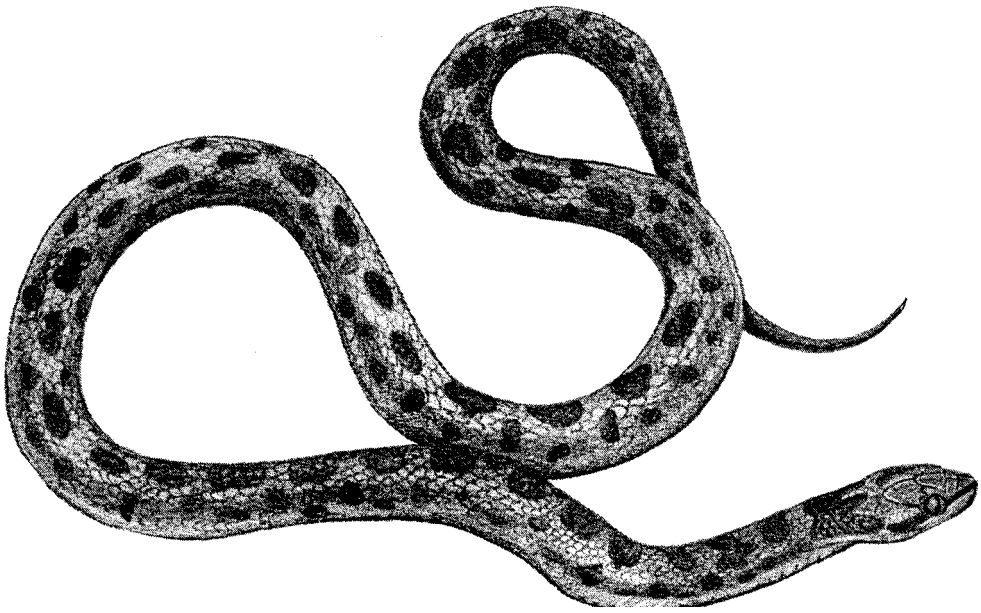
COSEWIC
Assessment and Status Report

on the

Night Snake
Hypsiglena torquata

in Canada



ENDANGERED
2001

COSEWIC
COMMITTEE ON THE STATUS OF
ENDANGERED WILDLIFE
IN CANADA

COSEPAC
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Night snake — Illustration of night snake by Sarah Ingwersen, Aurora, Ontario.

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COSEWIC
Assessment Summary

Assessment summary — May 2001

Common name
Night snake

Scientific name
Hypsiglena torquata

Status
Endangered

Reason for designation
Only about 20 night snakes have been reported in Canada, all from a small region in southcentral British Columbia that is under intense development pressure. The combination of small population size, widespread habitat loss and no possibility of rescue effect places the night snake at imminent risk of extirpation.

Occurrence
British Columbia

Status history
Designated Endangered in May 2001. Assessment based on a new status report.

COSEWIC
Executive Summary

Night Snake
Hypsiglena torquata

Species information

The Night Snake is a small snake with dark grey or brown blotches on a light grey or brown back, and a yellowish or white belly. While it is technically venomous, it is a member of the family of "harmless snakes", which includes most Canadian species of snakes. The Canadian population is identified as the *deserticola* subspecies of *Hypsiglena torquata*.

Distribution

In Canada, the Night Snake is found exclusively in the hot, dry interior of British Columbia; fewer than 20 individuals have been found. The snake's distribution ranges extensively throughout the southwestern states of the USA, Mexico and parts of Central America to Costa Rica. In general, it is less common than other snakes that occur in the same habitat and more common in southern than northern parts of its range.

Habitat

Most of the Night Snakes found in British Columbia were in areas with rocks, shrubs and grasses. They show a preference for south facing talus slopes or rock outcrops.

Biology

Common food items of the species are lizards, squamate eggs, frogs and snakes, although the only recorded food item for a Night Snake in Canada is a neonate rattlesnake. They sometimes burrow in sand to ambush their prey. *Hypsiglena torquata* is oviparous and lay 3 to 9 eggs in a clutch. Time of nesting is variable and is unknown in Canadian populations. Night Snakes hibernate during the winter, occasionally sharing dens with rattlesnakes. Night Snakes in British Columbia can live at least four to five years. Most aspects of the life history of Night Snakes in general, and the Canadian populations in particular, are not well studied.

Population sizes and trends

Very little is known about the Night Snake's population size. Despite intensive and frequent searches they have rarely been found and appear to be confined to habitat this is rapidly disappearing in Canada.

Limiting factors and threats

The Night Snake is threatened by human activities. The preferred habitat in British Columbia is quickly being developed for urbanization, vineyards and orchards, and talus materials are harvested for use in the construction and landscaping industry. In addition to the habitat loss, Night Snakes are also vulnerable to fragmentation of their habitat as it may act as a barrier to dispersal. Finally, Night Snakes are susceptible to being killed on roads. With increased development of their habitat, the incidence of road killed snakes is likely to increase.

Special significance of the species

Young Night Snakes can be confused with rattlesnakes and may therefore be subject to added persecution by humans. Night Snakes in Canada may prove to have adaptations allowing them to survive in the colder climate.

Existing protection

The Night Snake is Red-listed in British Columbia.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determines the national status of wild species, subspecies, varieties, and nationally significant populations that are considered to be at risk in Canada. Designations are made on all native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fish, lepidopterans, molluscs, vascular plants, lichens, and mosses.

COSEWIC MEMBERSHIP

COSEWIC comprises representatives from each provincial and territorial government wildlife agency, four federal agencies (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biosystematic Partnership), three nonjurisdictional members and the co-chairs of the species specialist groups. The committee meets to consider status reports on candidate species.

DEFINITIONS

Species	Any indigenous species, subspecies, variety, or geographically defined population of wild fauna and flora.
Extinct (X)	A species that no longer exists.
Extirpated (XT)	A species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A species facing imminent extirpation or extinction.
Threatened (T)	A species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk (NAR)**	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)***	A species for which there is insufficient scientific information to support status designation.

* Formerly described as “Vulnerable” from 1990 to 1999, or “Rare” prior to 1990.
** Formerly described as “Not In Any Category”, or “No Designation Required.”
*** Formerly described as “Indeterminate” from 1994 to 1999 or “ISIBD” (insufficient scientific information on which to base a designation) prior to 1994.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list.

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COSEWIC Status Report

on the

Night Snake
Hypsiglena torquata

in Canada

Linda Gregory

2001

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INTRODUCTION

The Night Snake, *Hypsiglena torquata* Günther, is unique among species in Canada in being rear-fanged. In such species, the teeth that deliver venom are enlarged, may or may not be grooved, and are located at the rear of the maxillary bone of the upper jaw. The snake chews to bring the teeth into contact with prey or potential predators (Greene, 1997). Although technically venomous, it is a member of the family Colubridae ("harmless snakes"), which includes most Canadian species of snakes. Unlike other Canadian snakes, except perhaps *Contia* and *Diadophis* (Greene, 1997), it is in the dipsadine lineage of the New World Colubridae. Most snakes within this lineage are neotropical, found primarily in Central America (Greene, 1997).

