

Review Article

Perianesthetic Mortality Data in Exotic Companion Animals Call for a Husbandry- and Stress-Adjusted ASA Classification

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The American Society of Anesthesiologists (ASA) Physical Status (PS) classification is widely used in veterinary anesthesia to stratify perianesthetic risk, but its evidentiary basis has been formally assessed almost exclusively in dogs, cats, rabbits, and pigs. The only systematic review of ASA-PS in veterinary anesthesia states explicitly that avian studies did not meet its inclusion criteria; reptile studies are not mentioned at all. Since that review, single-taxon retrospective studies have documented perianesthetic mortality and converging risk factors in rabbits, birds, snakes, and lizards: prey-species symptom masking, husbandry-linked subclinical disease, and handling-related stress. The rabbit evidence is cross-institutionally independent, while the avian and reptile evidence originates substantially from one research group working across taxa at a single institution, a distinction made explicit here rather than overstated. No published work has synthesized these taxon-specific findings into a cross-species account of perianesthetic risk, nor proposed how husbandry quality and stress exposure might be incorporated into physical status assessment. This review synthesizes the existing evidence, identifies risk factors that standard ASA-PS categories do not capture, and proposes a conservatively scoped, qualitative husbandry- and stress-exposure flag system as a structured hypothesis for clinical documentation and future prospective validation, not as a replacement for the standard ASA-PS score or for clinical judgment, and not intended for clinical implementation prior to such validation.

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1. Introduction

Exotic companion species — rabbits, small rodents, birds, and reptiles — undergo general anesthesia with a mortality risk that is, and has consistently been shown to be, several-fold higher than that reported for dogs and cats. The Confidential Enquiry into Perioperative Small Animal Fatalities found rabbit anesthetic mortality of 1.39%, against 0.17% in dogs and 0.24% in cats over the same UK multi-center cohort ^[1], an eight-fold difference that has since been replicated, with even wider margins, in single-institution cohorts (4.8% ^[2] and 2.05% ^[3], respectively). This elevated risk is not confined to mammals: retrospective cohorts published since 2017 document comparable concerns in birds ^{[4][5]} and reptiles ^{[6][7]}, though, as detailed below, the avian and reptile studies are not independent of one another in the way the phrase “independent cohorts” might suggest.

The ASA-PS classification, developed for human patients and subsequently adapted into small-animal veterinary practice, remains the default tool by which this risk is stratified and communicated to owners across all these taxa. Yet the only systematic review to formally evaluate the evidentiary basis of ASA-PS in veterinary anesthesia, a meta-analysis of 15 studies and 258,298 patients ^[8], restricted its eligible population to dogs, cats, rabbits, and pigs, and states explicitly that studies in other animal species, including horses and birds, did not meet its inclusion criteria. Reptile studies are not mentioned in that review at all, an absence that could reflect either active exclusion or simply that no reptile studies of this kind were returned by the review’s search strategy; the review’s text does not distinguish between these possibilities. Either way, no systematic evaluation of ASA-PS has been undertaken for reptiles, and the tool’s use in avian and reptile patients rests on an assumption of transferability from mammalian data that has never itself been formally tested.

In the years since that review, retrospective single-taxon cohorts covering rabbits ^[3], birds ^[5], snakes ^[6], and lizards ^[7] have converged on a similar set of concerns: symptom concealment delaying accurate pre-anesthetic risk assessment, husbandry-linked subclinical disease invisible to a standard physical exam, and handling- or capture-related physiological stress as a contributor to perianesthetic morbidity independent of underlying disease status. The strength of this convergence should, however, be read with an important caveat regarding source independence. The rabbit evidence is genuinely independent across two separate institutions and continents (United Kingdom ^[2] and Australia ^[3]). The bird, snake, and lizard evidence, by contrast, originates substantially from a single research group: one senior author is common to the bird ^[4], snake ^[6], and lizard ^[7] studies, with two additional authors common to both

the snake and lizard papers, and all three drawn from the same institution over overlapping case-collection windows (2000–2022/2023). These should therefore be read as one expert group's systematic extension of its own case archive across taxa, rather than as independently arising confirmation from unconnected sources, a distinction that does not weaken this review's central finding (no cross-taxon synthesis with the mammalian ASA-PS literature exists, regardless of who produced the underlying single-taxon data) but should not be obscured by loose language suggesting broader independent replication than the avian and reptile evidence base currently supports.

