



## The unfortunate journey of *Pterapogon kauderni*: A remarkable apogonid endangered by the international ornamental fish trade, and its case in CITES

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### General introduction to *Pterapogon kauderni* (the Banggai cardinalfish)

#### *A species with a unique combination of traits*

*Pterapogon kauderni* (Koumans 1933) is a popular aquarium fish that is endemic to the Banggai Archipelago in eastern Indonesia. It is generally found in calm zones on the leeward side of larger islands, commonly in sheltered bays. It inhabits a variety of shallow habitats, including coral reefs, sea-grass beds and less commonly, open areas of low branching coral and rubble. Its depth distribution ranges between 0.5 m and 6 m, but is most common between 1.5 m and 2.5 m. It is a sedentary species associated with a variety of marine organisms, principally sea urchins, anemones and branching corals, and forms small groups frequently composed of a few dozen individuals of mixed age classes.

*Pterapogon kauderni* possesses a number of biological characteristics that make it an exceptional species, and of great interest in comparative studies on ecology and evolution of coral reef fishes. For instance, it is a rare example of a marine fish with an extremely limited geographic range. It has a very unusual mode of reproduction among coral reef teleosts, including advanced parental care of post-hatch embryos and an absence of a pelagic dispersal phase during its entire ontogeny. It is an atypical diurnal apogonid with a puzzling ontogenetic shift in its habitat and microhabitat preferences. It presents the highest population structure ever documented in a marine fish. It has special commensal relationships with several organisms to which it remains associated, and it plays an important role in its environment by preying on the larval stages of coral reef fishes' parasites.

Unfortunately, the human impact on *Pterapogon kauderni* is very significant. Overfishing for the international ornamental fish trade and rampant habitat destruction (primarily due to dynamite fishing) have led it to an endangered status in little

more than 10 years since the beginning of its commercial trade.

#### *A brief chronology of the scientific interest in Pterapogon kauderni*

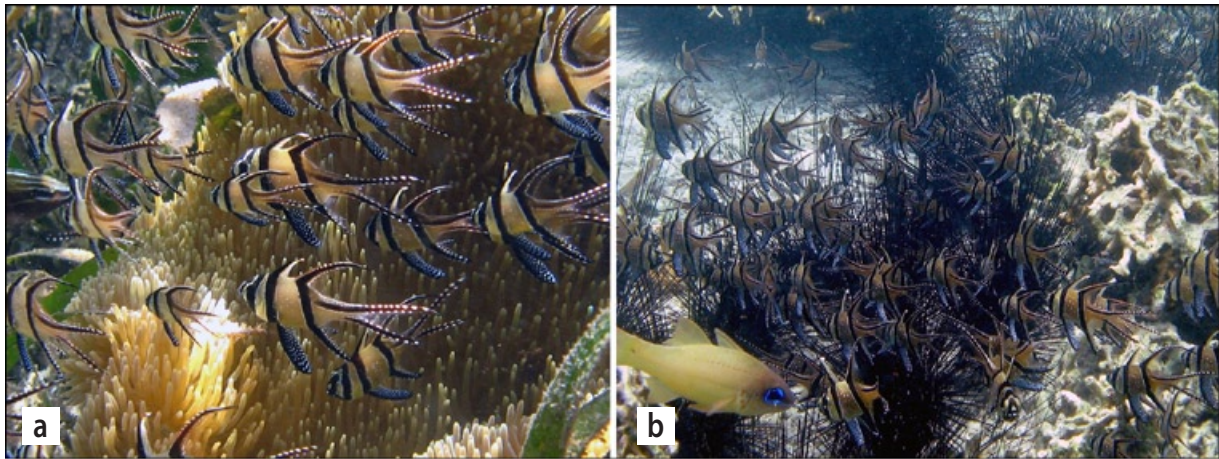
*Pterapogon kauderni* was first discovered by science in 1920 when Kaudern collected two specimens, most likely off Banggai Island, and sent them to the Leiden Museum of Natural History (Netherlands).

In 1933, Koumans found the specimens at the museum and described them, creating the genus *Pterapogon* (Koumans 1933). About 40 years later, Fraser (1972) studied the osteology of those preserved specimens. Then, in November 1994, Gerald Allen went to southwest Banggai Island to search for what he thought was an undescribed cardinalfish. He published his observations on general ecological aspects and the first photographs of live specimens in their natural environment (Allen and Steen 1995). In 2000 and 2002, Kolm visited the Banggai Archipelago and conducted studies on (reproductive) territorial behaviour, group and homing behaviour, and the effect of collecting on group size and density (Kolm and Berglund 2003, 2004; Kolm et al. 2005).

