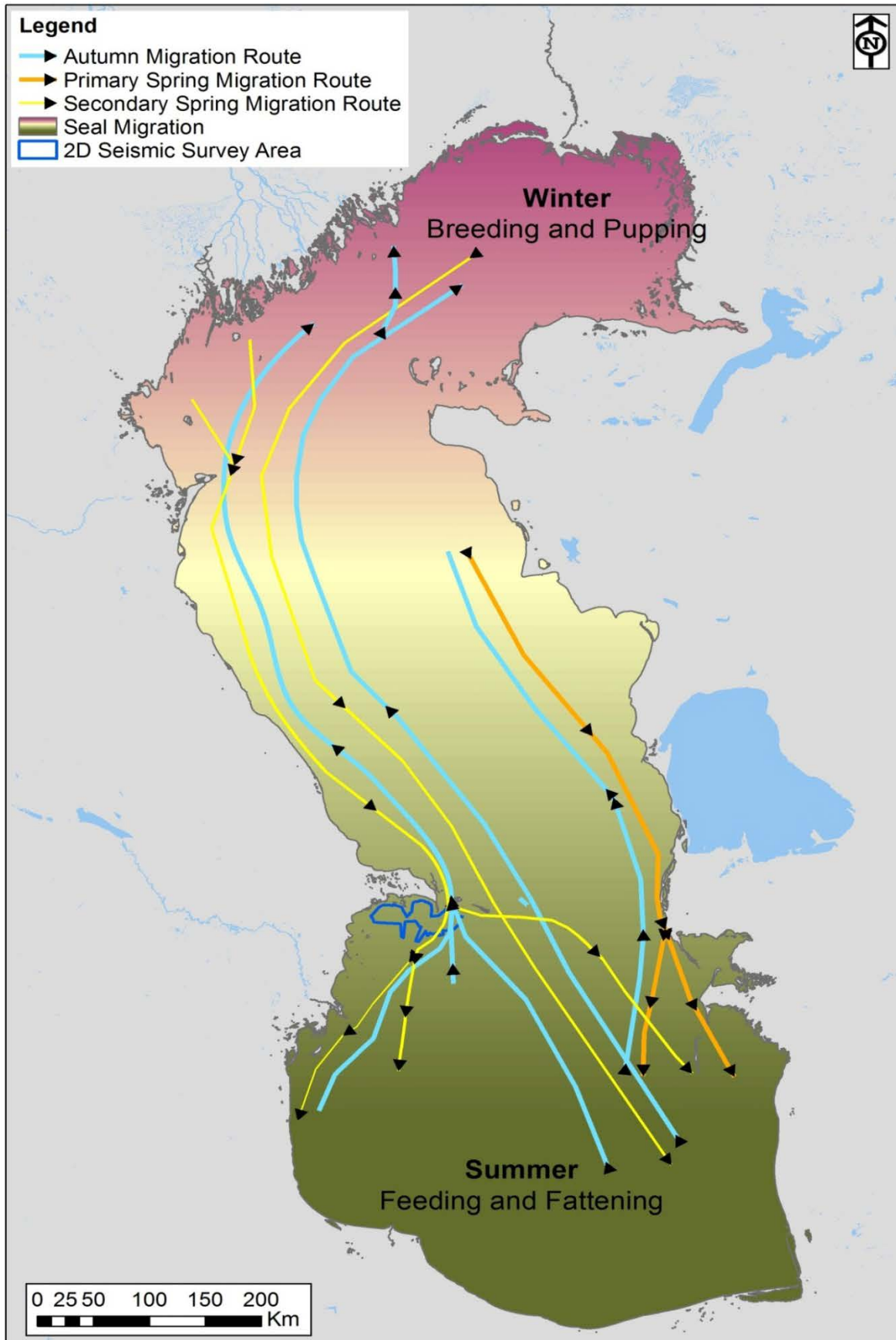
## Table of Contents

1	Introduction .....	3
2	Ecology of the Caspian Seal.....	7
2.1	Environmental Monitoring .....	7
2.2	Information on the Caspian Seal for the Last 5 years .....	9
2.3	Seasonal Distribution of Seals in the Contract Area.....	14
2.3.1	The First Stage of the Survey: November and December 2015 and January 2016 .....	15
2.3.2	Nature of Seasonal Distribution of Seals in the Eastern and Southern Aquatic Area of the Absheron Peninsula in the Contract Zone .....	16
3	References:.....	18

# 1 Introduction

The Caspian seal is a unique species endemic for the Caspian basin, a universal biological indicator of any environmental impact. The seal is the only marine mammal in the Caspian basin. It is included in the IUCN Red List of Threatened Species and the Red Book of Azerbaijan as vulnerable species. Maximum lifespan of the Caspian seal is identified as 50 years (Ref. 29 - Eybatov, 1976). Age of maturity of females is 7 or 8 years. Climax starts at 30 or 32. Only one 34 year old female was found with an embryo. Male species mature at the age of 8 or 9 years of age. Physical maturity age is 18-22 years. Signs of aging (osteocondrosis, osteoporosis, deforming arthrosis, root fragmentation in teeth) occur at 28-32 years of age (Ref.23 - D.B. Hajiyev, T.M. Eybatov, 1995). Throughout their life Caspian seals migrate from the North Caspian into the South Caspian where they spend summer months and come back in winter to pup on ice. Pupping occurs between the 25<sup>th</sup> of January and the 5<sup>th</sup> of February; the new born is called a "white pup" ("belyok") due to the colour of his long fur; it weighs about 5 kg. Two weeks after birth moulting commences: long white fur is replaced with grey, and a new development stage begins ("tulupka"). A month later moulting completes, and the grey stage of development begins; it lasts up to 6 months and grey fur is then replaced with yellowish (yellow stage, "jeltyak"). A year later adult colours appear: males are usually bluish dark with bright spots, the colour of females is lighter. Seals mate on ice rather than in water, soon after females finish nursing white pups, i.e. a month after pupping. Males spend feeding period on ice and wait for the lactation to finish, then mate and stay on ice with females for some time; spring moulting occurs on ice. Females do not take any further care of their pups. When ice melts, seals start migrating south in two directions: the majority goes along the east coast of the Caspian, and the minority – down the west coast. They appear in the waters of Azerbaijan usually in late April – early May. Depending on weather, pupping and migration can move in time by a month. In the Absheron peninsula seals are found in the largest numbers in late April – early July. Later seals migrate to South and Middle Caspian; they feed in the central part and along the coast of Iran. They appear in Iran in June. The reverse migration starts in October and finishes in late November – early December. Figure 1 provided below illustrates seals migration routes in different seasons.

Figure 1: Spring and Autumn Migration of Caspian Seal



It should be noted that spring migration flow in the north-south direction is not narrow; it is observed as a wide strip to the centre of Caspian. Significant part of seals remains in the north from the Absheron Peninsula, whilst major part migrates to the east and south-east towards Turkmenistan and Iranian waters. In spring some seals in small groups migrate to the south along the shallow near-shore zone through Shirvan and Kyzyl-Agach National Reserves. Small group moves to the deeper area of Caspian. Autumn migration follows practically same route in reverse direction. It was found that seals migrating along the western coast travel for wintering both to Russian and Kazakhstan water areas.

Following personal communications with Liliya Dmitriyeva, UK, it was possible to review papers on the airborne survey of seals in the North Caspian during 2005-2012 and a paper on seals' tagging with the purpose of the study of seasonal migrations. These papers are currently being reviewed and will soon be published. After a review of the aforementioned papers, an updated picture of seal migration in the area has emerged. Seal tagging showed that migration takes place also through the central part of Caspian. Also, in summer months many seals remain in the northern part of the Azerbaijan waters, and to a lesser degree found in deeper southern waters of the Republic. In the southern part of Azerbaijan territorial waters Caspian seals are mainly concentrated in the central part of the Caspian.

If in the late 19th century the population was, according to estimates, 1-2 million species, at the beginning of the 20th century the population was estimated at 1 million species approximately. During XIX and XX centuries hunting for seals, mainly white-coat seals, continued on the ice of North Caspian. At the end of XIX, beginning of XX century 115 thousand seals in average were caught every year. During 30-s of the XX century seals' catch was maximum - 227.6 thousand animals. Average catch in those years was 164.6 thousand animals (Ref. 24 - Caspian Sea, 1989). During 60-s of XX century seals' catch reached 85-100 thousand animals.