This review has three aims: first, to synthesize the taxon-specific perianesthetic mortality and risk-factor literature for exotic companion mammals, birds, and reptiles published since the 2018 systematic review closed its search, while being explicit about which findings are cross-institutionally independent and which originate from a single research group's work across taxa; second, to identify the risk factors that recur across this literature but that standard ASA-PS categories do not capture; third, to propose, explicitly as a clinically derived hypothesis rather than a validated instrument, a husbandry- and stress-adjusted modification of the ASA-PS framework.

2. Search Strategy

A literature search was conducted using PubMed-indexed records and web-based academic search engines, covering the period from January 2017 (the year after the closing search date of the only existing systematic review of ASA-PS in veterinary anesthesia) through August 2026, using combinations of the terms anesthesia, anaesthesia, mortality, perianesthetic, perioperative, ASA, physical status, rabbit, avian, bird, reptile, snake, lizard, and exotic. Full abstracts of candidate sources were reviewed directly rather than relying on search-result summaries alone. Reference lists of retrieved articles were hand-searched for additional taxon-specific cohort studies. This review is not a systematic review and does not follow PRISMA methodology; it focuses on salient, methodologically comparable retrospective cohort studies reporting perianesthetic mortality and risk factors in exotic companion mammals, birds, and reptiles, consistent with the narrative review format.

3. Why Standard ASA-PS May Underperform in Exotic Companion Species

3.1. *Symptom Masking and Pre-Test Probability Distortion*

Exotic companion species are, with few exceptions, prey animals, and prey-species behavioral ecology favors concealment of illness until disease is advanced, a pattern documented widely enough in the exotic-medicine literature to have its own established name, the masking phenomenon. The clinical consequence for anesthetic risk assessment is specific: a patient that presents as behaviorally normal, and that would on a standard pre-anesthetic exam be assigned ASA I, may in fact be harboring occult disease that a dog or cat at the same exam would be far less likely to conceal. This is not a defect in the ASA-PS categories themselves so much as a distortion of the pre-test probability that any given exam finding reflects true health status, a distortion that is structurally different in magnitude for a rabbit or parrot than for a dog.

3.2. *Husbandry-Linked Subclinical Pathology*

A substantial proportion of morbidity in exotic companion animals originates directly from husbandry deficiency rather than from an independently arising disease process: metabolic bone disease from inadequate UV-B or dietary calcium, hepatic lipidosis and atherosclerosis from seed-dominant diets, and obesity-associated endocrine disease from inappropriate feeding are among the most common presentations in general exotic-animal practice, a pathogenesis chain documented extensively in the standard husbandry- and nutrition-disease literature. Critically, these processes can be present at a subclinical stage, detectable on history (poor UV-B provision, seed-dominant diet) well before they produce exam findings that would elevate a patient's assigned ASA class. A history-based husbandry assessment therefore carries prognostic information that a physical exam alone does not yet capture.

3.3. *Capture-and-Handling Stress as a Plausible Independent Contributor*

In birds and small prey mammals specifically, capture and restraint are widely understood in clinical practice to provoke an acute stress response, and minimizing this response is the stated rationale behind standard techniques such as dark-box induction in birds and towel-wrap handling in rabbits. Whether this stress response constitutes an independent physiological risk factor for perianesthetic mortality, distinct from, and additive to, the patient's underlying disease status, has not, to the author's knowledge,

been directly tested in a controlled perianesthetic outcome study in these taxa; the point is presented here as a plausible mechanism consistent with established handling practice, not as an established causal finding. If real, it would in any case be a risk factor realized at the point of induction rather than at the pre-anesthetic exam, and so one that a pre-anesthetic ASA assignment could not, by design, capture.

4. Synthesis of Taxon-Specific Evidence (2017-2025)

4.1. Rabbits

Lee et al. ^[2] reported 210 anesthetic events in 185 pet rabbits at a UK referral hospital, with an overall mortality of 4.8%. No single risk factor reached significance for mortality specifically, but body weight was independently associated with postanesthetic gastrointestinal complications, which developed in 38% of surviving rabbits. Pieper et al. ^[3], analyzing 1,757 rabbits undergoing isoflurane-based general anesthesia at a Melbourne referral practice between January 2019 and April 2023, found a lower but still substantially elevated perioperative mortality of 2.05% (95% CI, 1.39-2.71%), with increased mortality most strongly associated with poorer ASA status and non-routine procedures; body mass below 1 kg (relative risk [RR], 7.57) and Netherland Dwarf breed specifically (RR, 23.4) independently elevated risk, while use of a supraglottic airway device was protective relative to endotracheal intubation (RR, 0.27). Both findings sit against the historical baseline of 1.39% rabbit mortality ^[1], itself roughly 6 to 8 times the contemporaneous canine and feline rates.