In 2001, Lunn and Moreau conducted a detailed study on the collecting effort and trade of *Pterapogon kauderni* in the Banggai Archipelago and north Sulawesi. Also, they conducted observations on group structure, density and microhabitat associations at the only site within the Banggai region in which all fishing, including the capture of *P. kauderni*, has not been allowed since before the beginning of its trade (Lunn and Moreau 2002, 2004).

In 1996, the author began a comprehensive research project on the natural history and conservation of *P. kauderni*. All aspects of its reproductive biology were studied, and a captive breeding programme was developed, which included studies on nutritional requirements of juveniles raised in captivity (Vagelli 1999, 2004b). In addition, most ecological

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**Figure 1.** The capture of *P. kauderni* does not require expensive equipment and it is facilitated by its sedentary and social behaviours. This species remains attached to shallow substrates such as anemones (a) and sea urchins (b), forming groups that are easily collected (photos by A.A. Vagelli).

aspects, geographic distribution, and the conservation status of *P. kauderni* were clarified for the first time as a result of expeditions to the Banggai Archipelago and north and central Sulawesi in 2001, 2002, 2004 and 2007 (Erdmann and Vagelli 2001; Vagelli 2002, 2004a, 2005a; Vagelli and Erdmann 2002; Vagelli and Volpedo 2004).

In September 2007, *Pterapogon kauderni* was included in the IUCN Red List of Threatened Species. It was assessed as “endangered,” a category meant for species “considered to be facing a very high risk of extinction in the wild.”

#### **The particular susceptibility of *Pterapogon kauderni* to overfishing**

*Pterapogon kauderni* is a small (maximum ~ 65 mm standard length, SL) fish especially vulnerable to indiscriminate collecting due to its highly restricted geographic distribution, low productivity, and the ease of its capture (which is greatly facilitated by its attachment to shallow microhabitats, sedentary nature and group formation) (Figs. 1a,b). In addition, given its biological and ecological characteristics, *P. kauderni* is not capable of naturally recolonising areas from which it has been eliminated.

The natural range of *Pterapogon kauderni* covers an area of approximately 5,500 km<sup>2</sup>. However, its available habitat is limited to only about 300 km of coastline of 32 islands, confined within a maximum area of about 30 km<sup>2</sup> (<http://www.cites.org/eng/cop/14/prop/E14-P19.pdf> 2008)<sup>2</sup> (Fig. 2).

Unlike most coral reef teleosts, including other apogonids, *Pterapogon kauderni* has very low fecundity. Females produce small egg clutches of up to 60–70 large eggs (the mean clutch size found in wild incubating males was 41 eggs). Females can reproduce at about 8–9 months of age and at 35 mm SL. The smallest female with signs of advanced gonad maturation found in the wild was 41 mm SL. Females require about one month between spawns. Mated pairs isolate themselves for up to a few days, and display a variety of behavioural patterns easily interrupted by the presence of other individuals. Spawning and recruitment appears to follow a lunar cycle. Males mouthbrood the egg clutch for about 20 days, and after hatching, the embryos remain within the male’s oral cavity for about a week until their release as juveniles. Males do not feed while incubating and are limited to just a few brooding cycles per year.

The fertility rate is not more than about 70%, and it is frequently less due to loss of eggs during the clutch transfer. Contrary to the expectation for a species with high parental energy investment per offspring and with parental care of an advanced degree, *P. kauderni* suffers high early mortality, most likely due to predation, shortly after recruitment (Vagelli 1999, 2005a; Vagelli and Volpedo 2004).

*Pterapogon kauderni* exhibits the highest degree of genetic structure reported for a marine fish. Some populations occurring on reefs of the same islands are genetically distinct from one another (Bernardi and Vagelli 2004; Hoffman et al. 2005).

2. A very small population is restricted to inside Luwuk Harbor (central Sulawesi). It is likely a product of human introduction. The nearest population is found ~100 km southeast, across the 900 m deep Peleng Strait in the Banggai Archipelago. Another population was introduced 400 km north of the species’ natural range by trade activities in north Sulawesi. It was first detected in 2000 in the Lembeh Strait. In 2002, specimens were introduced by local resort operators on Lembeh Island. Also, in Tumbak (a main purchase centre on north Sulawesi) another small population was established through the routine discharge of specimens by sellers and buyers.



Habitat loss due to destructive fishing practices (dynamite and cyanide fishing) and coral diseases greatly affects *P. kauderni*. As its reef habitat is diminished, fewer shallow areas with sufficient living substrates remain for this species, forcing it in some areas to inhabit deeper waters. However, at deeper depths the microhabitats used by *P. kauderni* are much scarcer, reducing the capacity of these areas to sustain sizable populations (Vagelli 2005a).

