Imidacloprid

Imidacloprid is a neonicotinoid pesticide that works by blocking a neurotransmitter necessary for nerve function. It specifically targets insect and other invertebrate nerve receptors, making it a relatively narrow-spectrum insecticide. According to the National Pesticide Information Center, over 400 products containing imidacloprid are sold in the United States for use on crops, in homes, and even on pets.

As part of the development of an integrated pest management (IPM) plan for burrowing shrimp in Willapa and Grays Harbor, imidacloprid was identified as the only viable option after testing dozens of potential biological, mechanical, cultural, and chemical management methods. Imidacloprid was ultimately not permitted for aquatic use on shellfish beds, leaving farmers with few options for managing burrowing shrimp. Several years of field trials and five impact assessments on the aquatic use of imidacloprid were conducted, but *the overall lack of evidence from marine and estuarine environments increased scientific and regulatory uncertainty.*

Fate, Transport and Persistence

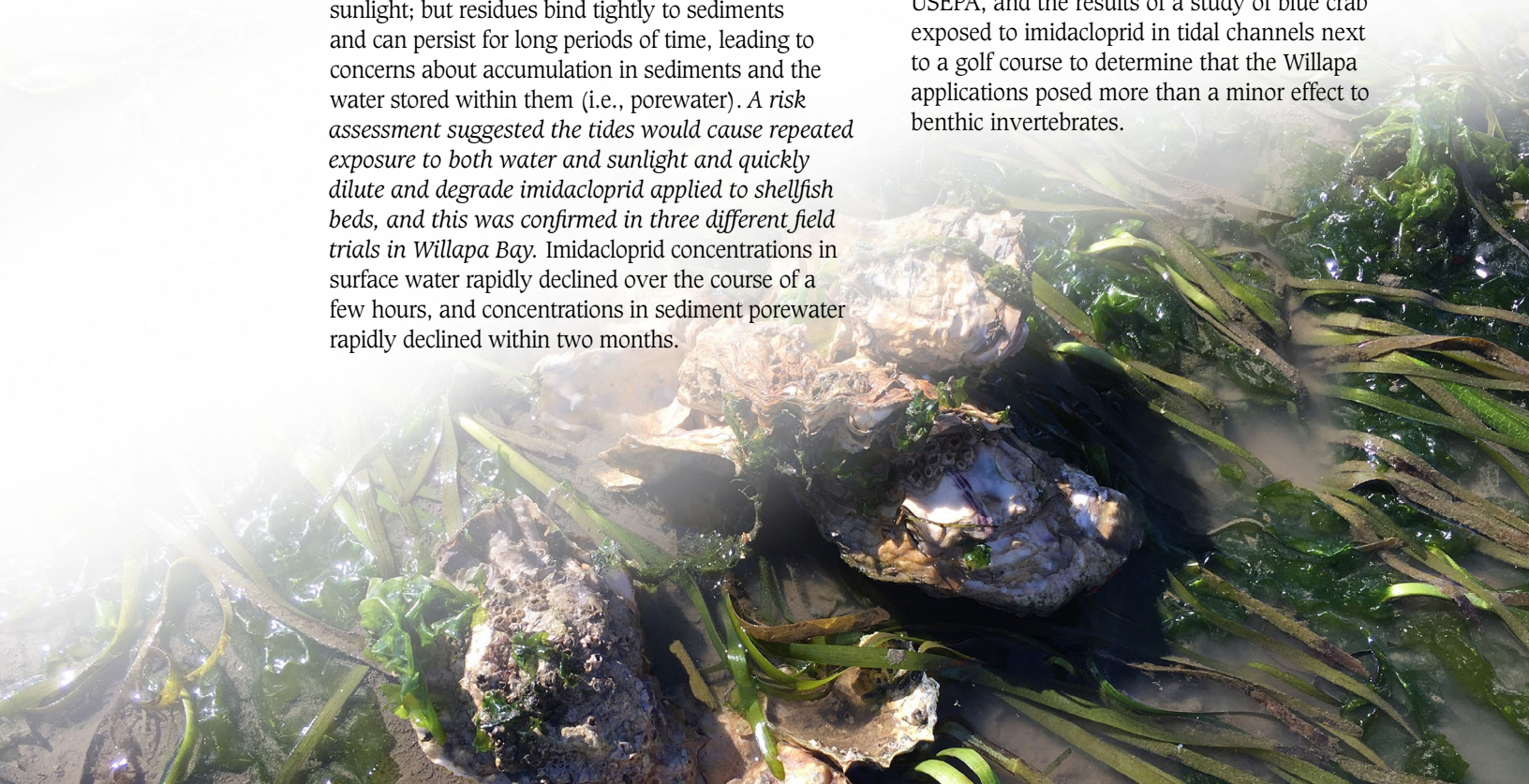
The environmental impact of a pesticide is often assessed based on its fate, transport, and persistence. Fate is what happens to a substance once it is released into the environment, which is influenced by how it moves through the environment – transport – and how long it remains in the environment – persistence.

