MASOTEN (DYLOX) AS A CONTROL FOR CLAM SHRIMP IN HATCHERY PRODUCTION PONDS

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Abstract: Information relative to control of problematical clam shrimp (Eubranchiopoda-Conchostraca) with Masoten (Dylox) was accumulated over a 10 yr period at several Southwestern hatcheries. Laboratory and field studies showed that control could be achieved with single applications of Masoten as low as 0.01 mgl (active ingredient). No deleterious effects on fry, fingerlings, or adult fish of several species were noted. Decomposition of the chemical, as well as effects on plankton and bottom fauna, are discussed. The paper places on record the efficacy of Masoten against clam shrimp, a level of treatment for same, and a suggested approach to control.

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Although clam shrimp (Eubranchiopoda-Conchostraca) are geographically widespread and the problems associated with their presence are well understood by fish culturists, only a publication by Dexter and McCarraher (1967) is currently available for reference. In their paper, the authors cited the deleterious effects of a clam shrimp (*Cyzicus mexicanus*) upon goldfish (*Carassius auratus*) production, the clogging of outlet screens by shrimp during pond-draining operations, and the arduous task of separating shrimp from fish in holding tanks prior to distribution. They also mentioned that the shrimp did not contribute to the diet of northern pike fingerlings (*Esox lucius*) reared in earthen ponds.

In our experience, turbidity caused by excessive numbers of foraging clam shrimp complicates collection and transfer of swim-up fry from spawning to rearing ponds. Turbidity also reduces fingerling production because of its undesirable effects upon photosynthesis and related natural food production, so essential for fry survival and growth. Additionally, all Eubranchiopoda compete to some degree with fry for desirable, naturally-occurring food organisms (Pennak 1953).

Dexter and McCarraher (1967) discussed 2 methods of control: interruption of the wet-dry cycle essential for the shrimp's perpetuation by not allowing ponds and associated debris to dry following harvest; and a pond treatment consisting of 29.6 ml of a liquid formulation of parathion per 37,850 l of water.

In 1965 single applications of 0.25 mg/l Dylox, an organic phosphate insecticide, were reported to be effective against related Eubranchiopoda (Hornbeck et al. 1965). As Dylox was a welcome alternative to either of the aforementioned methods, it was employed in 1966 for clam shrimp (*Leptestheria compleximanus*) control at the Dexter, New Mexico, National Fish Hatchery, a station with a history of recurrent shrimp problems (Bennel A. Nelson and Harry Bishop, personal communication). The treatment proved to be highly efficacious at Dexter. However, observed losses of chironomid larvae following treatment, coupled with scant information concerning the effects of the chemical upon plankton, prompted an investigation into the usefulness of reduced levels of Dylox against clam shrimp.

This report relates laboratory findings and results of field testing in several Southwestern states from 1967 to the present. It places on record the efficacy and level of treatment for Masoten (Dylox) against clam shrimp and suggests an approach for using the chemical for shrimp control.

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MATERIALS AND METHODS

Although most of the information contained in this report was obtained with Dylox, Masoten is an excellent alternative as it contains trichlorfon, the same active ingredient found in Dylox, Dipterex, Neguvon, etc., and is readily available from fish cultural supply houses. Masoten was developed by Chemagro and is registered for use as a parasiticide on non-food fish in impounded waters. It is effective against a variety of ectoparasites, including anchorworms (*Lernaea* sp.), fish lice (*Argulus* sp.), and gill flukes (*Cleidodiscus* sp., *Dactylogyrus* sp., and *Gyrodactylus* sp.). Masoten is available as an 80 percent soluble powder. It decomposes rapidly at temperatures above 30 C and at a pH greater than 7.4 (Ellis 1974).

Initially, 2 series of static bioassays were conducted in 1972 to provide guidelines for control at lower treatment levels. The first was undertaken at the National Fish Hatchery, Tishomingo, OK. Glass jars containing 3 l of pondwater or well water and 10 clam shrimp (*Caenestheriella setosa*), 4 tadpole shrimp (*Triops longicaudatus*), and 12 fairy shrimp (*Streptocephalus texanus*) each were treated once with Dylox at 0, .01, .04, .07 or .10 mg/l (active ingredient). All assays were run in duplicate; water temperatures ranged from 18 - 19 C. Test organisms were introduced 24 hr prior to treatment, during which time the water was aerated. Total alkalinity of the pond water was previously determined to be 254.0 mg/l, total hardness (expressed as $CaCO_3$) was 262.0 mg/l, and pH ranged from 7.75 - 7.85. The second series of assays was conducted in the same year at the Dexter National Fish Hatchery. Glass jars containing 3 l of pondwater and 10 clam shrimp (*Leptestheria compleximanus*) each were exposed to single applications of Dylox at 0, .05, .10, .15, .20 or .25 mg/l (active ingredient). All assays were run in duplicate; water temperature was a constant 23 C. Length of acclimation and aeration periods were the same as those employed at Tishomingo. Total alkalinity of the pondwater was previously determined to be 178.0 mg/l, total hardness was 2,240 mg/l, and pH ranged from 7.5 - 8.5.

