ALASKA DEPARTMENT OF FISH AND GAME
JUNEAU, ALASKA

STATE OF ALASKA
Jay S. Hammond, Governor

Department of Fish and Game
Ronald O. Skoog, Commissioner

Division of Game
Ronald Somerville, Director
Donald McKnight, Research Chief

OTTER AND MARTEN LIFE HISTORY STUDIES

BY: LOYAL JOHNSON

Volume I
Project Progress Report
Federal Aid in Wildlife Restoration
rojects W-17-10 and W-17--11 (1st half), Job 7.10 R

(Printed May 1979)

JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperator: Loyal Johnson

Project No: W-17-10 and W-17-11 Project Title: Furbearer Investigations

Job No: 7.10 R Job Title: Life History of Southeastern Alaska Land Otters and Marten

Period Covered: July 1, 1977 through December 30, 1978

SUMMARY

A comprehensive review of the world marten and land otter literature was completed. Carcasses of otters and marten were obtained from trappers in Southeastern Alaska. Preliminary autopsies were performed, measurements taken and specimens stored.

CONTENTS

BACKGROUND

OTTER

The river or land otter (*Lutra canadensis*) is native to North America and occupies most of that continent except for the treeless Arctic and arid southwestern United States (Palmer 1954, Hall and Kelson 1962). Being powerful swimmers and capable of rapid overland travel, otters can occupy all suitable habitat throughout their range. Hall and Kelson (1962) list 19 subspecies for North America.

I was not able to locate a single publication describing otters inhabiting the marine environment, as occurs in coastal Alaska. There are no recently published accounts to substantiate that this species is declining. Ingles (1947) reported them reduced "today" (1947) in California. Tabor and Wight (1977) report decreasing catches from Oregon in late 1960's but, based on modeling, concluded that population was static. Otters have undoubtedly suffered from the encroachment of civilization and/or industrialization in local situations, especially water pollution in industrialized areas.

Reproductive biology of the otter is poorly understood, and the literature is scanty and conflicting. Being the captivating creatures they are, many otters have been raised and bred in captivity. It is from these circumstances that the published accounts of otter reproduction have been documented. However, these accounts are more frequently of popular style rather than scientific. Liers (1951), in describing his captive otters, reported that they breed in winter and early spring. He reported that female otters have a 42-46-day period of heat and that there is a 6-day cycle of active receptivity. Liers also reported that few male otters in captivity have the ability to successfully breed upon command during the rut and that males appear incapable of breeding until they are 5 to 7 years of age even though both sexes are sexually mature at 2 years of age. Liers listed breeding records of four of his captive female otters, including one that whelped on four occasions during a 9-year period. The period between observed breeding and whelping varied from 9 months, 18 days to exactly 12 months. Three other females, ages 4, 4, and 8, showed intervals between observed breeding and whelping

of 11 months, 20 days to 12 months. Wilson (1959) questioned the validity of Liers' data because of the artifacts of captivity. His own data, based on an examination of four pregnant females, supported a 61-day gestation period considered normal for the European otter (*Lutra lutra*) (Cocks 1881). Delayed implantation in the otter was not qualitatively documented until 1964 (Hamilton and Eadie 1964).

In a later report Liers (1958) retracted his earlier contention that otters are not sexually mature until they are 2 and presented an account of the breeding of a 16-month-old female followed by the birth of four pups 9 months, 18 days later on January 24.

Liers' reports then show a breeding season from January 1 through February 22 with birth dates from November 11 through January 16. Most instances of breeding occurred in January, and most whelping occurred in January. These breeding and whelping dates observed by Liers in captive otters are contrary to those observed in wild otters, i.e., females lactating or containing implanted embryos are not taken in the wild during winter months. It appears that the artifacts of captivity may have altered the normal reproductive phenology of his animals.

Liers (1951, 1958) reported litter size to range from two to four young, with four being the most prevalent. All his data are for Minnesota otters.

A review of otter reproduction by Hamilton and Eadie (1964) noted the paucity of data on otter reproduction. Based on examination of carcasses of trapped otters in New York state, these workers reported that 10 of 12 females over 2 years of age taken between November 5 to December 20 showed breeding history, but no implanted blastocysts were recovered. No blastocysts were recovered after December 28, but no adult females were examined during January. They estimated the implantation date as late January-early February. Fetuses ranging in size from 76 mm (crown-rump) to 275 (total length) were recovered from adult females taken during the period March 12 to April 14.

Hamilton and Eadie's data showed that breeding takes place soon after birth in multiparous females in late March-early April and at the same time for primiparous 2-year-old females. In summary, these workers found that New York otters mate in March and April and blastocysts implant the following January-February. Development proceeds rapidly upon implantation; and young, commonly two per litter, are born in March-April, for a gestation period of about 12 months. They also found that there was a close correlation between litter size of implanted fetuses (mean = 2.11) and corpora lutea (mean = 2.38).

Hamilton and Eadie (1964) also reported finding no active spermatogenesis in males under 23 months of age, but all males over that age possessed mature spermatozoa in the epididymis (no specimens were available from May through October). They also reported that the testes of males regress in size following their first breeding season, but thereafter no such regression was noted.

