

# Melanistic Diversity in the Maritime Gartersnake, *Thamnophis sirtalis pallidulus*, in Nova Scotia, Canada

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We describe an unusual diversity of melanistic conditions in populations of the Maritime Gartersnake, *Thamnophis sirtalis pallidulus*, in Nova Scotia: pure melanism, melanism, nigrismus (predominantly melanistic), abundismus (mosaic melanism). This variability is widespread in Nova Scotia, and it includes coastal islands.

Key Words: Maritime Gartersnake; *Thamnophis sirtalis pallidulus*; pure melanism; melanism; nigrismus; predominantly melanistic; abundismus; mosaic melanism; coastal islands; Nova Scotia

## Introduction

Rowell (2012) explained that melanism is a Mendelian recessive trait that is rare or absent in most Common Gartersnake (*Thamnophis sirtalis*) populations. Peters (1964) and Klauber (1972) provide definitions of melanism, nigrismus, and abundismus. Melanism is an unusual increase in the normal amount of black pigment within a particular individual as contrasted with other members of his species. Occasionally used to characterize a species in which all individuals are equally black. Nigrismus is a type of melanism in which the specimen is not completely black and shows a change in the elements of the basic pattern as a consequence of an increase in the size of the black portion of the pattern, making the specimen predominantly black. Abundismus is a mosaic type of melanism in which the specimen is not completely black but shows a change in the elements of the basic pattern as a consequence of an increase in the number of black spots or blotches in the non-black areas of the pattern.

We propose a fourth type of melanism: pure melanism. The pure melanistic condition is uniform black on the back and does not show a spotted pattern when the skin is spread. This is the main character which separates the pure melanistic condition from the melanistic condition.

All four melanistic conditions are variable in the Maritime Gartersnake, *Thamnophis sirtalis pallidulus*, and are widespread in specimens found on the mainland, on Cape Breton Island, and on two coastal islands in Nova Scotia (Figure 1). In general terms, these melanistic conditions in the Maritime Gartersnake in Nova Scotia can be defined as follows.

### *Pure melanism*

Individuals are a uniform satiny black to bluish-black on the back (Figure 2), rarely with purplish gleam. The back will be lustrous in some lights when the snake is

freshly shed. The top of the head, the underside of the trunk, and the tail are glossy black to bluish-black, (like the melanistic condition, see the photograph on the cover). The infralabials, chin shields, and gular scales, are enamel white, rarely bright pinkish-white. The white shades change abruptly to black or bluish-black on the first few anterior ventral scales, and the black or bluish-black extends to the tip of the tail. The skin between the scales is dull dark grey to bluish-grey throughout. Only 4 specimens of the Maritime Gartersnake are known to manifest the pure melanistic condition (Table 1). They do not show a Maritime Gartersnake spotted pattern when the skin is spread.

### *Melanism*

Individuals are usually satiny black to bluish-black on the back (Figure 3 before shedding and the same snake, see cover, two days after shedding), rarely with a purplish gleam. The back is lustrous in some lights, particularly when the snake is freshly shed. The top of the head and the underside of the trunk and tail are glossy black to bluish-black. The infralabials, chin shields, and gular scales can be enamel white, bluish-white, yellowish-cream, light orange (on snakes from Georges Island, Halifax County), and rarely pinkish-white. In addition, some individuals have black spots or streaks on the side of the jaw, the chin, and the throat. These light colours change abruptly to the darker ventral colour on the first few anterior ventral scales. The skin between the scales can be bluish-white, light grey, or light yellowish-brown. When the skin is spread, large ellipsoid-shaped spots or smaller alternating spots, and dorsal stripe, if present, (characteristic of the Maritime Gartersnake spotted pattern), are revealed. This pattern, when the skin is spread, is the most distinguishing character which separates it from the pure melanistic morph.

