

# Raptor Gastroenterology

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## KEYWORDS

- Raptors • Rehabilitation • Gastrointestinal anatomy • Gastrointestinal physiology
- Nutrition • Gastrointestinal disease conditions

## KEY POINTS

- Raptor gastrointestinal anatomy and physiology differ substantially from noncarnivorous birds.
- An understanding of raptor gastroenterology is crucial to the successful rehabilitation of free-living raptors.
- Providing proper nutrition and critical care nutritional support are imperative to gastrointestinal and overall health.
- Clinicians treating free-living raptors should be aware of infectious and noninfectious causes of gastrointestinal pathology.

Free-living raptors are frequently presented to wildlife rehabilitation centers, often due to anthropogenic factors, such as motor vehicle collisions and toxicoses.<sup>1–3</sup> Restoring these birds to health and returning them to the wild is both challenging and rewarding. A thorough understanding of the anatomy, physiology, and natural history of these species is crucial to successful treatment and rehabilitation. This article addresses raptor gastroenterology with an emphasis on conditions affecting free-living birds.

The term *raptor* encompasses a variety of avian species with different natural histories, anatomic features, and diets. Most commonly, *raptor* is used to refer to hawks, falcons, and owls. Although these birds share certain similarities, they are taxonomically distinct groups. Based on genetic analyses showing that birds in the family Falconidae are not closely related to other birds previously included in the order Falconiformes, in 2010 the American Ornithologists' Union (AOU) recognized the new order, Accipitriformes, which contains 3 families.<sup>4</sup> Owls are in the order Strigiformes, which contains 2 families. Current classification based on the AOU Checklist of North and Middle American Birds<sup>5</sup> is given in [Table 1](#).

## ANATOMY AND PHYSIOLOGY

### *Beak and Tongue*

Raptors have strong, curved beaks, the color of which varies among species. In birds of the genus *Falco*, the beak is distinguished by a notch along the cutting

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Order	Family	Birds Included	Examples
Falconiformes	Falconidae	Falcons, caracaras	Peregrine falcon ( <i>Falco peregrinus</i> ), American kestrel ( <i>Falco sparverius</i> )
Accipitriformes	Accipitridae	Hawks, eagles, kites	Red-tailed hawk ( <i>Buteo jamaicensis</i> ), bald eagle ( <i>Haliaeetus leucocephalus</i> ), Cooper's hawk ( <i>Accipiter cooperii</i> )
	Pandionidae	Osprey	Osprey ( <i>Pandion haliaetus</i> )
	Cathartidae	New World vultures	Turkey vulture ( <i>Cathartes aura</i> ), California condor ( <i>Gymnogyps californianus</i> )
Strigiformes	Strigidae	Typical owls	Great horned owl ( <i>Bubo virginianus</i> ), eastern screech-owl ( <i>Megascops asio</i> )
	Tytonidae	Barn owls	Barn owl ( <i>Tyto alba</i> )

edge, or tomia, of the upper bill, referred to as the tomial tooth or tomial notch (Fig. 1). This structure is believed to allow falcons to quickly sever the spinal cord of their prey.<sup>6</sup>

Food is manipulated with the beak and tongue, which like in most other birds (except parrots) lacks intrinsic muscles.<sup>7</sup> The tongue in raptors is nonprotrusible, and the rostral portion is firm and rough.<sup>7</sup> In eagles and vultures, the rostral portion of the tongue may be curved into a troughlike shape (Fig. 2).<sup>7</sup>

### ***Esophagus and Crop***

The crop, or ingluvies, is an enlargement of the cervical esophagus that functions to store food,<sup>8</sup> allowing a bird to ingest a large amount to be digested at a later time. Spindle-shaped crops are present in the Falconiformes and Accipitriformes.<sup>9</sup> The crop is particularly well developed in vultures (Fig. 3).<sup>10</sup> The Strigiformes do not have crops,<sup>9</sup> but food can be stored throughout the length of the esophagus.<sup>8</sup>



**Fig. 1.** An anesthetized peregrine falcon. The tomial notch on the distal aspect of the upper bill is a characteristic of birds in the genus *Falco*.

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