Tabor and Wight (1977), working in Oregon on trapped otters taken between November 15 and February 15, found no evidence of breeding in 2-year-old land otters, but found that female otters 3 years old and older breed annually. They found a high correlation between the number of corpora lutea (3.02), blastocysts (2.80), and implanted embryos (2.75). There was no significant difference in corpora lutea counts in otters 3, and 4-11 years of age. Seton (1929) reported that otters breed annually. Liers' (1951) suggested his captive females did not breed annually.

Attempts to develop precise techniques for determining the ages of otters have received very little attention until only recently. In 1949 Hooper and Ostenson described a technique based on cranial and osteological characteristics which allowed segregation into four age groups: group 1 (comparable to otters up to about 9 months of age); group 2 (otters in first and second year); group 3 (otters in third and fourth year); and group 4 (older). The size and shape of the baculum can only reliably be used to differentiate adults from immatures in otters (Friley 1949) and in other mustelids (Wright 1947). Tabor and Wight (1977) and Stephenson (1977) described techniques for sectioning canine teeth, which provide specific ages of individual animals. These workers were hampered by a lack of known-age materials, but Stephenson reported high agreement between his few known-age animals and cementum annuli.

Longevity records for otters are scanty. Liers (1951) discussed one of his captive otters which was 16 years old. Stephenson (1977) aged two animals at 13 years using the cementum annuli technique, and Tabor and Wight (1977) reported one otter of 11 years of age on the basis of this technique.

The subjects of habitat requirements for the river otter and the impact of alteration of that habitat on otter populations has not been specifically reported in the otter literature. Liers (1951) described otter natal dens as being in burrows, cavities among tree roots, and vegetation thickets and mentioned that these burrows are dug by other animals whereas Seton (1929), quoting others, noted that they dig their own dens. Seton (1929) and Palmer (1954) provide the only written descriptions of otter habitat: Seton, "...where there are forests and water, pg. 675," and "ideal surroundings in good-sized clear streams that abound with fish, and that are much varied in bank and bed with pools, rapids, log jams, and overhanging rocky banks (pg. 676)"; and Palmer "...all types of inland waterways, also marine coves, estuaries, and about islands (pg. 112)."

In coastal Alaska it has been my observation that otter dens, whether for resting or for raising young, are under tree roots and usually within a few feet of salt water.

Liers (1951) and Seton (1929) noted that otters are territorial but, because of the distances they quickly travel, will occupy territories recently voided by the death of previous occupants.

females, respectively. Yearling animals were slightly smaller and lighter, except for hind foot lengths, than 2-year-old animals. These data are from otters taken by trappers from November to March.

MARTEN

The genus *Martes* occurs throughout the northern hemisphere (Marshall 1946). A single species (*Martes americana*) inhabits North America and, at least in former times, occupied a range that coincided with the transcontinental coniferous forest (deVos 1952). Marten distribution in Alaska coincides with that of climax spruce forests (Anon 1978). Hall and Kelson (1959) listed 14 subspecies for North America.

Marten are native to Southeastern Alaska but apparently did not occur naturally on the islands north of Frederick Sound or Prince of Wales Island. To provide jobs for unemployed Alaskans, monies were made available, starting in 1934, through the Bureau of Biological Survey and the Civil Works Commission to transplant or relocate various species, including marten (Alaska Game Commission 1935), in Alaska. Initial releases were made of *M. a. actuosa* (Hall and Kelson 1959) on Prince of Wales Island (10 animals) and Baranof Island (7 animals; 4 males, 3 females). Despite the small numbers released, the transplants succeeded in establishing marten at both release sites.

Efforts began in 1949 to establish marten on Chichagof Island when six animals, two males and four females, were captured on Baranof Island and released on Chichagof. That transplant was bolstered by the release of a total of 15 animals in the Pelican area during 1951 and 1952. The source of the transplant stock was Southeast Alaska; Ketchikan (1 animal), Stikine River (6 animals), and Petersburg-Wrangell (5 animals). However, three animals, presumably *M. a. kenaiensis* (Hall and Kelson 1959), were obtained at Polly Creek near Anchorage (Elkins and Nelson [1954] and Burris and McKnight [1973]).

To protect the new introductions, no trapping season was allowed for marten on Baranof Island during the 1948-1949 and 1949-1950 seasons, and no trapping was allowed on Chichagof Island from 1948 through 1962. Apparently no such protective closure was ever effected for the Prince of Wales marten introduction (Johnson 1978). In addition to that specific closure, marten seasons were generally offered only on an alternate year basis from 1925 through 1962 over most of Alaska.

Despite the small numbers of animals released, all transplants succeeded in establishing marten on previously uninhabited islands. In fact, they have since spread to adjacent islands, such as Kruzof. This is particularly striking in light of the relatively low reproductive potential of this species. Populations of martens are now reasonably dense throughout Southeastern Alaska.

It is not known where or how marten became established on Admiralty Island. There are no records of transplants. Holzworth (1930) did not mention them in his account of mammalian fauna nor are they mentioned by

Short (1964) in his account of trapping and homesteading in the 1950's. One oldtime trapper reports that they were absent until the late 1950's (Fred Manley, pers. comm.). However, there are five marten specimens in National Museum of Natural History which were collected by Alan Hasselborg, a noted Admiralty Island resident, on Admiralty Island in 1915 (Mrs. Joy Gold, Zoology Docent, Nat. Mus. Natl. Hist., pers. comm.).