Counting the 3 young from Wellington, there are 27 records of the melanistic condition (Table 2) in Nova

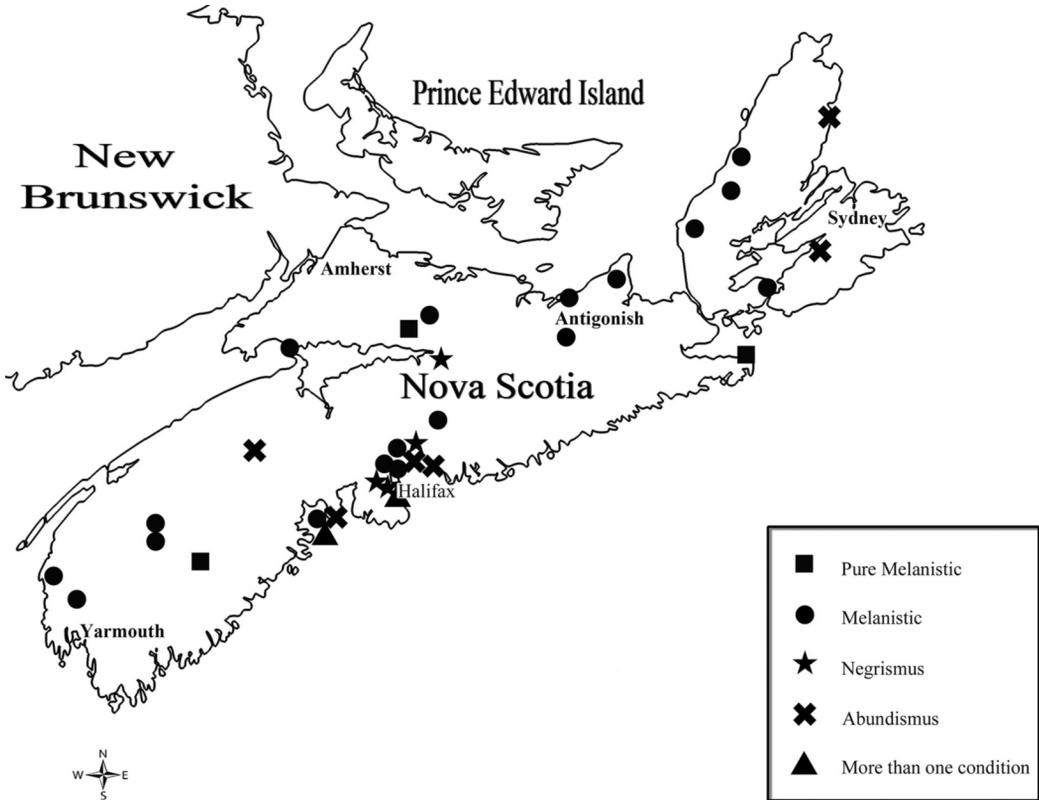


FIGURE 1. Distribution of the four melanistic conditions in the Maritime Gartersnake, *Thamnophis sirtalis pallidulus*, in Nova Scotia.

TABLE 1. Four pure melanistic Maritime Gartersnakes, (*Thamnophis sirtalis pallidulus*) from Nova Scotia, Canada, in chronological order.

Age	Sex	Locality	Date collected	Remarks
Adult	Female	Canso, Guysborough County	5 October 1905	Nova Scotia Museum, Piers no. 2937
Adult	Female	Lake Rossignal, Queens County	21 October 1970	Nova Scotia Museum 970-Z-400-1 (Figure 2)
Adult	Female	Londonderry, Colchester County	24 May 1980	Sight record
Adult	Female	Big Tancook Island, Lunenburg County	18 August 2013	Anomaly. Brown labials, black ventral scales, and grey subcaudals (Figure 7)

Scotia; 11 of these reported observations were made from a distance and do not include a description of the underside of the body or tail.

