EXPERIMENTAL STUDY OF THE EFFECT OF OIL ON SOME REPRESENTATIVES OF BENTHOS IN THE CASPIAN SEA

A. G. KASYMOV and A. D. ALIEV

Institute of Zoology of the Academy of Sciences of Azerbaijan SSR (Baku), U.S.S.R.

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Abstract. Experimental studies of the influence of crude oil on the bottom fauna of the Caspian Sea were carried out in 1970-1971 at Artem Island 86 km from Baku. The investigated species on the sensitivity to oil contamination are divided into 3 groups: more sensitive species – Ch. albidus; the sensitive – C. lamarecki, N. elinguis; and less sensitive species – N. diversicolor, P. dubia and A. ovata. Under high concentrations of oil (higher than 3 to 5 mgI\(^{-1}\)) the animals initially do not change weight and then they lose weight and perish. In a weak solution of oil (below 1 mgI\(^{-1}\)) a speed up in normal evolution, growth, and reproduction took place in the animals.

1. Introduction

During recent years oil contamination has reduced the fish stocks of the World Ocean. The oil contamination destructively influences not only the fodder and the fishing productivity (Kasymov, 1970), but also water birds (Clark, 1969) of the seas and oceans. According to Clark, the contamination of the seas leads to a considerable decrease of the number of birds and in some cases to extinction of specific races of birds.

Such effects are also observed with respect to invertebrates and fish inhabiting the shelf regions of the seas. Experimental study of the influence of crude-oil on hydrobionts of the Caspian Sea has significant scientific and practical importance. Experimental studies of the influence of crude-oil on the bottom fauna of the Caspian Sea were carried out in 1970-1971 at Artem Island, which is 86 km from Baku.

The experimental organisms were gathered in the littoral zone of the sea near Artem Island with a Petersen bottom-grab and a net, made from the mill-sieve N20. The experiments were conducted in crystallizers and aquariums with a capacity of 0.3 to 5.0 l. A working solution was made from Artem oil by Veselov’s method (Veselov, 1959). The solution was prepared in the following way: the crude-oil in necessary quantity was weighed on a pharmaceutical balance and injected into a 3 l ballon, filled with the sea water. Then it was dosed by a cover, through which was let an electrically driven beater. The solution was mixed for 15 min, after which it set for 30 min. Then this solution was passed through a funnel with the cotton-wool (the latter material is often changed, because once saturated with oil, the water passes poorly). The working solution, prepared in this manner and emulgired by oil parts, was used for the experiments. The necessary concentration of oil was prepared by diluting it with sea water in definite correlations: resin – 32.0%; benzene – 2.2%;
ligroin – 7.1%; viscosity – 196.5 ccg; acidic number – 2 mgKOH; paraffin – 0.13%; and naphten acids – 1.8%.

The concentration of oil in the aquariums varied from 0.2 to 4.0 mg l⁻¹ with intervals 0.5 to 2.5 to 5.0. In control and in each experiment there were about 10 specimens of animals. Each series of experiments was repeated 2 to 3 times and on this basis the average indices were calculated. At the beginning and at the end of the experiments the organisms were weighed and measured. In aquariums, the temperature of water was measured three times a day and the maintenance dilute O₂ in water was measured daily. Average temperature in the aquariums during the observations was varied within the limits of 19.3 to 24.4 °C. The maintenance of dilute O₂ in water in aquariums was 4.5 to 7.0 mg l⁻¹ by the saturations 49.7 to 79.9%. The experiments were carried out with multibristling worms: *Nereis diversicolor* Müller, oligochaets-*Nais elinguis* Müller and molluscs-*Pyrgohydrobia dubia* Logv. et Star., *Cerastoderma lamarckii* Reeve, *Abra ovata* Philippi and larva of *Chironomus albidus* Konst.

Before the experiments each species of animals was kept in the total aquarium for 15 to 20 days to adapt to the conditions of abiotic surroundings.

### 2. *Nereis Diversicolor* Müller

The dimensions of worms varied from 6.0 to 130.0 mm. During acute experiments with concentrations of oil of 7.0 to 14.0 to 20.0 mg l⁻¹ *Nereis* began the convulsive movements, at this time the mouth gradually became drawn out and displayed the gullet graters-teeth. One could see swelling of the mouth of *Nereis*, with the naked eye. The *Nereis* shrinks and coelomic fluid is accumulated in its tail. When death is approaching, the *Nereis* become flabby and do not respond to irritations.

In order to determine death the separate specimens were transplanted into fresh water. In Figure 1 the dependence of the duration of life of *Nereis* from the concentration of oil is reflected. From this figure it is evident that there is obvious dependence between the concentration of oil and the duration of life i.e., with decrease of concentration of oil the duration of life of *Nereis* is increased. This figure also shows, that with low concentrations (0.5 to 1.0 mg l⁻¹) the line of duration survival falls slight, i.e., with the low concentrations there aren’t noticeable deviations.

The curve line on Figure 2 shows the dependence between concentration of oil and the term of survival of *Nereis* with a body length of 20 mm. From this figure 1.7 is evident, that for a concentration of oil of 30 mg l⁻¹, the duration of the life of *Nereis* was less than 1 hr and with decreasing concentrations the length of survival increased.

It is necessary to note, that the survival term of *Nereis* depends not only on concentration of oil, but on the dimension of organisms too (Figure 3).

Figure 3 shows, that with an increase in the dimension of the *Nereis* the duration of survival is increased. In our experiments such dependence is shown to be weak: the dotted line is an average index of this dependence, which has the direct character. It is necessary to note, that in some cases under the same concentrations the average