REPTILES AND AMPHIBIANS–A MANAGEMENT DILEMMA

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ABSTRACT: Reptiles and amphibians despite general public revulsion have a more positive than negative potential. On the positive side are food, scientific and educational benefits, biological control of pests, medicine, ornamentation, carrion cleanup, pets and aesthetic values. On the negative side are predation, human confrontation and health. Where control is deemed a necessary management procedure, it can be achieved to some degree by cultural controls, repellents, trapping and reductional methods, such as, hand capture, den hunting, electric fence and pesticides (though none are currently registered for this purpose).

Mankind has held an unrelenting grudge against reptiles ever since a snake gave dietary advice to Eve, the first woman. Amphibians are also held in the same low regard because of the frog who conned a gullible princess into kissing him and that old wart peddler, the toad. However, a closer examination of the ecological niche filled by these abused animals would indicate there is much to be said in their favor.

McAtee (1934) evaluated the "game and commercial" values of vertebrate species in this country against their "vermin" labels. The categories are not clearly defined and there has been considerable readjustment in public attitudes since that date. However, his figures make the point there is more good than evil in the Reptilia and Amphibia compared to the track record of other vertebrates:

Vertebrate Group	Total Number of Species	Values	
		Positive	Negative
Fish	600	132	378
Amphibians	139	3	3
Reptiles	149	24	60
Birds	811	69	142
Mammals	670	197	189

The "positive" values of reptiles and amphibians are:

FOOD

Frogs, turtles, snakes and lizards were not only important to the diet of early man but the first two, at least, are still an acceptable entree for modern man. The latest economic value of frogs and turtles on the current U.S. Market (unpublished data, U. S. Department of Commerce, NOAA, Fisheries Statistics Division) are as follows:

	1966	1967	1968	1969	1970
Turtles (lbs)	759,000	865,000	637,000	681,000	1,080,000
Value	$127,000	$176,000	$130,000	$148,000	$240,000
Per pound	17¢	20¢	20¢	22¢	22¢
Frogs (lbs)	38,000	41,000	55,000	66,000	45,000
Value	$18,000	$20,000	$33,000	$61,000	$27,000
Per pound	48¢	49¢	60¢	71¢	60¢

The lowly snapping and soft-shelled turtles make up 71 percent of the turtle poundage and 58 percent of the market value.

While not a direct food use, South American tribes use the venomous secretions of some colorful frogs (Dendrobates spp.) as arrow poisons to help them capture their food (Cochran, 1961).

SCIENTIFIC AND EDUCATIONAL BENEFITS

Amphibian larvae are basic teaching tools in the study of developmental mechanisms. Also I am sure each of you had to trace out the nervous system on your own little frog in elementary zoology. As in the case of food, numbers of wild individuals are rarely sufficient to fulfill the demand. This is an area where these animals could be raised under artificial propagation if the technology was sufficiently advanced.

BIOLOGICAL CONTROL OF PESTS

Hisaw and Gloyd (1926) claim one gopher snake will take all pocket gophers off a 1.5 acre field. Kirkland (1904) states toads are worth at least $19.44 on the basis of their potential consumption of cutworms. However, Dr. Hamilton (1954) sums up my opinion on this: "To place a monetary value on any animal which may aid man in the control of insect pests is ridiculous." Vertebrate predators as a group are opportunists. They do not intentionally seek out the maimed and sick in a prey population but take whatever opportunity presents. Thus while stomach contents may show amazing numbers of pest species, field evidence of the actual benefits accruing from this predator pressure have yet to be satisfactorily demonstrated.

MEDICINE

While reptiles and amphibians have long been a part of the Chinese pharmacopoeia (Noble, 1931), the efficacy of powders and mummified parts have yet to pass FDA standards. The venom of poisonous snakes will provide antivenin serum but claims this venom can be used to treat epilepsy, neuritis, laryngitis, insomnia, etc., lack scientific proof (Klauber, 1972).

ORNAMENTATION

The fads of alligator shoes and purses have done much to hasten the passing of these relicts of the age when reptiles were dominant. Kellogg (1929) estimated that 12,500,000 alligators were killed for their skins between 1800-1891. By the 1920's, he reports the scarcity of alligators had dropped the annual take to under 50,000 animals.

In Japan toad skins are made into fine leather (Noble, ibid). Rattlesnake rattles and skins and even the snakes themselves are inportant in the ceremonials of some North American Indian tribes.

CARRION CLEANUP

These crawling and hopping little "white wings" do some good in breaking down large protein masses left in the environment by dead vertebrates. Even poisonous snakes will swallow prey they have not killed themselves (Klauber, ibid).

PETS AND AESTHETIC VALUES

While they don't purr or chase sticks, reptiles and amphibians have given much joy and companionship to humans who like this sort of company. However, this can sometimes be a dangerous attraction as illustrated by the 16-year-old youth who stole 26 snakes from the London Zoo, 7 of which were deadly vipers (Anonymous, 1967).

There are also those who thrill as much at the sight of a brightly-colored lizard darting along the ground as others at the sight of a red-tailed hawk soaring in an azure sky.

