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HISTORY AND STATUS OF PREDATOR CONTROL IN TEXAS

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ABSTRACT: A historical review of predatory animal damage and the development of the Texas animal damage control (ADC) program is provided, including a discussion of predator species, methods of control and limitations caused by laws, regulations and policies. Recommendations are made for improvements to permit a more comprehensive program with adequate funding, personnel and control methods.

HISTORY

Historical accounts of old Spanish missions in Texas record poultry and livestock losses to mountain lions (Felis concolor), gray wolves (Canis lupus), red wolves (Canis rufus), bobcats (Lynx rufus), and coyotes (Canis latrans) among numerous other causes. Young (1944, 1951, 1958) and Young and Goldman (1946) have described in some detail the nature and extent of predation by these species on livestock and other wildlife species, particularly on game animals. More recent accounts by Wentworth (1948), Lehman (1969), Caroline (1973, 1978), Carlson (1982) and others of the range sheep and goat industries indicate the relative importance of predation according to Texas sheep and goat producers. Wolves, mountain lions, grizzly bears (Ursus horribilis), black bears (Ursus americanus), coyotes, red foxes (Vulpes vulpes), gray foxes (Urocyon cinereoargenteus), dogs (Canis familiaris) and golden eagles (Aquila chrysaetos) were the major predators of sheep and goats, although several other carnivore species caused occasional or local problems.

Early accounts of predation on Texas cattle indicate that jaguar (Felis onca), mountain lions, black and grizzly bears, red wolves, coyotes and domestic dogs may have been locally important predators of cattle. However, it seems generally agreed that until about 1925 gray wolves, called "lobos" or "buffalo wolves," were the major cause of cattle losses to predators in Texas, as reported by Young (1944), Birchfield (1970), Riley and McBride (1972), Caroline (1978), Brown (1983) and others. In more recent times coyotes and dogs have been the major causes of Texas cattle losses due to predators.

Organization of private predator control efforts had begun sometime after 1900 by various groups, primarily sheep and goat producers. These included payment of bounties on predatory animals, cooperative efforts by local groups of producers to remove predators and the beginning of use of netwire fences to restrict access by predators as well as to control livestock (Caroline 1978). Caroline (1973, 1978) reported that the first hiring of professional predator hunters on a temporary basis began in 1914 and that they were established on a permanent basis in 1915.

Although published literature is sparse regarding the early history of predation in Texas, there is substantial information in early anecdotal accounts as recorded by Birchfield (1970), Caroline (1978), Brown (1983) and others, particularly from the annual reports of the professional animal damage control (ADC) agency which was fully organized in 1915 under the U.S. Bureau of Biological Survey (USBBS).

The first effort to provide for a federal and state cooperative program in predator control occurred with passage of a bill in the Texas legislature in 1919 which appropriated \$25,000 per year for 2 years and provided that none of these funds should be expended on bounties. After 1920, contributions to the program were made by individuals, livestock associations and counties, generally at the rate of two-thirds local funds to one-third federal funding provided by the USBBS. No further funds were appropriated by the Texas legislature for this purpose until 1927 when the same level of funding again was provided for a 2-year period. This was bolstered by funding from other sources to approximately \$100,000 total support in 1928 for the professional program.

The Texas Predatory Animal Eradication Association (TPAEA) was formed in 1929 after passage of a state law which authorized continuous appropriations for predator control. During 1929 a lobbying effort by the TPAEA was successful in establishing an annual appropriation of \$70,000 by the Texas legislature. Also, increased matching funds were available from local and county sources and the program was expanded from 20 counties in 1929 to more than 100 counties in 1934. At that time predators were considered a significant problem in 196 of Texas' 254 counties.

Local funds collected in Texas were sent to the USBBS in Washington to be returned to Texas as needed for hunter-trapper salaries, travel costs, etc. However, passage of a federal law in 1939 required that such funds revert to the federal treasury. Thus, they would not be available to the

program so other arrangements were made. The USBBS requested the Texas Predatory Animal Control Association (TPACA; formerly the TPAEA) to serve as custodian of the local funds and the Texas Cooperative Trapping Fund (TCTF) was established to serve this purpose by agreement of all cooperating parties.

