ORAL DRUGS USED TO CAPTURE WATERFOWL[1] [2]

By E. Dale Crider and Jimmie C. McDaniel,
Wildlife Research Projects Office,
Florida Game and Fresh Water Fish Commission,
Gainesville, Florida.

ABSTRACT

Between 1964 and 1968, diazepam, methohexital, methoxymol, secobarbital and tribromoethanol were administered on bait to free-feeding waterfowl of several species in Florida. Characteristics for each of five such agents include varying speed of induction, duration of anesthesia, toxicity, and other pharmacological considerations. Anesthesia was produced with several dosages of each compound, but additional tests are needed to refine dosage rates. Distasteful compounds were not readily ingested which may have biased results in a few cases.

The use of anesthetic agents for zoo and domestic animals has been discussed by Lumb (1963), Lawrence and Bacharach (1964), and Barnes and Eltherington (1966), but little information is available about anesthetic agents for wild animals.

Literature on the relatively few central nervous system depressants which have been used orally to capture wildlife is reviewed elesewhere in these proceedings (Crider, *et al,* 1968). Until now alpha-chloralose has been the principal agent used. Williams (1966), Crider and McDaniel (1966), and Crider and McDaniel (1967) suggested that faster acting compounds would improve the capture of wild turkeys *(Melagris gallopavo),* Canada geese *(Branta canadensis)* and several species of ducks.

The objective of this study was to test rapid-acting, safe drugs which might be substituted for alpha-chloralose. The continuing search for better anesthetic and tranquilizing agents in human and veterinary medicine has produced a number of marketed compounds that might serve this purpose. This report presents the results of several drug-to-bait mixtures of five drugs in free-feeding waterfowl. These data were collected in Florida. Also collected during this study, but not included here, are data on secobarbital and triflupromazine to capture Canada geese and stelazine to potentiate secobarbital anesthesia. These data were not conclusive enough to be presented here but they can be found in Florida Pittman-Robertson Project, W-48-R Annual Report (Crider, 1967).

Acknowledgment is extended to M. J. Fogarty, L. E. Williams, Jr., R. W. Phillips and P. E. Hawker of the Florida Game and Fresh Water Fish Commission for their assistance with this manuscript and field work. The following pharmaceutical companies kindly furnished samples of their respective drugs for this study:

Compounds	*Supplier*
Diazepam (Tranimul, Valium)	Hoffman-LaRoche, Inc. Nutley, New Jersey
Methohexital Sodium (Brevital, Brevane)	Elanco Products Co. Indianapolis, Indiana
Methoxymol	Johnson and Johnson New Brunswick, New Jersey
Secobarbital Sodium (Seconal) (and its non-sodium form)	Elanco Products Company Indianapolis, Indiana
Tribromoethanol (Avertin)	Winthrop Laboratories, 90 Park Avenue, New York, New York

[1] A contribution from Federal Aid to Wildlife Restoration Program, Florida Pittman-Robertson Project W-48.

[2] Presented at the 22nd Annual Conference of Southeastern Association of Game and Fish Commissioners, Baltimore, Maryland, October 21;23, 1968.

MATERIALS AND METHODS

Drugs to be tested.

The compounds listed above were obtained in approximately 100 g quantities. Corn for bait was acquired locally. The Welch triple beam balances on which the drugs were weighed were purchased from W. H. Curtin and Company, Jacksonville, Florida. Measuring cups (½ liquid pint size), mixing, and holding containers were obtained at local hardware stores.

Prebaiting, mixing, and presenting treated bait, pick-up procedures, and post-capture activities are described elsewhere in these proceedings (Crider, *et al.,* 1968)

Bait Sites. Only floating platform bait stations of old boards, logs, or four foot strips of ¼ inch marine plywood mounted on 1½-inch styrofoam were successfully used for ringnecked duck *(Aythya collaris)* and wood duck *(Aix sponsa)* captures. Platforms were anchored with wires attached to scraps of iron on the bottom. On-shore bait stations 1 to 15 feet from the water were frequently used for other species including Canada geese, mallards *(Anas platyrhynchos),* blue-winged teal *(Anas Discors),* green-winged teal *(Anas carolinensis),* and American coot *(Fulica americana).* Peninsular or island bait stations, which were free of obstructing vegetation, were chosen when available.

