Assessment of the state of the Caspian Sea ecosystem due to the impact of climate changes in recent years based on the results of studies in the coastal waters of Azerbaijan

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Ministry of Ecology and Natural Resources of the Republic of Azerbaijan

The virtual Scientific Conference on Climate Change in the Caspian Sea Region on 27-28 October 2021

The human-induced and climate change impacts on the Caspian ecosystem

- Climate Change and Global Warming
- Worsening of the environmental and climatic conditions of the Caspian Sea
- Pollution from the land-based sources and economic activities
- Reduction of Hydrological Flows in the Caspian basin
- The Caspian biodiversity change
- Biodiversity loss of destruction of habitats (fish spawning, nursery and feeding grounds)
- Reduction of the fish populations (kilka and sturgeon fisheries) as the results of climatic and anthropogenic factors (unsustainable fisheries management)
- Invasion of alien species such as ***Mnemiopsis leidyi and Beroe ovata***

The “Alif Hajiyev” Research Vessel

The participants of the Caspian Complex Environmental Monitoring Expedition off the coast of Azerbaijan in July-August 2021

Historical monitoring stations (a century old) for the research in the Caspian Sea

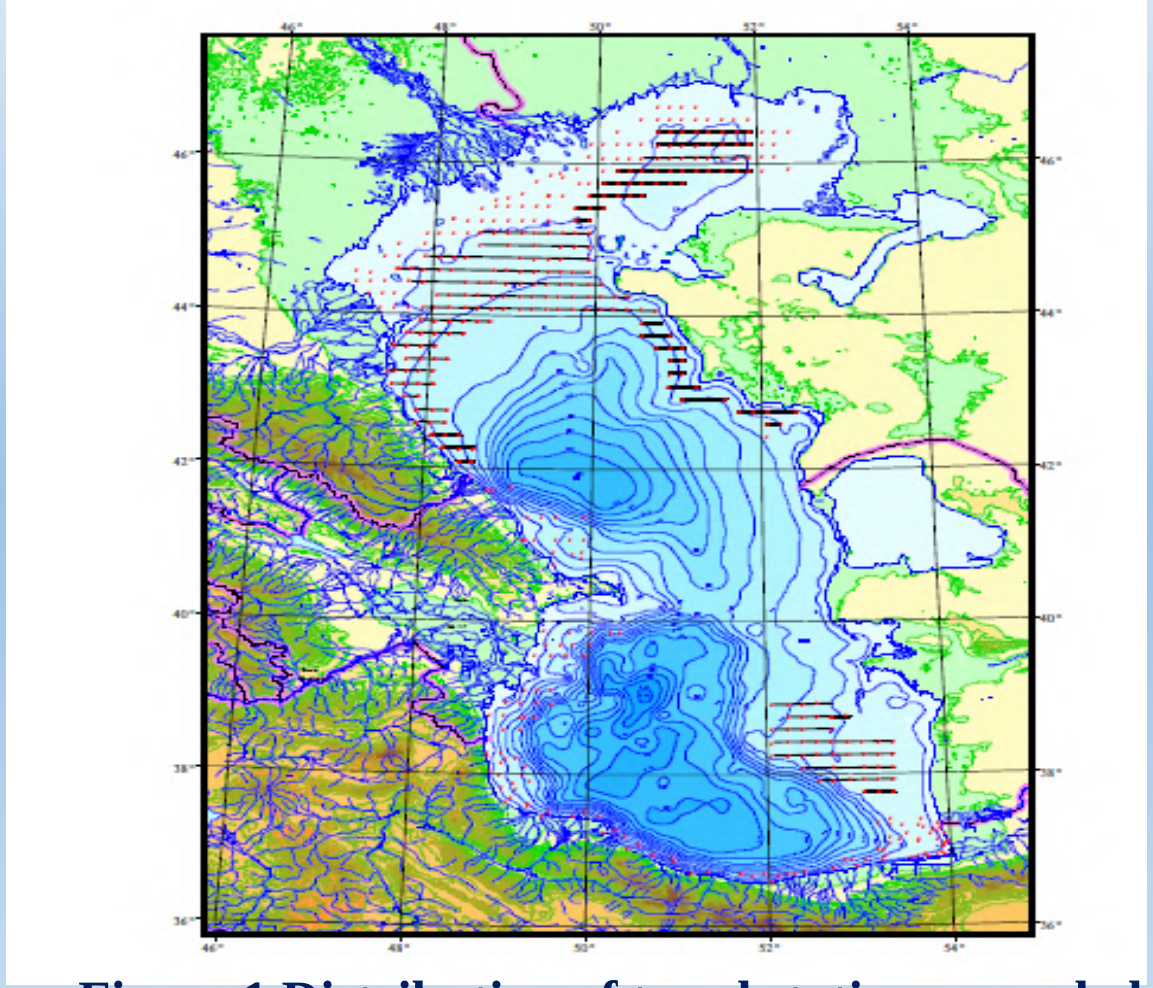


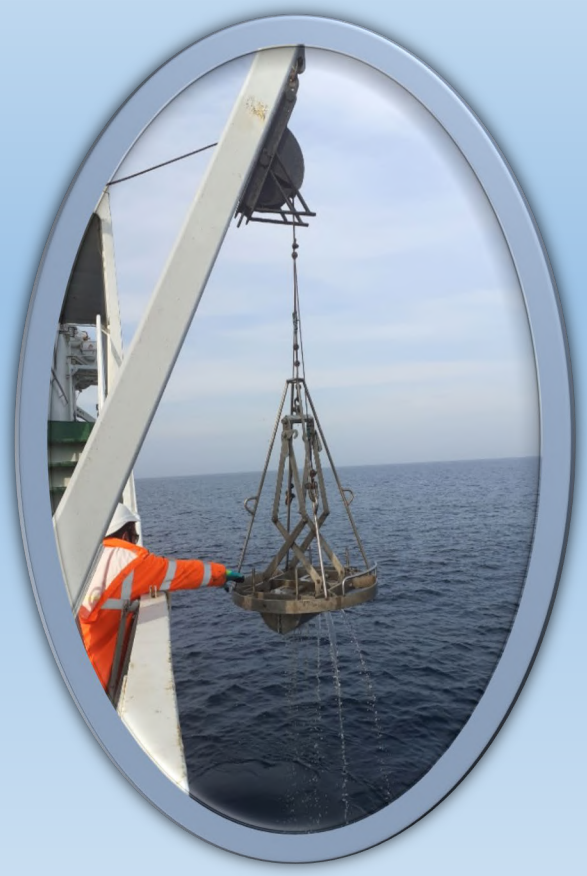
Figure 1 Distribution of trawl stations sampled in the Caspian Sea on annual basis for the purpose of stock assessment and TAC determination.

A 24.7 m bottom trawl is used for the fish stock assessment in the Central and Southern Caspian

In the Central and Southern Caspian at greater depths a 24.7 m bottom trawl is used for the survey by Azerbaijan, Kazakhstan, The Russian Federation and Turkmenistan which adopted a fixed-station sampling design with stations allocated along fixed transects.

Hydrological and Hydrobiological Observations

Zoobenthos and zooplankton sampling



Water sampling

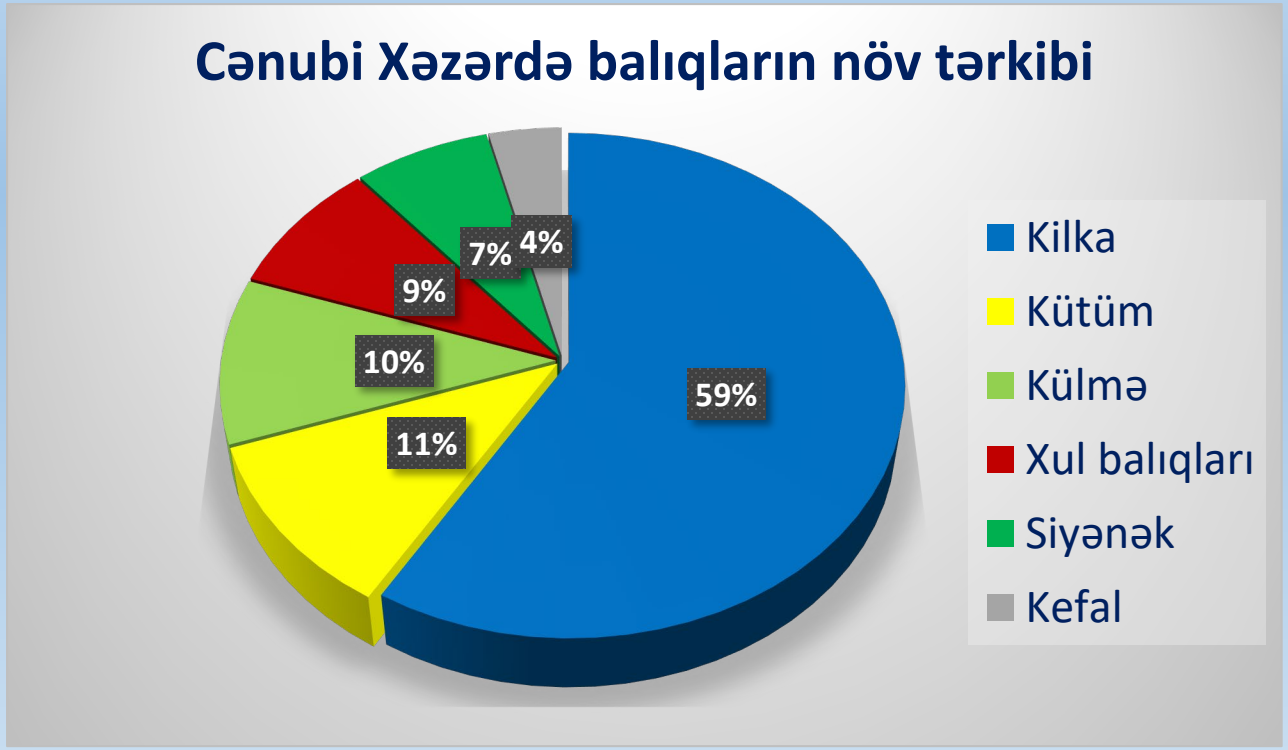
Collection of benthic animals

Collecting and Processing materials

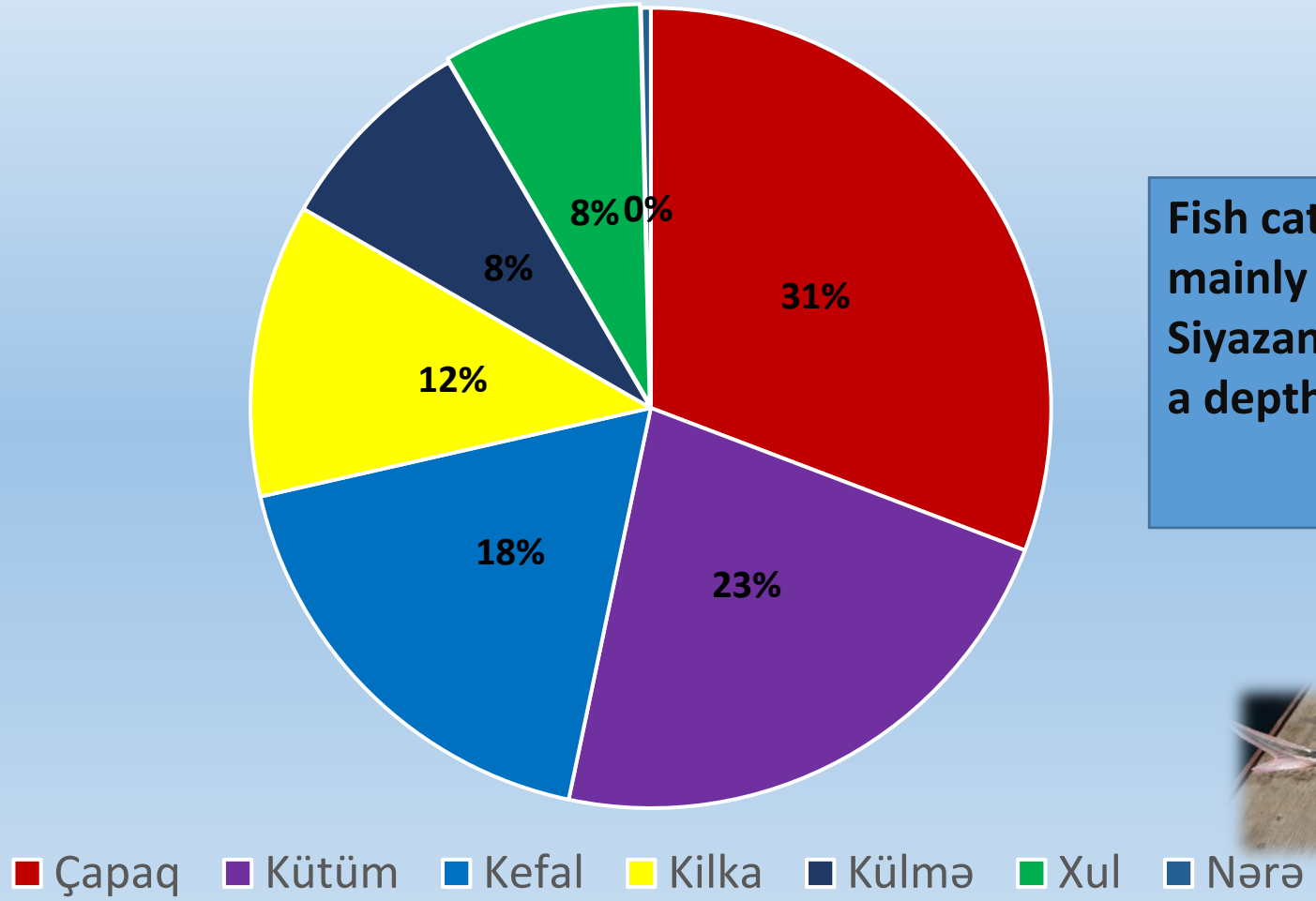
Fish catches by the trawl off the coast of Azerbaijan in 2021

Species composition of trawl catches in the Southern Caspian in July 2021

Fish catches mainly observed at the areas of Shahaghach, Lankaran, Kür dili, South-East Kultuk at depths ranging from 10 to 25 m.