### Conservation situation of *Pterapogon kauderni* and its path to “endangered” status

#### *The beginning of the trade*

The aquarium hobbyist community first learned about *Pterapogon kauderni* in 1995 when Allen introduced it at the Marine Aquarium Conference of North America (MACNA) VII, and through his publication describing the re-discovery of this species in a popular aquarium magazine (Allen 1996). By the late 1990s, *P. kauderni* became very popular in the aquarium hobbyist community and the demand for it grew enormously. Soon, however, the first concerns for its conservation were expressed when Allen, during his survey of the Banggai Islands with Conservation International in 1998, found holding nets with thousands of specimens waiting to be sold, leading him to recommend the inclusion of *P. kauderni* in the IUCN Red List (Allen 2000, 2001). In addition, Kolm and Berglund (2003) showed that (in 2000) collecting activities could have a significant detrimental impact on its populations.

In 2001, the first ecological and geographic distribution survey of *Pterapogon kauderni* was completed, as well as the first census and assessment of its fishery and trade. The results showed that *P. kauderni* was absent in most of the small and southern islands of the Banggai Archipelago, and that at least 700,000 specimens per year, and probably many more, were reaching a north Sulawesi export centre, and several thousands more were being sent to Bali each year (Lunn and Moreau 2004; Vagelli 2002; Vagelli and Erdmann 2002).

#### *Present conservation situation*

##### *Collecting pressure and population declines*

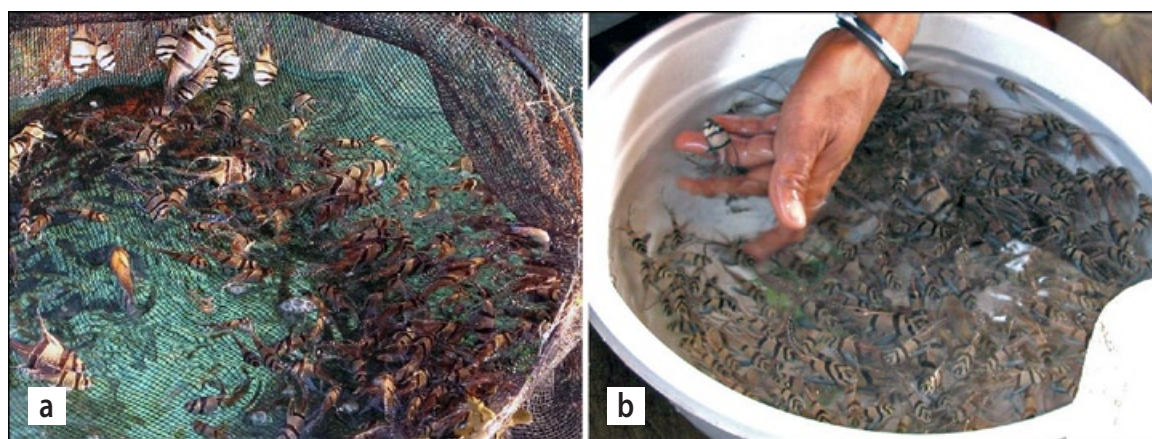
Three main collecting centres dominate the capture-trade operations in the Banggai region (Fig. 2). One is located in northwest Banggai Island, where about 20 fishers collect *Pterapogon kauderni* (and one of them is a buyer). They collect around Banggai, Labobo, Bakakan, and Peleng Islands. The

local buyer purchases 6,000 specimens per month. In addition, another four buyers come to this centre to purchase about 30,000 specimens per month. All five buyers go to Tumbak (north Sulawesi) to sell specimens with a reported 25% mortality during this 24-hour trip, and 15% rejection by the buyers due to poor specimen condition (Figs. 3a,b). The second centre is located in southeast Bangkuru Island, where about 15 fishers collect an average of 15,000 fish per month, mostly around Bangkuru Island. Buyers come two to three times per month and take the fish to Kendary (south Sulawesi) (Figs. 4a,b). The third centre is located in southeast Bokan Island, where the village chief is the main buyer of the region and organizes collection around Bokan, Buang Buang, Loisa, Masepe and Kokudan Islands. He purchases approximately 15,000–20,000 specimens per month and transports them directly to Bali (4–5 day trip) with a 30% mortality and rejection rate. In addition, three to four buyers come to Bokan from Manado (north Sulawesi) to purchase 35,000 specimens monthly (Fig. 5).