RESULTS AND DISCUSSION

Pharmacological Considerations. Response to drugs is influenced by a number of factors in a given case, among the more obvious of which are total body weight and amount of body fat.

Young, extremely old, and females of given species are generally more sensitive to many drugs. During controlled situations, lesser amounts of drugs are administered to these groups.

Other factors, such as individual temperment, influence physiological reactions and are taken into account in veterinary and human anesthesia (Barnes and Eltherington, 1966), but for obvious reasons these considerations cannot be applied in wildlife capture at this time.

Time of Administration. We considered the hour of administration particularly important because most drugs are best absorbed in an "empty stomach." Varying results were obtained from birds with different amounts of esophageal and gizzard contents due to their having eaten elsewhere before they arrived at the bait station.

The action of the central nervous system depressants is more pronounced after a period of activity. This, according to most pharmacologists, is due to fatigue and the presence of physiological factors leading to normal sleep (Barnes and Eltherington, 1966). Since most capture activities were before noon, this aspect was not pertinent to our tests.

Initial Field Tests. To determine a starting dosage for field trials with each species of waterfowl, data derived for each compound in pen tests on mallards were used. We had previously learned that birds in pens were more sensitive to drugs and that pen test results could not be directly applied to field conditions; therefore drug-to-bait ratios for field trials were slightly greater than the most satisfactory rates used in pen tests.

Table 1 lists test dosages of five drugs. Results of initial dosages suggested adjustments in dosages thereafter, and the average size of each species was taken into account.

Central Nervous System Depressants. Diazepam is a tranquilizer of the benzodiazepine class (Randall, *et al.,* 1961). It is a highly insoluble white crystalline compound which rapidly calms naturally wild or aggressive animals (Parkes, 1968). Knight and Burgess (1968) recently reported on the pharmacology and chemical properties of diazepam. Murray and Dennett (1963) found diazepam to be a fast-acting tranquilizer in a variety of wild animals. Their study prompted our use of this agent.

TABLE 1

Results of different dosages of anesthetic agents on bait in Florida during the winters since 1964-65.

Compound	Dose (g/cup)	Number Caught	Species	Approx. Induction Time (min.)	Approx. Duration of General Anesthesia	Mortality
Diazepam	1.5	15	mallard (14) Canada goose (1)	5	8-15	0
	2.0*	9	mallard (7) Canada goose (1)	5	8-15	0
	2.5	29	blue-winged teal	5	8-10	0
	3.0	8	mallard (5) Canada goose (3)	5	8-15	0
Methohexital	.50	13	blue-winged teal	15	1	0
Sodium	.75	11	mallard	15	1	0
	1.0*	3	mallard	12	1	0
	1.5**	7	wood duck	12	1	1
	2.0**	11	wood duck	10	1	1
	3.0**	1	wood duck	8	1	0
	4.0**	0	wood duck			
Methoxymol	1.0	8	blue-winged teal	4	3	0
	2.0	5	blue-winged teal	3	3-4	2
	2.0*	1	Canada goose	4	3-5	0
	3.0*	18	green-winged teal (5) blue-winged teal (13)	8	3-5	10
	4.0**	1	Canada goose	10	1	1
Secobarbital	1.5**	0	wood duck			
Sodium	1.0**	4	wood duck	10	1	0
	.75**	2	blue-winged teal	15	1	0
Secobarbital	.50	12	Canada goose	18	4-5	0
(Free Acid)	.50	8	American coot	7	5-6	0
	.60	1	ringnecked duck	4	--	1
	.75*	5	wood duck	10	3-4	2
	.75	28	Canada goose	15	5-6	1
Tribromoethanol	2.50	8	blue-winged teal	5-10	5	0
	2.75	19	American coot	12	5-6	0
	2.75	5	mallard	5-10	5	0
	3.0	16	American coot	15-30	3-5	0
	3.0	11	wood duck	5-15	5	0
	3.0	2	Canada goose	10	4-6	0
	5.2	15	mallard	3-5	8-10	5