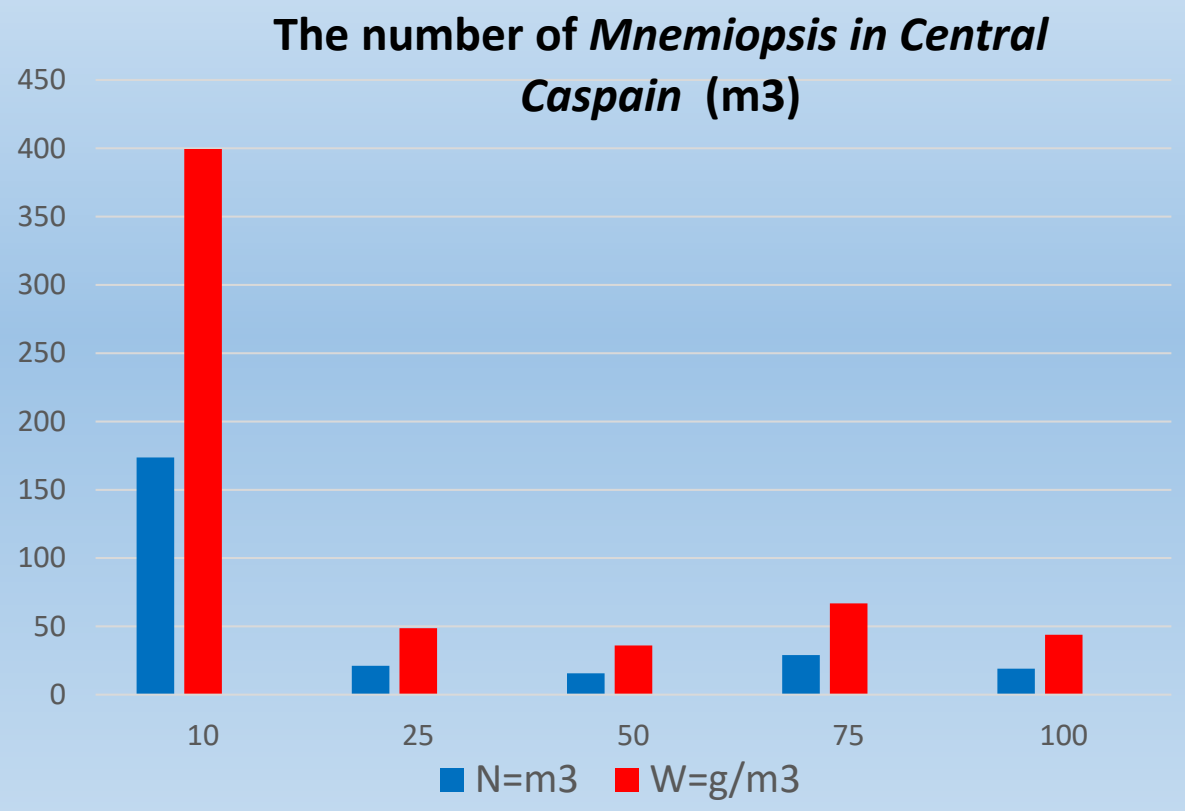
Species Composition in the Central Caspian

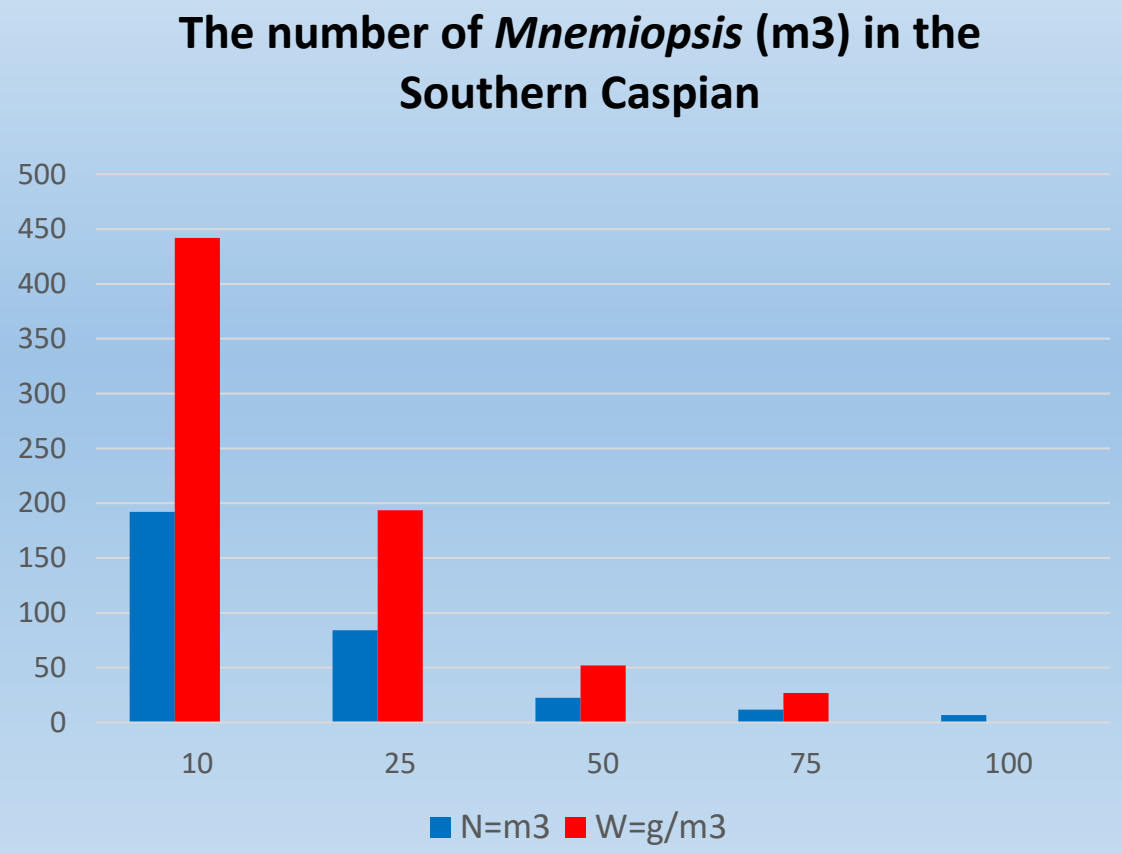


Fish catches were mainly observed in Siyazan and Quba at a depth of 25 m.

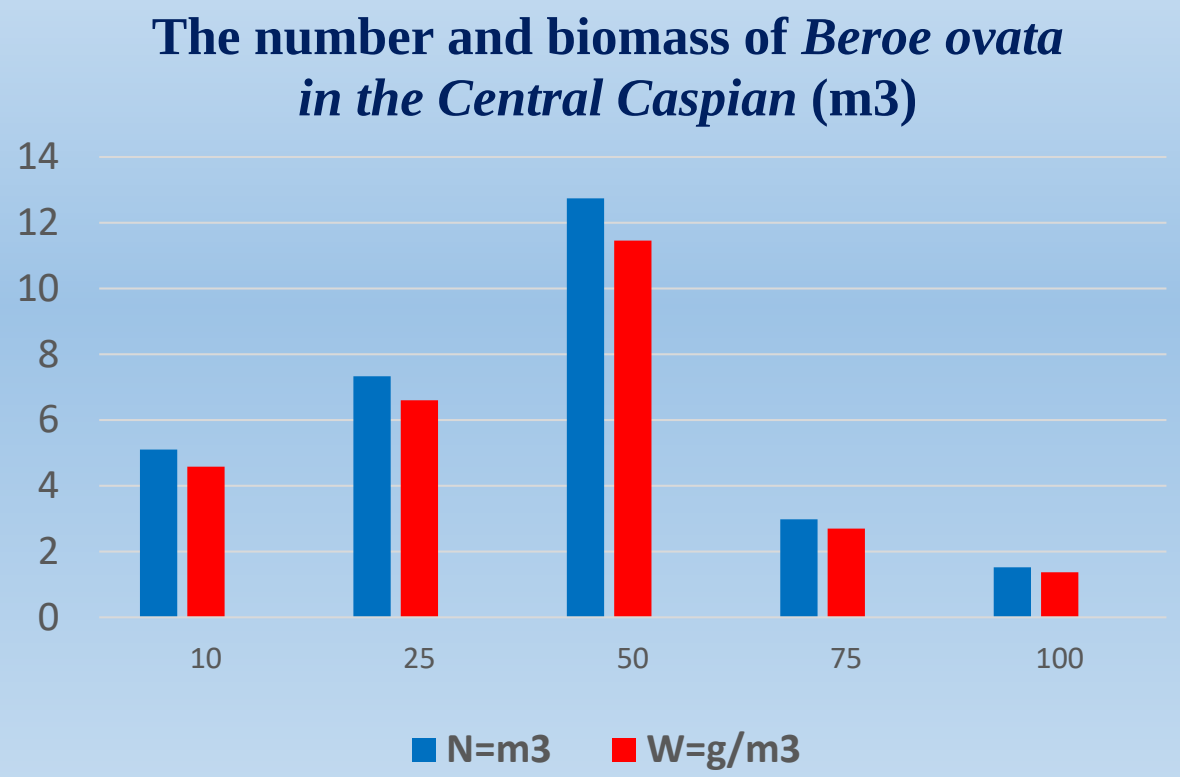
Sturgeon juvenile caught during the trawl survey was released into the Caspian Sea after the biological measurements

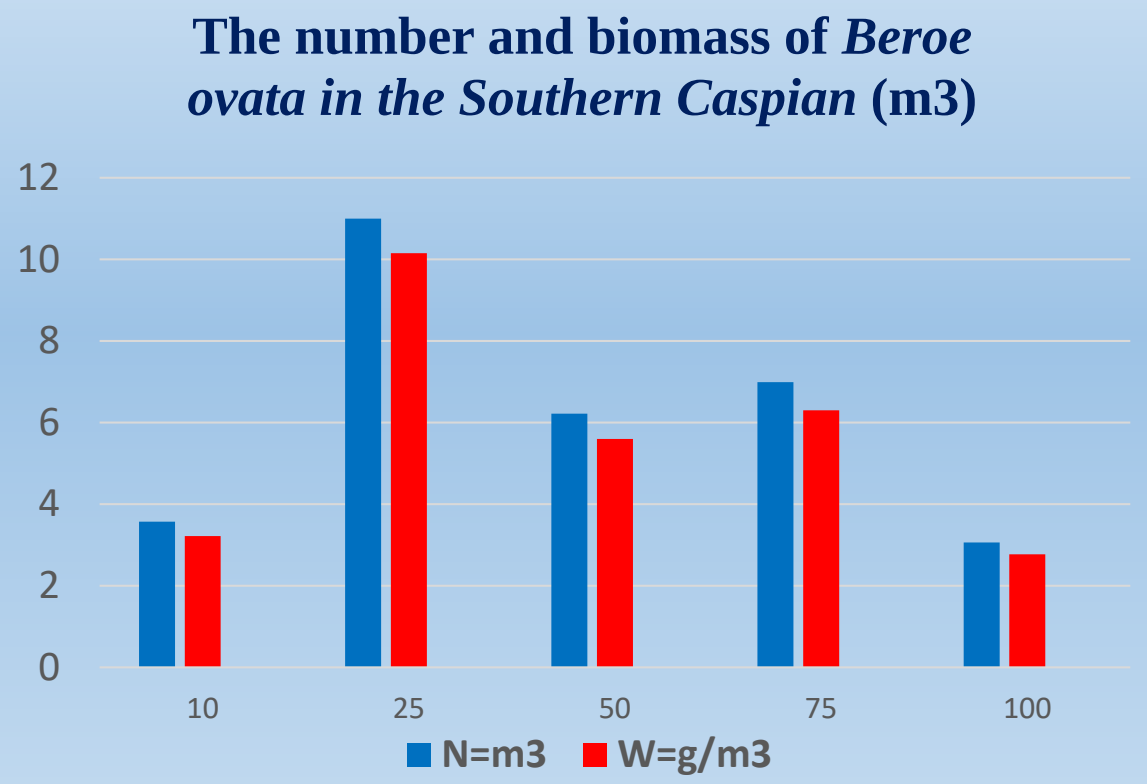
The abundance and biomass of *Mnemiopsis leidyi* in the Central and Sothern Caspian (N/m3) and weight (g/m3) in 2021



