ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM

Animal Abstract **Element Code:** AMABA01300
Data Sensitivity: No

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Sorex navigator*
COMMON NAME: Western Water Shrew

SYNONYMS: *Neosorex navigator*
OTHER COMMON NAMES: Rocky Mountain Water Shrew
FAMILY: Soricidae

AUTHOR, PLACE OF PUBLICATION: Baird, S. F. (1857). "Mammals." In Reports of Explorations and Surveys to Ascertain the Most Practicable and Economical Route for a Railroad from the Mississippi River to the Pacific Ocean. Part 1. General Report upon the Zoology of the Several Pacific Railroad Routes, Volume 8, bk. 1. Washington, D.C., Beverly Tucker, 11.

TYPE LOCALITY: "Fort Vancouver, W. T. (Washington Territory)," Washington, USA.

TYPE SPECIMEN: Baird, 1857. USNM 629/1780

TAXONOMIC UNIQUENESS: *Sorex navigator* is 1of 86 North American species of long-tailed shrew in the Genus *Sorex*, and 1 of 5 in Arizona. Molecular phylogenetic analyses support recognition of three species-level clades among the subspecies formerly included in *Sorex palustris*: eastern *S. albibarbis*, western cordilleran *S. navigator*, and boreal *S. palustris* (Hope et al. 2014, Woodman 2018). This taxonomic status is accepted by the Mammal Diversity Database of the American Society of Mammalogists (ASM) (2020).

The lineage of *S. navigator* occurring in Arizona was found to be the most divergent lineage and have the oldest split from other lineages (Hope et al. 2014). Due to the degree of differentiation and isolation, this population may represent a distinct evolutionarily significant unit that may warrant taxonomic recognition, though additional studies are needed to better understand its distribution and population status (Hope et al. 2014, Frey and Calkins 2020).

DESCRIPTION: A large, semiaquatic, long-tailed shrew; males average slightly heavier and longer than females. Total length is 14-16 cm (5.5-6.3 in) including a 6 to 8 cm tail (2.4-3.1 in); length of hind foot 1.8-2.2 cm (0.71-0.87 in); weight ranges from 8-18 g (0.28-0.63 oz). The dense pelage is black or black frosted with gray, and white tinged with gray or brown ventrally. Tail is distinctly bi-colored (dark above, light below). Their front and hind feet have a fringe of stiff hairs (fibrillae) located on the outer and inner margins of the feet and toes. The large hind feet provide the main thrust for swimming, and the middle toes are partially webbed. The chin is usually lighter in color than other parts of the body. The head has bead-like eyes,

inconspicuous ears, a pointed snout not greatly down-turned, and 32 simple teeth, mostly with sharp single-cusps. Sexually active males (February-September) have prominent dermal glands on each side between fore and hind legs. The skull is large and each side of the upper jaw has five unicuspid teeth; each premolar bears a distinctive, medially directed, pigmented ridge. The anterior part of the rostrum is comparatively short and not curved ventrally. No post-mandibular foramen is present. (Beneski, Jr. and Stinson, 1987; Wilson and Reeder, 2005).

Specimens of *S. navigator* from the White Mountains of Arizona were small in external measurements (particularly tail length), in comparison with specimens from Colorado and Montana (Conaway 1952, Armstrong 1972, Frey and Calkins 2020). Several individuals with white-tipped tails have been captured in Arizona, New Mexico, and southern Colorado (Jackson 1928, Frey and Calkins 2020).

AIDS TO IDENTIFICATION: *Sorex navigator* differs from *S. monticolus*, *S. merriami*, *S. arizonae*, *S. nanus*, and from *Notiosorex crawfordi* in longer head and body, tail and hind feet; fringe of stiff hairs on hind feet; color blackish or slate gray rather than some shade or mixture of brown; and longer skull. It also differs further from *S. merriami* and *S. arizonae* in no post-mandibular foramen, and from *Notiosorex crawfordi* in five rather than three upper unicuspids (Hoffmiester 1986).