Species Description

Hypsiglena torquata is a small snake (255 - 530 mm SVL) with dark grey or brown blotches on a light brown or grey dorsal body surface, a flat and somewhat triangular head, two or three distinct but variably shaped brown blotches on the back of the neck, dark brown longitudinal bars behind and in front of the eye, vertical pupils and a yellowish or white belly (Gregory and Campbell, 1984; Stebbins, 1985; F. Cook, pers. comm. to P. Gregory). The dorsal blotches are in several rows, described by Gregory and Campbell (1984) as "a mid-dorsal row of more or less paired blotches with an alternating row of smaller blotches on each side and a second row of still smaller spots low on each side." The scutes are smooth (Gregory and Campbell, 1984). *Hypsiglena* has 19 to 23 scale rows at mid body (Tanner, 1944). The two specimens from British Columbia for which data are available have 21 and 23 scale rows at mid body (Lacey *et al*., 1996). Males, but not females, have supra-anal keels (Blanchard, 1931).

Taxonomy

Originally, Cope (1860) described the genus *Hypsiglena* (Night Snakes) for the snake he named *Hypsiglena ochrorhyncha.* Earlier in the same year Günther described a snake, from Laquana Island, Nicaragua (type-locality) as *Leptodeira torquata* (original description). Because the snake described by Günther was later assigned to the genus *Hypsiglena,* Cope is credited for naming the genus and Günther the species. Within the dipsadine lineage of the New World Colubridae, Rodríguez-Robles *et al*. (1999) show *Hypsiglena* (Night Snakes) with *Leptodeira* (Cat-eyed Snakes, 8 species*), Crophis hallbergi* (Cloud Forest Snake), *Imantodes* (Blunt-headed Vinesnakes, 6 species), *Eridiphas slevini* (Baja California Nightsnake) and *Pseudoleptodeira latifasciata* (Banded Nightsnake) as members of the "*Leptodeira* clade", and the latter two, Baja California Nightsnake and Banded Nightsnake, with *Hypsiglena torquata* Günther (Night Snake) as members of the "*Hypsiglena* clade".

Hypsiglena has undergone extensive splitting and combining of species and subspecies (see Gregory and Gregory, 1999). Tanner (1944) recognized five species, with one of the species, *Hypsiglena ochrorhyncha,* containing 10 subspecies, including the representative from British Columbia. However, within 15 years this number was

reduced to one species, *Hypsiglena torquata* Günther, and 11 subspecies, six of which are from North America (Schmidt, 1953; Wright and Wright, 1957). There have since been controversies about the number of species (Dixon, 1965; Hardy and McDiarmid, 1969), re-grouping of subspecies (Dixon, 1965; Dixon and Dean, 1986), the description of a new species, *Hypsiglena tanzeri*, from Central Mexico (Dixon and Lieb, 1972; Dixon and Dean, 1986) and the creation of a new genus, *Eridiphas (Hypsiglena slevini to Eridiphas slevini*). The result is at least two species, *Hypsiglena tanzeri* and *Hypsiglena torquata* and 11 subspecies of *H. torquata* (Dixon and Lieb, 1972; Dixon and Dean, 1986; Collins, 1997). The only subspecies found in Canada is *H. t. deserticola* Tanner (Gregory and Cambell, 1984). Other subspecies are; *H. t. ochrorhyncha* Cope, *H. t. nuchalata* Tanner, *H. t. klauber*, Tanner, *H. t. loreala* Tanner, *H. t. jani* Duges, *H. t. torquata* Günther, *H. t. venusta* Mocquard, *H. t. affinis* Boulenger, *H. t. chlorophaea* Cope and *H. t. tortugeaensis* Tanner (Tanner, 1981; Dixon and Dean, 1986; Collins, 1997). Collins, in the Center for North American Amphibians and Reptiles (CNAAR) 1997 web site, based on a paper by Grismer *et al*. (1994), suggests additional grouping of the subspecies, making *H. t. deserticola* and *H. t. klauber* synonyms for *H. t. ochrorhyncha*. This change would affect the subspecies name for the representative of British Columbia. However, the reason for this change is not apparent and the subspecies name *H. t. deserticola* (Tanner, 1944) is retained and appropriate for the subspecies in Canada.

History of the Night Snake in Canada

The Night Snake was first found in Canada in the Okanagan valley of south-central British Columbia on September 28, 1980 (Gregory and Campbell, 1984). Since that time, only 16 additional individuals have been observed, photographed or collected (Lacey *et al*., 1996). Fewer than five individuals have been reported since May 1995 (M. Sarell, pers. comm.). There are no studies specifically on Night Snakes in British Columbia, but Lacey *et al*. (1996) summarized data available on the specimens from British Columbia. These data include information contained in a magazine article by Valadka (1992) and an unpublished report from Bufo Incorporated (1993) on the status of the Night Snake in British Columbia.

DISTRIBUTION

Hypsiglena torquata is found in southern British Columbia, 11 of the western states of the USA, throughout Baja California and mainland Mexico, and at least along the Pacific slope of Central America to Costa Rica (Wright and Wright, 1957; Peters, 1970; Tanner, 1981; Gregory and Campbell, 1984; Stebbins, 1985; Dixon and Dean, 1986; Fig. 1). A report of the distribution of the Night Snake extending south to Ecuador in South America is apparently erroneous, based on a single questionable specimen (Peters, 1956). The general distribution of the species within the USA covers central and western Washington and Oregon, southwestern Idaho, central and southern California, Nevada, Utah (except central area), southwestern Colorado, Arizona, New Mexico, western Oklahoma, most of Texas and islands off southern California

