with the largest specimens found by Fauvel from Cam Ranh.

I am indebted to E. and C. Berkeley for directing my attention to Fauvel's paper.

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Oil Pollution of Marine Organisms

ALTHOUGH much publicity has been given to the harmful effects of oil on bird life, little evidence is available to show how marine organisms are influenced by oil pollution. Recent accidents involving the release of crude oil in Milford Haven afforded an opportunity to commence an assessment of the effects of this substance on the commonest intertidal animals and plants of a rocky coast.

It was found that even when the surface of the water is covered by a thick layer of oil, only a very thin film of oil is deposited on littoral animals and plants as the tide recedes, and much of this is washed off as the tide returns. Oil is, however, deposited at high-tide mark in the form of a band the width of which varies according to the degree of wave action on the shore at the time, and successive high tides may leave a series of bands of oil at slightly different levels. On very sheltered shores, each band may be only a few inches broad but on exposed shores the oil may be spread over several vertical feet of rock face. Clearly, therefore, the intertidal organisms most likely to be affected by oil pollution are those which occur between the lowest high water level of neap tides and the extreme high water level of springs, and include the acorn barnacles, *Elminius modestus*, *Balanus balanoides* and *Chthamalus stellatus*, the limpet, *Patella vulgata*, and on sheltered shores the algae *Fucus spiralis* and *Pelvetia canaliculata*.

Once deposition of crude oil has occurred, the lighter fractions gradually evaporate to leave a tarry residue which seems to be resistant to leaching by rain and moderate wave action. Erosion by water-borne particles (corrasion) probably occurs, but this is likely to be a very slow process except on shores subjected to intense wave action.

Examination of contaminated shores shortly after oil had been deposited showed that those acorn barnacles and limpets the shells of which had been covered by oil appeared to be unharmed and no barnacles were found in which the opercular plates had been glued together by the tarry residues. Examination a fortnight after deposition showed that the amount of oil remaining on surfaces in the immediate vicinity of limpets had been much reduced and that residual patches of oil situated a short distance from these animals exhibited the characteristic imprints of limpet radulas. It appeared likely that these molluscs were continuing to browse over the nearby barnacles and areas of bare rock in order to obtain food, but that in doing so they were inadvertently removing the layer of deposited oil. Since there was no decrease in the limpet population in the contaminated area, it seemed probable that the oil was non-toxic and that it was being passed through the alimentary canal and voided with the other fæcal material.

Some confirmation that limpets are at least partially responsible for removing oil from contaminated shores was obtained during an examination of the latter six months after the accident. All traces of oil had been removed from the areas which support a population of limpets, but on one shore where oil had been deposited to a level above that of the uppermost limpets the tarry residue remained. Examination of barnacles which had been thickly smeared with oil showed that not only had all of it been removed but also that they had suffered no unusual mortality. Plants of *Pelvetia* and *F. spiralis* were also apparently unaffected and had continued to grow at a normal rate.

During the past two or three years, industrial emulsifiers have been increasingly used to clean up oil-polluted shores and they have been found to give effective results on sand and shingle beaches where the amenity value is of importance. Emulsifiers have also been used to clean up contaminated rocky shores, but it has been noticed that their use is followed by a severe mortality in intertidal organisms. Subsequent observations, as yet unpublished, have shown that the type of emulsifier most commonly used destroys all the limpets on a shore and 80–95 per cent of the acorn barnacles, and is extremely toxic to all other forms of intertidal life. It is suggested that in view of the fact that oil films are fairly quickly removed from rocky shores by natural processes, it is both wasteful and unnecessary to use emulsifiers on such shores.

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MICROBIOLOGY

Solute Requirements for preventing Lysis of Some Marine Bacteria

PREVIOUS work has revealed a specific requirement of a number of marine bacteria for sodium for growth[1,2] and oxidative metabolism[3,4]. For optimum rate and extent of growth, 0·2–0·3 M Na^+ was required though limited growth could occur after a sufficiently long incubation period at as low as 0·03 M Na^+ (ref. 2). Since sucrose and K^+ exerted only a slight sparing action on the Na^+ requirement of the organisms examined it was concluded that the maintenance of an appropriate osmotic pressure in the medium was by no means the sole, or even the primary, function of Na^+ in the growth of the cells. Nevertheless, cells of many of the species lysed quickly when washed in distilled water, and in the case of one of the species examined in more detail, lysis occurred also when cells were suspended in solutions containing sodium chloride and potassium chloride at concentrations of these salts that were optimum for growth. Lysis, however, did not occur when 0·05 Mg^{2+} or Mn^{2+} was included in the suspending medium[3].

Since Mg^{2+}, and in some cases Ca^{2+} as well, are required for growth by all the species examined[5], the presence of these ions in the growth media used could possibly explain why no apparent osmotic requirements could be demonstrated during growth of the cells. Support for this conclusion was obtained when it was observed that cells of a number of