TCTF funds are disbursed by the Texas Rodent and Predatory Animal Control Service (TRPACS) for salaries, supplies, mileage, etc., under the regulations of the master project agreement for the ADC program. This agreement, which continues to the present time (1984), is between the U.S. Fish and Wildlife Service (USFWS), the Texas Agricultural Extension Service (responsible by Texas state law as the cooperating state agency) and the Texas Animal Damage Control Association (by title change and reorganization in 1972 from the Texas Predatory Animal Control Association). Thus, the three federal, state and private entities together provide the basis for and supervision of the Texas animal damage control (ADC) program. Under the terms of the master project agreement, overall program supervision is provided by the USFWS. In addition, separate field agreements are executed between the cooperating counties and the USFWS to carry out the ADC activities required in those counties (137 counties in 1984).

PREDATORS

Individual rancher control efforts using hunting dogs, firearms, traps, etc., had been the major methods of control until the organized program began in 1914. Bounties paid on wolves, mountain lions and other species may also have been significant in encouraging private control efforts and in reducing wolf, mountain lion and other predator populations. Den-hunting of wolves, the use of strychnine-treated livestock carcasses, and small meat baits made more effective use of limited funds and manpower and was instrumental in the removal of gray wolves in Texas. Except for isolated individual gray wolves, they were eradicated in most of the state by about 1925 but persisted in the Trans-Pecos until the early 1940s.

Red wolves, which may have been the dominant predator in the south and the eastern half of Texas, were much less able to compete with and tolerate man. For this reason and due to severe reduction by ADC efforts, the effects of netwire fences and hybridization with coyotes, red wolves became insignificant except in local areas along the Gulf Coast by about 1960 (Caroline 1973). Thus, red wolves are no longer significant predators in Texas and were declared extinct in the wild by the USFWS in 1980 (Texas Parks and Wildlife 1980).

Although grizzly and black bears were locally important predators in the last century, they were never as significant as wolves, mountain lions and coyotes. No grizzly bears are now known to exist in Texas. Black bears are only sparsely distributed in the timbered area of the eastern part of the state; they occasionally appear in the Davis Mountains, the Big Bend, and as far down river as Comstock and Langtry.

Jaguars were not common except possibly along the Rio Grande River and Gulf Coast early in the last century and have never been a significant factor in predation of livestock in Texas. Similarly, jaguarundi (Felis yagouaroundi) and ocelots (Felis pardalis) are uncommon and insignificant to livestock production in addition to being endangered species.

There are occasional instances of predation on livestock by badgers (Taxidea taxus) and skunks, particularly hog-nosed skunks (Conepatus leuconotus), but these are not significant. Traps and shooting are normally used to remove the individual animals causing loss. Raccoons (Procyon lotor) may cause significant local losses by killing poultry and young or helpless livestock, primarily sheep and goats. This seems to be more commonly by occasional single animals or family groups. It develops primarily during periods of severe drought and food shortages, but raccoons that become livestock predators may persist in the practice. Feral and wild hogs (Sus scrofa) may also cause significant losses on individual ranches. Although toxic baits were used effectively in the past to control badgers, skunks, hogs, and raccoons, these are no longer available for use. As a consequence, traps and shooting are the primary methods of control for these species. Snares are used to some extent to capture hogs. Also, trained dogs may be used to trail and bay hogs and raccoons in order to capture individual animals or reduce local populations.

Black vultures (Coragyps atratus) and turkey vultures (Cathartes aura) are among the bird species which normally scavenge carcasses. However, when food shortages occur, flocks of vultures readily attack newborn and helpless animals. Females giving birth are also subject to such attacks. Locally, vultures may cause severe losses of lambs, goat kids and calves. Historically, vultures were trapped in wire pens by using animal carcasses as bait. Since vultures are now protected species, repelling and/or frightening methods are the primary means of preventing vulture predation. This is not always successful since vultures can be extremely persistent as predators.

While bald eagles (Haliaeetus leucocephalus) are occasional predators of lambs, kids and fawns of exotic game animals, golden eagles (Aguila chrysaetos) are much more common predators of small livestock and game animals. Some become persistent predators of livestock and exotic game and may cause severe losses to individual ranch operations, particularly where migratory groups or other eagle concentrations exist (Kalmbach et al. 1964, Glover and Heugly 1970, Wade and Livingston 1979, O'Gara 1982). Historically, toxic baits, trapping, shooting and aerial hunting were the primary methods used by ranchers to remove depredating eagles. However, the protective Bald Eagle Act of 1940 was amended in 1962 to provide golden eagles with additional protection. This also terminated the USFWS involvement in operational control of golden eagle predation. While the amendment specifically prohibited the use of airplanes and poisons as control methods, it did permit ranchers to control depredating golden