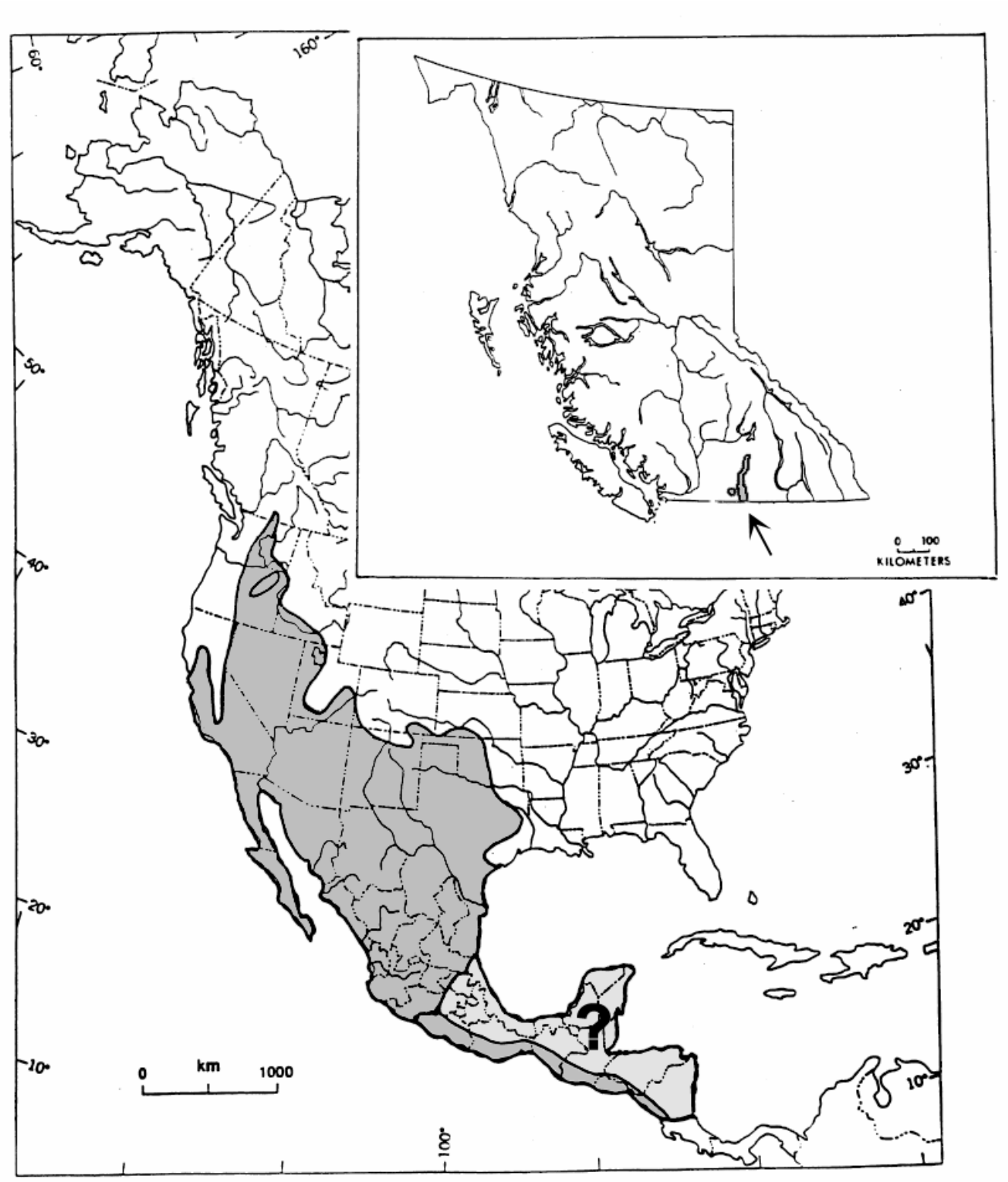

Figure 1. Distribution of *Hypsiglena torquata* in North and Central America. The insert shows its distribution in Canada.

(e.g. Santa Catalina) and in the Gulf of Mexico (e.g. Tiburon Island) (Wright and Wright, 1957; Tanner, 1981; Stebbins, 1985). Range extensions continue to be recorded; e.g. *H. t. deserticola* in Oregon (Cooper, 1996), *H. t. jani* in Texas (Lannutti *et al*., 1996), and *H. t. loreala* in Colorado (Rybak *et al*., 1996). Eight of the subspecies and *H. tanzeri* are found in Mexico, including Baja California (Dixon and Dean, 1986), and at least one, the nominate subspecies, extends south to Costa Rica (Peters, 1970). In Canada, *Hypsiglena torquata deserticola* is known from about 20 specimens from the south Okanagan Valley, and one from the Similkameen Valley, both in British Columbia (Lacey *et al*., 1996; Fig. 1). This known range is small, from Penticton south almost to Osoyoos in the Okanagan Valley, and west to near Keromeos in the Similkameen Valley (Lacey *et al*., 1996). The same subspecies is found south through central Washington and Oregon to northern Baja California, excluding western California, and in southwestern Idaho, Nevada, western Utah and northwestern Arizona (Wright and Wright, 1957; Dixon and Dean, 1986). There is only about 110 km between the most northerly record of the Desert Night Snake in Washington and the most southerly location in southern British Columbia (Lacey *et al*., 1996). The similarity of habitat between these sites suggests that the distribution of the Desert Night Snake may be continuous between British Columbia and Washington. Storm and Leonard (1995) note that the Night Snake is probably more common than the records indicate for Washington and Oregon and show its the distribution in Washington extending north to the Canada / U.S.A. border.

HABITAT

Habitat Requirements

Night Snakes are found in hot, dry areas that are associated with talus slopes or rock outcrops — for example, lava beds — as well as shrubs and grasses (Gates, 1937; Svihla and Knox, 1940; Dundee, 1950; Dunlap, 1959; Diller and Wallace, 1981; 1986; Lacey *et al*., 1996). Night Snakes have been collected under driftwood in riparian areas (Llewellyn, 1998), in dry creek beds (Storm, 1953) and in sand (Wright and Wright, 1957). In western Mexico, *Hypsiglena torquata* are abundant in tropical semiarid forests and moderately abundant in tropical thorn woodlands and dry forests (Hardy and McDiarmid, 1969). In a non-rocky habitat, two *H. t. deserticola* were found in rodent burrows (Diller and Wallace, 1986).

In British Columbia, night snake habitat is described as shrub-steppe, with near desert conditions in some areas. Within this general habitat type, seven of 14 individuals were found under rocks, on talus slopes, or in the open, four in funnel traps and five dead on or near roads (Lacey *et al*., 1996). Unfortunately, the limited number of specimens and life-history information obviates a detailed description of the range of habitats required by this species in Canada.

Shewchuk (1996) found a nesting site for Racers (*Coluber constrictor*) and Gopher Snakes (*Pituophis catenifer)* in sandy habitat near where Night Snakes are known to

occur. Presumably similar habitat is required for the oviparous Night Snake. The importance of lizards and snakes in the diet of *Hypsiglena* (see Food Habits) and the apparent co-occurrence of the Night Snake with the more common Pacific Rattlesnake (*Crotalus viridus*), Gopher Snake (*Pituophis catenifer,* Racer *(Coluber constrictor)* and Western Skink (*Eumeces skiltonianus*) (Bufo Inc., 1993; Lacey *et al*., 1996; Shewchuk, 1996) suggest that areas important for better studied species are also probably important for *Hypsiglena*. If this is the case, *Hypsiglena torquata* may be found farther north and west of the present known distribution, where these other species also are found (Gregory and Campbell, 1984) and where apparently suitable habitat occurs.

Habitat Trends

All but one of the *H. t. deserticola* found in British Columbia are from the south Okanagan Valley. This area is also desirable to people, and the human population is growing rapidly. In addition, the use of the land for agricultural activities, particularly orchards and vineyards, contributes to the loss of habitat of *H. t. deserticola.*

Habitat Protection

Two of the individuals found in British Columbia were in an Ecological Reserve (Lacey *et al*., 1996). Unfortunately, the specific habitats used by the Desert Night Snake in this protected area are not known, nor is the extent of their use by that species. Perhaps an indirect approach to habitat protection is most advantageous at this time when little information is available. Continued education of residents, particularly those who have acreage with talus slopes, rock outcrops and sandy terraces would help maintain habitat potentially suitable for the Night Snake.

BIOLOGY

Reproduction

Night Snakes are oviparous, or egg-laying, snakes. Table 1 summarizes the reproductive life-history data available for female *H. torquata*. The data are listed from north to south. Although there are no data from Canada, the subspecies from Canada is represented (Idaho data) and it is possible to make some general observations on the reproductive biology of *Hypsiglena torquata*.