At the present time marten are reasonably abundant on Admiralty Island. I personally observed a marten swimming several miles offshore from Baranof Island, and it is possible that the present Admiralty population is a natural extension from the population on the mainland. It is an interesting observation that the present Admiralty population possesses very low quality fur which can readily be identified by experienced fur buyers (Don Davis, Juneau, Alaska, and Chuck Peterson, Sitka, Alaska, pers. comm.). This they attribute to the absence of red squirrels (*Tamiasciurus hudsonicus*) on Admiralty, which are supposedly the mainstay food item for marten. In fact, red squirrels were introduced to Baranof and Chichagof Islands as a food source for the marten introductions (Elkins and Kelson 1954). Squirrels are very abundant on Baranof, Chichagof, Kruzof, and adjacent islands but are not known to occur on Admiralty (pers. obs.).

As was common in early day wildlife transplants, there were apparently no formal attempts to monitor the success of the marten transplants. I have not been able to find any references on the subject other than an occasional harvest report. In addition, there is a notable lack of literature and knowledge on Alaskan marten in general and for Southeast Alaska in particular.

The reproductive biology of the marten is well understood. Wild female marten are not sexually mature as yearlings, but males are (Jonkle and Weckwerth 1963). Others (Walker 1929, Enders and Leekley 1941, Markley and Bassett 1942, and Krott 1973) reported that they do not breed their first year of life. Breeding has been reported to occur May-July (Walker 1929), June-July (Krott 1973), July-August (Ashbrook 1930, Pearson and Enders 1944, and Jonkle and Weckwerth 1963), August (Brassard and Bernard 1939), and July-September (Ashbrook and Hansen 1927, Enders and Leekley 1941). Typical of the mustelids, marten show delayed implantation (Hamlett 1935, Brassard and Bernard 1939, Wright 1942, Marshall and Enders 1942, Pearson and Enders 1944, and Jonkle and Weckwerth 1963). Delayed implantation in marten was first described by Hamlett (1935) but was suspected earlier by Grinnell et al. (1937). The long gestation period was well known and reported earlier (Ashbrook and Hanson 1927 and Walker 1929). Parturition occurs in March-April (Hanson 1927, Walker 1929, Ashbrook 1930, Brassard and Bernard 1939, deVos 1957, and Jonkle and Weckwerth 1963) or May (deVos 1957). Blastocysts are free until at least January (Marshall and Enders 1942) and implant February-April with birth occurring within about 27 days after implantation (Jonkle and Weckwerth 1963). Litter sizes range from two to six and average about three (Ashbrook and Hanson 1927, Walker 1929, Ashbrook 1930, Jonkle and Weckwerth 1963, Mech and Rogers 1977, and Stickland and Douglas 1978).

Until recently techniques for age determination were imprecise and limited to observed osteological development. Dagg et al. (1975), using radiography on fall and winter-trapped marten in Ontario, Canada, determined that the distal femoral epiphysis of 142 specimens were fully closed by November, making it impossible to differentiate young of the year from adults after that date. Marshall (1942 and 1951a), using the following measurements: (1) standard body measurements; (2) tooth development and wear; (3) fusing of sutures; (4) other skull measurements; (5) bacula weight; (6) occurrence of corpora lutea; and (7) character of saggital crest of 107 marten trapped in central Idaho, determined that these measurements singly or in combination are useful only in separating marten into two age groups, immature and adult. Marshall (1942 and 1951a), Lensink (1957), and Grakov (1962) reported similar findings on the relationships between the degree of development of the saggital crest and size and weight of bacula of males and reproductive tracts and/or breeding history of females. These findings are: males whose bacula weigh less than 200 mg have an opening between the temporal muscles or at most a saggital crest less than 20 mm in length; females with a separation between the temporal muscles will show no evidence of having bred, i.e. no corpora lutea or corpora albicans. Lensink provided data on Interior Alaska marten and suggested that males with no saggital crest and bacula weights of less than 130 mg are less than 12 months of age. He provided no method of distinguishing yearling females from 2-year-olds. Quick (1956) concluded that female marten with saggital crests 0-10 mm long represent young of the year, 11-20 mm represent yearlings, 21-30 mm represent minimum breeding, and over 31 mm represent older adults. Among males, 0-10mm, represent young of the year, 11-30 represent youngish, and over 31 mm represent older age. These were not confirmed by comparison with known-age specimens.

In recent years M. A. Strickland (Regional Project Biologist, Parry Sound, Ontario, pers. corr.) and M. K. Brown (New York State Dept. Env. Cons., Warrensburg, pers. Corr.) have had encouraging results using cementum annuli techniques to determine ages of marten. However, they have no known-age specimens to verify their findings.

Analysis of marten reproductive tracts to determine fecundity rates has proven feasible (Marshall 1951 and Jonkle and Weckwerth 1963). There is evidence of a close correlation between corpora lutea counts and litter size. (Marshall 1951b and Lensink 1953). Recovery of identifiable blastocysts is contingent upon availability of specimen material before autolysis begins (J. J. Burns, Pers. Comm.).