eagles by other means under a "blanket permit" issued by the Secretary of the Interior to the Governor of the State in which depredations were occurring. In March 1970, USDI Secretary Walter J. Hickel placed a moratorium on the "blanket permit" system and replaced it with a provision for issuance of a "kill permit" on an individual case-by-case basis. Although these regulations permit the USFWS to issue kill permits for removal of depredating eagles, by policy of the Secretary, USDI, such permits have not been issued since March of 1970 (USFWS 1976, 1977; Crowe 1980, Wade 1983a). Thus, there are at present no legal methods permitted to control eagle predation, except for livestock husbandry practices and limited live-trapping and removal of depredating eagles by the USFWS.

Because of their threat to sheep and goats, intensive control of mountain lions had reduced their populations in Texas to low levels, primarily along the Rio Grande and in the mountainous areas of the Trans-Pecos by 1950. Trapping and hunting with trail hounds were the primary control methods. The reduction in sheep and goat production in these areas since 1945 resulted in a major decrease in mountain lion control efforts and their population has increased to a substantial level. They are now reported in many areas of Texas where they have been absent for several decades. Moreover, where they occur they now present a significant threat to sheep and goat production, to mule deer (*Odocoileus hemionus*) and to the desert bighorn (*Ovis canadensis*) sheep population in West Texas (McBride 1976, Winkler 1978, Kilpatrick 1979, Texas Parks and Wildlife 1982, Cox 1983).

Bobcats are relatively common and are found statewide in Texas. They may be a significant predator locally on poultry, small livestock, exotic game animals and some wildlife species (Brownlee 1977), Caroline (1977, 1978) and Hawthorne (1980, 1981, 1982, 1983) and others have recorded the need to remove bobcats for protection of poultry and livestock on a local basis, primarily by trapping. However, it is expected that increases in coyote populations may have an adverse effect on bobcats in some areas as is suggested by Linhart and Robinson (1972), Nunley (1977) and others.

There are persistent difficulties of predation on livestock from domestic dogs permitted to roam at large and occasional feral dogs throughout Texas. There are also occasional losses to true feral dogs and coydogs (coyote X dog hybrids). Also, red and gray foxes may become significant predators of lambs, goat kids and poultry at times, but the majority of losses to predators in Texas are caused by coyotes. Historically, predation by coyotes was most significant in sheep and goat industries but coyotes readily adapt and have become a source of loss to cattle, hog and poultry producers as well. They frequently cause damage to watermelon, canteloupe and other truck crops. Coyotes prey on exotic game species raised by ranch operators for hunting or sale and they have become a significant factor in depression of mule deer and pronghorn antelope populations in West Texas (Jones 1949, Winkler 1978, Reed 1980, Tucker 1980, Texas Parks and Wildlife 1982, Steiert 1983). Additional information on coyotes as a cause of mortality to mule deer and pronghorn (*Antilocapra americana*) has been reported from studies in other states (Arrington and Edwards 1952, Udy 1953, Knowlton 1968, Oregon State Game Commission 1971, Nielson 1975, Neff and Woolsey 1979, Smith and Lecount 1979, Truett 1979). Thus, it appears that coyote predation has the potential to limit certain game animal populations, particularly when combined with mountain lion predation. Since the Texas ADC program is structured to deal with coyotes as the major predator, coyote control methods are discussed below, under ADC Program and Methods.

ADC PROGRAM AND METHODS

Protection of livestock from predators has always been necessary and has required the use of all available and practical husbandry methods. Nass (1980a) has reviewed these methods at length. Those used most extensively in Texas at various times have been continuous herding and penning of livestock at night, netwire and other fencing to exclude predators and alternation of lambing and kidding seasons. Confinement raising of poultry is practical and is the common method of production. Confinement raising of sheep, goats and cattle has been used to some extent but does not permit effective and economic use of range forage. In general, husbandry and nonlethal control methods are in use to the extent practical and compatible with the use of range forage by sheep, goats and cattle in Texas.

Lethal control methods utilized historically by livestock producers initially included shooting, trapping, snaring, the use of dogs to trail and kill predators, and strychnine to treat livestock carcasses. Clearing of the Edwards Plateau of canid predators, which occurred by the late 1930s, involved these methods in addition to extensive use of netwire fencing as described by Jones (1938) and development of the professional control program (Caroline 1973, 1978a).

