presentation for the Louisiana Mosquito Control Association meeting, and identification cards for Mosquito Control personnel.

Classes were held for several groups including an environmental health class from Dillard, and a group of students from Pakistan.

Other video projects completed during the year include, "the War on Drugs" for the city's public information department, taping and editing the city's substance abuse seminar, and taping and editing an international seminar on mosquito borne diseases held at New Orleans Mosquito Control.

BIOLOGICAL CONTROL (COPEPODS) – GERRY MARTEN

During 1990 we continued to monitor field experiments that we started in 1989 with cyclopoid copepods (i.e., "cyclops") in discarded tires. All the Macrocyclops albidus that were in our Big Oak Island experimental tire piles during 1989 were killed when the water in the tires froze solid during a severe cold spell in December 1989. We reintroduced Macrocyclops to the tires in March 1990. The single treatment provided excellent control of Aedes albopictus and Ae. triseriatus larvae for the rest of 1990.

Many of the Macrocyclops albidus, Acanthocyclops vernalis, and Diacyclops navus that we introduced to the large tire pile near Resthaven Cemetery survived the cold spell and continued to provide control of Aedes larvae in 1990.

In 1990 we added a new species of cyclops to our mosquito control arsenal: Mesocyclops longisetus. We started field trials with M. longisetus in tires in May 1990. Mesocyclops longisetus proved highly effective for control of Aedes larvae. All fifty tires that were treated with M. longisetus at the beginning of the summer still had them at the end of the year, and the number of Aedes larvae in tires treated with M. longisetus was on average about 0.1% of the number of larvae in untreated tires.

Bti became a routine part of our cyclops operations during 1990. Bti has no deleterious effect on cyclops, but it can accelerate the full effect of cyclops treatment by killing larvae that are too large for cyclops to kill at the time the cyclops are introduced to a mosquito breeding site. The Bti kills all larvae, and the cyclops maintain the treatment by killing all new larvae. We tested the effectiveness of this procedure by treating 10 tires only with Bti and Macrocyclops at the same time. Ten untreated tires served as controls. All larvae were killed in the tires treated with Bti, but in tires with only Bti, the larvae were back in full force within a few weeks. All larvae eventually disappeared from the tires treated with Macrocyclops, but it took more than a month in some tires. In the tires treated with both Bti and

Macrocyclops, the larvae disappeared immediately and no more were seen for the rest of the year.

Our work with cyclops and container-breeding Aedes also included technical backup to add cyclops to Rockefeller Foundation/Johns Hopkins University projects for Ae. aegypti control in Puerto Rico and Honduras. The project in Puerto Rico was operated by the CDC San Juan Laboratory, and the project in Honduras by the Honduran Ministry of Public Health.

We started to explore the role of cyclops for mosquito control in groundwater habitats during 1990. We conducted a survey of cyclops in swales (temporary pools) that were created after a period of exceptionally heavy rainfall in February. About half the swales without larvivorous cyclops contained Ae. vexans larvae, and the same was true for swales that contained only Diacyclops navus. However, only 28% of the swales with Acanthocyclops vernalis contained Ae. vexans larvae, and none of the swales with Macrocyclops albidus contained Ae. vexans larvae.

We also studied cyclops in rice fields. At the beginning of May, shortly after the rice fields were flooded for the first crop, Mesocyclops ruttneri, Mesocyclops edax, Mesocyclops longisetus, and Macrocyclops albidus were introduced to a field in Jefferson Davis Parish. There were natural populations of Acanthocyclops vernalis in the treated field and adjacent fields at the time of the introductions. We did not see any of the introduced species in the field until the beginning of July, when all four introduced species were abundant. In the meantime, Acanthocyclops had disappeared from the treated field, even though it was still in adjacent, untreated fields. There were virtually no Anopheles larvae in the field, even though there were larvae in adjacent fields. The field was not flooded for a second crop, but when damp soil in the field was collected in November and flooded with water, live cyclops of all three species of Mesocyclops were abundant in the soil. When the field was examined in February 1991, Macrocyclops albidus was abundant in puddles in the field.

With collaboration from Jefferson Davis Parish Mosquito Control, we sampled a series of rice fields there for cyclops and mosquito larvae in August, a few weeks after flooding for the second crop. Some of the fields contained Acanthocyclops vernalis, and the other fields contained Mesocyclops ruttneri. Fields with Acanthocyclops vernalis contained fewer Anopheles larvae than fields with no larvivorous cyclops at all, and fields with Mesocyclops ruttneri contained even fewer larvae than fields with Acanthocyclops.

In collaboration with St. Tammany Mosquito Control, we sampled Nunez Marsh in St. Tammany Parish for cyclops in July 1990. Natural populations of Macrocyclops albidus were abundant in most of the marsh, though we did not find them everywhere. We sampled Bayou de Lesiere Marsh in Orleans Parish. This marsh is dry much of the time.

Acanthocyclops vernalis was abundant throughout the marsh, except in areas of open water, where there were fish.

We also studied cyclops in septic ditches in collaboration with St. Tammany Mosquito Control. Macrocyclops albidus was abundant in the ditches on a patchy basis in the spring. Small numbers of Acanthocyclops vernalis were occasionally found in the ditches. In the summer, when many parts of the ditches dried up and the water that remained was shallow, Acanthocyclops disappeared, and Macrocyclops retreated to the culverts. Macrocyclops began to appear in the ditches again in the autumn. We conducted experiments in 5-foot-diameter cylindrical enclosures in the ditches by placing the enclosures where there were natural populations of Macrocyclops or by introducing Macrocyclops to the enclosures if there were none in the first place. We then placed 1,000 or 3,000 newly hatched Culex quinquefasciatus larvae in the enclosures and counted them after five days. Whereas survival of the Culex larvae was 60% in controls (without cyclops), there were no survivals when 1,000 larvae were introduced. When 3,000 larvae were introduced, there were usually no survivors, but sometimes as many as one hundred larvae survived.

In summary, the results from various kinds of groundwater habitats have been very promising. It appears that natural populations of larvivorous cyclops are reducing mosquito larvae in every kind of groundwater that we examined. We will continue to monitor cyclops and mosquito larvae in these habitats during 1991, to clarify the relationship between cyclops and mosquito larvae, and we will initiate field trials by introducing larvivorous cyclops to some of the groundwater habitats.

We moved into our new biocontrol facility in September. The laboratory has an abundance of space for cyclops production. For cyclops production in the facility, we set up fifty fiberglass trays of the same design that the New Orleans Mosquito Control Board has used for Toxorhynchites production. By the end of the year, the production process was going smoothly, and we had the capacity to produce more than a million cyclops per month.