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Forensic Implications of Dorsal Scale Row Counts on Puff-faced Water Snakes (Colubridae: Homalopsinae: *Homalopsis buccata*)

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"The Dorsals. These scales are perhaps the most useful of all guides in enabling us to differentiate between species and genera, but authors have not availed themselves of their full value." [Wall 1902:338]

Wildlife, including live animals, parts, or products manufactured from wildlife, must be properly declared to species of origin when imported into, or exported from, the United States. Forensic scientists at the U.S. National Fish and Wildlife Forensics Laboratory (U.S. Fish & Wildlife Service) assist law enforcement agencies in identifying animals and animal products in cases where suspected wildlife violations have occurred (Goddard and Espinoza 2000). While the Laboratory does not initiate or lead such investigations, it provides forensic support in a broad range of areas including species identification (morphological and molecular), cause of death examination, forensic chemistry, digital evidence analysis (computer, audio, video and photography), fingerprint, firearm, and tool mark analysis, and crime scene investigation.

Rigorous methods for identifying species in the wildlife trade are critical to law enforcement efforts to enforce wildlife legislation and international treaties (e.g., CITES), and to facilitate the legal trade in wildlife. Here I review published accounts of dorsal scale row counts in the puffed-faced water snake (*Homalopsis buccata*) and their forensic implications for identifying this species in the wildlife trade. While this species is not listed on CITES, enforcement personnel are often called upon to identify this snake to facilitate the legal trade in wildlife. I show that published scale row counts vary considerably and summarize these for wildlife law enforcement purposes.

The puffed-faced water snake is exploited extensively in the wildlife trade, where its skin is used to manufacture leather products (Stuart et al. 2000). Zhou and Jiang (2004) reported that between 1991 and 2001 alone, 1,448,134 skins of this species were imported into China for the leather trade. Stuart (2004) reported numerous live specimens in reptile trade shops in Vietnam. Jenkins and Broad (1994) list *H. buccata* as the third most common reptile skin imported into the U.S. during the years 1984–1990, consisting of 1,645,448 skins.

This species is distributed through southeast Asia, including parts of Bangladesh, India, Nepal, Myanmar, Thailand, Cambodia, Malaysia, Indonesia, Laos, Singapore, and Vietnam (Al-Murani 1990; David and Vogel 1996). Various other common names have been applied to *H. buccata*, including the Masked Water Snake (Murphy et al. 1998), the Dog-faced Water Snake (Campden-Main 1984) [this name is more commonly applied to *Cerberus rynchops*], and the Asian False Water Boa (Franke and Telecky 2001). Reviews of the general morphology, ecology, and phylogenetics of *H. buccata* (in addition to those in Table 1) are provided by Berry and Lim (1967), Murphy and Voris (1994), Stuart et al. (2000), Voris and Murphy (2002), and Voris et al. (2002). Two subspecies (*H. b. buccata* and *H. buccata nigroventralis*) have been described (Deuve 1970), though few researchers appear to be aware of these designations.

Although morphological descriptions of this snake are provided by many researchers, there is marked variability in published ranges for dorsal scale row counts (Table 1). This has the potential to lead to confusion in law enforcement efforts to monitor trade in this species, and has implications for the concept of "scientific certainty" (Bird 2001) in identifying this snake in a forensic context. Snake skins in the leather trade are often dyed, obscuring any original body coloration or banding patterns. Identification, therefore, may rely on scale shape, keeled vs. smooth scale morphology, and dorsal scale row counts to determine if a leather item is consistent with the species it was declared to be.

One of the most widely available texts to assist law enforcement personnel in their identification of snake skins in the leather trade is Mahnert (1981). The entry for *H. buccata* in this volume lists the number of dorsal scale rows in this species as 43–47, citing Taylor (1965), a reference well known and extensively used by herpetologists. In this example, a dyed snake skin with a dorsal scale row count of 35 at mid-body could be interpreted to be inconsistent with *H. buccata*, given the fact that Taylor reports the range for this species as 43–47. However, further review of the literature shows marked variability in published scale row counts for this species (Table 1).

Taylor (1965) noted that "The number of scalerows on the body is an important character and the number may vary at different points on the body." His description is somewhat confusing though, in that he stated "...number of scalerows variable, 37–47" (Taylor 1965:921), while at the same time noting "Variation in scalerows at the middle of the body is 43–47, the usual number being 45" (Taylor 1965:922). Though not explicitly stated, Taylor's report of 37–47 scale rows presumably refers to variability across the entire body length of an individual.

Even more confusing is Smith's (1943) description. In his general description of the monotypic genus *Homalopsis*, he describes the scales as "...in 39 to 47 rows" (Smith 1943:390). However, his more detailed entry under the species name *Homalopsis buccata* lists "Scales in 43–47, usually 45, rows" (Smith 1943:43–47). In neither description did he note body location, a critical variable in interpreting scale counts.

