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Study of factors influencing the distribution and quality of non_finfish aquatic in Shamkir and Mingechaur reservoirs of Azerbaijan

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Abstract
There is information about the quantitative distribution of Palaemon elegans shrimp at different stages of ontogenesis in Shamkir and Mingecheaur reservoirs. There is a General high density of shrimp in the Mingechaur reservoir, compared with Shamkir, which is explained by the large eutrophication of water. The data on the daily dynamics of the distribution of different stages of shrimp in the surface water layers of both reservoirs are presented.

Keywords: palaemon elegans, ontogenesis, shrimp, eutrophication, crustaceans, marine plankton

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INTRODUCTION

It is known that the order Decapoda (Decapoda) are the most organized representatives of the class of crustaceans. Unlike other crustaceans, many Decapoda have direct nutritional value to humans, as many of their species are directly used for food as a delicacy in many countries around the world. In addition, almost all crustaceans have a huge role in creating a food base of marine and fresh water, eating smaller hydrobionts and, in turn, being food for many fish. Thus, representatives of crustaceans, including Decapoda, take an active part in the transformation of organic matter in marine and fresh waters.

It should be noted that the presence of shrimp Palaemon elegans in the fresh waters of the Shamkir and Mingechaur reservoirs was noted only in the most recent years. Currently, this species, introduced into these reservoirs, is widely distributed throughout the territory and takes an active part in the food chains of reservoirs.

In this regard, the study of factors affecting the distribution and quality of shrimp living in the Shamkir and Mingechaur reservoirs of Azerbaijan.

Analysis of Literature Data and Problem Statement

The aquatic environment is a Kingdom of crustaceans, but some of them have adapted to life on land. Many crustaceans are extremely numerous. Marine plankton at all latitudes and at all depths mainly (at least 90% by weight) consists of crustaceans. It should be noted that bottom crustaceans are also often found in mass numbers.

Crustaceans play a very important role in natural biological processes. Organic matter in water bodies is created mainly due to the activity of microscopic algae. Crustaceans eat these algae and, in turn, serve as food for fish. Crustaceans act as intermediaries that make the organic matter created by autotrophs in water bodies available to fish, i.e. they participate in the transformation of organic matter in aquatic ecosystems.

It should be noted that the study of shrimp is actively carried out by experts from different countries and continents. Most of the research is faunal and taxonomic (Andreev 2001). For example, Chinese experts have recently been described for the first time for science three species of shrimp found in the waters of cave reservoirs (Liang et al. 2005). An interesting fact is the discovery and description by Dutch scientists of a new genus and a new species of shrimp living in the inner cavity of sponges.

A new species of shrimp from the red sea was relatively recently described by Austrian specialists (Dworschak 2002). Described from the Gulf of Aqaba, Calianassa aqabaensis differs from other taxa in the shape of a rostrum, the different size and armament of the chelipeds.

Two more new species of shrimp have been described from the waters of East Asia (Kim Jand

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Hayashi 2000). One is P. gemmaceus and the other is P. candidus.

Many specialists from other countries are actively engaged in shrimp taxonomy (Sakai 1999), including the use of molecular biology methods.

Australian experts studied the molecular taxonomy and phylogeny of some species of Australian shrimp, members of the family Palaemonidae (Murphy and Austin 2003). The authors emphasize that the modern classification of the family Palaemonidae is based mainly on morphological features. They found that three species previously assigned to three different genera (Macrobrachium intermedium, Palaemon serenus and Palaemonetes australis) must belong to the same genus. It is established that the systematics of the family Palaemonidae based on morphological features does not correspond to the system constructed using the methods of molecular biology on the example of the Australian fauna.

English experts conducted a very interesting study of the vision of shrimp living at different depths and, therefore, at different light levels (Gaten et al. 2003). They first described the ultrastructure of the distal rhabdome in 5 species of shrimp living at different depths using electron microscopy. It was found that the size and structure of the rhabdom are associated with light conditions in the habitat.