As a result of barbarian hunting population of seals was reduced to 350,000-400,000 species by 1980-1990 leaving just one seal per square kilometre of the Caspian Sea in average. Recent estimates for the number of seals in the Caspian Sea vary between 105,000 and 110,000 seals. This figure is presented in the Caspian Seal International Survey Report, according to abundance estimate of the Caspian seal conducted in 2006 (Ref. - 9). Dynamics of seal mortality in Azerbaijan confirms this figure as well. Recent mass mortality cases of the Caspian seal reduced the seals abundance significantly. Thus, in 2000 mass mortality resulted in the loss of several tens of thousands of seals in the entire Caspian Sea (Azerbaijan, Kazakhstan, Russia and Turkmenistan). Scientists have long been noting on the accumulation of various parasitic infections, heavy metals and pesticides (DDT and its derivatives, in particular) in the Caspian basin, but the main agent, which caused seal mortality in 2000, was identified as canine distemper virus or morbilli virus (Ref. 34 - Forsyth M.A., Kennedy S., Wilson S., Eybatov T.M., Barret T., 1998). Almost all seals studied at the time, tested positive for this morbilli virus. Previous studies (Ref. 28 - V.I.Krylov et al, 1990) also showed that pollution can cause infertility of females (some believe that female fertility reaches 70 per cent). The ratio of females not participating in reproduction still remains high (according to some data, up to 80 per cent).

According to V.I. Krylov et al. (1990), mercury levels in liver of young-of-the-year and immature seals vary in the range of 1.84-4.52 mg/kg. High Hg content was established in dry and miscarried seal females, less often in pregnant females. Strong contamination of the Caspian basin had negative impact on reproduction and population of Caspian seals in recent years. Eildness of females varies from 39.8 to 59.8%. Toxicity studies carried out within the framework of ECOTOX program showed (Sh.Tanabe, 2002) that concentrations of 15 microelements (V, Mn, Fe, Cr, Co, Cu, Zn, As, Se, Mo, Ag, Cd, Tl, Hg, Pb) and organic mercury (Org-Hg) in liver, kidneys and muscles of Caspian seal.

The highest concentrations of these elements were observed in this order: liver, then kidneys and muscles of seals. In 2000 and 2001 concentrations of toxic elements (As, Ag, Cd, Tl, Hg, Pb, and Org-Hg) were registered in the organisms of Caspian seals, which were equal or lower than levels of same elements in the seals' organisms in 1993, or seals from other regions; this means that probably these elements are not the reason of mortality of Caspian seals. Alternatively, concentration of Zn and Fe in the affected organs of Caspian seals apparently was higher than that found in seals from other regions, which indicates to violation of homeostatic control and content of vitally important elements in the diet of Caspian seal.

According to V.I. Krylov et al. (1990), accumulation of pesticides (DDT and its metabolites, alpha- and gamma- hexachlorocyclohexane) in fat tissue varies in the range of 6.05-64.3 mg/kg of tissue mass, depending on the age, sex and capturing site. According to Sh. Tanabe and N.Kajiwara (ECOTOX 2002, 2008), polychlorinated biphenyls, dibenzo-p-dioxins and dibenzofurans, organochlorinated pesticides and organo-tin compounds were found in the liver oil of Caspian seals washed to the Caspian shores during unusually frequent cases of mass mortality in 2000 and 2001.

DDT contaminants, with concentrations from 3.1 to 560ng/g dominated among the investigated organochlorinated compounds based on lipidic-weight investigation. Content of organochlorinated compounds in Caspian seals washed to the Iranian shores was lower than in seals washed ashore in other regions. However, blubber layer was significantly thicker in seals washed ashore in Iran, and negative relationship between the contaminants' concentration and thickness of blubber layer in Caspian seals was observed.

Seasonal variation of blubber layer was evident, as this layer is thinning after the season of feeding and shedding. Consequently seals could be subjected to higher risk in spring, due to the impact of organochlorinated compounds. Levels of organochlorinated compounds found in Caspian seals in 2000 and 2001 were comparable to the levels of organochlorinated compounds in other marine mammals that have suffered from epizootics. Concentrations of dibenzo-p-dioxins / dibenzofurans in sick Caspian seals were lower than concentrations in seals from other regions, which meant that toxic effects of these contaminants were weaker, and they were not related to mass mortality of seals. Although level of toxic equivalent (TE) in seals was relatively low, current status of contamination with polychlorinated biphenyls and organochlorinated pesticides identified in Caspian seals poses a risk of immunodepression. Concentration of butyltin compounds in livers of seals ranged from 0.49 to 17 ng/g on a wet-weight basis, and octyltin compounds were below limit of detection in all analyzed samples, suggesting less contamination with organo-tin compounds in the Caspian seals.

In addition to hunting and pollution, the Caspian seal is affected by other factors. For a long time, one of the main food sources of the seal was kilka (*Clupeonella*), small and highly abundant fish. During the last decade its stock has significantly reduced for various reasons: mass mortality in 2001; increased harvesting in 1990-2000; invasion of comb jelly fish *Mnemiopsis leidyi*.

Anxiety during pupping and nursing became another threat to the seals which was assessed only in recent years.

The same sharp decline in seal numbers occurred in Turkmenistan sector of the Caspian. According to our colleagues, in the 1980's-1990's V.I. Krylov conducted several surveys (Ref. 25 - 1982, Ref. 27 - 1983, Ref. 26 - 1984, 1990) and counted up to 12,000 seals in Ogurchinsky island, but during the last 4 or 5 years, according to P.Yerokhin, the abundance has not exceeded 2,000 specimens, i.e. it is obvious that the population of seals in the rookeries has reduced by 6 times. The number of new born pups has also reduced abruptly.

There is a similar trend in Kazakhstan, however, our Kazakh colleagues have only recently started studying seals in rookeries, so the real scale of reduction is not clear; but if previously on the islands and sand islands of Kazakhstan the abundance of seals was described in tens of thousands species, at present their number is much less. As for the Iranian sector, there were never any rookeries there, and at present projects of building sand islands are considered, in order to create rookeries there.

From 1997 to 2001 unusually an extraordinary numbers of dead bodies of Caspian seals were observed on the Caspian coast. Whereas, if earlier certain numbers of seal bodies had been found only on the northern coast of the Absheron Peninsula, in these years masses of dead seal bodies were registered in the near-shore area of Kazakhstan, i.e. in the regions where such cases had not been registered over a century. Unusually numerous were also dead seal bodies on the western shores of Caspian. In 1997 this figure only during one month (July) was about 10 thousand, and approximately 6 thousand of them - on the Azerbaijan shores (Ref. 32 - T.M. Eybatov, 1997). Numbers of dead seal bodies in 2000-2001 were even more unusual. Only officially registered seals' mortality on the territory of Kazakhstan within a short period was over 10 thousand and over 30 thousand animals all across the Caspian (Ref. 30 - Eybatov, 2010). Main reason of mass mortality of seals in the first place was epidemic induced by canine distemper virus. It is possible

that this virus earlier was also present in Caspian seals, however mass epidemic took place during this period owing to concurrence of several circumstances (drastic fall of fish reserves, mass poisoning with DDT, which is widely used in agriculture of Caspian littoral states, mass disturbances for seals both offshore, and on the rookeries due to active oil-gas exploration and production, uncontrolled fishery when large numbers of animals get caught in nets, etc.). As for dead seal bodies found on the eastern shore, it is explained by the fact that earlier such investigations were not carried out there. With the appearance of Oil Company's interest in seals soared (see also Appendix 1).

## **2 Ecology of the Caspian Seal**

### **2.1 Environmental Monitoring**

None organizations in Azerbaijan carry out systematic studies of seals. Our group (late D.V. Gadzhiev - world known paleontologist and anthropologist) and T.M. Eybatov studied seals as a model group of mammals (for the development of complex osteology) as private initiative. These studies were never financed by the state organizations. Acquisition of information from fishermen, oilmen and helicopter pilots has been done using friendly relations. Vast collection of skeletons (more than 600) and large number of skulls of Caspian Seal accumulated by our team is stored in the Azerbaijan Medical University, where Professor Gadzhiev many years was the Head of the Chair of Biology and Genetics. Key information about the seals from the air we obtain from the helicopter pilots who transport oilmen shifts to Chilov island and Oil Rocks.

Employees of our laboratory carry out monitoring of dynamics of Caspian seal bodies washed ashore on the northern coast of the Absheron Peninsula since 1971 until present. During this time regular surveys were conducted over the Caspian shores, in particular over northern coast of the Absheron Peninsula, due to its geographic position with unique burials of dead seal bodies. Monitoring included calculation of seals on the coast, space distribution, sex-age composition and potential causes of death. Key monitoring area where investigations were carried out more regularly and comprehensively is 10-km coastal zone from the beach in Buzovny residential settlement to the North Power Station. Long-term observations have shown that dynamics of dead seal bodies washed ashore in this zone corresponds to averaged figure of dead seal bodies in the whole 100-km near-shore zone of North Absheron. (see main monitoring reports: Ref.: 29, 30, 31, 32, 33, 34, 35, 36 and also in the project: National report on the status of Caspian seal population in the Azerbaijan water of Caspian Sea. CasPEco project, T.M. Eybatov, K.M. Rustamova, 2010, 14 p. - Ref-17.

