Apogonidae Taxon Advisory Group

Husbandry guidelines Banggai Cardinalfish (*Pterapogon kauderni)*

E. Bruins, Artis Royal Zoo – Amsterdam, Octobre 2008

Background

P. kauderni originates from the East-coast of Sulawesi around the Banggai archipelago. Its habitat consists of both coral-reefs and sea-grass beds.

After it's discovery in 1920 by Dr. Kaudern, Koumans (1933) described a beautiful black and white cardinalfish as *Pterapogon kauderni*. This Banggai cardinalfish is a rare example of a marine endemic species, restricted to the Banggai Islands of Sulawesi in Indonesia. In 1992 the same species was 'rediscovered by science' by Kal Muller, as presented in Allen & Steene, 1995.

Today, the Banggai cardinalfish is extensively trade for the international aquarium market. Its attractive appearance and unusual mouthbrooding behaviour have made it popular among aquarists. Despite its widespread appeal, very little is known about the ecology or conservation status of this species in the wild, or about the habitats in which it lives.

The mouthbrooding behaviour, the large size of the eggs, the long embryonic development and the retention of the newly hatched embryos in the males mouth until the completion of their embryonic development likely reduces adult reproductive rates of the Banggai cardinalfish since it increases the parental investment for each brood. The absence of a pelagic larval stage could highly limit the geographical dispersal of juveniles. The relatively low fecundity, the highly restricted geographic range, the tendency to live in groups, and a low reproductive rate make that this species has been flagged as being especially unsuitable for high levels of exploitation. Yet the aquarium trade in this species, suspected to take large numbers of fish directly from the wild, is currently legal and unregulated by national and international laws. It is estimated that about 600,000 to 700,000 specimens are caught each year (Lunn&Moreau, 2002).

Quite apart from the direct threats it faces, the species is also subject to many indirect threats posed by coastal pollution, habitat degradation, and destructive fishing practices throughout the Banggai Islands

This species readily breeds in captivity. Efforts should be made to reduce the capture of wild specimen, for example by enlarging the captive breeding efforts and setting up a conservation program in situ.

Husbandry

The species is relative easy to keep in a mixed coral reef tank with other small, non-agressive fishes. They can be kept in groups or in pairs. If pairs are formed intra-specific aggression occurs more often. One pair has a territory of at least 250 cm^2 of bottom space. Or, for example for three adults, a minimum tank size would be 100x50x50 cm for three adults. In Artis Royal Zoo, about 20 animals and their offspring are kept in 200x200x200 cm tank. Introduction of hiding places is necessary (e.g. rocks, (live) coral or (artificial) sea-grass). Bottom substrate can be coral sand or any other fine sand.

Compatibility

An aquarium specialising in *P. kauderni* (both young and adult) with sea-urchins and for example some shrimpfish (*Aeoliscus strigatus*) and some Holothurians make a good display.

When looking for a combination with other fish species it is best to keep them together with other non-aggressive species. Vagelli and Erdmann (2002) describe a number of micro-habitats and fish associations for *P. kauderni* in situ. Besides many invertebrates and among other fish species, the Banggai cardinalfish is often seen is associations with other Apogonidae species and Amphiprion species. When interested in reproduction, the species should be kept with diadem sea urchins (*Diadema* spp.) and not too many other fish-species due to aggression.

Water quality

The use of filtration techniques should be used to achieve the following water quality parameters (table I):

Parameter	Unit	Minimum	Ideal	Maximum
Temperature	°C	22	24-26	30
oxygen saturation	%		>90	100
PH		7,8	8,0 – 8,2	8,5
Salinity	ppt	32	33-34	35
Nitrate	mg NO_3^- -N/l	0	0-20	50
Nitrite	µg NO_2^- -N/l	0	< 0,1	
Ammonia	mg NH_3-N/l	0	0	

Table II: Feeding of adults

Food type	specification
Artemia spec.	live or dead
Daphnia spec.	live or dead
(*Neo*)*mysis* spec.	live or dead
Shrimp	Dead, chopped
Krill	dead
Cyclops	Live or dead
Chopped fish	dead

The feeding frequency should be 1 to 3 times per day over a six day period. Variation in the food is of great importance. A high feeding regime will have a positive effect on the breeding of this specimen.

