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山口県響灘における小型底びき網の漁獲物

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Aquatic animals caught by a small beam trawl net from Hibiki-nada Sea off Yamaguchi Prefecture, Japan

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Abstract: Aquatic animals fished by 37 operations of a small beam trawl net at the Hibiki-nada Sea off Yamaguchi Prefecture, Japan, were surveyed in all seasons from 2002 through 2009. A total of 317 species including 1 chordate, 204 fishes(FS) and 112 invertebrates(IV) were caught. Among them, 126 FS and 75 IV were judged as rare(caught in less than 8 operations), 36 FS and 28 IV as occasional(8 to 14 operations), 21 FS and 8 IV as often(15 to 22 operations), 16 FS and 1 IV as frequent(23 to 29 operations), and 5 FS and 0 IV as general(more than 29 operations). Sixty-eight FS and 28 IV were caught in all seasons, 107 FS and 71 IV were in spring, 139 FS and 79 IV were in summer, 148 FS and 81 IV were in autumn, and 125 FS and 43 IV were in winter. From distributional point of view, 70 FS and 42 IV were subtropical species, 91 FS and 62 IV were temperate region species, and 43 FS and 7 IV were large areal species.

Key words: trawl fishery, fish, invertebrate, rare species, by-catch, biodiversity

緒 言

響灘は、山口県西部から福岡県北部に至る水深 80m 以浅の日本海南西部の海域で、沖合を対馬暖流が北東流する。海域の島礁周辺では好漁場が発達して沿岸漁業が盛んに営まれており¹⁾, 小型底びき網漁業はこの海域を代表する漁業の一つである。この漁法は魚介類選択性の低い漁業であり、その漁獲物は海域の生物相をよく代表していると考えられている²⁾。本海域を含む山口県日本海域に出現した魚類は 39 目 197 科 870 種³⁾, 稀に出現する特記的生物は無脊椎動物 140 種, 脊索動物 4 種, 魚類 245 種, 爬虫類 4 種におよぶことが報告されているが^{4,5)}, 実際に漁獲される魚介類の季節的変動や多寡については必ずしも明らかではなく, さらに無脊椎動物については特記種以外の十分な調査がなされているとは言い難い。本調査研究は, 7 年

間にわたって小型底びき網漁船に同乗し, 漁獲される魚介類の周年変動等に関する基礎資料を得ることを目的とした。

材料及び方法

本調査で乗船した漁船は, 下関市吉見沖から吉母沖の響灘において水深 28m から 35m の海域 (Fig. 1) で操業する「エビ漕ぎ網」と称される小型底びき網漁船一隻 (総トン数 2.9 トン) である。調査に用いた漁具は 1 条びき 1 網で, 曳網長は 200m, ビーム長 13m, 網全長 22m, コッドエンドの目合 24 本 9 節であった。曳網速度は 1.4 から 1.7 ノットで, 曳網時間は 2 時間から 2 時間 30 分であった。1 操業での曳網回数は 3 回から 5 回で, 日没前の 1 回目の網上げ以降は夜間操業であった。調査は 2002 年 9 月

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から 2009 年 10 月の間の周年にわたり, 春期 6 回, 夏期 11 回, 秋期 12 回, 冬期 8 回の合計 37 回実施した (Table 1)。

漁獲物は可能な限り船上で同定しおよその漁獲量を記録したが, 同定困難な種は持ち帰り, 分類群ごとの専門書⁶⁻¹⁵⁾に基づいて種の査定を行った。メバル属 *Sebastes* についてはアカメバル *S. inermis* Cuvier, クロメバル *S. ventriosus* Temminck and Schlegel, シロメバル *S. cheni* Barsukov に区別されているが⁶⁾, 船上での同定が困難であるものの重要な食用魚で持ち帰ることができなかったため, 本研究では *Sebastes* spp. と一括して扱うこととした。アカエビ属 *Metapenaeopsis* においても, アカエビ *M. barbata* (De Haan), トラエビ *M. acclivis* (Rathbun), ツノソリアカエビ *M. dura* Kubo, モギエビ *M. mogiensis* (Rathbun), およびキシエビ *M. dalei* (Rathbun) が混在すると考えられたが, 同様に持ち帰ることができなかったため本研究では *Metapenaeopsis* spp. と一括して扱うこととした。