On 17-19 September 2009 International Workshop was held in Atyrau city (Kazakhstan) on Caspian Seal conservation: "Threats to existence of Caspian Seals. Obtained data, required investigations and mitigation measures". Workshop was organized by the Caspian International Seal Survey group (CISS); oil company Agip KCO jointly with the Darwin Caspian Seal Project research groups, and also representatives of the Caspian states involved in Caspian seal monitoring (Ref.20). As leader of the Caspian Seal research group within the framework of Darwin Initiative project for the Azerbaijan waters of the Caspian I presented results of monitoring studies of the Caspian seal in Azerbaijan.

Studies within the framework of Darwin Initiative project began on 1 July 2006 and were completed on 1 July 2010. Results of this project were partly published (Ref. 36 - Wilson S., Eybatov T. et al. 2014), or are in the editors offices of scientific journals.

The studies conducted during the previous years identified the following:

1. The aerial survey conducted in the North Caspian in winter, during the pupping of seals in ice rookeries, from 2005 till present, showed that the total abundance of pregnant females and, accordingly, pups, had reduced by a factor of 4, compared with 1990; it is 20,000 specimens at present. Thus, the abundance of the Caspian seal population at present is 100,000-110,000 specimens (CISS report).

2. It was also found that during the last three years from 2006 to 2009 pup production declined by 60%, namely besides general decline of seals population, birth rate falls down even more (Ref. 20 - CISS Report -2009 -Atyrau);



3. It was also identified that the total area of ice tends to reduce, which also affects the abundance of seals who pup on the ice (report by L. Dmitriyeva in 2015). Meeting in Moscow. 12-13 March 2015 "Caspian Seal: current status and problems of preservation and use"

4. Special attention is given to the mass death of seals during illegal fishing (poaching) and the preventive measures. It is believed at present, that the main reason of the mass death of seals in the Caspian is fishing with nets. Death in nets was always considered one of the main causes of seals' mortality; this was discussed practically at all meetings, however after the collapse of the USSR in all Caspian states, due to the absence of proper control over the fishery large-scale illegal fishing was observed (Ref. 17, 21, 22, 30, 31, 32)

5. It was also found that illegal seal fishing exists practically in all Caspian littoral states. For the first time it was reported at the meeting that in the Russian sector of Caspian Sea, in addition to licensed commercial fishing, illegal fishing and commercial processing of seals also took place in Dagestan Ref. 12 and Ref. 19 (report of the Russian research group led by A.Kondakov, 2009; in 2015 this information was confirmed: Ilya Yermolin and Linas Svokinas - Fishing for Caspian Seal and use of products thereof in the Republic of Dagestan, Russia). Group of Kondakov also initiated monitoring of dead seal bodies found on the Russian coast of the Caspian Sea, which would enable in future comparison of obtained data with numbers of dead seal bodies in Azerbaijan and Iran.

6. A group of Iranian colleagues presented information about measures combating death of seals in nets, including preventive activities (awareness campaigns among fishermen and local population, ref 21). The workshop also discussed the experience of colleagues from the European countries who designed nets safe for seals.

Monitoring conducted on the coast of the Absheron peninsula and on the island of the Absheron and Baku archipelagos, in the Azerbaijani sector of the Caspian, showed that since 2005 there were no permanent rookeries. Temporary haul-out sites are only observed during the spring migration from the north to the south (from April till May) and during autumn migration from the south to the north (in October-December). And these temporary haul-out sites are only found on the Southern spit and Urunos on Chilov island, as well as on small islands between Pirallahi and Chilov islands (Malaya Plita, Bolshaya Plita, Podplitochny and Dardanella, Coltush, Baklaniy and so on). There are no haul out sites or rookeries on the Shakhova spit any more. (Ref. 17. National report on the status of Caspian seal population in the Azerbaijan waters of Caspian Sea. CaspEco project, T.M. Eybatov, K.M. Rustamova, 2010, 14 p.)

In this report coordinates of seal rookeries (haul-outs) and sites visited by seals, as well as reasons of seals' absence at Shakhova spit are given. Absence of permanent rookeries on the territory of Azerbaijan and decline of sites of temporary seals' haul-outs to the islands at present is absolutely logical. As a result of violent urbanization - large scale construction in the coastal zone, population increase in the coastal zone, sharp increase of number of vessels involved in commercial transportation and activity of oil companies, as well as appearance of a large number of yachts and motor boats with high-power engines seals lost the areas of exit to the shore.

In 2009 helicopter pilots found an early migration of the Caspian seal in the Caspian. The first large group of seals, 300-500 specimens, was found on the 1<sup>st</sup> of April in the area of the Southern spit and islands located Pirallahi and Chilov islands (Malaya Plita, Bolshaya Plita, Podplitochny and Dardanella) (Ref. 30 - T.M. Eybatov. Caspian Seal (*Pusa Caspica* Gmel.) - Endemic of Caspian. News of the Azerbaijan National Academy of Sciences, Geosciences, № 4, 2010 p. 151-169 pp.

In the last 35 years seal monitoring has been conducted using vessels; observations have been recorded by offshore platforms staff and residents of Chilov Island. In addition, observations on the northern shores of Absheron peninsula, on Shakhova spit and Chilov Island have also been recorded. Since 1997, this data has been supported by ad-hoc observations by helicopter pilots. Based on the results of this monitoring, spring migration of seals has never commenced as early as did in 2009. Usually seals appeared in the area of Absheron archipelago at the end of April, beginning of May, occasionally at the end of May, and mass wash-outs of dead bodies to the northern shore was mainly observed in May and June. However beginning from 2009 this tendency changed and continued later. E.g., in 2011 and 2014 seals appeared in the area of Absheron archipelago on 1 April, and in the Azerbaijani waters - on 20 March. In these periods' dead bodies of seals appeared on the northern shore earlier. There are many causes of mass mortality. In the first place Absheron peninsula is unique natural burial ground of Caspian seals - it protrudes far to the East and main directions of currents and wind rose from the North Caspian bring dead seal

bodies to its gently sloping shores. (Ref. 30 - Eybatov, 2010). Main causes of the first deaths are fishing nets, wherein mainly young of the current year and undernourished pups are caught.

## 2.2 Information on the Caspian Seal for the Last 5 years, 2010-2015 (A Meeting in Moscow on the 13th -14th March 2015)

**The name of the meeting:** The Caspian seal (CS): current status and problems of conservation and use.

**Organizers:**

IEE RAS, Marine Mammal Council, Russian Theriological Society, UNDP, University of Leeds

The dates and venue of the workshop - 11th to 13th March 2015, in Severtsov Institute of Ecology and

Evolution RAS (IPEE RAS), 33 Leninski prosp., Moscow, 119071, RUSSIA.