In addition to the use of strychnine single-dose baits in the ADC program, early in the 1940s the Humane Coyote Getter[®] sodium cyanide device was introduced experimentally and soon became a highly effective method particularly during fall and winter months. This was followed by experimental use of Compound 1080-treated large baits in 1949. Success in this project was followed by operational use of 1080 baits from 1950 to 1972, when cancellation of the use of toxicants in the federal program by order of President Nixon (Nixon 1972) and the Environmental Protection Agency (EPA) occurred (Ruckelshaus 1972).

Following cancellation of the predicides in 1972, by order of USDI Assistant Secretary Reed, the USFWS temporarily implemented an "accelerated" program with additional federal funds in an attempt to demonstrate that mechanical control methods were adequate to control coyote predation. Despite the additional funds the "accelerated" program was only partially successful and was discontinued after 1978. However, with the loss of chemicals and the need for additional methods, aerial hunting became more important in the ADC program.

Aerial hunting with fixed-wing aircraft had been in use by some Texas ranchers at least as early as 1925. These were followed later by use of rotary-wing aircraft which are more effective than the fixed-wing over brush and rough terrain. Helicopter hunting of coyotes by the Texas ADC program was first done experimentally in 1965 to meet the need for more effective control of predation. Since this was successful, helicopters were used on a limited basis until additional federal funding of the "accelerated" program in 1972, when aerial hunting was emphasized and became a more common control method. In Texas, helicopters are utilized on a contract basis from private companies.

Due to the costs of helicopter operations, aerial hunting with fixed-wing aircraft was evaluated in 1978-79 in the Texas ADC program but an accident caused the tragic loss of the aircrew and craft in August 1979. This delayed full operational use of such aircraft until 1983. By late 1983, two fixed-wing planes were fully operational in west Texas and they are rapidly becoming important to control of predation in the area where the terrain is relatively flat, open and free of brush.

Helicopters are considerably more expensive to operate but are highly effective in some areas where fixed-wing operations are not safe or are ineffective. Aerial hunting has now become an essential part of the ADC program despite high operational costs and is used in many areas of Texas for resolution of severe predation problems.

Prior to 1972, environmental opposition to the use of chemicals and some administrative concerns regarding the potential hazards of the Humane Coyote Getter[®] led to development of a mechanical ejector, the M-44[®] device, for use of sodium cyanide in coyote control. This device was adopted by USFWS policy in 1967 as the operational replacement for the Humane Coyote Getter. The order by President Nixon in 1972 cancelled the use of both devices in federal programs and on federal lands, but the increased need for chemical control methods led to re-registration of the M-44 in 1975 for operational use under an extensive list of restrictions imposed by the EPA.

The M-44 was never as efficient and effective as the Humane Coyote Getter and has always been plagued by common malfunctions. These have been thoroughly documented and quantified recently in extensive tests carried out near Port O'Connor in South Texas, which confirmed long-standing reports by field staff of the need for improvements. Some of these have been implemented in the attempt to improve the device. However, the M-44 has been used extensively in the Texas ADC program. In order of importance for control of predation in 1983, the numbers of coyote taken by Texas ADC specialists is as follows:

- | | | |
|------------------|-------------------|--------------------|
| 1. M-44 | 3. Snares | 5. Ground shooting |
| 2. Leghold traps | 4. Aerial hunting | 6. Denning |

Thus, the M-44 is an essential method to the ADC program despite the need for extensive maintenance for the device to be used effectively. A highly desirable alternative would be re-registration of the Humane Coyote Getter with the new plastic insert and seal which would greatly reduce the presumed hazard from use of the older shell which used a tar seal to protect the cyanide from moisture. Since the Humane Coyote Getter is more effective than the M-44 and requires much less maintenance, greater efficiency would be possible in the use of ADC funds and staff effort.

As noted in the methods listed above, leghold traps and snares are next in importance to the M-44 for control of coyote predation by the Texas ADC program. These are particularly important during the warmer months when coyote behavior sharply reduces effectiveness of the M-44. Traps and snares are also the primary methods used when vegetative cover prevents use of aircraft, particularly during summer and fall, and when coyotes are shy of aircraft. As noted above, ground shooting and denning take the fewest numbers of coyotes, but these methods are necessary to reduce predation in some situations.