出現したそれぞれの種について, 鈴木・宇野による研究¹⁶⁾を参考に漁獲時期を春期 (3-5 月), 夏期 (6-8 月), 秋期 (9-11 月), 冬期 (12-2 月) に区分し, 1 操業時の漁獲数を 1 個体 (1), 2-19 個体 (+), 20-99 個体 (++), 100 個体以上 (+++) に分けて整理した。

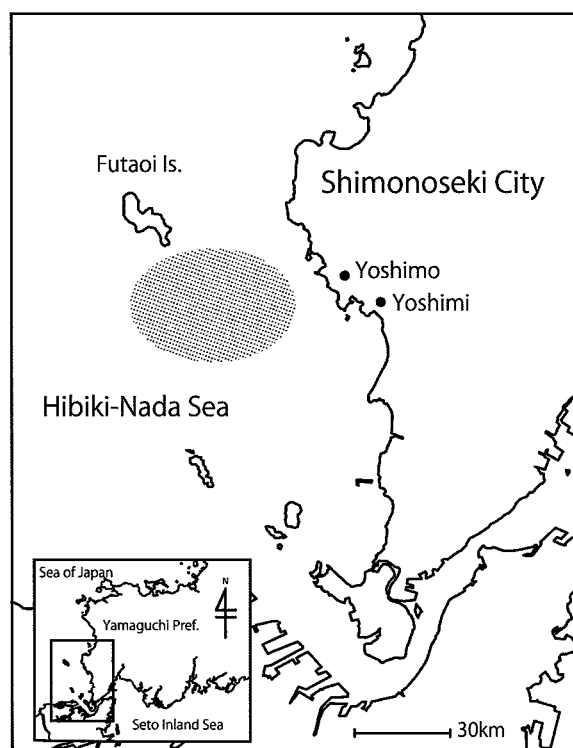


Fig. 1. Map showing the Hibiki-nada Sea area where beam trawl fishing was operated.

また, 調査回数 37 回に対する出現頻度は, 稀 (rare, 7 回以下), やや稀 (occasional, 8-14 回), 普通 (often, 15-22 回), やや頻繁 (frequent, 23-29 回), 頻繁 (general, 30 回以上) の 5 段階に区分した。さらに, 分類群ごとの専門書⁶⁻¹⁵⁾による情報を基に, 海洋生物気候帯区分に基づく生物地理区に従って^{7,17)}, 南方系種 (subtropical species), 温帯性種 (temperate region species) および広域分布種 (large areal species) の 3 群に分布特性を大別した。

結果及び考察

出現した漁獲生物は魚類 204 種 (複合種 1 を含む), 無脊椎動物 112 種 (複合種 1 を含む), 及び脊索動物ホヤ綱 1 種の合計 317 種であった (Appendix 1)。魚類の内訳はメタウナギ綱 1 種, 軟骨魚綱 11 種, 硬骨魚綱 192 種, 無脊椎動物の内訳は刺胞動物 12 種, 有櫛動物 2 種, 軟体動物 32 種, 環形動物 1 種, 節足動物 50 種, 棘皮動物 15 種であった。

稀種は魚類 126 種, 無脊椎動物 75 種, やや稀種は魚類 36 種, 無脊椎動物 28 種, 普通種は魚類 21 種, 無脊椎動物 8 種, やや頻繁種は魚類 16 種, 無脊椎動物 1 種, 頻繁種は魚類 5 種, 無脊椎動物 0 種であった。

多くの種が稀にしか漁獲されず, 逆に頻繁種はマダイ *Pagrus major*, シログチ *Pennahia argentata*, タマガンゾウビラメ *Pseudorhombus pentophthalmus*, メイタガレイ *Pleuronichthys cornutus*, カワハギ *Stephanolepis cirrifer* の 5 種で, タマガンゾウビラメ以外はいずれも重要な漁獲対象魚類であった。

魚類 17 種, 無脊椎動物 10 種については調査期間を通じて 1 個体しか漁獲されなかった。魚類ではシャチブரி *Ateleopus japonicus*, イタチウオ *Brotula multibarbata*, ヨロイイタチウオ *Hoplobrotula armata*, サギフエ

Table 1. Sampling numbers at beam trawl operations in Hibiki-nada Sea, Yamaguchi Prefecture, from 2002 through 2009