In addition to collection by local fishers, boats come directly from Bali to collect in the Banggai region. This outside (illegal) collection was detected as long ago as 2001 (Lunn and Moreau 2004). Boats bringing about 10 fishers generally collect for a week before returning to Bali. Although the present magnitude of this outside capture is unknown, a reasonable figure may be several thousand fish per month.<sup>3</sup>

In conclusion, assuming that weather and/or logistical problems may cause some interruptions in both harvesting and shipping, a conservative estimate of the present total rate of capture of *Pterapogon kauderni* within the Banggai Archipelago is about 1,000,000 specimens per year. When this figure is compared with the estimated total number of individuals inhabiting the entire Banggai region (i.e. 2,200,000), it reveals the bleak conservation situation of *P. kauderni*. Several populations monitored since 2001 clearly show the impact of overexploitation. For instance, the population on Masoni Island, monitored since 2001, has been dramatically reduced. In 2007 only 37 individuals were found in the census site (4,800 m<sup>2</sup>), and a search of the entire island uncovered no more than about 150 individuals. The population in southeast Peleng Island, followed since 2002, has been practically exterminated, with only 27 individuals found at the census site. The population in Bakakan Islands did not recover from the dramatic decline suffered between 2002 and 2004. Approximately 350 individuals remain at both islands, compared with the 6,000 estimated to have been present in 2001. The small popula-

3. In the past, it was common for these outside boats to hire local collectors to capture *P. kauderni*. For instance, in 2003–2004 local fishers in Kokudan and Banggai sold about 3,000 and 20,000 specimens per month, respectively, to boats from Bali.



**Figure 3.** At Bone Baru, Banggai Island, *P. kauderni* are moved from a holding pen (a) and then transported to a buyer's boat, where they are sorted by size and are counted (b) (photos by A.A. Vagelli).



**Figure 4.** Local collectors at Bone Bone, Bangkuru Island, taking their catch to a buyer's boat (a), which can transport more than 12,000 specimens (b). Mortality during transport is usually about 25%, but can reach 50% or more (photos by A.A. Vagelli).



**Figure 5.** Mr Rahman, Chief of Panapat Village, Bokan Island, in his home providing the author with a detailed description of how the collection and trade of *P. kauderni* is organized under his supervision, as well as of places of collection and capture volumes (photo by Junico Seba).

tion inhabiting the census site in southeast Limbo Island, which had a low density of 0.02 individuals  $m^{-2}$  in 2001, and was determined to be virtually eradicated in 2004, has not recovered. A total of only four specimens were found. Thus, it did not come as a surprise that by 2007, population surveys had documented a reduction of close to 90% in the species' abundance, with a reduction in mean density to 0.08 individuals  $m^{-2}$ . This can be compared with the estimated historical baseline density of *P. kauderni* within its natural range of about 0.6 individuals  $m^{-2}$  (Vagelli 2002, 2005a, 2007).

#### **Habitat degradation affecting *Pterapogon kauderni***

In addition to the unsustainable collection of *Pterapogon kauderni* for the aquarium trade, populations of this species are threatened by habitat loss due to destructive fishing, which was already affecting this region for years prior to the beginning of the *P. kauderni* trade (Indrawan 1999). Today, dynamite fishing for food fish remains widespread, and the narrow reefs and limited available habitats for *P. kauderni* are being destroyed throughout its natural range (Figs. 6, 7).

In 2007, an undetermined disease affecting hard corals was detected in several islands. It particularly affected the top sections of long-branched *Acropora* species as well as species of *Porites*. In some areas, *Millepora* formations were covered by green algae and some have lost more than 50% of their structure. These corals form substrates where *Pterapogon kauderni* is commonly found. In addition, a new viral disease has been documented in wild-harvested *P. kauderni* individuals imported into the United States. The origin of this iridovirus (genus *Megalocytivirus*), as well as its prevalence in and impacts on wild populations, are currently under investigation. However, it is known to occur in ornamental fishes exported from Southeast Asia (Weber et al. in press).

#### **The Banggai cardinalfish and CITES: A biologist's disappointing experience**

##### ***The proposal to include P. kauderni in CITES Appendix II***

The need for protecting this species became evident earlier in this decade as a result of the author's and other researchers' fieldwork (Allen



**Figure 6.** A recently bombed reef patch in Labobo Island. Dynamite fishing is widespread throughout the Banggai Archipelago and includes areas inhabited by *P. kauderni* (photo by A.A. Vagelli).

2000; Lunn and Moreau 2002; Vagelli 2002; Kolm and Berglund 2003).