ADC PROGRAM ORGANIZATION

The Texas ADC program is somewhat unique among the western states in having had only three state supervisors in its 70-year history: C. R. Landon from 1914 to 1958, Milton Caroline from 1958 to 1979, and Donald W. Hawthorne from 1979 to the present time.

In addition to the state office at San Antonio, there are nine district offices which have responsibility for supervision of both rural and urban ADC programs as follows:

- | | |
|--|--|
| 1. Brownwood District ----- 12 counties | 6. Fort Stockton District ---- 12 counties |
| 2. College Station District -- 57 counties | 7. Orange Grove District ---- 19 counties |
| 3. Fort Worth District ----- 57 counties | 8. San Angelo District ----- 13 counties |
| 4. Kerrville District ----- 13 counties | 9. Uvalde District ----- 8 counties |
| 5. Lubbock District ----- 63 counties | |

There are two full-time fixed-wing aircraft crews (pilot and gunner) located at Fort Stockton and Big Spring in west Texas, and 16 Wildlife Damage Control Specialists in the Mobile Forces ("Trouble Shooters") who do not have a fixed location but are moved to specific problem areas where predation is severe and extensive effort is needed. The program has 120 specialists in predatory animal control with fixed assignments in various counties. Due to extensive animal damage problems in urban areas, the Texas program has offices and Wildlife Damage Control Specialists in Abilene, Austin, Corpus Christi, Dallas, Fort Worth, Houston, Laredo, McAllen, San Antonio, Tyler, Waco, and Wichita Falls. These specialists deal with an immense variety of urban mammal and bird pests in addition to other wildlife-related problems.

Most Texas ADC specialists in rural areas deal with an extensive list of problem mammal and bird species, but there are some who tend to specialize in predator, rodent or bird damage control due to the nature of the major problems in their assigned areas. Thus, although the majority of these specialize in predatory animals, there are several who work extensively in prairie dog (Cynomys ludovicianus), pocket gopher (Geomys spp., etc.) and beaver (Castor canadensis) damage.

A wide variety of methods are used in resolving pest problems, including those caused by predatory animals. Repellents, frightening devices, exclusion, livetraps, kill-traps and toxic baits are among the methods which may be employed depending on the species, circumstances and local laws and regulations as well as other factors.

ADC PROGRAM EFFECTIVENESS

Despite opposition by preservationist groups and others to ADC programs and methods (cf: Cain et al. 1971), there is no doubt that these programs can be and commonly are highly effective in reducing or preventing losses of livestock and crops, damage to property, protection of domestic animals and human health and safety. Development and organization of these programs were directly the result of needs expressed where these losses and threats were real. Early descriptions of the needs and the effectiveness of ADC efforts have been reported by many authors, among them the following: Lantz (1905), Goldman (1930), Darling (1934), Green (1945), Presnall (1948) and Young (1951). More recent accounts are numerous and include those by Knowlton (1972), Linhart and Robinson (1972), Shelton and Klindt (1974), USDI (1974), Wade et al. (1977), Guthery and Beasom (1977), USFWS (1978, 1979a, 1979b), Cargile (1980), F. Howard (1980), L. C. Howard (1980), Kensing (1980), Nass (1980b), WRCC-26 (1980), Wade and Connolly (1980), Nunley (1981), Till (1982) and Wade (1981, 1982, 1983b), among many others.

Moreover, the ADC program and methods have been found to be effective in protection of other wildlife species as noted by the following: (Arrington and Edwards 1951, Udy 1953, Oregon State Game Commission 1971, Beasom 1974, Trainer et al. 1977, Winkler 1978, Hailey 1979, Kilpatrick 1979, Reed 1980, Duebbert and Lokemoen 1980, Eldredge 1981, Stout 1982, Cox 1983), including some of the endangered species (Byrd and Springer 1976, Andrus 1978, O'Connor 1981, Pesticide and Toxic Chemical News 1983).

ADC PROGRAM LIMITATIONS

As earlier indicated, opposition by preservationist groups has led to regulatory and policy decisions which severely limit the efficiency and effectiveness of the ADC program in Texas as well as other states. As a consequence of various political pressures by environmental groups, and acquiescence by federal administrators, major alterations had begun by 1964 and accelerated rapidly from that time on. Decisions made by federal administrators were progressively geared to satisfy environmentalist demands, partially due to lawsuits brought against the agencies by these groups.

