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DISTRIBUTION OF CRAYFISH (CRUSTACEA) IN THE ZARAFSHAN RIVER BASIN AND THEIR SUITABILITY FOR AQUACULTURE

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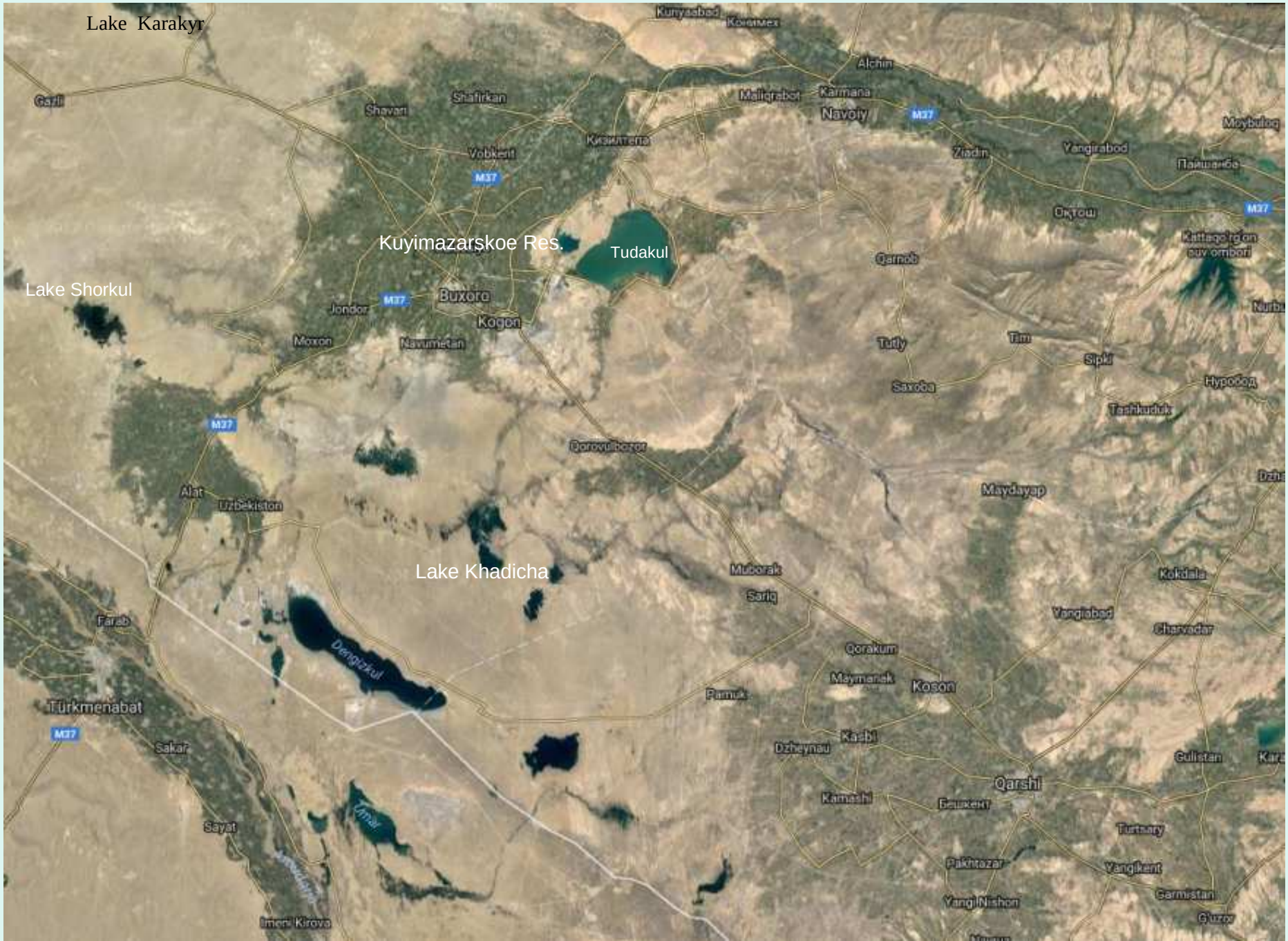
- The Zerafshan River is about 877 km long and starts in Tajikistan. Two third of its length is in Uzbekistan .
- It seeps away 20 km before it reaches the Amu Darya. The transported water quantity is about 5.5 cubic km.
- Due to high demand in Uzbekistan for agricultural purposes the salinity of the water rises steadily until up to 2.7 g/L.
- Many mines and industries pollute the river and most of its sediments with heavy metals.