All of the female *H. torquata* in Table 1 had mated, presumably in spring, as indicated by the presence of yolked ova. Clark and Lieb (1973) suggested that ovarian eggs are several weeks from oviposition and oviductal eggs are several days from oviposition. If this were the case, all of the snakes in Table 1 would have laid eggs within the period of known oviposition (April 25 to September 1, Table 1). Diller and Wallace (1986) suggested that ovulation and oviposition for *H. t. deserticola* occurred in June. This timing estimate was based on the size and position of eggs in five females, and a female that was gravid when caught on June 10, but not when recaptured on

July 6. These dates indicate oviposition occurred slightly earlier than the dates given by Shewchuk (1996) for oviposition by Gopher Snakes (late June to early July) in the southern Okanagan Valley of British Columbia. Vitt (1975) suggested that the late oviposition — September 1 — by one of the females from Arizona, (Table 1) could have represented a second clutch. The variable dates for oviposition may be due to the number of clutches per year (Vitt, 1975), environmental conditions (Clark and Lieb, 1973) and food availability. Furthermore, in more northern areas, the date of oviposition might be influenced by the period of time that the eggs are retained (Mathies and Andrews, 1996).

Table 1. Summary of the reproductive life-history data for *Hyspiglena torquata*.

Location	Females	Eggs			Hatchlings			Author
	SVL mm (No.)	No. & State of Dev't	Date	Size l (mm) d (mm) m (g)	No./ Eggs	Date & Incubation Temp.	Size	
Idaho	385-523 (5)	3-7 yolked ova	May 14 to July 10	l=8.4-20 d=2.9-6.2				1
Utah	367**	4** oviductal	May 18					2
Kansas	?	4 probably ovarian	June 12					3
Arizona	?	4 probably ovarian	July 22	l=9.8 (µ)				4
Arizona	1 snake***	3 ovarian	June 22					2
Arizona	340	3oviposited	July 15	l=30.9-31.5 d=10.0-10.2 m=2.22-2.41	2/3	Sept 12 24-33˚C	svl=134-160 m=0.78-2.30	2
Arizona	391	3 oviposited	Sept. 1	l=45.3 (µ) d=12.0 (µ) m=4.3 (µ)				5
Arizona	?	? yolked follicles	June 9-14					5
Oklahoma	338	6 oviposited	July 7	l= 22-28 d=10.0-11.5 m=1.6-1.9	0			6
Texas	3 snakes***	3 ovarian	April 10 & May 2	l=12.7-19.9				2
Texas	361**	4**oviductal	May 28					2
Texas	425	oviposited	April 25		2/4	June 18 21-32˚C	svl=146 & 153	7
Mexico	? TL=568	8****oviposited	Aug. 28	l=24.0-28.5	3/8	Oct. 25/27 20-24˚C	svl=141-159	8

* had ovarian eggs (l = 12 – 24 mm) and two had yolked follicles (l = 8.2 – 8.9 mm)
** estimated values
*** females 307, 328, 337 & 347 mm
**** female laid one additional egg one week later. It was eaten by a male *H. t.*

Diller and Wallace, 1986
Clark and Leib, 1973
Hibbard, 1937
Gates, 1957
5. Vitt, 1975
6. Dundee, 1950
7. Wegler, 1951
8. Tanner and Ottley, 1981

Some inferences about hatching times and success can be extracted from data summarized in Table 1. From a total of 24 eggs laid by Night Snakes, 19 were incubated. Seven of the 19 eggs produced hatchlings (134 to 160 mm, SVL) after 54 - 60 days at 20 to 33°C. These were snakes from Arizona, Texas and Sonora in western Mexico, and hatching occurred as late as October 27. Presumably, hatching would occur in British Columbia before late October when daily minimum temperatures approach freezing. Near the location where a Night Snake was found in British Columbia, Shewchuk (1996) collected hatchling Gopher Snakes and Racers from a nest site in mid-September.

The SVL of mature female Night Snakes ranges from 338 to 523 mm (Table 1). Diller and Wallace (1986) gave SVL of five mature females as 423 to 523 mm (mean ± SE, 494 ± 19) but noted that one female — deemed mature because of the presence of 3 eggs — was only 385 mm SVL. Comparing the sizes of mature females given by Diller and Wallace (1986) to the specimens from British Columbia, Lacey *et al*. (1996) concluded that all but one of the females collected in British Columbia were mature. Six of the 22 females collected by Diller and Wallace (1986) were sexually mature. Variation in size does occur, however, as Diller and Wallace (1986) reported two females considered immature at 405 mm and 415 mm SVL. It is possible that these snakes had reproduced in previous years and actually were mature.

Diller and Wallace (1986) sampled 41 mature males. The mean SVL and body mass (± SE) were 331 ± 5 mm and 12.1 ± 0.5 g, respectively. These were both significantly less than the SVL and body mass for females. Tanner (1944) listed the total length of only the largest specimens, but of the 206 males and 185 females from the species *Hypsiglena ochrorhynchus* (now included in *Hypsiglena torquata)*, the largest female was 642 mm and the largest male 479 mm, suggesting a male-female size dimorphism. All except two of the 55 males captured by Diller and Wallace (1986) were mature. Maturity was based on the presence of spermatozoa in the ductus deferens (Diller and Wallace, 1986). Five of the snakes collected in British Columbia were recognized as males, and based on the SVL for mature males found by Diller and Wallace (1986), all of these were mature.

Figure 2 shows the mass-length relationships for males and females from British Columbia (Lacey *et al*., 1996), Idaho (Diller and Wallace, 1986; J. Beck, pers. comm. to P. Gregory), Baja California (P. Gregory, unpubl. data) and Oklahoma (Dundee, 1950). The female from Oklahoma had oviposited and one female from Idaho was gravid. Although the female snakes are larger, there is no apparent difference in the morphometric relationship of length-mass between males and females.

Diller and Wallace (1986) noted that female Night Snakes mature at a smaller size in southern areas. The size of mature females given in Table 1 supports this observation, as all except one of the mature females from south of Idaho were smaller than the mean size of females from Idaho. The extension of this observation is that there is a decrease in size of Night Snakes from north to south. Figure 3 is a plot of the length-mass relationships for the same snakes as given in Figure 2. It supports the suggestion that mature Night Snakes are larger in more northern areas (British Columbia and Idaho).

