Fisheries and Environment Canada
Pêches et Environnement Canada
0022470E S

CANADIAN WILDLIFE SERVICE. PESTICIDE SECTION. MANUSCRIPT REPORTS

ELIAS

PESTICIDE SECTION

CANADIAN WILDLIFE SERVICE

MANUSCRIPT REPORTS

AMPHIBIAN AND REPTILE MONITORING DURING THE 1969-1971 NEW-BRUNSWICK SPRUCE BUDWORM SPRAY PROGRAM

No. 30

A.M. RICK
&
I.M. PRICE

1974

QP
82.2.P6
C36
No.30

CANADIAN WILDLIFE SERVICE

PESTICIDE SECTION

MANUSCRIPT REPORTS

C.W.S. Manuscript Reports are compilations of research data reflecting the activities of Toxic Chemicals (formerly Pesticide) Section personnel and contractors and are not intended for general distribution. Some of the material in this report will eventually appear in published form, and prior right to publication is reserved. Enquiries concerning the content of this report should be addressed to the author; requests for copies should be made to the author or to the Toxic Chemicals Section, Canadian Wildlife Service, Department of the Environment, Ottawa, Ontario, K1A 0H3.

0022470E S
7008141E M

AMPHIBIAN AND REPTILE MONITORING DURING THE 1969-1971 NEW BRUNSWICK SPRUCE BUDWORM SPRAY PROGRAM

Anne Meachem Rick

National Museum of Natural Sciences

Ottawa

and

Iola M. Price

Canadian Wildlife Service

Ottawa

ENVIRONNEMENT CANADA
BIBLIOTHÈQUE
RÉGION DU QUÉBEC

SCF

QP
82.2.P6
C36
No. 30

In 1969 the Canadian Wildlife Service extended its environmental monitoring of the New Brunswick spray program to include amphibians and reptiles. Those vertebrates, especially frogs and toads, are common throughout most of the area during June, when most budworm (Choristoneura fumiferana) spraying occurs, and therefore seemed good candidates for a study on possible pesticide-wildlife effects. Brief investigations of both amphibians and reptiles by CWS during 1952 in the Upsalquitch region had shown that DDT applied at the rate of 1 lb/acre caused some mortality among frogs and tadpoles[1]. Analysis of salamanders, tadpoles, frogs and snakes collected by CWS in 1967 in the Boisetown area had indicated the presence of DDE and other DDT residues in those animals in the spray area[2].

No data were available concerning either immediate or long-term effects of the newer organophosphate and carbamate budworm insecticides on any of those animals. We therefore studied the effects of three new budworm control chemicals on amphibians and reptiles: in 1969, Zectran in the Acadian Forest Experiment Station east of Fredericton; in 1970, fenitrothion in Fundy National Park; and in 1971, Matacil in the area west of Richibucto. Insecticides were reported to have been released from aircraft at the following rates: Zectran, 1 oz/acre; fenitrothion, 2 oz/acre in each of two sprayings 9 to 17 days apart; and Matacil, 1.5 oz/acre[4][5][6].

SCF

We had three prime considerations in designing our study: it had to be inexpensive, short-term (2-3 weeks), and extremely flexible. CWS bird census studies in previous years had shown that elaborate population studies or long-term activity censuses were not feasible in the operational context of the New Brunswick spraying program[3]. Frequent changes in spray schedules, because of weather and other technical problems faced by the spraying company, often meant that spray block locations and spraying times were not known until the last minute. Our experiences confirmed this judgement; control plots were sprayed, some ponds were destroyed by a bulldozer, spray schedules were changed and captive animals died from starvation or dessication when spray dates were postponed. Additionally, we had no voice in the selection of study blocks and therefore did not always find enough suitable study sites within and near the designated spray blocks to carry out a balanced evaluation.

What we present here is a generalized outline of three years' experimentation with simple techniques for assessing immediate effects of forest spraying on amphibians and reptiles, in an attempt to find study methods compatible with the operations of the spraying agency, Forest Protection Limited. Although the experimental design remained basically the same through the three years, there was variation in emphasis on techniques in different years as well as some refinement in study design. Because of the difficulty of giving a meaningful summary of data from all three monitoring studies in a short report, we have broadly summarized our findings in the hope that this will help others who attempt amphibian and reptile monitoring.