Imidacloprid is rapidly broken down by water and sunlight; but residues bind tightly to sediments and can persist for long periods of time, leading to concerns about accumulation in sediments and the water stored within them (i.e., porewater). *A risk assessment suggested the tides would cause repeated exposure to both water and sunlight and quickly dilute and degrade imidacloprid applied to shellfish beds, and this was confirmed in three different field trials in Willapa Bay.* Imidacloprid concentrations in surface water rapidly declined over the course of a few hours, and concentrations in sediment porewater rapidly declined within two months.

Non-Target Impacts

Imidacloprid is highly toxic to insects, but its effects on marine invertebrates are largely unknown.

- Impacts to 3 groups of benthic invertebrates – polychaete worms, mollusks, and crustaceans -- were studied during 8 experimental field trials conducted over the course of 3 years and among 5 study sites in Willapa Bay. Results were initially analyzed in accordance with a test in the Washington Authorization Codes that described an adverse effect as a 50% lesser difference among the abundance and taxonomic richness of the 3 groups on a test plot compared to an untreated control plot, an outcome which occurred among only 2 metrics at 1 site/year. Ecology initially interpreted the results at the single site as an anomaly due to a number of factors and required that the trial at that site should be repeated. Ecology later cited that result as definitive, cited an updated endpoint for estuarine invertebrates derived by Canada Health that was more conservative than that used by the USEPA, and the results of a study of blue crab exposed to imidacloprid in tidal channels next to a golf course to determine that the Willapa applications posed more than a minor effect to benthic invertebrates.



- A reanalysis of the data by Pacific Shellfish Institute according to multivariate ordination technique that separated treatment from time effects indicated a negative effect among 6 of 60 tests; 2 were mollusks and 1 was crustaceans at a different site/year than that the site\year in the Ecology determination test; the same 3 metrics showed a negative effect when all site\years were pooled.
- Field and laboratory experiments with Dungeness crab and mysid shrimp showed that imidacloprid sends crustaceans into a state of tetany, or temporary paralysis, which can indirectly cause mortality through predation or other means.
- Given the importance of structured habitat for juvenile crabs, one study suggested the indirect habitat benefits provided by commercial shellfish beds would outweigh the direct costs of mortality caused by imidacloprid.

Imidacloprid is slightly toxic to fish, but only at concentrations much higher than what would have been applied to shellfish beds in Willapa Bay and Grays Harbor.

- The estimated maximum surface water concentration of imidacloprid after treatment would be 5600 ppb.
- In a laboratory study of fish species commonly found in the area, the imidacloprid concentrations needed to observe any adverse effects in juveniles – typically more sensitive than adults – were much higher: 32,000 ppb for rainbow trout, 46,000 ppb for white sturgeon, and 96,000 ppb for Chinook salmon.
- Field studies measuring imidacloprid exposure in juvenile Chinook salmon captured near treated shellfish beds after imidacloprid application found detectable levels in only 1 Chinook salmon (out of 20).
- Indirect exposure to imidacloprid through prey was considered unlikely to affect local fish species, but the Supplemental Final Environmental Impact Statement raised concerns about the effect of declines in prey abundance after treatment.

Imidacloprid is considered mostly non-toxic to birds, and most migratory bird species are not present in Willapa Bay and Grays Harbor during the summer when imidacloprid would have been applied. However, impacts on prey items might lead to indirect effects.

- For mallard ducks, 5000 milligrams is the amount of imidacloprid needed to kill half of the test animals.
- Black brants, which often forage for eelgrass on mudflats, would have to consume at least 454 kilograms of eelgrass to consume a similar amount of imidacloprid.
- The risk of imidacloprid ingestion by birds is minimal, given the small size of granules, how quickly they dissolve, and how quickly imidacloprid is diluted and broken down.

Human Health Impacts

Imidacloprid is minimally toxic to mammals and has not been found to cause cancer in humans; but *exposure to high concentrations of imidacloprid can cause temporary irritation, respiratory and/or gastrointestinal distress.*

For more information contact Nicole Naar, Social Science and Education Specialist at Washington Sea Grant at nanaar@uw.edu

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Sea Grant WASHINGTON

Washington Sea Grant
3716 Brooklyn Ave NE
Seattle, WA 98105
seagrant@uw.edu
wsg.uw.edu
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