ILLUSTRATIONS:
Black and White drawing (Woodman 2018)
Color photo (Frey and Calkins 2020)

TOTAL RANGE: Rocky Mountain cordillera from Alaska south to Arizona and New Mexico (Hope et al. 2014).

RANGE WITHIN ARIZONA: White Mountains, Apache and Greenlee Counties. This population is disjunct by approximately 350 kilometers from the nearest population in the Jemez Mountains of New Mexico.

SPECIES BIOLOGY AND POPULATION TRENDS

BIOLOGY: Water shrews are always associated with water. Per Beneski, Jr. and Stinson (1987) "they are capable of sustaining forced dives of 31.1 to 47.7 seconds, along with reducing their metabolic demands, thereby allowing them to dive year-round in cold mountain streams. Remaining underwater is difficult because during a dive a water shrew is surrounded by a silvery layer of air that causes it to surface and float like a cork whenever it stops paddling. The fringe of hairs on the hind foot, increases the foot's surface area, trapping air bubbles, which allows this shrew to actually run on the water's surface. Water shrews molt in fall and spring; winter pelage is somewhat paler than summer pelage. Flank glands, composed of enlarged sweat and sebaceous glands, are present in all shrews. In coping with their environment, water shrews seem to use their environment, and seem to use their sensory

abilities synergistically; however, the relative acuity and functional significance of individual senses are not well understood. The vibrissae and sensitive muzzle of water shrews seem to aid in detection of prey (especially when diving), and the vibrissae also may serve as lateral feelers in confined areas. The hearing ability seems acute to distances of 3 meters, particularly for high-pitched sounds."

Water shrews are very active, foraging day and night year-round to fuel their high metabolic rate and prodigious appetite. They need to consume approximately their weight in food every day (Conaway 1952, Sorenson 1962 *in* NatureServe 2001). In the wild, they seem unable to store significant body fat and can die of starvation within a few hours. When a surplus of food is available it is often hoarded, with the particular gatherer sometimes defecating on it to keep other shrews away. There are two major activity periods, from sunset to 4 hours after sunset, and just before sunrise. They enter a relatively deep slumber for an hour or two at time, several times each day. Nests constructed of sticks, leaves and moss (or other soft material), are found in tunnels and in or under hollow logs within 10 feet of water. Mean diameter of nests is 8 cm. Captive water shrews neither defended individual nests nor nested in social groups. They were generally solitary and most intraspecific behavior was antagonistic (Sorenson 1962, *in* Beneski, Jr. and Stinson 1987). Much of the water shrew's food is captured while swimming or diving, which makes them vulnerable to predatory fish, garter and water snakes, marsh birds, hawks, and owls. They lead short and intense lives, with an average lifespan measured in months (Belitsky 1992). Average lifespan is around 18 months.

REPRODUCTION: In water shrews, ovulation is not spontaneous, but induced by copulation, as reported in other shrews. They may begin breeding as early as January and continue through August. Adult females produce two or three litters per breeding season. The gestation period is not known, but for most shrews is approximately 21 days (ranges from 17-28 days). Estimated duration of gestation and lactation in the water shrew does not exceed 10 weeks (Conaway 1952, *in* Beneski, Jr. and Stinson 1987). Gestation ranges from 17-28 days. Females have six mammae, two pair abdominal and one pair inguinal. Embryo counts range from 3 to 10, with 6 being the most common. The young, born blind and naked, are weaned within 2 to 4 weeks and are reproductively active within a few months of birth. Water shrews mature earlier and with greater individual variation than reported for other *Sorex* species, although most females do not reproduce until after their first winter. Females born early in the year may reproduce later the same year (Conaway 1952).