Russian specialists are also studying the taxonomy and ecology of shrimp in different groups. A great contribution to the clarification of the systematics of shrimp genus Nematocarcinus is made in (Burukovsky 2000). A comprehensive study of the early ontogenesis of the giant freshwater shrimp Macrobrachium rosenbergii has not been conducted until our time. In (Ovsyannikova 2004) the histo - and organogenesis of the giant freshwater shrimp from the hatching stage to the adult stage was first described. The author analyzes the comparative dynamics of the development of normally developing larvae of giant freshwater shrimp and larvae with developmental abnormalities. The key stages in the development of the internal organs of the giant shrimp, where the main organ-genetic transformations take place, are revealed. For the first time, these authors noted the presence of glandular cells in the gills of adult shrimp.

In (Bukin 2003) long-term data on distribution and biological cycle of Northern shrimp are generalized, morphometric study is carried out, age structure of populations is revealed, coefficients of natural and General mortality are defined, individual and population fertility is considered. Established significant phenotypic differences between populations, determined the timing of spawning and release of larvae, the size and age of Mature females. The author calculated the volume of allowable catch in the waters of Sakhalin and proposed some measures to regulate the fishery.

Experts from different countries study some aspects of shrimp ecology (Makarov 1968). For example, the salinity stability of shrimp and its relationship with the survival of post-larvae and juveniles in estuaries of rivers was studied (Saoud and Davis 2003). The author in experimental conditions showed that the rapid transfer of postlichinok from water with a salinity of 25 in salinity 2, 4, 8, significantly reduced survival. The growth of juveniles at 8 and 12 was higher than in water with less salinity.

Similar studies of the combined effect of temperature and salinity on the larval development of estuarine shrimp have shown that the optimal salinity for this species is close to the sea (30-35℃) and temperature 25℃ (Paula et al. 2001).

The question of the possibility of the influence of water salinity on the reproduction of shrimp Crangon. Crangon has been studied by French experts (Gelin et al. 2001). Interestingly, this study was triggered by major flooding in the Rhone river basin and subsequent years of desalination of coastal lagoons and estuaries. The salinity of the water during this period fell from 15 to 5, which led to a serious change in the composition of the fauna of the coastal areas. The authors found that the salinity of 5℃ prevents the reproduction of shrimp.

The resistance of shrimp to hypoxia and their avoidance of hypoctic conditions was studied by Chinese experts (Wu et al. 2002). They found in experimental conditions that the heart rate of juvenile shrimp falls strongly at oxygen concentrations below 1 mg / l and that juveniles actively avoid hypoxic conditions, moving to more oxygen-rich waters.

The influence of temperature and salinity on the growth and survival of Penaeus shrimp larvae has been studied by Australian scientists (Jackson and Burford 2003). They found that at 28℃ salinity growth and survival are reduced, and even greater salinity does not have a significant impact on these processes.

Very interesting research on the consumption of oxygen shrimp were performed by Chinese experts (Jiang et al. 2003). They found that the maximum oxygen consumption was observed at 12 o'clock in the afternoon, and the minimum-at two o'clock in the morning. In addition, it was found that different types of shrimp consume different amounts of oxygen.

The effect of shrimp on bottom sediments in Brazilian rivers was studied by experts from the University of Rio de Janeiro (De Souza and Moulton 2005), who found that in areas without shrimp, the decontaminated dry mass of sediments was 4 times higher. A strong direct and indirect influence of shrimp on the composition of benthos as a result of food consumption has been established.

Unfortunately, in Azerbaijan, the special study of shrimp before until now, due attention has not been paid. Although the settlement of fresh waters of our Republic by shrimp was noted only in the most recent years, now shrimp firmly occupied its ecological niche in the Shamkir and Mingechaur reservoirs, which served as the main argument for our choice of this object of research.

Purpose and objectives of the study. The aim of the work is to study the distribution of shrimp at different stages of ontogenesis in Shamkir and Mingechaur reservoirs of Azerbaijan.

