

This Week's Citation Classic

Sprague J B. Measurement of pollutant toxicity to fish. I. Bioassay methods for acute toxicity. *Water Res.* 3:793-821, 1969. [Fisheries Research Board of Canada, Biological Station, New Brunswick, Canada]

Advantageous methods for toxicity tests with fish are recommended, following a review. Fisheries biologists should adopt a combination of existing techniques including pharmacological ones. Investigators should use thresholds of effect, probit analysis, confidence limits, and tests for significant differences. [The SCI[®] indicates that this paper has been cited over 115 times since 1969.]

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"Timing of this article probably accounts for its citation. The 1960s had seen an upsurge in environmental research, including tests of potential pollutants against aquatic organisms. Fisheries biologists doing this work tended, however, to form a 'splinter group,' apparently not fully aware of approaches in other fields of toxicology. Indeed, beneficial methods for fish-testing did not even seem to be spreading very well between countries. So the time was right for appraising available methods. Continued expansion of pollutant-testing in the 1970s seems to have made my comments on basic procedures useful. It has always been mildly surprising to me that second and third parts of the review were less frequently cited,^{1,2} although they went further into application of results and sublethal effects.

"Circumstances combined to provide me with a fortunate background for reviewing aquatic toxicology. I had started in water pollution research in 1953, and a 15-year collection of early papers and references sorted itself easily into topics. Graduate

school at Toronto under F.P. Ide taught me about aquatic invertebrates, and brought exposure to the F.E.J. Fry school of work on relations of fish to lethal and sublethal temperatures. My supervisors had insisted on courses in pharmacology. I nearly failed the one for medical students, but enjoyed the graduate course which covered principles of testing drugs. Another benefit was the Canadian characteristic of having both US and British ties. Workers at the UK Water Pollution Research Laboratory provided illuminating examples of research.

"The reviews were written under very favourable circumstances. An invitation from the editor of *Water Research* provided stimulus. Sabbatical leave had been generously granted by the Fisheries Research Board of Canada, an organization so excellent that it has since been dismantled. Leave was spent at Oregon State University, partly at the satellite laboratory of the department of fisheries and wildlife, and partly in the library. Oregon's climate and geography alone were enough to recharge one's vitality, but the lab was an eye-opener. Graduate students filled small buildings with far-out pollution research on artificial ecosystems and metabolic pathways. Charles Warren invited comments on the manuscript of his book on water pollution biology.³ Peter Doudoroff, a pioneer in the field, paced up and down the lab chewing a pipe and grumbling out deductions, as he unravelled a major new approach to the oxygen requirements of fish.⁴ The library provided a monastic carrel without windows but adjacent to stacks of journals — a perfect place to read and write. A cyclically-low Canadian dollar strained family finances, favouring the thrifty occupation of sitting in one place to write.

"Rereading the article shows a lot of progress. For example, access to computers has turned a former 'short-cut' analysis into a relatively tedious one. Reprint requests still continue, but it is probably good that the supply ran out long ago."

1. **Sprague J B.** Measurement of pollutant toxicity to fish. 2. Utilizing and applying bioassay results. *Water Res.* 4:3-32, 1970.
2. **Sprague J B.** Measurement of pollutant toxicity to fish. 3. Sublethal effects and safe concentrations. *Water Res.* 5:245-66, 1971.
3. **Warren C E.** *Biology and water pollution control.* Philadelphia, PA: JB Saunders, 1971, 434 p.
4. **Doudoroff P & Shumway D L.** *Dissolved oxygen requirements of freshwater fishes.* New York, NY: Food & Agriculture Organization of the United Nations, Technical paper No. 86, 1970. 291 p.