

**HERMAPHRODITISM IN THE SOUTHERN LANTERN SHARK,
*ETMOPTERUS GRANULOSUS***

Sarah Beth Irvine
Deakin University / CSIRO Marine Research
P.O Box 1538 Hobart Tasmania 7001 Australia
sarah.irvine@csiro.au

Laurie J.B. Laurenson
Deakin University
P.O. Box 423 Warrnambool Victoria 3280 Australia
<mailto:llauren@deakin.edu.au>

John D. Stevens
CSIRO Marine Research
G.P.O Box 1538 Hobart Tasmania 7001 Australia
john.stevens@csiro.au

Abstract

Abnormalities in the reproductive system of sharks are rare and hermaphroditism of any elasmobranch species has not been reported from Australian waters. In May 2001, a hermaphrodite *Etmopterus granulosus* was collected from the Cascade Plateau, south-east of Tasmania. The animal is considered a true-hermaphrodite as it possessed both male and female internal sexual organs and if it had grown to maturity it could have been fully functional as either sex. Only one other *E. granulosus* hermaphrodite has been documented - a pseudo-hermaphrodite from New Zealand.

Introduction

The southern lantern shark, *Etmopterus granulosus*, is found in the temperate waters of the southern hemisphere. Males attain a maximum length of 74cm total length, TL, whilst females reach 87cm TL. This species makes up a large percentage of the bycatch labelled 'black shark' in the deepwater demersal trawls targeting orange roughy (*Hoplostethus atlanticus*) and oreo dories (Family Oreosomatidae) from Tasmania.

Table 1. Intersexuality in elasmobranchs of the Family Squalidae.

Species	No. found	Location	Structure	Author
<i>Centrophorus lusitanicus</i>	1		Female with small claspers	Cadenat 1960
<i>Centroscyllium owsonti</i>	1	Suruga Bay, Japan	Female with one short uncalcified clasper	Yano 1985
<i>Etmopterus unicolor</i>	16	Suruga Bay, Japan	15 were females with claspers, 1 male had an 'ovoteste'	Yano and Tanaka 1989
<i>Centroscyllium fabricii</i>	6	Greenland	4 males had 'ovotestes', 2 others were females with uncalcified claspers	Yano 1995
<i>Etmopterus granulosus</i>	1	New Zealand	Female with partially developed claspers	Wetherbee 1996
<i>Squalus acanthias</i>	1		Female with developed claspers	Gelsleichter et al. 1997

Atz (1964) reviewed the occurrence of hermaphroditism in fish and commented on its rarity in elasmobranchs. There have been few documented hermaphrodite discoveries from the family Squalidae (table 1) and intersexuality of Australian sharks have never been reported. Two main types of hermaphrodites are currently recognised; pseudo-hermaphrodites are internally one sex and externally another while true-hermaphrodites are internally both sexes with claspers and if mature could function as both male and female.

Methods

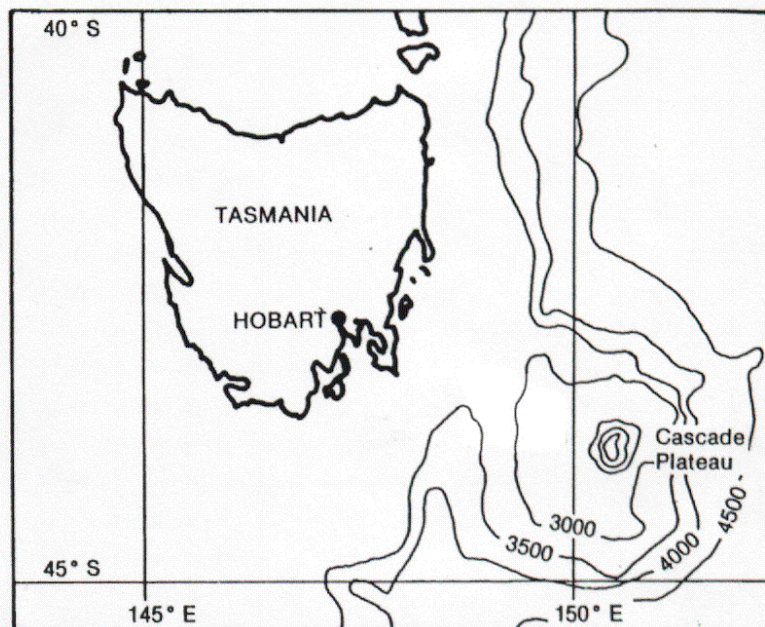
Etmopterus granulosus are regularly collected from demersal trawl vessels porting in Hobart, Tasmania. Each specimen is examined for biological information and spine and vertebrae samples are retained for ageing. The following measurements were taken during the dissection: total length, TL (distance from the snout to the tip of the caudal fin) cm, weight (grams), sex, clasper length (distance from the distal tip to the adjoining pelvic fin) and clasper calcification. The uterus width and maximum ova diameter were measured to the nearest mm. The testes were examined for degree of lobulation. The female reproductive stage was determined according to King (1995) and

the gonad tissue was weighed to the nearest 0.1 gram. Photographs were then taken and the specimen was frozen for later examination.