After evaluating his field data gathered in 2004, which showed no indications of a reduction in collecting effort and a significant decline of some populations (including the extinction of one), the author decided to recommend that *Pterapogon kauderni* be included under an appropriate CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) Appendix at the next CoP (Conference of the Parties) meeting.

In March 2006, the recommendation was submitted by the author to CITES United States, which evaluated it favourably. CITES United States invited its Indonesian counterpart to co-sponsor a proposal to include *P. kauderni* under Appendix II<sup>4</sup> of CITES at CoP 14. After several requests by CITES United States, CITES Indonesia finally answered, declining to co-sponsor it. In its response, CITES Indonesia did not oppose the proposal, but stated that it was "not able to provide strong support", and that it was expecting "positive impacts from the current management program being undertaken at the area, such as the establishing of District Marine Protected Areas and a fishermen certification system in collaboration with the Marine Aquarium Council (MAC)" (Susmianto 2007). CITES United States did, however, receive supporting letters from Yayasan Pemerhati Lingkungan (YPL), the only local non-governmental organisation (NGO)

4. CITES' objective is to ensure that international trade in specimens of wild organisms does not threaten the survival of the species. Species are placed into three appendices depending on the threat of trade to their survival, current or future. Appendix I includes the most endangered among CITES-listed species. They are threatened with extinction and CITES prohibits their international trade except for non-commercial purposes (e.g. scientific research). Appendix II lists species that are not necessarily threatened with extinction, but may become so unless trade is regulated. International trade of such species may be authorized by granting permits, but only if the relevant authorities are satisfied that international trade will not be detrimental to the survival of the species in the wild. Appendix III includes species that are not globally threatened, and they are listed at the request of a Party that already regulates trade in the species and that needs the cooperation of other countries to prevent unsustainable or illegal exploitation.



**Figure 7.** Typical “bomb” used in the region: It is made with a beer bottle filled with fertilizer and phosphorus scraped from matches (photo by A.A. Vagelli).

that has been working on educational and conservation issues in the Banggai Archipelago (Lunn and Moreau 2004; Vagelli 2005b), and from the head of the Banggai Fisheries and Marine Affairs Department. In the end, CITES United States submitted the proposal to the CITES Secretariat.

### **The opposition**

By June 2007, the CITES Secretariat, IUCN, the European Community, and several international conservation organizations supported the proposal. Furthermore, YPL was adamant in its support of the proposal and expressed it to local, regional and federal fisheries department authorities as well as to CITES Indonesia.

At CoP 14, after the proposal was introduced on the floor, CITES Indonesia voiced opposition. It argued that the regulation of trade of *Pterapogon kauderni* would have severe negative impact on the livelihoods of the people of the Banggai region. It also stated that conservation efforts were underway by Indonesia’s central and local governments, including in situ aquaculture programs and the development of sustainable collecting practices.

Indonesia did not refute the data contained in the proposal, which clearly indicated the appropriateness of including *Pterapogon kauderni* under Appendix II, if not Appendix I. The only instance in which CITES Indonesia referred to any survey data, they grossly misrepresented them. The CITES Indonesia representative, in a statement made in opposition to the listing proposal at the CoP 14, said that in the “most recent assessment done in the Banggai region

[referring to the author’s survey in 2007] only six out of 77 sites surveyed were found with a significant decline in population.” What the representative did not mention was that out of the 77 sites surveyed, *P. kauderni* was found in only 35, and that the 2007 censuses were conducted in only 11 of the sites that had been followed since 2001.<sup>5</sup> Therefore, the more relevant finding was that 6 out of the 11 long-term monitoring sites showed significant reductions in population sizes relative to 2004 (including 3 sites with only 38, 27 and 4 individuals remaining) (<http://www.cites.org/common/cop/14/inf/E14i-37.pdf>). The conservation implications of this finding were, of course, quite different than those portrayed by CITES Indonesia in its opposition to the proposal.

The United Nations Food and Agriculture Organization (FAO) expressed its opposition to the proposal and incorrectly stated that *P. kauderni* was a high-productivity species. Subsequently, several countries adopted CITES Indonesia’s position. Most cited the hardship that the inclusion of the species under CITES would bring to the local people, and mentioned the alleged conservation efforts already put in place by Indonesia. Some criticized the CITES United States’ lack of consultation with CITES Indonesia in preparing the proposal. As a result of this opposition, the US delegation to the CoP 14 withdrew the proposal before a vote could be called.