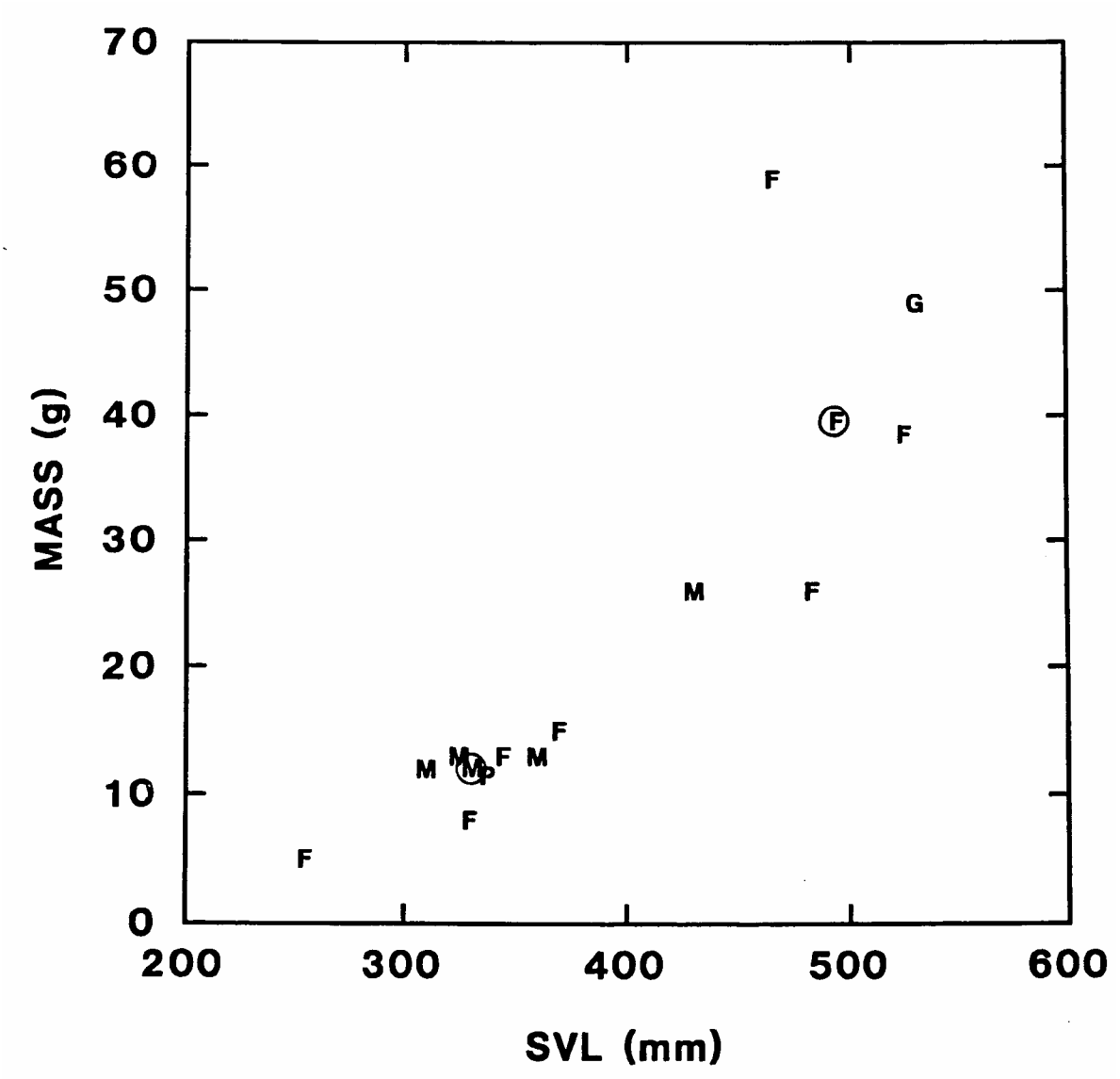

Figure 2. Mass vs. SVL for male and female *Hypsiglena torquata*. M = male, F = female, G = gravid and P = post oviposition. Circled points are mean values from Diller and Wallace (1986). Data from Lucey *et al*. (1996); Gregory (unpubl. data); Beck (pers. com) and Diller and Wallace (1986).

The sexes of 13 of 17 specimens from British Columbia were determined and one juvenile was tentatively recorded as a female. If the juvenile is included as a female, the small collection consisted of eight females and five males. Diller and Wallace (1986) found samples highly biased towards males in both drift fences (34/51 males) and from hand captures (20/23 males), but noted that this may be due either to behaviour and activity or to the sex ratio. Most of the snakes that were collected by hand under rocks (21/23 males) were obtained in one day, April 23, and most of the snakes in the drift fences were found in May and June. The sample is therefore primarily a spring sample. In spring-breeding colubrids, males are frequently more abundant or, at least more easily found and caught in spring than females (P. Gregory, pers. comm.).

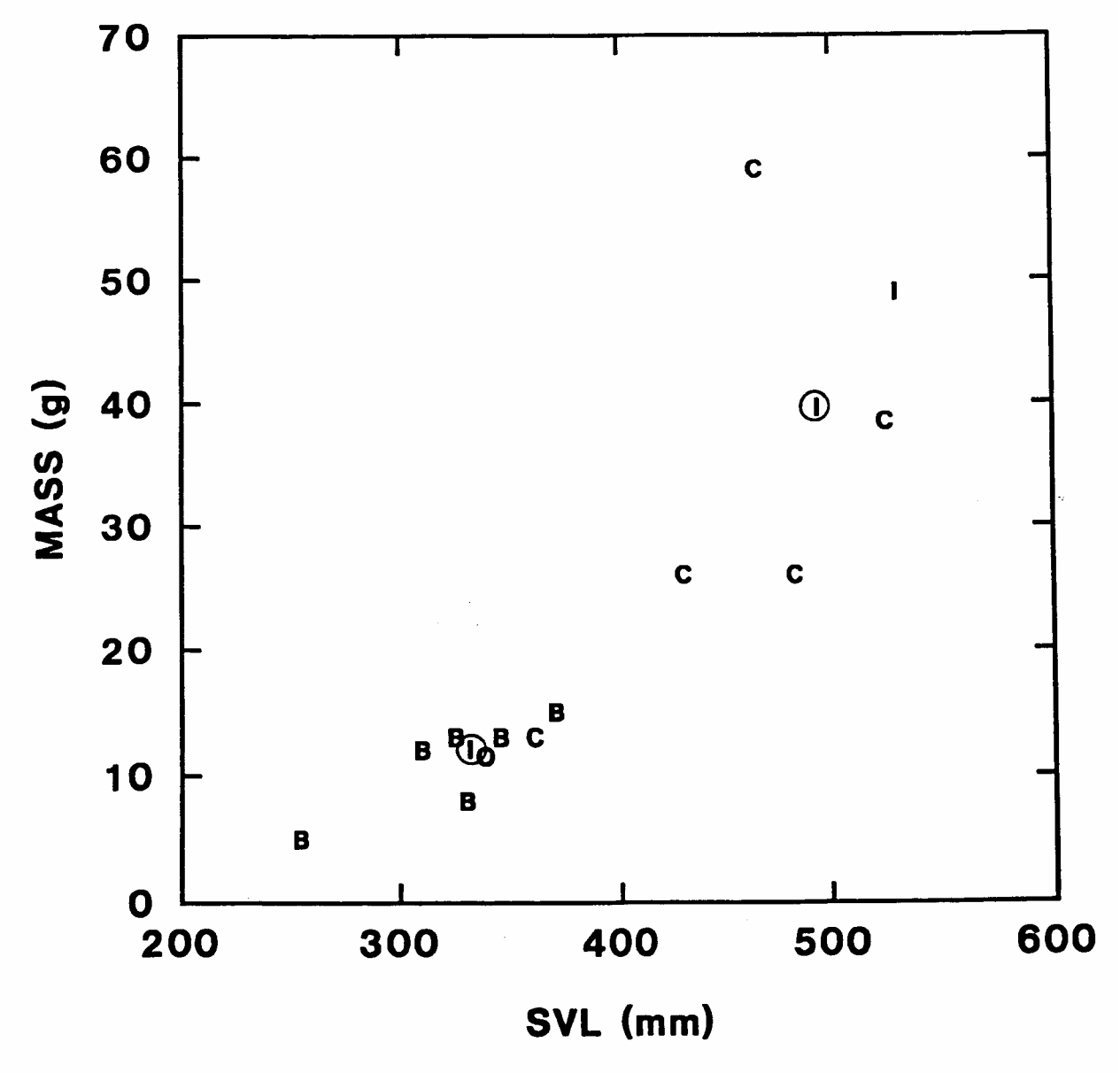

Figure 3. Mass vs. SVL for *Hypsiglena* from Canada (C), Idaho (I), Baja California (B) and Oklahoma (O). Circled points are mean values from Diller and Wallace (1986). The data are the same as those in Figure 2.

