

tolerated. Mice inoculated intravenously tolerated 1, 2, and 3 g/kg and showed no gross pathology upon sacrifice.

Paolin 1 inhibited the *in vitro* growth of gram positive as well as gram negative organisms such as *Staphylococcus aureus*, *Streptococcus pyogenes*, beta-hemolytic strain, *Salmonella typhosa*, *Shigella dysenteriae*, etc. at a concentration varying from 4 to 100 ug/ml. Its *in vivo* activity against *S. pyogenes* is illustrated by the following typical experiment. A group of 50 Swiss white mice were fed with oyster extract for 2 weeks using a daily dose of 0.1 g/kg of body weight. Three days after the first feeding these mice, along with 50 controls, were challenged intraperitoneally with a sublethal dose of *S. pyogenes* beta-hemolytic strain. Although about 60% of mice in either group developed abscesses, the death rate at the end of 50 days was 36% for the controls and 10% for the treated animals. Paolin 1 was also prepared in a more purified form by chloroform extraction and Reinecke salt precipitation. The purified material inhibited the growth of *S. aureus in vitro* at a concentration of 1 ppm.

Paolin 2 inhibited poliovirus, type I, in tissue cultures and in mice. In tissue cultures, paolin 2 was not toxic for primary monkey kidney monolayer culture cells at a concentration of 100-500 ug/ml and did not inactivate poliovirus in absence of living cells. However, it interfered with multiplication of the virus when incorporated in the medium, reducing virus yield by 1 or 2 logarithmic units. When Swiss white mice were fed for 3 days with oyster extract in a daily dose of 0.5 g/kg of body weight starting 24 hours before intracerebral infection with type I poliovirus, the death rate of the treated mice was about 25% to 50% lower than that of the controls. After further purification by alcohol fractionation, paolin 2 in a single intra-peritoneal dose of 2.5 mg/kg of body weight, given 5 hours before intracerebral infection with type I poliovirus, reduced the death rate from 53% in 30 control Swiss white mice to 26% in the same number of treated animals.

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## Estuarine Pesticide Studies

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### Abstract

During the past four years, the Bureau of Commercial Fisheries has been engaged in a nation-wide pesticide research program involving laboratory and field studies to determine the effects of pesticides on estuarine organisms. The acute toxicity of a majority of the more widely used chemicals has been established, under controlled laboratory conditions, to plankton, crabs, shrimp, oysters, and fish. The sub-lethal effects of some of the most important insecticides have been studied by exposing mollusks and fish to low concentrations for several months. The significance of laboratory data is being evaluated in the field by the study of pilot scale applications and large scale pest control programs.

The economic importance of pesticides insures that not only will they be widely used for some time to come but also that a variety of new types and formulations will be developed to fill specific needs. Consequently, a continuing objective of the research program must be the screening of these chemicals to evaluate their effect on commercial fisheries resources. At the same time it will be possible to assist manufacturing chemists in the screening of potentially

useful but still undeveloped compounds. This screening program requires the development of standard testing techniques which may be modified and augmented as our knowledge and needs increase.

The potential hazard of pesticide use has been clearly shown by laboratory observations but with few exceptions we are still unaware of the magnitude of their danger to our natural resources under field conditions. Therefore, a second objective of our expanding field program is the comparison of the acute and residual toxicities of these chemicals under a variety of field conditions with the relative toxic levels that were determined in laboratory tests.

Detailed studies are required to show how the persistence of chemicals in the environment may be affected by weather conditions, amount of ground cover, drainage patterns, and soil structure. Projects are also being designed to determine if some of the more important pesticides may be concentrated or biologically magnified in the estuarine food web. There is laboratory evidence that man's food supply may be contaminated even in areas where chemical contamination levels are extremely low.

Finally, it is proposed that teams of observers be trained to make appropriate before and after studies of large scale pest control programs to determine when and under what condition there may be significant danger to our natural resources. These teams will be concerned also with the monitoring of estuarine environments supporting important commercial fisheries. We are hopeful that technically and economically reasonable bio-assay methods will be developed so that we can maintain a continuing vigilance over the estuarine habitat.

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## **Shellfish Advisory Service — Cooperation With the Industry**

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MOLLUSK SHELLFISH at the present time account for more than 12 per cent of the total landed value of our domestic commercial fisheries. In cold cash this represents about 45 million dollars. They are therefore of major importance to our United States fisheries economy and of direct concern to us in the Bureau of Commercial Fisheries which, in cooperation with the research and management agencies of the maritime states, is charged with the conservation and wise management of these important natural resources. While all of us should be, and no doubt are, consumers of this fine food, we should be vitally aware also of the significant place members of the shellfish industry, with their background of experience, have in this discussion. This makes a quartet of forces, state and federal research, state and industry management, that must work together in complete harmony to stabilize and increase production, to improve quality, to stimulate consumer demand, and as a result to develop and maintain a healthy shellfish industry.

These statements imply that there are conditions under par in this industry. This is unfortunately so. The list of problems is long and I shall not enumerate them at this time. Dr. J. L. McHugh, Assistant Director for Biological Research of the U.S. Bureau of Commercial Fisheries, in his speech entitled "Research and the Oyster Industry" told the members of the Oyster Growers and Dealers