Habitat requirements of marten in Southeastern Alaska are not known. Elsewhere within their range it has been reported that marten are creatures of mature forests (Seton 1929, deVos 1952, Marshall 1951b, Lensink 1953, Hawley 1955, Koehler et al. 1975, Mech and Rogers 1977, Koehler and Hornocker 1977, and Soutiere 1978). Alteration of the pristine forest can have significant impact on marten populations. Mech and Rogers (1977) in Minnesota, deVos (1952) in eastern Canada, and Marshall (1951b) in Idaho have reconstructed the decline of marten populations following settlement with its attendant forms of land alteration, especially clearing, logging, and fire. Marshall (1946) reported little

marten sign in winter in areas devoid of tree cover. In Canada deVos (1952) noted that marten were less abundant in second growth stands than in mature forests. Koehler et al. (1975) in Idaho showed that marten prefer stands older than 100 years and that such a stand must have a canopy cover greater than 30 percent. Koehler et al. also reported that marten will cross but not hunt in openings less than 300 feet in width during winter. They noted that marten were not observed to have crossed openings greater than 300 feet and that marten do not use "dog hair thickets" because of minimal small rodent populations. Soutiere (1978) observed marten tracks in openings as wide as 200 m. Habitat requirements in summer seem to be less rigid than in winter (Grinnell et al. 1937 and Marshall 1946).

Koehler et al. (1975) postulated that fire and man-made disturbances, such as logging, are normally negative factors because marten require large blocks of habitat. Russian studies have shown that marten catches decrease following cutting of mature forests in which the cuts are of the magnitude of 65-75 percent of the total forested area (Grakov 1972), and that such reductions are related to a reduction of the marten's food source (Vaisfel'd 1972). **Martell and Radvanyi (1977) reported** that clear-cutting of upland black spruce forests in northern Ontario produced a dramatic change in species composition of small mammals, but may have caused little change in density. Red-backed voles (*Clethrionomys gapperi*) were most negatively impacted. Gashwiler (1970), Hoovan (1969), Tevis (1956), and Sims and Buckner (1973) have also documented reductions in vole populations following clear-cuttings, while Krefting and Ahlgren (1974) documented similar results following fire. These workers also noted significant increases in population densities of *Peromyscus* sp. following disturbance. This is noteworthy, for small mammals, particularly the red-backed vole, have been shown to be the staple food of marten. Soutiere (1978) in Maine reported that marten are not necessarily restricted to mature spruce-fir forests and can tolerate men and machines associated with logging. He further reported (p. 51) that clear-cuts are detrimental to marten populations, but suitable marten habitat can be provided if cuts "Retain a minimum of 25 percent of the area in spruce-fir forest cover having a basal area of at least 25 m^2/ha in pole stage and larger trees". Soutiere believed that nonoperable and immature timber, especially along watercourses and as islands within clear-cuts, are essential elements of marten home ranges. These findings should be of profound importance in land use planning in Southeast Alaska.

Seton (1929) and Cowan and MacKay reported the cyclic nature of marten populations (based upon harvest figures). From their food habits studies, Cowan and MacKay (19?) deduced that marten cycles are not related to similar and coincidental cycles in snowshoe hares (*Lepus americanus*) and the grouse family.

Natal dens are rarely found. One such den located in a "rocky bank" in California was occupied for 6 years consecutively (Ingles 1947). A den with four young was observed about 60 feet above ground in a hollow fir tree on June 20, 1898, in California (Linsdale 1936).

Seton (1929) described their dens as being in hollow trees and at considerable height and that woodpecker nests may be appropriated. Seton quoted others as listing trees as preferred den sites, but suggested that ground dens may also be excavated. Seton did not specify or imply whether or not these were natal dens.

Microtine rodents are reported as being the primary prey of marten (Cowan and Mackay 1950, Newby 1951, Remington 1951, Lensink 1953, Hawley 1955, Lensink et al. 1955, Lensink et al. 1955, Quick 1956, Murie 1961, Lockie 1961, Weckwerth and Hawley 1962, and Koehler and Hornocker 1977). The above cited reports noted that red squirrels and *Peromyscus* sp. do not appear to be preferred food items for marten, although Grinnell et al. (1937), Marshall (1946) and Newby (1951) reported that tree squirrels may at times be important. The above studies all noted or implied the catholic nature of marten food habits, often dictated by prey distribution and abundance rather than preference.

There is little in the literature on the size of marten in general, and no information could be found on those from Southeastern Alaska. DeVos (1957) gave the following measurements for a lactating female taken in Ontario: TL 530 m, T 150 m, hind foot 81 mm. No weight was given. In California, Grinnnell et al. (1937) gave the following measurements for 14 "adult or nearly adult" male marten in mm: TL 620, T 197, HF 85, weight 983 gms and for 4 "adult or nearly adult" females: TL 577, T 187, HF 76, and weight 741 gms. Weckwerth and Hawley (1962) reported that the average live weights of female marten ranged from about 525 to 680 gms and males ranged from about 920 to 1,160 grams. Hawley and Newby (1957) reported that female marten averaged 635 grams (N=20) and males 1,006 gms (N = 69), with seasonal variation. The lowest weights occur during the winter months. Mech and Rogers (1977) give 885 gms as the average weight of four male adults and 672 gms for one female marten in Michigan. They reported considerable variation in weights on successive recaptures, as did Hawley and Newby (1957). In Maine, Soutiere (1978) listed mean weights of live-trapped males in fall and winter as 712 gms and females as 453 gms. He, too, noted considerable seasonal variation. Hall and Kelson (1959), without listing the source of specimens or season, listed males as having total length of ranges of 570-682 mm, tail 170-240 mm, hind foot 79-90 m, and weights up to 2 3/4 pounds; while females are 513-560 mm, 165-195 mm, 70-78 mm, and up to 0.85 kg. Palmer (1954) reported that males measured 25-30 inches with a 7 1/4-10 inch tail and ranged in weight from 1 1/4 to 4 pounds with females 1/4 smaller and 1/3 lighter.