On the other side of the ledger, we have the following "negative" values.

PREDATION

This can range from interference with the fisherman by stealing his bait or eating fish off his stringer (Moss, 1953) to depredation on waterfowl. Crawford (1971) reported

mallards raised 2 young annually on a Colorado refuge. Following a turtle control program, the production went up to 60 ducklings. Imler (1945) found that bull snakes destroyed 42% of the duck nests on a Nebraska refuge. Snakes were reported as causing problems in 25 percent of fish hatchery installations (Lagler, 1939). Neess (1970) noted that the toad (Bufo marinus) caught nestling birds. Thus control of some reptilian or amphibian species is a necessary management practice when they appear in important rearing and production areas for waterfowl, fish and even muskrats (Anonymous, 1939).

Neither is there a place for them in the apiary. Toads have been observed taking bees in great numbers as the latter cluster in hive openings ventilating the hives on hot evenings (Eckert, 1934).

They may also interfere with the so-called "balance of nature" when introduced into a new environment. Moyle (1973) blamed the disappearance of two native species of frogs (Rana aurora and R. boylii) in the San Joaquin Valley of California in part to the competition and predation by the bullfrog (R. catesbeiana) following its introduction about 1920.

Conversely the effect of herpetological predators on wild populations is a moot point. While snapping turtles cannot be tolerated in a fish hatchery, Lagler (1940) estimated they took only one fish per acre daily which is a negligible loss factor in fishery management.

HUMAN CONFRONTATION

Even though this is a negative value more imagined than real, it accounts for the greatest number of objections lodged against these groups. Deaths to snake bites in the United States average 0.027 per 100,000 per year (Neess, ibid). In the area of highest confrontation, Burma, with its large number of deadly species present, primitive methods of treatment and constant exposure of unprotected humans, the death toll is 15.4 per 100,000 annually.

The crocodilians have become so depleted they can no longer be considered a human population depressant of any magnitude though they still command respect in some local areas. The only poisonous lizard in the United States is the Gila monster who is so sluggish and rare that anyone who gets bitten and dies probably deserves his fate.

Reptiles and amphibians cause minor and transitory problems when migrations or large hatches suddenly flood an area with an astounding number of individuals. This can be quite messy as well as noisy.

HEALTH

Snakes, frogs and turtles can act as intermediate hosts for several cestode, nematode and trematode parasites of man (Chandler, 1940). Pet turtles are notorious for spreading food poisoning (Salmonella spp.) among owners too young or too foolish to take the necessary sanitary precautions when handling these pets. While toads don't cause warts, the secretions of skin glands can cause an allergic reaction in susceptible humans. They can also be toxic enough to kill dogs and other predators who gulp them down. That this is not foolproof protection is demonstrated by accounts of raccoons preying on them. The raccoons carefully ate around the head and shoulders containing the poisonous glands (Schaaf and Garton, 1970; Wright, 1966).

Thus it can be seen that reptiles and amphibians present a difficult management dilemma. If we could overcome the average person's reluctance to encountering these animals, the need for control would be minimal. Where management is necessary, the problem is complicated by the lack of selective, economical methods. While chlorinated hydrocarbons, other insecticides and rodenticides have proven imminently successful at extremely low dosages against snakes, toads, etc., (Flattery, 1949; Kaplan and Overpeck, 1964; Mulla, 1962; and Sanders, 1970), none of these have been registered for this purpose by EPA. We are left only the following sad little list of control measures:

CULTURAL CONTROLS

Though habitat alteration is rarely practical and often more ecologically upsetting than the use of chemicals, this control approach has the blessing of the "instant ecologist".

In poisonous snake country, removal of brush piles, stacking building supplies off the ground, filling in rodent burrows, burning and plowing fields and keeping vegetative cover

closecropped are good methods of reducing confrontations with these reptiles. Around buildings, holes in the floors, foundation walls and fireplaces should be tightly stopped. For large areas and basement windows, 1/4-inch mesh hardware cloth should be used.

The encouragement of natural predators in an area is an uncertain method of achieving control. While there are many vertebrate enemies -- badgers, mink, skunks, opossums, raccoons, foxes, coyotes, peccaries, deer, antelope, hawks, eagles, owls, crows, roadrunners, domestic livestock and poultry plus some reptilian enemies as king snakes, whipsnakes, blacksnakes, blue racers and indigo snakes -- these rarely depress a population to acceptable "economic" levels.

REPELLENTS

The next most acceptable control measure is repellents. Here again social acceptability is not necessarily a standard for reliability. One of the better snake repellents is no longer on the market because of cancellation by EPA. While it contained eight different ingredients, the inclusion of chlorinated hydrocarbon chemicals in this list permanently incapacitated (Washingtonese for "killing") individuals not influenced by the other additives.