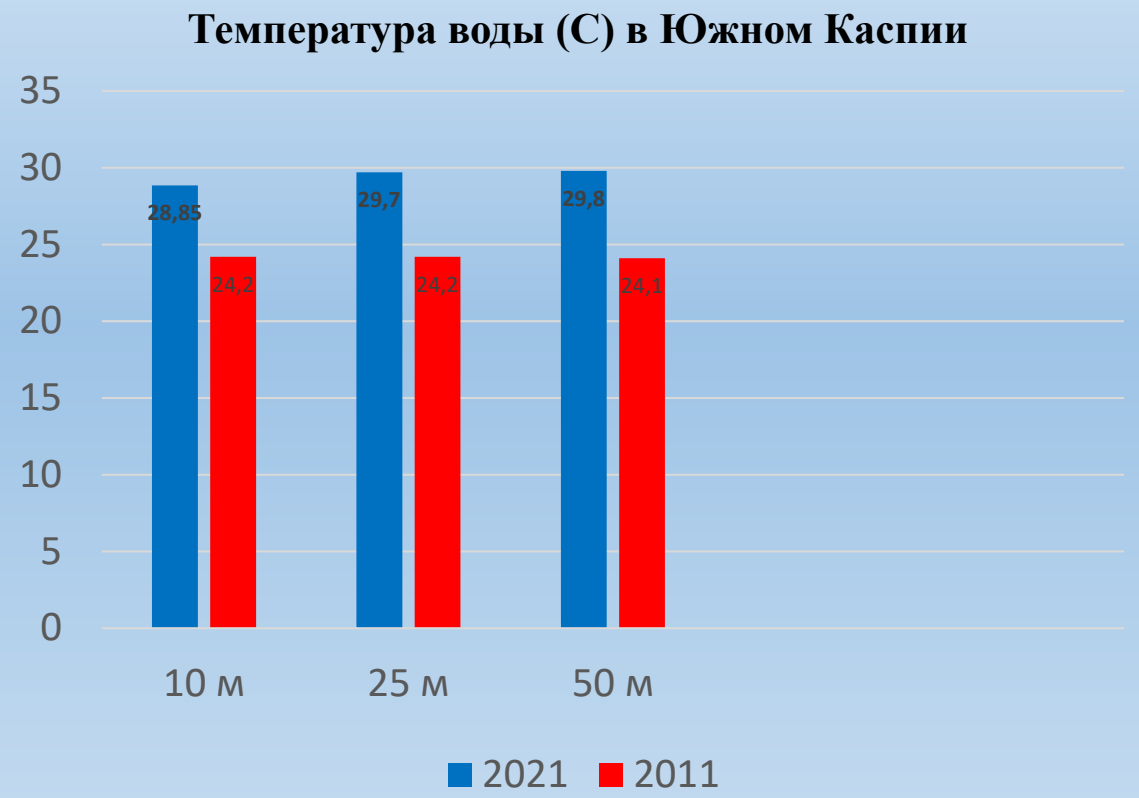


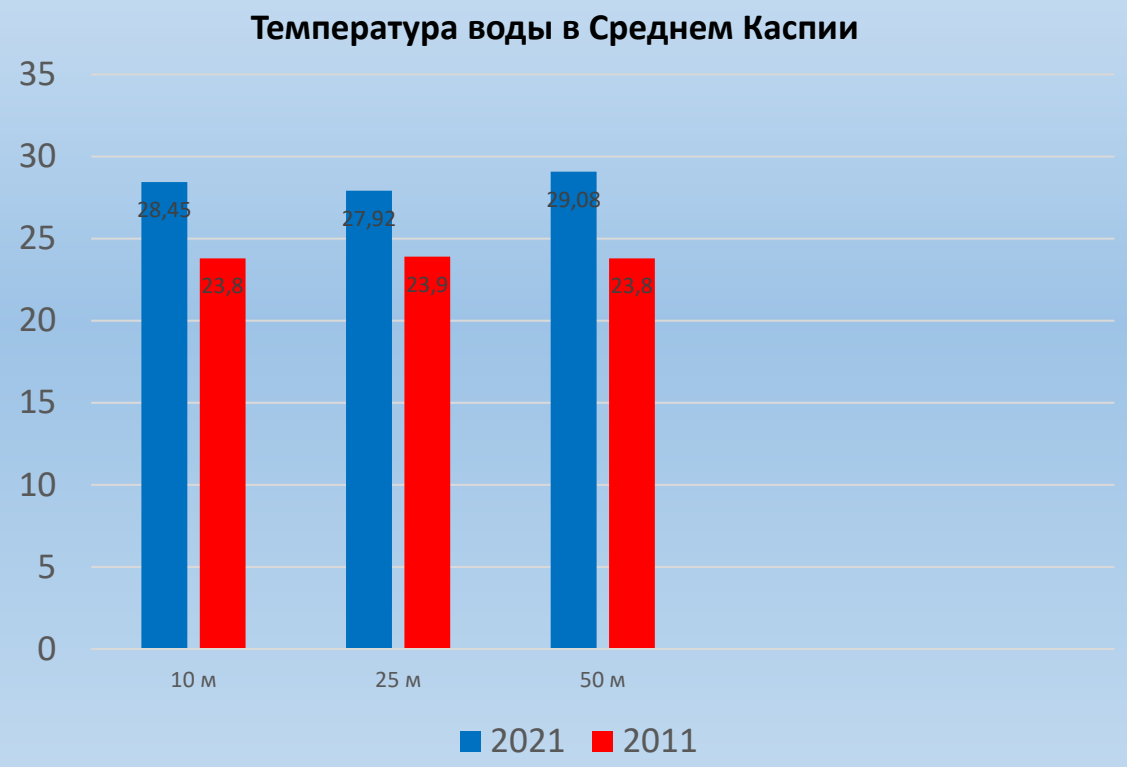
The number and biomass of *Beroe ovata in the Central And Southern Caspian* (N/m3) and weight (g/m3)



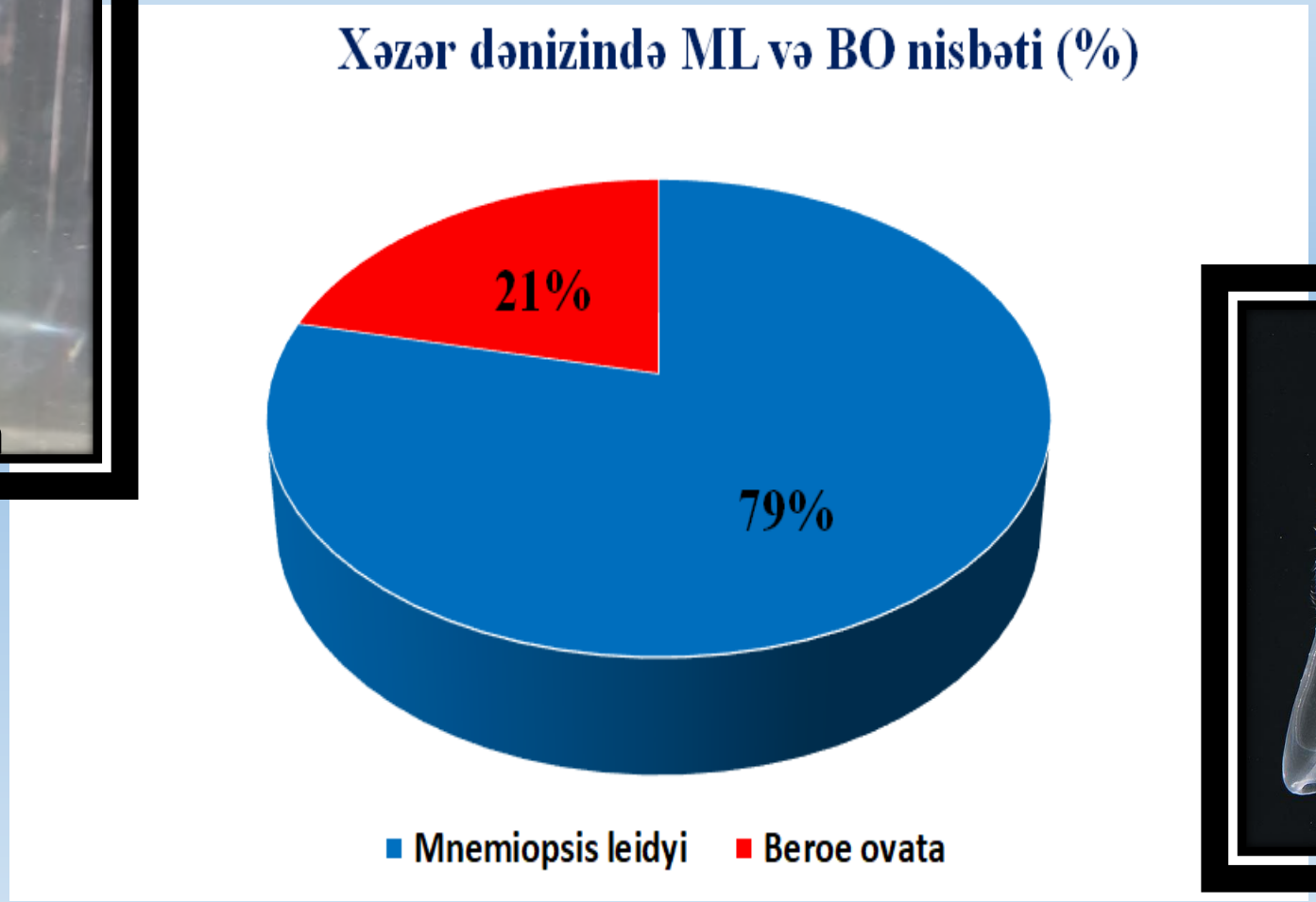


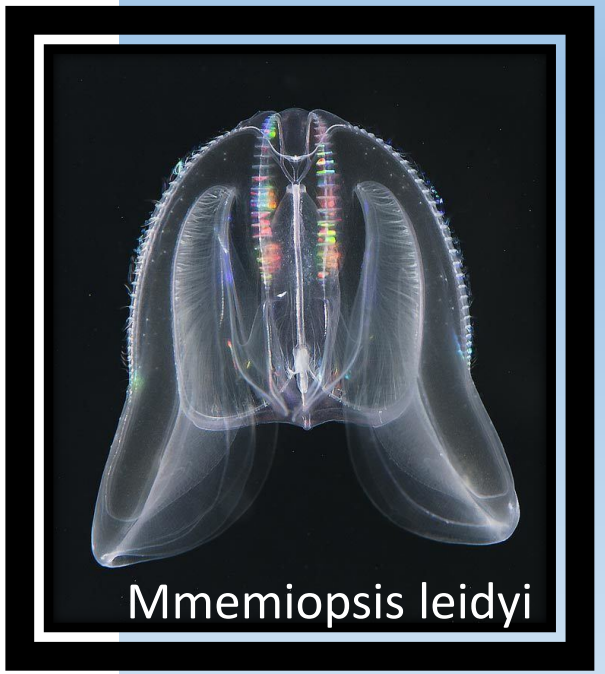
Water temperature in Central and Southern Caspian (oC)