Longevity records are limited and are for captive animals. Markley and Bassett (1942) discussed a female that whelped at age 9 and mentioned an 11-year-old male. Hawley and Newby (1957) mentioned a 16-year-old. Burton (1962) and Seton (1929) reported that captive marten may live to 17 years.

Population Dynamics

A disproportionate number of males in the catch of marten has been documented by numerous observers. Harvested males typically outnumber

females by a ratio of about 160 to 100 (Grinnell et al. 1937, Parsell 1938, Twining and Hensley 1947, Yeager 1950, deVos 1952, Lensink 1953, Hawley 1955, Quick 1956, Hawley and Newby 1957, and Soutiere 1978). Markely and Bassett (1942) reported the sex ratio at birth to be nearly 1:1 in captive marten. A similar at-birth ratio was reported by Yeager (1950). In heavily exploited populations the sex ratio is frequently close to 1:1 (Marshall 1946, Quick 1956). Hawley and Newby (1957) differentiated three groups of marten (resident, temporary resident, and transient) and noted the sex ratio of the resident group was about 1:1. Another sex ratio phenomenon has been frequently observed in catches of marten, that is, an increase in the percentage of females in the catch as the season progresses into January and February (Grinnell et al. 1937, Parsell 1938, Twining and Hensley 1947, Yeager 1950, and Lensink 1953).

Various authors have reported on the age structure of trapped marten. Lensink (1953) reported that 45 percent of the annual catch in Interior Alaska was young-of-the-year on an exploited population; that percentage decreased markedly as trap lines were established in new areas. Strickland and Douglas reported that young contributed 50-60 percent of the catch in an expanding population in Canada. Hawley and Newby (1957), in Glacier National Park, caught 30 percent young in their live trapping effort on a nonexploited population.

Quick (1956) observed that the percentage of young-of-the-year increased from 48 percent to 77 percent on successive years in an area that was trapped "exhaustively"; yet in an adjacent area subject to lesser trapping intensity the percentage of young in the catch did not show the same increase. Quick suggested that it is possible to catch all the resident marten with excessive trapping and that the area will be repopulated by immigration of young transient animals from adjacent areas. This is supported by the observations of deVos (1952) and Hawley (1955). In addition, Hawley noted that the various sex and age classes can fluctuate widely from year to year in response to food supply. It is thus important to recognize that sex and age data from trapper-caught samples over 1 to 2 years are not sufficient to draw quantitative or qualitative conclusions on a marten population.

Densities of marten populations are known to fluctuate in response to food supplies (Weckwerth and Hawley 1962) and overexploitation (Grinnell et al. 1937, Marshall 1946, Cowan and Mackay 1950, deVos 1952, Quick 1956, and Mech and Rogers 1977). In addition, of course, some areas are capable of supporting greater densities than are others. Consequently, published density figures must be viewed with those concepts in mind. Densities determined by live trap-recapture studies of unexploited populations in Glacier National Park, Montana, ranged from 2.4 to 4.3 per mi^2 (Weckwerth 1937 and Hawley 1955). In Idaho, Marshall (1942) suggested a catch of one marten per 3 mi^2 was a sustainable yield. DeVos (1952) and Quick (1956) suggested a catch of about one marten per 2 mi^2 was a sustainable yield. Quick hypothesized that the catch should not exceed the ratio of young-of-the-year to one adult female.

The limited published accounts show marten to be relatively free of parasites. Four authors reported marten to be the host of an unusual stomach worm, *Soboliphyme baturini* Petrov (Cheng 19?, Bezdek 1942 *in* Hopla 1965, Marshall 1942, and Newby 1951). Two other species of round worms have been identified, *Ascaris devosi* Sprent (deVos 1952) and *Ascaris columnaris* Leidy (Marshall 1942). DeVos (1952 and 1957) listed two species of ticks, *Ixodes cookei* Packard and *I. texanus*, and two species of fleas, *Monopsyllus vison* (Bak) and *Megabothris atrox* (Jord).

One Trichina cyst was observed in a marten from Arctic Village, Alaska (Dunagan 1957 *in* Hopla 1965).

The published data on parasites of marten appear to be very superficial, for my casual examinations of marten have revealed considerable ectoparasitological information. Three species of fleas, *Chaetopsylla floridensis* (I. Fox), *Monopsyllus ciliatus protinus* (Jordan), and *Hystrichopsylla dippiei spinata* Holland, and one species of fur mite, *Lynxacarus mustelae* all heretofore unrecorded for marten have been identified (G. E. Haas, District Sanitarian, Alaska Dept. Health and Social Services, Anchorage, pers. corr.; Haas et al. 1978; Haas et al. unpubl.).

OBJECTIVES

To determine the sex and age composition of land otters and marten harvested in Southeastern Alaska, to establish baselines of body growth in these species, and to determine breeding history of harvested females of these species.

