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THE DIVERSITY SPECIES OF THE ORDER TETRAODONTIFORMES FROM VIETNAM

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Summary: *The present paper deals with the species composition of the order Tetraodontiformes from Vietnam. One hundred and nine species were recorded belonging to fifty one genera in seven families, four suborders.*

A comprehensive species list is provided including: the Puffers (Tetraodontidae) with 47 species, 13 genera; Filefishes (Monacanthidae): 26 species, 16 genera; Triggerfishes (Balistidae): 16 species, 11 genera; Boxfishes (Ostraciidae): 9 species, 3 genera; Porcupine fishes (Diodontidae): 6 species, 3 genera; Triplespine (Triacanthidae): 3 species, 3 genera and Ocean sunfishes (Molidae): only 2 species, 2 genera. Calculation of Sorrenson's index shows relative similarity of Tetraodontiformes fauna between Vietnam and Taiwan, Japan, Indonesia.

INTRODUCTION

Order Tetraodontiformes is one of the largest orders of fish fauna in Vietnam. They are locally exploited for food, and a lots for ornamental use in the aquariums. However, some species of the order are very dangerous because their bodies contain toxins (e.g. tetrodotoxin) that are responsible for a number of human deaths. The toxin could be in ovary (testis), liver, intestine, flesh or even the skin. Therefore studies on the species composition and distribution of the order are important to theoretical biology and to practical fisheries. However, there have been very few numbers of studies on those respects in Vietnam (Orsi, 1974; Ministry of Fisheries, 1996; Nguyen Huu Phung, 1999; Nguyen Nhat Thi, 2002, 2003 ...) up to present.

Studying on the composition and distribution patterns as well as the taxonomy, biochemistry and biology of the fish species of the order Tetraodontiformes has been carried out by the Institute of Oceanography in Vietnam since 2000.

The present paper provides basic information for future research on the order Tetraodontiformes in Vietnam.

MATERIALS AND METHODS

The fish specimens for this study were collected along the central coastal waters of Vietnam during 2000-2004 from Thanh Hoa to Ba Ria Vung Tau. Five hundred and fifty specimens were collected. Examination on species and their distribution from other areas were based on the collections of the Nha Trang and Hai Phong museums as well as previously publications (Sukhawisit, 1990; Nguyen Nhat Thi, 2002, 2003; Mai Dinh Yen, 2002...). Species identification was following literatures of Beaufort and Briggs (1962), Chu. (1962), Gloerfelt – Tarp and Kailola (1984); Shen (1993); and FishBase (2000).

After identifying, all fish specimens were preserved in Nha Trang and Hai Phong Marine museums for later taxonomical revisions.

We investigated compositional similarity between certain pairs of areas using Sorrenson's index. Both the qualitative (species presence) measures were calculated for the cluster. This measure provided information on compositional change at different levels as the abundance-based measures are more sensitive.

Sorrenson's index: $S = \dfrac{2c}{a+b}$

In which: a = number of species in zone A

b = number of species in zone B

c = number of species present in zones A and B

RESULTS

1. The species composition of the order Tetraodontiformes in Vietnam

The results have shown that species composition of the order Tetraodontiformes from Vietnam is rich. A total of 109 identified species belonging to 51 genera in 7 families and 4 suborders was recorded herein (Appendix). This is the most comprehensive list of fish species of the order Tetraodontiformes recorded from Vietnam.

The three most abundant families are Puffers (Tetraodontidae) (47 species, 13 genera), Filefishes (Monacanthidae) (26 species, 16 genera) and Triggerfishes (Balistidae) (16 species, 11genera). They comprise 89 species (81,6% of the total number of species of Tetraodontiformes from Vietnam). The next abundant families were Boxfishes (Ostraciidae) (9 species, 3 genera); Porcupine fishes (Diodontidae): (6 species, 3 genera); Triplespine (Triacanthidae): (3 species, 3 genera) and Ocean Sunfishes (Molidae): (2 species, 2 genera).