Table III: Feeding of juveniles

Age	Food type	% of diet	Frequency (# /day)
0-1 months	*Artemia* sp. (live) [1]	70	2
0-1 months	Enriched *Artemia* sp. (live) [2]	30	1
1-2 months	*Artemia* sp. (live) [1]	60	2
1-2 months	Enriched *Artemia* sp. (live) [2]	20	1
1-2 months	*Daphnia* sp. (live or dead)	20	1
2-4 months	(*Neo*)*mysis* sp. (live or dead)	60	2-3
2-4 months	*Dapnia* sp. (live or dead)	20	1
2-4 months	*Artemia* sp. (live) [1]	10	2
2-4 months	Enriched *Artemia* sp. (live) [2]	10	1

[1] Encapsulated *Artemia* sp. (24 hours old)

[2] Enriched of 1 day old *Artemia* sp. (for 24 hours) with Mikrozell, Liquifry or Selco.

Sexing the animals
According to Mai (2001) the best (but still difficult) way of sexing the animals is looking at the genital papillae which look like two black spines, 2 or 3 mm behind each other, between the ventral fins and the anal fin. In males, the triangle-shaped front spine is twice as thick as the hind-spine and a maximum of ally 0.8 mm long. The hind-spine is a maximum of 1 mm long. In females, both spines are very thin and shorter, a maximum of 0.3 and 0.8 mm respectively.
Some are not convinced that this is a completely reliable method. Looking at the behaviour still seems to be the best method of sexing live animals.

Reproduction
P. kauderni is a mouth-brooder like most Apogonidae. She produces between 20-50 eggs which are then mouth brooded by the male. After 20-25 days the young will leave the males mouths and will stay between the spines of the sea-urchins. Considering the large size of the young and the right conditions it is possible to rear the species successfully using (enriched) *Artemia* sp (table III). It might be possible to catch young fish from a mixed tank by slowly removing the sea urchins with the young, into a container, or by using a fake urchin to reassure young fish.
It is also possible to take the eggs out of the mouth of the male and put them in an incubator (Janse, pers. comm, 2002).
From 2002 on, more and more institutions report having problems breeding this species, after having bred plenty before. The cause is not known yet. It might be inbreeding, management related (no moonlight; offspring removed to early, etc), or others. Eugène Bruins (e.bruins@artis.nl) is gathering information on this case.

Studbook on the way
Eugène Bruins plans to coordinate a studbood (ESB) for this species, as soon as ZIMS is useful as a tool for this. Hardly anyone administrates the species in ARKS or another system. Everyone keeping the species is now urged to keep a record about transacties, births, death, comments etc, etc., for example in an excel file.

Behaviour
Schooling behaviour occurs when brought newly into a tank, when other species are aggressive and when the density is too high. Extensive reproductive behaviour may be seen. Cannibalism of young by larger specimens or adults have been seen on different occasions, especially when the density is high. A typical behaviour is seen with ± 1,5 cm sized fish that collapse in a 'trance' when caught. After a couple of minutes they will resume normal behaviour.

Transport
Transportation should be done in plastic bags with 100 % oxygen. Concerning density: Artis Zoo - Amsterdam had a successful transport to Pretoria of 20 nearly adult fishes in 10 litres of water.

Diseases
This cardinalfish is quite new in the aquarium world so not many disease problems have been encountered. So far the following health problems have been found:

– *Oodinium*

- Problems with the airbladder. At Artis Zoo many young juveniles show a distinct behaviour. They try to swim upwards, but fall downwards when stop with swimming. This vertical swimming behaviour is possibly caused by a gasbladder problem.
- Congential deformities, particularly operculum area and drooping or shortened dorsal fin, possibly due to inbreeding?

Treatment

Health problem	Possible treatment
Oodinium	

Further reading

Allen, G.R. & Steene, R.C. 1995. Notes on the ecology and behaviour of the Indonesian cardinalfish (Apogonidae) *Pterapogon kauderni* Koumans. *Revue fr. Aquariol.*, **22**(1-2).7-9.

Allen, G.R., 1996. The king of the cardinalfishes. Tropical Fish Hobbyist 44(9):32-45.

Allen, G.R., 2000. Threatened fishes of the world: *Pterapogon kauderni* Koumans (1933), (Apogonidae). Environmental Biology of Fishes, 57(2):

Boruchowitz, D.E., 2001. Ideal Little Marines - Genus Apogon. Tropical Fish Hobbyist: mai 2001: 86-92

Bruins, E.B.A.W., M.A. Moreau, K.E. Lunn, A. Vagelli and H. Hall, in press. 10 Years after rediscovering the Banggai cardinalfish. EUAC proceedings 2002.