PROCEDURES

Marten and otter carcasses were solicited from trappers throughout Southeastern Alaska. A reward incentive of $2 per marten and $5 per otter carcass was offered. Carcasses were gathered in Sitka, where they were autopsied. Standard body measurements (Anderson 1948) were taken, weights recorded, sex determined and general physical well-being determined. Skulls, bacula. testes, reproductive tracts, femurs, and pelvic girdles were collected, labeled, and refrozen. In 1977 muscle tissue samples were collected from marten for cessium 137 content determination. Gross parasitological examinations were made.

FINDINGS

A literature review revealed that considerable research was conducted on marten in the 1940's and 1950's, when the demand for their furs was great; but little has been done since then. Most of these studies were conducted on penned animals, particularly those describing the reproductive life history of the marten. Many of these studies dealt with the ecology of discrete and often isolated populations. No literature could be found on marten for Southeastern Alaska except a description of transplants.

Life history, habitat requirements, food habits, and reproduction are well documented. No techniques were described for precise age determinations except for unreported ongoing research. Numerous reports documented

impacts of habitat destruction on marten in North America and Russia, and most reports described the reliance of marten on undisturbed, climax vegetation. No reports were located which described marten ecology in a coastal forest situation as exists in Southeastern Alaska.

A search of the literature revealed that very little quantitative or qualitative information is available on otters. The few published accounts conflicted on such basic knowledge as length of gestation period, breeding season, time of parturition and even size of otters. No information could be found documenting otter habitat requirements nor could any data be located describing any aspect of otter life history in a marine environment as occurs in Southeastern Alaska.

Trapper response to this research program was excellent. Carcasses of 506 marten and 83 otters were purchased in the 1977-1978 season. An additional 202 marten and 26 otter carcasses were collected through December 1978. These carcasses were received frozen and a few were in a fairly advanced state of decomposition. The volume of specimens and problems with adequate storage made it necessary to autopsy the carcasses and collect the desired specimen materials as time allowed and refreeze the labeled specimens. Therefore I decided to concentrate on specimen collections and literature review during the first 2 years of study and defer all analyses until after the second year's carcass collection has been made and the carcasses reduced to specimens.

Recent work by others has shown the potential for accurate age assessment of marten and otters through tooth sectioning. This work will be done in the Division's Anchorage laboratory beginning in 1979.

As time permits, age determinations will be made using tooth sectioning techniques and all size, weight, sex ratio, reproductive analysis, and other calculations made. These will be reported in the final report. At that time recommendations for future research and management direction will be made.

BIBLIOGRAPHY

Alaska Game Commission. Annual Reports, 1925-1937. Juneau. (mimeo.)

Anderson, R. M. 1948. Methods of collecting and preserving vertebrate animals. Nat. Mus. of Can., Bull. No. 69, Biol. Ser. No. 18.

Anon. 1978. Alaska's wildlife and habitat. Vol. II. State of Alaska Dept. Fish and Game.

Anon. 1978. North American furbearers. E. F. Deems, Jr. and D. Pursley ed. Publ. by Intl. Assn. Fish and Wildl. Agencies, Fur Resour. Comm. Univ. Maryland Press. 171 pp.

Ashbrook, F. B. 1930. The normal breeding season and gestation period of martens. U.S. Dept. Agric. Circ. No. 107. 7 pp.

Ashbrook, F. G. and K. B. Hanson. 1927. Breeding martens in captivity. J. Hered. 18(11):499-503.

Brassard, J. A. and R. Bernard. 1939. Observations on breeding and development of marten, *Martes a. americana* (Kerr). Can. Field-Nat. 53(2):15-21.

Burris, O. E. and D. E. McKnight. 1973. Game transplants in Alaska. State of Alaska Dept. Fish and Game, Game Tech. Bull. No. 4.

Burton, M. 1962. Systematic dictionary of mammals of the world. Thos. Y. Corwell Co., New York. 307 pp.

Cheng, T. C. 1967. The biology of animal parasites. W. B. Saunders, Co., Philadelphia. 721 pp.

Cocks, A. H. 1881. Notes on the breeding of the otter. Proc. Zool. Soc., London. pp 249-250.

Cowan, I. McT. and R. H. MacKay. 1950. Food habits of the marten (*Martes americana*) in the Rocky Mountain region of Canada. Can. Field-Nat. 64(30):100-104.

Dagg, A. I., D. Leach, and G. Sumner-Smith. 1975. Fusion of the distal femoral epiphysis in male and female marten and fisher. Can. J. Zool. 53:1514-1518.

deVos, A. 1952. Ecology and management of fisher and marten in Ontario. Ontario Dept. Land, For. Tech. Bull. 90 pp.

_____. 1957. Pregnancy and parasites of marten. J. Mammal. 38(3):412.

Elder, W. H. 1951. The baculum as an age criteria in mink. J. Mammal. 32(1):43-50.

Elkins, W. A. and U. C. Nelson. 1954. Wildlife introductions and transplants in Alaska. Proc. 5th Alaska Sci. Conf. 21 pp. (mimeo).

Enders, R. K. and J. R. Leekley. 1941. Cyclic changes in the vulva of the marten. The Anat. Rec. 79(1)1-5.