The Puffer was the most diverse in terms of species composition. The prevalent genera were Canthigaster (9 species), Lagocephalus (7 species), Takifugu, Tetraodon and Arothron (6 species for each). Many of them are very dangerous to human. The Filefishes

(Monacanthidae) are the second importance and include 26 species, especially Unicorn *Aluterus monoceros* (Linnaeus, 1758), a commercial edible fish with relatively high production and can be exported to Taiwan, China and Japan.

The others of them and a lot of Triggerfishes, Boxfishes and Porcupine fishes are ornamental use in aquariums.

In the Central Vietnam (from Da Nang to Vung Tau), the species composition of this order is very diverse (72 species), next the Gulf of Tonkin (49 species).

2. Similarity analysis among distribution areas

In Vietnam waters, based on the results in table 1, it shows that Sorrenson index (S) arranges from 0.0 to 0.57. It is highest between the zone of Central Vietnam (CV) and Gulf of Tonkin (GT) next Southern Vietnam (SV): 0.48. The similarity level between Spratly islands (Si) and Central Vietnam is also present highly with the index being: 0.45. There are some freshwater species recorded in the central waters with the highest index between Southern Vietnam and freshwaters - 0.15.

Table 1: Similarity coefficients among areas of Vietnam

Zones	GT	CV	SV	GTL	Si
CV	0.57				
SV	0.46	0.48			
GTL	0.36	0.46	0.42		
Si	0.19	0.45	0.28	0.26	
F	0.09	0.07	0.15	0.09	0.0

The similarity coefficient among nations in Indo-Pacific Ocean is presented in table 2. The similar level of Vietnam waters and others is following: Taiwan (TW): 0.74 and Japan (Jap), Indonesia (Ind.) and South China (SC): 0.73, as equal as between Japan (Jap) and Indonesia (Ind.) and is even lowest with Philippines (Phi.): 0,62.

Table 2: Similarity coefficients of some nations in Indo-Pacific Ocean

National waters	VN	Jap	SC.	TW	Phi.
Jap	0.73				
SC.	0.73	0.77			
TW	0.74	0.87	0.77		
Phi.	0.62	0.69	0.75	0.71	
Ind.	0.73	0.73	0.75	0.78	0.72

CONCLUSION

The species composition of the order Tetraodontiformes from Vietnam was presented. One hundred and nine species were collected belonging to fifty one genera in seven families, four suborders. By comparison with some adjacent nations Tetraodontiformes fauna of Vietnam is relatively similar to Taiwan, Japan and Indonesia.

REFERENCES

1. **Beaufort, L. F. de and J. C. Briggs, 1962.** The fishes of the Indo- Australian Archipelago – M. Weber and L. F. de Beaufort, Vol. XI, p. 262 – 421.
2. **Chu Y. T., 1962.** Fishes of the South China Sea. Science Published, p. 1015 – 1114.
3. **Froese N.; S.M. Luna and E.C. Capuli, 1996.** Checklist of Marine Fishes of Indonesia, Compiles from Published Literature – in Baseline studies of Biodiversity: The Fish Resources of Western Indonesia, p. 271 - 274.
4. **Gloerfelt-Tarp, T. and P.J. Kailola, 1984.** Trawled Fishes of Southern Indonesia and northern Australia - Published by Australian Development Assistance Bureau, Directorate General of Fisheries, Indonesia, German Agency Technical Cooperation, p. 280 - 299.
5. **Herre, A. W., 1953.** Check list of Philippine fishes - Research Report 20. Fish and Wildlife Service. United States Department of Interior, p. 821 - 851.
6. **Mai Dinh Yen, 2002.** The list of Freshwater fishes found in Vietnam. In: " Hydrobiology of the island waters in Vietnam". Science & Technique Publishing house, p. 389.
7. **Mai Dinh Yen, Nguyen Van Trong, Nguyen Van Thien, Lê Hoang Yen, Hua Bach Loan, 1992.** Identification of the Freshwater fishes of the Southern Vietnam. Science & Technique Publishing house, p.327 - 337.
8. **Masuda, H.; K. Amaoka, C. Araga, T. Uyeno and T. Yoshino, 1984.** The fishes of the Japanese Archipelago. Tokai University Press, Tokyo, Japan. p. 357 – 366.
9. **Ministry of Fishery, 1996.** Vietnam fish Resources. Agriculture Publishing house, p. 451 — 453.
10. **Nguyen Huu Phung, 1999.** Checklist of Marine Fishes in Vietnam. Vol. 5. Agriculture Publishing house, p.150 - 239.
11. **Nguyen Nhat Thi, 1999.** Species composition and distribution of coral reef fishes in Quang Ninh – Hai Phong coastal waters. Proceedings of the fourth National Conference on Marine Science and Technology. Hanoi, p. 1086 - 1101.