#### *Nigrismus* or predominantly black

This is a type of melanism in which the individual looks uniform black from a distance and up close it is predominantly black. The spotted pattern, and dorsal stripe, when present, of a Maritime Gartersnake are black and the remaining ground colour is a mosaic of blackish clove-brown with scattered white scales (Gilhen 2000) (Figure 4). This morph is dark steel grey

“plumbeous” to grey-black on the underside of the trunk and the tail (Figure 5). The underside of the tail of one individual was blackish clove-brown. The infra-labials, chin shields, and gular scales may be bluish-white, or yellowish-cream to orange-cream, and may be freckled with grey. There are only four observations of the nigrismus or predominantly black condition in Nova Scotia (Table 3).

#### *Abundismus* or mosaic

In these Individuals, the normal spotted pattern is invaded by dark grey-black to black spots and/or blotch-



FIGURE 2. Pure melanistic Maritime Gartersnake, *Thamnophis sirtalis pallidulus*, from Lake Rossignol, Queens County, Nova Scotia, captured on 21 October 1970, by James Harding. Photo: R. Merrick.



FIGURE 3. Melanistic Maritime Gartersnake, *Thamnophis sirtalis pallidulus*, from Big Tancook Island, Mahone Bay, Lunenburg County, Nova Scotia, captured on 7 May 2012 (before it shed its skin). Photo: H. Dionne.

TABLE 2. Twenty- seven melanistic Maritime Gartersnakes (*Thamnophis sirtalis pallidulus*) from Nova Scotia, Canada, in chronological order.

Age	Sex	Locality	Date collected	Remarks
Unknown	Unknown	McNabs Island, Halifax County	13 May 1929	Nova Scotia Museum no. 6519. "from its colour it would be mistaken for a Black Snake ( <i>Coluber constrictor</i> )"
Adult	Female	Fletcher 's Lake, Halifax County	15 July 1962	Sight record
Adult	Unknown	Jacques Landing, Queens County	16 August 1971	National Museum of Canada 13674. Park highway road kill.
Adult	Female	George 's Island, Halifax County	4 July 1991	Sight record
Adult	Female	George 's Island, Halifax County	23 July 1992	Sight record no. 1
Adult	Female	George 's Island, Halifax County	23 July 1992	Sight record no. 2. Dark brownish-black individual
Adult	Male	George 's Island, Halifax County	10 August 1992	Anomaly. Individual had Yellow dorsal stripe anteriorly (Figure 8)
3 Young	Unknown	Wellington, Yarmouth County	27 June 1995	F. R. Cook field numbers 18758, 18762 and stillborn 18771
Unknown	Unknown	Mull River, Inverness County	16 May 1999	Nova Scotia Herpetological Atlas no. 3679
Unknown	Unknown	Upper Margaree, Inverness County	10 June 1999	Nova Scotia Herpetological Atlas no. 10072
Unknown	Unknown	Margaree Forks, Inverness County	10 June 1999	Nova Scotia Herpetological Atlas no. 11900
Unknown	Unknown	Margaree Forks, Inverness County	11 June 1999	Nova Scotia Herpetological Atlas no. 10073
Unknown	Unknown	Clark Lake, Colchester County	25 July 2000	Nova Scotia Herpetological Atlas no. 4352
Unknown	Unknown	Ponds, Pictou County	15 August 2000	Nova Scotia Herpetological Atlas no. 4883
Adult	Female	Dilligent River, Cumberland County	3 July 2002	Nova Scotia Herpetological Atlas no. 9196
Unknown	Unknown	Timberlea, Halifax County	August 2002	Remains of house cat kill
Unknown	Unknown	Sampsonville, Richmond County	12 October 2002	Nova Scotia Herpetological Atlas no. 10000
Adult	Female	Fairmont Road, Antigonish County	9 June 2003	Nova Scotia Herpetological Atlas no. 10451
Adult	Female	Grafton Lake, Queens County	10 July 2003	Sight record. Individual had bluish stripes
Unknown	Unknown	Gamble Lake, Colchester County	6 July 2004	Sight record
Adult	Female	Dilligent River, Cumberland County	12 August 2004	Nova Scotia Museum catalogue no. 55514
Adult	Female	Argyle Sound, Yarmouth County	Summer 2004	Nova Scotia Museum catalogue no. 55593
Adult	Female	Garden of Eden, Pictou County	4 July 2008	Sight record. Individual near shedding, blue eyes
Adult	Female	Big Tancook Island, Lunenburg County	7 May 2012	Individual has bluish stripes
Adult	Female	Lake Doucette, Digby County	30 September 2012	Nova Scotia Museum catalogue no. 55587