To achieve the goal, the following tasks were set:

- to study the distribution and density of P. elegans shrimp in the Shamkir and Mingechaur reservoirs.
- determine similar patterns of distribution of P. elegans shrimp in winter and summer.
- to analyze the incubation period of shrimp larvae In Shamkir and Mingechaur reservoirs.

MATERIAL AND TECHNIQUE

The collection of material was carried out seasonally in the period 2004-2007 from various parts of the coastal zone of Shamkir and Mingechaur reservoirs.

Shamkir reservoir also refers to large reservoirs created relatively recently. It was established in 1982 on the Kure river, above the Mingechaur reservoir. In terms of water volume, the Shamkir reservoir ranks second after the Mingechaur reservoir.

Shamkir reservoir is fed by the waters of the rivers Kur and Sayama. The reservoir area of 11.6 hectares, the volume of 2.67 km3, the length of the reservoir 36 km, width – 2.6 km, average depth 23 m and a maximum depth of 70 m. the Annual exchange of water – 2.5 times. The water temperature of the reservoir in winter is 6-8℃, in spring 9-17℃, in summer 24-26℃, in autumn 9-17℃ the Oxygen regime is at the level of 95-100% to the saturation norm.

Mingechaur dam is located between the bozdag ranges, which extends to the village of Khanabad.

The area of the Mingechaur reservoir is 625 km2 with a width of 6-25 km, the length of the reservoir is 75 km, the volume is 16 km2, the depth is 75 m, the length of the coastline is 259.5 km.

The temperature of the coastal waters of the reservoir in winter +60℃ (February), spring + 16℃ (May), summer +28℃ (August), autumn +19, 5℃ (October). Water transparency is 4.5 m in spring and 9.0 m in summer. the pH of the water is 7.1 to 7.5. Saturation of water with oxygen ranged from 51-99%.

When selecting collection points, we tried to ensure that they cover all available biotopes in reservoirs and differ in depth, substrate nature, gas regime, etc. in Total, more than 650 samples were collected and processed during the period of our research.

Caught shrimp in an amount of at least 20 specimens were weighed and measured. Before weighing, everyone was quickly dried on a sheet of filter paper.

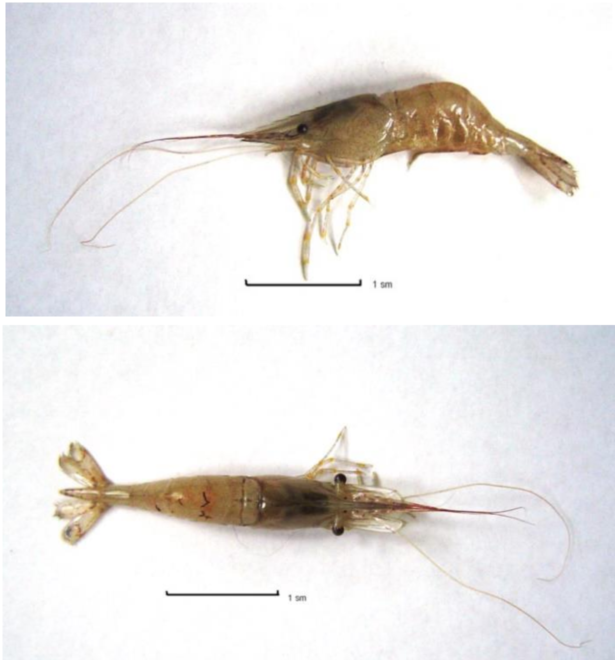

Fig. 1. General view (a – side view; b – top) the shrimp Palaemon elegans (enlarged; size-2.7 cm).

Then the analysis of the caught shrimps was carried out-the sex was determined to take into account the sexual structure of the population, the size and total number of eggs were taken into account in females during the breeding season. Measurements of linear sizes of each individual and their weighing, accounting of body weight were carried out. In the case of larval stages, dimensions were measured under binoculars using an eyepiece micrometer.(Eidelman et al. 2019)

For quantitative accounting of shrimps for various biotopes of Shamkir and Mingechaur reservoirs, the average of several collections was taken into account, followed by recalculation per 1 m2.

