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HOOPA VALLEY INDIAN RESERVATION FISHER STUDY: PROGRESS REPORT

22 JANUARY 1996 to 5 JANUARY 1998

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ABSTRACT

Summaries of preliminary data from 22 January 1996 to 5 January 1998 are presented for the ongoing fisher project on the Hoopa Valley Indian Reservation. Forty-six individual fisher (36 females: 10 males) were captured 118 times (61.02% recapture) with 980 trap nights of effort (12.04% trap success). Radio collars were affixed to 16 animals (11 females: 5 males). We located fisher rest sites on 227 occasions averaging 18.31 times per animal (Range 1-52). Reuse of previously identified rest sites (not including den sites) occurred at 13.22% of locations. Minimum Convex Polygon (MCP) and 95% Adaptive Kernel (ADK) home range estimates were calculated for animals with greater than 10 locations (including breeding season except den sites). Mean female home ranges (n=7) were 174.77 ha (MCP) and 244.53 ha (ADK). Mean male home ranges (n=2) were 744.64 ha (MCP) and 1022.89 ha (ADK). Fisher used live hardwood trees most frequently for resting (57.14%) followed by live conifer trees (26.29%), snags and logs (14.86% - hardwoods and conifers combined) and on the ground (1.71%). Douglas fir was the most frequently used species of tree (37.93%) followed by black oak (26.44%) and tanoak (26.44%). Of actual resting structures in which fisher were located, tree cavities comprised 54.48%, followed by stick nests (20.86%), large branches or other platforms (19.42%), log cavities (3.44%), and on the ground under bushes or in wood rat nests (2.06%). Live conifers used had a mean diameter at breast height (dbh) of 110.1 cm and live hardwoods averaged 74.6 cm dbh. Eight den sites of five females were located, all within cavities of hardwoods with a mean dbh of 63.4 cm. To date, 201 vegetation plots centered around rest and random locations have been completed.

Introduction

Concern of the status and viability of Pacific fisher (Martes pennanti pacifica) in the Western United States (Thomas et al. 1988, Gibilisco 1994), and submission of petitions for protection under the Endangered Species Act (Central Sierra Audobon Society et al. 1990, Biodiversity Legal Foundation 1994) has increased interest in the species and instigated research in the region. Although the fisher was denied listing under the Endangered Species Act by the United States Department of the Interior (USDI) Fish and Wildlife Service, the United States Department of Agriculture (USDA) Forest Service considers fisher a sensitive species (Powell and Zielinski 1994). Hoopa Valley Tribal Forestry's wildlife department began to research fisher on the Reservation because of its ceremonial importance to the Hupa people, and a desire to make informed forest management decisions.

Powell and Zielinski (1994) suggested trapping and logging may have substantially contributed to the decline of fisher populations and reduced distribution from their former range in the United States. California has not had an open trapping season since 1946, but with continued timber harvest in the Pacific Northwest and greater than 80% of virgin forest altered (Thomas et al. 1988), there is a need to better understand the habitat requirements of this species.

Fisher are found in conifer and mixed conifer-hardwood forests with overhead canopy cover (Buck et al. 1983, Arthur et al. 1989, Jones and Garton 1994). Resting sites may have specific characteristics that define habitat at a fine scale. Two studies on the Shasta-Trinity-National Forest, one near Big Bar (Buck et al. 1983), the other near Trinity Lake (Seglund 1995), have characterized fisher rest sites as predominantly in live Douglas fir trees of greater than 90 cm dbh quite, often within close proximity to drainages. Different habitats may offer a varying availability of structures used for resting. If resting structures are a limiting resource of fisher, the amount or type of structures available might affect population density.

Objectives

Objectives of this study were primarily to determine structural composition and habitat vegetation characteristics surrounding fisher rest sites on the Hoopa Valley Indian Reservation (hereafter Reservation). This information will be used to make informed forest and riparian management decisions.

Questions were:

- What are the vegetative and topographical characteristics surrounding fisher rest and den sites on the Reservation?
- Are resting structures (e.g. live trees, snags and logs) used in proportion to their availability at home range and study site levels?
- Are habitat vegetation types in which fisher are resting used in proportion to their availability at home range and study site levels?

