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Non-target impacts of imidacloprid on oyster and clam larvae, young juvenile crab and estuary fish species

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Introduction: Imidacloprid is proposed as a new chemical alternative for burrowing shrimp control. Field efficacy has been shown to be adequate and its registration potential appears to be feasible. It is critical to assure that imidacloprid does not affect commercial species or native species in Willapa Bay. The goal of this project is to determine the detrimental effects of imidacloprid to oyster and clam larvae, oyster set, young juvenile crab, and small estuary fish species commonly found in vernal tide pools.

Results:

Clams: Three studies were conducted on clams in the laboratory (Figures 1,2,&3). There was no evidence that up to 72 hours exposure to imidacloprid at rates 1000 fold what they might experience for only a few hours (<1 ppm) caused any significant mortality.

Oysters: Four studies were conducted on oyster larvae (Figure 4,5,6 &7). Two of the studies suggested that imidacloprid could affect oyster larvae at concentration >1 ppm (Figure 4 & 7) , while two studies indicated that there was minimal effect up to 10 ppm (Figure 5& 6). While additional work should be done to refine the data on risk of oyster larvae to imidacloprid, it is unlikely at the water column where oyster larvae are swimming would be ever be above 0.1 ppm for even the briefest of times.

Fish: Only was study was conducted to date on estuary fish (Table 1). Those results indicate that there was no affect of imidacloprid on Threespine Stickleback or Staghorn sculpin under exposure conditions that would occur in a vernal tide pool. This contrasts to carbaryl which resulted in 89% mortality of stickleback.

Crab: Juvenile Dungeness (2-3" carapace) were not affected by imidacloprid in vernal tide pools, even at rates ten –fold of what they could be normally exposed to (Table 2 &3).

Conclusion: Based on these preliminary studies the risk to commercial and native species in Willapa Bay to imidacloprid appears minimal.

Figure 1. Mortality of freshly dug Manila clams place on 3 liter of bay water containing imidacloprid (Admire). Mortality was evaluated after 48 and 72 hours, water was held at 49^0 F. There were 29 large clams and 16 small clams per treatment rate.

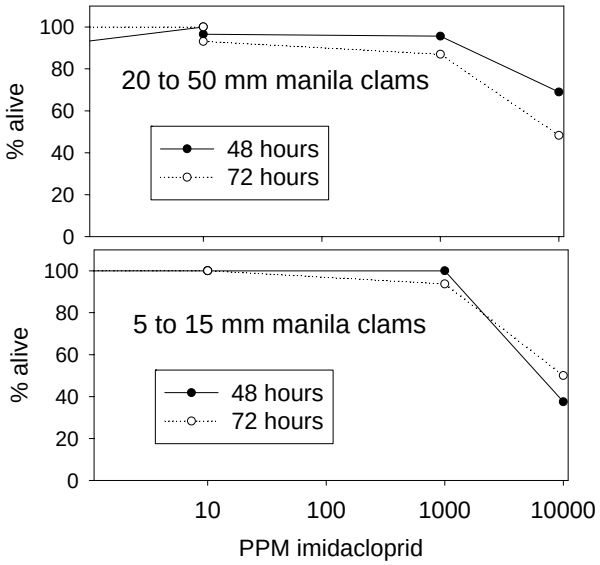


Figure 2. Morality of freshly dug Manila clams place on 4 liter of bay water containing imidacloprid (Admire). Mortality was evaluated after 48, water was held at 48^0 F. There were 10l clams per treatment rate.