Zhadin's monograph (Dworschak 2002) and other publications were used as a determinant.

RESULTS

In the conditions of fresh waters of Azerbaijan, the shrimp Palaemon elegans usually lives in thickets of aquatic plants, where it keeps large clusters. To distinguish animals by sex is possible when they reach sizes of 8-10 mm in length. However, they become sexually Mature at the age of about one year with a length of 25-30 mm (**Fig. 1**). The arithmetic mean weight of the shrimp we studied was 3.95 g.

Females are larger than males, inside the body they have visible maturing eggs. In males, the first pair of abdominal legs is longer and there is an additional process on the second pair.

The female lays several hundred sticky eggs, which are glued to her abdominal legs. The newly laid eggs are colored dark green, but as they Mature, the color of the

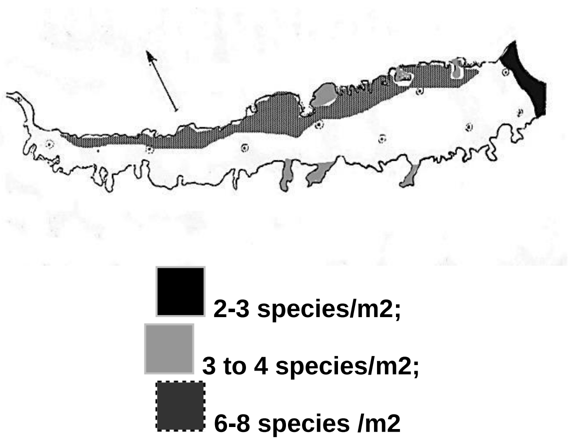

Fig. 2. Distribution of shrimp Palaemon elegans in the water area Shamkir reservoir

eggs changes. The period of development of caviar completely depends on the water temperature and accordingly ranges from 2 weeks to a month. In the first 5 days there is I - I stage of development. At this time, the eggs are almost circular (0.4-0.6 mm) with gradual elongation as they develop to oval. At this stage, the caviar has a dark green color. II-I stage of development is characterized by active cell division, which lasts 5 days. After 7 days (III-I stage) become discernible eyes and visible pulsation hearts. At this time, the color of the eggs changes to light green. Stage IV is observed after 8 days of development, the color of the eggs does not change gray-green, the eyes become round and black (eye stage), the body is translucent. The nauplius stage ends at 8-10 days and is characterized by a matte green-brown ovary, the eggs are quite oval, the larvae are still inside the egg membrane. The last VI stage (zoea-nauplius) is characterized by the exit of the larva from the egg shell, the larva is translucent, in the zone of the rostrum the color is darker, there is a pair of antennae, incompletely determined 4 segments, a telson and a uropod ending in a fan shape. The newly hatched larvae are about 1.2 mm in size and at first attach to the ventral legs of the female, and then move on to independent life.

For **Fig. 2**. the distribution of Palaemon elegans over the area of the Shamkir reservoir is shown. As can be seen from this figure despite the almost ubiquitous presence of shrimp throughout the water area of the reservoir, the largest concentrations of them are observed mainly in the coastal zone. For example, if in the pelagic part of the reservoir the density of Palaenom elegans did not exceed 26-36 species/m3, in the shallow coastal part the average density of shrimp was 2-3 species/m2, and in the few shallow biotopes with aquatic vegetation their density reached at times 12-17 species/m2.

In the seasonal aspect, we noted the following clearly distinguishable patterns. In the cold season (winter season) of the year throughout the water area.