Study Area

The Hoopa Valley Indian Reservation (Humboldt County, California) is situated in the Klamath mountain range and encompasses approximately 360 km^2. Approximately 65 km^2 of the southeastern portion of the Reservation was used as the study area (Figure 1.). For the most part, the lands are mountainous with deep valleys along rivers and streams. Elevation ranges from 100m to 1075m. The area consists primarily of montane hardwood-conifer communities (Mayer and Laudenslayer, 1988). The western edge of the study site includes urban areas of the community of Hoopa. Dominant tree species are Douglas fir (Pseudosuga menziesii), tanoak (Lithocarpus densiflorus), and Pacific madrone (Arbutus menziesii). California black oak (Quercus kelloggii) and Oregon white oak (Quercus garryana) are also wide spread within the western half of the study area. Scattered sporadically throughout the forest are many other species such as big-leaf maple (Acer macrophyllum), incense cedar (Calocedrus decurrens), chinquapin (Chrysolepis chrysophylla), Pacific yew (taxus brevifolia), mountain dogwood (Cornus nuttallii), willow (Salix sp.), and canyon live oak (Quercus chrysolepis). The shrub layer (when present) is generally dominated by evergreen huckleberry (Vaccinium ovatum) or salal (Gualtheria shallon).

Methods

Capture and Immobilization

Modified Tomahawk live traps (Tomahawk Live Trap Company, Tomahawk, WI, model # 207) were, and will continue to be, used to capture fisher. Trap modifications include the addition of a wooden nest box (Seglund 1995) which provides protection from inclement weather and likely helps reduce stress to captured animals. All non-target species were immediately released. New fishers captured, or those requiring a new radio collar, were immobilized with a combination of ketamine and diazepam (1 mg diazepam per 200 mg ketamine; approximately 15-20 mg ketamine per kg body weight). Once anesthetized, fisher were affixed with a radio collar (Telonics, Mesa, AZ, models # mod-125 and mod-80) and/or color coded rototags (Nasco Industries, Ft. Atkinson, WI.) for individual identification. Body measurements and age estimation were also recorded while fisher were immobilized.

Telemetry

Radio-collared fisher were located with a portable receiver and "H" antenna (Telonics, Mesa, AZ, receiver model TR-4 and antenna model RA-14K). The precision needed to identify resting structures precludes use of triangulation as a means of locating specific rest sites. Therefore, specific resting sites were located by walking to the signal point of origin of stationary animals.

Precision ratings, 1,2,or 3, were assigned to each location identified as a resting site. A precision "1" was assigned to locations where fisher are seen or heard (e.g. vocalization or movement in a cavity). Precision "2" locations were identified by isolating the signal to one structure. If the exact location of the fisher could not be determined in structures

within close proximity (e.g. a snag with cavities leaning on a live hardwood with cavities), a precision "3" was assigned.

Each individual was located as frequently as possibly with consecutive locations separated by at least one night period. Fisher locations were plotted on 1995 aerial photos (1:1000) and 1993 USGS orthophotoquads (1:24000), then digitized into a GIS database using ARCVIEW software (ver. 3.0a Environmental Research Systems Institute, Inc., Redlands CA).

Due to the difficulty of determining time of parturition (birth) and subsequent movements, a den site was considered to be spring locations regularly reused over greater than a two-week period and/or evidence of kits.

Habitat Use vs. Availability

Habitat use for rest sites is being investigated at two scales; that of individual home range and study area. Habitat availability will be determined by sampling locations within individual home ranges and study area. A systematic ½ mi. grid (already established on the study area) will be supplemented with random locations, determined from GIS, to collect enough random/systematic locations to have a 1:1 ratio of used to available sites. The area bounded by all fisher rest sites combined will define the study area.

Rest site locations (precision codes 1 through 3) were used to estimate the home range of each individual. The TELEM computer program (McKelvy, USDA Forest Service Redwood Sciences Lab, Arcata, CA) was used to generate 95% Adaptive Kernel (Whorton 1989) and Minimum Convex Polygon (Mohr 1947) estimates of home range area.

Microsite Measurement and Analysis

To quantify microsite characteristics of habitat use vs. availability at fisher rest sites, vegetation variables were measured on nested 0.04 ha and 0.08 ha plots (see Appendix 1 for variables). Vegetation at resting locations was measured only at sites assigned precision codes "1" and "2".

Results

Trapping and Morphometrics

Trapping occurred sporadically from 22 January 1996 to 26 November 1997 primarily to affix or replace radio-collars. During this period, 980 trap nights captured 46 individuals (36 females: 10 males) 118 times (12.04% trap success). Recaptures of the 46 individuals occurred 72 times (61.02% recapture). Evidence of ear tag loss was noted on six animals. Three fisher were missing tags in both ears, and three others were missing tags only in the left ear.

Animals were immobilized on average for 27.57 minutes (minimum; 17 minutes: maximum 41 minutes) allowing researchers to obtain most morphometric measurements from each animal (Table 1).