Limitations at the federal level began with issuance of the "Leopold Report" (Leopold et al.) in 1964 and the "Cain Report" (Cain et al.) in 1971, which ostensibly was the genesis of the Executive Order by President Nixon (1972) and the EPA (Ruckelshaus 1972) order which cancelled the predacides. In fact, the decision to cancel had been made much earlier by collusion in the USDI and the President's Council on Environmental Quality in a procedure deliberately planned to circumvent legal and due process (Wade 1975, Wade and Beasom 1979, MacIntyre 1982, Howard 1979, 1984) and came about by secret agreement of counsel for the USDI and certain environmental groups in 1971 (U.S. District Court of Columbia 1971). However, the approach was effective in subverting legal and due process to secure cancellation of the predacides.

Since 1971 there have been numerous policy and regulatory decisions at the federal level which have further restricted control methods and have sharply reduced ADC program efficiency. A definitive list would be voluminous but examples include the policy statement by USDI Assistant Secretary Reed (1971) which delineates his plans to cancel the use of the predacides and the memorandum from Reed (1972) to the USDI Secretary which further opposes the use of predacides and attempts to justify Reed's position. Another example is the USDI draft Program Management Document for ADC (USDI 1976) which states in the attached "Note to Reviewers":

"...the ADC program no longer has an objective to perform operational damage control for the purpose of abating economic losses caused by wildlife..."

These continued efforts to curtail the effectiveness of the entire ADC program were heightened in the decision by USDI Secretary Andrus in his November 8, 1979, memo to the Assistant Secretary, to severely restrict ADC operational use of aircraft, denning and traps, both preventive and corrective control of predation, in addition to research on 1080, and a major reduction of the ADC operational budget. This was followed in 1980 by various memoranda which described how the Andrus proposal would be "sold" to the livestock industry and other agricultural groups, state fish and game agencies, etc. (e.g., USDI 1979), and by the "Service Management Plan" (USDI 1980) in June 1980 in which the only "Important Resource Problem" listed with respect to ADC involved migratory waterfowl and shorebirds.

Sharp criticism of this departure from the U.S. Congressional mandate to carry out ADC responsibilities rapidly developed (e.g., Laxalt 1979, WRCC-26 1980) and led to strong opposition by state senators, representatives and governors, in addition to numerous other groups. As a consequence, these restrictions were removed by order of USDI Secretary Watt in 1981. However, there have been continued efforts at the federal level to further curtail ADC funding and personnel and limit ADC

activities. More recent efforts by Secretary Watt would have had the states assume ADC responsibilities. Grieb (1983) has summarized some of the strong objections to this approach by the International Association of Fish and Wildlife Agencies (IAFWA) and their growing inability to support the USFWS as the responsible ADC agency. Grieb recognized the desire of the agricultural industry to have the ADC program transferred back to the USDA where it had been until 1939 when the USDI became responsible in an executive transfer by President Franklin Roosevelt. Grieb commented that:

"The International Association believes that this wildlife program belongs in the Fish and Wildlife Service. We have been successful in our support of this to the present time. However, it is difficult to continue this support in face of the Service's continued desire to eliminate funding and change the program."

These reviews by the IAFWA (Grieb 1983) and more specific reviews by the WRCC-26 (1980) and the U.S. General Accounting Office (1981) have pointed out numerous deficiencies and errors in the USDI policies and the need for decisions which are based on biological and economic facts. Many such objections to USDI, EPA and CEQ decisions have been noted from Congress (Laxalt 1979), the USDA and state agencies, in addition to the IAFWA position documents (Hutchens 1982, Grieb 1983) and IAFWA comments (Miller 1983). Howard (1983, 1984) and numerous others have pointed out the apparent inability of the USDI to carry out its ADC duties due to its concern for endangered species, etc.

There is resentment by state fish and wildlife agencies of the USDI abdication of its responsibility in wildlife management and ADC to the EPA to appease political groups, as well as the decisions by USDI, EPA, CEQ and other federal entities which have eroded state rights to manage resident wildlife (Hancock 1979, Grieb 1983, Miller 1983). In addition, some groups have expressed concern over the USDI's opposition to transfer the ADC program back to the USDA, where some believe it should be, despite the USDI's unwillingness to abide by the Congressional mandate of 1931.