We tried to measure immediate effects of spraying by means of 1) a frog and toad activity census; 2) post-spray observations on caged and free-living adult amphibians, tadpoles and reptiles; and 3) post-spray searches for dead individuals. The activity census was based on counts, made almost every afternoon and night throughout the study period, of every frog and toad at each census site, and this census constituted the major portion of each year's monitoring project. Frog and toad breeding choruses heard at and near the study sites were identified and their intensity estimated, as another indication of amphibian activity which could supplement data from the daily counts.

Each spring we arrived at the selected area from two to seven days prior to the scheduled spray date and immediately made a rapid survey of suitable frog and toad habitat, noting the species present and selecting ponds and ditches for use as experimental and control census sites. Numbers of both experimental and control sites varied each year depending on location and availability, but we utilized a total of 10 - 15 sites each year. Censusing began at each site as soon as we found it and continued for several days after the experimental forest plot was sprayed. We counted frogs and toads each afternoon and night (whenever possible) by walking around and/or through each census area and counting numbers of each species seen. This technique permitted us rapid identification and counting without the need to handle the animals, so there was minimal disturbance of ponds and ditches during each circuit. One complete circuit of the census route (afternoon or night) usually took 3 - 4 hours, depending

on accessibility of the sites as well as the distance between experimental and control plots. Night counts were made with the aid of headlamps or 6-volt flashlights.

While we easily identified large individuals in this manner, we sometimes (mostly in 1971) confused small leopard frogs (Rana pipiens) and green frogs (R. clamitans) and this had to be taken into account when tabulating data. Another problem occurred in distinguishing mink frogs (R. septentrionalis) from green frogs, for some individuals of these two species look much alike. Because we could not visually separate some of these frogs during our census counts we arbitrarily classified them as green frogs in the census. We assumed, on the basis of our knowledge of the region and our preliminary surveys each year, that only a small proportion of these "doubtfuls" were actually mink frogs and that their inclusion in the green frog counts did not affect the overall census results. Frogs or toads reaching hiding places in the water before they could be seen and identified were enumerated by sound when they hit the water and classified as "unidentified". Although these animals obviously could not be assigned to species, we used their numbers when assessing total frog and toad activity at each site during each circuit. Frog calling intensity was also noted during all census rounds.

Just prior to a scheduled spraying we placed tadpoles in cages (up to 20 per cage) made entirely of aluminum window screening or in screen-covered plastic trays and returned them immediately to their point of capture. Separate experiments had shown us that under these

conditions and with proper handling, tadpoles survived for at least four days with no mortality. We then observed the tadpoles periodically for several days after spraying and noted any deaths. In 1970 we collected American toads (Bufo americanus), green and mink frogs, a wood frog (R. sylvatica), red-backed salamanders (Plethodon cinereus), red-spotted newts (Notopthalmus viridescens) and an eastern garter snake (Thamnophis sirtalis) from several nearby locations and transported them to census sites for exposure to the spray or to act as control specimens. In 1971 we ran only one cage test — with a leopard frog; in 1969 no animals were caged. In all years we made one or two special circuits of the census route immediately after the spraying to search the vicinity of each site for dead tadpoles, adult amphibians and reptiles, and for animals exhibiting aberrant behavior. The caged animals were also observed during these post-spray circuits. We resumed regular censusing within 32 hours after each spraying and continued for 2 - 14 days post-spray.

During each year's study we recorded a total of approximately 2000 separate observations of frogs and toads in the activity census. In 1969 green frogs comprised the vast majority of our observations and American toads, leopard frogs, wood frogs and mink frogs were present in only small numbers. In 1970 green frogs were again the major species; a few American toads, leopard, wood and mink frogs as well as some pickerel frogs (R. palustris) were also noted. Only three species were present at the 1971 census sites: green and leopard frogs and American toads. Interpretation of 1971 data was more difficult than that of previous years because there were about

three-fourths as many leopard frogs counted as green frogs; the green frog was thus not the overwhelmingly dominant species it had been in the other two years. Since many small frogs escaped into hiding before they could definitely be identified, we do not know the real 1971 green frog to leopard frog ratio.

Spring peeper (Hyla crucifer) choruses were heard during many of our census rounds each year, but these small frogs were seldom seen and thus do not appear in our counts.

Most of the tadpoles we used for our cage studies in all three years were wood frog tadpoles; a few were green frog tadpoles which had overwintered. Salamanders and snakes were seldom seen; only in 1970 did we see a few salamanders. We also saw a few eastern garter snakes each year.

