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Популяционный статус каспийского тюленя (*Pusa caspica*): угрозы, приоритеты и проблемы сохранения

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Population status of Caspian seals (Pusa caspica): threats, priorities and barriers to conservation

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Ру текст

In 2008 the Caspian seal was designated as 'Endangered' by the International Union for the Conservation of Nature (IUCN) on the basis of a greater than 70% decline in population size in the last three generations and the presence of many ongoing threats to the population, including high levels of anthropogenic sourced mortality (principally hunting and fishing by-catch), together with habitat loss and degradation (Härkönen 2008, Härkönen et al. 2008, 2012). Wider changes to the Caspian ecosystem due to invasive species and over exploitation of commercial fish species, disease, pollution and climate change are also considered threats (Härkönen 2008). The Caspian seal is endemic to the Caspian Sea and as a key predator, is an indicator of overall ecosystem health. Here we assess current population status based on aerial surveys of the breeding population, reconstruction of historical demography from hunting statistics and review the nature and magnitude of key threats.

Fixed-wing aerial surveys of the breeding population on the Caspian winter icefield were carried out in late February 2005-2012. In each year approximately 11% of potential breeding ice in Kazakhstan and Russia was covered by parallel north-south transects spaced at intervals of 6 minutes longitude. Flying at an altitude of 90m all seals within 400m strips on each side of the aircraft were recorded and counted from GPS stamped digital photographs. Observations were replicated by two observers for each side of the aircraft and assessed for observer detection error. Total pup numbers were estimated to be approximately 25,100 (2005), 19,450 (2006), 7,150 (2007), 6250 (2008), 19,500 (2009), 6,700 (2010), and 21,950 (2011) using methods as described in Härkönen et al. 2008. Uncertainty ranges were based on confidence intervals derived from the coefficient of variation (CVs), which ranged from 4.15 to 8.16 in different years.

Annual differences in pup production indicate 2 to 3 fold fluctuations in fecundity between consecutive years. These extreme changes do not appear to be attributable to varying ice conditions. Of the three years where pup production was 6000-7000 (2007, 2008, 2010), compared to greater than 19,000 in all other years, only 2007 had reduced ice field area and duration. Apart from 2010 with 12,250, the total number of adults observed on the ice did not fall below 23,000, with a maximum of 53,378 in 2009. 2010 was characterised by high wind speeds during the survey period which may have reduced haul out periods for adults, and therefore may partly account for lower number of adults observed in this year.

Extrinsic factors in the wider Caspian ecosystem affecting the ability of fertile females to achieve breeding condition, may account for some of the observed variation in pup production over the last 8 years. One potential driver is food availability (Haug & Nilssen 1995; Boyd 2000) due to over fishing and the impact of *Mnemiopsis leidyi* (Ivanov et al. 2000, Yousefian and Kideys 2003). Quantitative information on current seal diet, Caspian productivity, and the population size/accessibility of prey species, is either incomplete or not available. As a potential index of prey availability, we tested for correlations between fisheries production data 2004-2010 provided by the Caspian Environment Programme (www.caspianenvironment.org). Correlations were tested using the fisheries data for the year preceding the seal surveys since it is the females nutrition status in the year before pupping which will determine a successful pregnancy. Fisheries data for all years 2004-2010 were available only for total bony fish catch in Iran, total kilka catch in Iran, total kilka catch in Azerbaijan and vobla catch in Kazakhstan. Spearman's rank correlation tests indicate that there is no significant association between annual pup production and any of these fishery variables ($P>0.05$). More complete fisheries data, satellite derived measures of Caspian productivity, and increasing the length of the time series are required to develop more powerful analyses of ecological drivers that influence seal population demography.

A population model based on Caspian seal life-history parameters suggests a total current population of approximately 100,000 individuals, while a hind-casting analysis of hunting statistics extending to 1867, indicates this represents a decline of more than 90% against a population exceeding 1 million individuals around 1900 (Krylov 1990, Härkönen et al. 2012). The principal driver of historical decline was unsustainable hunting through the 20th Century. Although commercial hunting now only occurs intermittently, anthropogenic sourced mortality continues as the greatest short-term threat. An interview based study conducted with fishers in Dagestan and Kazakhstan in 2009 suggests there is a minimum annual by-catch rate exceeding several thousand seals per year in illegal sturgeon fisheries, which likely contributes to the on-going decline (Dmitrieva et al. 2012).

Conservation priorities should focus on eliminating anthropogenic sourced mortality and establishing pan-Caspian protected areas to safeguard critical habitat from degradation and industrial development. Implementation of effective conservation measures in the Caspian is impeded by lack of transparency in fisheries policy, lack of institutional capacity, limited availability of resources for conservation, and competing interests among stakeholders. Current official hunting quotas set by the Caspian Commission on Aquatic Bioresources still greatly exceed sustainable levels relative to current pup production.

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Методика определения направления на широкополосный источник звука с помощью стереогидрофона применительно к импульсным звукам косаток (*Orcinus orca*)

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Two-hydrophone method of estimating direction to broadband sounds recorded from killer whales (Orcinus orca)

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Одной из основных проблем, связанных с изучением акустической коммуникации китообразных, является то, что исследователь не может определить источник акустических коммуникативных сигналов. При исследовании наземных млекопитающих, как правило, возможно определить визуально или на слух, какое животное издает звук. При исследовании акустического поведения морских млекопитающих исследователи лишены такой возможности и вынуждены полагаться только на данные приборов. Существуют методы, позволяющие достаточно точно локализовать источники подводных звуков, однако все они имеют ряд существенных недостатков, делающих их ограниченно применимыми для исследования морских млекопитающих. Использование стационарного массива гидрофонов требует длительной и дорогостоящей предварительной подготовки. Использование направленных приемников звукозаписи не позволяет контролировать обмен сигналами между несколькими животными, кроме того, может порождать ошибки, связанные с невозможностью контролировать положение животного относительно приемника большую часть времени.

Оба эти варианта трудно применимы к исследованию таких морских млекопитающих, как косатки, так как эти животные высоко мобильны и держатся большими группами. Для более детального исследования акустического поведения этих животных Миллер и Тиак (Miller and Tyack 1998) предложили методику, использующую буксируемый гидрофон-

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