

## Evolution of *Naso thynnoides* and the Status of *N. minor* (Acanthuridae; Actinopterygii)

Richard Winterbottom

Department of Ichthyology & Herpetology, Royal Ontario Museum,  
100 Queen's Park, Toronto, Ontario, Canada M5S 2C6

**Abstract** *Naso minor* was described from a single specimen (Smith, 1966). Only one other specimen has since been reported (Randall, 1986). The species apparently differed from *N. thynnoides* in the ratio of fork length to head length and eye diameter, the shape of the caudal peduncle spine, and in number of dorsal spines. Collections of 24 specimens of four- and five-spined individuals (putatively assigned to both species) from the Philippines revealed that the first three differences are not valid. However, spine number, the length of the nasal groove, the pigmentation of the basal plate of the caudal peduncle spine, and the morphology of the first dorsal-fin pterygiophore confirm the distinctness of the two species.

In 1966, J. L. B. Smith revised the acanthurid fishes currently assigned to the genera *Naso* and *Prionurus*. He recognized several additional genera and subgenera allied to *Naso* that are not usually accepted by other workers, and described *Axinurus minor* from a specimen (186 mm fork length = FL) from Pinda, Mozambique. Smith (1966) compared *A. minor* with *Naso thynnoides* (Valenciennes in Cuvier and Valenciennes, 1835), which latter species he placed as the only other member of *Axinurus*. Smith (1966) expressed some reservations as to the validity of his new species (*A. minor*) because his single specimen was a little smaller than the specimens of *N. thynnoides* he had available for comparison, and the differences in character values seemed rather trivial. Randall (1986: 822) maintained the two species (in *Naso*) using the same key for their separation that Smith (1966) had developed, and stated that the Bishop Museum had a single specimen of *N. minor* from the Philippines. This specimen, when fresh, had a yellow caudal fin and a black peduncular plate. Smith (1966) had used four characters to distinguish the two species (character state for *N. thynnoides* given first, followed by the state in *N. minor* in parentheses): keel of peduncular plate feeble and rounded (vs well developed with an antrorse spine); four dorsal spines (vs five-note: here and throughout I have followed convention in enumerating the dorsal-spine counts for *Naso*, which do not include the much reduced but still present first dorsal spine); head 4.5–4.8 in FL (vs 4.3); and eye 3.2–3.9 in head (vs 2.9). A collection of 24 speci-

mens of *Naso* with yellow caudal fins from the reefs and fish markets in the vicinity of Dumaguete City, Negros Oriental, Philippines in 1987 prompted me to examine the validity of *N. minor*.

Tyler (1970) illustrated two potential autapomorphies of *N. thynnoides*—two epurals (all other *Naso* and other acanthurids he examined had three epurals—cf Tyler, 1978, figs. 2 and 3), and the absence on the anterodorsal margin of the first dorsal-fin pterygiophore of a posteriorly- and laterally-directed expansion, forming a broad round shield similar to that seen in the first anal-fin pterygiophore (cf Tyler, 1978, figs. 10 and 11).

### Results and discussion

The 24 Philippine specimens (108–215 mm FL) were examined for the four characters used by Smith (1966) to distinguish *N. thynnoides* and *N. minor*. Twelve specimens had four dorsal spines, twelve had five. The peduncular spine ranged from a very low flange to a rounded or angular plate, but no specimens exhibited any trace of a retrorse spine. The sample was divided into four-spined and five-spined groups, and the FL to head length and head length to eye diameter ratios were calculated. For the four-spined specimens (putatively *N. thynnoides*), the values were 4.3–4.6 ( $\bar{x}=4.5$ ) and 3.1–3.4 ( $\bar{x}=3.3$ ) respectively; and for the five-spined specimens (putatively *N. minor*) 4.3–4.7 ( $\bar{x}=4.5$ ) and 3.0–3.4 ( $\bar{x}=3.3$ ) respectively. It therefore appeared that only a single species with 4–5 dorsal spines was present.

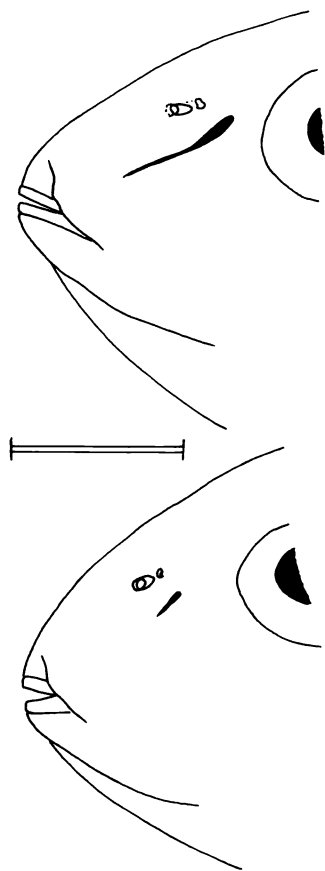


Fig. 1. Left lateral view of the anterior portion of the head of: above—*Naso thynnoides*, ROM 56517, 130 mm FL, and below—*Naso minor*, ROM 56516, 129 mm FL, to show extent of nasal groove. Scale = 1 cm.