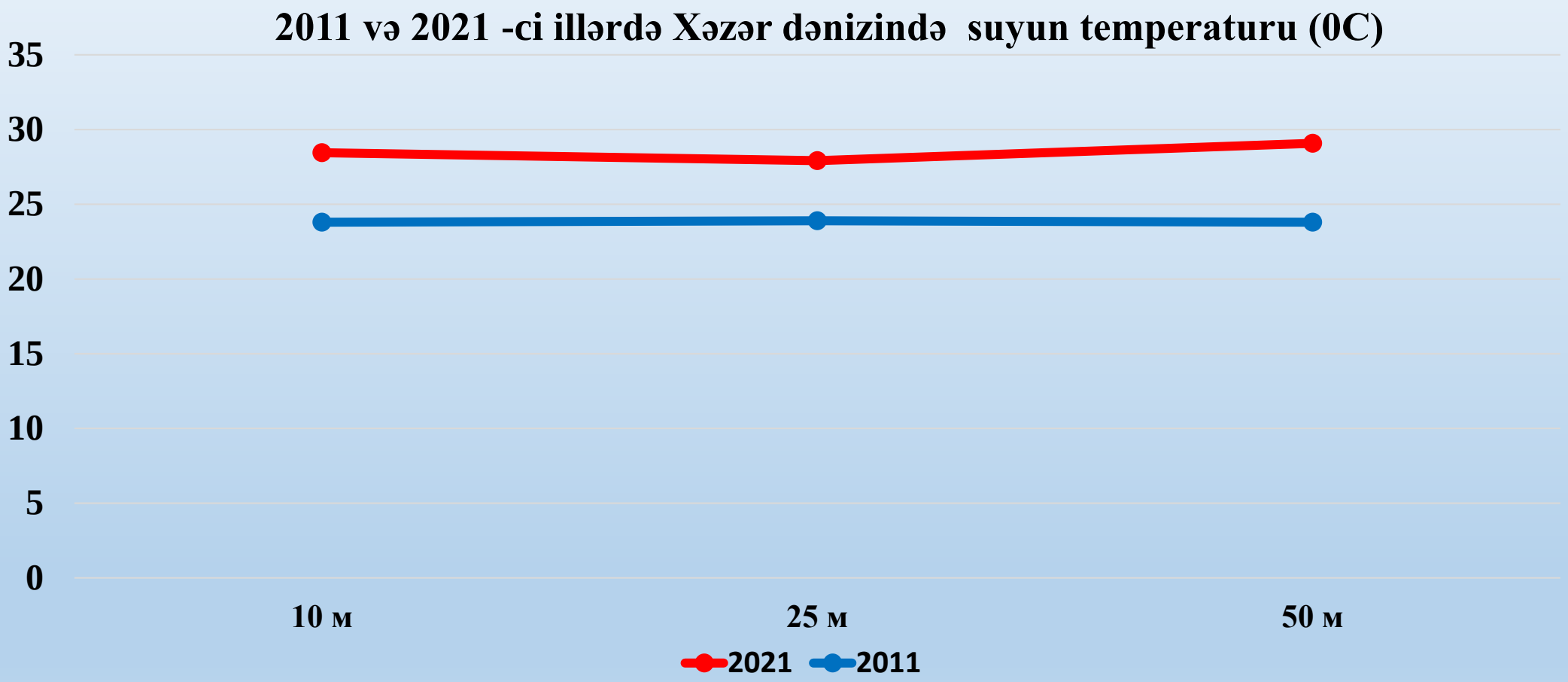


The relative number of *Mnemiopsis leidyi* & *Beroe ovata in the Caspian Sea* (%)

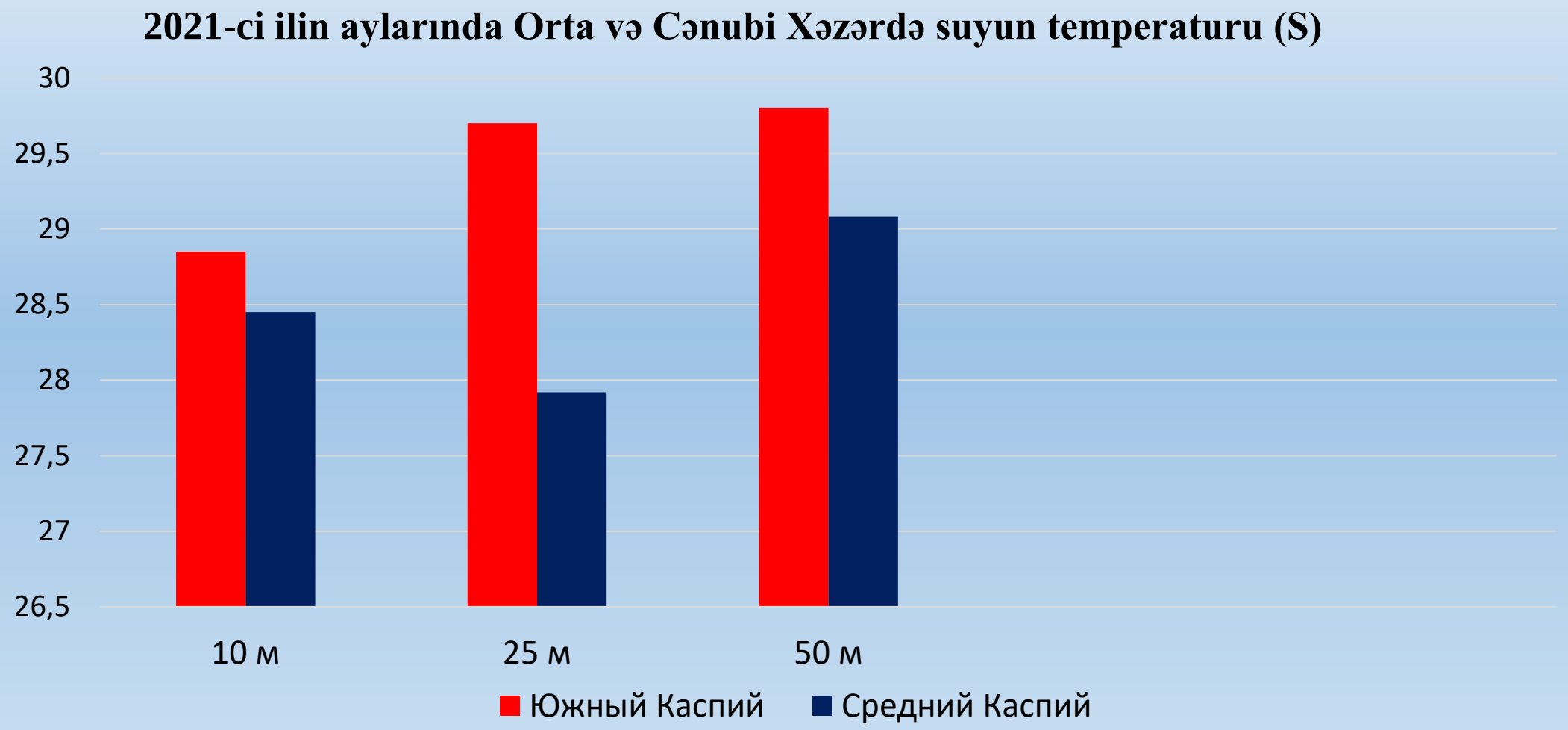




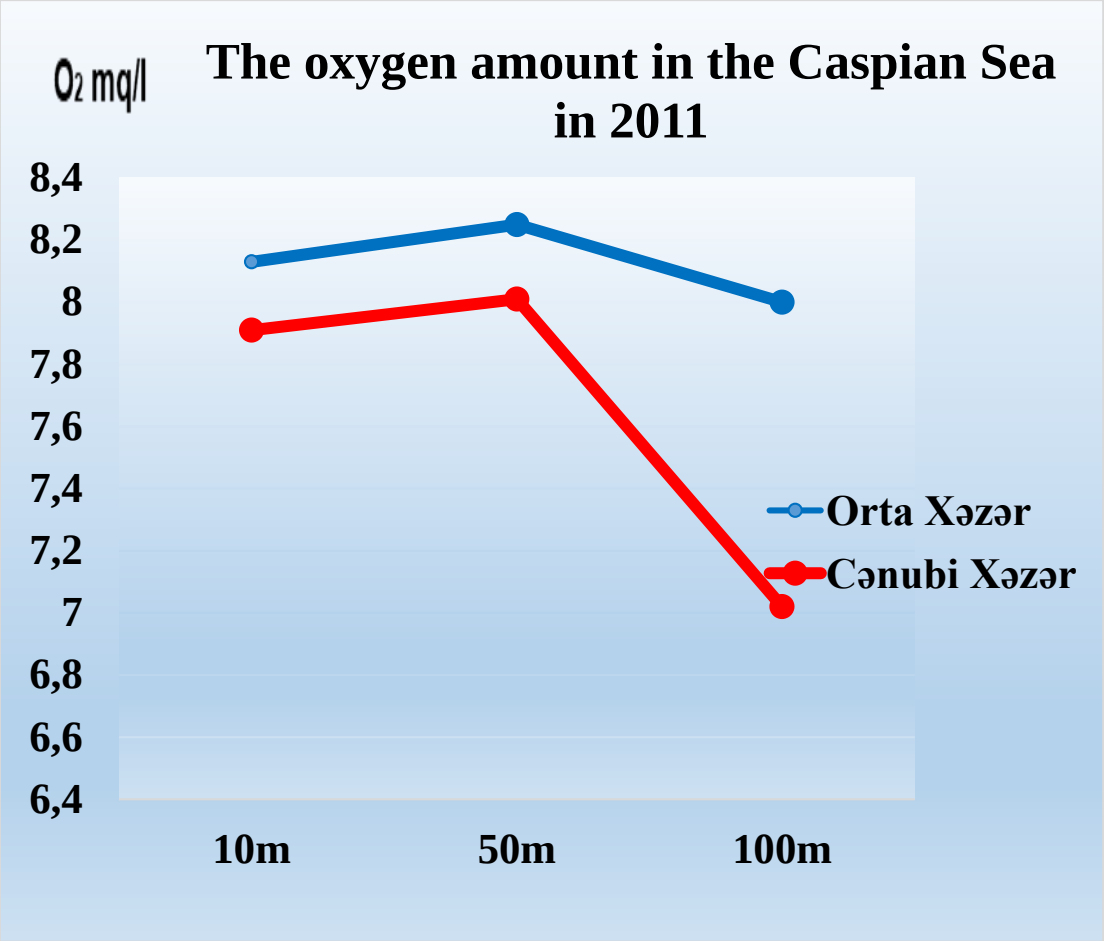
Water temperature in the Caspian Sea in 2011 and 2021(oC)

