SOME PERSONAL OBSERVATIONS ON THE TREATMENT OF
CLEAR LAKE, CALIFORNIA FOR THE CONTROL OF
THE CLEAR LAKE GNAT

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I had the good fortune on September 15
and 16, 1946, to witness the treatment of
Clear Lake in California, for the control of
the Clear Lake gnat (Chaoborus asiecopus
Dyar and Shannon). Without doubt, this
operation together with the research lead-
ing to the final operation, was among the
most unique ever carried out in the field
of entomology.

This is not a scientific report of the
research or of the control procedure. It is,
rather, a brief popular account of this
unusual insect control program.

The Clear Lake gnat problem is strictly
a local one confined to Lake County,
California. During summer months on
warm calm evenings, the gnats are on the
wing in countless millions. They create a
serious nuisance in many ways by sheer
weight of numbers. They are strongly at-
tracted to lights. Homes are invaded.
They smear windshields on cars. They
plug car radiators. They make any func-
tion unpleasant, either indoors or out-
doors, by contaminating foods. Their
presence in such huge numbers creates a
favorable situation for spiders; practically
everything becomes encased in a veil of
spider webs. The gnats constitute a health
problem, I am told, because a number of
local people have developed allergies to
them.

This otherwise wonderful recreational
area could not develop to its maximum
potential because of the gnat nuisance. It
is believed, and I think rightly, that gnat
abundance at Clear Lake is the only reason
people from near-by metropolitan areas do
not take full advantage of this splendid
recreational area. The people of Clear
Lake are naturally anxious to control the
gnat, not only to relieve a personal nuis-
ance, but also with the hope that the area
will develop from a financial standpoint.

A great deal of research has gone into
the Clear Lake gnat problem. In the early
thirties research was undertaken by the
University of California. Basic information
on the gnat’s biology was obtained, and
possibilities of utilizing light traps were
also studied as a control measure.

Congress appropriated funds to the
Bureau of Entomology and Plant Quar-
antie in 1938 to study the biology and
control of the gnat. This work was under-
taken by the Division of Insects Affecting
Man and Animals, then headed by Dr.
F. C. Bishopp.

Mr. A. W. Lindquist was placed in
charge of the research station located at
Clear Lake. He was assisted by Dr. C. C.
Deonier. Intensive studies were under-
taken on the life history, habits, ecology,
and possible control measures during 1938
to 1942. Valuable scientific information
was obtained, not only about the gnat
itself but also with regard to other forms
of aquatic life including fish. All promis-
ing control measures were explored.
Among these were light traps and burning
of gasoline in areas where the eggs of the
gnat had accumulated, usually along the
shore line. No control program was initi-
ated, however. During the war the work
was discontinued and the personnel were
assigned to the Bureau’s laboratory at
Orlando, Florida, for research on other
problems then demanding solution.

In 1946 Mr. Lindquist was placed in
charge of the Corvallis, Oregon, laboratory
of the Bureau. Fortified with the vast
amount of experience he had gained at
Orlando in research on mosquitoes and
other problems involving the use of new
insecticides, he undertook exploratory
studies to determine if the gnat larvae or adults might be controlled with the new chemicals. It was difficult to carry out a research program at Clear Lake from Corvallis headquarters. Nevertheless, through a series of brief trips, he and his assistants demonstrated, by laboratory tests, that the application of certain chemicals offered exceptional promise as a control measure for the gnat larvae. DDT was among the most effective of the new materials when used at dosages as low as 1 part to 100 million parts of water. TDE appeared equally outstanding.

The primary unanswered questions were: (1) Will treatment of a lake with these insecticides kill the gnat larvae? (2) Will control be obtained without killing fish?

Various formulations of DDT and TDE were then tested against gnat larvae under different conditions. The California Fish and Game Department cooperated by testing the formulations against fish. Finally it was decided that TDE applied as an emulsion concentrate offered most promise from both the standpoint of larvicidal efficiency and safety to fish. A small lake of about 75 acres near Clear Lake was selected for a "pilot plant" test, in December, 1947. Mr. Lindquist and Mr. Roth of the Corvallis laboratory applied the treatment at the rate of 1 part of TDE to 50,000,000 parts of water. Mr. Garth Murphy of the California State Fish and Game Department studied the effects of the treatment on fish directly and also studied the important question of possible long range effects of the treatment on fish due to destruction of aquatic life consumed as food by fish.

The experiment was considered a success. Complete control of the gnat larvae was attained after about one month. A few fish were killed, however. Death of the few fish was attributed largely to improper dispersion of the emulsion in the water.

To be certain, however, a second test was made in 1948 in another small lake. TDE was applied at the rate of 1 part of TDE to 75 million parts of water. Complete control of the gnat larvae was attained in this test without apparent harmful effects on the fish.

Residents of Lake County, California, were greatly interested in the progress of these experiments. They cooperated in every possible way and supported the work by meeting a part of the expenses of the research program. They organized a gnat and mosquito abatement district under the laws of the State of California. Then the County appropriated funds for a program to treat Big Clear Lake. The Bureau of Vector Control of the California State Health Department, allocated part of the funds and cooperated in other ways.