However, the five-spined specimens consistently had the basal plate of the peduncular spine much more densely pigmented than the surrounding area, as reported by Randall (1986) for his specimen of *N. minor*, as opposed to evenly distributed pigmentation in the peduncular region in the four-spined specimens. In addition, the nasal groove, a character not used by Smith (1966) or Randall (1986), is differently developed (Fig. 1). The groove is formed by a narrow line lacking scales, lying just ventral to the nasal apparatus at the posterodorsal edge of the underlying lachrymal bone. The groove begins below the posterior nasal opening and continues anteroventrally on the snout. In the five-spined specimens, the groove seldom extends anterior to a vertical with the anterior nasal opening (groove

length in head length 9.6–31.4,  $\bar{x}$  = 18.1), whereas in the four-spined specimens it extends well anterior to this point (groove length in head length 3.5–5.1,  $\bar{x}$  = 4.3). The nasal groove in the five-spined species is shorter at larger sizes (>120 mm FL, 13.4–31.4 in head length,  $\bar{x}$  = 22.7,  $n$  = 6; <120 mm FL, 9.6–16.3 in head length,  $\bar{x}$  = 13.5,  $n$  = 6). Given that the nasal groove is well developed in other species of *Naso* and most other acanthurids, a short groove would appear to be autapomorphic. The sample of four-spined specimens contained both male and female individuals (although none of the gonads was ripe or well developed), but I was unable to sex the five-spined specimens macroscopically. I conclude that *N. minor* is a valid species, and probably occurs syntopically with *N. thynnoides*. On the two occasions when specimens were purchased at a fish market (from a single vendor) both species were present in approximately equal numbers.

*Naso* is defined by six autapomorphies (Tyler et al., 1989; Winterbottom, in press): i) four branchiostegal rays; ii) first spine of dorsal and anal fins reduced; iii) anteroventral margin of first anal-fin pterygiophore expanded laterally and posteriorly to form a broad, round shield; iv) reduction of first uroneural pair; v) hypurals 1–4 fused together and to ural centrum; and vi) adductor mandibulae A1 $\beta$  section reduced to a simple tendon arising from the anterodorsal margin of A2 $\beta$ . Both *N. thynnoides* and *N. minor* exhibit all of these autapomorphies (derived states).

The lack of the posterolaterally directed flange on the first dorsal-fin pterygiophore in *N. thynnoides* is similar to the condition found in acanthurids other than *Naso*, and raises the possibility that all other species of *Naso* form a monophyletic assemblage defined by the presence of such a flange in both dorsal- and anal-fin pterygiophores. In this scenario, *N. thynnoides* forms the sister group of all other *Naso*, including *N. minor*. Dissection of two specimens of *N. minor* revealed that the flange was indeed present. However, further dissection also revealed the presence of only two epurals in *N. minor*, an apomorphic condition shared with *N. thynnoides* indicating that they are sister taxa. Further evidence of the latter relationship is afforded by the adductor mandibulae section A1 $\alpha$ , which, in other *Naso* and all other acanthurids (=primary and secondary outgroups) is broadly inserted on the anterolateral face of the maxilla. In the two species of *Naso* being discussed here, insertion is restricted to the dorsal



Fig. 2. *Naso minor* being cleaned by *Labroides dimidiatus* off Apo Island, southern Negros. Note the black basal plate of the peduncular spine.

one-quarter of the length of the maxilla. In addition, these two species have many more hastate, minutely-denticulated teeth ( $\geq 60$ ) in each jaw than do other *Naso* or other acanthurids, another synapomorphy. I therefore conclude that *N. thynnoides* and *N. minor* are sister taxa; thus the lack of a posterolateral flange on the anterodorsal portion of the first dorsal-fin pterygiophore in *N. thynnoides* is a reversal rather than the historical retention of the primitive character state.

*Naso thynnoides* ranges from Mozambique (Smith, 1966) westward to the Kii Peninsula in Japan (Kishimoto, 1984), whereas *N. minor* has been recorded from Mozambique (Smith, 1966) to the Philippines (Randall, 1986). It is probable that Herre (1927) had specimens of both species under the name *Naso thynnoides*, since he listed four to five dorsal spines for the material he described. Munro (1967) reported this species as being recorded from western New Guinea, and stated in the key that it had three to five dorsal spines, so both species may be present there too. Huge schools of yellow-tailed *Naso* were frequently seen feeding within 3–7 m of the surface off the drop-offs in the vicinity of Sumilon and Apo Islands, and off Tonga Point, Siquijor, Philippines. It is not known whether one, the other or both the species discussed here comprised these schools. However, at least *N. minor* does descend

from the water column to the reef-front to attend cleaning stations hosted by *Labroides dimidiatus* (Fig. 2).