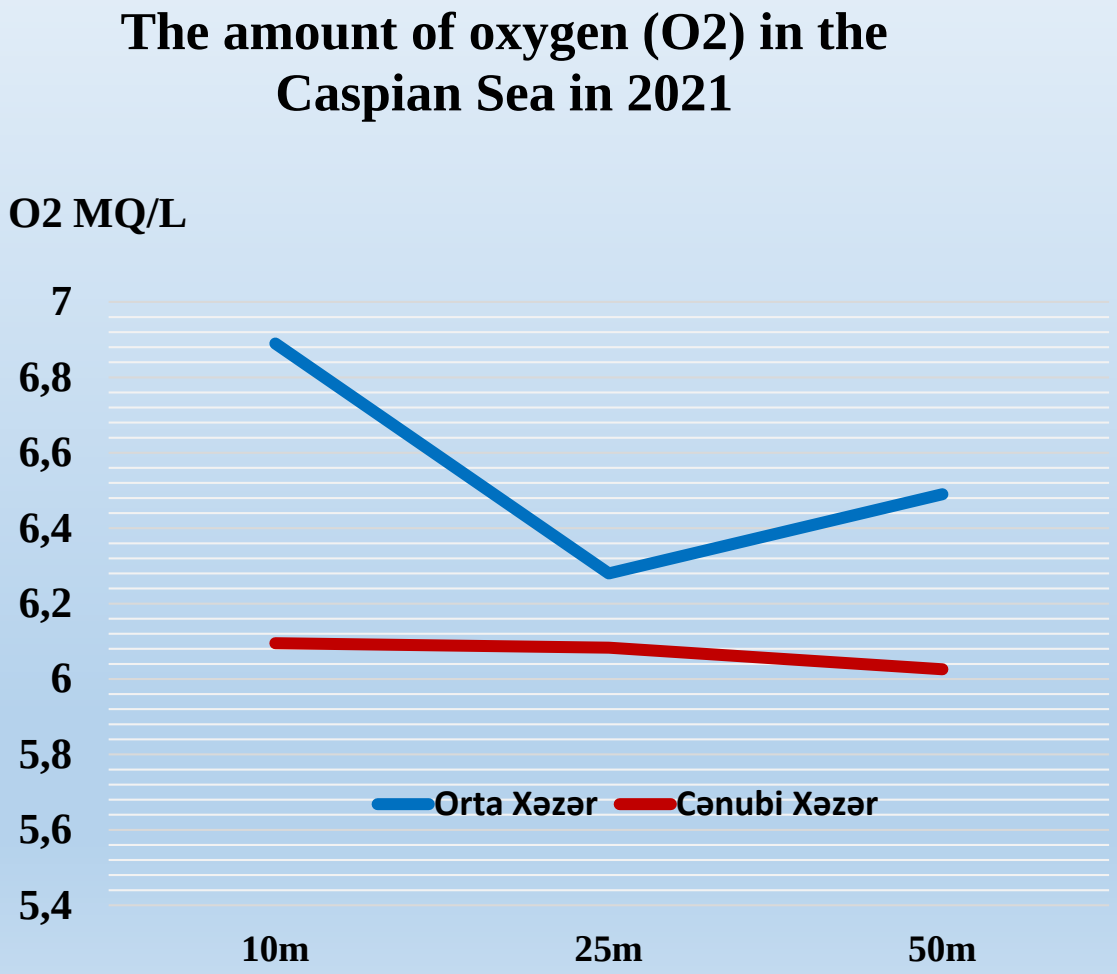


Water temperature in the Central and Southern Caspian in 2021

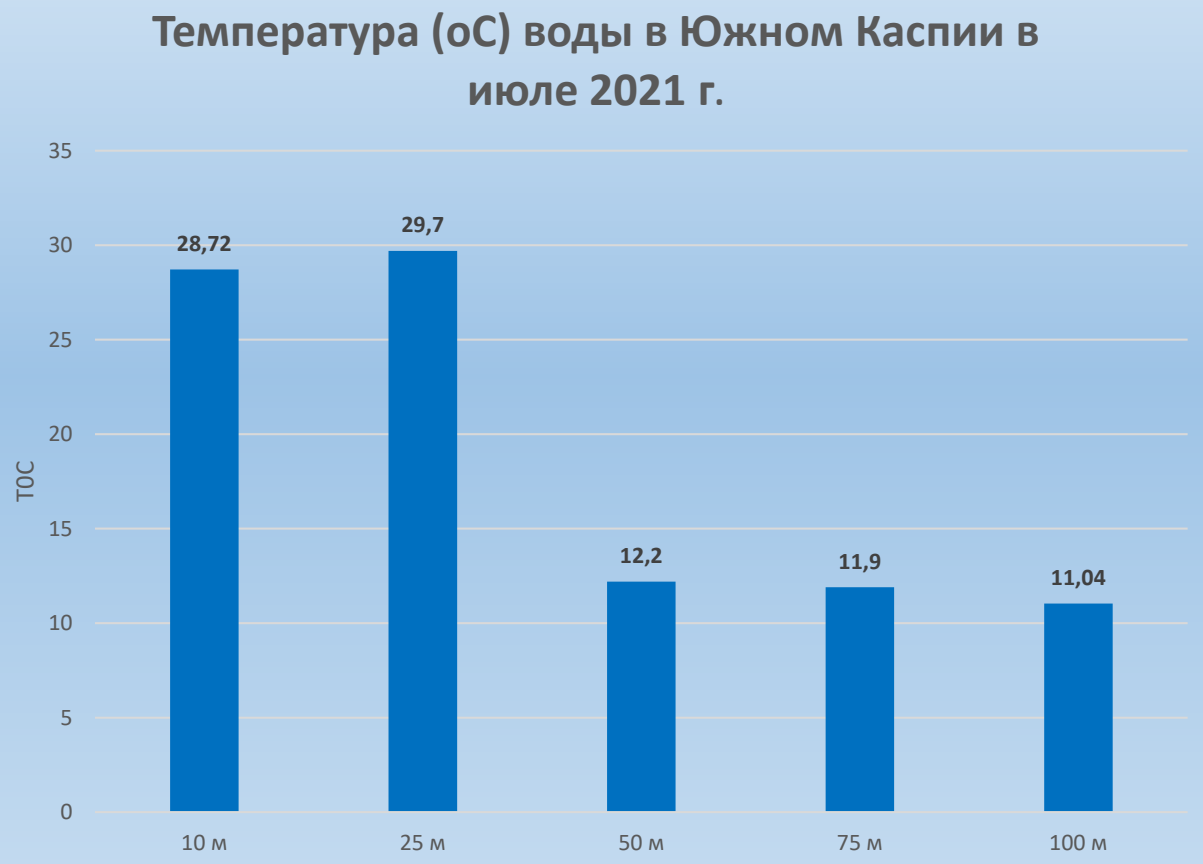


Changes of the oxygen amount (O2 mg/l) in the Caspian Sea (2011 and 2021)

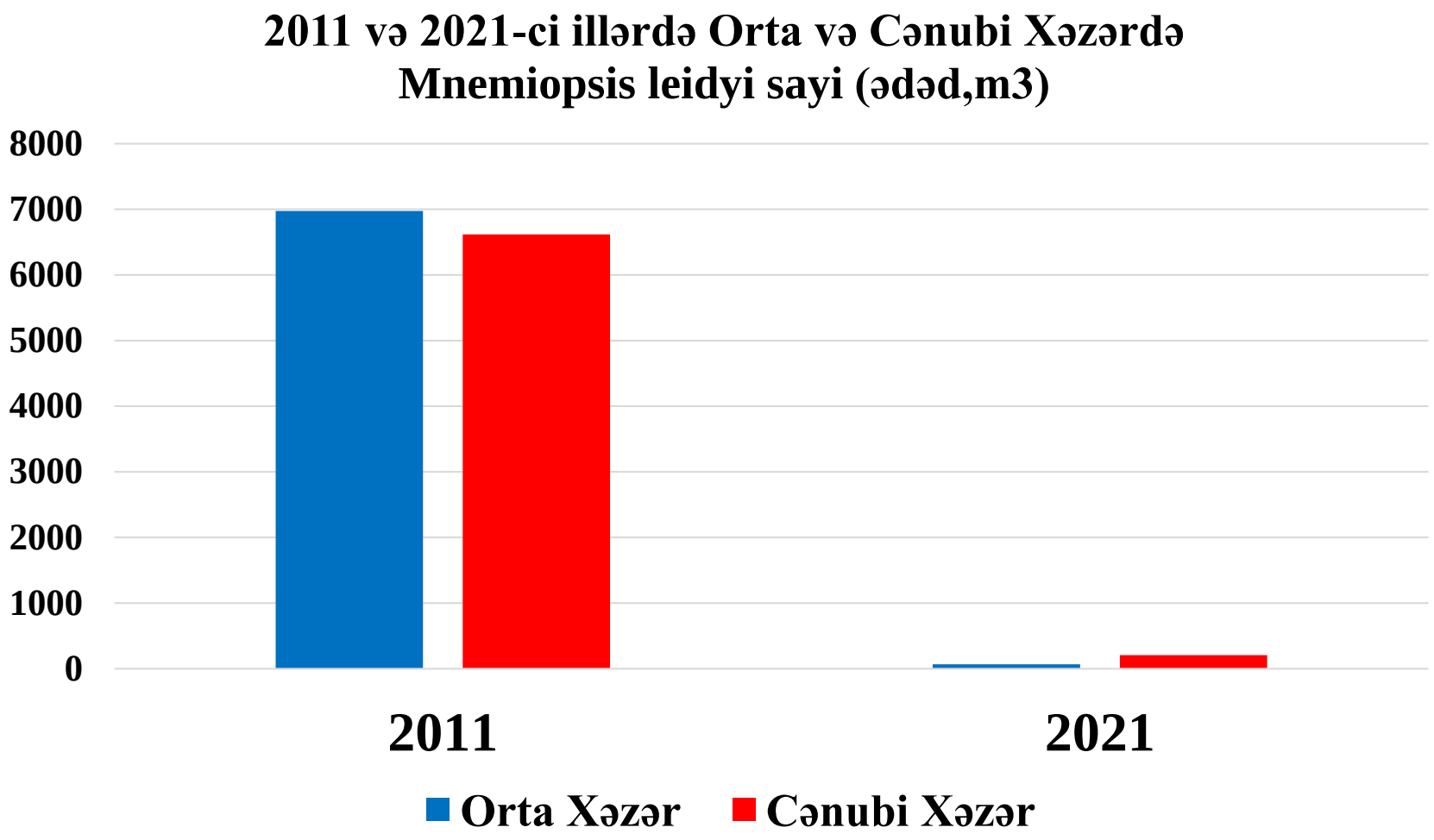




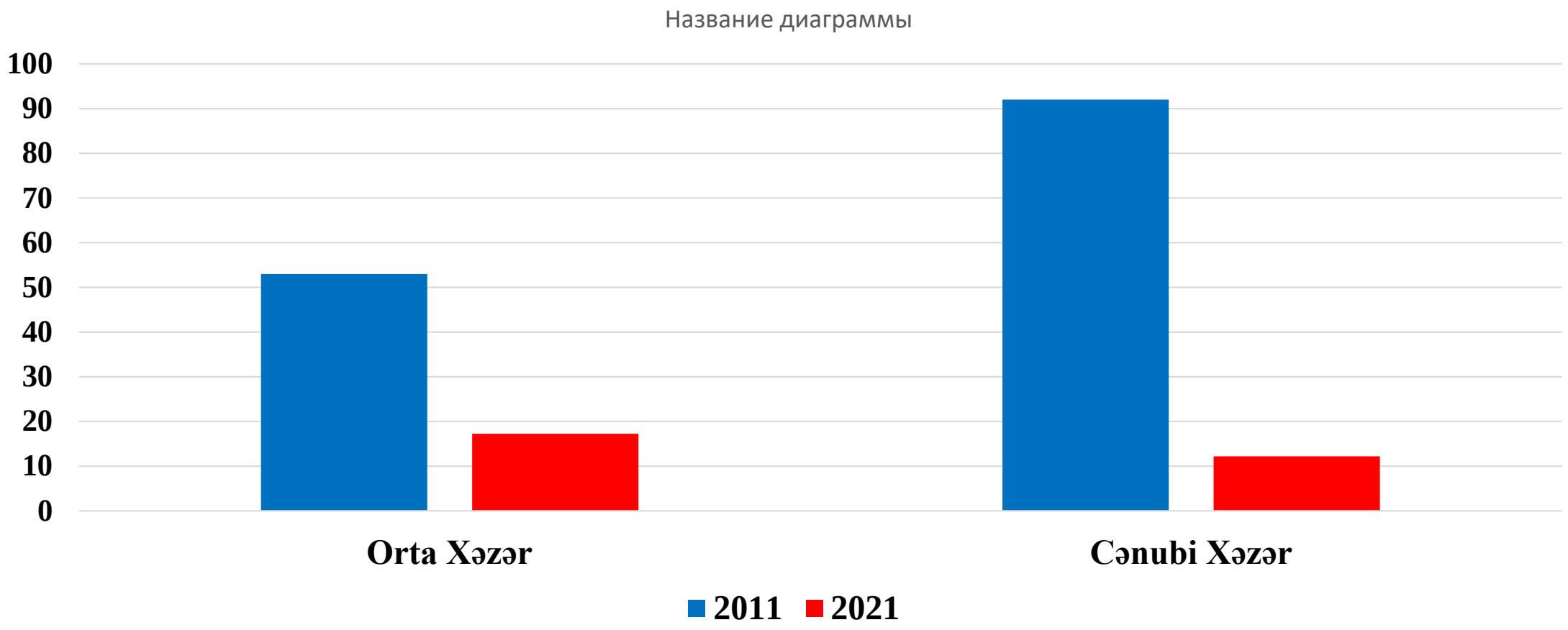
Water temperature in the Central and Southern Caspian in 2021(oC)