* Initial dose tested

** Appeared distasteful, birds only swallored a few kernels.

Diazepam in combination with alpha-chloralose was successfully used to capture several species of waterfowl (Crider, et al, 1968). Used alone, this agent produced only deep tranquilization which did not completely immobilize the birds. With dosage mixtures exceeding 1 g/cup of corn, regurgitation of the bait accompanied by oral and nasal secretion were noted.

Birds captured in these tests (Table 1) were mostly driven into emergent vegetation or hemmed against fences where they were caught with dip nets.

This compound may be used to drive-trap large numbers of birds by day or night. On one occasion 5 mallards, while under diazepam influence, were caught at night with a 6-volt head light and dip net.

Additional work may reveal a variety of methods for this or other tranquilizers to be used in capturing wildlife.

Methohexital Sodium is an ultrashort acting, barbituric acid derivative. Beckman (1961) reports it to be a classic oxybarbiturate anesthetic which is usually used intraveneously in man and laboratory animals. Anesthesia is accomplished in a very few minutes and recovery is quite rapid.

Methohexital is a white crystalline compound readily soluble in water or alcohol. Reportedly, it is not stored in the body fat deposits to the same extent as most anesthetics. Instead, it is metabolized rapidly in body tissues which undoubtedly accounts for the more rapid recovery.

Bellville *et al.* (1960) reported the relative potency of methohexital and Taylor and Stolting (1960) compared its duration of effects with other agents.

Martin (1967) reported favorable results with this compound in capturing mourning doves *(Zenaidura macroura).*

In waterfowl, methohexital effects were observed usually within 10 minutes after feeding began. This compound was refused at mixtures about 3 g/cup. Mixtures from 1-3 g/cup were usually avoided, although hungry individuals fed on these mixtures sufficiently to be caught. In situations where a slower reaction time can be tolerated, mixtures below 1 g/cup of bait may be more readily eaten. Sodium-free methohexital is also available from Elanco Products Company. It may be more palatable to some species.

Methoxymol is a white, finely powdered imidazole derivative of high solubility and very astringent taste. It is a "new, experimental drug" by legal definition and cannot be purchased. It shows especially strong hypnotic activity in birds. Information on its chemical properties and pharmacology can be found in Marsboom, *et al.* (1964) and Marsboom, *et al.* (1965).

Methoxymol used in capturing wild turkeys is described by Williams (1967) and for mourning doves by Martin (1967). In waterfowl, this compound was extremely fast-acting (3-5 minutes). Its taste apparently prevented some individuals from ingesting anesthetic quantities, however. Methoxymol would probably be more useful in capturing waterfowl if a taste mask could be found.

Tribromoethanol is an unstable white cyrstalline powder which has an aromatic odor and taste. Beckman (1961) reviewed its chemical and pharmacological properties. Mosby and Cantner (1956) described its use in capturing wild turkeys and other wild animals. Wolmeldorf and Mortenson (1960) reported its use for control of pigeons *(Columbia livia).* H. M. Wright (undated multilith, about 1953) was apparently the first to suggest its use for capturing mourning doves.

Our results with tribromoethanol (Table 1) were favorable at all drug to bait ratios below 5 g/cup. Fast induction (about 5 min.) progressed into capture narcosis in Anatidae within 10 to 20 minutes.

Recovery from anesthesia usually took 5 to 6 hours. Coots reacted more slowly, but were safely narcotized within 30 minutes and recovered in 3 to 5 hours. Further study is planned to more thoroughly test this compound. L. E. Williams (Pers. comm.) reports promising results in field trials to capture mourning doves and bobwhite quail *(Colinus virginianus).*

Secobarbital Sodium is a derivative of barbituric acid. It is used in man and laboratory animals as a central nervous system depressant for any degree of narcosis from light tranquilization to general anesthesia by varying the dose. The average oral hypnotic dose in adult man is 100-200 mg. Used in combination with the sodium salt, it is a hygroscopic powder, soluble in water and very soluble in alcohol. This high solubility renders it less palatable by oral administration in humans except in gelatin capsules or with other taste masks. Beckman (1961) summarizes its physiological and chemical properties.

