Pesticides in Environment (Review)

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Abstract: These chemicals are important as a potential hazard to aquatic life because they are designed and used to kill living organisms. It is beyond the scope of this book to describe in detail the effects of all the pesticides in common use; instead, a few examples will be given to indicate the types of problem encountered.
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Introduction:

The toxicity of aluminium to fish is extremely complex because it can exist in many different chemical forms in water, depending on the and these forms have differing toxicities. The most toxic chemical form is found within the pH range 5.2-5.8, and this may account for the reduced populations of fish found in waters with this range of acidity. As with other metals, the toxicity of aluminium is reduced when the calcium concentration of the water is increased and added protection also given by silicon salts.

The correlation between the results of laboratory experiments and field observations on the effects of low pH and aluminium is made difficult because of the problems of controlling the acidity of test solutions to the required accuracy in the former, and the wide seasonal fluctuations in the latter which can depend on the frequency and extent of the rainfall or, in some cases, the snow melt. It should be pointed out that these fluctuations in chemical conditions are more severe in watercourses than in lakes where such changes are buffered by the large volume of water. However, there can still be effects on lake fish populations because the feeder streams where they may breed can be subject to intermittent harmful pulses of acidity.

The biological activities of the different types of vegetation in the catchment area may also be a factor in affecting the acidity of the run-off water. It is these reasons that the effect of 'acid rain' on fisheries is still difficult to quantify, even though the main contributing factors to the problem have been identified and in some cases the concentration-effect relationships have been accurately established. But the example of acidity serves to illustrate the difficulties in establishing the harmful effects of diffuse inputs of chemicals, in this case from the atmosphere via the soil, on fisheries.

Organochlorine compounds

Pesticides

Historically, it was the persistent organochlorine pesticides (DDT, dieldrin, etc.) that formed the first focus of attention, mainly because they were very persistent in the environment and so were found far from the sites where they had been used to control local pests. These chemicals have been used not only in agriculture but also to control the insect vectors of disease; this use is continuing in developing countries where the problems of insect pests and insect-transmitted disease are severe and alternative methods of control are too expensive or insufficiently developed. These pesticides were also used by industry, for example in the moth-proofing of carpets where the effluents from the treatment processes were discharged to rivers. The recognition of the global distribution of these chemicals, aided by the increasing sensitivity of chemical analysis, has led to the steady withdrawal of their permitted uses as less persistent and effective alternative pesticides were developed.

Nevertheless, these chemicals remain in sinks, either terrestrial such as in land that has received repeated applications (e.g. dieldrin on narcissus fields and in soakaways from sheep dips) or in aquatic sediments. From there they will steadily diffuse and disperse into the wider environment.

Except where the usage of these chemicals was very high, or in watercourses receiving effluents that contained high concentrations, the damage caused to

fisheries was probably very small. One reason for this is that these chemicals of low solubility bind strongly on to sediments and suspended particulate matter, so that the concentrations that occur in solution are extremely small.

However, it is possible that eels, which can accumulate high amounts of these chemicals in their fatty tissues, may be affected when they reach their breeding grounds in the Sargasso Sea. The mobilization of their fat reserves during the migration may release the stored pesticide so that it can affect other, more sensitive, tissues. Alternatively, the pesticide may be passed into the fat reserves of the eggs and so affect the developing larvae. Because so little is known about this stage of the eel's life history, it is difficult to prove whether these speculations are correct. As pointed out earlier, the main concern has been the transfer of sub-lethal levels of these pesticides through the food chain to fish-eating predators such as herons, birds of prey and otters.

Control of pesticides

The problems caused by these organochlorine compounds have led to increasingly strict controls being placed on the marketing and use of all pesticides. As a result, the possibility that the authorized use of these substances will cause damage to fisheries is becoming increasingly remote. There is always the possibility of water being polluted by accidental spillages or by the careless disposal of surplus spray and partially emptied container's. However users of these chemicals are becoming increasingly aware of the potential dangers, so the incidence of such events should decrease. All pesticide containers should contain information on the potential harmfulness of the product to fish and other aquatic life, and the need to dispose of the contents safely.

Tecnazene

Problems can arise with the changes in the processing of agricultural products which have been treated with a pesticide. A recent example is the use of tecnazene to control fungal infection and prevent early sprouting in stored potatoes (Whale et al., 1988). When the product was first approved for this use, the chance that it would get into watercourses seemed to be remote; any pesticide removed from the potatoes when they were prepared for cooking would be considerably diluted by domestic waste water and then treated by the normal sewage treatment processes. However, in recent years there has been an increasing demand for each potatoes which are packed in transparent bags for sale. This has led to the proliferation of vegetable washing operation ranging from cottage industries to large installations. The effluent from many of these operations is discharged after some settlement directly to water, and so the tecnazene from the potato skin has a direct point source entry into the aquatic environment. Surveys have shown that in some cases the concentration of tecnazene in small streams receiving these effluents is sufficiently high to have a direct effect on fish if sustained for a few weeks. Investigations to determine the extent of this problem are continuing. An interesting side-issue is that the analytical technique commonly used to measure pesticide concentrations in water dose not separate tecnazene from linden, another common organochlorine pesticide, and so its occurrence in water may have gone unsuspected for several years; also, the concentrations reported for linden in water may have been erroneously high if tecnazene was also present.

Implication for pesticide controls

It is difficult to forecast such events at the time of product registration and considerable time and effort is required to investigate such problems when they arise in order to establish a causal relationship with an observed effect, or establishing whether the concentrations occurring in water are having a significant effect on fish populations. However, the number of such problems are few in relation to the number of pesticides in use, and it is clear that the data submitted on the fate and effects of new products at the time of registration are sufficient for making an accurate prediction of the likely risk to aquatic life which would arise from their use. The data requirements for pesticide registration are steadily updated to take new information into account; at present the emphasis is on the rate at which pesticides leach from soil into the surface and underground water, either in solution or attached to soil particles.

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Learn where pesticides are found in our environment, how they are used, and the potential human health risks of exposure. Find out how to protect yourself, your family, and your community.Â Environmental health concerns and toxic chemicals where you live, work, and play. Search Keyword. Search. Pesticide persistenceâ€”or how long it remains toxic in the environmentâ€”is also a factor in the safety of pesticides. Pesticides that break down rapidly usually have less negative impact on the environment, but are more difficult to use. Because they don't leave toxic residues that will kill pests arriving hours or days after the application, they must be applied precisely when the vulnerable stage of the pest is present. Because pesticides are sprayed over large areas of land, they have a widespread impact on the environment. Research has shown, for example, that over 95% of herbicides and over 98% of insecticides do not reach the targeted pest. This is because pesticides are applied over large tracts of land and carried away by wind and water runoff. As these chemicals travel to other areas, they affect a number of plant and animal species.