Year	Spring	Summer	Autumn	Winter	Total
2002	0	0	3	0	3
2003	3	3	2	3	11
2005	0	1	2	1	4
2006	1	1	1	1	4
2008	0	4	2	2	8
2009	2	2	2	1	7
Total	6	11	12	8	37

Macroramphosus sagifue, タツノオトシゴ
Hippocampus coronatus, キツネメバル
Sebastes vulpes, シマヒメヤマノカミ
Dendrochirus brachypterus, アブオコゼ
Erisphex pottii, ヒレナガカナガシラ
Lepidotrigla kanagashira, ハタタテダイ
Heniochus acuminatus, カゴカキダイ
Microcanthus strigatus, マサバ *Scomber japonicus*, サワラ *Scomberomorus niphonius*, アラメガレイ *Tarphops oligolepis*, ベニカワムキ *Triacanthodes anomalus*, サラサハギ
Thamnaconus hypargyreus, ハコフグ

*Ostracion immaculatum*であった。そのうち、マサバ、サワラ、ハコフグのように本海域に多く生息していると推測されるものの底びき網の漁獲特性から入網しにくかった種以外は、実際に本海域では稀な魚類がほとんどであると考えられる。一方、無脊椎動物はスナイツギンチャク *Dofleinia armata*, ウミカラマツ *Antipathes japonica*, ウズラミヤシロガイ *Tonna sukosa*, ホソハスエラウミウシ *Armina semperi*, オオカイカムリ *Dromidiopsis dormia*, サメハダヘイケガニ *Paradorippe granulata*, アカホシコブシ *Urnalana haematostica*, シワガザミ *Liocarcinus corrugatus*, シマイシガニ *Charybdis (Charybdis) ferata*, アカウニ *Pseudocentrotus depressus*で、定置網や潜水などのほかの漁法でも漁獲されるシワガザミ、アカウニ以外はこの海域では珍しい種であると考えられる。

季節を通じて周年出現した魚類は68種、無脊椎動物は28種におよんだ。春期に出現した魚類は107種、無脊椎動物71種、夏期に出現した魚類は139種、無脊椎動物79種、秋期に出現した魚類は148種、無脊椎動物81種、冬期に出現した魚類は125種、無脊椎動物43種で、魚類、無脊椎動物共に秋期が最も出現種数が多く、逆に出現種数が少なかったのは魚類では春期、無脊椎動物では冬期という結果であった。

春期のみの出現は魚類10種と無脊椎動物8種、夏期のみの出現は魚類20種と無脊椎動物10種、秋期のみの出現は魚類20種と無脊椎動物14種、冬期のみの出現は魚類10種と無脊椎動物1種であった。一季節しか出現しないが大量に出現する種としては、春期のカナダ *Lepidotrigla guentheri*, 秋期のキダイ *Dentex hypselosomus*, 秋期のイトフエフキ *Lethrinus genivittatus*, 夏期のアンドンクラゲ *Carybdea brevipedalia*, 春期のスルメイカ *Todarodes pacificus* が挙げられ、それらは定期的な回遊種でキダイや

Table 2. Numbers of species collected by the beam trawl fishing in Hibiki-nada Sea from 2002 through 2009, shown by the occurrence frequency from rare to general and by the distribution area from subtropical to large areal species

Distribution area	Occurrence frequency					Total
	Rare	Occasional	Often	Frequent	General	
FISH						
Subtropical sp.	43(34.1%)	15	8	4	0	70(34.3%)
Temperate sp.	50(39.7%)	17	9	10	5	91(44.6%)
Large areal sp.	33(26.2%)	5	4	1	0	43(21.1%)
INVERTEBRATE						
Subtropical sp.	29(39.2%)	10	2	1	0	42(37.8%)
Temperate sp.	42(56.8%)	14	6	0	0	62(55.9%)
Large areal sp.	3(4.0%)	4	0	0	0	7(6.3%)

スルメイカは重要な水産資源となっている。これら5種以外は季節的に来遊する稀な種であると考えられる。

山口県日本海域に出現が確認されている魚類870種³⁾のうち、約23%に相当する種が本調査で確認された。山口県での特記的な(稀な)魚類245種^{4,5)}のうちの32種(13%)が、無脊椎動物140種^{4,5)}のうち15種(11%)が本調査で確認されたが、それ以外の種はこの海域で通常に分布する種と考えられる。