No breeding aggregations have been reported for *Hypsiglena*. However, out of 21 snakes Diller and Wallace (1986) found under rocks, 16 were in pairs, seven pairs of males and one of females. Many of the snakes were entwined, however, the pairs were of the same sex and thus it is unlikely that this behaviour was related to breeding (Diller and Wallace, 1986). It is not uncommon to find more than one individual under a single rock throughout the active period (P. Gregory, pers. comm.).

Physiology

As with most aspects of the biology of Night Snakes, there is little information available on the species' physiology. Cunningham (1966) gives the cloacal temperature of a Night Snake found under a boulder in southern California as 5.4°C. The snake showed only "slow lateral body undulations" and it is unlikely that Night Snakes would be active at this temperature. Winter temperatures where the Night Snake is found in Canada are frequently less than 5°C. At Osoyoos, near the collection site for three *Hypsiglena*, the daily maximum temperature is less than 5°C from December to mid-February (Environment Canada, 1993). Over the 21-year period that Night Snakes were recorded from British Columbia, snakes were found from late May to early September. Long-term weather records show daily minimum temperatures greater than 5°C and daily maximum 5°C temperatures greater than 15°C between May and September. Temperature is a critical determinant of snake activity; a possible evolutionary consequence of this in feeding behaviour of Night Snakes is given in the section on Food Habits.

Food Habits

The only prey item reported for Night Snakes in British Columbia is a neonate Western Rattlesnake (Lacey *et al*., 1996). Three of the specimens from British Columbia that were kept in captivity ate Long-toed Salamanders (*Ambystoma macrodactylum*), Western Toads (*Bufo boreas),* Pacific Tree Frogs (*Hyla regilla),* Wall Lizards (*Podarcis muralis*) and Northwestern Garter Snakes (*Thamnophis ordinoides*), as well as pieces of dead frog (Lacey *et al*., 1996). Rodríguez-Robles *et al*. (1999) recorded 92 different prey items eaten by 89 *Hypsiglena torquata* (not in captivity). Of these 92 items, 48 (52.2%) were lizards, 21 (22.8%) were squamate eggs, 11 (12.0%) were frogs, six (6.5%) were snakes and three (3.3%) were insects. In addition, they found one amphisbaenian and two unidentified animals. They found no apparent geographic variation in diet but did observe some indication of differences in diet with snake size. All sizes of Night Snakes ate lizards and squamate eggs, but few large snakes ate insects, and large snakes also ate frogs and snakes and an amphisbaenian. The Western Skink (*Eumeces skiltonianus*) is found in the southern interior of British Columbia (Gregory and Campbell, 1984) and a Western Skink was recorded at one of the Night Snake locations (Bufo Inc., 1973). Given the importance of lizards in the diet of Night Snakes, the Western Skink is a potential prey for the Night Snake in British Columbia (Lacey *et al*., 1996).

The Night Snake is typically described as nocturnal or crepuscular (Nussbaum *et al*., 1983; Gregory and Campbell, 1984; Stebbins, 1985). The snakes have vertical pupils and lack cones in the retina, characteristics typical of nocturnal snakes (Repérant *et al*., 1992). Furthermore, Peterson (1992) used *Hypsiglena* as an example of snakes in which the outer segment of the retina is especially massive, typical of nocturnal snakes that depend on vision for foraging. The eye of *Hypsiglena torquata* is turned partially upward. Because Night Snakes are known to burrow (e.g. *H. t. texana*, Dundee, 1950 now *H. t. jani*), they may partially bury themselves with just the eye and the top of the head exposed, and ambush unsuspecting prey.

Night Snakes do not locate food strictly by vision. They apparently use chemosensory cues while foraging to obtain squamate eggs (Diller and Wallace, 1986), an important component of their diet (Rodríguez-Robles *et al*., 1999). Perhaps supporting the use of chemosensory clues is the recorded ingestion of a rock by a Night Snake and the subsequent suggestion by Goodman (1958) that the rock was acceptable because it had been in contact with recognizable food items.

Night Snakes are not strictly nocturnal or crepuscular. Rodríguez-Robles *et al*. (1999) found that 27/35 (77.1%) of the lizard species eaten by *H. torquata* were diurnally active. In addition, one of the authors observed a small *H. torquata* ingesting a lizard in the early afternoon (Rodríguez-Robles *et al*., 1999). Diller and Wallace (1986) also reported that *H. torquata* remains were found in the nest of a Red-tailed Hawk (*Buteo jamaicensis*), a diurnal hunter. Rodríguez-Robles *et al*. (1999) suggested that some of the diurnal lizards may have been located under rocks at night by foraging Night Snakes, but they also hypothesize that diurnal feeding by ambush is a derived feeding trait important in more northern areas where the nights can be cold even in summer. In British Columbia, low night temperatures would be particularly important limiting factors in spring and fall.

Hypsiglena torquata are rear-fanged snakes with a Duvernoy's (parotid) gland (Hill and Mackessy, 1997). The venom is released during ingestion (McKinstry, 1978) from enlarged posterior maxillary teeth that have a slight, although not always obvious, groove-like depression (Cowles, 1941). Several authors have observed envenomation of prey by Night Snakes (Cowles, 1941; Goodman, 1953; Jameson and Jameson, 1956), but feeding without apparent use of venom has been observed as well (Lacey *et al*, 1996). McKinstry (1978) summarized the main responses to venom observed in the prey as altered respiration, paralysis, discolouration and edema. To explain these responses Goodman (1953) suggested that the venom contains a neurotoxin and hemorrhagic agent. The venom of Night Snakes is not known to be dangerous to humans.

Growth and Survivorship

Hypsiglena torquata are relatively small snakes. The smallest recorded sexually mature female is 307 mm SVL (Clark and Lieb, 1973). The largest gravid female is 530 mm SVL (J. Beck, pers. comm. to P. Gregory). Yancey (1997) also recorded an adult (sex unknown) with SVL 530 mm (615 total length, TL) and Tanner (1944) listed the largest Night Snake as a female 642 mm TL. The size of mature Night Snakes varies geographically (Fig. 3), with larger snakes found in more northern areas. There is some suggestion that females are longer than males but there are no apparent differences in mass-length relationships between the sexes (Fig. 2).

The time to maturity is not known. Also, no long-term mark-recapture studies have been conducted and there are no data on growth rates. Two individuals collected from the south Okanagan were kept in captivity over fairly long periods (Lacey *et al*., 1996). An adult female collected in September 1992 survived in captivity over 3 1/2 years until

the spring of 1995. An adult male collected in August 1993 also lived over 3 1/2 years, until the spring of 1996. If Night Snakes reach sexual maturity in the fall of their first full summer, these captive snakes would have been at least 4 to 5 years old when they died.