4.2. Birds

Seamon et al. ^[4] reviewed 352 cases of inhalation anesthesia in birds at a veterinary referral hospital (2004-2014), finding that abnormal pre-anesthetic health status and longer anesthetic duration were each independently associated with death, while anesthesia of healthy birds carried low mortality risk, a finding that itself underscores how much prognostic weight rests on accurate pre-anesthetic health classification in this taxon. Dobbs et al. ^[5] conducted a 5-year retrospective analysis of avian anesthesia-related mortality and associated risk factors in a UK zoological collection, adding a second independent avian dataset to the post-2018 literature.

4.3. Reptiles

Morrison et al. ^[6] reported a retrospective assessment of general anesthesia-related challenges, morbidity, and death across 139 snake cases (2000–2022) at a US veterinary teaching hospital, documenting taxon-specific anesthetic challenges not previously synthesized at this scale. Gise et al. ^[7], from the same institution, reviewed 104 lizard anesthetic events (99 with complete records) spanning October 2000 to January 2023, concluding that general anesthesia can be undertaken reliably and safely in lizards without severe pre-existing disease, but identifying inconsistent and non-standardized record-keeping as a systemic barrier to further risk analysis, and explicitly calling for standardized pre-anesthetic disease screening and uniform anesthetic-stage documentation across the field.

4.4. What the General ASA-PS Evidence Base Does and Does Not Cover

Portier and Ida's ^[8] systematic review and meta-analysis, covering 15 studies and 258,298 patients, found consistent evidence that ASA-PS category III or higher predicts anesthesia-related death in dogs, cats, and rabbits specifically, with the rabbit relative risk (11.31; 95% CI, 2.70–47.39) the largest effect size among the three general species-level pooled analyses reported (dogs, 3.26; cats, 4.83; rabbits, 11.31; higher figures in that review apply only to specific surgical subpopulations, not species-wide estimates). This finding is independently corroborated by Pieper et al.'s ^[3] cohort, in which ASA status was again the strongest single mortality predictor identified, convergent evidence, from two independent rabbit datasets collected roughly a decade apart, that the ASA-PS framework does carry real prognostic signal in at least one exotic companion taxon. Critically, however, the 2018 review's own eligibility screening explicitly excluded avian studies (and did not identify reptile studies at all), and no husbandry-quality or capture-stress variable was incorporated into the analysis for any species. The convergent rabbit finding therefore supports extending and adapting the ASA-PS framework to birds and reptiles, rather than either assuming its transferability untested or discarding it in favor of an entirely new instrument.

4.5. Confounding Variables Not Yet Synthesized Across This Literature

The convergent risk factors identified above (masking, husbandry deficiency, handling stress) are not the only plausible drivers of the mortality differences reported across taxa, and the primary studies synthesized here vary substantially in how completely they captured, and this review varies in how consistently it has extracted, the anesthetic and procedural variables needed to disentangle these explanations from one another.

At one end, several of the underlying studies collected exactly these variables in detail. Seamon et al. [4] recorded ASA status, premedication agent, induction agent, type of maintenance anesthesia, procedure, and both anesthesia and surgery duration for every bird in their series; Pieper et al. [3] distinguished routine from non-routine procedures and airway management (supraglottic device versus endotracheal intubation) as independent predictors in rabbits; Lee et al. [2] examined premedication (alpha-2 agonist use) and endotracheal intubation alongside ASA status. Dobbs et al. [5] used a uniform anesthetic protocol across all cases (no premedication, induction with 5% isoflurane), which controls for premedication and induction-agent variability by design, at the cost of external validity to non-uniform clinical practice elsewhere. The primary rabbit and bird literature underlying this review therefore already contains data on most of the variables an adversarial reader would rightly ask about, even though the present synthesis has not cross-tabulated them.