According to fish production statistics, during the years 2011-2014 estimated 2.5-6.7 thousand tons of food fish were produced both from capture fishery and aquaculture in the lower Zarafshan valley.

Region	Year			
	2011	2012	2013	2014
Navoi	1434	1664	3109	3771
Samarkand	513	594	1124	1384
Bukhara	569	870	1321	1571
Total	2516	3128	5554	6726

- The highest annual catch of fish was obtained from Tudakul reservoir. This water body has now relative lower salinities and stable water level for they receive now water from Amu Darya by means of the Amu-Buchara canal.
- The lower salinity and stable water level now are the reason for the higher yield.

The most saline reservoirs are: Karakyr (12 thousand ha), Tuzgan (5.7 thousand ha) and Shurgak (1.6 thousand ha). These reservoirs fed mainly by collector water are of little value for fish industry, since the salt content is usually 3–7 g/L, which is too high for the offspring of almost exclusively bred carp.



Crayfish and Shrimps an alternative to fish?

- Aquaculture of fishes is already widespread in Uzbekistan.
- But especially the rising salinity of the water mainly in the collector lakes prohibits the rising of fishes.
- An alternative for diversification and improvement of aquaculture is the rearing of crayfish and shrimps
- They can stand a higher salinity of the water, use mainly vegetarian food and are already captured in several reservoirs and lakes in the Zarafshan area.
- The higher salinity stimulates the fertilisation of eggs and the rise of juveniles probably by facilitating the process of moulting in such an environment.

- The development of agriculture, including aquaculture and capture fisheries in arid lands in Central Asia, has one very common problem, namely – deficit of clean freshwater.
- At the same time there are huge volumes of mineralized water resources of agricultural origin which are classified by many people as useless waste because of expected low quality.
- But there are a wealth of big water bodies which could be used as basis for aquaculture or natural replenishment of aquatic animals and plants.

Water bodies (lakes) of the Zarafshan River Basin

Water body	Water surface area, ha	Depth, m		Transparency, cm (Secchi disk)
		average	max.	
Ayakagitma	7900	8–10	40	≤300
Dengizkul	35500	8–10	30	≤220
Karakyr	26200	1.5–2	5	≤300
Tugkan	14200	1–2	8	≤270
Khadicha	12300	2–3	6–8	≤200
Shorkul reservoir	5000	3–4	10–15	≤ 180
Todakul	22700	5–7	17	≤180
Western Aydarkul	151000	12.5	33.6	≤500

Water quality of the (lakes) of the Zarafshan River Basin

Water body	Salinity, g/L	pH	Dissolved oxygen, mg/L	Chemical oxygen demand, mgO/L
Ayakagitma	7.31–9.23	7.0–8.6	6.2–7.6	48.7
Dengizkul	17.0–20.58	8.2–8.8	5.0–6.8	15.5
Karakyr	10.69	8.0	3.6–5.8	41.5
Tugkan	2.66–4.30	7.9–8.2	5.8–6.2	24.4
Khadicha	4.15–22.00	8.1–8.6	2.0–8.6	43.5
Shorkul reservoir	1.70	7.6–7.8	5.2–8.8	23.9
Todakul	1.5–4.0			
Western Aydarkul	8.10–10.30	6.60–8.13		21.4–56.1

- Although our knowledge of the crustacean fauna in Uzbekistan is very fragmentary we know that these larger shrimps and crayfishes are so far living in Uzbekistan and Kazakhstan:
  Macrobrachium nipponense De Haan, 1849,
  Caspiastacus pachypus (Rathke, 1937),
  Pontastacus leptodactylus leptodactylus (Eschscholtz, 1834),
  Pontastacus leptodactylus boreoorientalus (Birstein and Winogradov, 1934),
  Pontastacus kessleri (Schimkewitsch, 1884).
- *Pontastacus eichwaldi eichwaldi* (Bott, 1950) was accidentally introduced and is already partly used commercially.
- In the Shorkul water reservoir e.g. *Pontastacus kessleri* and *Macrobrachium nipponense* are caught and marketed in some years.
- We propose to start to culture some of these animals to improve the food situation in the Zarafshan River Basin.
- The technology and culture systems of Crustaceans are already an integral part of the agricultural value chain in many other countries.