分布特性においては、魚類では南方系種70種(34.3%)、温帯性種91種(44.6%)、広域分布種43種(21.1%)、無脊椎動物では南方系種42種(37.8%)、温帯性種62種(55.9%)、広域分布種7種(6.3%)であった。出現頻度と分布特性の関係をTable 2に示した。南方系の種がより稀に出現する、またはその逆などの傾向は特に認められなかった。

本研究での出現魚類の分布特性を、鳥取県浦富¹⁷⁾、福岡県津屋崎¹⁸⁾、及び長崎県野母崎¹⁹⁾の沿岸魚類相と比較すると(Table 3)、南方系魚類は北に行くに従って減少し、逆に温帯性魚類は増加する傾向にあったが、南方系魚類は鳥取県浦富より若干少ない割合であった。また、本調査における山口県の結果では広域分布種が約20%と他地域よ

Table 3. Coastal fish species composition in % as shown by the distribution area from subtropical, temperate, and large areal species, from Nagasaki (Nomoaki¹⁹⁾), Fukuoka (Tsuyazaki¹⁸⁾), Yamaguchi (Hibiki-nada), and Tottori (Tottori¹⁷⁾) Prefectures

	Nomoaki ¹⁹⁾	Tsuyazaki ¹⁸⁾	Hibiki-nada	Tottori ¹⁷⁾
Subtropical sp.	63.0	49.8	34.3	37.9
Temperate sp.	28.7	42.2	44.6	53.1
Large areal sp.	8.3	8.0	21.1	9.0

17) Wada et al.(2014); 18) Nishida(2008); 19) Tawa and Takegaki(2009).

り高い傾向が認められた。これは、今回が底びき網の漁獲物調査であることに對し、他地域では沿岸の潜水調査に基づいたものであることによるものと考えられる。

今後、定置網のような他の漁法についても同様の調査を行うことにより、この海域での水産資源生物の出現状況がさらに明らかになってくるものと考えられる。また本調査で、漁獲生物の多くが稀にしか出現しないものであることが明らかとなった。しかもそれらの多くは有用種の混獲として取扱われることが多いであろう。それら低利用資源の有効利用を図ること、およびできるだけそのような混獲を避ける漁法を工夫することは、資源を無駄にしないためにもますます重要になってくるであろう。

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Appendix 1. List of animals caught by the beam trawl fishing in Hibiki-nada Sea, Yamaguchi Prefecture, from 2002 through 2009

