weasel finally killed the chipmunk, apparently with a bite to the back of the neck. Then the weasel retreated into the underbrush. It did not seem to leave the chipmunk as a result of our presence; its retreat was deliberate and apparently not the result of fear. We looked at the chipmunk, which appeared to be dead. After about 2 min we noticed the weasel approaching from the direction in which it had disappeared. At this point the weasel could not possibly have avoided seeing us, but it paid no attention to us. We moved back away from the chipmunk and watched as the weasel moved in, picked up its prey in its jaws and dragged it off.

During the entire chase the chipmunk's movements seemed frantic. When in the trees, it never went all the way to the tips of the branches, but remained near the trunks on large branches. The weasel apparently could climb as well as the chipmunk and seemed to take the falls from the trees with less injury. The most surprising thing was to see the weasel, presumably adapted to pursuing prey on and under the ground, climb trees. There was an abundance of *Citellus tridecemlineatus* living in the area, so apparently the weasel was not forced to prey on the more arboreal species for lack of food.

E. R. Hall (Univ. Kansas Publ., Mus. Nat. Hist., 4: 196, 1951) reported that a weasel (*M. frenata*) chased a red squirrel up a large hemlock, then descended the trunk after the squirrel dropped into a stream. The weasel caught and killed the squirrel as it emerged from the stream. John Pearce (J. Mamm., 18: 483–488, 1937) discusses a weasel (*M. frenata*) chasing a chipmunk up a black cherry tree. In this case the weasel did not keep up the chase, for after climbing 10 ft it came back down. In neither of these two instances did the weasel jump from the trees to the ground after its prey.—Robert L. Jeanne, *Box 1234, Denison University, Granville, Ohio.* *Accepted 10 January 1965.*

EFFECTS OF THREE IMMOBILIZING DRUGS ON WEDDELL SEALS

The recent advent of the automatic projectile syringe (Crockford et al., Vet. Med., 53, 1958) has made it easier to capture live large mammals than was possible in the past. By delivering immobilizing drugs via such syringes, the handler can weigh, measure, mark or closely examine and then release animals with less danger to the animals and to himself. Before this technique can be used effectively to capture individuals of a particular species, it is necessary to determine the correct dosage of the drug. Preliminary tests are best made on captive animals.

Seals present a special problem. They are not common enough in captivity to be used for such experiments and are difficult to approach in the field. They usually lie close to water, quickly sliding into it and disappearing when alarmed.

The Weddell seal (*Leptonychotes weddelli*), in contrast to other species, appeared to be an ideal animal for field testing. These seals haul out on the Antarctic ice where they are easily accessible and show almost no fear of man. The work reported herein was conducted on Ross Island in the "summer" of 1963 or 1964. Some lethal dosages were used, and the dead animals helped fill the seal quota for dog food at Scott Base.

Sleeping seals were injected in the gluteal region with a 10 ml hand syringe bearing a 3-inch 15-gauge needle. The drugs were prepared so that in all but a few cases the amount of fluid injected was 10 ml. Length and girth of the seals were measured, and weight was obtained by comparison with data from animals of known weights.

Upon receiving an injection, the seals immediately awoke and either rolled over or thrashed their hind flippers. They did not move far and could be observed from a distance of 15 to 20 ft.

Three drugs were used: nicotine alkaloid, phencyclidene and succinylcholine chloride (Table 1). All three drugs have been used to capture other wild mammals.

An effective dose of nicotine alkaloid (1.7–3.9 mg/kg of body weight) usually caused convulsions. These could probably be reduced or eliminated by an anticonvulsant such as pentobarbital sodium, but to avoid complicating the reactions, antidotes were not used.

TABLE 1.—*Effects of injecting immobilizing drugs into Weddell seals in the Antarctic, 1963 and 1964*

Estimated weight range of animals (kg)	Effect of injection	Number of animals	Dosage range mg/kg	Mean dosage mg/kg[1]	Duration	Latent period (minutes)
		NICOTINE ALKALOID				
227–331	sub-paralytic	2	3.0–6.2	4.6		
127–295	paralytic	3	1.7–3.9	3.0	63 min	14
91–286	lethal	4	5.0–9.8	7.4		4
		PHENCYCLIDENE				
286–367	sub-paralytic	2	0.1–0.3	0.2		
45–304	paralytic	11	0.2–1.1	0.5	9 hr	18
164–181	lethal	2	1.2–4.4	2.8		7
		SUCCINYLCHOLINE CHLORIDE				
181–227	sub-paralytic	2	0.6–2.2	1.4		
91–295	paralytic	9	1.8–3.4	2.8	34 min	9
128–340	lethal	3	2.5–3.9	3.3		3

[1] Mean dosage is based on calculations for each individual, not the summarized weight range.

After the nicotine had been injected, the first symptom usually was a shaking of the animal's head; these movements gradually became more violent. Sometimes the head would be thrown back, and the animal would open its mouth and groan or vomit. Following these initial reactions, the animal would enter a state resembling sound sleep, which would last from ½ to 2 hr.