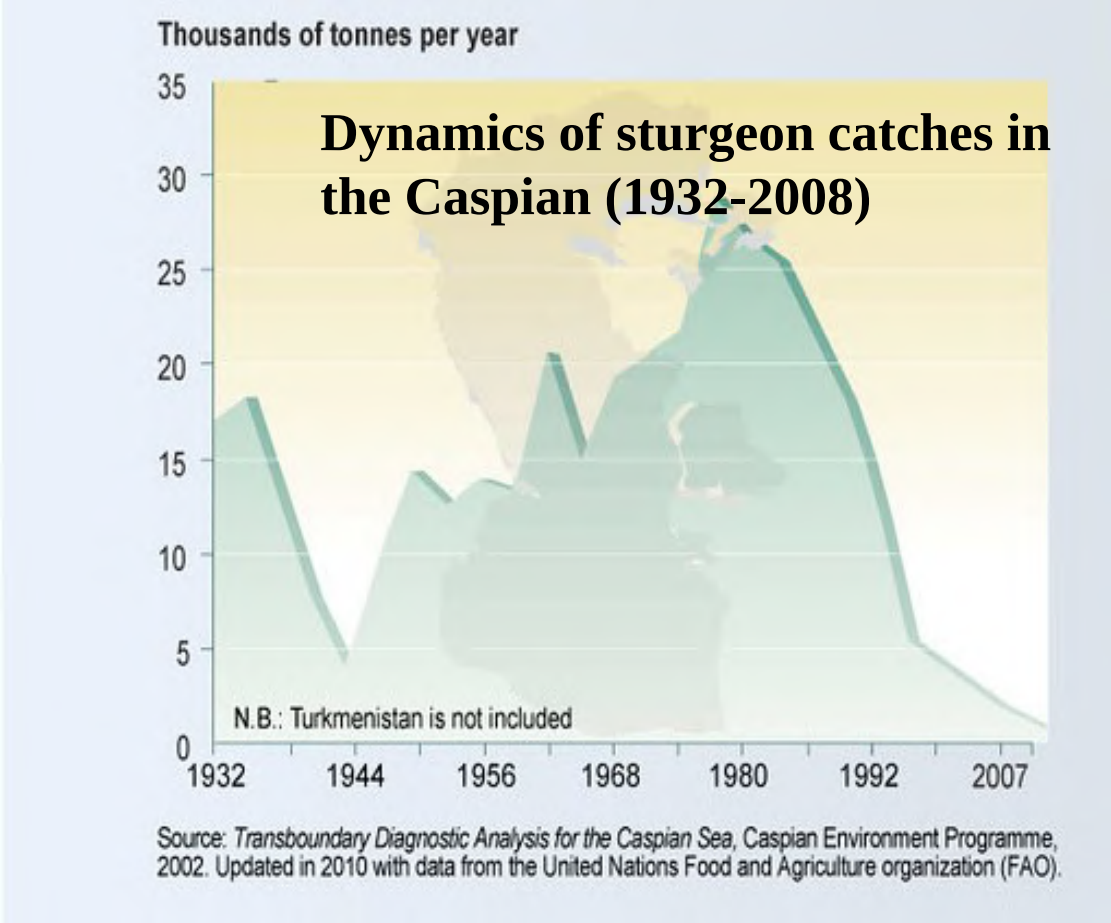
The number of zooplankton in Central and Southern Caspian in 2011 and (m3)



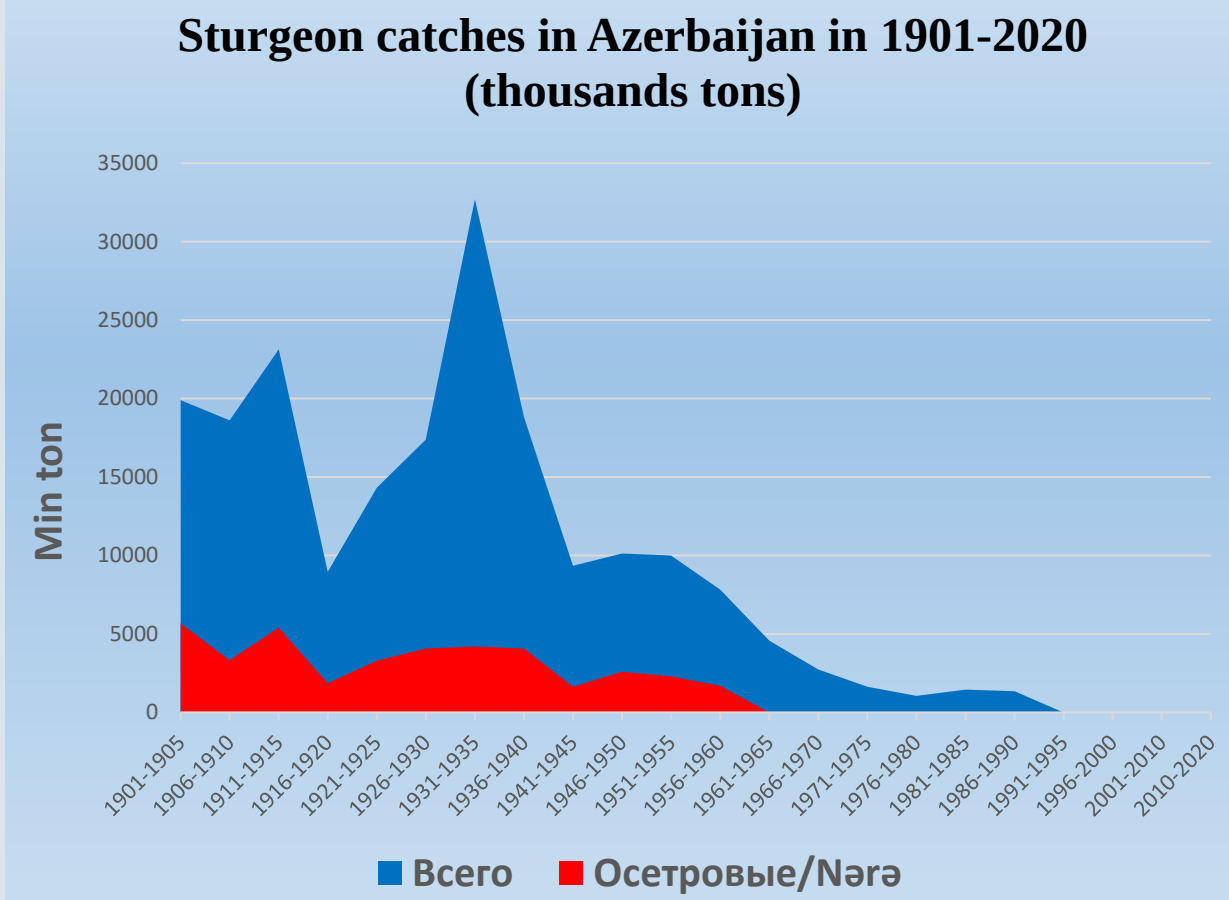
The number of *Mnemiopsis leidyi* (m3) in the Central and Southern Caspian in 2011 and 2021



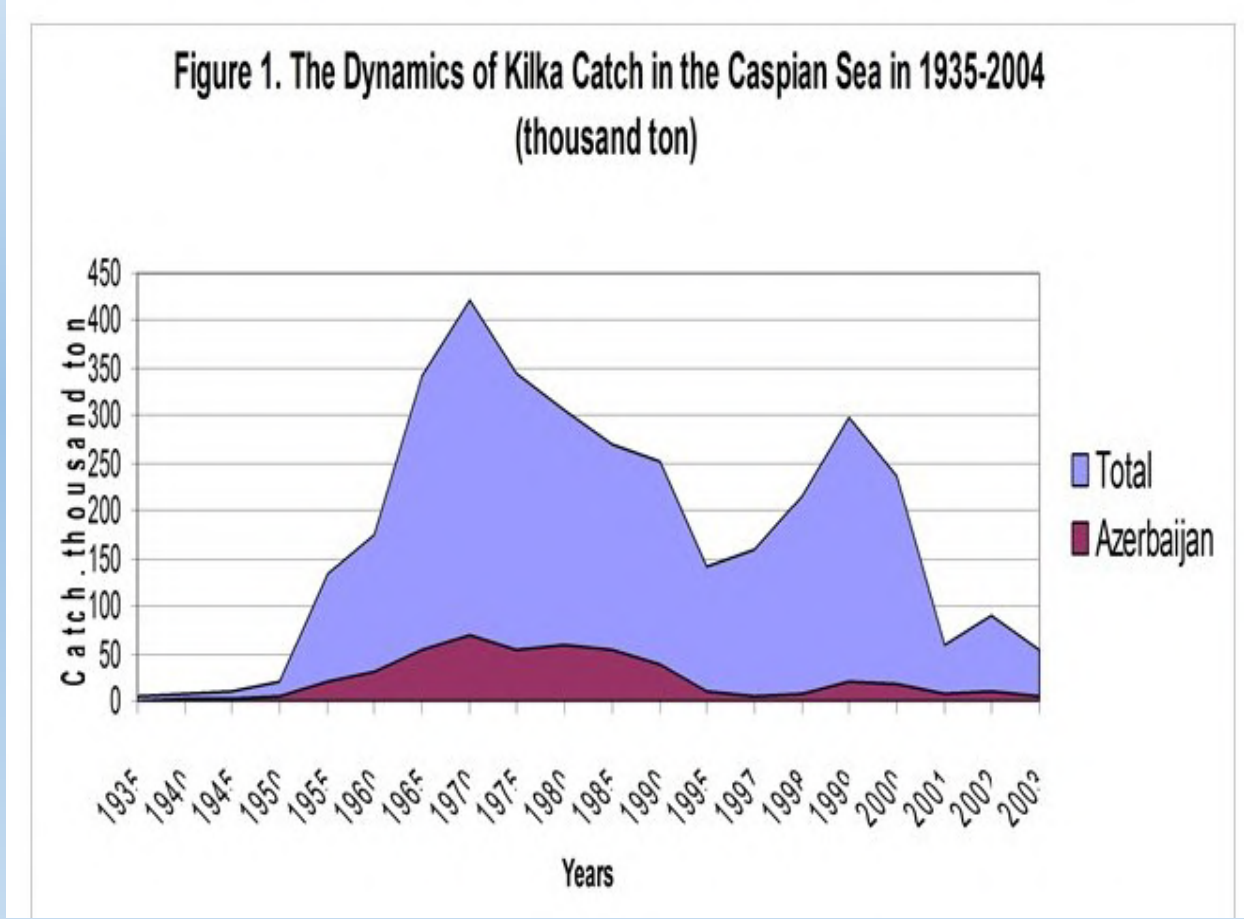
The long-term dynamics of sturgeon catches in the Caspian Sea and Azerbaijan (thousands tons)



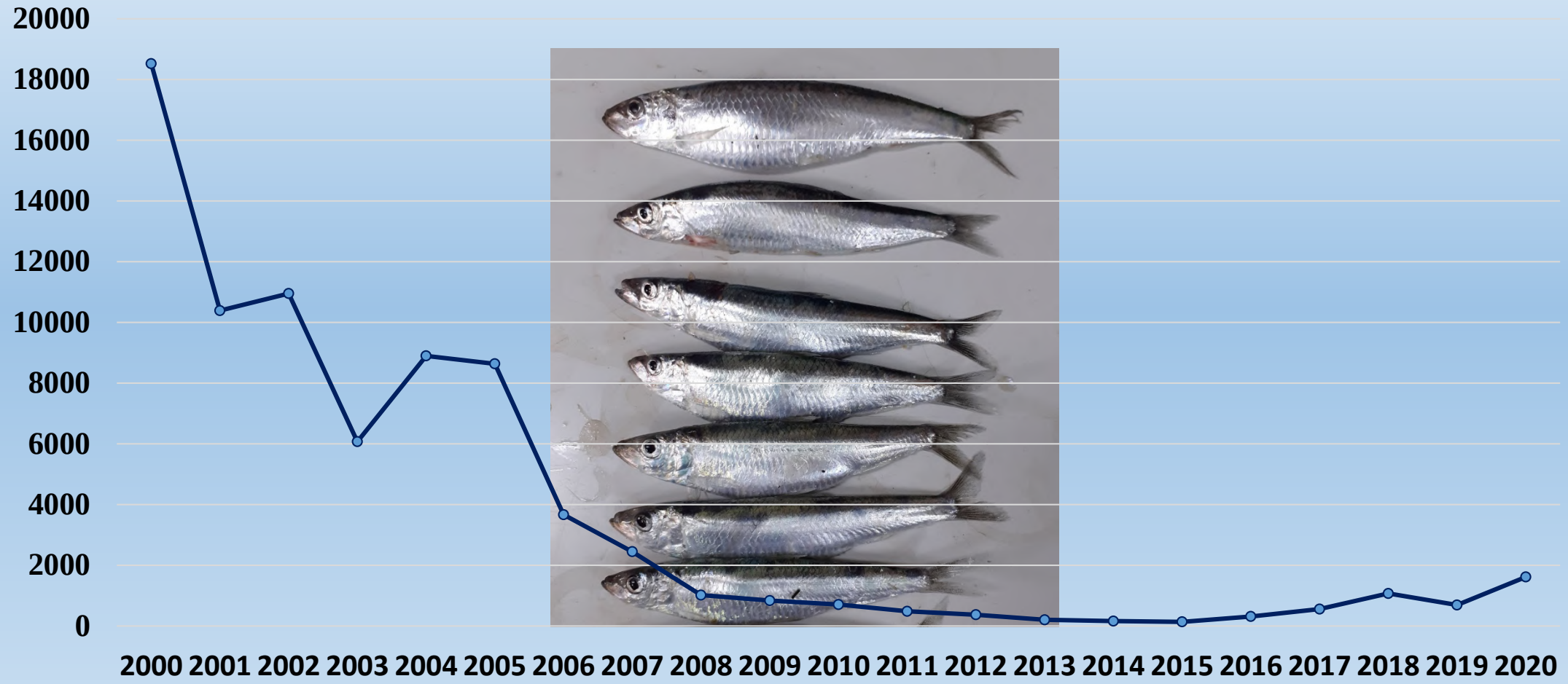
Dynamics of sturgeon catches in the Caspian (1932-2008)