FOOD HABITS: Water shrews usually prey on insects and other invertebrates such as worms and snails, but may take small vertebrates when available, including fish, fish eggs, amphibians, and carrion. They also eat fungi and green vegetation. Water shrews are capable of reducing their metabolic demands, thus allowing them to dive year-round in cold mountain streams for food; even diving under ice (Beneski and Stinson 1987).

HABITAT: Generic accounts of the Western Water Shrew describe the species as occurring along swift, rocky mountain streams that individuals enter to elude predators and hunt aquatic insects (Ingles 1965, Beneski and Stinson 1987). In western Montana, *S. navigator* were

encountered primarily along swift streams under overhanging banks or where rocks or logs provided cover (Conaway 1952). However, areas of *S. navigator* capture in the White Mountains were along small (<2 m wide) streams in mostly low gradient, slow moving reaches occurring in meadows with few rocks in the substrate (Frey and Calkins 2020). Several shrews were captured on tiny seeps (0.3 m wide, 2 cm deep) that ran into small creeks (Frey and Calkins 2020). Similar stream characteristics were reported for shrew capture in Montana (Kinsella 1967).

Only one study of habitat use by *S. navigator* in Arizona has been conducted (Frey and Clakins 2020). In this study, sites where shrews were captured were dominated by grass and sedge cover with significantly less forb and alder cover than non-capture sites. Elevation was the only significant predictor of species presence, with sites with elevations of 2,695 m or higher being correlated with capture. Microhabitat at capture locations was typified by flat slopes with uniformly saturated soil, variable but generally low canopy cover, high mean vertical cover and vertical stubble height, and variable to low litter depth (Frey and Calkins 2020). Sedges were the dominant ground cover at successful capture locations, though grasses, forbes, and open water also had high coverage (Frey and Calkins 2020).

ELEVATION: 8,200 - 9,630 ft. (2500-2935 m) in Arizona.

PLANT COMMUNITY: Montane riparian communities.

POPULATION TRENDS: Not well known, but because of their limited range in Arizona and narrow requirement for riparian habitats, they are rarely encountered and are of concern. According to NatureServe (2010), "Large range in the boreal and montane regions in North America; secure, if not abundant, throughout the northern part of the range; in the south, habitat has been fragmented since the retreat of the last glaciers, making isolated populations vulnerable to extirpation; some subspecies are rare enough to be of concern."

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS: None

STATE STATUS: 2 (AZGFD, AWCS 2022)
[1B (AGFD SWAP 2012)]
[WSC (AGFD, WSCA 1996 in prep)]
[Endangered, TNW AGFD 1988]

OTHER STATUS: Forest Service Sensitive (USDA, FS Region 3 2007, 2013) (As *Sorex palustris*)

MANAGEMENT FACTORS: The White Mountain population of *S. navigator* is genetically distinct and restricted to a small, isolated region. The species is a habitat specialist, and subpopulations may be isolated due to natural fragmentation caused by topography (Frey and Calkins 2020). Riparian habitat in the White Mountains has been lost due to livestock

grazing, loss of *Castor canadensis* (beaver), wildfire, drought, and hydrological alterations (USFWS 2014). Climate change may pose a threat, as indicated by an up-slope range shift of *S. navigator* in the Ruby Mountains of Nevada (Rowe et al. 2010). Limited information on habitat and population status precludes specific delineation of management needs (Belitsky 1992).

PROTECTIVE MEASURES TAKEN:

SUGGESTED PROJECTS: Research is needed to understand genetic variation, distribution, habitat use, threats, and taxonomic status of *S. navigator* in Arizona.

LAND MANAGEMENT/OWNERSHIP: USFS – Apache-Sitgreaves National Forest; Private.

SOURCES OF FURTHER INFORMATION

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ADDITIONAL INFORMATION:

If the main dispersal corridors for water shrews in Arizona are the streams that they inhabit, habitat alteration above river forks could isolate multiple subpopulations, thereby cutting off dispersal corridors and drastically increasing the chances of extinction for this population as a whole (Markow and Hocutt 1994).

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