The reaction to phencyclidene was milder than in the case of nicotine. The effective dosage was 0.5 mg per kg. Following injection, the animal became progressively less responsive to the observer until finally it did not respond to the touch of a hand on the face. On three occasions, the animal exhibited a few slight convulsive jerks of the flippers or head and body muscles before complete immobilization was achieved. During recovery, some animals aimlessly swung their head back and forth constantly for 5 or 10 min. Animals given phencyclidene were immobilized up to 24 hr.

Succinylcholine chloride was the fastest acting of the three drugs. It also immobilized the animal for the shortest time, sometimes for only a few minutes. Whereas the seals that received nicotine or phencyclidene had tense muscles, those immobilized with succinylcholine were completely relaxed. No convulsions were produced and the effective dosage was approximately 2.8 mg per kg. The hind flippers were the last part of the animal affected, which was not the case with the other two drugs.

The response of Weddells to succinylcholine chloride is similar to that reported by Ling and Nichols (Nature, 200: 1021–1022, 1963) for elephant seals (*Mirounga leonina*). Their dosages of from 0.5 mg/kg to 2.0 mg/kg were similar to ours, as were their reported time required for immobilization, duration of paralysis and manner of action.

Variations in reactions could be due to: (1) individual differences in susceptibility; (2) accidental injection of a portion of the drug into the blubber, thereby delaying drug distribution or (3) errors in estimated weights, although most are believed to be within 10% of the actual weight.

Nicotine was the least satisfactory drug because it often caused convulsions. The drug of choice for Weddell seals would be either phencyclidene or succinylcholine, depending upon the needs of the investigator. Phencyclidene can be administered in successive dosages until the desired effect is attained. However, experience with other mammals demonstrates that succinylcholine should not be administered a second time until the first injection has been overcome (Pisty and Wright, Can. J. Comp. Med. and Vet. Sci., 25: 59–68, 1961). One-half hour should elapse before the next (and greater) injection is given. In this way increasingly greater dosages can be administered stepwise at ½-hr intervals until immobilization is effected. This procedure is especially useful in handling valuable animals.

If administered via automatic projectile syringes, these drugs would not act quickly enough to capture a seal lying on the edge of the ice. The animal would be in the water before the drug could act. However, these drugs may be useful in subduing seals captured by other means.

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This is contribution no. 280 of the Natural Resources Institute, University of Maryland.—VAGN FLYGER, *University of Maryland, College Park, Md.;* MURRAY S. R. SMITH, *Canterbury University, Christchurch, New Zealand;* ROBERT DAMM AND RICHARD S. PETERSON, *The Johns Hopkins University, Baltimore, Md.* *Received 27 February 1965.*

ELK DEPOSIT ON THE SAN FRANCISCO PENINSULA

Subfossil skeletal remains of elk were unearthed in a peat bog near Pacifica, San Mateo County, California, by contractors working on a housing development in May 1962. Laguna Alta, the pond in which the peat accumulated, was formed by activity along the San Andreas Fault, which blocked the headwaters area of a small drainage, thus impounding the water. The lake was in existence up to the time of development, and peat was being formed until recently. The depth of burial of the mammal remains is questionable since the peat was continuously slumping during excavation where the bones were found. Depth of burial could range from 0 to about 15 ft.

Five specimens of elk are known to me, and still others may be in the possession of persons connected with the construction work.

Three specimens were obtained by the University of California Museum of Paleontology, and were later transferred to the Museum of Vertebrate Zoology (no. 130107, 130108 and 130109). One is a nearly complete skull lacking only one ramus of the mandible and the incisors, and carrying a magnificent set of large and symmetrical antlers. The others are an antler fragment and part of a skeleton including a humerus, 7 vertebrae and 16 ribs.

A fourth specimen is in the California Academy of Sciences (no. 12762) and consists of an antlered skull (missing the lower jaw and broken off in front of the orbits), scapula, cannon bone and lumbar vertebra.

The fifth known specimen, consisting of the base of an antlered skull and the remainder of the skull as far anteriorly as the orbits, is in the possession of Charles A. Repenning, of the United States Geological Survey, Menlo Park, California. He has also part of a tibia and a second upper molar (?) of an elk.

These animals are clearly related to the tule elk (*Cervus nannodes*) rather than the Roosevelt elk (*C. canadensis roosevelti*). Qualitative and statistical comparisons of skulls showed no significant difference from the living representatives of *nannodes*, while they did differ significantly from *roosevelti*. An exception is the backward projection of the occipital condyles of the Repenning skull, a character always present in *roosevelti*, sometimes in *C. c. nelsoni*, but lacking in 38 specimens of *nannodes* examined by me. In *nannodes* the condyles project decidedly downward. The aberrant skull may be an exceptional individual, or possibly the deposit is old enough that some intermediate characters are present.

Mammal remains uncovered besides *Cervus* include *Equus*, *Sylvilagus*, and Cervid, perhaps *Odocoileus*, plus several unidentified elements.

Eventually, C^{14} tests may give reliable information on age of the deposit. At present its age is largely conjecture; but on the basis of available evidence it seems likely to be