FIGURE 4. Dorsal view of nigrismus Maritime Gartersnake, *Thamnophis sirtalis pallidulus*, from McCabe Lake, Halifax County, Nova Scotia, captured on 24 June 1969. See also Figure 5. Photo: J. Gilhen.



FIGURE 5. Ventral view of the nigrisumus Maritime Gartersnake, *Thamnophis sirtalis pallidulus*, shown in Figure 4. Photo: J. Gilhen.

es (Figure 6). The spots may be small, and involve only a few scales on one side, may be large and invasive of the dorsal spotted pattern and stripe, or may involve just the underside of the trunk and tail. The remaining ground colour or pattern is as variable as any Mar-

itime Gartersnake in Nova Scotia. There are 9 records of the abundismus condition (Table 4). Abundismus individuals are often referred to in Nova Scotia as part-melanistic.

TABLE 3. Four nigrisumus Maritime Gartersnakes (*Thamnophis sirtalis pallidulus*) from Nova Scotia, Canada, in chronological order.

Age	Sex	Locality	Date collected	Remarks
Adult	Unknown	Paddy Lonis Brook, Halifax County	29 April 1918	Nova Scotia Museum catalogue no. 4604
Adult	Female	Withrod Lake, Halifax County	6 May 1934	Nova Scotia Museum catalogue no. 7783
Unknown	Unknown	Mill Brook, Colchester County	7 August 1935	Nova Scotia Museum Catalogue no. 8224
Adult	Female	McCabe Lake, Halifax County	24 June 1969	Canadian Museum of Nature Amphibians and Reptiles no.12153 (Figures 4 and 5)

TABLE 4. Nine abundismus Maritime Gartersnakes (*Thamnophis sirtalis pallidulus*) from Nova Scotia, Canada, in chronological order.

Age	Sex	Locality	Date collected	Remarks
Adult	Male	Tomahawk Lake, Halifax County	5 July 1970	Site record
Unknown	Unknown	Big Pond, Cape Breton County	17 August 1977	National Museums of Canada NMCAR25368
Adult	Male	George’s Island, Halifax County	26 May 1989	Sight record no. 1 (see Figure 6)
Adult	Male	Georges Island, Halifax County	26 May 1989	Sight record no. 2
Adult	Male	George’s Island, Halifax County	14 April 1992	Sight record
Adult	Male	George’s Island, Halifax County	11 May 1992	Sight record
Adult	Male	South Ingonish beach, Victoria County	5 September 1996	Nova Scotia Museum 55056
Adult	Male	Big Tancook Island, Lunenburg County	24 May 2003	Sight record
Adult	Male	Mack Lake, Kings County	23 August 2003	Nova Scotia Museum 55592



FIGURE 6. Abundismus Maritime Gartersnake, *Thamnophis sirtalis pallidulus*, from Georges Island, Halifax Harbour, Halifax County, Nova Scotia, captured on 26 May 1989. Photo: J. Gilhen.

## Discussion

For almost a century and a half, there have been published and oral reports of black snakes from Nova Scotia, New Brunswick, and Prince Edward Island (Bleakney 1958). John Matthew Jones (1865) published the first list of amphibians and reptiles of Nova Scotia and he included the Black Snake, *Coluber constrictor* (i.e., North American Racer). Gilpin (1875) also gives an account of the Black Snake. These reports of the Black Snake, *C. constrictor*, are believed to be in error and actually can be attributed to the melanistic morph of the Maritime Gartersnake, as indicated by Harry Piers (Gilhen 2000) and mentioned by Bleakney (1958), Cook (1967), and Gilhen (1984). The North American Racer and North American gartersnakes (*Thamnophis* spp.) are easily distinguished from one another by the scales on their back. The North American Racer has smooth dorsal scales and North American gartersnakes have strongly keeled scales.

