

SUPPLEMENTAL MATERIAL

Table S1. Mammalian species at different conservation statuses. Asterisks indicate captive species that were kept after quality filtering. Hashtags indicate wild species that were kept after quality filtering.

Conservation status	Scientific name	Common name
Least concern	<i>Aepyceros melampus</i> *#	Impala
	<i>Alouatta caraya</i>	Black howler
	<i>Alouatta palliata</i>	Mantled howler
	<i>Alouatta seniculus</i>	Venezuelan red howler
	<i>Antidorcas marsupialis</i> *	Springbok
	<i>Canis lupus</i> *	Wolf
	<i>Cercopithecus ascanius</i>	Red-tailed monkey
	<i>Cercopithecus cephus</i> *	Moustached guenon
	<i>Cercopithecus neglectus</i> *	De Brazza's monkey
	<i>Cercopithecus wolfi</i>	Wolf's guenon
	<i>Colobus angolensis</i> *	Angola colobus
	<i>Colobus guereza</i>	Mantled guereza
	<i>Connochaetes gnou</i> *	Black wildebeest
	<i>Connochaetes taurinus</i> *	Blue wildebeest
	<i>Giraffa camelopardalis</i> *#	Giraffe
	<i>Hippotragus equinus</i> *	Roan antelope
	<i>Hippotragus niger</i> *	Sable antelope
	<i>Orycteropus afer</i> *#	Aardvark
	<i>Papio anubis</i>	Olive baboon
	<i>Papio hamadryas</i>	Hamadryas baboon
<i>Papio ursinus</i> *#	Chacma baboon	
<i>Phacochoerus africanus</i> *#	Warthog	
Near threatened	<i>Canis lupus</i> *	Iberian wolf
	<i>Ceratotherium simum</i>	White rhinoceros
	<i>Equus hemionus</i> *	Onager
	<i>Equus quagga</i> *#	Zebra

Vulnerable	<i>Acinonyx jubatus</i> *	Cheetah
	<i>Equus zebra</i> *#	Mountain zebra
	<i>Eulemur rubriventer</i>	Red-bellied lemur
	<i>Eulemur rufus</i> *	Red-fronted brown lemur
	<i>Myrmecophaga tridactyla</i> *	Giant anteater
Endangered	<i>Alouatta pigra</i> *	Guatemalan black howler
	<i>Ateles belzebuth</i>	Whitebellied spider monkey
	<i>Equus przewalskii</i> *	Przewalski's horse
	<i>Equus grevyi</i> *	Grevy's zebra
	<i>Lemur catta</i> *	Ring-tailed lemur
	<i>Lycaon pictus</i> *#	African wild dog
Critically endangered	<i>Ateles fusciceps</i> *	Blackheaded spider monkey
	<i>Ateles hybridus</i>	Brown spider monkey
	<i>Diceros bicornis</i> *#	Eastern black rhinoceros
	<i>Equus asinus</i> *	Somalian wild ass
	<i>Gorilla gorilla</i> *	Western gorilla