The reptile literature is different. Morrison et al. [6] and Gise et al. [7] both report incomplete and inconsistent anesthesia records as a central finding of their studies (only 106 of 139 snake cases and 99 of 104 lizard cases had complete records), and neither performed a multivariable risk-factor analysis linking procedure type, premedication, or anesthetic duration to outcome; their conclusions are descriptive rather than adjusted. For snakes and lizards specifically, the confounding variables an adversarial reader would rightly ask about, anesthetic protocol, procedure invasiveness, comorbidity burden, cannot currently be disentangled from husbandry and stress exposure, because the underlying records do not support that analysis. This is a genuine limitation of the evidence base this review draws on, not merely of the synthesis presented here.

Two implications follow. First, the H and S modifiers proposed in Section 5 below should be read as one candidate explanatory factor among several plausible contributors to the reported mortality differences, not as an isolated or dominant one; anesthetic protocol, procedure type, and comorbidity burden remain unadjusted-for alternative explanations in the mammalian and avian data, and are simply unrecorded in the reptile data. Second, the case for prospective, standardized data collection made in Section 5 is strengthened rather than weakened by this gap: only a dataset that captures husbandry and stress exposure alongside the conventional anesthetic and procedural variables already collected by Seamon et al. [4], Pieper et al. [3], and Lee et al. [2] could distinguish the relative contribution of each factor to perianesthetic mortality.

5. Proposed Husbandry- and Stress-Adjusted Modification (Working Framework)

The recurring risk factors identified independently across the post-2018 taxon-specific cohorts, occult disease from symptom masking, husbandry-linked subclinical pathology, and handling-related physiological stress, converge on two structured clinical variables that standard ASA-PS categories do not record. Each of these three underlying risk factors is independently evidenced by the taxon-specific literature reviewed in Sections 3 and 4 above; what follows is a structured notation for documenting factors already supported by that cited evidence, not a new primary claim requiring its own supporting dataset. As Section 4.5 makes explicit, husbandry and stress exposure are proposed here as one candidate contributor to the reported mortality differences among several that remain unadjusted for in this synthesis, not as the demonstrated or dominant explanation; anesthetic protocol, procedure invasiveness, and comorbidity burden remain live alternative or additive explanations that only prospective, standardized data collection can disentangle. These are proposed as explicit qualitative modifiers layered onto, and never replacing, the standard ASA I–V assignment.

Modifier H (Husbandry Adequacy). H0 denotes documented adequate husbandry on history (appropriate UV-B provision and thermal gradient for reptiles; appropriate diet composition for all taxa). H1 denotes a husbandry deficiency identified on history-taking, regardless of current physical exam findings, reflecting that husbandry deficiency independently signals occult-disease risk even in a patient that otherwise presents as ASA I–II.

Modifier S (Stress Exposure). S0 denotes a minimal-stress presentation and handling process (successful low-stress capture, minimal transport distress, brief habituation achieved). S1 denotes high capture, transport, or handling stress with observed prey-species behavioral distress, reflecting the plausible contribution of the stress response itself, realized at the point of induction rather than at the pre-anesthetic exam.

Modifier	Code	Definition
H (Husbandry Adequacy)	H0	Documented adequate husbandry on history (e.g., appropriate UV-B/thermal gradient for reptiles; appropriate diet for all taxa)
H (Husbandry Adequacy)	H1	Husbandry deficiency identified on history-taking, regardless of current physical exam findings
S (Stress Exposure)	S0	Minimal-stress presentation and handling (successful low-stress capture, minimal transport distress)
S (Stress Exposure)	S1	High capture/transport/handling stress with observed prey-species behavioral distress

Table 1. Summary of proposed H and S modifier codes

Notation. A qualitative flag notation is proposed rather than an additive numeric score, for example, “ASA II–H1–S0” for a husbandry-deficient but low-handling-stress patient. This choice is deliberate: no prospective outcome data yet exist to justify assigning quantitative weights to either modifier, and a numeric composite score would imply a validated risk-weighting the current evidence base cannot support. There is additional reason for caution here: even the unmodified ASA-PS score has documented inter-observer variability among veterinary anesthetists ^[9], and there is no basis to assume that H and S, newly proposed, unvalidated categories, would be assigned any more consistently. A qualitative flag keeps this acknowledged subjectivity visible rather than concealing it behind a spuriously precise number. The standard ASA I–V score is left untouched, it is not proposed as a replacement, while husbandry and stress status become structured, chartable data points. This structured visibility is itself the necessary precondition for any future prospective study that might validate, refine, or discard quantitative weighting, and any such study should also assess inter-observer agreement on the H and S flags themselves.