Shrimp and Crayfish species (Crustacea) suitable for aquaculture in Zarafshan River Basin

The freshwater shrimp (oriental river prawn) *Macrobrachium nipponense* De Haan, 1849 is a possible aspirant for aquaculture

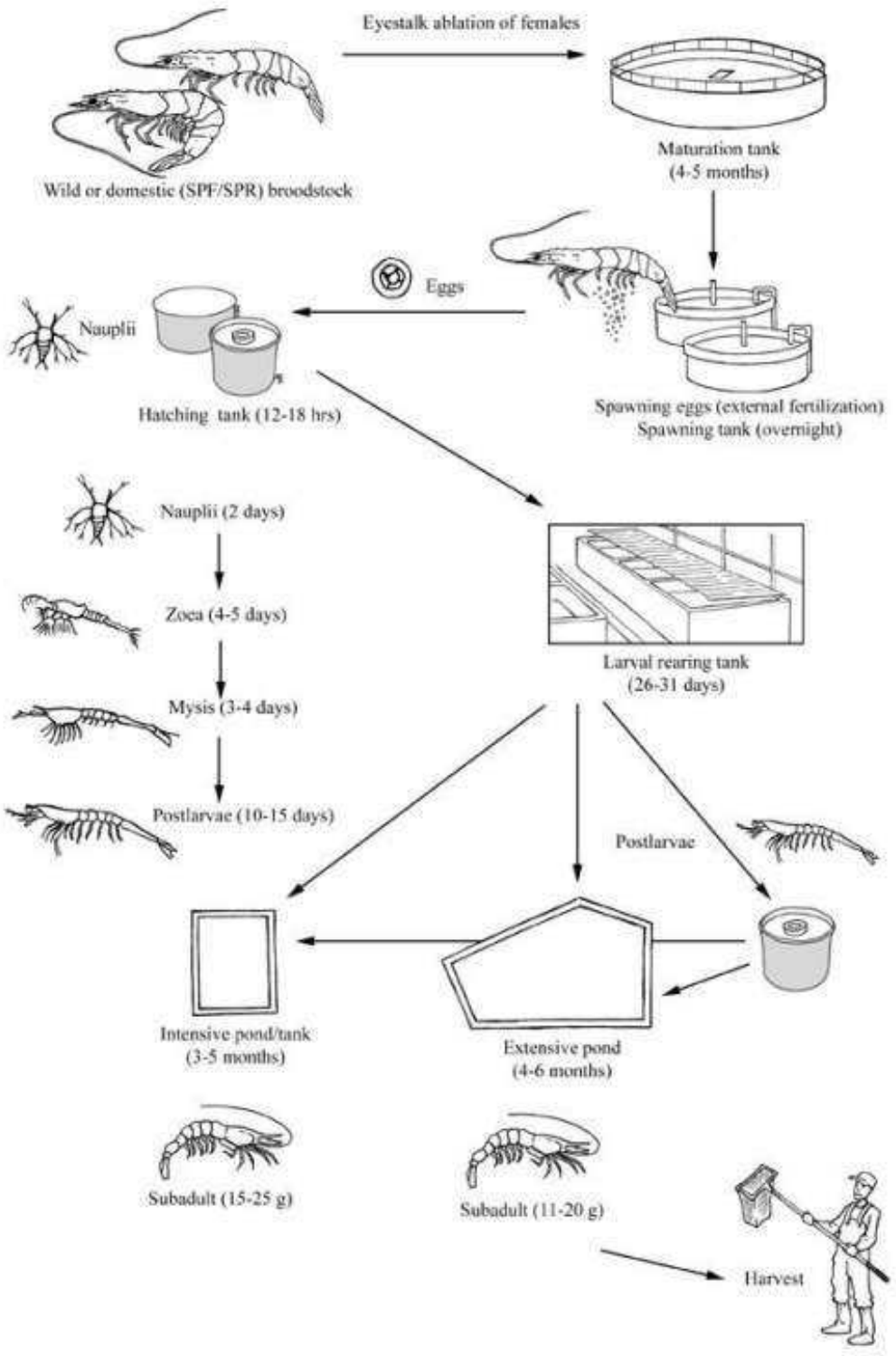
Already successfully cultured in many neighbouring countries (Turkey, Iran, Armenia), is the Galician crayfish *Astacus leptodactylus* Eschscholtz, 1823. This can tolerate up to 14 g/L salt content.