12. **Nguyen Nhat Thi, 2002.** The preliminary study on species composition and distribution of Marine fishes in the coastal water of the Northern province centre. Journal of Marine Science and Technology, p. 41 - 63.

13. **Nguyen Nhat Thi, 2003.** Species composition and structure of the Marine fish fauna in Ha Long Bay. Journal of Marine Science and Technology, p. 56 - 65.

14. **Orsi, J.J.,1974.** A check list of the marine and freshwater fishes of Vietnam. Publications of the Seto Marine Biological Laboratory, vol. 21, No. 3/4., p. 176.

15. **Rainboth, W. J., 1996.** Fishes of the Cambodian Mekong, Food and Agriculture Organization of the United Nation. Rome, p. 225 - 227.

16. **Shen S. C., 1993.** Fishes of Taiwan, Department of Zoology, National Taiwan University Taipei, p. 586 – 609.

17. **Sukhawisit, P., 1990.** Check list of the marine in the Gulf of Thailand. Fish Marketing Organization, Department of Fisheries, Thailand, 149 pp.

APPENDIX: LIST OF FISH SPECIES OF THE ORDER ETRAODONTIFORMES RECORDED FROM VIETNAM

No.	Species	Distribution in Vietnam						Distribution in neighboring waters				
		GT	CV	SV	GTL	Si	F	Jap	SC.	TW	Phi.	Ind.
	BALISTOIDEI.											
	TRIACANTHIDAE.											
1	*Pseudotriacanthus strigilifer* (Cantor, 1849)	+	+		+				+	+	+	+
2	*Triacanthus biaculeatus* (Bloch, 1786)	+	+		+			+	+	+	+	+
3	*Tripodichthys blochi* (Bleeker, 1852)		+						+	+	+	+
	BALISTIDAE.											
4	*Abalistes stellaris* (Bloch and Schneider, 1801)	+	+		+			+	+	+	+	+
5	*Balistapus undulatus* (Mungo Park, 1797).	+	+		+	+		+	+	+	+	+
6	*Balistes echarpe* Anonymous, 1799	+										
7	*Balistoides conspisilum* (Bloch and Schneider, 1801)		+		+	+		+	+	+	+	+
8	*Balistoides viridescens* (Bloch and Schneider, 1801)		+		+	+		+	+	+	+	+
9	*Canthidermis maculatus* (Bloch, 1786) = *C. rotundatus* (Proce, 1822)				+			+	+	+		+
10	*Melichthys vidua* (Solander, 1845)		+			+			+	+	+	+
11	*Odonus niger* (Ruppell, 1836)		+		+	+		+	+	+	+	+
12	*Pseudobalistes flavimarginatus* (Ruppell, 1829)				+			+	+	+	+	+
13	*Pseudobalistes fuscus* (Bloch and Schneider, 1801)		+		+			+	+	+	+	+
14	*Rhinecanthus aculeatus* (Linnaeus, 1758)		+			+		+	+	+	+	+
15	*Rhinecanthus rectangulus* (Bloch and Schneider, 1801)	+	+			+		+	+	+	+	+
16	*Sufflamen bursa* (Bloch and Schneider, 1801)		+	+		+		+		+	+	+
17	*Sufflamen chrysopterus* (Bleeker and Schneider, 1801)	+	+	+		+			+	+	+	+
18	*Sufflamen fraenatus* (Latreille, 1804)		+			+		+	+	+	+	+
19	*Xanthichthys lineopunctatus* (Hollard, 1854)					+		+	+	+		
	MONACANTHIDAE											
20	*Acreichthys tomentosus* (Linnaeus, 1758)		+					+	+		+	+
21	*Aluterus monoceros* (Osbeck, 1757)	+	+	+	+	+		+	+	+	+	+
22	*Aluterus scriptus* (Osbeck, 1765)		+					+	+	+	+	+
23	*Amanses scopas* (Cuvier, 1829)			+				+		+		+
24	*Anacanthus barbatus* Gray, 1831 = *Psilocephalus barbatus* (Gray, 1831)		+						+		+	+