This framework is offered as a clinically derived hypothesis, synthesized from convergent findings across taxon-specific literatures, genuinely independent in the case of rabbits, and consistent output from one expert group’s case archive in the case of birds, snakes, and lizards, that have not previously

been read together across taxa or connected to the mammalian ASA-PS gap identified above. It has not been prospectively validated, and is proposed as a basis for future validation studies and as a structured aid to clinical documentation and owner communication, not as a replacement for clinical judgment or for the standard ASA-PS system itself. It is not intended for immediate clinical implementation or decision-making, and prospective validation, including formal assessment of inter-observer agreement on the H and S flags themselves, is a necessary precondition for any such use.

6. Limitations

The primary studies synthesized here vary in their case definitions of anesthesia-related death, in follow-up windows (ranging from immediate perianesthetic death to 72-hour postoperative windows), and in the taxonomic breadth captured within each taxon group, the same sources of heterogeneity identified as limiting the dog, cat, and rabbit meta-analysis [8] apply here as well, and likely more severely, given the greater taxonomic and husbandry diversity within “birds” and “reptiles” as clinical categories. As noted above, the avian and reptile evidence base synthesized here is not drawn from independent research groups: three of the four non-rabbit source studies share overlapping authorship and a common institution, so the apparent convergence across bird, snake, and lizard findings should be read as consistent output from one expert group's case archive rather than as independent multi-site replication; the rabbit evidence, by contrast, is genuinely cross-institutional. No prospective study has yet tested the proposed H and S modifiers against clinical outcomes, nor their inter-observer reliability, a concern reinforced by documented inter-observer variability in the standard ASA-PS score itself among veterinary anesthetists [9]; the framework offered above is hypothesis-generating, not confirmatory. As discussed in Section 4.5, this synthesis has also not adjusted for anesthetic protocol, procedure invasiveness, or comorbidity burden, variables that several of the underlying studies recorded but that this review did not cross-tabulate against the husbandry and stress factors it foregrounds; for snakes and lizards specifically, incomplete record-keeping in the primary studies themselves currently precludes such an analysis. The literature search underlying this synthesis was limited to English-language sources in mainstream veterinary journals; this is not believed to reflect a geographically or linguistically restricted evidence base for this particular topic, but is noted for transparency. Finally, perianesthetic mortality data in fish and amphibians remain too sparse to support inclusion in a synthesis of this kind, and the scope of this review is accordingly limited to mammalian, avian, and reptilian exotic companion species.

7. Conclusions

Three findings, taken together, motivate this review. First, at the level of the field's only existing systematic review, the evidentiary basis for applying the ASA-PS classification to exotic companion species is formally established for rabbits alongside dogs and cats, but has never been evaluated for birds and reptiles. Second, taxon-specific retrospective studies published since that review, genuinely independent across institutions for rabbits, and a single expert group's systematic extension of its own case archive for birds, snakes, and lizards, have converged on a consistent set of risk factors (symptom masking, husbandry-linked occult disease, and handling-related stress) that fall outside what standard ASA-PS categories record, without any of these studies connecting its findings to the cross-taxon ASA-PS gap identified above. Third, these convergent findings support a structured, conservatively scoped modification: qualitative husbandry and stress-exposure flags layered onto the unmodified ASA-PS score. This framework is proposed not as a finished instrument but as a basis for the prospective, multi-taxon validation work that the field's evidence base, strong within single taxa, silent across them, has not yet undertaken.

Statements and Declarations

Funding

This research received no external funding.

Potential Competing Interests

The author declares no conflict of interest.

Ethics

This is a literature-based narrative review that did not involve new animal experimentation. This study did not involve human participants or identifiable patient data.

Data Availability

No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Author Contributions

Conceptualization, literature search, formal analysis, writing — original draft, and writing — review and editing were all carried out by R.B. The author has read and agreed to the published version of the manuscript.

Use of Generative AI

An AI-assisted research tool was used to support literature searches and verify bibliographic information. All information provided by the AI tool was independently reviewed by the author. The selection and accuracy of sources, as well as all scientific content, interpretations, evaluations, and conclusions presented in this work, remain the sole responsibility of the author.

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Declarations

Funding: No specific funding was received for this work.

Potential competing interests: No potential competing interests to declare.