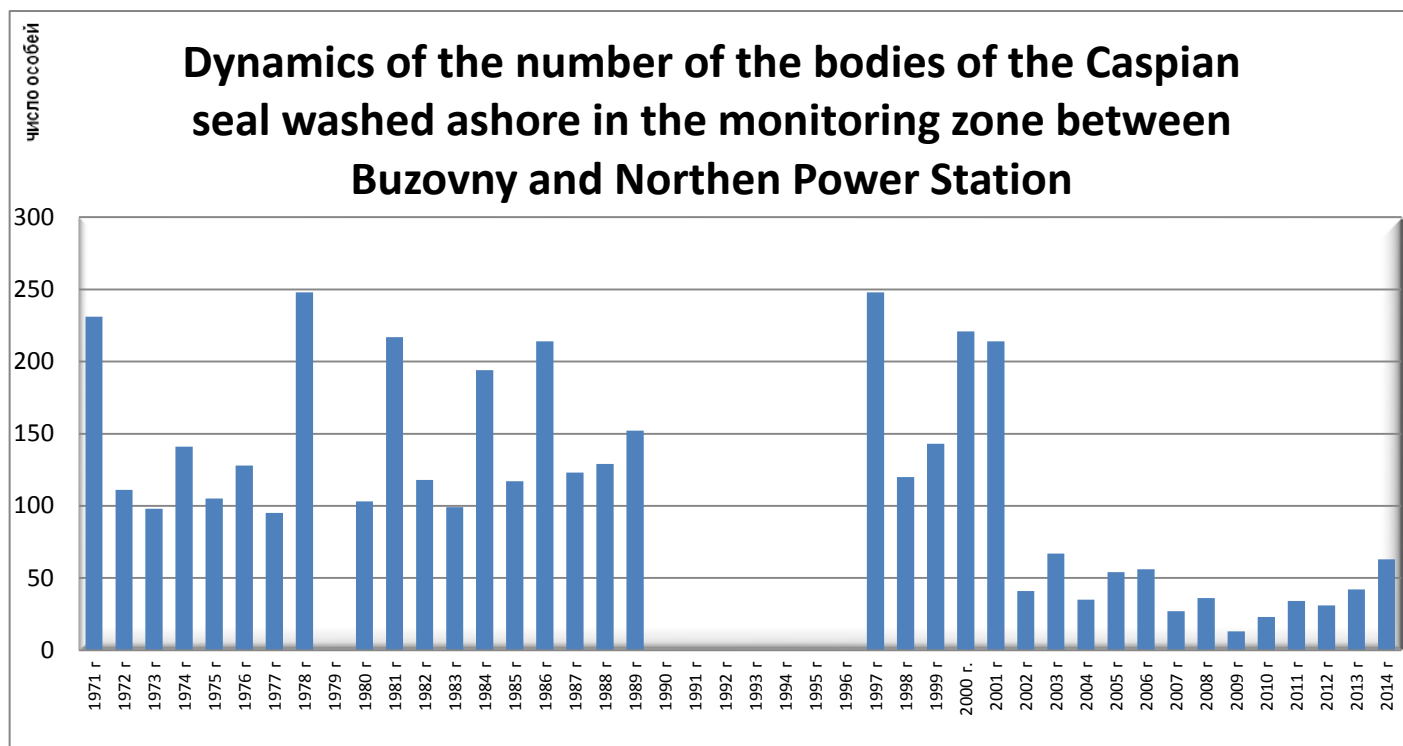
**Two presentations were conducted by Tariel Eybatov:**

1. The current state of the Caspian seals in Azerbaijan. Conservation of the seal habitats - status and prospects.

2. Caspian seal mortality in Azerbaijan – causes and solutions



Figure 2: The Total Abundance of Seals in the Caspian, According to the Last Meeting on the Caspian Seal which was Held in Moscow on the 13<sup>th</sup>-14<sup>th</sup> March:



At present the total abundance of seals in the Caspian is identified at 100,000-105,000 species. The abundance was identified on the basis of aerial surveys made in the North Caspian during 10 years by CISS (the Darwin Initiative project) (L. Dmitriyeva, 2015. Registration of the Caspian seal rookeries by aerial survey in 2005-2012, summary). In Moscow Russian scientists tried to oppose this data with the information that the abundance of seals is much higher, that is between 400,000 and 450,000, i.e. it has not really changed in the last 20 years. They attempted to base their conclusion on thermal aerial survey in the Russian sector of the Caspian (V. Chernook, S. Shipulin, V. Kuznetsov, 2015. However, first, they carried out their investigations only during one year and just on the territory of Russia, not regularly, whilst at present most seals are breeding on the territory of Kazakhstan. On the territory of Russia seals breeding usually takes place in mild winters, in harsh winters - only on the eastern shores of Kazakhstan.

Table 1: Sex Composition of the Bodies Washed Ashore and the Ratio of Pregnant Females in the North Coast of the Absheron Peninsula

Sex composition of the bodies washed ashore and the ratio of pregnant females in the North coast of the Absheron peninsula				
Years	∑ specimen	% ♂ male	% female	% with embryos
2000	221	57,5%	42,5%	2,7 %
2001	214	63,5%	36,5%	0,5%
2002	41	41,5%	58,5%	2,4%
2003	67	31,3%	68,7%	6%
2004	35	42,8 %	57,2%	2,8%
2005	54	51,5 %	48,5%	3,7%
2006	56	32%	68%	8,9%
2007	27	40,7%	59,3%	11,1%
2008	36	38,9%	61,1%	16,6%
2009	13	38,5%	61,5%	7,7 %
2010	23	52,2%	47,8%	13%
2011	34	58,8%	41,2%	11,8%
2012	31	48,4%	51,6%	9,7%
2013	42	42,5%	57,5%	11,9%
2014	63	55,5%	44,5%	6,3%

As the graph shows (Fig.1), the abrupt reduction of the number of seals commenced in the early 21<sup>st</sup> century. Significant mortality of seals in 2000 and 2001 resulted in the fact that the abundance of seals did not exceed 100,000-105,000 starting from 2002, and this trend continued till 2009. In 2009 the number of bodies washed ashore was the lowest (13 specimens) since 1971. In the following years the number of bodies washed ashore remained low; however, their number tended to increase slowly, as did the abundance of seals in the Caspian. In 2014 the number of bodies washed ashore in the North Absheron increased significantly although not in the monitored area Buzovny-North Power Station, but in the villages of Nardaran, Pirshagi, Noukhani and the city of Sumgait. It is too early to speak about stabilization of the abundance of seals in the Caspian but there are two possible interpretations of the increased number of bodies washed ashore: either the abundance of seals is slowly increasing, or the number of bodies washed ashore in 2014 increased due to the increase in poaching. The animals found onshore were not skinny or sick. They were all well-nourished and had enough subcutaneous fat.

There were no very early migrations or bodies washed ashore since 1971, however, from 2009 till recent cases of early appearance of seals in Azerbaijani sector of the sea have become more often (see Table 3). Obviously, it is connected with the reduction of the area of ice in the North Caspian and early melting of the ice which made seals migrate south earlier.

It is also possible that the pups were undernourished and the mortality rate was higher among young specimens. At the meeting in Moscow L. Dmitriyeva also mentioned the reduction of the area of ice in the North Caspian during the last years.

During spring migrations of seals to the Middle and South Caspian the majority of seals moves along the east coast (approximately 75,000-80,000 specimens), and the rest – along the west coast (15,000-20,000 specimens). Part of seals (5,000-10,000 specimens) stays in the North Caspian. In spring, from April till June, until seals reach Iran, their abundance in Azerbaijan can reach 20,000. In spring a significant number of seals (up to 500) rests on the island of the Absheron peninsula (Malaya Plita, Bolshaya Plita, Podplitochny, Dardanella, Baklaniy, the Southern Spit and Urunos island, a part of Chilov island).

Beginning from June, significant part of seals migrates from the Azerbaijan aquatic area to the territorial waters of Iran (10-15 thousand seals) (South Caspian) for summer fattening where they often get into the fishermen nets. (Correct: Absheron archipelago and aquatic area of Azerbaijan are different notions. Absheron archipelago is a small group of islands located to the east from the Absheron Peninsula, whereas aquatic area of Azerbaijan is a large territory that begins in the north with Yalama seashore and ends near Astara, in the south of Azerbaijan. (Ref. 30 - Eybatov, 2010).

In summer period not more than 5-10 thousand seals remain in the whole aquatic area of Azerbaijan; during this period they avoid the nearshore zone and are distributed more or less evenly in the deep-water area of Caspian as small groups. Between April and October seals are feeding all across the aquatic area of Azerbaijan, 1-3 km away from the shoreline and deeper offshore, they dive to 100-150 m depth and can stay underwater up to 30 minutes (Ref.23 - D.B.Hajiyev, T.M.Eybatov, 1995). Small groups of seals, usually 2-3 individuals, swim to the islands Bolshaya Plita, Malaya Plita, Podplitochny, Dardanella, Baklaniy and also to the Southern spit and Urunos island, Chilov island (see Table 4).

<b>Table 2: Seasonal Distribution of Seals in the Aquatic Area of Azerbaijan</b>	<b>Jan</b>	<b>Feb</b>	<b>March</b>	<b>April</b>	<b>May</b>	<b>June</b>	<b>July</b>	<b>Aug</b>	<b>Sept</b>	<b>Oct</b>	<b>Nov</b>	<b>Dec</b>
	The least vulnerable period – no seals or small number											
	The most sensitive period/ spring and autumn migrations/ peak abundance											
	Seals are distributing by groups according to the migration of food components											

Main changes in the nature of Caspian Seal migration during the last 5-6 years:

1. Earlier appearance of seals in the aquatic area of Azerbaijan and on the islands of Absheron archipelago comparing to previous years. Whilst earlier seals appeared in the Azerbaijani waters in the beginning of April, and on the islands of Absheron archipelago at the end of April - beginning of May, recently they most often appear in the north of Azerbaijan, at Yalama seashore in mid-March and on the islands of Absheron archipelago at the end of March, beginning of April. Thus, when planning surveys we must include the last decade of March and April month as the periods of intensive spring migrations (Table 2-3)
2. It is also necessary to take into account that unlike in previous years during the autumn migration major part of seals continue moving to the north in the first half of December, and during this period significant number of seals may still remain in the aquatic area of Azerbaijan, hence half of December must be also included into the blue zone of seals' distribution (Table 2-3). The 1<sup>st</sup> and 2<sup>nd</sup> changes are probably related to the earlier melting of ice in the North Caspian, and also to the fact (December delay) that seals need more time for fattening because of depletion of fish reserves, first of all kilka.
3. One should also take into account potential gradual increase of seals population in the Caspian, and accordingly in the Azerbaijani waters. (This assumption is based only on dynamics of numbers of dead seal bodies found on the Northern shore of the Absheron Peninsula (Figure 2). It is shown that recently number of dead seal bodies again slightly increased. In previous years numbers of washed ashore dead seal bodies closely correlated with the population of seals in the Caspian.)