Friley, C. E. 1949. Age determination, by use of the baculum, in the river otter, *Lutra c. canadensis* Schreber. J. Mammal. 30(2):102-110.

Gashwiler, J. S. 1970. Plant and mammal changes on a clearcut in west-central Oregon. Ecol. 51(6):1018-1026.

Grakov, N. N. 1962. [(On methodology of determining the age of pine marten.)] In Problems of Zoological studies in Siberia. Knigoizdat: Gorno-Altaisk. pp 55-57. 1962. Referat. Zhur. Biol. 1963. No. 19I165.

_____. 1972. [(Effect of concentrated clear fellings on the abundance of pine marten (*Martes martes* L.)]. Bull. Moscow Nat. Biol. Ser. 1:14-23.

Greer, K. R. 1955. Yearly food habits of the river otter in the Thompson Lakes region, northwestern Montana as indicated by scat analysis. Am. Midl. Nat. 54(2):299-313.

_____. 1957. Some osteological characters of known-age ranch minks. J. Mammal. 38(3):319-330.

Grinnell, J., J. S. Dixon, and J. M. Linsdale. 1937. Fur-bearing mammals of California. 2 Vols. Univ. Calif. Press, Berkeley. 1:184-210.

Haas, G. E., R. E. Barrett, and N. Wilson. 1978. Siphonaptera from mammals in Alaska. Can. J. Zool. 56(2):333-338.

Haas, G. E., T. Rumfelt, L. J. Johnson, and N. Wilson. Siphonaptera from mammals in Alaska. Suppl. I. (unpubl.)

Hagmeier, E. M. 1956. Distribution of marten and fisher in North America. Can. Field-Nat. 70(4):149-168.

Hall, E. R. and K. R. Kelson. 1959. The mammals of North America. The Ronald Press Co., New York. 1083 pp.

Hamlett, G. W. D. 1935. Delayed implantation and discontinuous development in the mammals. Q. Rev. Biol. 10:432-447.

Hamilton, W. J. Jr., and W. R. Eadie. 1964. Reproduction in the otter, *Lutra conadensis*. J. Mammal. 45(2):242-252.

Hawley, V. D. 1955. The ecology of the marten in Glacier National Park. Mont. State Univ. (unpubl., M.S. thesis.)

Hawley, V. D. and F. E. Newby. 1957. Marten home range and population fluctuations. J. Mammal. 38(2):174-184.

Holzworth, J. M. 1930. The wild grizzlies of Alaska. G. P. Putnam and Sons, New York. 417 pp.

Hooper, E. T. and B. T. Ostenson. 1949. Age groups in Michigan otter. Univ. Mich. Mus. of Zool., Occas. Pap. No. 158. 22 pp.

Hopla, C. E. 1965. Parasites of Alaskan vertebrates. Host-parasite index, between Dept. of the Army and Univ. of Oklahoma Research Institute, Norman, Oklahoma. 73 pp.

Ingles, L. G. 1947. Mammals of California. Stanford Univ. Press, Stanford. 258 pp.

Johnson, L. J. 1978. Pages 40-44 In R. H. Hinman ed. Annual report of survey-inventory activities. Part IV, Alaska Fed. Aid. in Wildl. Rest. Proj. W-17-9. 194 pp.

Jonkle, C. J. and R. P. Weckwerth. 1963. Sexual maturity and implantation of blastocysts in wild pine marten. J. Wildl. Mgmt. 27(1):93-98.

Koehler, G. M., W. R. Moore, and A. R. Taylor. 1975. Preserving the pine marten, management guidelines for western forests. W. Wildl. 2(3): 31-36.

Koehler, G. M. and M. G. Hornocker. 1977. Fire effects on marten habitat in the Selway-Bitterroot Wilderness. J. Wildl. Manage. 41(3):500-505.

Krefting, L. W. and C. E. Ahlgren. 1974. Small mammals and vegetation changes after fire in a mixed conifer-hardwood forest. Ecol. 55(6): 1391-1398.

Krott, P. 1973. DIE FOZTPFLANZUNG DES EDELMARDES [*MARTES MARTES* L) IN FREIER WILBAHN. (THE REPRODUCTION OF THE PINE MARTEN (*MARTES MARTES* L.) IN THE WILD.] Z. Jagdwiss 19(3):113-117 (1 fig.), Sept. 1973. In German with French and English summ.

Lagler, K. F. and b. T. Ostenson. 1942. Early spring food of the otter in Michigan. J. Wildl. Manage. 6(3):244-254.

Lensink, C. J. 1953. Population dynamics, movements, food habits, and habitat preferences for the marten in Interior Alaska. In Q. Prog. Rep., Surveys and Inventories. Alaska Fed. Aid in Wildl. Rest. Proj. W-3-R-8 8(1):53-79.

Linsdale, J. M. 1936. William H. Parkinson: California naturalist. J. Mammal. 18(1):30-37.

Linsdale, J. M., R. O. Skoog, and J. L. Buckley, 1955. Food habits of the marten in interior Alaska and their significance. J. Wildl. Manage. 19(3): 364-368.

Liers, E. E. 1951. Notes on the river otter (*Lutra canadensis*). J. Mammal. 32(1):1-9.