25	*Arotrolepis sulcatus* (Hollard, 1854) = *Monacanthus sulcatus* Hollard, 1854	+							+	+		
26	*Cantherhines dumerili* (Hollard, 1854)	+						+	+	+		+
27	*Cantherhines pardalis* (Ruppell, 1837)		+			+		+	+	+	+	+
28	*Chaetodermis penicilligerus* (Cuvier, 1817)		+		+			+		+		+
	Species	**GT**	**CV**	**SV**	**GTL**	**Si**	**F**	**Jap**	**SC.**	**TW**	**Phi.**	**Ind.**
29	*Monacanthus chinensis* (Osbeck, 1765)	+	+		+			+	+	+	+	+
30	*Oxymonacanthus longirostris* (Bloch & Schneider, 1801		+		+	+		+	+	+	+	+
31	*Paraluteres prionurus* (Bleeker, 1851)	+	+					+		+		+
32	*Paramonacanthus choirocephalus* (Bleeker,1852)				+							
33	*Paramonacanthus japonicus* (Tilesius, 1810) = *Laputa japonica* Tilesius, 1810	+						+	+			+
34	*Paramonacanthus nematophorus* (Gunther, 1870) = *Stephanolepis nematophorus* Gunther, 1870	+										
35	*Paramonacanthus nipponensis* (Kamohara, 1939)	+						+	+			
36	*Pervagor aspricaudus* (Hollard, 1854)					+				+		
37	*Pervagor janthinosoma* (Bleeker, 1854)		+							+		+
38	*Pervagor melanocephalus* (Bleeker, 1853)		+						+			+
39	*Pseudalutarius nasicornis* (Schlegel, 1846)	+	+					+			+	+
40	*Pseudomonacanthus elongatus* Fraser-Brunner, 1940		+									
41	*Pseudomonacanthus pusillus* (Ruppell, 1829)	+										
42	*Rudarius ercodes* Jordan & Fowler, 1902	+						+	+			
43	*Stephanolepis cirrhifer* (Temminck and Schlegel, 1850)							+	+	+		
44	*Stephanolepis hispidus* (Linnaeus, 1766) = *S. setifer* (Bennet, 1831)	+									+	
45	*Thamnaconus modestus* (Gunther, 1877) = *Cantherhines modestus* Gunther, 1877	+	+					+		+		
	OSTRACIOIDEI											
	OSTRACIIDAE											
46	*Lactoria cornuta* Linnaeus, 1758		+	+	+			+	+	+	+	+
47	*Lactoria fornasini* (Bianconi, 1846)	+	+					+		+		+
48	*Ostracion cubicus* Linnaeus, 1758 = *O. tuberculatus* Linnaeus, 1758		+			+		+	+	+	+	+
49	*Ostracion immaculatus* Temminck and Schlegel, 1846	+	+					+				
50	*Ostracion meleagris* Shaw and Nodder, 1796		+			+		+		+		+
51	*Ostracion nasus* (Bleeker, 1785)	+	+	+	+				+		+	