Table 1. Summary of fisher morphometric measurements on the Hoopa Valley Indian Reservation 22 January 1996 to 5 January 1998.

	Weight (kg)	Total Length (cm)	Tail Length (cm)	Hind Foot Length (cm)	Ear Length (cm)
Female					
Mean	2.00	86.76	34.20	10.34	4.22
SD	0.23	6.31	2.90	0.50	0.25
Min	1.48	55.00	23.50	9.50	3.50
Max	2.50	93.70	39.60	11.80	4.60
n=	44	42	43	43	75
Male					
Mean	3.54	97.87	36.30	12.03	4.91
SD	0.52	2.57	6.44	0.56	0.30
Min	2.71	94.60	32.10	11.20	4.20
Max	4.36	102.00	56.00	13.50	5.50
n=	13	11	12	12	21

Incidental captures include 16 gray fox (Urocyon cinereoargenteus), 15 ringtail (Bassariscus astutus), five raccoon (Procyon lotor), one Douglas squirrel (Tamiasciurus doglasii), and one domestic cat (Felis domestica).

Telemetry

Radio-collars were affixed to 11 females and 5 males. (See Appendix 2. for animal summaries.) Fisher were located 293 times identifying rest structures on 227 occasions (precision codes 1 and 2). On average, each animal was located 18.31 times (Range 1-52). Reuse of previously identified rest sites (not including den sites) occurred at 13.22% of locations. Minimum Convex Polygon (MCP) and 95% Adaptive Kernel (ADK) home range estimates were calculated for animals with greater than 10 locations (including breeding season except den sites). Female (n=7) home ranges (mean $\pm$ SD) were 174.77 $\pm$ 49.61 ha (MCP) and 244.53 $\pm$ 83.30 ha (ADK). Two males had enough points for home ranges estimates. Male M02's home range encompassed a 873.95 ha (MCP) and 1313.84 ha (ADK) area. Male M04's home range encompassed a 615.33 ha (MCP) and 731.93 ha (ADK) area.

Rest Site Use

Fisher used live hardwood trees most frequently for resting (57.14%) followed by live conifer trees (26.29%), snags and logs (Figure 2). Douglas fir was the most frequently used species of tree (37.93%) followed by black oak (26.44%) and tanoak (26.44%). Tree cavities comprised 54.48% of actual resting structures in which fisher were located, followed by stick nests (20.86%), large branches or other platforms (19.42%), log cavities (3.44%), and on the ground under bushes or in wood rat nests (2.06%). Live conifers had a mean ($\pm$SD) dbh of 110.1 $\pm$ 45.5 cm and live hardwoods averaged 74.6 $\pm$ 25.3 cm dbh (Figure 3).

Den Site Characteristics and Reproduction

Eight den sites of five females were located during the reporting period (Table 2). Two other sites were presumed to be den sites, but did not meet the den criteria. All were within cavities of hardwoods with a mean (± SD) dbh of 63.4 ± 14.8 cm. Seven of the eight dens had a southerly exposure, with the eighth on a ridge-top.

Kits were seen or heard with their mother on several occasions throughout the study confirming reproduction. Of four radio-collared fisher during the 1996 breeding season only female F03 was confirmed with kits. Two other females (F01 and F04) showed signs of nursing when recaptured, but we were unable to determine their den locations or confirm kits.

During the 1997 breeding season all seven radio-collared females showed signs of reproduction. Females F03, F05, F06, and F08 were confirmed with kits. Female F02 exhibited denning behavior and signs of nursing, but no kits were seen or heard. When recaptured, females F07 and F22 showed signs of nursing, but we were unable to determine their den locations or confirm kits.

A juvenile female weighing 0.62 kg was found dead off the study site on 7 July 1997. The body was found in good condition with none of the carcass consumed. Several puncture wounds on the rib cage, presumably from a medium-sized carnivore, were identified from x-rays and a necropsy performed by Dr. Rick Brown at Humboldt State University.

Table 2. Fisher den sites located on the Hoopa Valley Indian Reservation 22 January 1996 to 5 January 1998.