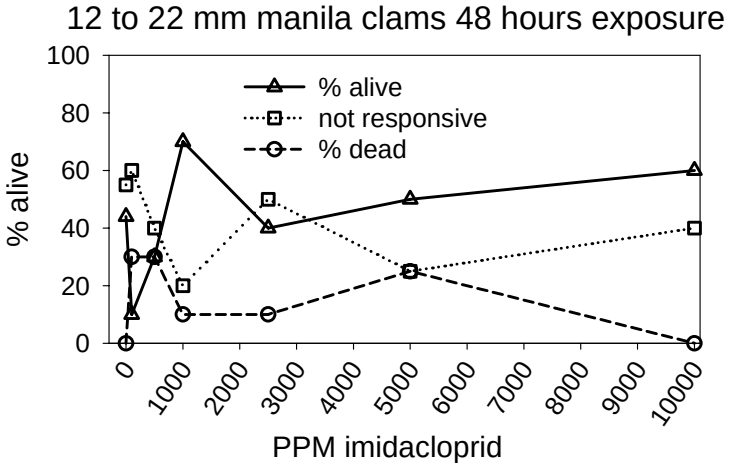


Figure 3. Morality (± SE) of fresh hatchery raised Manila clams place on 700 ml of bay water containing imidacloprid (Etigra). There were 50 1-3 cm diameter clam/ replication (3 replicated containers). Water temperature was 67^0F . After 24 hours of exposure all clams with rinsed 4 times and placed in fresh water for 24 hours, after which mortality was measured.

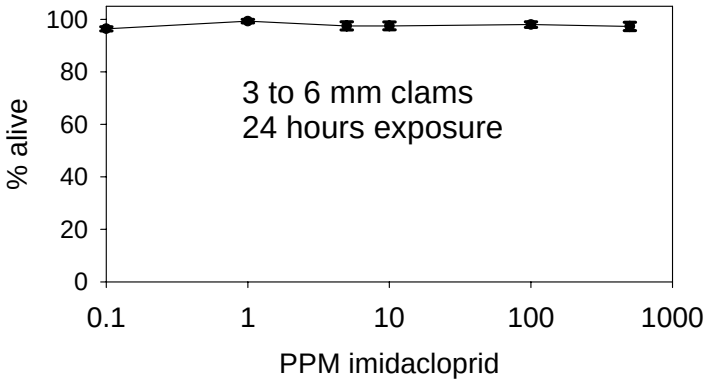


Figure 4. Free swimming tetraploid oyster larvae in 6 ml aliquot of water after 24, 48 and 96 hours of exposure to imidacloprid water (3 (2 replicated tank per treatment each ~23,000 larvae in 2000ml water @ 74^0 F).

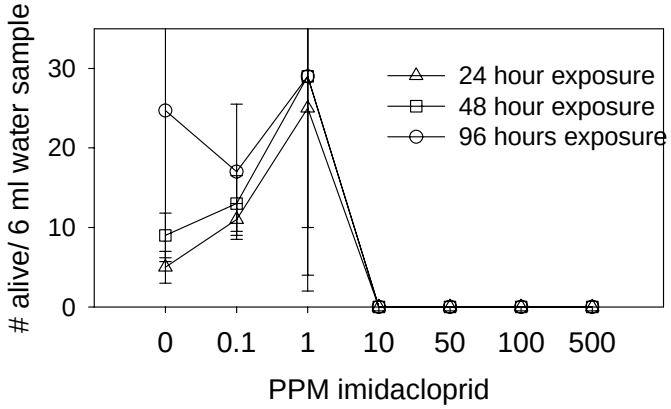


Figure 5. Tetraploid oyster larvae survival after 24 , 48 and 96 hours exposure to imidacloprid water (50 larvae in 10 ml water per test tube/ 3 replication), held at 58^0F.

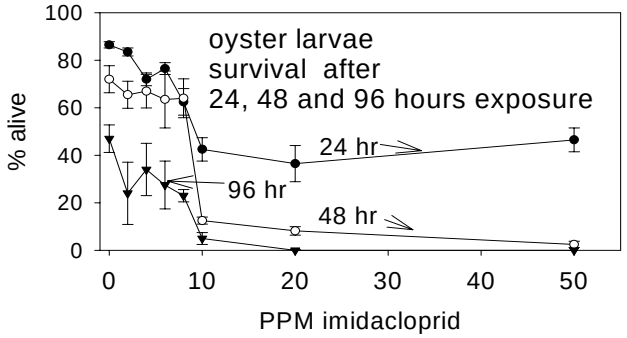


Figure 6. Tetraploid oyster larvae set on shell placed in tank from 0 to 24 hour and 24 to 48 hours exposure to imidacloprid water (3 (2 replicated tank per treatment each ~23,000 larvae in 2000ml water @ 74^0 F).