It should be noted that in summer 10-15 thousand seals accumulate in the Azerbaijan waters and one third of this number - 3-5 thousand seals feed in the northern part of Caspian waters., northwards from the Absheron Peninsula, where they stay 1-2 km away from the shoreline to the middle part of Caspian; their maximum concentration is observed at 2-8 km distance from the shoreline.

During spring migration from the islands of Absheron archipelago and Oil Rocks in the beginning or mid-May main mass of seals instead of south moves to the east and south-east, to the central part of Caspian or closer to Turkmenistan waters, and from there most seals move towards Iran.

In the deep-water zone of Azerbaijan located to the south from the Absheron Peninsula population of seals is not usually high. Their small number in the area of Shirvan National Reserve is probably related to the nets for small (ordinary) fish, as seals heartily steal small fish from the nets (herring, Caspian roach, etc., as well as crayfish), occasionally eating out the whole catch.

Appearance of significant numbers of seals in summer, in the area of Kyzyl-Agach Natural Reserve can be explained by migration of Caspian roach (vobla) in delta of Kura River. Thus, minor flow of seals migrating in spring takes place in the shallow zone near the southern shores of Azerbaijan.

Autumn migration takes place in the opposite direction. Again, from the central part of Caspian to the islands of Absheron archipelago, and from there, as a wide front along the western shores to Russian waters and partly - to the north-east, to Kazakhstan territory. Unlike spring migration, autumn migration is characterized by lower speed of movement that is why large accumulations of seals are not observed on the islands of Absheron archipelago.

**Table 3: Observation<sup>1</sup> of Seal Presence and Activity During the Last 5 Years in the Vicinity of the Absheron Peninsula, Mainly in the Project Impacted Region (Up to 40 Km Offshore from the Coast, where Seals Could be Affected by the Sounds of Seismic Survey).**

Year	Spring	Summer	Autumn	Winter
2010	Seals appeared in the area Pirallahi island - Chilov island - Oil Rocks at the end of April. In this year unusual (diffuse) spring migration was observed. Seals arrived in small groups - 3-5 individuals in a group and distributed evenly in the aquatic area up to Oil Rocks. There were no seal accumulations at the island haul-out sites.	Small groups of seals - 2 to 10 individuals swim along the shores of aquatic area of Azerbaijan, from Yalama to Lenkoran, at approximately 1 km from the shore.	In this year also very unusual autumn migration took place - no accumulations. At all sites of monitoring (about 20 altogether) 2-3 seals swam.	On 5.12.2010 analyses were done on two seal bodies in the monitoring zone Buzovny - North Power Station: female with embryo and male individual with GPS coordinates. In January and February no seals were observed on the islands; in December seals were observed on the Southern spit, Chilov island and Podplitochny (2-3 individuals at each site).
2011	Early migration, 1 April. Concentration of seals again is related to migration of herring. The first large shoal of seals (200 – 400 individuals) was registered on 1 April in the area of Southern spit and islands between Pirallahi island and Chilov (Malaya Plita, Bolshaya Plita, Podplitochny, Dardanella). According to fishermen, at that time mass migration of small herrings took place. At the end of April - beginning of May seals moved to the sea area between Chilov island and Shakhova spit. Small groups of seals were also observed by oilmen at Oil Rocks. The first seals appeared in the Iranian waters in the beginning of June.	Small groups of seals (2-3-7 individuals) swim in the area of Oil Rocks between Chilov and Pirallahi islands. Small groups of seals accompany ships that service offshore platforms.	Significant accumulations of seals on the islands between Pirallahi and Chilov islands began appearing at the end of October, beginning of November. To the end of November practically all seals disappeared.	Neither fishermen, no helicopter pilots did not see seals during this period.
2012	Helicopter pilots informed that seals came to the islands between Pirallahi and Chilov at the end of April, and disappeared one week later. In some places occasionally individual seals can be seen. Migration of seals was related to migration of kilka, then migration of Black sea roach (small kutum) began, and only now - migration of gray mullet. Diffuse migration in the beginning of May.	Seals are distributed evenly as small groups all across the aquatic area of Azerbaijan.	Seal migration without large accumulations on the islands of Absheron archipelago	Individual seals on the Urunos, Southern spit and 2-3 individuals on Baklaniy island.

2013	Migration began in mid-April. Significant accumulations were observed westward from Chilov island. Large group of seals swam in waters of Lebyazhi island, which seals usually do not visit	Small groups of seals swam to the south from Shakhova spit and in the east between Chilov island and Oil Rocks	Shoals of several hundred seals around the islands of Absheron archipelago	Small groups of seals (2-5 individuals) on Dardanella island, Malaya Plita and Podplitochny. One seal lies on the Southern spit of Chilov island.
2014	1 April - early migration was observed. Namely, seals appeared in the Azerbaijan waters, in the area of Yalama seashore at the end of March. Usually one week prior to appearance on the islands of Absheron archipelago. In the recent years migration of seals in the first place was related to migration of shoals of herring. Fishermen complain that seals eat out fish in the nets.	Seals are distributed evenly, as small groups in the aquatic area, at significant distance from the coast - 1-2 km. Groups of 7-15 seals periodically appeared in the area of Oil Rocks. In dark hours also small groups of seals swam around the brightly illuminated ships.	Small groups of seals around Shakhova spit and also numerous groups of seals to the south from Shakhova spit at the level of Sangachal terminal. There are numerous seals in the area of Kyzyl-Agach National Reserve and Shirvan National Reserve	Individual seals (1-2) on the Southern spit, 2-3 seals on Urunos. Groups of seals - 1-3 animals swim between Chilov island and Oil Rocks.
2015	Mass spring migration in the area between Pirallahi and Chilov islands was observed on 19-20 April. The largest number of seals was observed near Baklaniy and Urunos islands			

**Table 4: Expected Total Number of Seals that Supposedly can be Found in the Nearshore Waters of the Islands of Absheron Archipelago (Chilov, Bolshaya Plita, Malaya Plita, Podplitochny, Dardanella, Koltush, etc.)**

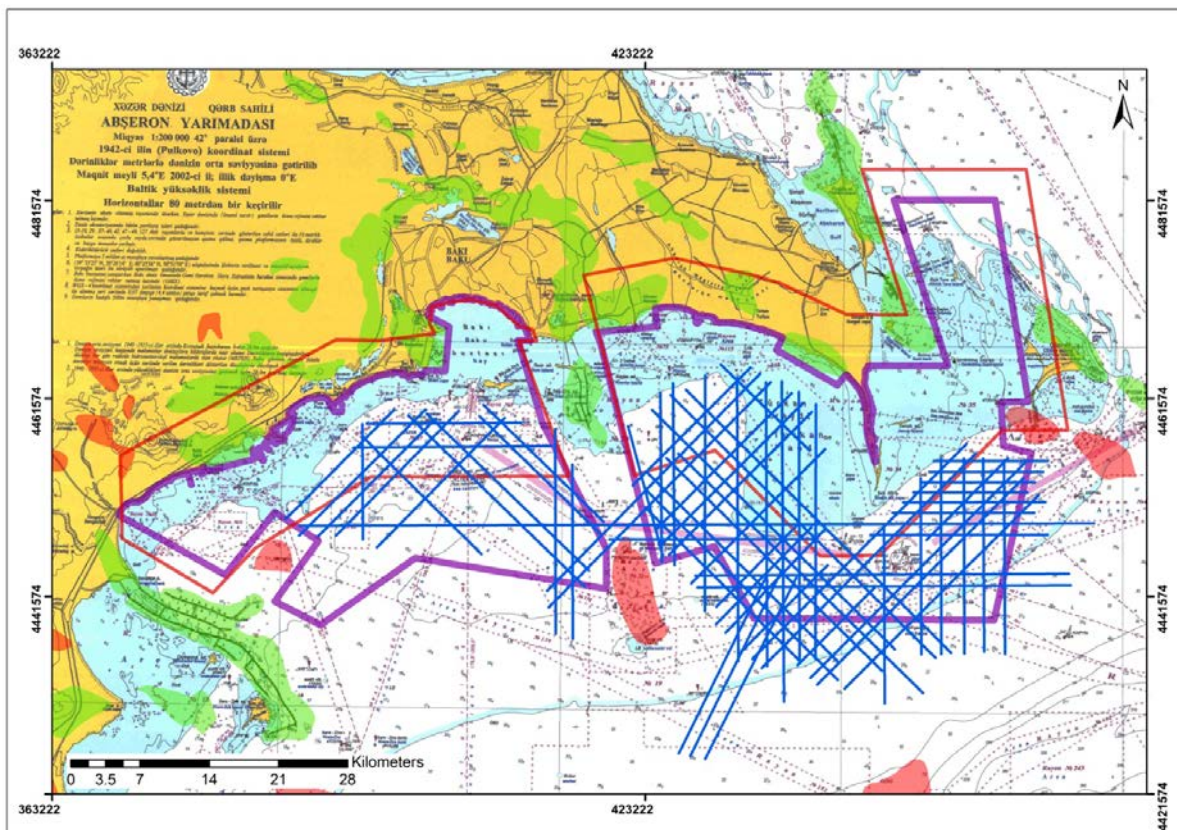
Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
8-10	8-10	8-10	2-3 ths.	2-3 ths.	30-50	20- 40	20- 40	30-50	2-3 ths.	2-3 ths.	50-60