Cowles and Phelan (1958) found snakes reacted strongly to human odor. As a hair rope would retain some human odor there might be some truth in old cowboy tales that a hair rope ringed around a campsite would keep rattlers out. Mercaptan, a component of skunk musk, has also been recommended. Brock and Howard (1962) reported thio-alcohol n-butyl mercaptan soaked on charcoal would repel snakes. However, Cowles and Phelan (ibid) found that snakes gave no reaction to the odor unless they were touched or detected movement. This conclusion was borne out in tests by Whitmire and Stout (1965) where mercaptan or mink odors did not repel poisonous snakes but made them more defensive and ready to strike. Non-poisonous species, such as, blacksnakes and blue racers, left the area where possible. These latter researchers also found unnatural scents, such as, hot essential oils, mustard, pepper and chloropicrin, had no apparent effect as the snakes would stay in the area to the point of death. A Pest Control Operator reported that gasoline sprayed in and under rock ledges would drive snakes out. Under current energy crisis conditions this becomes and unavailable alternative.

A more satisfactory area repellent is the use of snakeproof fencing. This is practical around a small play yard for young children. Stickel (1953) recommends a 36-inch wide 1/4-inch wire mesh buried in the ground for a few inches and then bent outward at a slope of 30 degrees. Klauber (ibid) thinks the same size mesh should be buried a foot in the ground and then topped with another three feet of 1/2-inch mesh. This would not have to be slanted. In either case, gates to the area should swing inward and be protected. Overhanging branches should be cut and constant vigilance maintained to block rodent burrows that might penetrate the barricade.

TRAPPING

This is another acceptable method in that non-target individuals can usually be released unharmed. There are only two basic automatic trap designs: pits or funnel traps. The pits are made of straight-sided trenches (about 3 feet deep), glass jars or metal cans. An interesting modification is to prop a cardboard cover a few inches above the pit opening. Reptiles attracted to the shade crawl under the cover and drop into the container (Banta, 1967). Another intriguing one uses a dry trout fly with the barbs removed. This is suspended two inches above a gallon glass jar. As fast desert lizards catch the fly, they are supposed to swing out over the open jar and drop into it (Lannom, 1962).

A floating turtle trap for basking species uses the same pit principle. When turtles dive off the rim into the screened center of the trap, they are prevented from climbing back out by a metal collar or spikes projecting inwards.

The pits may be baited with small, live animals. Their effectiveness is definitely increased by the addition of wings or drift fences to herd wandering individuals into the pit. These can be made of cheesecloth as temporary barriers to divert migrating frogs into pits (Noble, ibid). More effective fences are made of 1/4-inch mesh. These need be only 8-9 inches high in open cover but 12 inches or more in denser vegetation (Imler, ibid).

In funnel traps the animals enter the trap compartment through the small end of a funnel several inches off the floor of the trap. Jackley (1943) used this principle on a den trap. All entrances from the den were closed except the one leading into the trap compart-

ment through a chute covered with a one-way clear–plastic door. One-way trap doors are sometimes used on funnel turtle traps (Yeager, 1973) but it is usually sufficient to keep the small funnel end a few inches off the level of the trap compartment floor.

The success of these traps can be increased with the addition of drift fence wings as described previously for pit traps. However, Fitch (1951) feels that the material used to make the drift fence would be better employed if it was used to make more traps. Without drift fences, it is necessary to bait the trap with live animals unless topography puts the trap site in a natural funnel.

Deadfall traps are of limited value. Museum snap traps can be used to catch small lizards if large beetles or grasshoppers are tied to the treadle (Heatwale, etc., 1964). Dillard (1973) described a method of catching snapping turtles by floating a modified steel jump trap upside down.

REDUCTION METHODS

Hand capturing is a slow but selective method for removing individuals. This can be done by noosing on long poles (Bertram and Cogger, 1971; Peaker and Peaker, 1967), catching tongs (Pillstrom, 1954), netting (Jones, 1966), trot lines, probing with a hook (snapping turtles in winter hibernation dens), shooting or clubbing.

Den hunting can be a profitable method of capturing large numbers of snakes. The dens can be dynamited but results are uncertain. Catlin described a frontier method of tying a lighted powder horn to a rattlesnake and letting it crawl down the den (Klauber, ibid). Gassing is only slightly better. Cyanide seems to be the best (Uhler, 1949) but the slow metabolism of snakes as well as the uncertainty of the den structure makes this a questionable technique. Probably the best approach is to trap the snakes as they go into or come out of hibernation.

Smith (1971) described an electric fence. This reputedly kills snakes, amphibians and small mammals that cross the hot wire. A 6-volt car battery will run about 120 meters of fence.

The use of chemicals is at present only of academic interest as none have been registered by EPA. The chlorinated hydrocarbons are particularly effective but the emotional feeling against these long-lived pesticides makes it doubtful any will be accepted. Rotenone as a spray (Whitmire and Stout, ibid) and nicotine in water (Flattery, ibid), can kill. Being biological compounds they have a somewhat cleaner image. Strychnine is another potential control chemical. However, it must be in bait form acceptable to snakes. This is not insurmountable as shown by the taking of water mocassins with poisoned sardines (Landon, 1953) and the killing of gopher snakes (Brock, 1965) and rattlesnakes with strychnine-poisoned rodents (Campbell, 1952) and eggs (Uhler, ibid).

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