Due to the research which has been done with Compound 1080, several agricultural groups, state fish and game agencies and ADC professionals have urged registration of the compound in collars to protect sheep and goats and for use in single-dose baits to control coyotes, foxes and feral dogs. Since President Reagan (Reagan 1982) rescinded Nixon's Executive Order of 1972, which banned the use of chemicals in federal programs and on federal lands, only USDI policy decisions would prohibit such use. Public hearings beginning in 1982 by the EPA led to the judicial decision that these uses of 1080 should be allowed (Nissen 1982, Thomas 1983). However, opposition and inertia have caused any such progress in EPA to be extremely slow and no registration has yet occurred, despite extensive research data on use of the 1080-collar (Connolly 1980, Wade and Connolly 1980, Texas Agricultural Experiment Station 1983) and extensive field data on the use of single-dose toxic baits. However, the EPA and USDI moved with alacrity to allow diphacinone in single-dose toxic baits for protection of Aleutian Canada geese in 1983 (Pesticide and Toxic Chemical News 1983).

RESULTS OF ADC POLICIES

The TAEX is authorized and directed by law to cooperate with federal agencies to conduct predator and rodent control for protection of livestock, crops and feed, food supplies and range. This cooperative agreement, created by legislative mandate, had been entered into with the USFWS. It is the basis for the TRPACS, which carries out both operational control programs and technical educational activities in urban and rural areas in close cooperation with county extension agents and others. In addition, TAEX Wildlife and Fisheries specialists carry out educational activities in support of county extension programs statewide in all aspects of wildlife management, including damage control. In spite of this unique blend of TAEX educational and TRPACS operational control programs, the predator-livestock problem continues to increase in Texas. Direct economic losses to sheep and goat producers in 1978 were estimated at \$13 million (Texas Crop and Livestock Reporting Service 1979). A survey of Texas cattle producers indicated that 1.65 percent of the calves were killed by coyotes in 1981. At this level the loss of calves to coyotes in 1982 might have been \$30 million to Texas cattle producers. This does not include losses of other classes of livestock, poultry, crops and economically important wild game species. Also, these values do not include indirect costs to producers, which often exceed direct losses, nor do they include the ultimate losses to consumers.

Management of natural and renewable resources is critical to the well-being of the Texas economy and its citizens. The diversity of these resources often requires relatively sophisticated management due to the complex nature of many management problems. Texas has about 23 million acres of forests and 97 million acres of rangeland with a wide variety of crops, livestock, and wildlife as major products. At present, over 80 percent of the rangeland is moderately to severely limited in production due to infestation by noxious weeds and brush. Many areas are virtually useless for crop and livestock production due to dense brush cover. Much of this is due to poor management and overgrazing in the past which led to invasion of brush on millions of acres of grassland. In addition to loss of production, there have been major declines in water yield and quality as a consequence (Smith and Rechenthin 1964, Scifres 1980).

Recognition of these factors has led to increased efforts in recent years to improve management through grazing and cropping practices. Although improvements have been noted, there are numerous factors which have limited efforts to improve management, particularly in the use of sheep and goats which can be a major factor in biological control of brush species (Scifres 1980, Bowns 1982). Droughts, low livestock prices and high production costs have been significant limiting factors. In many instances, however, losses of sheep and goats to predators have forced abandonment of sheep and goat production.

The relationship of coyote population density to predation losses has been shown by Shelton and Klindt (1974), Neilsen (1977) and Howard and Shaw (1978). Sheep and goat losses increase in areas where coyote densities increase and sheep and goat densities decrease. Consequently those producers in the periphery of sheep and goat production areas find it increasingly difficult or impossible to control losses to predators. This is most evident for isolated producers who are most exposed to predation. Despite intensive effort by them as well as the Texas ADC program, there is only partial success in reducing predation losses. Also, fear of such losses has prevented the use of these animals even where predation has been reduced or controlled. Losses to predators, primarily to coyotes, have thus become the major limiting factor to sheep and goat production in many areas in Texas and are beginning to impact other wildlife species.

TEXAS ADC PROGRAM NEEDS

Specific needs for an adequate statewide program include the following:

1. A consistent federal policy which recognizes ADC as an essential element in wildlife management and protection of resources.
2. Sound operational policies which permit ADC professionals to make decisions on programs, methods and procedures at the state and local levels.
3. Additional funding and personnel to meet current needs.
4. Registration of toxic collars and baits for use in control of coyote predation.
5. Re-registration of the Humane Coyote Getter®.

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