### **Misinformation on the Banggai cardinalfish CITES proposal**

The author’s personal discussions at The Hague with several Latin American CITES representatives, which took place previous to the proposal’s introduction, highlighted the lack of familiarity of those delegations with the Banggai cardinalfish proposal. Yet they were prepared to follow CITES Indonesia’s portrayal of the situation; that is, a region highly dependant on an allegedly well-managed natural resource, the livelihoods in the entire region being disregarded by a powerful country (i.e. the US, the proponent), and a proposal prepared without consultation with the host nation.

It was disappointing to know that these Latin American delegations were prepared to vote against the proposal as a block without considering additional information that was provided by the US to all CITES parties (<http://www.cites.org/common/cop/14/inf/E14i-.pdf>). This additional information described in detail the impact of the *Pterapogon kauderni* trade in the Banggai region and refuted the faulty assessment by FAO. This regrettable position seemed far from

5. The information on the number of sites surveyed and the presence/absence of *P. kauderni* in 2007 that was cited (and misused) by CITES Indonesia is part of a detailed report presented by the author to the Indonesian CITES authorities in Jakarta in May 2007.

the mission of CITES; that is, “to ensure that international trade in specimens of wild animals and plants does not threaten their survival.” Although unfortunate, this position might have been the product of lack of interest rather than part of a tactical approach regarding their relationship with Indonesia, as was most likely the case with the Asian block of countries that opposed the proposal.

Economically driven interests were likely behind the positions of several organizations representing the ornamental aquarium industry. They exerted strong efforts, both financial and logistical, to oppose the proposal and cloud its interpretation. They even produced a propagandistic brochure in association with CITES Indonesia that was given to all CoP participants (<http://www.zza-online.de/aktuelles/88.html> 2008). For instance, as published in *Aquarama Magazine*, “... seven representatives from the ornamental aquatic industry, three of whom were from the European Pet Organisation (EPO), and one from each of the following: Ornamental Fish International (OFI), Pet Industry Joint Advisory Council (PIJAC), Ornamental Aquatic Trade Association (OATA) and Pet Care Trust (PCT) ... and after much cooperative lobbying before and during CoP, they were able to influence the final decision not to list the Banggai cardinalfish in CITES Appendix II ...” (September 2007, Issue 9, News Section). Another interest group, World Conservation Trust, also congratulated the failure of CITES in protecting *P. kauderni*, exemplifying how misinformation about the Banggai cardinalfish proposal has been disseminated. In this case it accepted both the false notion that CITES United States did not consult with CITES Indonesia before submitting the proposal, and that the proposal did not meet listing requirements. The editorial page of the July-August 2007 Sustainable e-News/ IWMC World Conservation Trust argued that “the success factor [at CITES] for some officials and delegations now clearly has more to do with securing a listing. Why else... would the US (Banggai cardinalfish) make proposals without first consulting with range states as they are required to under CITES rules?”

After pointing out that CITES rejected the listing of four species (spiny dogfish, porbeagle, Banggai cardinalfish and red/pink coral), as well as the creation of a position for a CITES fisheries officer, the editorial thanked “all the colleagues for their hard work in achieving this outcome.” In the same issue, it states that “IWMC advocated the rejection of the proposals because, in each case, they clearly failed to meet requirements of a listing” (<http://www.iwmc.org/newsletter/2007/A2007-08.pdf>).

### The reality

Despite the above-mentioned arguments put forward by CITES Indonesia for declining the US’s request for co-sponsorship and for opposing the proposal at CoP 14, and the false notion that CITES United States did not consult with CITES Indonesia (e.g. Moore and Ndobe 2007), the reality is quite different and is described in the following paragraphs.

First, no conservation programme involving *Pterapogon kauderni* was ever attempted in the Banggai region. Neither the author’s first three expeditions spanning the entire archipelago (2001, 2002, 2004), nor regular visits by YPL to the Banggai region ever uncovered evidence of a conservation or aquaculture programme being implemented or planned by any federal, regional, or local institution or NGO.<sup>6</sup>

During the field survey of March–April 2007, the author made a special effort to determine if a conservation project was being developed, because the main reason put forward by CITES Indonesia in declining the invitation by CITES United States in submitting a joint proposal to include *P. kauderni* in CITES, was that “it will hamper current conservation projects underway in the region.” As suspected, there were no areas being established to protect *P. kauderni*, no local aquaculture project being developed, and no village in the Banggai Archipelago was approached by the government to implement any conservation or management plan directed toward *P. kauderni*. In addition, in late March 2007 while in the Banggai region, the author was contacted by MAC Indonesia, which had been asked to advise on the *P. kauderni* CITES proposal. In the course of several conversations, the author clarified several aspects of the biology of this species and its present conservation situation. MAC Indonesia representatives acknowledged their unfamiliarity with both the species’ conservation status and the Banggai region, and stated that they were not planning a certification system directed towards *P. kauderni*. Furthermore, they suggested that the author request a meeting with CITES Indonesia in order to inform them about the real situation involving *P. kauderni*, since apparently they were being misinformed by other parties.