Table 1. Quantitative distribution of Palaemon elegans shrimp by biotopes in Shamkir reservoir (species/g * m2)

years	biotopes					Mid-annual
	stony	stony sand	silt	silty sand	vegetable	
2005	2/8,4	3/12,5	1/4,5	2/8,6	6/36,0	3,0± 0,26 14,6±0,38
2006	2/8,0	4/13,4	1/5,2	2/7,4	7/49,0	4,1± 0,31 18,2±0,43

Table 2. Quantitative distribution of Palaemon elegans shrimp by biotopes in Mingechaur reservoir (ex. / g * m2)

Years	biotopes					Mid-annual
	stony	stony sand	silt	silty sand	vegetable	
2005	3/9,2	3/11,0	2/3,5	2/8,8	5/28,5	3,3± 0,21 12,9±0,34
2006	2/8,3	3/9,4	1/4,2	2/7,3	7/30,8	3,7± 0,27 13,4±0,40

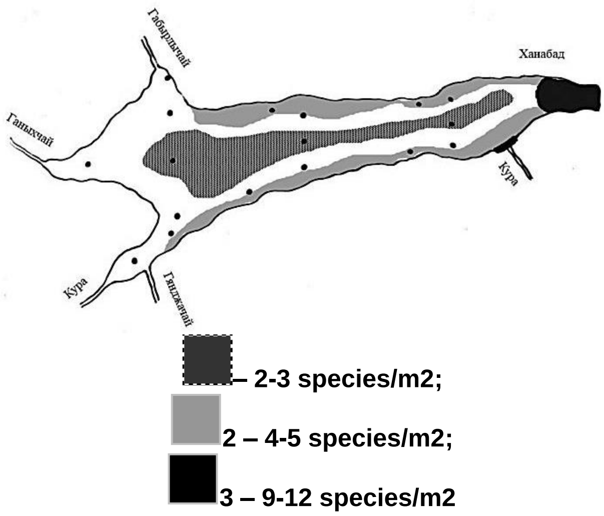

Fig. 3. Distribution of shrimp Palaemon elegans in the water area Mingechaur reservoir

We noted the departure of Palaemon elegans from 1.5-2-meter shallow water to deeper (8-12 m) horizons. In General, the motor activity of shrimp in the winter is significantly reduced.

Tables 1 and **2** present data on the quantitative distribution of Palaemon elegans shrimp in Shamkir (**Table 1**) and Mingechaur (**Table 2**) reservoirs by the main biotopes – stony, stony sand, silt, silty sand, vegetable.

In the Mingechaur reservoir, the distribution of Palaemon elegans is in principle similar to that of Shamkir, which is naturally the close location of both studied reservoirs in the same zone of Azerbaijan. For **Fig. 3**. the density of shrimp distribution in the water area of the Mingechaur reservoir is shown.

As can be seen from it, the General trend of distribution of Palaemon elegans in the water area of the Mingechaur reservoir is the same as in Shamkir. The highest density of shrimp was observed in the coastal shallow zone, especially in areas overgrown with aquatic and near-aquatic plants.

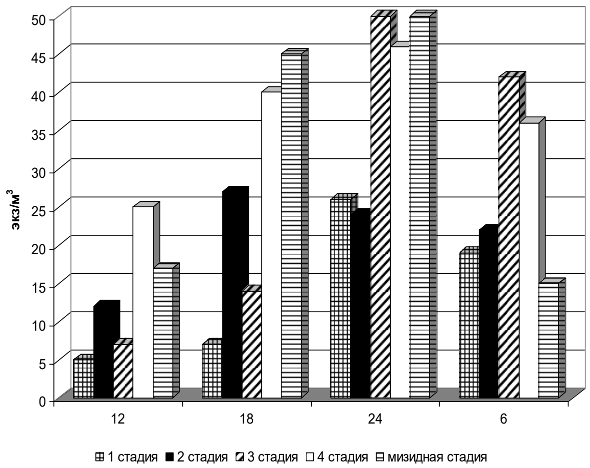

Fig. 4. Diurnal dynamics of the number of different stages of larvae Palaemon elegans in surface water layers (0-50 cm)

The author draws attention to the fact that despite the similarity of the General trend of shrimp localization in both reservoirs, there is a significant difference in the shallow coastal zone –the density of shrimp in the Mingechaur reservoir is much higher than in the Shamkir reservoir. This is especially noticeable in areas with increased eutrophication-the middle section in urban wastewater discharge sites and in the Khanabad Bay.