	Species	GT	CV	SV	GTL	Si	F	Jap	SC.	TW	Phi.	Ind.
52	*Ostracion rhinorhynchos* (Bleeker, 1852)		+	+				+	+	+	+	+
53	*Tetrosomus concatenatus* (Bloch, 1786)	+	+	+	+			+	+	+		
54	*Tetrosomus gibbosus* (Linnaeus, 1758)	+	+	+	+			+	+	+	+	+
	TETRAODONTOIDEI.											
	TETRAODONTIDAE.											
55	*Amblyrhynchotes honckenii* (Bloch, 1785)	+	+						+			
56	*Arothron hispidus* (Linnaeus, 1758)	+	+	+		+		+	+	+	+	+
57	*Arothron immaculatus* (Bloch and Schneider, 1801)	+	+					+	+	+	+	+
58	*Arothron mappa* (Lesson, 1826)		+					+		+	+	
59	*Arothron nigropunctatus* (Bloch and Schneider, 1801)	+	+	+		+			+	+	+	+
60	*Arothron reticularis* (Bloch and Schneider, 1801)		+					+		+	+	
61	*Arothron stellatus* (Bloch and Schneider, 1801)	+	+	+				+	+	+		+
62	*Canthigaster amboinensis* (Bleeker, 1865)		+									
63	*Canthigaster bennetti* (Bleeker, 1830)		+			+		+		+	+	
64	*Canthigaster coronata* (Vaillant & Sauvage, 1875)		+					+		+		+
65	*Canthigaster jactator* Jenkin, 1901					+						
66	*Canthigaster margaritata* (Ruppell, 1828)				+							
67	*Canthigaster ocellicincta* Alen and Randall, 1977					+						+
68	*Canthigaster rivulata* (Temminck & schlegel, 1857)	+	+	+				+	+	+		
69	*Canthigaster solandri* (Richardson, 1845) = *C. cinctus*(Richardson, 1845)		+			+				+		+
70	*Canthigaster valentini* Bleeker, 1953		+	+		+		+	+	+	+	+
71	*Carinotetraodon lorteti* (Tirant, 1885)						+					
72	*Chelonodon biocellatus* (Tirant, 1885) = *Tetraodon biocellatus* (Tirant, 1885)						+					
73	*Chelonodon fluviatilis* (Hamilton, 1822) = *Tetraodon fluviatilis* Hamilton, 1822						+				+	
74	*Chelonodon patoca* (Hamilton, 1822)	+	+	+	+		+	+	+	+	+	+
75	*Chonerhinos nefastus* Robert,1982						+					
76	*Chonerhinos modestus* (Bleeker, 1851)						+					
77	*Lagocephalus gloveri* Abe & Tabeta, 1983		+		+			+		+		
78	*Lagocephalus inermis* (Temminck & Schlegel, 1847)	+	+	+	+			+	+	+		+
79	*Lagocephalus lagocephalus* (Linnaeus, 1758).	+										+
80	*Lagocephalus lunaris* (Bloch and schneider, 1801)	+	+	+	+			+	+	+	+	+