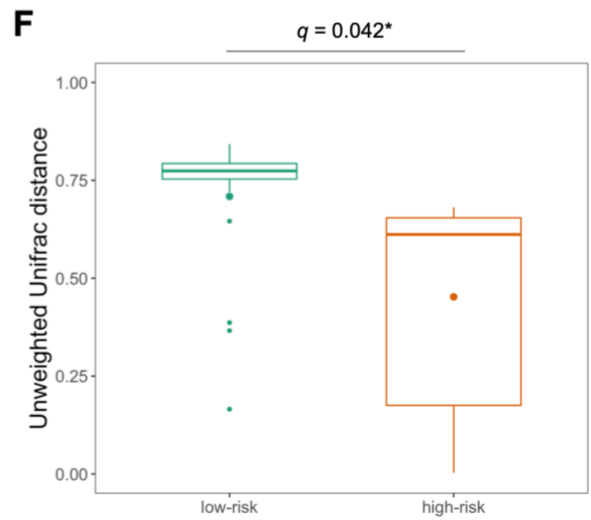
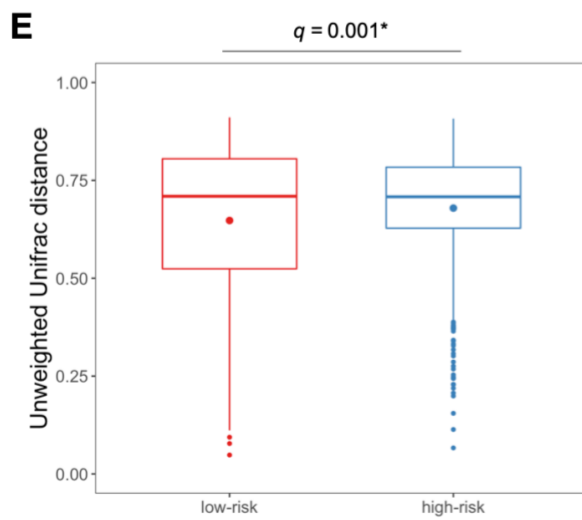
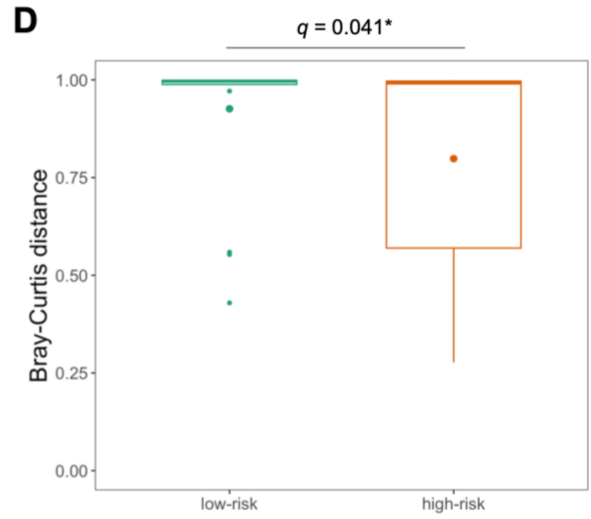
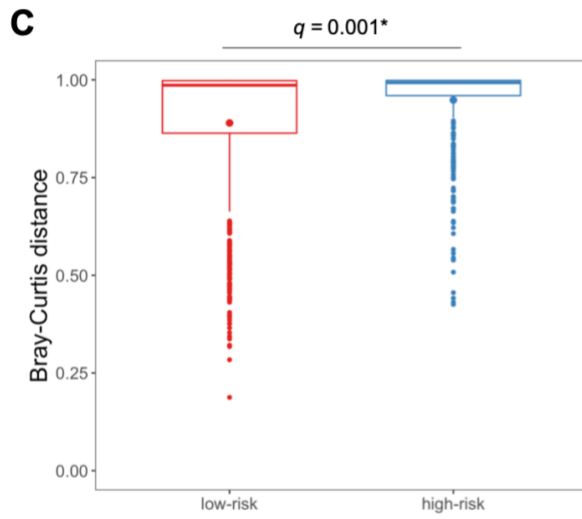
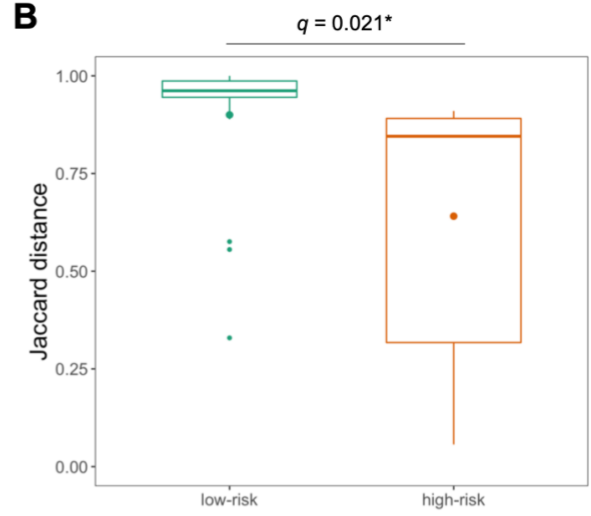
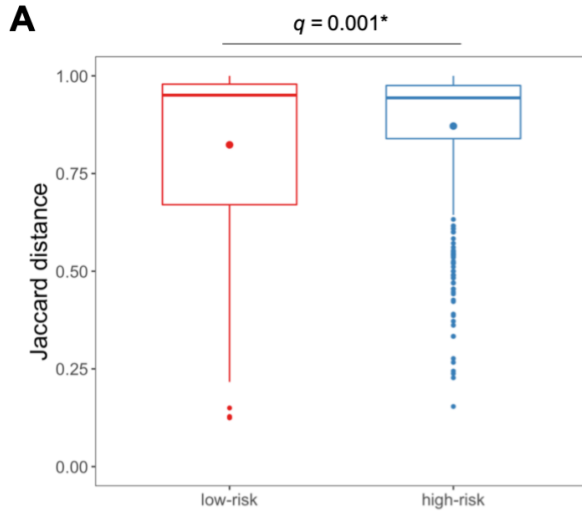