### 2.3 Seasonal Distribution of Seals in the Contract Area

The total working area in the Caspian is 3500km<sup>2</sup>

The total working area in the shallow part of the Caspian is 1500km<sup>2</sup> (<10m) and about 2000 km<sup>2</sup> in the deep area (>10m).

**Figure 3: A Map of the Contract Area – the Shaded Area Indicates Where the Survey will be Conducted between November 2015 and January 2016 and then from March 2016 till November 2016**



The map of the contract area (shaded) where survey will be conducted between November and January and then from March 2016 till November 2016.

### 2.3.1 The First Stage of the Survey: November and December 2015 and January 2016

This map shows two clear areas: 1) south-west and 2) south-east. 2<sup>nd</sup> area can be subdivided into east and south.

The east area shall be divided into the northern part – without shading, and southern part – shaded; that's where the survey will be conducted between November and January. The border of the eastern part will go along the straight line stretching from the north to the south along the Shakhova spit. This is the area of the most active migration of the Caspian seal in spring and autumn. Therefore in November a large number of seals will move through this area (from 3,000 to 5,000 or 6,000).

All calculations are extrapolation of data obtained by Russian specialists during 1980-1990, in the first place by V.I. Krylov (Krylov - 1979, Ref. 27 - 1983, 1990), who based on results of surveys from vessels investigated distribution of seals in the middle and southern Caspian (except Iranian water with forbidden access). Due to the 4-fold drop of seals population in the Caspian during the last 25 years, results of calculations of their population in the Azerbaijan waters were also divided by 4.

Our calculations are also based on local surveys of seals on the islands and from the air during helicopter fly-overs organized by BP, and interviews of fishermen and helicopter pilots transporting oilmen to the Pirallahi, Chilov, Oil Rocks and individual offshore platforms. It is pointless to observe the seals from the coastal line, as they do not swim so close to the shore.



**Table 5: The First Stage of the Survey to be Carried Out in the Shaded Area**

2015	November	December	2016	January					
	Period of autumn migration: the highest number of seal in the east part may reach 3,000-6,000 specimens. In the west part there will be less seals – between 100 and 300 specimens.								
	The end of autumn migration: the number of seals reduces. Some groups of 2 to 10 specimens may be observed moving north; the number of seals in the survey area may reach 200-300 specimens.								
	Period of the lowest number or absence of seals. Usually there should not be any seals in the shaded area. Seals not involved in reproduction.								

If the survey starts in November, this period would be connected with the mass autumn migration of seals from the South Caspian into the North Caspian. During this period a significant number of seals (up to 500 specimens) appears on the islands of the Absheron archipelago; mass migration is observed along the entire zone from Pirallahi – Chilov – the Oily Rocks – and further eastwards. It is necessary to be careful while conducting the survey far offshore in the deep water Caspian at night. Bright light of the ships attracts seals, and kilka moves to the upper part of water column.

**Table 6: The Second Stage of the Survey - March - November 2016**

2016	March	April	May	June	July	Aug	Sept	Oct	Nov
	The period when seals are most unlikely to be in the Contract Area – there may be no seals. Small groups (1-3 specimens) may be seen on the islands on the Absheron peninsula. Small groups of young seals may also be found far from the shore in the deep water part of the Azerbaijani sector of the Caspian.								
	It's a period of active feeding. During the period seals will migrate through the Contract Area in small groups. The total number of seals in the Contract Area will not exceed 300-500 specimens. Most of them can be found far away from the shore and in the deep water (3-40 km).								
	The period of the highest number of seals: it's a period of spring and summer migration. Between 5,000 and 10,000 seals can be seen in the east part of the Contract Area. Remaining 5-10 thousand may swim eastwards from this area.								

### 2.3.2 Nature of Seasonal Distribution of Seals in the Eastern and Southern Aquatic Area of the Absheron Peninsula in the Contract Zone

As the Contract area is not evenly populated by seals, it can be divided as minimum into 3 zones: 1-st eastern (most frequently visited by seals); 2-nd southern (poor attendance) and 3-rd south-western (least attended) (please see Appendix 2 for detailed map)

Seals in the third zone can appear only in summer and far from the shores (2-3 km to the centre of Caspian); their numbers during the whole period of survey will not exceed 200-300 animals.

In the second zone number of seals can be slightly higher - to 300-500 individuals. In the first zone up to 10 thousand seals are registered in spring and autumn, in summer - to 1 thousand and in winter not more than 100-150 animals.

It should be taken into account that due to significant recession of water level in the Caspian Sea, area of small islands of Baku and Absheron archipelagos expands, and new small islands and banks appear from under the water.

One must also pay attention to concentration of seals in the delta of Kura during migrations, which could be related to migration of the Azerbaijan population of Caspian roach in this area. Fattening period of Caspian seals earlier lasted 5-6 months, from May to October. Currently it is somehow longer - from April to November-December, i.e. it lasts 7-8 months.

It is necessary to consider that the Caspian seal mainly feeds on Anchovy, big-eyed and common kilka; gobies, roach, silverback and fingerlings of other species. Anchovy kilka is endemic to the Caspian; it inhabits deep water (up to 500 m), and it is the main component of the ration of the Caspian seal. It is also the most harvested species. The big eyed kilka is second after the Anchovy. Both the Anchovy and the big eyed kilka inhabit only the Middle and the South Caspian. It stays at the depth of at least 20 m, far from the coast, mainly between 50 and 200 m (20-1989). In spite that

most seals migrate along the east coast of the Caspian, Anchovy kilka migrates mainly along the west coast of the Middle and South Caspian. It is also necessary to mention that the highest concentrations of kilka (Anchovy) are observed in July, and the lowest in May (20.1989). As the Contract Area is on the migration route of both Anchovy and big-eyed kilka, it is necessary to remember that the highest number of seals will be seen in the zone of the highest concentration of these fish species. It should be mentioned that we had to use outdated information of 1989-1990, as currently fishing is in the hands of commercial organizations, which do not provide information to scientific institutions about the sites and volumes of catches.

An extract from the National report on the status of population of Caspian seals in the Azerbaijan waters of the Caspian Sea (Ref. 17 CaspEco project. T.M. Eybatov, K.M. Rustamova - 2010) Chapter 3: "Within the framework of reforms of state organizations undertaken in the Azerbaijan Republic, in 2001 fishing industry of the country was divided into 2 parts: commercial fishing, processing of raw products, commercial fish-farming and fish & fish products trading were handed over to private sector, whilst reproduction, protection and control of fisheries were assigned to Department of Reproduction and Conservation of Water Bioresources under the Ministry of Ecology and Natural Resources of the Azerbaijan Republic.

Hence, as fishing was handed over to private sector, it was very difficult to fully understand an impact of this activity on seals' mortality. Although there are relevant teams issuing quotas /licenses and responsible for the protection of aquatic bioresources in the Ministry of Ecology and Natural Resources, it is impossible to keep full control over the process, first of all because illegal fishing always dominated.