Eubranchiopoda populations characteristically occur sporadically in nature and fluctuate from year to year and even from pond to pond at a given location. Consequently, the effects of various pond treatment levels were opportunistically assessed at several hatcheries from 1968-77. The first pond observations were made at the Dexter hatchery in 1968. Nine 0.4 ha largemouth bass (*Micropterus salmoides*) spawning and rearing ponds were treated that year with single applications of Dylox at the usual 0.25 mg/l (active ingredient) level. The chemical was applied by spraying the surface of affected ponds.

Because of personnel changes, it was not until 1972 that arrangements could be made to resume testing at Dexter. At that time, another 0.4 ha largemouth bass spawning pond was affected by clam shrimp. The pond was treated once with 0.25 mg/l Dylox applied as a spray. Turbidity readings were made prior to and 24 hr following treatment with a Bausch and Lomb Spectronic 20.

In 1973 3 more largemouth bass rearing ponds were affected by shrimp at Dexter. Two ponds were treated once with Dylox at 0.15 mg/l and the other at 0.12 mg/l. In all instances, the chemical was applied by spraying. Earlier that same year, 3 striped bass (*Morone saxatilis*) rearing ponds at Tishomingo were affected by clam shrimp. In this case, all ponds were treated once with 0.1 mg/l Dylox. A boat-bailer was used to disperse the chemical thoroughly in the ponds.

Only 1 pond developed shrimp problems at Dexter in 1974. It was treated with Dylox at 0.1 mg/l as a spray. Turbidity readings were again taken prior to and following treatment at 24 hr. Water temperature was 22 C at the time of treatment.

In 1975 10 largemouth bass rearing ponds at the San Marcos State Hatchery were affected by clam shrimp and/or tadpole shrimp. Single applications of 0.1 and 0.15 mg/l Dylox were used. The higher rate was employed in ponds where both shrimp types were present. Treatments were applied by introducing the chemical as a slurry along an upwind levee. Six additional largemouth bass ponds containing only clam shrimp were similarly treated with 0.1 mg/l Dylox at San Marcos in 1976. In 1977 2 striped bass rearing ponds were treated with Masoten for clam shrimp control at the 0.1 mg/l rate. Total hardness of San Marcos pondwater normally ranged from 160.0 - 225.0 mg/l. Temperatures at treatment ranged from 13°-24° C and pH from 7.5 - 9.0.

RESULTS AND DISCUSSION

Results of bioassays conducted at Tishomingo and Dexter in 1972 were essentially the same, despite inherent differences in water quality. At levels of .01 mg/l or greater, all clam shrimp were dead by 2 hr posttreatment. No shrimp in the untreated (control) jars succumbed during the trials. In the presence of tadpole and fairy shrimp, clam shrimp were found to be most sensitive to Dylox, followed by tadpole shrimp and lastly, fairy shrimp. This same observation has been made on numerous occasions in ponds.

Field results closely paralleled those obtained in the laboratory. Clam shrimp control was achieved with Dylox at all levels tested. Shrimp treated at levels of .15 mg/l or more were killed more rapidly than those exposed to .12 or .10 mg/l.

Turbidity measurements of water samples collected from affected ponds prior to and following treatment were indicative of the degree of control achieved. For example, a turbidity of 112.0 J.U. (Jackson Units) was recorded from a Dexter pond prior to treatment at .25 mg/l. Twenty-four hours later, turbidity had been reduced to 44.0 J.U. In another Dexter pond, a turbidity of 114.0 was recorded prior to treatment with .10 mg/l Dylox. Similarly, turbidity 48 hrs later was reduced to 8.0 J.U.

No losses of fry, fingerlings, or adult fish attributable to treatment were observed during the course of the study period. This observation is in agreement with the work of Hornbeck et al. (1965). Largemouth bass in spawning ponds affected by shrimp at Dexter remained on their nests during treatment and the ensuing "clearing" period.

Although no attempt was made during this study to define the effects of treatment upon plankton and benthos, it was generally noted that some plankters were not affected. In some instances chironomids were, particularly at the 0.25 mg/l rate. Information reported by Ellis (1974) indicates that phytoplankton and rotifera are unaffected at 0.25 mg/l, whereas, cladocerans are susceptible to Masoten at levels as low as 0.1 mg/l. He further reported that copepodids were killed in one instance at levels ranging from 0.1 - 0.5 mg/l. However, McCraren and Phillips (unpublished data) found populations of *Diaptomus* sp. to be unaffected by single applications of Masoten at 0.25 mg/l. Effects of the compound on benthos warrant further investigation.

Based on laboratory and pond observations, newly hatched clam shrimp can be recognized approximately 3 days following introduction of water and highly turbid conditions can be anticipated by 2 weeks. Consequently, effective control measures must be based on early recognition of the problem. A suggested approach to control is as follows: (1) fill ponds rapidly to effect as complete a hatch of shrimp as soon as possible; (2) observe ponds daily for newly hatched shrimp (water control structures and steps provide an excellent background for observation); (3) when shrimp are noted, treat with no more than 0.1 mg/l Masoten (active ingredient); and (4) initiate routine fertilization program. Use of this approach should circumvent any effects on desirable, naturally occurring fish-food organisms because of the low level of treatment and the compound's rapid degradation rate.

The control related in this paper was obtained under favorable conditions. Attempts to control clam shrimp at temperatures near 30 C coupled with a pH of 8.5 may require a higher treatment level.

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