Figure S1. Both captive and wild mammals have significant differences in gut microbial diversity at different conservation statuses. Jaccard, Bray-Curtis, and unweighted UniFrac distances for captive (A, C, E) and wild (B, D, F) mammals. Groups are composed of least-concern and near-threatened (low-risk) and vulnerable, endangered, and critically-endangered (high-risk) animals. Significant q -values ($q < 0.05$) are marked with an asterisk.

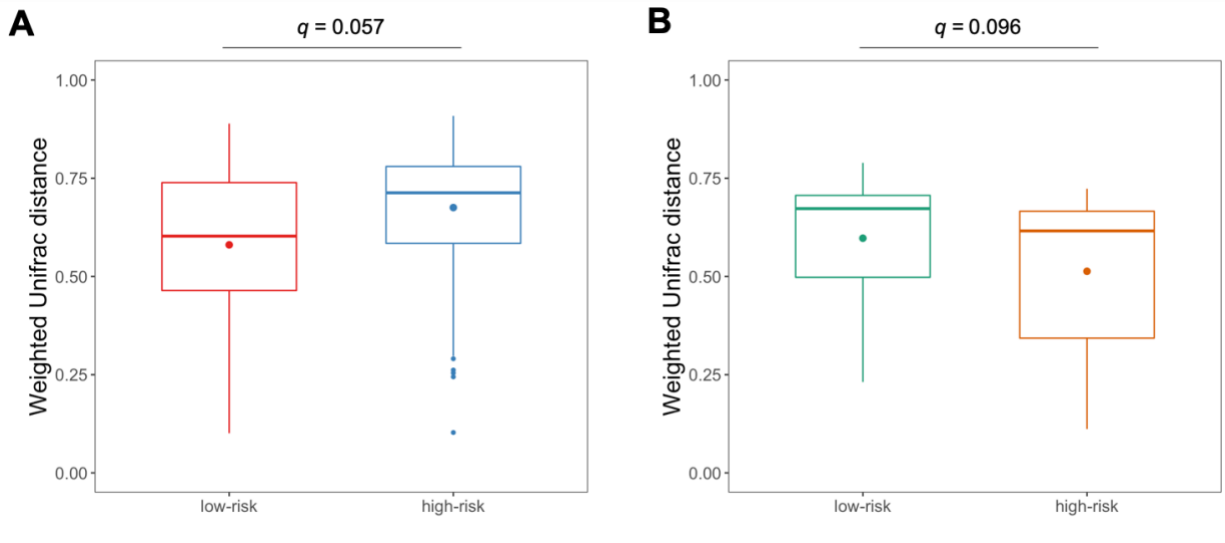


Figure S2. Both captive and wild mammals do not have a significant difference in gut microbial diversity at different conservation statuses when considering richness, abundance, and phylogenetic distance of microbial taxa together. Weighted UniFrac distances for captive (A) and wild (B) mammals. Groups are composed of least-concern and near-threatened (low-risk) and vulnerable, endangered, and critically-endangered (high-risk) animals.

Table S2. Differentially abundant microbial genera between low- and high-risk mammals in captivity and the wild. Reference for log₂-fold change is mean abundance. Uncultured groups (UCG) lack information from the literature and are thus not discussed. Asterisks indicate genera common to all four groups: low-risk captive, high-risk captive, low-risk wild, and high-risk wild.

Captive (Figure 4A)				
Genus	log₂-fold change	Characteristics	Known to be associated with pathogenicity?	Ref
Greater abundance in low-risk mammals				
<i>Oceanobacillus</i>	-25.564	- Halophilic bacteria, found in deep sea - Some strains are chromium-reducing	No	1
<i>Ignatzschineria</i>	-24.846	- Most commonly found in digestive tract of parasitic flies associated with myiasis infections in livestock	Yes	2 3
<i>Falsochrobactrum</i>	-24.711	- Non-spore generating, gram-negative - Only two species known to this date, one isolated from placenta of sheep, another isolated from paddy soil	No	4 5
<i>Helicobacter</i>	-23.979	- 18 species, many linked to pathogenesis of gastric and enterohepatic diseases in humans and other animals	Yes	6
<i>Gastranaerophilales</i>	-9.674	- Found in human and other animal gut - Posited to be beneficial to host digestion - Source of vitamins B and K	No	7
<i>Atopostipes</i>	-9.110	- Isolated from pig manure - Non-spore generating, rod-shaped, gram-positive - Only one species known (<i>Atopostipes suicloacale</i>)	No	8