- Pacific white shrimp *Penaeus vannamei* Boone, 1931 is among the most widely cultivated shrimp in the world.
- This species is found in waters with a wide salinity range (1 to 40 g/L). The high tolerance of *Penaeus vannamei* to low salinity and the year-round availability of healthy post-larvae (PL) make this species an excellent candidate for inland farming.

Intensive culture of Pacific white shrimp in aerated freshwater pond in Thailand

Main producer countries of *Penaeus vannamei*

(FAO Fishery Statistics, 2006)



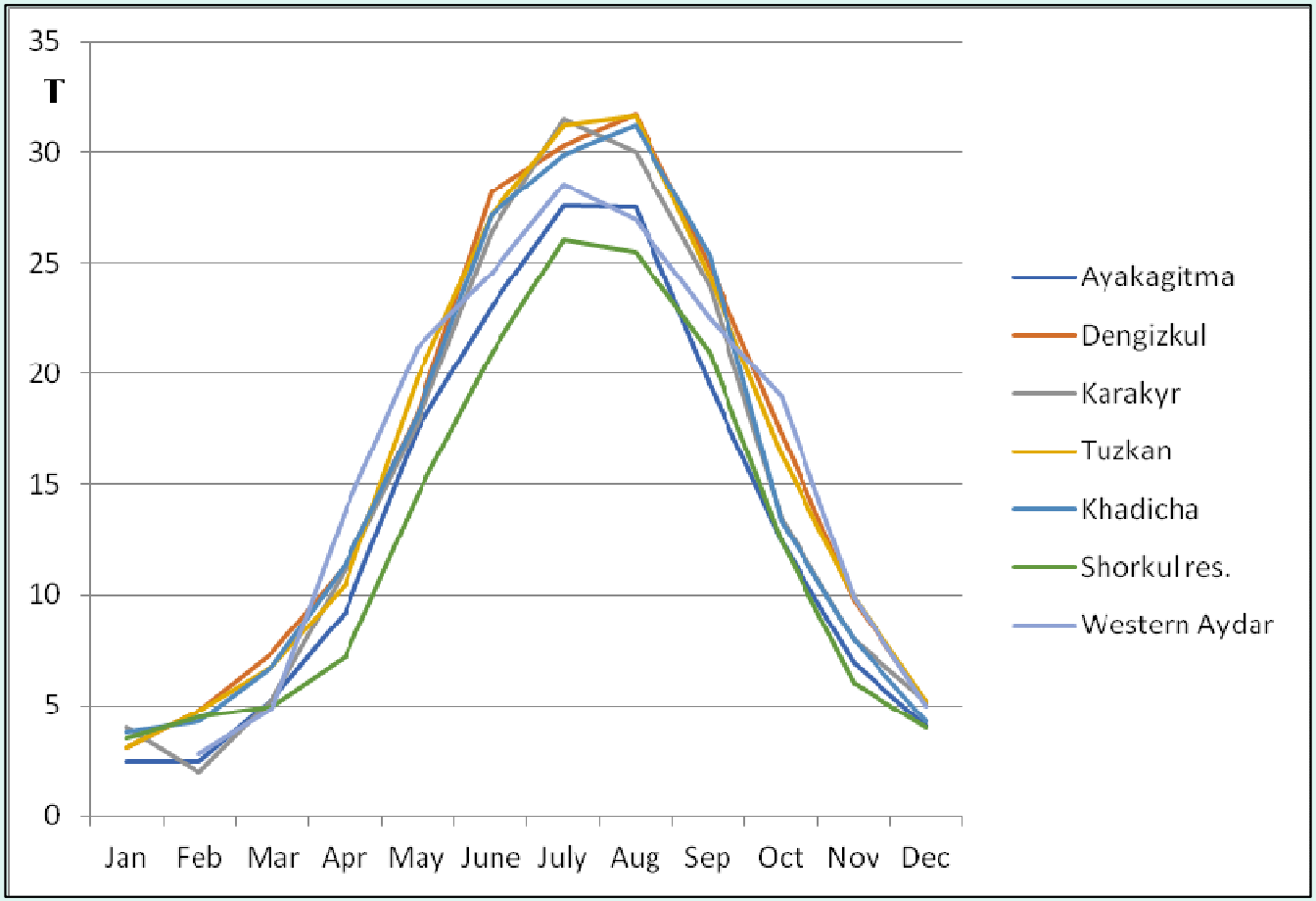
Production cycle of *Penaeus vannamei*

(http://www.fao.org/fishery/topic/16180/en)

- In extensive ponds (5–10 ha) range from 150–500 kg/ha/crop, with 1–2 crops per year.
- In semi-intensive ponds (1–5 ha) range from 0.5–2 thousand kg/ha/crop, with 2 crops per year.
- Intensive ponds are generally small (0.1–1.0 ha) and square or round. Water depth is usually >1.5 m.
- Heavy aeration is necessary for water circulation and oxygenation.
- Production yields of 7–20 thousand kg/ha/crop, with 2–3 crops per year can be achieved, up to a maximum of 30–35 thousand kg/ha/crop.

- In shrimp farms situated on Sonora Desert, Mexico pacific white shrimp is cultivated by direct using pumped seawater (salinity 35 g/L) from the Gulf of California.
- The shrimp grew from 1.2 g to about 20 g. Harvesting begins after 120 days. Quality of pond-raised shrimp is normally high.

Water temperature profile of main fishery water bodies of Zarafshan river Basin



- Analyses of hydrophysical and hydrochemical indicators of water bodies in Zarafshan River Basin have revealed the suitability of salinity, pH, water temperature, etc. for the culture of Crayfish.
- Regarding suitable water temperatures for crayfish culture, the period of the year with temperatures higher than 10°C can be accepted as active culture period, i.e. from early April to late October – 7 months.

Such fish ponds build in Uzbekistan are fully suitable for the development of shrimp culture

Besides fresh and brackish lakes and reservoirs, also saline and hypersaline lakes and reservoirs are available in Zarafshan River Basin. In these hypersaline water bodies it is possible to raise brine shrimp *Artemia parthenogenetica* and other species of *Artemia*.