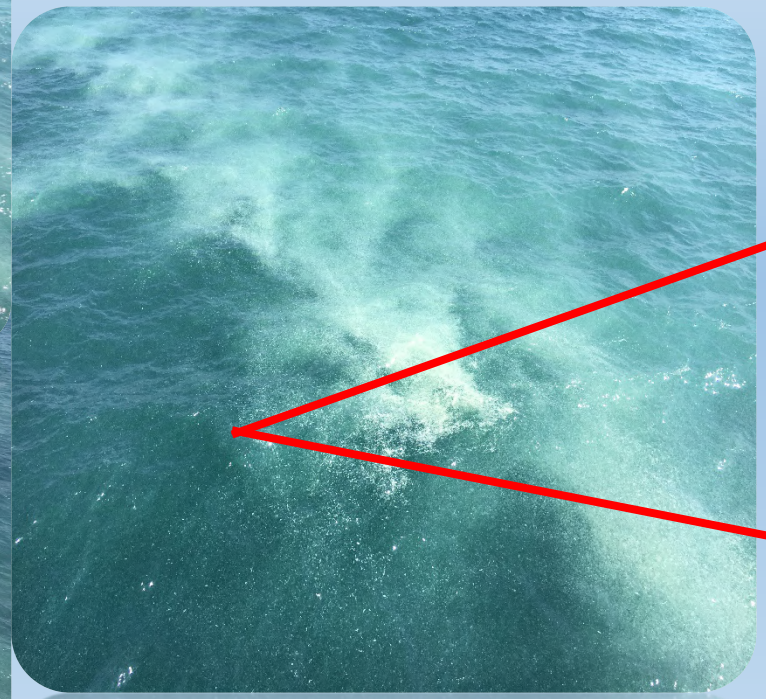
The dynamics of kilka catches in the Caspian Sea and Azerbaijan in the period 1935-2004

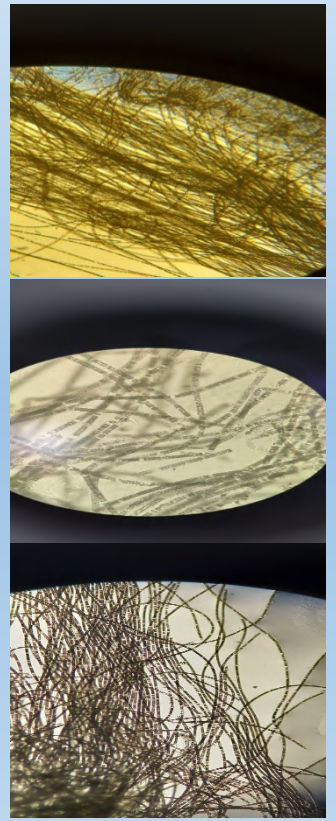


Dynamics of kilka catches in Azerbaijan (tons) in 2000-2020



2021-ci il iyul ayında Cənubi Xəzərdə Lənkəran-Cənubi Şərq Kultuk sahilində (50-100 m dərinliklərdə) suyun yüksək temperatur şəraitində (29-30oC) müşahidə olunan yosunların anomal çiçəklənməsi





Nodularia. Photo Elnara Djafarova

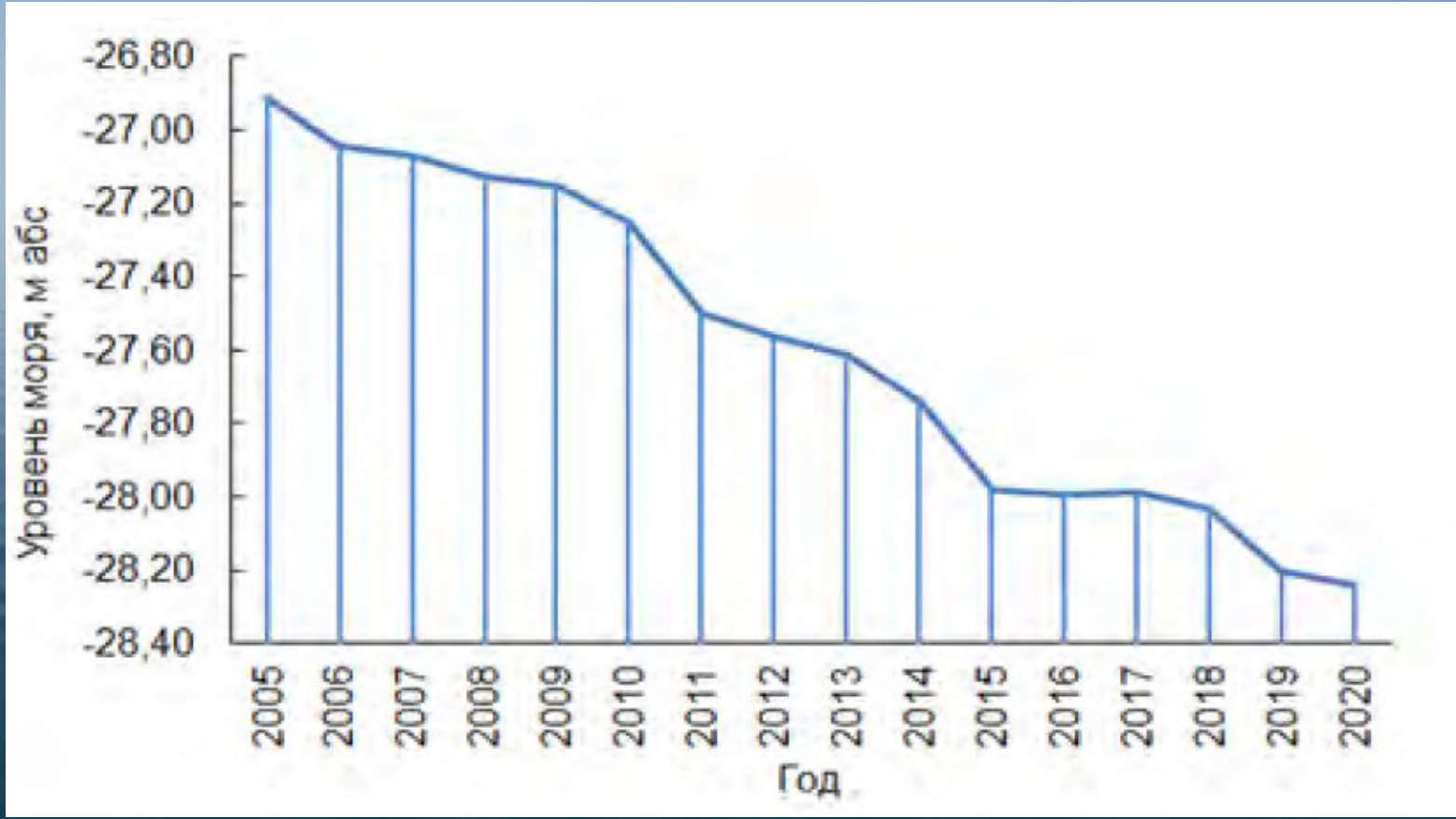
Algae bloom off the coast of Azerbaijan

For the first time *Beroe ovata* which is a natural predator of *Mnemiosis leidyi* is found in the Caspian Sea in 2021

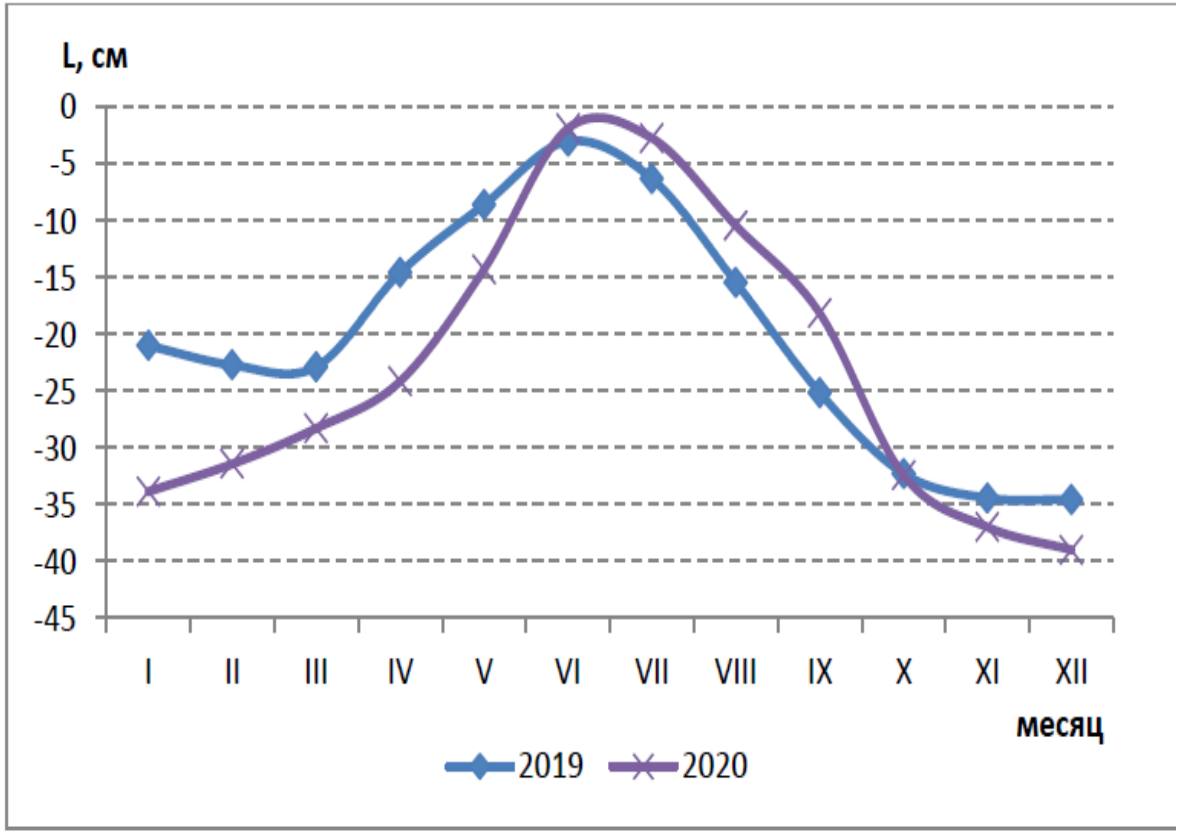
Beroe ovata

Caspian Sea level drop (2005-2020)

In the last decade, the background level of the Caspian Sea has a steady downward trend. The sea level drop for **the period from 2005 to 2020 was about 1,5 m.**



Сезонный ход уровня Каспийского моря в 2020 г. в сравнении с 2019 г. (КАСПКОМ, 2021)