Dral, A. & M. Janse, 1997. Een juweel van een visje. *Artis* **43**(1):12-17.

Dürbaum, J., 1997a. *Pterapogon kauderni*: Ethologische Beobachtungen. *Datz*, **50**(6):390-393.

Dürbaum, J., 1997b. *Pterapogon kauderni*: Ethologische Beobachtungen. *Datz*, **50**(7):426-429.

Duys, B.M., A.M. van Polanen Tetel & I.W. Schenk, 1997. An ethological study of the cardinalfish *Pterapogon kauderni* in the Artis aquarium. *Thesis, Department of Animal Behaviour, University of Amsterdam.* 20p.

Erdmann, M. & A. Vagelli, 2001. Banggai cardinalfish invade Lembeh Strait. Coral reefs 20: 252-253.

Garnaud, J., 1950. La reproduction et l'incubation branchiale chez *Apogon imberis* G. et L.. Bull. Insti. Oceanog. Monaco 47 - 977: 1-10.

Grobe, J., 1996. *Pterapogon kauderni*, Gelungene Nachzucht des Schwarzweißen Kardinalbarsches. *Das Aquarium*, **328**:35-39.

Hof, T., 1996. De wondervis in Limburg. *Het zeeaquarium*, **46**(11):256-257.

Janse, M., A. Dral, F.J. Engelsma & G. van der Sijde, 1998. Conservation project of the Indonesian Cardinalfish *Pterapogon kauderni* in Artis. Congres EUAC, Bazel 1997. Mem. Inst. Oceano. P Ricard 1998, pp: 101-105

Koumans, F.P., 1933. On a new genus and species of Apogonidae. *Zool. Meded.* (Leiden), **16**(1-2):78.

Lange, J., 1986. Korallenfische im Aquarium. Verlag Eugen Ulmer, Stuttgart.

Lange, J. & R. Kaiser, 1988. Einige Bemerkungen zur erstmals gelungenen Aufzucht vor Zwergbarschen (Pseudochromidae) und Kardinalfischen (Apogonidae). Zool. Gart. N.F. 58 (5/6): 306-312.

Lunn, K.E. & MA Moreau, 2002. Conservation of Banggai cardinalfish populations in Sulawesi, Indonesia: an integrated research and education project. Final report. Zoological Society of London (Unpublished report).

Luther, T. 1996. Zur Pflege und Fortpflanzungsbiologie des Schwarzweißen Kardinalbarsches, *Pterapogon kauderni*. *Das Aquarium* **30** (7):27-29.
Luther, T., 1996. Over de verzorging en voortplantingsbiologie van het zwartwitte kardinaalbaarsje *Pterapogon kauderni*. *Het Zeeaquarium*, **46** (11):252-253.
Mai, W., 2001. Einfache Vermehrung des Banggai-Kardinalbarsches. Datz **54** (12): 6-10
Ounaïs, N., 1996. Reproduction de *Pterapogon kauderni*, L'expérience de l'aquarium de Monaco. *Aquarium Magainze*, **130**:55-57.
Ounaïs, N, P. Letournel & S. Travers, 1998. *Pterapogon kauderni*: reproduction. Congres EUAC, Bazel 1997. Mem. Inst. Oceano. P Ricard 1998, pp: 97-100
Rayner, G., 19??. The Banggai cardinalfish and bigger fish to fry.
Thaler, E. 1996. *Pterapogon kauderni*. Ein "Modefisch"? *Datz*, **12**:780-783.
Vagelli, A., 1999. The reproductive biology and early ontogeny of the mouthbrooding Banggai cardinalfish, *Pterapogon kauderni* (Perciformes, Apogonidae). Environmental Biology of Fishes 56: 79-92
Vagelli, A.A. & M.V. Erdmann, 2002. First comprehensive ecological survey of the Banggai cardinalfish, *Pterapogon kauderni*. Environmental Biology of Fishes 63: 1-8.
Vagelli, A.A., 2002. Notes on the biology, geographic distribution, and conservation status of the Banggai cardinalfish *Pterapogon kauderni* Koumans 1933, with comments on captive breeding techniques. Tropical Fish Hobbyist 51 (3): 84-88.

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