81	*Lagocephalus sceleratus* (Gmelin, 1789)		+	+	+		+	+	+	+	+	+
82	*Lagocephalus spadiceus* (Richardson, 1844)	+	+	+					+			+
83	*Lagocephalus suezensis* Clark & Gohar, 1953	+	+						+			
84	*Sphoeroides maculatus* (Bloch & Schneider, 1801)	+										
85	*Takifugu bimaculatus* (Richardson, 1844 – 1845)	+										
86	*Takifugu niphobles* (Jordan and snyder, 1901)	+	+	+				+	+	+		
87	*Takifugu oblongus* (Bloch, 1786)	+	+	+			+	+	+	+	+	
88	*Takifugu ocellatus* (Osbeck, 1757)	+					+		+		+	
89	*Takifugu poecilonotus* (Temminck & Schlegel,1850) = *T. alboplumbeus* Richardson, 1845	+	+					+	+	+		
90	*Takifugu xanthopterus* (Temminck and Schlegel, 1847).	+	+					+	+	+		
91	*Tetraodon alboreticulatus* Tanaka, 1908	+										
92	*Tetraodon cambodgiensis* (Chabanaud, 1923) = *Monotretus cambodgiensis* (Chabanaud, 1923)						+					
93	*Tetraodon cutcutia* Hamilton, 1822 = *Monotretus cutcutia* (Hamilton, 1822)						+					
	Species	**GT**	**CV**	**SV**	**GTL**	**Si**	**F**	**Jap**	**SC.**	**TW**	**Phi.**	**Ind.**
94	*Tetraodon fangi* (Pellegrin and Chevey, 1940) = *Monotretus fangi* (Pellegrin and Chevey, 1940)						+					
95	*Tetraodon leiurus* Bleeker, 1850						+					
96	*Tetraodon palembangensis* Bleeker, 1852						+					
97	*Torquigener brevipinnis* (Regan, 1903)		+									+
98	*Torquigener hypselogeneion* (Bleeker, 1852) ?	+						+	+	+	+	+
99	*Torquigener pallimaculatus* Hardy, 1983		+									
100	*Tylerius spinosissimus* (Regan, 1908) = *Amblyrhynchotes spinosissimus* Regan, 1908	+	+						+			+
101	*Xenopterus naritus* (Richardson, 1848)						+					
	DIODONTIDAE											
102	*Cyclichthys orbicularis* Bloch, 1785.		+	+	+				+		+	+
103	*Cyclichthys spilostylus* (Leis and Randall, 1982)		+									+
104	*Diodon holacanthus* Linnaeus, 1758	+	+	+	+	+		+	+	+	+	+
105	*Diodon hystrix* Linnaeus, 1758	+	+	+				+	+	+	+	+
106	*Diodon liturosus* Shaw, 1804		+			+		+	+	+		+
107	*Lophodiodon calori* (Bianconi, 1854)		+									+
	MOLOIDEI.											
	MOLIDAE											

108	*Masturus lanceolatus* (Linnaeus, 1841)		+					+	+		+	
109	*Mola mola* (Linnaeus, 1758).	+			+			+	+	+	+	+
Total		**50**	**72**	**24**	**28**	**26**	**15**	**62**	**63**	**64**	**49**	**62**

Notes:

GT: Gulf of Tonkin
CV: Central Vietnam
SV: Southern Vietnam
GTL: Gulf of Thailand
Si: Spratly islands
F: Fresh waters (Mai Dinh Yen et al., 1992)
Jap: Japan (following Masuda et al., 1984)
SC.: South of China
TW: Taiwan (Shen, 1993)
Phi: Philippines (Herre, 1953)
IND: Indonesia (Froese et al., 1996)
VN: Vietnam waters

ĐA DẠNG VỀ LOÀI CỦA BỘ CÁ NÓC (TETRAODONTIFORMES) Ở VIỆT NAM

TRẦN THỊ HỒNG HOA, NGUYỄN HỮU PHỤNG, TRẦN THỊ LÊ VÂN, VÕ VĂN QUANG

Tóm tắt: *Bài báo trình bày thành phần loài của bộ Cá Nóc Tetraodontiformes ở Việt Nam, bao gồm 109 loài, 51 giống, 7 họ và 4 phân bộ.*

Các loài được xếp trong một bảng, bao gồm họ Cá Nóc có 47 loài, 13 giống, họ Cá Bò Giấy Monacanthidae có 26 loài, 16 giống; họ Cá Bò Balistidae có 16 loài, 11 giống; họ Cá Nóc Hòm Ostraciidae có 9 loài, 3 giống; họ Cá Nóc Nhím Diodontidae có 6 loài, 3 giống; họ Cá Bò Ba Gai Triacanthidae có 3 loài, 3 giống và họ Cá Mặt Trăng Molidae chỉ có 2 loài, 2 giống. Đây là một nhóm cá tương đối phong phú và đa dạng ở Việt Nam. Phân tích chỉ số Sorrenson cho thấy khu hệ cá Nóc Việt Nam tương đối giống với khu hệ cá này ở Đài Loan, Nhật Bản và Indonesia.

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