The 4 melanistic conditions described above are uncommon in Nova Scotia but widespread. The ratio of melanistic individuals to four other recognized colour patterns in wild populations in Nova Scotia is not known. Only Georges Island, Halifax County, was sur-

veyed specifically for Maritime Gartersnakes (Barnes *et al.* 2006). Between May and October 1993, a total of 391 Maritime Gartersnakes were marked on this 5-ha drumlin in Halifax Harbour. Barnes *et al.* (2006) state, "Rarely were individuals melanistic (solid black) or partially melanistic (five individuals)."

Over 100 Maritime Gartersnakes have been observed on Big Tancook Island by JG but only 3 individuals — one pure melanistic anomaly, one melanistic, and one abundismus were observed and photographed. We have kept 6 melanistic females from various localities until they gave birth, but they did not produce melanistic young. We have observed more than 20 non-melanistic females from various localities in Nova Scotia give birth, and none of their young were melanistic. Also, we have not found melanistic young in the field. However, Francis R. Cook collected two non-melanistic pregnant females from Wellington, Yarmouth County, one on 27 June 1995 and the second on 2 July 1995. Both females gave birth in captivity. The female from 27 June, gave birth to 16 young (3 melanistic and 13 non-melanistic). The female from 2 July gave birth to 13 normal young. During annual visits from 1963 to 1995 to the former Frank Crosby farm at Wellington,

Francis R. Cook and Joyce Cook never saw a melanistic Maritime Gartersnake. Also, Joyce Cook lived there from 1948 to 1958 and did not see a melanistic snake, nor were any noted by her parents or two brothers.

Melanism is more common in the Eastern Gartersnake, *Thamnophis sirtalis sirtalis*. Rowell (2012) provides a table (Table 24.1) listing the incidence of melanism reported at locations in southern Ontario, particularly on islands of western Lake Erie and at nearby mainland locations. The incidence varied from 6.4% at Point Pelee to 12%–59% at Point Pelee Island, East Sister Island, and Middle Island, and 24%–51.2% at Long Point.

#### *Pure melanistic*

The first recorded observation of pure melanism in a Maritime Gartersnake is by Harry Piers (Accession Book No. 1, Nova Scotia Museum no. 2937). He stated, “Melanistic variety of Common Garter Snake, All Saints Rectory grounds, Canso, Guysborough County, by Rev. R. M. Leigh’s man on 5 October 1905”. Under Remarks he stated “Colour. – Back black, with no sign whatever, in any light, of blotches or stripes, etc.; underside of head white; belly slate-coloured, the under plates

(belly & tail) narrowly margined with lighter. Ventral plates with a black spot on outer margin, near beginning of dorsal scales, thus being almost concealed by the next ventral plate.”

A large female from Londonderry was most unusual in that it was black with a distinct purplish lustre. The infralabial scales, chin shields, gular scales, and first few ventral scales were glossy pinkish-white and the remaining underside was grey-black with a pinkish lustre. The large female from Big Tancook Island was different and unusual in that the supra-labials and neck were brown fading to yellowish-cream on the infra-labials, chin shields, gular scales, and first few ventral scales. This snake had a light lateral stripe on both sides anteriorly. The belly was black nearly to the anal plate and then changed abruptly to grey to the tip of the tail (Figure 7). It resembled mostly the pure melanistic condition. When the skin was spread, a Maritime Gartersnake spotted pattern was not revealed.

#### *Melanistic*

The first recorded observation of melanism in a Maritime Gartersnake is by Harry Piers (Accession Book No. 3, Nova Scotia Museum no. 6519). He recorded a



FIGURE 7. Adult male melanistic Maritime Gartersnake, *Thamnophis sirtalis pallidulus*, anomaly with light yellow anterior dorsal stripe from Georges Island, Halifax County, Nova Scotia, captured on 10 August 1992. Photo: J. Gilhen.