		Species	Japanese name	Spring	Summer	Autumn	Winter	frequency (actual times)	Distribution area
FISH									
MYXINI									
Myxiniformes									
	Myxinidae	<i>Eptatretus burgeri</i> (Girard)	Nutaunagi	+	+	+	+	rare (7)	temperate
CHONDRICHTHYES									
Carcharhiniformes									
	Triakididae	<i>Mustelus manazo</i> Bleeker	Hoshizame	+	+	1~+	1~++	often (20)	temperate
		<i>Mustelus griseus</i> Pietschmann	Shirozame	1~+	+	1~+	+	often (16)	temperate
Rhinobatiformes									
	Rhinobatidae	<i>Rhinobatos hynnicephalus</i> Richardson	Komonsakatazame	+	1~+	+	+	fequent (29)	temperate
	Platyrrhinidae	<i>Platyrrhina tangi</i> Iwatsuki,Zhang and Nakaya	Uchiwazame		1	+	1~+	occasional (9)	temperate
Torpediniformes									
	Torpedinidae	<i>Narke japonica</i> (Temminck and Schlegel)	Sibireei	+	+	1~+	+~++	occasional (11)	temperate
Rajiformes									
	Rajidae	<i>Dipturus kwangtungensis</i> (Chu)	Gangiei		1	+	+	rare (6)	temperate
		<i>Okamejei kanojei</i> (Müller and Henle)	Komonkasube	1~+	+	+	1~++	often (16)	temperate
Myliobatiformes									
	Dasyatidae	<i>Dasyatis akajei</i> (Müller and Henle)	Akaei	+	+	1~+	++	fequent (25)	subtropical
	Gymnuridae	<i>Gymnura japnica</i> (Temminck and Schlegel)	Tsubakuroei	1~+	+	1~+	+	occasional (11)	subtropical
	Myliobatididae	<i>Myliobatis tobijei</i> Bleeker	Tobiei	1~+	1~+	1~+	+	often (17)	subtropical
		<i>Aetobatus narutobie</i> White, Furumitsu and Yamaguchi	Narutobie		1	+		rare (3)	subtropical
OSTEICHTHYES									
Anguilliformes									
	Muraenidae	<i>Gymnothorax minor</i> (Temminck and Schlegel)	Amiutsubo		1~+			rare (2)	subtropical
Ophichthidae									
		<i>Ophisurus macrorhynchos</i> Bleeker	Dainanumihebi	1		+		rare (2)	subtropical
		<i>Ophichthus altipennis</i> (Kaup)	Hotateumihebi		1~+	+		rare (4)	temperate
	Congridae	<i>Ariosoma meeki</i> (Jordan and Snyder)	Gotenanago	+		1~+	+	occasional (9)	large area
		<i>Ariosoma majus</i> (Asano)	Ooshiroanago			1	+	rare (4)	subtropical
		<i>Conger myriaster</i> (Brevoort)	Maanago	1~+	1~+	1~+	1~+	often (20)	large area
		<i>Conger cinereus</i> Rüppell	Kirianago		+			rare (1)	subtropical
		<i>Conger japonicus</i> Bleeker	Kuroanago		1			rare (2)	large area
	Muraenesocidae	<i>Muraenesox cinereus</i> (Forssakâi)	Hamo	1~+	+	1~+	+~++	often (21)	large area
Clupeiformes									
	Clupeidae	<i>Konosirus punctatus</i> (Temminck and Schlegel)	Konoshiro	+			1	rare (3)	large area
	Engraulidae	<i>Engraulis japonica</i> Temminck and Schlegel	Katakuchiiwashi	+	+		+	rare (5)	large area
Siluriformes									
	Plotosidae	<i>Plotosus japonicus</i> Yoshino and Kishimoto	Gonzui	+~++	+	+~+++	+~+++	often (21)	subtropical

+, 2–19 individuals: ++, 20–99: +++, 100 or more.

Rare, less than 8 times: occasional, 8–14: often, 15–22: frequent, 23–29: general, 30 or more.