Second, CITES United States invited Indonesia to co-sponsor the proposal. In addition, it requested from Indonesia available information on the conservation status of *Pterapogon kauderni*, including data on its collection, captive breeding efforts, existing legislation, trade regulations and management plans. Furthermore, CITES United States shared with CITES Indonesia the full recommendation for *P. kauderni* to be included in an appropriate CITES

6. That is, other than the programme jointly proposed by the YPL and the author to the local fisheries authorities in Banggai Island (Vagelli 2005b).

Appendix as well as reprints of published papers on the biology and conservation status of *P. kauderni* that the author submitted to CITES United States (Gabel 2006).

In May 2007, the author, following the advice given by MAC Indonesia, travelled twice to Jakarta to meet with the scientific and the management authorities of CITES Indonesia, with high officials at the Ministry of Marine Affairs and Fisheries, and with the head of the regional government and local fisheries department (Fig. 8). They were presented with a detailed report on the current conservation situation of *P. kauderni*, including the latest data on each population's status, trade volumes, habitat degradation, and significance of its trade to the local economy. During those meetings, it became evident that neither CITES Indonesia nor the local government authorities were familiar with the species' conservation situation, nor with any regulation aimed to protect it, nor with the implementation of any marine protected area in the region.

It is known now that it was not until August 2007 that the first step was taken to develop a Banggai cardinalfish management plan (specifically, a meeting among stakeholders was conducted) (Moore and Ndobe 2007).



**Figure 8.** The author speaks with Dr Nurdjana, Indonesia's Director of Directorate General for Aquaculture, prior to the author's presentation on the conservation status of *P. kauderni* at the Indonesia Ministry of Marine Affairs and Fisheries (Jakarta) (photo by Suryani Mile).

### ***The real impact of the Pterapogon kauderni trade in the Banggai Archipelago***

The main opposition to regulating the capture and international trade of *Pterapogon kauderni* was based on the alleged significant economic impact that its inclusion under Appendix II would have brought to the entire Banggai region. However, the real economic importance of the capture and trade of this species within this region is virtually nil. The

reality is that the overwhelming majority (> 99%) of the approximately 160,000 local residents (Head of Regional Government, pers. comm. 2007) do not depend on *P. kauderni* for their livelihood. The vast majority of the Banggai people make their living with more profitable and traditional economic activities such as agriculture, seaweed culture, and fisheries (Fig. 9a,b,c). About 55% of the region's GDP is due to agricultural and traditional fisheries activities (<http://www.banggai-kepulauan.go.id> 2008). The rest comes from mining, industry, public service, and trade activities.



**Figure 9.** The economic activity due to the collection and trade of *P. kauderni* within the Banggai region is negligible. The overwhelming majority of people dedicated to sea-based activities focus their efforts on traditional fisheries, including production of salted-dried fish (a), squid (b), and seaweed culture (c) (photos by A.A. Vagelli).

The production of salted and dried fish, squid, octopuses, shark fin and sea cucumber is by and large the main fishing activity in the region.<sup>7</sup> In addition, a small number of fishers are involved in the live fish trade for both food and ornamental species. Among them are no more than 60–80 fishers actively engaged in the capture and local trade of *P. kauderni*. The low price obtained per fish (~USD 0.03), which is 10–100 times lower than that obtained for other ornamental species, is the reason why so few people are dedicated to the capture of *P. kauderni*. Moreover, these collectors do not rely solely on this activity as a source of income, but as a complement to their other, more traditional sources of livelihood. Thus, the capture and trade of *P. kauderni* is negligible in terms of both economic impact and employment within the Banggai Archipelago.

### The benefits of regulating the collection and trade of *P. kauderni* through CITES

The inclusion of *Pterapogon kauderni* in the IUCN Red List as “endangered” underscores its bleak conservation status. However, this designation does not restrict international trade or collection. If it is not regulated, the current unsustainable capture of *P. kauderni* will deplete many sub-populations and, given their genetic distinctiveness, entire genetic lines will be lost.

The inclusion of *Pterapogon kauderni* under CITES is the best practical way to ensure the protection of both the species and the ability of local people to sustainably harvest it over the long term. The regulation of trade will likely facilitate the restoration of its populations, increase protection of its habitats, and create an incentive to develop comprehensive management plans for the species. In addition, a CITES listing might provide more opportunities to seek international funding to conduct additional surveys, to expedite the implementation of management plans<sup>8</sup>, and to establish captive breeding operations managed by local people.