In both reservoirs, the density of P. elegans shrimp in these areas is very high – in Shamkir reservoir, the density of shrimp in these biotopes was 12-17 species/m2, and in Mingechaur-16-24 species/m2. At the same time, despite the General regularity of the maximum density of P. elegans shrimp in both reservoirs in coastal shallow bays overgrown with macrophytes, the significantly higher density of shrimp in the Mingechaur reservoir is striking.

In our opinion, the reproduction and high density of shrimp in the Mingechaur reservoir contribute to large areas of water plants in the coastal zone. In these habitats, juveniles of shrimps find shelter and abundant food for the development and rapid growth.

We conducted a special study of the movement of Palaemon elegans larvae in the water column during the day.

The newly hatched larvae had a size of about 1.2 mm. Before reaching a size of about 7 mm, they lead a planktonic lifestyle. With good nutrition, these larvae often shed and grow rapidly, but it is during this period of early ontogenesis that they are most vulnerable and are actively consumed by fish and other groups of hydrobionts.

As seen in **Fig. 4**, our observations showed that the vast majority of larvae at various stages of development in the near-surface layer of water met during the day (24 hours). However, attention is drawn to the fact that in the near-surface microhorizons with the onset of darkness, the number of larvae increases sharply compared to daytime samples. For example, at 12 o'clock in the afternoon the number of all stages of shrimp larvae was minimal (**Fig. 4**). At the same time, by 18 o'clock their number in the surface layers increases significantly, reaching the larvae of the 4th stage 37 species/m3. The maximum number in the surface layers was observed in 24 hours, and this is most pronounced in stage 3 and 4 larvae.

At 6 o'clock in the morning the number of larvae of Palaenom elegans began to decrease, but if the number of larvae of the 3rd and 4th stages decreased slightly (respectively 40 and 35 species/m3), the decrease in the number of larvae of other stages was more pronounced.

In our opinion, the determining factors that determine the concentration of larval stages of shrimp Palaemon elegans in the surface layers of water in the dark is the increased temperature and the availability of food.

Since the rate of metamorphosis of shrimp larvae directly depends on the water temperature, they are concentrated in the layer where it is highest. It should be noted that the larval period in the life of shrimp is the most vulnerable and during this period there is the greatest mortality. Therefore, the reduction of the period of metamorphosis due to stay in the zone of elevated temperatures, should be recognized as a protective property for larvae, developed in the process of evolution. Other specialists hold the same opinion (Kim and Hayashi 2000, Sakai 1999). In addition, it is known that for the normal development of shrimp larvae, they need a combination of both plant and animal food, the absence of which leads to a delay in metamorphosis, while lengthening their inter-larval period. It is the upper layer of pelagial that is most rich in all the necessary complex of food organisms. Thus, the larvae of the shrimp Palaemon elegans from the surface of the water find the greatest amount of food, which gives them the opportunity to shorten the most vulnerable period of their ontogenesis.

SUMMARY

1. Distribution and density of P. elegans shrimp in Shamkir and Mingechaur reservoirs were studied. It was found that in both reservoirs the highest density was observed in shallow, overgrown with aquatic plants bays, where the density in the Shamkir reservoir was 120-230 species/m2, and in Mingechaur 220-470 species/m2.

2. In both reservoirs, similar patterns were observed in the seasonal aspect – in winter, the departure of P. elegans shrimp from shallow water to deeper horizons - 8-12 m, and in the warm season, on the contrary - in the shallow coastal zone – 1.5-2 m.

3. In the conditions of Shamkir and Mingechaur reservoirs the incubation period of shrimp larvae takes 9-11 days at a temperature of 20-27 C, and the postlarval stage occurs on 22 days.

