FOREWORD

Marine contamination by petroleum, whether by natural seepage or by spills from ships at sea, by accidents in harbour or at offshore installations or by atmospheric or terrigenous input is by no means a new or rare phenomenon. In recent years however, the problems have been highlighted not only by the increased utilisation and marine transport of oil but also by a number of spectacular accidents which have raised questions about possible effects on the ecosystem. A number of detailed studies have been carried out in an attempt to answer these questions. The demands for such knowledge have been further increased by the various questions raised as a result of expansion of offshore exploration and exploitation for oil, particularly in environments hostile to these operations, in regions as far apart as the northern North Sea and the coast of Alaska.

Consequently, diverse aspects of the problem are being studied in several parts of the world by chemists and biologists who are often asking the same questions but using different approaches and sometimes producing conflicting views. Against this background, it seemed timely therefore to bring together a group of scientists from university, industry and government, actively engaged in such work, to examine and discuss common problems relevant to petroleum hydrocarbon contamination of the marine ecosystem and so a Workshop was sponsored by the International Council for the Exploration of the Sea, and held in Scotland at Aberdeen in September 1975.

The Workshop considered methodology, occurrence and fate in the environment, and effects on the ecosystem of petroleum hydrocarbons in the sea. Most of the papers presented and updated where necessary, are brought together in the present volume together with an edited version of the recorded discussion that followed each session. Of necessity, the reportage of the discussion is very brief although the proportion of time available for discussion compared favourably with that set aside for formal presentation of the papers. In preparing the discussion reports, the editors were assisted in particular by Dr R. Hardy, Dr R. Johnston, Mr P. R. Mackie and Dr I. C. White, and by comments from several contributors.

No attempt was made to produce specific recommendations but a study of the papers in this volume does give a clear indication of several lines of research which must be followed up before an adequate understanding can be reached of the effects of petroleum in the sea and it is evident that widespread monitoring operations will be fully effective only when the basis of our knowledge has been thus extended.

A list of participants to the workshop may be found in Appendix I.

A. D. McIntyre
K. J. Whittle

Rapp. P.-v. Réun. Cons. int. Explor. Mer, 171: 189–190. 1977.

THE TOXICITY OF PURE HYDROCARBONS TO MUSSEL LARVAE

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INTRODUCTION

We have been working in our laboratory on the toxicity of hydrocarbons to mussels (*Mytilus edulis*) and other bivalve larvae. Mussel larvae are good experimental material, because they can be obtained at any time in the year and are reared easily. The larvae are more sensitive to toxic substances than the adults, and their reactions to these substances are not affected by adaptation, behaviour or reproduction. During a normal experiment some mortality occurs, so the classical LC 50 and LT 50 tests must be used with caution.

METHODS

We prefer to study the effect of sub-lethal concentrations on the growth of living animals during the 10 or 20 days after fertilisation of the eggs and we conclude the experiment if mortality exceeds 50 %.

Treated sea water is prepared in the same way for each test. It is first filtered (0·2 microns) and then mixed with the hydrocarbon on a magnetic stirrer for one hour and the mixture decanted.

The larvae are treated only with the aqueous solution. They are exposed to this solution in two ways: firstly by Permanent Contamination by Hydrocarbons (CPH). Each day throughout the experiment, a particular concentration of the solution is added with each water change.

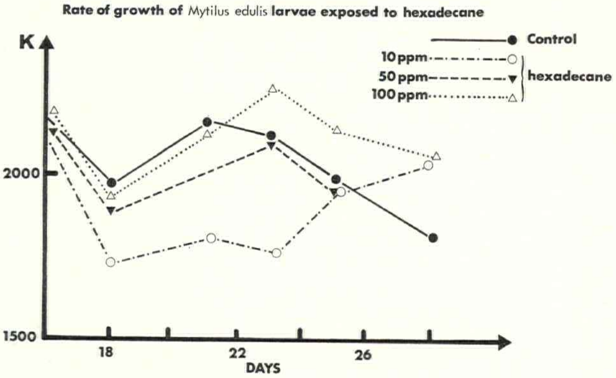

Figure 110. Toxicity of hexadecane to mussel larvae.

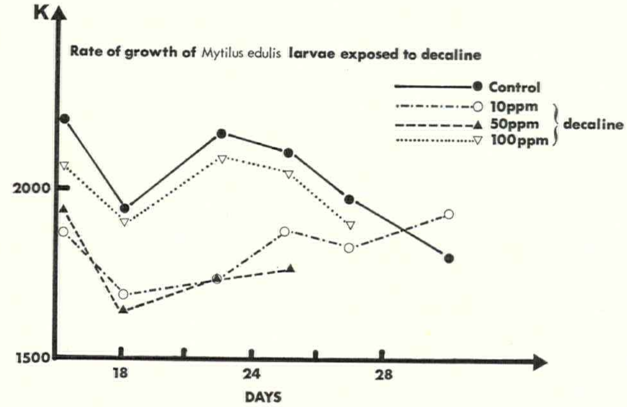

Figure 111. Toxicity of decalin to mussel larvae.

