

SOURCE: Packard, Jane (2003) **WOLF BEHAVIOR: REPRODUCTIVE, SOCIAL, AND INTELLIGENT**, In: The Ecology, Behavior and Conservation of the Wolf. L. D. Mech and L. Boitani (eds.). The University of Chicago Press, Chicago, Ill.

Modified from Table 2.2. Abbreviated ethogram of wolf behavior....

Inference		Observation
<i>Category</i>	<i>Sub-category Code</i>	<i>Description of Typical action patterns (behavioral assay of internal physiological state)</i>
Activity ²	A1	Inactivity: lying, sitting or standing; without changes in angle of neck
	A2	Moderate Activity: walking, interacting, exploring, feeding, grooming; neck angle changes
	A3	Strenuous Activity: directional rapid movement, e.g. trotting, galloping, running
Care ³	C1	Care-solicit: suckle, whimper, lick-up, paw, roll-on-back, solo-howl
	C2	Care-ritual: grovel, over-the-muzzle-bite, roll (passive submission), curl (active submission)
	C3	Care-give: nurse, carry-pup, carry-food, regurgitate, lick-other, watch, follow, lead
Flight/Fight ⁴	F1	Flight: avert-gaze, avoid, crawl, head-down, low-posture-retreat, ignore, leave, run, slink, refuge
	F2	Defensive (mixed fight/flight): bark, crouch, gape, growl, hackles, snap, snarl, whirl
	F3	Fight: chase, face-off, holding-bite, lunge, jaw-spar, nip, pin, sidle, stand-high, wrestle-fight
Humbleness ⁵	H1	Humble-low: pricked-ears, high-posture, high-tail, flexed- & raised-leg-urination, scrape-back
	H2	Humble-neutral: ears-side, hanging-tail, squat- & stand-urinate, wait
	H3	Humble-high: brows-together, ears-back, low-posture, tuck-tail, long-mouth-line, hunchback
Ingest ⁶	I1	Hunt: directional trot, chase, zigzag, sniff-ground, give-eye, dig
	I2	Handle: sprint, grab, hold, lunge, knock-down, pounce, neck-shake, nose-stab, cache, pluck
	I3	Consume: chew, swallow, rip, drink, lick
Maintenance ⁷	M1	Maintenance-low: apathetic, foot-drag, disgust-mouth, head-hang, glazed-eyes, disheveled
	M2	Maintenance-normal: lick-self, scratch-self, head-shake, rub-body, urinate, defecate
	M3	Maintenance-high: repetitively-lick- injury, vomit, scoot-rear, limp, diarrhea
Proximity ⁸	P1	Proximity-brief: approach, touch-nose, lick, lie-near, pass
	P2	Proximity-moderate: chorus-howl, carry-object, rally, stand-near, look-over-shoulder, wag-tail
	P3	Proximity-prolonged: bow, bounce-follow, gallop, play-wrestle, circle-wag, play-jaw-spar, roll
Sexual ⁹	S1	Bonding: follow, mark-over (double-mark), nuzzle, parallel-walk
	S2	Courtship: chin-rest, prance, dart, ears-together, head-flick, hug, sniff-rear, T-formation, wrestle
	S3	Copulatory: escort, tail-avert, mount, thrust, ejaculatory-contraction, dismount, tie, tooth-clack

- ¹ This behavioral catalogue was compiled for observer reliability training at the Houston Zoo, from a more complete ethogram compiled from several sources (Bekoff 1972, Bekoff 1979a, Derix 1994, Fox 1971b, Goodmann and Klinghammer 1990, Zimen 1971, 1982). The categories are inferences based on the following mental models. Categories are not mutually exclusive, subcategories are mutually exclusive within categories.
- ² **Model A:** Indicator of low (1) to high (A3) cardiovascular activity; measured in field by variation in radio-telemetry pulses.
- ³ **Model C:** C1 is indicative of generalized state of need in juveniles (hunger, cold, full bladder); C2 indicative of low serotonin and moderate adrenal activity in juveniles, subadults and adults; C3 indicative of high prolactin
- ⁴ **Model F:** indicative of adrenal activation above the individual's set-point range; F1 more effect of noradrenaline than adrenaline; F3 indicative of more adrenaline than noradrenaline effect (likely associated with high androgens); F2 indicative of both noradrenaline and adrenaline activity
- ⁵ **Model H:** continuum of serotonin above the group norm (H1) to serotonin below the group norm (H3); note that some authors use the terms dominant/subordinate instead of humbleness; the reason dominant/subordinate terms are not used in this ethogram is because the terms are reserved to describe learned relationships between individuals. Some authors do not distinguish the difference among mental models of relationships, temperament and internal states as expressed overtly by actions. This inferences in this ethogram are based on mental models of internal physiological state.
- ⁶ **Model I:** low blood-glucose, low fatty acids, empty gut in context of no food (I1), burst of epinephrine and endorphin activity (I2), low blood-glucose, low fatty acids, in context of available food; caching when stomach is full (I3)
- ⁷ **Model M:** M1 indicative of one or more diagnostic blood parameters outside the normal range; M2 indicative of diagnostic blood parameters within normal range; M3 may be indicative of active healing processes, e.g. cortisol, histamines
- ⁸ **Model P:** indicative of serotonin activity at or above the individual's set-point range and a continuum of endorphin activity below (P1) to above (P3) the individual's set-point range.
- ⁹ **Model S:** low steroid hormones (S1); estrogen above in females, androgens in males (S2); declining estrogen, rising progesterone above 10 ng/ml and LH above in females, moderate testosterone responsiveness in males (S3)

NOTE: An Ethogram is a list of behaviors, analogous to a dictionary for a species. Some ethograms list the names of the actions in alphabetical order. This may be confusing when different people use different names for the same behavior. The names of the behaviors are in the column labeled "Observations". The names are clustered in groups based on the categories in the columns marked "Inference". These categories are defined by mental models of the physiological basis of the behaviors, also called "behavioral assays". The models are described in the footnotes. These models have not yet been tested, they are hypotheses. Other authors group actions in categories based on their hypotheses about function. To test hypotheses about function, one would need to collect evidence on how the survival and reproduction of genotypes compares in different environment. For captive wolves, testing hypotheses about physiological cause is easier than collecting information on function. The environment in captivity differs from the wild, and function involves looking at the "match" between behaviors and the changing conditions in the wild. This table would be called a "behavior catalogue" by scientists who recognize that it is not an exhaustive list of all behaviors shown by the species.