Practically all kinds of fishing to some extent result in death of seals. In the first instance this concerns coarse nets for sturgeon and fine-meshed nets for ordinary fish. We often found dead seal bodies entrapped in nets, or bodies with the marks on the skin from nets (see files album). Long ago we noticed that most fresh dead bodies were washed-out on the shore near the sites with fishermen's cooperatives, however fishermen usually keep back this information. Questioning of fishermen that we carried out in 1996 and 1997 demonstrated that in average 5 seals fall per one net in a year."

Let us add that fly-overs of the coast in 1996-1997 were done jointly with the employees of BP (T.Glushko) and figure 5 seals/year was confirmed when we landed on the shore of Shirvan and Kyzyl-Agach Natural Reserves.

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## **Appendix 1**

### **Seals Death Causes Summary**

## Part of Published article:

T.M. Eybatov. **Caspian seal (*Pusa Caspica Gmel.*) - endemic of Caspian.** News of the Azerbaijan National Academy of Sciences, Geosciences, № 4, 2010, p. 151-169.

### Dead seal bodies washed ashore on the Caspian coast ("drifts")

The first comprehensive study of dead seals found on the shores was carried out by K.K. Chapski (1932), who investigated an issue of the appearance of dead seals drifting in water. The author noticed regular appearance of dead seals in autumn. Dead seals are found on the shores of Dagestan from the end of August and till the freeze-up near Chechen island. Distribution of dead seal bodies in this area is not even: most dead seals are found on Uch spit, where Chapski investigated up to 30 dead seals washed ashore. Their age composition was the following: of breeding age 6, adults 13, old 3, male 10, female 12 (only one female was with an embryo). It was difficult to investigate all seal bodies due to strong deterioration of some of them. The author did not make any well-founded conclusions about the causes of seals' death. Investigation of this issue is a matter for the future (S.I. Ognev, 1935). Ognev (1935) writes: "Drifts. After the Caspian opening in spring in some years large number of dead seals appear, locally referred to as "plavun" ("drifts"). It is possible that those are animals that accidentally suffocated under the ice, as they could not get out (because of the frozen holes, collision of big ice fields, etc.) page 559. S.V. Dorofeev and S.Yu. Freyman (cited from Badamshin, 1971) noted cases of dead seals found on the coast, however they did not try to explain the cause of their death.

They began talking about the dead seals washed ashore since 1875, however only S.I. Ognev (1935) assumed that the main cause of the appearance of dead seals was their death under the ice and collision and overlapping of the blocks of ice. K.K. Chapski (1930-1932) investigated dead seal bodies on the western shore, mainly on the territory of Dagestan, however he did not interpret the reasons because of the poor knowledge of the process. B.I. Badamshin was the first who attempted to explain the cause of mass appearance of dead seals on the shore (1971). According to Badamshin, main cause of mass deaths of seals is related to late hunting, i.e. during the period when most ice has been melted, half of wounded seals goes down under own weight and only after certain time they rise to the surface and move southwards (before Badamshin some researchers thought that seals died of diseases, another that they suffocated under the ice, however without any strong arguments). Seals lie at the edge of ice-cakes, usually with the head towards water. Hunters on small boats swim to the shoals of seals, at 30-40 m distance and begin shooting. They rarely manage to make more than two shots, as the seals hearing noise leave the resting place. Fatally wounded animals very often jump to the sea and immediately sink. The same fate expects seals killed while swimming. As a result hunters get maximum 2-3 animals of 4-5 killed or heavily wounded. Considering that during spring hunt catch earlier was up to 30 thousand animals and more, losses were significant: "Sunken dead bodies had no time to decompose underwater; with the accumulation of gases in the gastrointestinal system they rise to the surface and under the action of wind and currents are washed ashore. In cold spring water dead seals probably may remain under water quite long, however in summer, as is evident from the tagged bodies (investigation in 1968) they rise to the surface within 1-3 days.

Unlike dead seals found during spring-summer, which usually takes place in the North Caspian and partly on the western shore of Middle Caspian, where dead bodies are brought by the western branch of permanent circular current, at the end of 1955 and beginning of 1956 masses of dead seals were found on both shores of Middle and South Caspian. This was not observed earlier.

During 3 to 12 March 1956 Badamshin surveyed the shores, from Chechen island and to Pervomaiski fish processing plant. Along the overall length of survey (260 km) he discovered 108 dead seals. Whilst when moving from the north to the south number of "plavuns" increases. Most dead animals were mature. Of 108 seals 31 females were with embryo.

According to B.I. Badamshin, based on the size of embryos, dead seals found on the shore died at the end of October - beginning of November.

Previous researchers stated that main cause of dead bodies found ashore was specificity of hunting and explosive works during prospecting for oil and gas.

Our studies demonstrated (my researches since 1971 and earlier researches by D.V. Gadzhiyev, since 1961) that there are many causes of seals mortality:

Hunting for seals, its shortcomings and inefficiency: in the first place incorrect quotas for shooting, and low efficiency when about 50-60% of hunted seals are lost.

**Poaching:** earlier it was shooting of seals using shotguns (in our collection there are dozens of seals' skeletons with shots. Illegal fishing for sturgeons using self-made devices "kaladas" (sets of large hooks. In our collection in twenty dead seals found on the shore had kalada hooks in their mouths. In recent years, as a result of mass poaching - illegal fishing for sturgeons using nets - large number of seals dies: in average 5 seals/year per each net, both coarse and fine-meshed (photo № 15 and photo №16 - three seals get ensnared in one of the nets, and were washed ashore together with the net in highly macerated form. Certain share of seals is killed by oilmen on Oil Rocks and individual offshore platforms: during the spring-summer fattening period seals often interfere with fishing, so oilmen try to shoot them. Besides, recently local population use seals caught in the nets for food: mainly liver and fat, skins are used by some people for manufacturing fur hats. Fat of seals is especially valued by local population (it is considered healing and is used as ointment). Hunting for seals reached special scope island: here you could always buy both fat and liver of seals; most locals on the island wear hats of seal skins, and this despite the fact that just two rookeries remain in the Azerbaijan waters - Shakhova spit and Chilov island. Only minor part of seals occasionally rests on Malaya Plita and Podplitochny islands. Surveys show that islands of Baku archipelago, beginning from 1997, are not any longer used as rookeries. Even during the period of mass spring migration southwards seals recently avoid this group of islands (to our mind, due to permanent disturbances, dirty water, reduction of fish population in this region because of intensive multiple net fishing).

**Urbanization** - in recent years number of built-up beaches increased sharply, they cover Absheron coast all along perimeter: maintenance facilities & personnel are permanently at the coast and frighten away seals, especially during spring migration, when hungry animals, in particular young pups need to come ashore. Same picture is observed across the whole Caspian. In the first place this concerns fishermen - earlier major part of the nearshore zone and islands in the Caspian were uninhabited and seals during mass migration periods could rest on the shore and sea cliffs). Now fishery cooperative associations are located compactly all along the coast.

Owing to our long-term surveys and statements of in 70-80 and in the beginning of 90-s during spring migrations and in summer seals often come ashore to the Absheron beaches and to the sea cliffs. As for the recent years (1997-2002), such cases practically were not observed. Only in 2000, in the area of Sumgait city local citizens caught sivar (seal's pup eye-witnesses, after the first change of coat) and kept it on the sunken ship. Besides, only occasionally one can see swimming seals in the aquatic area of Absheron and on surrounding territories.

Killing seals onshore: only in 2001 in the monitoring zone Buzovny- North Power Station we found three dead seals with the broken skulls recently killed by people. According to eye-witnesses, one of the seals was caught by local people in the evening in the area of North Power Station. They tied him with then rope to a stone. Early in the morning vacationers going to the beach broke the skull of live animal with stone. The same attitude is observed in other regions. Fishermen are against Caspian seals, as they regard them as competitor and guilty in driving away fish shoals and eating out fish in the nets. That is why when possible they kill seals. Residents of coastal zones are frightened by the cases of seals attacking people (which is highly exaggerated) and also kill seals where possible.

Natural enemies: occasionally wolves, foxes, racoon dogs, white-tailed eagles and earlier very large beluga.