<i>Lysinibacillus</i>	-8.773	- Entomopathogenic bacteria, commercial relevance as insecticide	Yes	9
<i>Mailhella</i>	-7.965	- Isolated from human stool - Gram-negative bacillus, non-spore forming	No	10
<i>Prevotellaceae UCG-001</i>	-6.428	Uncultured		
<i>Alistipes</i> *	-4.943	- Phylum <i>Bacteroidetes</i> - May be associated with dysbiosis and disease - Isolated from human gut	Yes	11

		<ul style="list-style-type: none"> - Contrasting evidence of <i>Alistipes</i> being protective against some diseases but associated with pathogenicity in others - Contrasting roles in health and nutrition, may be dependent on host 		
<i>Prevotellaceae UCG-004</i>	-3.904	Uncultured		
<i>Bacteroidales RF16 group*</i>	-3.444	<ul style="list-style-type: none"> - Found in yak rumen - May affect isobutyrate and isovalerate production - Little is known about their metabolism 	No	12
Greater abundance in high-risk mammals				
<i>Solobacterium</i>	26.450	<ul style="list-style-type: none"> - Pathogenic, associated with foul breath (halitosis) and other human infections - Isolated from human feces 	Yes	13
<i>UCG-004</i>	25.496	Uncultured		
<i>SP3-e08</i>	24.628	<ul style="list-style-type: none"> - Phylum <i>Bacteroidetes</i> - Native in the rumen of sheep 	No	14
<i>Megasphaera</i>	24.223	<ul style="list-style-type: none"> - Normal fecal flora - Rarely causes disease in humans 	No	15
<i>Proteus</i>	23.570	<ul style="list-style-type: none"> - Parasitic/commensal in mammals, pathogenic to humans 	Yes	16
<i>Anaerostipes</i>	10.345	<ul style="list-style-type: none"> - Human gut - Butyrate formation, may be good for colon health 	No	17
<i>Lactobacillus</i>	9.973	<ul style="list-style-type: none"> - Commensal to humans and animal gut - Probiotics, restore normal flora 	No	18
<i>Subdoligranulum</i>	6.593	<ul style="list-style-type: none"> - May be beneficial - Butyrate-producing - Associated with better metabolic health 	No	19
Wild (Figure 4B)				
Genus	log₂-fold change	Characteristics	Known to be associated with pathogenicity?	Ref
Greater abundance in low-risk mammals				
<i>Alistipes*</i>	-27.731	<ul style="list-style-type: none"> - Phylum <i>Bacteroidetes</i> - May be associated with dysbiosis and disease - Isolated from human gut - Contrasting evidence of <i>Alistipes</i> being protective against some diseases but associated with pathogenicity in others - Contrasting roles in health and nutrition, 	Yes	11