Secobarbital was vigorously rejected by waterfowl at moderate to high applications on bait. But it was eaten in small quantities in mixtures at, or less than .75 g/cup. Its onset of induction was rapid with short duration of action. A non-sodium form of secobarbital, P-M-C-A barbituric acid, is less bitter to human

taste due to its solubility in saliva. It is also more acceptable to waterfowl. Field tests with this sodium free compound were more satisfactory (Table 1).

Tests with different dosages of each of the above anesthetic agents were generally favorable with regard to induction speed, duration of anesthesia, and toxicity. Mortalities occurred only in the higher dosages of four of the five compounds. No mortalities occurred with diazepam dosages.

Some dosages of methoxymol, secobarbital sodium and methohexital sodium were apparently distasteful to waterfowl. The more concentrated mixtures were rejected. This probably biased the respective induction speeds and mortality rates in Table 1. Mixtures of diazepam and tribromoethanol were readily ingested by waterfowl.

Diazepam was unsatisfactory for completely immobilizing the majority of the birds which fed on the bait. However, used in connection with other capture methods, diazepam showed much potential for capturing large numbers of waterfowl.

Tribromoethanol did not cause mortalities in six of seven tests. The induction speed and duration of anesthesia were most favorable, but additional tests are currently being made to refine dosages for various situations.

LITERATURE CITED

Barnes, C. D. and L. G. Eltherington, 1966. Drug dosage in laboratory animals; a handbook. University of Calif. Press. Berkeley and Los Angeles. 302 p.

Beckman, H. B. 1961. Pharmacology. W. B. Saunders Co., Philadelphia and London. 805 p.

Bellville, J. W., P. J. Fennel, T. Murphy and W. S. Howland. 1960. The relative potencies of methohexital and thiopenetal. J. Pharmacol. and Exper. Therap., 123:108.

Crider, E. D. and J. C. McDaniel. 1966. Technique for capturing Canada geese with alpha-chloralose. Proc. Annu. Conf. Southeastern Assoc. Game and Fish Commission 20:206-233.

_____ and _____. 1967. Alpha-chloralose used to capture Canada geese. J. Wildl. Mgmt. 30(2): 258-264.

_____. 1967. Oral narcotic capture technique for Canada geese. Florida Job Completion Report, Pittman-Robertson Proj. W-48-R. July 1966 through June 30, 1967.

_____, V. C. Stotts and J. C. McDaniel. 1968. Diazepam and alpha-chloralose mixtures to capture waterfowl. Proc. Annu. Conf. Southeastern Assoc. Game and Fish Commission 22 (in press).

Godefroi, E. F., P. A. J. Janssen, C. A. M. Van Der Eycken, A. H. M. T. Van Heertum, and C. J. E. Niemegeers. 1965. DL-1 (1-arylalkyl) imidazole-5 carboxylate esters. A novel type of hypnotic agent. J. Med. Chem. 8:220-223.

Knight, P. F. and C. G. Burgess. 1968. Diazepam in anesthesia. Rep. Proc. Symp. Royal Soc. Med., London, June 30, 1967. 106 p.

Lawrence, D. R. and A. L. Bacharach. 1964. Evaluation of drug activities; pharmacometrics. Volume 1. Academic Press. New York. 456 p.

Lumb, W. V. 1963. Small animal anesthesia. Lea and Febiger. Philadelphia. 420 p.

Marsboom, R. J. Mortelmans, and J. Vercruysse. 1964. A new hypnotic agent in birds.:200-201. In International zoo yearbooks, vol. 5.

_____, _____ and _____. 1965. Methoxymol induced hypnosis in birds. In Seventh Symp. Dis. Zoo Anim. Zurich p. 7-9 April, 1965.