This crustacean could be used for practical purposes. The body of these adult organisms could be used for feeding of various aquatic animals. It is also possible to store bodies of brine shrimps frozen.

Nauplii of brine shrimp are also an excellent food for small or young aquatic animals. In the connection of this the harvesting and storage of *Artemia* resting eggs/cysts is a profitable business around the Globe.

Floating cysts of *Artemia*

- Beside this proposal the biodiversity of Crustacea in Uzbekistan is still widely unknown. There are only isolated findings that have been mentioned in the literature.
- A comprehensive study of the distribution and diversity of the various species that are suitable for aquaculture is overdue. Also in view of problems of imported species for economic purposes. The effects of such alien species on the native animal world cannot be estimated if reliable data on the local fauna are not available.
- Moreover, it is much more effective when native animals are used for aquaculture, since they have already adapted to the prevailing environmental conditions.
- To anchor these questions and work in the scientific landscape of the participating institutions is a significant step forward in a sustainable development of the country.

Way forward

- Freshwater prawns are suitable candidates for inclusion in polyculture systems and in integrated aquaculture-agriculture. By occupying bottom niche of fish ponds they generate additional aquatic food products in fish farming.
- In order to introduce large-scale commercial aquaculture practices of Crustaceans in Zarafshan River Basin following measures are needed to realize taking into account world's leading experience:
  - Work out the biodiversity of the Crustacea to record crayfish populations in the country.
  - Establishment of a database for the distribution and composition of Crustacean fauna in the Zarafshan river Basin and in whole of Uzbekistan.
  - Construction of an aquaculture plant for *Pontastacus leptodactylus leptodactylus* on the selected large drainage canal or lake fed by collector water.
  - System analysis of the potential risk for the biological systems and the possible breeding of other species of crayfish.
  - Biodiversity research and investigations on different types of water bodies.
  - Impact of pollution of the environment, biodiversity, etc.
  - Establish a relevant information system on biodiversity.


Thank you for your attention