Results

The hermaphroditic *Etmopterus granulosus* specimen was collected by FV Adriatic Pearl from the Cascade Plateau (figure 1) at a depth range of 800-850 metres on the 28th of May 2001.

Figure 1. Cascade Plateau, 138nm east south-east of Hobart Tasmania, Australia.



The specimen (figure 2) measured 63cm TL and weighed 1205g. Two fully calcified claspers measuring 17.5mm were present. Each clasper had spurs and developed siphon sacs. Internally, the animal possessed both male and female reproductive tracts.

The right side of the cavity was female and contained one ovary with maturing white (un-yolked) ova with a maximum diameter of 5.4 mm. An undeveloped nidamental gland was also found. The undeveloped uterus had a width of 6.1mm and was still attached to the central body cavity. The ovary weight was 4.1g.

The internal tract on the left side contained two mature and lobulated testes. The vas deferens was coiled only for a short portion of its length. The major portion of the vas deferens formed a thin relatively straight tube that widened posteriorly into a poorly developed seminal vesicle. A large yellow unknown 'growth' was found on one teste. The male gonad weight was 25.9g.

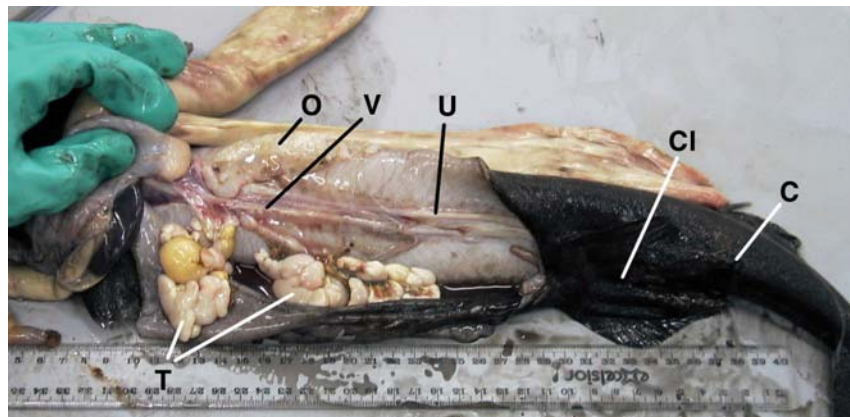


Figure 2. Hermaphrodite *Etmopterus granulosus* collected from south eastern Tasmanian waters. O; ovary, T; testes, V; vas deferens, U; uterus, CI; cloaca, C; claspers

Discussion

Etmopterus granulosus from Tasmanian waters are 50% mature at 53cm and 62cm TL while 100 % maturity is reached at 60cm and 69cm TL for males and females respectively. This animal is therefore within the correct size range to be a fully mature male and a maturing female. The size of the reproductive organs is similar to other animals of the same size, hence being a hermaphrodite has not delayed maturation. The presence of both mature testes and claspers, with maturing ova and uteri suggests that this animal may have been able to fully function as a hermaphrodite.

Of the 800 plus *E. granulosus* specimens collected in Tasmanian waters to date this is the only hermaphrodite encountered. In the same month a 61cm TL male specimen caught at a similar location by a different vessel was found to have several yellow 'growths' on its right teste similar to that found in this hermaphrodite.

Hermaphroditism, although uncommon in elasmobranches, has been known to occur in fish since ancient times (Atz, 1964). The fact that only one hermaphrodite specimen was found among 1500 dogfish suggests that intersexuality in elasmobranches, particularly those from Australia is extremely rare.

References

- Atz, J.W. (1964) Intersexuality in Fishes, In Intersexuality in vertebrates including man, Armstrong, C.N. & Marshall, A.J. (eds), Academic Press Inc. London, 145-232.
- Cadenat, J. (1960) Notes d'ichtyologie ouest-africaine- Sur un cas d'intersexualite chez un requin de l'espece *Centrophorus lusitanicus* Bocage et Capello 1864. Bull. Inst. Franç. 'Afr noire. (A), 22(4):1428-32 (In French).
- Gelsleichter, J., Grubbs, R.D. and Musick, J.A. (1997) Morphology and histology of the reproductive tract of a hermaphroditic spiny dogfish, *Squalus acanthias*. Abstract from ASIH/AES Meeting, Seattle, WA 26 June-2 July 1997
- King, M. (1995) Fisheries Biology, Assessment and Management. Fishing News Books. England. page 155
- Wetherbee. B.M (1996). Distribution and reproduction of the southern lantern shark, *Etmopterus granulosus* from New Zealand. J. Fish Biol. 49: 1186-1196
- Yano, K (1985). Studies on morphology, phylogeny, taxonomy and biology of Japanese squaloid sharks, order Squaliformes. Ph.D thesis, Tokai University. (In Japanese).

- Yano, K and Tanaka, S. (1989). Hermaphroditism in the Lantern shark *Etmopterus unicolor* (Squalidae: Chondrichthyes). *Japan. J. Ichthy.*, 36(3): 338-45
- Yano, K. (1995). Reproductive biology of the black dogfish, *Centroscyllium fabricii*, collected from waters off western Greenland. *J. Mar. Biol. Assoc. U.K.*, 75: 285-310.