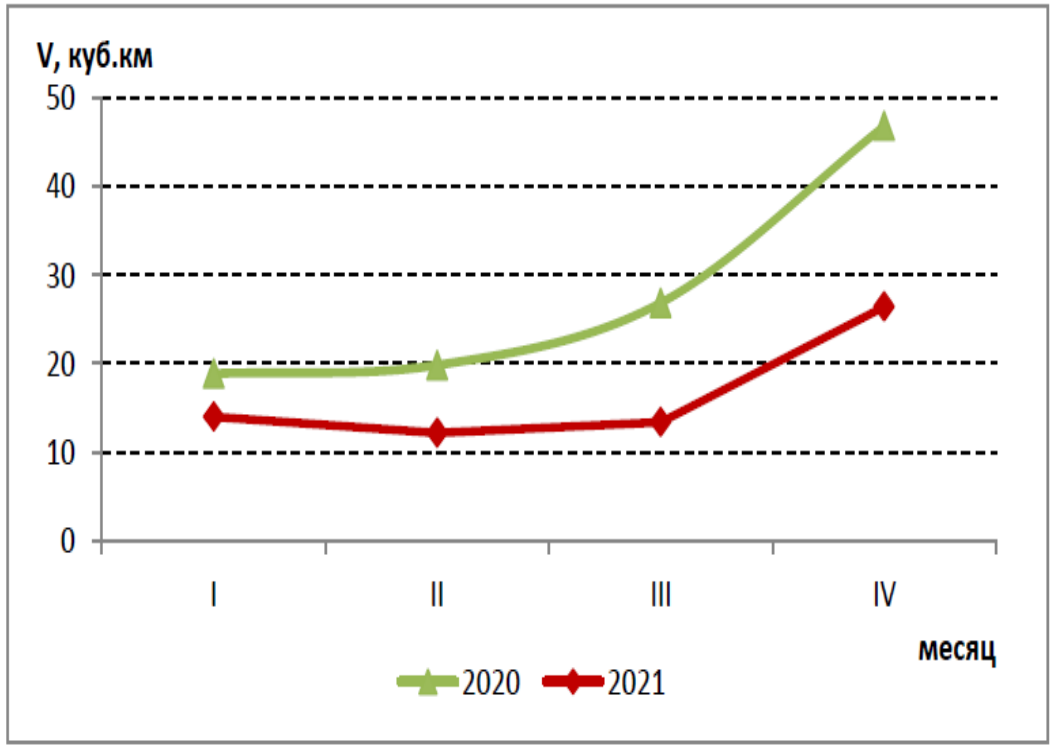
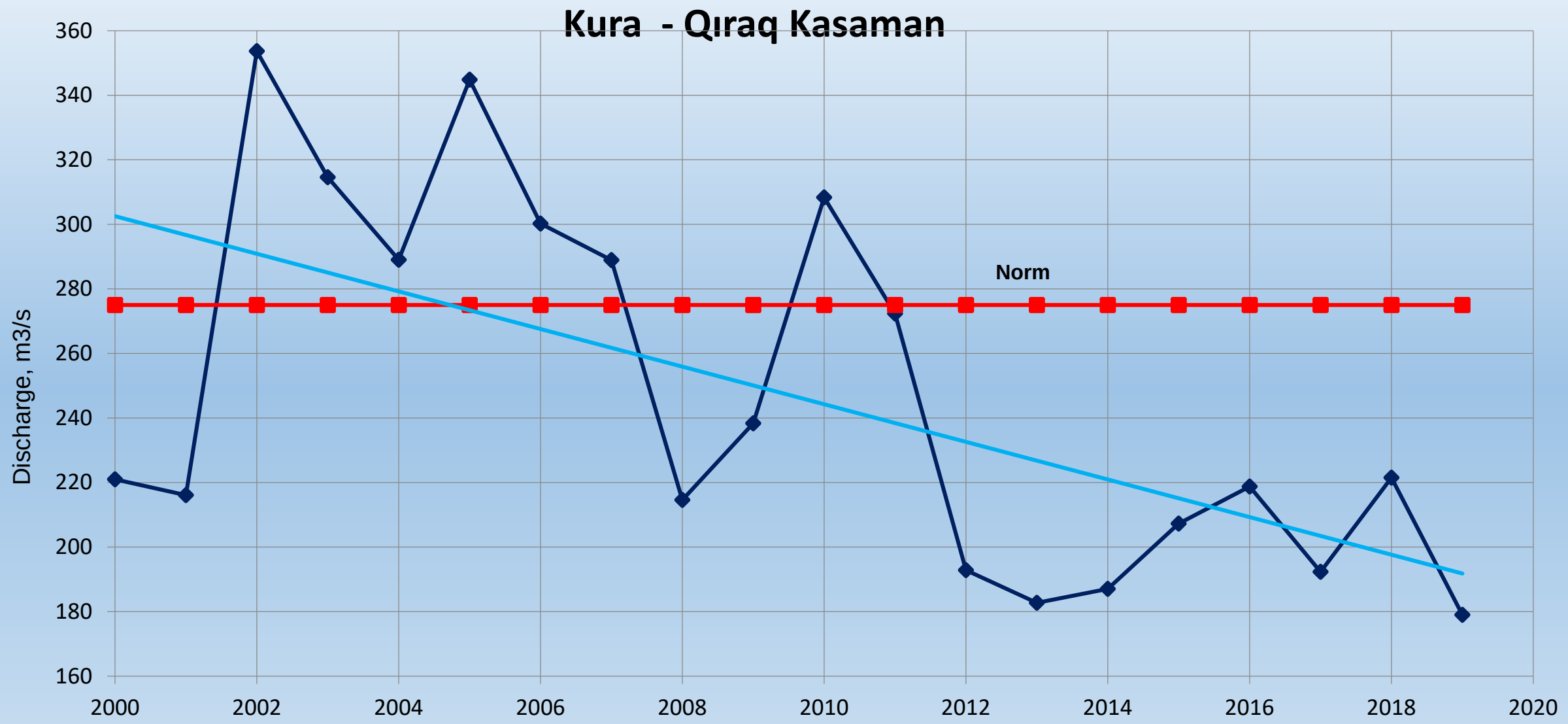


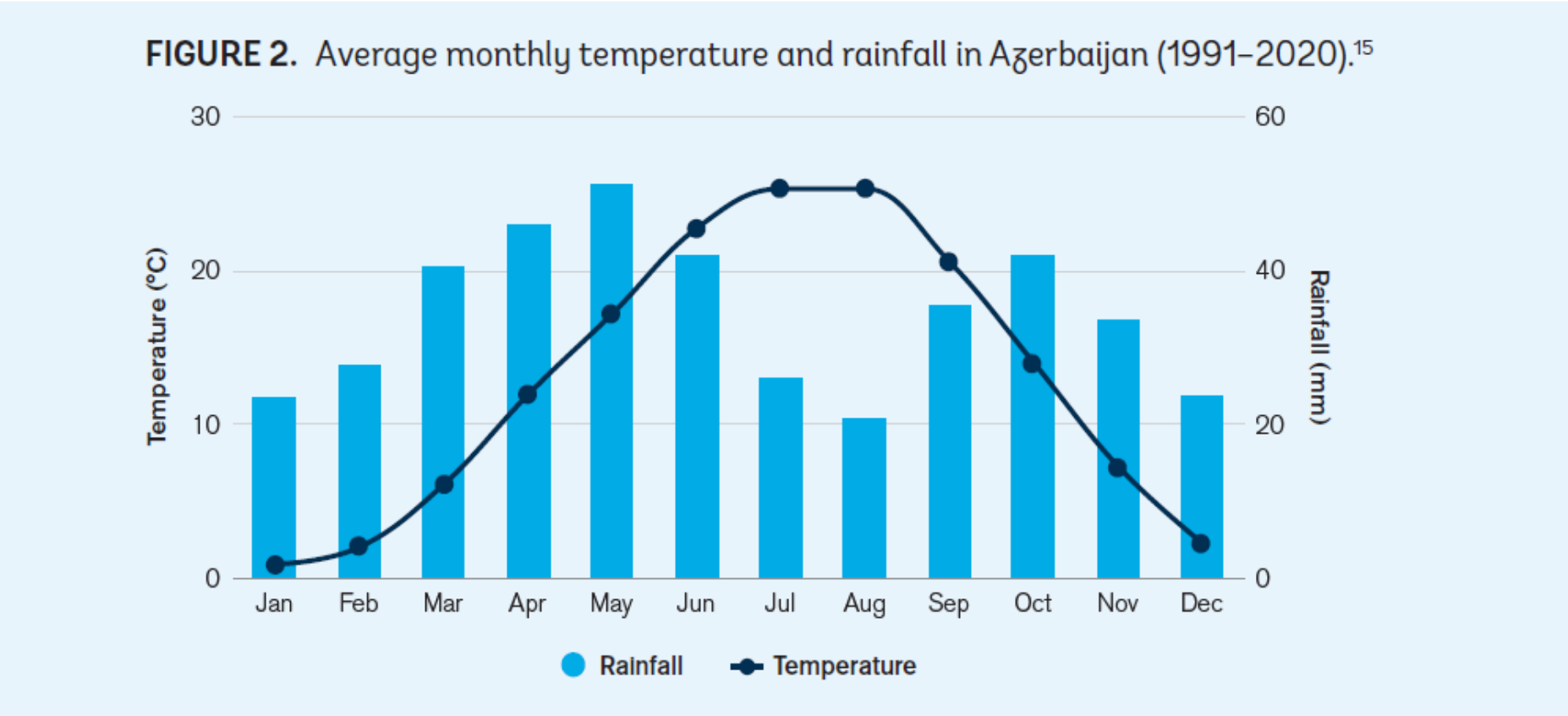
Рис. 3 Сток Волги в начале 2021 г. в сравнении с 2020 г.

Согласно прогнозу, ожидается, что в связи с прогнозируемой низкой водностью р. Волги в 2021 г. средний годовой уровень Каспийского моря будет на 12-17 см ниже, чем в предыдущем.

The mean annual discharge of the Kura River in 2000-2020

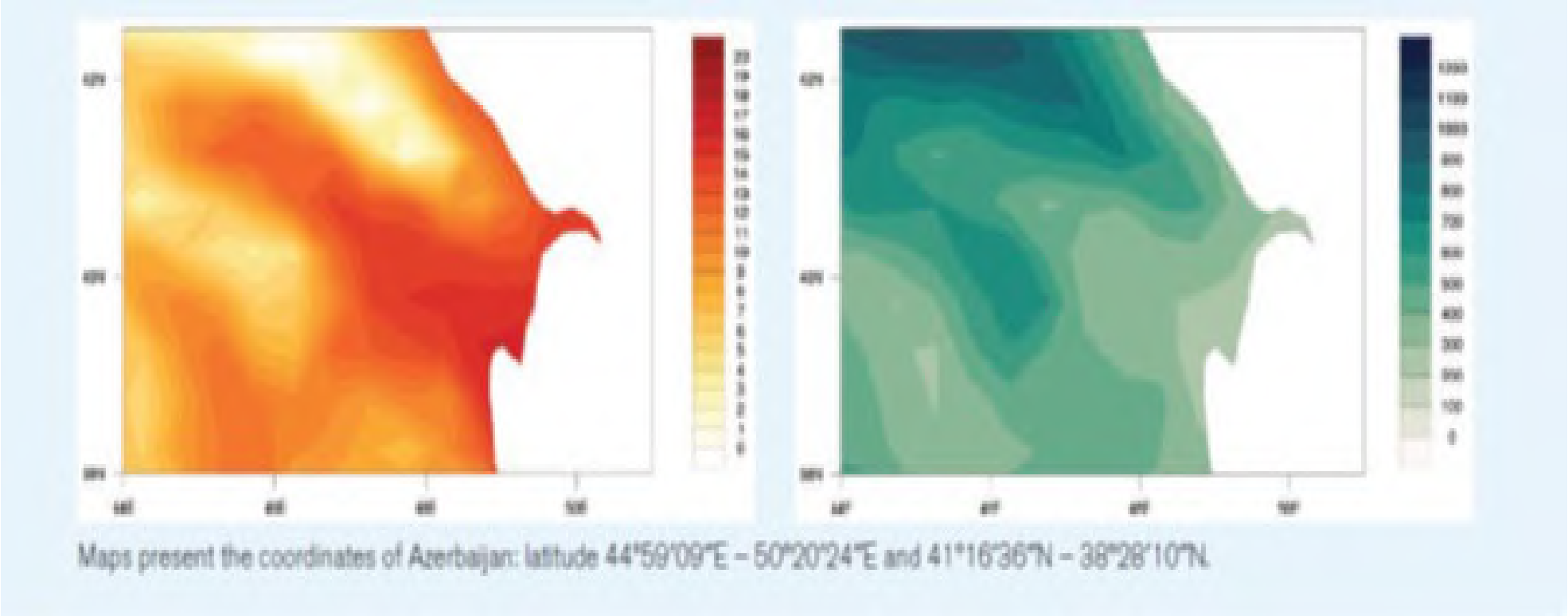


In 1991-2020 the average monthly temperature in Azerbaijan



The change in climate is expected to stress water resources. Surface water is predicted to decrease by 23% up to 2050, and water resources are predicted to decrease by 29% from the baseline year level till 2100.

Annual mean temperature(Co)(left) and annual rainfall (mm) (right) in Azerbaijan in 1990-2020



- **According to UNDP (2015) an increase in temperatures across the country of 1.3°C in 2010, relative to the average annual temperatures observed in the period 1961–1990.**

In 2020-2021 years the intrusion of saline water of the Caspian Sea in the upper parts of the Kura River Delta in Azerbaijan for about 60 km distance up to the Salyan city

Conclusions

- During the last decade (2011-2021) stocks of commercial fish species near the Azerbaijan coast of the Caspian Sea have been catastrophically reduced due to both natural (climatic) and anthropogenic factors.
- The unfavorable climatic and hydrological conditions of the Caspian Sea resulted in the redistribution of fish populations from the Southern to the Central Caspian.
- The impact of climatic changes was also reflected in the species composition, abundance and distribution of zooplankton in the Southern and Middle Caspian.
- Significant changes in the structure of planktonic and benthic communities occurred in the Caspian ecosystem under the influence of an invasive species ***Mnemiosis leidyi***.
- There is a sharp decrease in the number and the species composition of zooplankton.
- For the first time in the Caspian Sea a new invasive species ***Beroe ovata*** - a natural enemy of Mnemiopsis was found.
- Under the influence of high temperatures (29-30oC) of surface waters an abnormal algae bloom (cyanobacteria) was observed in the Southern Caspian along the Lenkoran coast at depths of 75-100 m.

THANK YOU!

Diqqətinizə görə təşəkkür edirik!