Martin, L. L. 1967. Comparison of methoxymol, alpha-chloralose and two barbiturates for capturing doves. Proc. Annu. Conf. Southeastern Assoc. Game and Fish Comm. (in press).

Mosby, H. L. and D. E. Cantner. 1956. The use of Avertin in capturing wild turkeys and as an oral-basal anesthetic for other wild animals. Southwestern Veterinarian 9(2):132-136.

Murray, R. E. and D. Dennett. 1963. A preliminary report on the use of tranquilizing compounds in handling wildlife. Proc. Annu. Conf. Southeastern Assoc. Game and Fish Commission p. 134-139.

Parkes, M. W. 1968. The pharmacology of diazepam. Diazepam in anesthesia Rep. Proc. Symp. Royal Soc. Med., London, June 30, 1967. 1-7 p.
Randall, L. O., G. A. Heise, W. Schallek, R. E. Bagdon, R. Banziger, A. Boris, R. A. Moe, and W. B. Abrams. 1961. Pharmacological and clinical studies on valium. A new psychotherapeutic agent of the benzodiazepine class. Curr. Ther. Res., 3:405.
Taylor, C. and V. K. Stoelting. 1960. Methohexital sodium, a new ultrashort acting barbiturate. Anesthesiology, 21:29.
Williams, L. E., Jr. 1966. Capturing wild turkeys with alpha-chloralose. J. Wildl. Mgmt. 30(1):50-56.
_____. 1967. Preliminary report on methoxymol to capture turkeys. Proc. 21st Annu. Conf. Southeastern Assoc. Game and Fish Comm. (in press).
Womeldorf, D. J. and E. W. Mortenson. 1960. The Fresno pigeon control program. Calif. Dept. Pub. Health, Bureau Vector Control. Publ. M-3-60, 9 pp.

DATA ON CAPTURING BLACK BEARS WITH ALPHA-CHLORALOSE[1]

By Steven K. Stafford and Lovett E. Williams, Jr.,
Florida Game and Fresh Water Fish Commission, Wildlife Research Projects, Suite 21, 412 N. E. 16 Avenue, Gainesville, Florida 32601.

ABSTRACT

Experimental dosages of alpha-chloralose, an odorless and nearly tasteless oral anesthetic, were administered on baits to 17 wild black bears *(Ursus americanus)* and two captive wild bears. Nine of the 17 were sufficiently narcotized to permit handling without mechanical restraint up to 48 hours later. The other free-living bears escaped in sub-effective narcosis or if anesthetized, were not located in the field. One bear died as a result of chloralose overdosage and another succumbed from an overdose of pentabarbital sodium administered after capture. Preliminary data on the application of the method and some suggestions for further research are presented.

Investigations on bears sometimes involve trapping and handling for collecting data and marking. An initial step in such studies is to find or develop effective trapping techniques.

INTRODUCTION

Two widely used trapping methods are the wheel-mounted culvert trap and the steel-jaw trap. Both were described by Erickson (1957) in Michigan. The culvert trap has been found to be especially effective on garbage-dump or "nuisance" bears. Black (1958) and Stickley (1961) in their work with black bears used both methods but reported better success with steel traps. Craighead (1960) used culvert traps exclusively to trap grizzlies *(Ursus horribilis)* in Yellowstone National Park. A major short-coming of the bulky culvert trap is the tray-shyness it causes. The major problem with steel traps is frequent injury to the animal.

The Aldrich Spring Activated Snare has been used on black bears with some success. D. J. Pierson reported that his best success with snares in Washington was along fish runs or trails.

The recent application of anesthetics and immobilizers has greatly facilitated the capture and handling of large animals. Drugs are usually administered by intramuscular or intra-peritoneal injections with the "Cap-Chur" gun syringe (Crockford, Hayes, Jenkins, and Feurt, 1957) or simply by hand-held hypodermic. Drugs which act on the central nervous system and motor coordination centers have

[1]A Contribution of Federal Aid to Wildlife Restoration Program, Florida Pittman-Robertson W-41-R.