		may be dependent on host		
<i>Izempasmatales</i>	-24.882	- Predominant occupants of intestinal microbiota of deep sea invertebrates - This order of bacteria may provide essential amino acids to host under oligotrophic conditions	No	20
<i>Anaeroplasma</i>	-24.854	- Beneficial, enhances levels of mucosal IgA → anti-inflammatory - Potent probiotic	No	21
<i>Bacteroidales RF16 group*</i>	-24.812	- Found in yak rumen - May affect isobutyrate and isovalerate production - Little is known about their metabolism	No	12
<i>Clostridia vadin BB60 group</i>	-24.725	- Poorly classified - Little is known about their function in the microbiota	No	22
<i>Cerasicoccus</i>	-24.574	- Gram-negative, obligate anaerobe, non-spore forming - Belongs to family <i>Puniceicoccaceae</i> within the phylum <i>Verrucomicrobia</i>	No	23
<i>Blautia</i>	-22.775	- Acetogen, beneficial - Butyric acid and acetic acid producing, associated with decreased obesity - Most abundant genera in human gut	No	24
Greater abundance in high-risk mammals				
<i>Eubacterium nodatum group</i>	14.030	- First isolated from human subgingival samples - May contribute to moderate to severe adult periodontitis	Yes	25
<i>Eubacterium brachy group</i>	13.675	- First isolated from human subgingival samples - May contribute to moderate to severe adult periodontitis	Yes	25
<i>Streptococcus</i>	12.001	- Gram positive commensal coccus - Implicated in swine and human infections - Many pathogenic strains including <i>Streptococcus agalactiae</i> , <i>S. mutans</i> , <i>S. pneumoniae</i> , <i>S. pyogenes</i> and <i>S. suis</i>	Yes	26
<i>Desulfovibrio</i>	11.794	- Sulfate-reducing anaerobic bacterium - 30 species, some of which are capable of causing human opportunistic infections and disease	Yes	27 28

		- Ubiquitous in nature, found in the GI tracts of sheep, dogs, ferrets, hamsters		
<i>Peptococcus</i>	11.042	- Non-spore-forming gram positive cocci - Found in human mouth, vagina, upper respiratory tract, and umbilicus - Can be isolated from anaerobic infections	Yes	29 30
<i>Odoribacter</i>	10.972	- Linked with presence of <i>Alistipes</i> as both produce sulfonolipids - Usually found in mammals with high-fat diets (e.g., mice) - Part of the human gut microbiota - Decreased abundance linked to non-alcoholic fatty liver disease, cystic fibrosis and inflammatory bowel disease - May have the potential to be an opportunistic pathogen	No	31 32 33
<i>Anaerobiospirillum</i>	10.608	- Gram negative anaerobic bacterium - Pathogenic to humans, causing bacteremia and diarrhea - Not isolated in human feces, but isolated in cat and dog feces	Yes	34

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