_____. 1958. Early breeding in the river otter. J. Mammal. 39(3):438-439.

Lockie, J. D. 1961. The food of the pine marten *Martes martes martes* in west Scotland. Proc. Zool. Soc., London 136(2)187-195.

Markley, M. H. and C. F. Bassett. 1942. Habits of captive marten. Am. Midl. Nat. 28(3):604-616.

Marshall, W. H. 1942. The biology and management of the pine marten in Idaho. Univ. Mich. 107 pp plus App. (unpubl., Ph.D. thesis.)

_____. 1946. Winter food habits of the pine marten in Montana. J. Mammal. 27(1):83-84.

_____. 1951a. An age determination method for the pine marten. J. Wildl. Manage. 15(3):276-283.

_____. 1951b. Pine marten as a forest product. J. For. 49(12): 899-905.

Marshall, W. H. and R. K. Enders. 1942. The blastocyst of the marten (*Martes*). Anat. Rec. 84(3):307-310.

Martell, A. M. and A. Radvanyi. 1977. Changes in small mammal populations after clearcuttings of northern Ontario black spruce forest. Can. Field-Nat. 91(1):41-46.

Mech, L. D. and L. L. Rogers. 1977. Status, distribution, and movements of martens in northeastern Minnesota. U.S. For. Serv., Res. Pap. N.C. 143. 7 pp.

Murie, A. 1961. Some food habits of the marten. J. Mammal. 42(4):516-521.

Newby, F. E. 1951. Ecology of the marten in the Twin Lakes area, Chelan County, Washington. The State College of Washington. (unpubl., M.S. thesis.)

Palmer, R. S. 1954. The mammal guide. Doubleday and Co., Garden City. 384 pp.

Park, E. 1971. The world of the otter. Lippincott Co., Philadelphia. 159 pp.

Parsell, J. A. 1938. Notes on marten management. U.S. For. Serv., Northern Region News (Missoula, Montana). (25 pp mimeo.)

Pearson, O. P. and R. K. Enders. 1944. Duration of pregnancy in certain mustelids. J. Exp. Zool. 95(1):21-35.

Petrides, G. A. 1950. The determination of sex and age ratios in fur animals. Am. Midl. Nat. 43(2):355-382.

Quick, H. F. 1956. Effects of exploitation on a marten population. J. Wildl. Manage. 20(3):267-274.

Seton, E. T. 1929. Lives of game animals. Vol. 2, Part 2. Chas. T. Branford Co., Boston. 369-746 p.

Sheldon, W. G. and W. G. Toll. 1964. Feeding habits of the river otter in a reservoir in central Massachusetts. J. Mammal. 45(3):449-455.

Short, W. 1964. The cheechakoes. The Book Press, Brattlebro, Vermont. 244 pp.

Shepherd, P. E. K. 1978. The marten in Alaska. State of Alaska Dept. Fish and Game, Wildl. Notebook Series. Juneau. (1 p mimeo.)

Solf, J. 1972. The land otter in Alaska. State of Alaska Dept. Fish and Game, Wildl. Notebook Series. Juneau. (1 p mimeo.)

Soutiere, E. C. 1978. The effects of timber harvesting on the marten. Univ. Maine, Orono. 61 pp plus supplement. (unpubl., Ph. D. thesis.)

Stephenson, A. B. 1977. Age determination and morphological variation of Ontario otter. Can. J. Zool. 55(10):1577-1583.

Strickland, M. A. and C. W. Douglas. 1978. Some predictions for fisher and marten harvests for 1978-1979. Can. Trapper 7(2):18-19.

Tabor, J. E. and H. M. Wight. 1977. Population status of river otter in Oregon. J. Wildl. Manage. 41(4):692-699.

Twining, H. and A. Hensley. 1947. The status of pine martens in California. Calif. Fish and Game. 33(3):133-137.

Vaisfel'd, M. A. 1972 [(Effects of felling on the abundance of pine marten.)] Byull. Mosk. O-va Ispyt. Prir. Ofd. Biol. 77(5):29-39.

Walker, E. P. 1929. Evidence on the gestation period of martens. J. Mammal. 10(3):206-209.

Weckwerth, R. P. 1957. The relationship between the marten population and the abundance of small mammals in Glacier National Park. 72 pp plus App. (unpubl., M.S. thesis, Univ. Montana, Missoula.)

Weckwerth, R. P. and V. D. Hawley. 1962. Marten food habits and population fluctuations in Montana. J. Wildl. Manage. 26(1):55-74.

Wilson, K. A. 1959. The otter in North Carolina. Proc. 13th Ann. Conf., S.E. Assoc. Game and Fish Comm. pp 267-277. (mimeo.)

Wright, P. L. 1942. Delayed implantation in the long-tailed weasel (*Mustela frenata*), the short-tailed weasel (*Mustela cicognani*), and the marten (*Martes americana*). Anat. Rec. 83(3):341-353.

_____. 1950. Development of the baculum of the long-tailed weasel. Proc. Soc. for Exp. Biol. and Med. 75:820-822.

Yeager, L. E. 1950. Implications of some harvest and habitat factors on pine marten. Trans. N. Am. Wildl. Conf. 15:319-334.

PREPARED AND SUBMITTED BY:

Loyal Johnson
Game Biologist

APPROVED BY:

Donald L. Sommerich
Director, Division of Game

Donald E. McKnight
Research Chief, Division of Game