Gyi (1970), in his extensive and often cited revision of the subfamily Homalopsinae, reported dorsal scale rows in *H. buccata* as "37–41 at midbody." However, a closer review of his raw data (Table 12, p. 141) shows a range of 35–47 scale rows at midbody. In his key to the genera of the Homalopsinae, he describes *Homalopsis* with "dorsal scales in 39–47 rows" (Gyi 1970:61). The origin of this significant discrepancy by Gyi in these three instances is not clear.

The earliest report of scale row counts for *H. buccata* uncovered in my review is Günther (1864), who described the scales as ranging from 37–47 rows. The two most recent references (Fuchs and Fuchs 2003; Stuebing and Inger 1999) also produced the widest ranges (Table 1). While the notation of Fuchs and Fuchs (2003:229) (see Table 1) is not elaborated, the inference is that scales typically occur in 43–47 rows, but are known to range from

TABLE 1. Published ranges for dorsal scale row counts in *Homalopsis buccata*.

Citation	Dorsal scale rows (range)	Body location	Geography[1]
Al-Murani 1990:128	39–43	Mid-body	—
Bergman 1951:514	37–47 (citing Rooy 1916)	—	
	43–47 (citing Smith 1943)	—	
	33–41 (citing Kopstein 1930)	Gallbladder[2]	Indonesia
	34–40 (p. 514)	Gallbladder[2]	
Bosch 1985:30	37–47	—	Sulawesi
Campden-Main 1984:82	43–47	Mid-body	Vietnam
Cox 1991:198	43–47 ("usually 45")	Mid-body	Thailand
David and Vogel (1996:183)	37–47	Mid-body	Sumatra
Deuve 1970:179–185	37–47 (*H. b. buccata*)	—	
	35–39 (*H. buccata nigroventralis*)	—	Laos
Fuchs and Fuchs 2003:229	(37) 43–47 (49)	Mid-body	—
Günther 1864:285	37–47	—	British India
Gyi 1970:61, 138, 141	39–47 (p. 61)	—	
	39–45 (p. 138)	Anterior	Myanmar, Thailand,
	37–47 (p. 141)	Anterior	Malaya, Sumatra, Java
	37–41 (p.138)	Mid-body	
	35–47 (p. 141)	Mid-body	
	27–31 (p. 138)	Anterior to vent	
	23–33 (p. 141)	Anterior to vent	
Lim 1964:182	> 35	Mid-body	Malaysia
Mahnert 1981	43–47	—	Thailand (by citing Taylor 1965)
Manthey and Grossmann 1997:307, 357	35–47	—	Southeast Asia
Marx and Rabb 1972:78–79	Range not reported, through range span listed as 11	Mid-body	—
Rooij 1917:186–187	37–47	—	Indo-Australian Archipelago
Saint Girons 1972: 48, 110–114	43–47	—	Cambodia
Smith 1943:390–391	39–47 (p. 390)	—	Myanmar, Sri Lanka, India
	43–47 (p. 391)	—	
	("usually 45, rows") (p. 391)		
Stuebing and Inger 1999:96	32–48	Mid-body	Borneo
Taylor 1965:921–922	37–47 (p. 921)	—	
	43–47 (p. 922)	Mid-body	Thailand
	("usual number being 45") (p. 922)	Mid-body	
Tweedie 1983:17, 103	37–47	Mid-body	Malay Peninsula (including parts of Thailand, Malaysia and Singapore)

[1]Refers to geographic coverage of the text
[2]Interpreted to mean mid-body

37–49 rows. This count of 49 scale rows is the highest of any mid-body dorsal rows reported for this species. The lowest count at mid-body is reported by Stuebing and Inger (1999), who list a range of 32–48. Interestingly, they do not elaborate on the low end of their range or compare it to previous accounts, which are generally higher. The combined ranges of Fuchs and Fuchs (2003) and Stuebing and Inger (1999) result in a published dorsal scale row count in *H. buccata* of 32–49 scales at midbody. This range is significantly different from most accounts in Table 1, especially that reported by Mahnert (1981), a reference used by many of those responsible for monitoring the wildlife trade. Based on this review, it appears that the entire range of dorsal scale counts of 32–49 at mid-body should be considered consistent with *H. buccata* by wildlife law enforcement personnel.

This review reiterates that both accurate and precise morphological descriptions are critical not only to taxonomic research, but to forensic efforts and the conservation of species. It is likely that many herpetologists are unaware that their research, even basic descriptions, may be used in a forensic and legal context. In addition, enforcement personnel must be made aware that published morphological descriptions may refer only to a limited range of variability within a species. It appears that Taylor's (1965) data have been used inappropriately by some as a diagnosis for the species from its entire range. The wide geographic range of *Homalopsis buccata* and additional research has revealed further variability in dorsal scale rows in this species. Additional documentation of scale count variability in *H. buccata* outside the range summarized here is also warranted, as are similar reviews of other snake species in the wildlife trade.

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