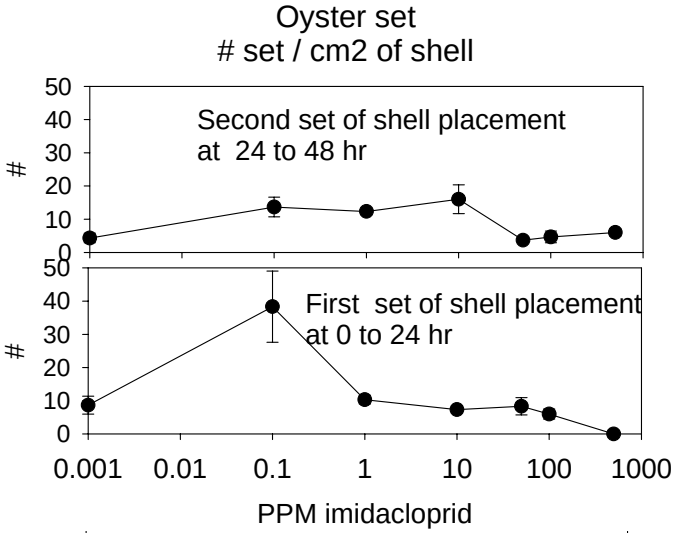
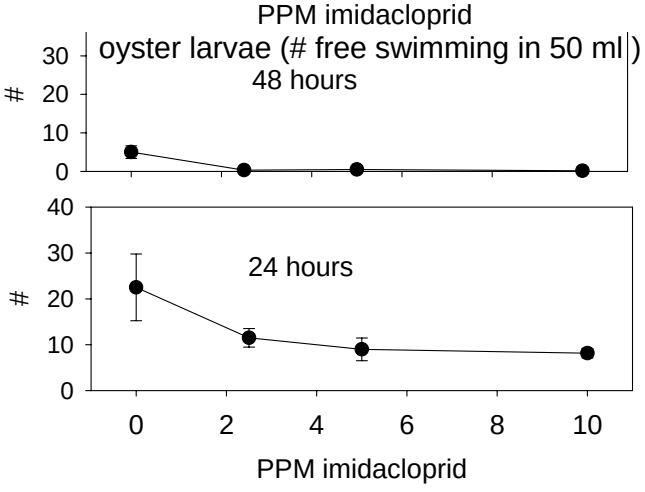


Figure 7. Free swimming tetraploid oyster larvae after 24 and 48 hour exposure to imidacloprid water (3 replicated tank per



treatment each ~23,000 larvae in 2000ml water @ 75^0 F).

Table 1. Fish mortality in vernal tide pools after being treated with an overspray of carbaryl or imidacloprid.		
	% mortality 48 hours	
Treatment	Staghorn sculpin	Threespine Stickleback
Carbaryl @ 8 lb ai/ac	88.7 a	36 a
Imidacloprid @ 0.5 lb ai/ac	0 b	0 b
control	0 b	0 b
mean separation by Duncan's multiple range test.		

Table 1. Juvenile Dungeness crab mortality in vernal tide pools after being treated with an overspray of carbaryl or imidacloprid.	
Treatment	% mortality 14 days
Carbaryl @ 8 lb ai/ac	70 a
Imidacloprid @ 0.5 lb ai/ac	5 b
control	0 b
mean separation by Duncan's multiple range test.	

Table 1. Juvenile Dungeness crab mortality in vernal tide pools after being treated with an overspray of imidacloprid at a 10x application rate. (~ 6 ppm in tidal pool water)	
Treatment	% mortality 21 days
Imidacloprid @ 5.0 lb ai/ac	90 a
control	86 a
mean separation by Duncan's multiple range test. 3 replication per treatment, 5 2-3” carapace crab per replicate.	