Hibernation

There is no information on over-wintering locations for Night Snakes. Klauber (1956) lists *H. t. deserticola* as one of the snake species occasionally found denning with rattlesnakes. Shewchuk (1996) identified three dens used by the Gopher Snake (*Pituophis catenifer*) within the Ecological Reserve where one of the British Columbia Night Snakes was found. At one of these dens, Shewchuk (1996) found all of the local snake species, except *Hypsiglena torquata* and *Thamnophis elegans*. Numerous other dens used by *Crotalus viridis* are known from farther north in the Okanagan Valley but no Night Snakes have been observed at these dens (Macartney, 1985).

Behaviour

Greene (1988), in a review of antipredator behaviours of reptiles, identified several seen in *Hypsiglena*: inoffensive, hiss, cloacal discharge, hide head, tail display, body thrash, coil body and s-coil (striking posture). Price (1987) suggested that coiling was interesting because it was infrequent (11 coiling responses from 136 Night Snakes) but persistent over time (five years) within the natural population.

Dundee (1950) kept several *Hypsiglena torquata texana* (now *H. t. jani*) in captivity and noted that the snakes made burrows in the sand and used the burrows more frequently than the cover objects provided. This burrowing behaviour may have three consequences. First, as noted above, the eye of *Hypsiglena torquata* is turned partially upward and Night Snakes might therefore partially bury themselves and ambush unsuspecting prey. Second, snakes buried in sand would be well hidden from roaming herpetologists and other predators. Finally, *Hypsiglena* possibly uses burrowing or remodeling of existing burrows in preparing egg-laying sites.

Recorded predators of Night Snakes are red-tailed hawks (Diller and Wallace, 1986) and scorpions (Hibbitts, 1992). Reports of predators of night snakes in captivity include a Ridge-Nosed Rattlesnake (*Crotalus willardi,* Klauber, 1956, p. 609). Conversely, both rattlesnakes (Western Rattlesnake, *Crotalus viridis,* Lacey *et al*., 1996) and scorpions (Cowles, 1941) are also prey for *Hypsiglena*.

Movement and Migration

No data are available on movements, but some inferences can be made about activity times.

The collection times for *H. t. deserticola* in British Columbia represent the only indication of activity periods. Of the 16 snakes recorded, seven were found in

May/June, three in July and six in August/September. This is consistent with the common spring/fall activity pattern of snakes (Gibbons and Semlitsch, 1987). Dundee (1950) emphasized the importance of looking for *H. t. texana* (now *H. t. jani*) in the proper season (June, several days after rain), in large part because of soil moisture. Webb (1970) also noted that *H. t. texana* (now *H. t. jani*) are more readily found after rain.

In Idaho, Diller and Wallace (1986) used drift fence captures as a measure of seasonal activity and found most *H. t. deserticola* in May/June but fewest in September. In addition, Night Snakes had a shorter seasonal activity period than the other snakes species present, which Diller and Wallace (1986) attributed to the cool nights in spring and fall. Presumably, the other snake species present were diurnal. Searching under rocks, (Diller and Wallace, 1986) collected 21 *H. t. deserticola* in one day in April and none in the same time and location in July. The July results probably reflect the high temperature under the rocks that could be turned (Huey *et al*., 1989), but the number of specimens might also have been influenced by the removal of previous specimens that were located.

POPULATION SIZES AND TRENDS

There are no data on the size of Night Snake populations in British Columbia. In fact, there have been no population estimates of Night Snakes anywhere. Data are available for numbers captured during surveys, both specifically for Night Snakes and indirectly as observations during other studies. In the Birds of Prey Natural Area (BPNA) along the Snake River in Idaho, Diller and Wallace (1986) collected 33 *H. t. deserticola* in drift fences from May through September 1978 and a total of 51 in drift fences from 1977 to 1979. An additional five specimens were obtained from road kills and hand captures. Of the snakes collected using drift fences, *Hypsiglena torquata deserticola* was the third most abundant, with *Pituophis catenifer* (Gopher Snake) and *Masticophis taeniatus* (Striped Whipsnake) being more abundant. In an earlier paper, Diller and Wallace (1981) noted that 60 *H. t. deserticola* were collected in the same area (BPNA) between 1975 and 1979. Presumably these include the 56 (51 + 5) snakes referred to by Diller and Wallace (1986). Diller and Wallace (1981) do, however, note that *H. t. deserticola* was the most abundant of the “secretive, fossorial or nocturnal” snakes and emphasize the importance of using proper sampling methods to obtain realistic estimates of the numbers of these secretive snakes. Season is also important, as demonstrated by Diller and Wallace (1986), who found 21 Night Snakes in one day in April 1983. In Oregon, Dunlap (1959) collected 8 *Hypsiglena torquata* from near a bridge in a volcanic area between May 1949 and September 1955. Farther south, Price (1987) found 136 *H. t. jani* in pit traps over a six-year period, while conducting a study on lizard ecology.

Given that less than two dozen night snakes have been reported in British Columbia since 1980, despite many searches, it is reasonable to infer low population numbers, but these low numbers may be biased by the cryptic behaviour of this species

and the fact that no rigorous work has been conducted on Night Snakes in British Columbia. On the other hand, British Columbia represents the northern limit of the range of these snakes and *Hypsiglena torquata* may truly be less abundant as a result.

As there have been numerous active naturalists in the Okanagan Valley for many years, the absence of observations of Night Snakes until 1980 is puzzling (Lacey *et al*., 1996). Whether the sudden appearance of Night Snakes in British Columbia reflects a northern extension of the range is not known, but it seems unlikely. Perhaps the sampling methods that have been emphasized are biased against finding the Night Snake.

VULNERABILITY AND LIMITING FACTORS

There is very little known about the biology of the Night Snake in Canada or in general. Therefore, its vulnerability based on life-history characteristics is unknown. However, its vulnerability with respect to potential habitat loss in Canada is significant.

Habitat Loss

The Okanagan-Similkameen area has one of the fastest growing human populations in British Columbia; from 1991-1996 the growth rate was 13.5% (Cannings *et al.*, 1999). Less than 9% of the Okanagan valley remains in a relatively undisturbed state (Redpath, 1990). Night Snake habitats (grasslands and shrublands) have experienced a 60% loss in the southern portions of the valley (MELP, 1999). According to Scudder (1996) there is less than 10% of the Antelope-brush habitat used by Night Snakes remaining. Recent work by Ted Lea (pers. comm. and n.d.) indicates that this remaining portion is quickly disappearing. Direct removal of habitat has been identified as a major threat to the night snake and many other species (MELP, 1999). Moreover, most of the land remaining in natural condition in the south Okanagan is in private hands (Cannings *et al.*, 1999), and is therefore subject to little government control. For more detailed information on habitat loss in the Okanagan see Dawe *et al.* (2001), Cannings *et al.* (1989), Cannings *et al.* (1999).

Talus materials found at the base of cliffs are thought to be an important component of the habitat of Night Snakes. Recently, removal of talus materials for use as rip-rap materials, fill and landscaping stone in the Okanagan has increased (Orville Dyer, pers. comm.), and provides an additional threat to this species (MELP, 1999).

Habitat Fragmentation

Suitable Night Snake habitat is highly fragmented. Hibernacula are presumed to be naturally patchy and scattered, however the loss of much of the natural landscape to urbanization, vineyards and orchards has reduced the opportunities for dispersal of Night Snakes. This includes dispersal from overwintering sites to feeding and breeding areas as well as movement of snakes between suitable habitat patches.