REFERENCES

Andreev VM (2001) Ecological and faunistic characteristics of the shrimp banks Rocky (North East Atlantic). Tesas.docl. 8 Congress Hydrobiol.General-VA RAS. Kaliningrad, 16-23 Sept 3: 8-9.

Bukin SD (2003) The northern shrimp, Pandalus borealis eous, in the Sakhalin waters: monograph. Moscow: National Fish Resources: 136 p.

Burukovsky RN (2000) Systematics of shrimp of the genus Nematocarcinus (Decapoda, Nematocarcinidae). 4. Description of species of the group Tenuirostris. The of.J 79(8): 898-906.

De Souza ML, Moulton TP (2005) The effects of shrimps on benthic material in a Brazilian island stream. Freshwater Biology 50(4): 592-602.

Dworschak PC (2002) A new species of ghost shrimp from the Gulf of Aqaba, Red Sea (Crustacea: Decapoda: Callianassidae). Annalen des Naturhistorischen Museums in Wien. Serie B für Botanik und Zoologie: 415-428.

Eidelman BM, Bunakov OA, Zaitseva NA, et al. (2019). Problems and Prospects for the Development of Ecological Tourism in the Russian Federation. Journal of Environmental Treatment Techniques, 7(4): 566-571.

Gaten E, Shelton PM, Nowel MS (2003) Interspecific variations in the morphology and ultrastructure of the rhabdoms of oplophorid shrimps. Journal of morphology 257(1): 87-95.

Gelin A, Crivelli AJ, Rosecchi E, Kerambrun P (2001) Can salinity changes affect reproductive success in the brown shrimp Crangon crangon?. Journal of Crustacean Biology 21(4): 905-911.

Jackson CJ, Burford MA (2003) The effects of temperature and salinity on growth and survival of larval shrimp Penaeus semisulcatus (Decapoda: Penaeoidea). Journal of Crustacean Biology 23(4): 819-826.

Jiang Y, Yao J-P, Niu Y-A, Huang F (2003) Hangzhou shifan xueyuan xuebao. J. Huzhou teach.Coll 25(3): 62-65.

Kim JN, Hayashi KI (2000) Two new shrimps of the genus Philocheras (Decapoda, Caridea, Crangonidae) from East Asian waters. Journal of Crustacean Biology 20(4): 687-698.

Liang X-Q, Chen H-M, Li W-X (2005) Dongwu fenlei xuehao. Acta zootaxon.sin 30(3): 529-534.

Makarov YN (1968) Some data on quantitative distribution zoobenthos shelf waters of the Mozambique channel. Oceanology 8(6): 29-30.

Murphy NP, Austin CM (2003) Molecular taxonomy and phylogenetics of some species of Australian palaemonid shrimps. Journal of Crustacean Biology 23(1): 169-177.

Ovsyannikova EV (2004) Digestive system of giant freshwater shrimp Macrobrachium rosenbergii. Actual problems of morphology: Materials of the all-Russian scientific and practical conference dedicated to the 70th anniversary of the Krasnoyarksky Krai. Krasnoyarsk, Collection scientific work. Krasnoyarsk: 203-204.

Paula J, Mendes RN, Paci S, McLaughlin P, Gherardi F, Emmerson W (2001) Combined effects of temperature and salinity on the larval development of the estuarine mud prawn Upogebia africana (Crustacea, Thalassinidea). In Advances in Decapod Crustacean Research (pp. 141-148). Springer, Dordrecht.

Sakai K (1999) A new species, Callianassa poorei sp. nov.(Decapoda: Crustacea: Callianassidae) from Tasmania. Journal of the Marine Biological Association of the United Kingdom 79(2): 373-374.

Saoud IP, Davis DA (2003) Salinity tolerance of brown shrimpFarfantepenaeus aztecus as it relates to postlarval and juvenile survival, distribution, and growth in estuaries. Estuaries 26(4): 970-974.

Wu RSS, Lam PKS, Wan KL (2002) Tolerance to, and avoidance of, hypoxia by the penaeid shrimp (Metapenaeus ensis). Environmental pollution 118(3): 351-355.