“Striped Garter Snake ABNORMAL MELANISTIC INDIVIDUAL!!” from McNab’s Island, Halifax Harbour, Halifax County, captured on 13 May 1929 by Joseph Perrin. “From its colour it would be mistaken for a Black Snake (*Coluber constrictor*)” (i.e., North American Racer). This may be the same variation of melanism exhibited by a female from Grafton Lake, Queens County, on 10 July 2003 and a female from Big Tancook Island, Lunenburg County, on 3 October 2011. Both females had blue-black dorsal and lateral stripes.

Of the 27 Maritime Gartersnakes reported here as melanistic, 9 were reported in the Nova Scotia Herpetological Atlas (NSHA). Since a description and/or image was not given, the Nova Scotia Herpetological Atlas number for each one is provided in Table 2.

The underside of the snake from Garden of Eden was not recorded and its blue eyes indicate it was about to shed. Two rare variations and one anomaly were found in the melanistic condition on Georges Island. One individual was dark brownish-black with orange at the corner of the mouth fading to yellowish-white on the chin and extending onto the first few ventral scales. Another snake from Georges Island was similar to a large pure melanistic female from Londonderry in that it was black with a distinct purplish gleam (Barnes *et al.* 2006.). The chin and first few ventral scales were glossy pinkish-white and the remaining underside was dark pinkish-grey. One snake from Timberlea, Halifax County, was

dark blueberry-blue on the back. The underside of the trunk was bluish-black. The sides of the head were blue fading to bluish-white on the chin shields. One adult male anomaly had a light yellow dorsal stripe anteriorly (Figure 8).

#### *Nigrismus*

The first recorded observation of nigrismus in a Maritime Gartersnake is also by Harry Piers (Accession Book No. 2, Nova Scotia Museum no. 4604). He recorded a striped garter snake, with melanistic tendency from Paddy Lonis Brook, one mile SSE of Enfield, Halifax County, on 29 April 1918. His detailed account of the colour is as follows: “Colour from fresh specimen. General colour very dark; stripes moderately plain (on anterior parts; spots very obscure owing to dark colour of back. Top of head and back blackish, Clove-Brown. Upper labials and lower part of snout plate (rostral) Buff. Iris, brown. Dorsal stripe (on dorsal row of scales and part of row on each side of it), dirty white; plainest for about 5 inches back of snout, and becoming lost about 12 ½ inches behind snout (that is, a little more than half-way of length). The stripe is broken for a couple of inches behind the head by the connection across it of 5 of the dark spots on each side of it. Lateral stripe on parts of 2<sup>nd</sup> and 3<sup>rd</sup> rows of scales pale olive-buff, plainest for about 5 inches behind snout, not so evident or so light as the dorsal stripe, and becoming lost about



FIGURE 8. Pure melanistic Maritime Gartersnake, *Thamnophis sirtalios pallidulus*, anomaly with yellowish-brown supralabials fading to yellowish-white on underside of head and with blackish ventral scales and greyish subcaudal scales, from Big Tancook Island, Lunenburg County, Nova Scotia, captured on 18 August 2013. Photo: R. Lloyd.

anus (about 17 inches from snout). Two rows of obscure black spots, the inner row about .10 inch diameter each spot, the outer row about .15 inch diameter each spot, arranged alternately (zig-zag fashion) on each side of dorsal stripe (that is between dorsal stripe and lateral stripe); these spots somewhat noticeable for 4 or 5 inches behind snout, but soon become lost in the general blackish colour of upper parts. Underside of head, bluish-white. Belly and underside of tail plumbous, the abdominal plates each with a black spot on the front lateral part. “

#### *Abundismus*

Abundismus or the mosaic condition is extremely variable. All 9 individuals recorded differed in the amount of black pigment. The spots can be small and involve only a few scales, large patches, or extensive grey-black areas, particularly on the posterior half of the body and tail, and the spots or areas invade or cover the normal spotted pattern and stripes (Figure 6).

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