Road Development

Snakes are particularly susceptible to being killed on roads (Rosen and Lowe, 1994). With increased human population growth within the range of the Night Snake in Canada, road development is expected to intensify. In addition, the volume of traffic has increased over the last few years, and is expected to continue to increase along with population growth. As gravel and dirt roads are paved, traffic volume and speed will increase. In addition, snakes are more likely to use paved roads for basking because the asphalt retains heat. Therefore, road killing of snakes will continue to be a significant and increasing mortality factor in the south Okanagan. Road use statistics are available for a number of highways within the Canadian range of the Night Snake (Ministry of Highways, 1999). Summer time use of paved roads ranged from 2872 vehicles per summer day just north of the Canadian border at Osoyoos to 20,017 vehicles per summer day on the highway near Penticton. Within the range of the Night Snake the Ministry of Highways monitors 16 road locations in the southern Okanagan; the average growth rate in the number of vehicles/day is 1.1% per year (Ministry of Highways, 1999).

SPECIAL SIGNIFICANCE OF THE SPECIES

The Night Snake is small and may be confused with the Western Terrestrial Garter Snake (*Thamnophis elegans*), Gopher Snake (*Pituophis catenifer*), Racer (*Coluber constrictor*) and the Western Rattlesnake (*Crotalus viridis*), which are all blotched, at least when young (Lacey *et al*., 1996). Although snakes in general may be persecuted, rattlesnakes are particularly disliked and the rattle is sometimes actively sought. Night Snakes, which can be easily confused with young rattlesnakes, may be killed for that reason.

The Night Snake in Canada is at the northern limit of its range and might be adapted to the cooler climate. It is not known whether Canadian specimens are genetically distinct from specimens elsewhere in the subspecies' range, but this northern population may have unique genetic and adapted traits because of its relative isolation from the populations of Night Snakes.

EXISTING PROTECTION

Sites at which the Night Snake has been found in British Columbia include one Ecological Reserve, which affords the species some protection. Because the species' distribution in Canada is not well established, the percentage of its range covered by protected areas is not known.

EVALUATION AND PROPOSED STATUS

The Night Snake (*Hypsiglena torquata*) has a very wide range, occurring from southern British Columbia, south through 11 states of the USA, Mexico and Central America to Costa Rica. Although the species is highly variable and divided into several subpecies (Wright and Wright, 1957; Dixon and Dean, 1986), even the northern subspecies, *Hypsiglena torquata deserticola*, which occurs in British Columbia, has a large range extending south to California and Baja California. However, the known range of this subspecies is fragmentary in northern Washington and southern British Columbia (Lacey *et al*., 1996).

In British Columbia, the Night Snake is Red-listed. "Red-listed species are either legally designated as endangered or threatened or are candidates." (Wildlife Bulletin No. B-74, Ministry of Environment, Lands and Parks, 1995). I concur with this designation and recommend that the Night Snake receive COSEWIC status of "Endangered". The reasons for this recommendation are as follows:

1. Fewer than 20 Night Snakes have been recorded in British Columbia and the species occurs nowhere else in Canada. The small number of specimens may be due to the species' small size and cryptic behaviour or to its rarity, but we do not at present have the means to discriminate between these two possibilities and it is best to err on the side of caution. It is noteworthy that in nearby Idaho, Diller and Wallace (1986) captured this snake readily and characterized it as the third most abundant snake species and the most abundant of the "secretive, fossorial, or nocturnal" snakes. Furthermore, although it is important to search for this species at the right time using the right methods, the number of observations of Night Snakes in the Okanagan is very small given the number of active naturalists there. Thus given current evidence, the species seems to be rare in British Columbia.

2. The known distribution of the Night Snake in British Columbia is very restricted. Again, caution dictates that this species should be given a high level of protection based on this criterion alone.

3. The natural habitat within the known distribution of the Night Snake in British Columbia is under considerable pressure from increasing human population and consequent agricultural, housing, and business developments. Thus, habitat loss is a serious threat to the Night Snake, especially given our extremely limited knowledge of its habitat requirements. Increasing human population also is a threat simply due to the disturbance from recreational and other activities and from deliberate and accidental killing by people, their vehicles and their pets.

4. Three other xeric-habitat species of snakes in the south Okanagan are Blue-listed, partly on the basis of the potential threat from habitat loss. "Blue-listed species are considered to be vulnerable or sensitive." (Wildlife Bulletin No. B-74, Ministry of Environment, Lands and Parks, 1995). All three species are

apparently much more abundant and widespread in British Columbia than the Night Snake; none are confined to the Okanagan, nor to such a small part of it. Therefore, the Night Snake merits a higher-risk designation than these other three species.

5. There is little potential of a rescue effect from populations in Northern Washington because much of the extensive suitable dry shrub-steppe habitat in that state has been converted to irrigation and is under cultivation for wheat and other grain crops (D. Frazer, pers.comm.)

Given the above points, I recommend that the Night Snake in Canada be listed as Endangered.

TECHNICAL SUMMARY

Hypsiglena torquata
Night Snake — Couleuvre: nocturne
British Columbia

Extent and Area information	
• *extent of occurrence (EO)(km²)*	Not yet calculated
• *specify trend (decline, stable, increasing, unknown)*	Unknown
• *are there extreme fluctuations in EO (>1 order of magnitude)?*	No
• *area of occupancy (AO) (km²)*	Not yet calculated; very small
• *specify trend (decline, stable, increasing, unknown)*	Unknown
• *are there extreme fluctuations in AO (>1 order magnitude)?*	No
• *number of extant locations*	2
• *specify trend in # locations (decline, stable, increasing, unknown)*	Unknown
• *are there extreme fluctuations in # locations (>1 order of magnitude)?*	No
• *habitat trend: specify declining, stable, increasing or unknown trend in area, extent or quality of habitat*	Declining
Population information	
• *generation time (average age of parents in the population) (indicate years, months, days, etc.)*	Unknown, about 5 years
• *number of mature individuals (capable of reproduction) in the Canadian population (or, specify a range of plausible values)*	Estimate <200
• *total population trend: specify declining, stable, increasing or unknown trend in number of mature individuals*	Unknown
• *if decline, % decline over the last/next 10 years or 3 generations, whichever is greater (or specify if for shorter time period)*	-
• *are there extreme fluctuations in number of mature individuals (>1 order of magnitude)?*	No
• *is the total population severely fragmented (most individuals found within small and relatively isolated (geographically or otherwise) populations between which there is little exchange, i.e., ≤1 successful migrant / year)?*	Yes
• *list each population and the number of mature individuals in each*	South Okanagan <100 Similkameen <100
• *specify trend in number of populations (decline, stable, increasing, unknown)*	Unknown
• *are there extreme fluctuations in number of populations (>1 order of magnitude)?*	No
Threats (actual or imminent threats to populations or habitats) [add rows as needed]	
-urban/agricultural developments -loss and fragmentation of habitat -pollution (pesticides) -mortality on roads -isolation of populations	
Rescue Effect (immigration from an outside source)	
• *does species exist elsewhere (in Canada or outside)?*	Yes
• *status of the outside population(s)?*	Stable?
• *is immigration known or possible?*	No
• *would immigrants be adapted to survive here?*	Yes
• *is there sufficient habitat for immigrants here?*	No
Quantitative Analysis	**No**

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