#### Key to the two species of *Naso*

- Four dorsal spines; nasal groove much longer than nasal apparatus; peduncle, including basal plate of peduncular spine, uniformly pigmented; no posterolateral expansion of the anterodorsal head of the first dorsal-fin pterygiophore . . . . . *Naso thynnoides*  
 Five dorsal spines; nasal groove equal to or shorter than nasal apparatus; basal plate of peduncular spine more darkly pigmented than surrounding area; a posterolateral expansion of the anterodorsal head of the first dorsal-fin pterygiophore present . . . . . *Naso minor*

#### Material examined

All specimens from the Philippines, fork length given in parentheses after number of specimens.

*Naso minor*: ROM 56098, 1 (126), Siquijor Island, north tip of Tonga Point, 21–35 m, rotenone. R. Winterbottom et al., 11 May, 1987. ROM 56516, 5 (123–145), Negros Island, Bais fish market (40 km N of Dumaguete). R. Winterbottom, 20 May, 1987. ROM 56519, 6 (108–117),

Negros Island, Malatpay fish market (30 km S of Dumaguete). R. Winterbottom, 5 May, 1987.

*Naso thynnoides*: ROM 56166, 3 (138–142), as for ROM 56516. ROM 56517, 9 (129–215), as for ROM 56519.

### Acknowledgments

I would like to thank the many people who participated in or facilitated the 1987 field trip to the Philippines. Special thanks to Peter Benjamin, of Benjamin Film Laboratories Ltd., who provided free film and processing, and acted as our dive officer. Thanks to my colleague, Dr. E. J. Crossman, for helpful comments and clarifications on the draft manuscript. Financial support from the Royal Ontario Museum's (ROM) Sciences Fieldwork Fund, and from NSERC Operating Grant No. A 7619 to the author, is gratefully acknowledged.

### Literature cited

- Cuvier, G. and A. Valenciennes. 1835. Histoire naturelle des poissons. Paris-Strasbourg.
- Herre, A. W. C. T. 1927. Philippine surgeon fishes and Moorish idols. Philip. J. Sci., 34(4): 403–478.
- Kishimoto, H. 1984. Family Acanthuridae. Pages 228–232 in H. Masuda, K. Amaoka, C. Araga, T. Uyeno and T. Yoshino, eds. The fishes of the Japanese Archipelago. Tokai University Press, Tokyo.
- Munro, I. S. R. 1967. The fishes of New Guinea. Department of Agriculture, Stock and Fisheries, Port Moresby, xxxvii + 651 pp., 1 + 78 plates.
- Randall, J. E. 1986. Family No. 243: Acanthuridae. Pages 811–823 in M. M. Smith and P. C. Heemstra, eds. Smiths' sea fishes. Macmillan South Africa (Publishers) (Pty) Ltd., Johannesburg.
- Smith, J. L. B. 1966. Fishes of the sub-family Nasinae with a synopsis of the Prionurinae. Ichthyol. Bull. Smith Inst., (32): 635–682.
- Tyler, J. C. 1970. Osteological aspects of interrelationships of surgeon fish genera. Proc. Acad. Nat. Sci. Philadelphia, 122(2): 87–124.
- Tyler, J. C., G. D. Johnson, I. Nakamura and B. B. Collette. 1989. Morphology of *Luvarus imperialis* (Luvaridae), with a phylogenetic analysis of the Acanthuroidei (Pisces). Smith. Contrib. Zool., (485): 1–78.
- Winterbottom, R. In press. Myological evidence for the phylogeny of Recent genera of surgeonfishes (Percomorpha, Acanthuridae), with comments on the Acanthuroidei. Copeia.

(Received August 3, 1991; accepted November 29, 1991)

ボウズハギ (*Naso thynnoides*) の進化と *N. minor* の分類学的地位

Richiard Winterbottom

*Naso minor* は1個体の標本に基づいて Smith (1966) によって記載された。本種は、模式標本と Randall (1986) がフィリピンから報告した1個体のみによって知られている稀種である。本種は、尾叉長に対する頭長と眼径の比率、尾柄棘の形、背鰭棘数によってボウズハギとは異なるとされていた。フィリピンで採集された24個体の標本(2種を含むと想定)を調べたところ、頭長と眼径の尾叉長に対する比率、尾柄棘の形は2種を分けるには有効ではないことが判明した。しかし、背鰭棘数、鼻溝長、尾柄棘基部の色素胞の分布状態、背鰭の第1担鰭骨の形態によって、両種は明瞭に区別される。