Appendix 1. Continued

	Species	Japanese name	Spring	Summer	Autumn	Winter	frequency (actual times)	Distribution area
Ateleopodiformes								
Ateleopodidae	<i>Ateleopus japonicus</i> Bleeker	Syachiburi		1			rare (1)	large area
Aulopiformes								
Synodontidae	<i>Saurida elongata</i> (Temminck and Schlegel)	Tokageeso	++~+++	++~+++	+~+++	+~+++	frequent (27)	temperate
	<i>Saurida macrolepis</i> Tanaka	Maeso	+	++	++	+	occasional (10)	subtropical
	<i>Saurida wanieso</i> Shindo and Yamada	Wanieso	++	++	++~+++	+~++	often (15)	subtropical
	<i>Trachinocephalus myops</i> (Forster)	Okieso		+	1~++	1	occasional (8)	subtropical
Aulopidae	<i>Hime japonica</i> (Gunther)	Hime		1			rare (1)	large area
Gadiformes								
Macrouridae	<i>Coelorinchus multispinulosus</i> Katayama	Yarihige				+	rare (1)	large area
Ophidiiformes								
Ophidiidae	<i>Brotula multibarata</i> Temminck and Schlegel	Itachiyo			1		rare (1)	subtropical
	<i>Siremba imberbis</i> (Temminck and Schlegel)	Umidojyou	+	+~++	1~+	+~++	often (19)	subtropical
	<i>Hoplobrotula armata</i> (Temminck and Schlegel)	Yoroiitachiyo		1			rare (1)	large area
Lophiiformes								
Lophiidae	<i>Lophiomus setigerus</i> (Vahl)	Ankou	1	+		1	rare (6)	large area
	<i>Lophius litulon</i> (Jordan)	Kiankou	+	1~+	1	1~++	occasional (12)	large area
Antennariidae	<i>Antennarius striatus</i> (Shaw)	Kaeruan kou		+		1	rare (2)	large area
Ogcocephalidae	<i>Malthopsis annulifera</i> Tanaka	Wanukefuuryuuo		1	1		rare (2)	subtropical
Beryciformes								
Monocentridae	<i>Monocentris japonica</i> (Houttuyn)	Matsukasauo	+	1~+	1~+		rare (6)	large area
Zeiformes								
Zeidae	<i>Zenopsis nebulosa</i> (Temminck and Schlegel)	Kagamidai		+			rare (4)	large area
	<i>Zeus faber</i> Linnaeus	Matoudai	1~+	1~+		+	occasional (14)	subtropical
Gasterosteiformes								
Fistulariidae	<i>Fistularia petimba</i> Lacepède	Akayagara		+	+		rare (3)	large area
	<i>Fistularia commersonii</i> Rüppell	Aoyagara		+		+	rare (4)	subtropical
Macroramphosidae	<i>Macroramphosus sagifue</i> Jordan and Starks	Sagifue	1				rare (1)	large area
Syngnathidae	<i>Hippocampus trimaculatus</i> Leach	Takakuratatsu		1			rare (2)	large area
	<i>Hippocampus kelloggi</i> Jordan and Snyder	Ooumiuma			1	+	rare (2)	large area
	<i>Hippocampus coronatus</i> Temminck and Schlegel	Tatsunootoshigo	1				rare (1)	temperate
Perciformes								
Sebastidae	<i>Sebastiscus marmoratus</i> (Cuvier)	Kasago	+	+	+	+~++	often (19)	temperate
	<i>Sebastiscus tertius</i> Barsukov and Chen	Ukkarikasago		+			rare (1)	large area
	<i>Sebastes schlegelii</i> Hilgendorf	Kurosoi				+	rare (1)	temperate
	<i>Sebastes</i> spp.	Mebaru	+	+	+		rare (7)	temperate
	<i>Sebastes vulpes</i> Döderlein	Kitsunemebaru				1	rare (1)	temperate

+, 2–19 individuals: ++, 20–99: +++, 100 or more.

Rare, less than 8 times: occasional, 8–14: often, 15–22: frequent, 23–29: general, 30 or more.