Fisher ID	Date initial location	Live/ Snag	Species	Structure	dbh (cm)	Den aspect	Elevation (m)	Notes
F02	3/21/97	Live	Black Oak	Cavity	82.6	South	238	Denning behavior ≥ 18 days
F03	3/12/96	Live	Black Oak	Cavity	84.1	Southwest	536	Denning behavior ≥ 30 days
F03	2/25/97	Live	Black Oak	Cavity	67.6	Southwest	439	Denning behavior ≥ 38 days
F03	7/30/97	Live	White oak	Cavity	51.3	South	195	Visual of 2 kits here.
F05	4/11/97	Live	Tanoak	Cavity	66.8	South	588	Kits heard squealing in cavity
F06	5/5/97	Snag	Chinquapin	Cavity	61.0	North	701	Denning behavior ≥ 28 days
F08	3/28/97	Live	Black Oak	Cavity	49.8	South	232	Visual of 1 kit inside den cavity on 4/4/97
F08	4/7/97	Live	Black Oak	Cavity	43.9	Southwest	354	Moved here after disturbance on 4/4/97
				Mean	63.4			
				SD	14.8			

Habitat Measurements

To date, 201 vegetation plots have been completed. Of these, 113 are of rest site locations (precision codes 1 and 2) and 88 random plots. All data have been entered into a database for analysis. Approximately 50 rest site plots and 75 random plots remain to be measured.

Track and Camera Stations

Five Trailmaster™ infrared cameras were purchased for den monitoring and to test their suitability of re-sighting individuals for estimating population abundance. We believe cameras at the den sites may have disturbed the females. Also, at one site, the sensor and its wires were chewed rendering it inoperable.

To estimate population abundance, the identification of an individual's ear tags is necessary for use in mark-recapture/resight abundance equations. With the Trailmaster™, identification of ear tags was highly variable, as animals did not regularly approach the camera in a consistent fashion. Development of a camera box attachment to the standard track plate cubby allowed us to rectify this problem. We purchased 20 additional cameras and components to build a triggering mechanism that have performed well during a December 1997 survey. Analysis is not complete, but approximately 80% of photos were of our tagged animals, meeting the requirements of the abundance equations.

Diet and Genetics

Over 100 samples of fisher fecal material (scat) were collected during captures, track plate surveys, and at rest sites. Fifty of these were sent to Humboldt State University for analysis. Analysis is complete and a final report should be available soon.

Ear tissue and tail hairs were taken from each individual during the capture procedure. The samples have been sent to the USDA Forest Service Pacific Southwest Research Station for analysis. Results are pending.

Comments and Future Goals

Trapping and Population Abundance

The number of individual fisher captured on the study site was surprisingly high. Comparisons of capture and track plate success during conversations with local fisher researchers suggest a higher abundance of fisher on the Reservation than elsewhere. Although measures of density are difficult with wide ranging animals, analysis of the photographs obtained during the December survey should help formulate a better estimate for comparison of populations.

Telemetry

Home ranges were substantially smaller than those of other studies conducted locally. Combining this information with a large observed overlap in home ranges and the high abundance of fisher captured implies a high density of fisher on the Reservation. Although a high density does not necessarily indicate quality habitat (Van Horne 1983), signs of reproduction by all radio-collared females in the spring of 1997 suggests it may indeed supply many habitat requirements.

It should be noted that the home ranges calculated here use only rest site locations. Locations of moving animals and trap locations were not included in these calculations, and therefore represent a minimum of actual area used.

Rest Site Use

Hardwoods appear to be important for resting sites on the Reservation. Other studies in California have found fisher to primarily rest in large conifers (Seglund 1995, Buck et al. 1983, Zielinski pers. com.). Whether the observed high use of hardwoods over conifers is due to actual higher use or some other factor is unclear at this time. Two potentially confounding issues are the relative abundance of hardwoods on the study site, and high cavity use.

Analysis of available habitat and rest sites is not yet complete, but hardwoods are visibly more abundant on the Reservation than at other study sites. The associated high use of hardwoods over conifers may be directly proportional to their availability.

Cavity use was also very high. Over 54% of identified fisher resting structures were within tree cavities. Eighty-six percent of cavities used were in hardwoods. It is unclear whether fisher are choosing the rest site because it is a hardwood or because of the presence of a cavity. The high use of cavities may partially be due to better success of identifying rest sites in the wetter months of the year. Approaching a resting fisher with a minimum of noise is essential. When vegetation and leaf litter are moist, noise of approaching researchers is greatly attenuated. It may also be that fisher feel more secure in cavities and are not as likely to flush from approaching researchers.

Other

On 16-17 September 1997, Tribal Forestry's Wildlife Department hosted a field trip for participants of The Wildlife Societies Mesocarnivore Workshop. During the trip, we toured fisher habitat, demonstrating various carnivore research techniques and presented preliminary results. Many participants were leading researchers from across the country who seemed enthusiastic with the results obtained so far.

Future Goals

We will continue to track the currently radio-collared fisher to locate rest sites and identify den locations. The remaining vegetation plots should be completed by August 1998. Habitat vegetation data will then be analyzed to identify important characteristics for construction of a habitat model for future planning of forestry impacts.