The second method is by Temporary Contamination by Hydrocarbons (CTH). The larvae are washed with a particular concentration of the solution and then soaked in the same solution for an hour. Next, they are rinsed with fresh filtered water and kept in this condition.

Finally, in collaboration with Mr Gatellier of the French Institute of Petroleum, we are examining the adsorption of hydrocarbons on larvae exposed for one hour.

RESULTS AND DISCUSSION

In Figures 110—114 the rate of growth

$$K = \text{Log } L_1 - \text{Log } L_0 \,/\, T_1 - T_0$$

is plotted against the time where L_0 is the initial length of the shell at time T_0 and L_1 is the length at time T_1. The lengths are an average of 30 measurements.

Figure 110 shows that the rate of growth increases with the concentration of the solution of hexadecane. The rate of growth is nevertheless better in the control

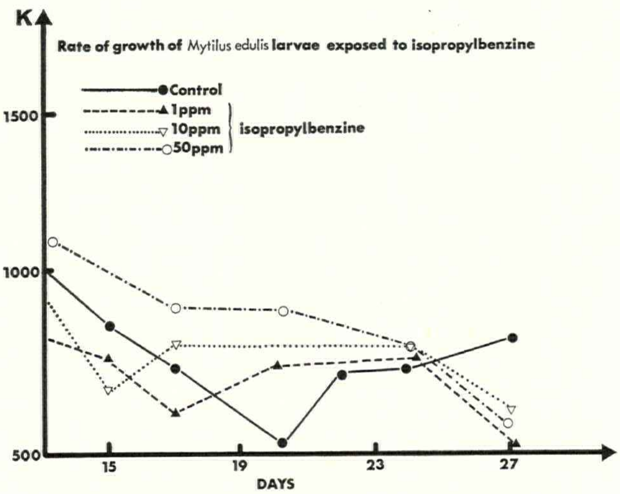

Figure 112. Toxicity of isopropylbenzene to mussel larvae.

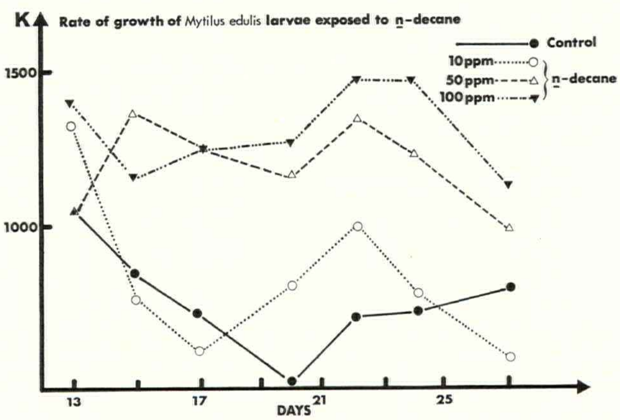

Figure 113. Toxicity of *n*-decane to mussel larvae.

group, except for the highest concentration of the test solution (100 µg/ml).

Figure 111 shows that the rate of growth is always better in the control group than those treated with

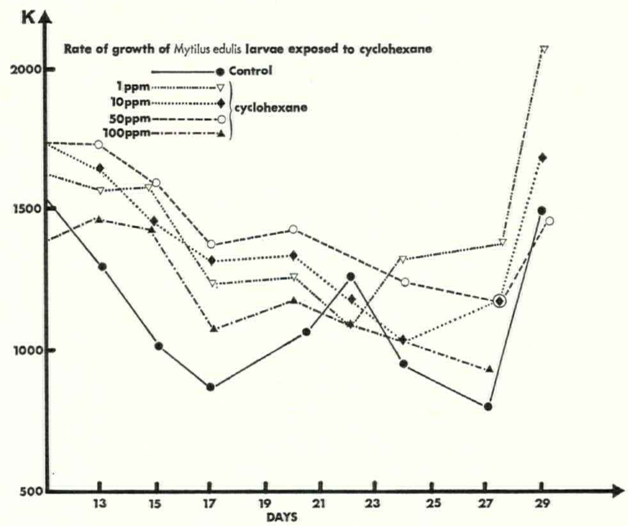

Figure 114. Toxicity of cyclohexane to mussel larvae.

decalin although the concentration of 100 µg/ml gives a very similar growth curve to the control.

In the case of isopropylbenzene (Fig. 112), it is not known whether the differences in growth are significant. However, it is curious to find a part of the three treatment curves above the control curve. The rate of growth increases with the concentration of isopropylbenzene.

Figure 113 shows that the phenomenon noted above for isopropylbenzene is accentuated for *n*-decane.

In the case of cyclohexane (Fig. 114), the growth curves are almost always higher than the control group.

The reason for this stimulation of the growth of the *Mytilus edulis* larvae is not known, but we think that the observation and measurement of the biodegradation of the hydrocarbons in the same way as bacterial biodegradation could provide an explanation.

ACKNOWLEDGEMENT

This work is supported by a grant from CNEXO.