When residents of Lake County showed determination to go through with a program to treat Clear Lake, Mr. Lindquist told them that according to the experimental results a successful program might be possible. He advised the County Supervisors and the abatement organization, however, that a venture of this type represented a large jump from treating a lake of 50 acres to treating one of 40,000 acres. No one could be sure, he explained, that the treatment would be a success but he offered to assist in every way possible, and agreed to provide necessary technical supervision in planning and carrying out the program. The county officials consulted with California State game specialists and Mr. Murphy was assigned to assist and to observe the effects of the insecticidal application on fish. The many details of arranging the program were carried out by Lake County residents. Tom Garner, County Clerk, Mr. Hutchcock, Chairman of the County Supervisors, J. K. Peterson, and many others did an excellent job in arranging all the details of the general plan which Mr. Lindquist proposed to them.

The program was carried out in every way according to plan. The actual treatment of the lake was made in an excellent manner.

The date for making the treatment was set for September 15, 1949. At dawn that
day six tugs, each pulling barges loaded with drums of TDE emulsion base containing 20 percent of TDE, 10 percent of Triton X-100 and 60 percent of xylene, were on their way to the respective sections of the lake assigned to them for treatment. See Figure 1.

The emulsion concentrate was applied undiluted to the water through a small hose by gravity feed. It was applied in the wake of the barges as shown in Figure 2 in order to obtain efficient emulsification in the water. The rate of delivery had been calculated beforehand, taking into account the speed of the tugs, the average depth of the water, and width of “swath.” The desired rate of application was 1 part of TDE to 75,000,000 parts of water. The schedule called for completion of the treatment in two days, which necessitated distributing 14,000 gallons of insecticide concentrate.

The enthusiasm of the people of Lake County was the real highlight of the occasion. This operation was not an experiment in any way to them—it meant the end of the Clear Lake gnat. They designated the date of the treatment as “G E day”—G E, meaning “Gnat Eradication.” A replica of the gnat, 4 feet long (Figure 3) was constructed by the local undertaker. The effigy was called “G. Nat.” It was placed in a coffin on the Court House lawn where it lay in state for several days prior to its disposition for all to “mourn.” (Figure 3)

Every resident of the county apparently was present on the night of September 15.
to pay final tribute to Mr. G. Nat. A number of notables were present, and a clever, well-prepared eulogy was delivered by Mr. Crump, a local attorney. This was followed by a song about the gnat, written by another Lake County resident. It was sung to the tune of "We'll be glad when you are dead—you rascal you." Following the ceremony, "G Nat" was placed on a bier in the lake and burned.

The celebration was certainly premature to those of us who know about the many disappointments that can occur in the best planned control projects, especially in new ones. I am sure all entomologists present, especially Mr. Lindquist, felt serious responsibility in developing this program, and he, more than anyone else realized how disappointed the people would be if the program failed to accomplish the objective.

The results of the treatment are being reported more fully by Mr. Lindquist and his associates, and by Garth Murphy, Arve Dahl (Bureau of Vector Control of California) and others. Although at this writing it is too early to estimate the success of the program, it can be stated that a good share of the estimated 714,000,000,000 gnat larvae (Mr. Lindquist's figure) in Clear Lake were dead within 48 hours after the treatment was applied.

Entomologists know that eradication means 100 percent kill, and they realize that it even one percent of a species survives it may be only a short time before the original numbers are back again. Nevertheless, we hope the treatment undertaken will mean relief from the gnat to residents of Lake County for at least a year. If so, in my opinion, the program will have been a great success.

FIELD NOTES ON MOSQUITOES COLLECTED IN LIBERIA, WEST AFRICA *

by

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The coast of Liberia is characterized by many tidal lagoons and creeks which are fringed with mangrove trees (Rhizophora mucronata). The land around the coastal towns and villages is low and swampy. Secondary vegetation is dominant since most of the land has been cleared of virgin forests.

Mixed forested regions prevail in the hinterland. Here, the land is marked with rolling hills and low mountains. Streams, which are fed by the heavy rainfall, are numerous. This water is usually clear and potable. There are no extensive ponds; swamps, however, are encountered frequently.

The rainy season begins in April and terminates in November. The rains are torrential and the total annual rainfall is usually more than 170 inches. During the wet season the trails are inundated and the narrow streams are considerably swollen.

Although there is a dry period, no month on the coast is entirely free from rain. As a rule, January and February are the driest months.

Due to the geographical position of Liberia, (4° 22' to 8° 50' north latitude, and 70° 33' to 11° 52' longitude west of Greenwich), the climate is equatorial. Humidity in the hinterland, however, is much less than that on the coast.

While stationed in Liberia (1943 to 1945) I had the opportunity to make brief reconnaissance collections of mosquitoes.

* A contribution from the Department of Biology, The Catholic University of America, Washington, D. C.