The census data gave us a good idea of the numbers and activity patterns of the major amphibian species in the area before and after insecticide was applied. Despite complex weather factors which caused variations in counts at both experimental and control sites, our own counting errors, and movement of frogs and toads to and from the census ponds and ditches, we could distinguish general activity patterns for each site. Therefore, we think that if insecticide spraying had caused significant mortality or lethargy, the established patterns would have been altered and we would have detected the change. In fact, no definite drop in numbers or other change in the

frog and toad populations occurred that could be attributed to effects of the spray.

Our estimates of frog-calling activity did not yield any useful data to supplement the census counts because we were inexperienced in estimating numbers of frogs or toads in a particular chorus. In 1970 and 1971 we made only brief notes on calling activity, preferring to allow more time for census counts. However, this technique may still be a useful one in monitoring studies.

Our post-spray searches for dead amphibians and reptiles produced no data to indicate immediate toxic effects of the spray insecticides. Over the three years we found very few dead animals (frogs at both control and experimental sites). The one frog found dead at an experimental site died before spraying occurred. The mortality we saw, then, was not connected with spray operations. Since our intensive post-spray searches were made soon after spraying, were sometimes repeated several hours later if time permitted, and were followed by shorter searches during the first regular census following spraying, we are confident that we would have spotted dead animals before they could be removed by scavengers.

Once we solved the technical problems involved in caging tadpoles there was no mortality at control sites. Nor was there any tadpole mortality at experimental sites in 1970. In 1969 some tadpoles died after a trial spraying with fuel oil but without insecticide; tadpoles were also found dead after a Zectran spraying. Mortality also occurred among caged tadpoles after a Matacil spraying in 1971. Most tadpoles died within a day after

spraying, some within a few hours after spraying took place. Many tadpoles in cages did survive spraying; we think the water depth and the uneven paths of the spray aircraft affected the amount of insecticide which actually reached them. However, we do feel that this caging technique is a valuable one which can be used as a sensitive indicator of aerial pesticide toxicity to larval amphibians.

The experiments with caged adult amphibians and reptiles exposed to the spray were of little value, in our opinion. Too much valuable time was spent in 1970 collecting and caring for the animals and we were not able to maintain them in good health until the spraying date. Perhaps a future monitoring project with a larger staff could make better use of this technique.

We came to no conclusions about effects of insecticide spraying on salamanders or snakes, since our observations on these were so few.

Results of our monitoring studies indicated that the three tested insecticides released from aircraft at the stated dosages had little immediate effect on frogs, toads and tadpoles, but we can say nothing of long-term effects on these forms or of immediate or long-term effects on salamanders and snakes. The three insecticides we monitored, Zectran, fenitrothion and Matacil, are modern chemicals which have been developed to be toxic to the target insects at low dosage rates, rates which one hopes are harmless to non-target organisms such as wild vertebrates. This hope was borne out by our studies, at least in regard to immediate toxicity.

Perhaps as important as the results of our studies was our development of monitoring techniques. Since little work of this kind has been done on amphibians and reptiles in the past, we think that our techniques may prove to be valuable to others who want to evaluate immediate effects of aerially-sprayed insecticides on amphibians and reptiles.

REFERENCES

1. Boyer, G.F., and S.W. Little. 1952. Effect of aerial spraying during the Upsalquitch Project, 1952. Report on file with Canadian Wildlife Service, Ottawa.

2. Canadian Wildlife Service, Ottawa, unpublished data on file with Toxic Chemicals Section.

3. Pearce, P.A., personal communication.

4. Pearce, P.A., and A.M. Rick. 1969. Effects of Zectran spraying on forest birds and frogs in New Brunswick. B. Effects on frogs. Canadian Wildlife Service, Pesticide Section Manuscript Report No. 18.

5. Rick, A.M., and I.M. Gruchy. 1970. Effects on amphibians. IN: Summary of Canadian Wildlife Service supported projects - 1970 New Brunswick Spruce Budworm Control Program. Appendix XX, Interdepartmental Committee on Forest Spray OPerations, October, 1970, Ottawa.

6. Rick, A.M., and I.M. Gruchy. 1971. Amphibian monitoring during 1971 Matacil trials in New Brunswick. Appendix VII, Interdepartmental Committee on Forest Spraying Operations, November, 1971, Ottawa.