The inclusion of *Pterapogon kauderni* in CITES Appendix II would require CITES Indonesia to issue export permits and to demonstrate that harvest and trade levels are not detrimental to the species. Moreover, the European Community, one of the largest markets, would impose additional (although not

required under CITES) controls and require import permits. Thus, the inclusion of *P. kauderni* in CITES II would significantly reduce the present export (harvest) volume.

However, it is the author’s opinion that given the current dire conservation situation of this species (confirmed by its recent listing as “endangered” in the IUCN Red List), a more appropriate measure to protect it would be its inclusion under CITES Appendix I. This listing would impose a ban on international trade and since there is no local market for *P. kauderni*, it would mean the cessation of its capture.

### Restriction on collecting and development of in-situ aquaculture

The current challenges and potential benefits of sustainable trade in Indonesian marine aquarium organisms are known (Reksodihardjo-Lilley and Lilley 2007). The various benefits of community-based aquaculture of marine ornamental fishes have been pointed out, and its important role as a complement to restrictions on trade and collection of threatened species has been recognized (e.g. Job 2005). The combination of commercial aquaculture of *P. kauderni* to reduce the need to capture wild specimens and a trade monitoring system established in collaboration with fish exporters has been strongly recommended (Wabnitz et al. 2003). Furthermore, CITES allows the international trade of specimens bred in captivity, even of species listed under Appendix I, as long as particular guidelines are followed (CITES, Article VII, paragraph 4, available at: <http://www.cites.org/eng/disc/text.shtml#VII>).<sup>9</sup>

The development of in-situ aquaculture of *Pterapogon kauderni* is feasible. The reproductive biology, husbandry, and captive breeding techniques to produce this species are well known (Marini and Vagelli 2007; Vagelli 1999, 2004a). These techniques can be applied to develop an extensive system of culture customized to local conditions, taking advantage of unlimited supplies of natural seawater and food.

The aquaculture of *P. kauderni* would facilitate the implementation of a product certification method such as the one administered by MAC, and it would reduce the number of intermediaries, giving local

7. Data from the first six months of 2004 show that on Banggai Island 16.5 metric tonnes (t) of seaweed, 1.2 t of demersal fish, 3.9 t of shark fin, 0.8 t dried fish, 1.1 t lobster, and 0.2 t sea cucumber were produced. For the same period on Bokon Island, 211 t of dried salt fish, 10 t of sea cucumber, and 4 t of shark fin were produced (EC-PREP 2005). Banggai and Bokon are two of the three islands where the main *P. kauderni* collection and trade centres are located (no data from Bangkuru Island were included).

8. Had CITES approved the listing of *P. kauderni*, CITES United States would have made funding available to implement the management programme dictated by CITES as well as to help develop an in-situ aquaculture project.

9. For example, “Ranching and trade in ranched specimens of species transferred from Appendix I to Appendix II” (CITES resolution Conf.11.16, available at: <http://www.cites.org/eng/res/11/11-16R14.shtml> 2008), and “Guidelines for a procedure to register and monitor operations that breed Appendix-I animal species for commercial purposes” (CITES Resolution Conf.12.10, available at: <http://www.cites.org/eng/res/12/12-10R14.shtml> 2008).

culturists more direct access to export activities. The restriction in trade of wild specimens (as would be imposed by Appendix I) would restrict the market to exclusively captive-bred specimens, which would provide to local producers a much better price than the current price paid to collectors, and the higher price per fish would more than offset the production costs. However, without restricting the trade of wild-caught specimens, it is difficult to see how in-situ aquaculture projects could succeed. Locals willing to invest several months of work and resources could not compete with the low price accepted by those that only require a hand net, a floating cage, and few hours of work.

At CoP 14, the conservation status of *Pterapogon kauderni* was disregarded. The parties chose to give more value to political and economic interests than to the survival of a species endangered by international trade, which is what the parties should be focusing on. It is hoped that personal interests and political susceptibilities will be put aside and that local, regional and national stakeholders can work together to develop a sustainable local aquaculture program. The author has offered technical assistance to develop such aquaculture projects to both federal (Director of Aquaculture, Ministry of Marine Affairs and Fisheries, Director of CITES) and regional authorities (Bupati Banggai Kepulauan District and head of Banggai Fisheries) during meetings held in Jakarta and Banggai in 2007, and he is still willing to provide such assistance if requested.

It is also hoped that non-local economic and political interests stop dictating the future survival of this species, which is a unique part of the special identity of the Banggai region.

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