## **PARASITES OF CASPIAN SEAL**

A large number of helminths was found in the organism of Caspian seal (currently more than 28 species are described pertaining to 5 classes: cestodes (tapeworm), nematodes (roundworms), trematodes (flat worms), acantocephala (thorn-headed worms) and proboscis worms:

Helminth fauna of Caspian seal:

Trematodes: according to data of V.N. Popov and M.Taikov (1982, 1986, 1990), 13 trematode species were registered in Caspian seals:

- *Bolbophorus cinfusus*
- *Hysteromorpha triloba*



- Tyloodelphys podicipina
- Mesorchis advena
- Cryptocotyle lingua
- Parascotyle sinoecum
- Pigidiopsis genata
- Miritrema sobolevi
- Opishorchis felineus
- Pseudavphistomm truncatum
- Ciureana badamschini
- Cyatocotylidae gen. sp.
- Paracoenogonivus ovatus

#### Nematodes:

- Anisakis schupakovi Mosgovoy, 1951
- Parafilaroides caspicus Kurotsckin et Zablosky, 1958
- Eustrongylides excisus Jagerskiold, 1908
- Nematoda gen sp. (Larva)
- Dioctophyme sp.
- Contracoecum sp.
- Dioctophyme renale

#### Cestodes:

- Diphylobothrium phocarum
- Cestoda gen. sp.

#### Proboscis worms:

- Acantocephala Corynosoma strumosum (Rudolphi, 1802)
- Corynosoma caspicum

Some of them should be particularly mentioned as major impact sources: mass infection with helminths and their large numbers in the animals' organisms also may result in death of seals. Of this number only 13 trematode species, 3 nematode species: Anisakis schupakovi, seal is accidental (optional) host for nematods Eustrongylides excisus Jagerskiold, 1908 (Yu.V. Kurochkin, 1961). From proboscis worms Corynosoma strumosum was registered. The third species of nematodes found in Caspian seals is Parafilaroides caspicus Kurotschkin et Zablosky, 1958; the fourth nematode (Kurochkin, 1961) has not been defined to species.

Ectoparasites in Caspian seals are represented by seal louse Echinophthirius horridus.

Of virus infections only *morbilli* virus giving rise to canine distemper was found.

Of bacterial infections currently only diplococcoid infection induced by diplococcus *Badamschini caspii* (Vilegzhanin), red staphylococcus and salmonella have been confirmed. This shows that virus and bacterial infections of Caspian seal are not studied well enough: there cannot be so little micro-infections. Initially number of helminths in Caspian seal was also estimated as 6, however later more than 27 species were defined.

So, 28 various forms of helminths were established in Caspian seal, 18 of them were identified to a species.

Also, it should be noted that not all helminths are equally dangerous, many of them use Caspian seal as a transition form and are not so dangerous for health.

According to data of S.L. Delyamure (1961) 174 kinds of helminths parasitizing in various organs of pinnipeds and cetacean have been described up to 1961. Delyamure wrote about this with certain purpose: some researchers (other than helminthologists) working with marine mammals were mistaken stating that helminths were parasitizing only within the intestines of these animals. However, this was not so: the following parasites are found in the blood circulatory system: Tictyocaulides, Pseudoaliides, Filariides, Setariides (Nematodes), in lungs and nasal cavities -

Dictyocaulides, Philarioidides, Pseudoaliides, in the hearing organs - Pseudoaliides, in the intestines - Campulides, Echinostomatides, Galactosamatides, Heterophyides, Opisthorchid flukes, Browniides, Notocotylidae, Pholetereides (Trematodes), Tetrabotriides, Difillobotriides (Cestodes), Anisakides, Ancylostomatides /hookworm (Nematodes), Polymorphids (proboscis worms), in liver - Campulidae, Opisthorchidae, Radziidae (Trematodes), occasionally Diphyllbothriides, in urinary system - Krassicaudides (Nematodes), in skin and blubber - larvae of phyllobothriides (Cestodes). Thus, idea that helminths in marine mammals infect only stomach and intestines is outdated and must be rejected.

### **Contaminations of Caspian basin**

Heavy metals. According to data obtained by V.I. Krylov et al. (1990) level of mercury accumulated in this year young and impuberal animals in liver varies within the range 1.84-4.52 mg/kg. High content of mercury was also established in dry and miscarried, more rarely in pregnant females. Strong contamination of Caspian basin has adverse effect on the reproduction and population of Caspian seal: in recent years eildness of females varies from 39.8-59.8%. Toxicity studies carried out within the framework of Ecotox program demonstrated (Sh.Tanabe et al., 2002) concentrations of 15 microelements (V, Mn, Fe, Cr, Co, Zn, As, Se, Mo, Ar, Cd, Tl, Hg, Pb) and organic mercury (OrgHg) in liver, kidneys and muscles of Caspian seal. The highest concentration of these elements was observed in the first place in liver, then in kidneys and muscles. In 2000 and 2001 concentrations of toxic elements (As, Ag, Cd, Tl, Hg, Pb and organic Hg) that were equal or less than concentrations of same elements in Caspian seals in 1993, and seals from other regions, meaning that these elements may not be specific cause of mortality of Caspian seals. Alternatively, concentration of Zn and Fe in infected of Caspian seal presumably was higher than that registered in seals from other regions. This indicates to violation of homeostatic control and content of vital important elements in food of Caspian seal.

Chloroorganic and organophosphorous poisonous compounds. According to of V.I. Krylov et al. (1990), accumulation of pesticides (DDT and its metabolites,  $\alpha$  and  $\gamma$ -hexachlorocyclohexane) in fat tissue varies from 6.05 to 64.3 mg/kg of mass of tissue, depending on the age, sex and place of catch. According to Sh.Tanabe and N. Kajivara (Ecotox, 2002, 2008), polychlorinated biphenyls (PXB<sub>1</sub>) dibenzo-p-dioxins (PXDD<sub>1</sub>) and dibenzofurans (PXDF<sub>1</sub>), chloroorganic pesticides and organo-tin compounds were found in the liver fat of Caspian seals on the shores of Caspian during unusually frequent mass mortality cases in 2000 and 2001. Lipidic-weight investigation showed that DDT contaminants were predominant among the investigated chloroorganic compounds with concentrations 3.1 to 560 ng/g. Content of chloroorganic compounds in the organisms of Caspian seals found on the shores of Iran was less than in other regions. However adipose (fatty) layer in seals found ashore in Iran was significantly investigated thicker, and negative relationship between the concentration of contaminants and adipose layer was observed in Caspian seals.

Seasonal change of the adipose layer was obvious as this layer is thinning after the season of fattening and change of coat. Consequently, seals could be subject to higher risk in spring under the impact of chloroorganic compounds. Levels of chloroorganic compounds established in Caspian seals in 2000 and 2001 were comparable with the levels of chloroorganic compounds established in other mammals suffering from epizootic diseases. Concentrations of PXDD/F in ill Caspian seals were lower than concentrations of these compounds in seals from other regions, which means that toxic effect of tee contaminants is weaker and they are not responsible for mass mortality of seals. Although level of TE (toxic equivalent) in seals was relatively low, current status of infection with polychlorbiphenyls and chloroorganic pecticides found in Caspian seals is dangerous in terms of immunodepression. Concentration of botulinum toxin in liver of seals varies in the range of 0.49 to 17 ng/g of wet weight, and compounds of octyltyne were below detection level in all studied samples, which indicates to lower level of contamination with organostannum compounds in the Caspian Sea.

Factors influencing seals' mortality:

- Drilling mud
- Formation water
- Corrosion-preventive chemical reagents
- Black water
- Radioactive elements used in drilling
- Household wastes
- Radioactive contamination related to the washaway of eastern shores of Caspian

- Discharges of hydrogen sulphide in Kazakhstan
- Introduction - invasion of comb jelly fish - *Mnemiopsis leidyi* to the Caspian
- Seismic survey; methods, scale and intensity of shooting
- Rock outbursts while drilling
- Oil discharges
- Paraffinic wastes
- Ethyleneglycol, sludge
- Permanent disturbance (stress for young animals)
- Commercial fishing
- Natural mortality because of age: in average about 8% from total number of found dead seals

### **Recommendations for Preservation of Caspian Seal**

1. General prohibition for hunting for Caspian seal.
2. Strengthening of control and elimination of illegal fishing for sturgeon and small fish.
3. Coordination of investigations all across the aquatic area of the Caspian agreed with all littoral states: Russia, Kazakhstan, Turkmenistan, Iran, Azerbaijan and international environmental organizations.
4. Apply to law enforcement agencies in order to stop killing seals on Chilov island and introduce fines for the hunting for seals on Oil Rocks and in other oil production areas.
5. Ban on fishing in the areas of mass migration and accumulation of seals.
6. Organize TV broadcasting and attract other mass media, as well as NGOs and educational organizations for the promotion of measures on protection and preservation of Caspian seals.
7. Strengthen control over discharges of various toxic chemicals (mainly DDT) and toxic metals into rivers, sewage systems and sea.
8. Develop various vaccination schemes against infections, in the first place against *morbilli* virus.
9. Improve control over the oil-producing companies in the Caspian through the Ministry of Ecology, so that they carry out seismic survey, drilling and operations accounting for specifics of seals' migration.

## Appendix 2

### Seals Abundance Zones