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Appendix 1. List of habitat variables measured at fisher rest sites on the Hoopa Valley Indian Reservation Humboldt County, California from 22 January 1996 – 5 January 1998.

Rest site structure
Species
Tree height
dbh/diameter
Height of rest site
Height of lowest available structure for resting fisher (subjective)
Decay class
Crown condition and canopy classification
Aspect of rest site
Weather conditions: % cloud cover; temperature, wind speed, precipitation, snow depth
Elevation
Distance to and type of habitat edge
Distance to and class of road and water

Microsite variables
Slope
Aspect
Topographic position: ridge top, mid slope, riparian zone
Habitat vegetation type: WHR and current Hoopa Forestry classifications
Height, species composition, % canopy closure (ocular estimate) and size class of each forest layer

0.04 ha plot
Logs (average diameter > 25 cm and total length > 1.5m)
- Species
- Log length within 0.04 ha plot, and total length.
- Diameter at midpoint of log within 0.04 ha plot
- Decay class
- Type of downed wood (cut down, blow down, broken top, other natural)
- Presence, type, and size of cavities

Snags (dbh > 25 cm)
- Species
- Diameter at breast height
- Height
- Decay class
- Presence, type, and size of cavities

Shrub cover (ocular estimate)
Sapling and pole tree count by species for east half of 0.04 ha plot in 2, 5 and 10 cm classes
Species, dbh, and count of all live trees > 12.5 cm

Appendix 1. Continued.

0.8 ha plot
Species, dbh, and count of all trees > 28 cm
Snags > than 75 cm
- Species
- Diameter at breast height
- Height
- Decay
- Presence, type, and size of cavities

Stand (as determined from aerial photos and GIS database)
Area
Habitat type
Management
- Managed or unmanaged
- Age if managed
- Silviculture
- Site preparation
- Distance to nearest unmanaged edge

Appendix 2. Summary of radio-collared fisher on the Hoopa Valley Indian Reservation 22 January 1996 to 5 January 1998.
* ADK = Adaptive kernel; MCP = Minimum convex polygon.

Fisher ID	# of Locations	% Site Reuse	95% ADK* (ha)	MCP* (ha)	Initial Capture Date	# Captures	Last Date Known Alive	# Days Monitored	Comments
Female-01	9	0.00%			1/22/96	3	2/5/97	380	Preyed upon by undetermined species
Female-02	32	10.71%	308.18	250.33	1/24/96	5	1/5/98	712	Alive, den and signs of nursing '97
Female-03	52	24.44%	181.29	150.44	1/31/96	3	1/5/98	705	Confirmed with kits '96 and '97
Female-04	2	0.00%			2/5/96	2	10/2/96	240	Un-collared and released
Female-05	17	7.14%	247.72	156.86	8/30/96	2	5/12/97	255	Human take/trapped; confirmed with kits '97
Female-06	41	12.90%	366.47	206.98	8/30/96	3	1/5/98	493	Confirmed with kits '97
Female-07	27	12.50%	129.88	91.41	9/23/96	3	1/5/98	469	Alive, signs of nursing '97
Female-08	30	8.00%	186.67	184.40	11/7/96	13	1/5/98	424	Confirmed with kits '97
Female-21	2	50.00%			3/11/97	1	4/21/97	41	Preyed upon by undetermined species
Female-22	25	20.00%	291.50	182.96	3/14/97	3	11/23/97	254	Unknown cause of mortality, necropsy results pending
Female-23	1	0.00%			10/7/97	1	1/5/98	90	Alive
Mean	21.64		244.53	174.77				369.36	
SD	17.01		83.30	49.61				220.76	

Fisher ID	# of Locations	% Site Reuse	95% ADK* (ha)	MCP* (ha)	Initial Capture Date	# Captures	Last Date Known Alive	# Days Monitored	Comments
Male-01	8	0.00%			1/29/96	1	10/3/96	248	Collar expired; unable to recapture
Male-02	22	8.33%	1313.84	873.95	1/29/96	3	4/17/97	444	Human take/trapped
Male-04	15	0.00%	731.93	615.33	11/5/96	3	5/24/97	200	Unknown cause of mortality, necropsy pending
Male-05	7	20.00%			12/13/96	4	5/8/97	146	Mortality from blunt trauma/vehicle or fall?
Male-07	3	0.00%			3/13/97	1	12/2/97	264	Moved off reservation
Mean	11.00		1022.89	744.64				260.40	
SD	7.52		411.47	182.87				112.48	
Mean all	18.31							335.31	
SD all	15.29							196.43	