Appendix 1. Continued

	Species	Japanese name	Spring	Summer	Autumn	Winter	frequency (actual times)	Distribution area
Scorpaenidae	<i>Pterois lunulata</i> Temminck and Schlegel	Minokasago	1~+	1~+	+~++	+	frequent (23)	subtropical
	<i>Dendrochirus brachypterus</i> (Cuvier)	Shimahimeyamanokarr	1				rare (1)	subtropical
	<i>Scorpaenopsis cirrosa</i> (Thunberg)	Onikasago		+	+		rare (3)	subtropical
	<i>Scorpaena miostoma</i> Günther	Kokuchifusakasago	+~++	+	+~++	+~+++	frequent (26)	temperate
	<i>Scorpaena onaria</i> Jordan and Snyder	Fusakasago				+	rare (2)	large area
Apistidae	<i>Apistus carinatus</i> (Bloch and Schneider)	Hachi		+	1~+		occasional (8)	subtropical
Tetrarogidae	<i>Hypodytes rubripinnis</i> (Temminck and Schlegel)	Haokoze	1~+		+	+	rare (6)	subtropical
Synanceiidae	<i>Inimicus didactylus</i> (Pallas)	Himeoniokoze	1			+	rare (3)	subtropical
	<i>Inimicus japonicus</i> (Cuvier)	Oniokoze	+~++	1~+	1~++	+~++	frequent (28)	subtropical
	<i>Minous monodactylus</i> (Bloch and Schneider)	Himeokoze	+	1~+	+	1~++	occasional (10)	subtropical
	<i>Minous pusillus</i> Temminck and Schlegel	Yaseokoze		+			rare (1)	subtropical
	<i>Erosa erosa</i> (Cuvier)	Darumaokoze	1~+		1~+	1~+	often (17)	subtropical
Aploactinidae	<i>Kanekonia florida</i> Tanaka	Hanachigookoze		+			rare (1)	temperate
	<i>Erisphex pottii</i> (Steindachner)	Abuokoze	1				rare (1)	large area
Triglidae	<i>Chelidonichthys spinosus</i> (McClelland)	Houbou	+	+	+	1~++	occasional (25)	large area
	<i>Lepidotrigla japonica</i> (Bleeker)	Togekanagashira		+	+~+++	+~++	rare (7)	subtropical
	<i>Lepidotrigla guentheri</i> Hilgendorf	kanado	+++				rare (1)	subtropical
	<i>Lepidotrigla kanagashira</i> Kamohara	Hirenagakanagashira				1	rare (1)	subtropical
	<i>Lepidotrigla kishinouyei</i> Snyder	Onikanagashira				+	rare (1)	subtropical
Platycephalidae	<i>Lepidotrigla microptera</i> Gunther	Kanagashira					rare (2)	large area
	<i>Platycephalus</i> sp.2	Magochi	1~+	+	1~+	+	occasional (10)	temperate
	<i>Cociella crocodila</i> (Cuvier)	Inegochi	+		+	+	rare (6)	temperate
	<i>Inegocia japonica</i> (Cuvier)	Tokagegochi	+~++	+~++	+~++	+~++	frequent (29)	subtropical
	<i>Inegocia ochiaii</i> Imahara	Wanigochi			+	+	rare (2)	subtropical
	<i>Sugggrundus meerdervoortii</i> (Bleeker)	Megochi	1		+	1	rare (4)	temperate
	<i>Onigocia spinosa</i> (Temminck and Schlegel)	Onigochi		+	+	+	rare (7)	subtropical
	<i>Thysanophrys celebica</i> (Bleeker)	Serebesugochi	+~++	+	+	+	occasional (10)	subtropical
Lateolabracidae	<i>Lateolabrax japonicus</i> (Cuvier)	Suzuki	+	+		+	rare (7)	temperate
Serranidae	<i>Triso dermopterus</i> (Temminck and Schlegel)	Tobihata			+		rare (1)	subtropical
	<i>Anyperodon leucogrammicus</i> (Valenciennes)	Azukihata	1				rare (2)	subtropical
	<i>Epinephelus septemfasciatus</i> (Thunberg)	Mahata	+	1~+	1~++	+	occasional (14)	subtropical
	<i>Epinephelus areolatus</i> (Forsskal)	Oomonhata				+	rare (1)	subtropical
	<i>Epinephelus awoara</i> (Temminck and Schlegel)	Aohata	+	+	1~++	1~+	often (19)	subtropical
Opistognathidae	<i>Opistognathus evermanii</i> (Jordan and Snyder)	Nijiamadai		1	1	1	rare (3)	temperate
Priacanthidae	<i>Priacanthus macracanthus</i> Cuvier	Kintokidai		+~++	+		rare (6)	subtropical

+, 2–19 individuals: ++, 20–99: +++, 100 or more.

Rare, less than 8 times: occasional, 8–14: often, 15–22: frequent, 23–29: general, 30 or more.

Appendix 1. Continued

	Species	Japanese name	Spring	Summer	Autumn	Winter	frequency (actual times)	Distribution area
Apogonidae	<i>Apogon kiensis</i> Jordan and Snyder	Teppouishimochi	++	+~++	+~++		rare (7)	subtropical
	<i>Apogon semilineatus</i> Temminck and Schlegel	Nenbutudai	++	1~+	+~+++	++	often (17)	temperate
	<i>Apogon endekataenia</i> Bleeker	Kosujiishimochi		+	1~+		rare (4)	subtropical
	<i>Apogon niger</i> Döderlein	Kuroishimochi			1~+	+	occasional (8)	subtropical
	<i>Apogon carinatus</i> Cuvier	Matoishimochi	++	+~++		+	occasional (8)	subtropical
	<i>Apogon lineatus</i> Temminck and Schlegel	Tenjikudai	+~+++	+~+++	+~++	+~+++	frequent (24)	large area
Scombroptidae	<i>Scombrops boops</i> (Houttuyn)	Mutsu			+		rare (1)	large area
Rechycentridae	<i>Rachycentron canadum</i> (Linnaeus)	Sugi			+		rare (3)	large area
Family Carangidae	<i>Seriolina nigrofasciata</i> (Rüppell)	Aiburi			1~+		rare (2)	subtropical
	<i>Trachurus japonicus</i> (Temminck and Schlegel)	Maaji	+	1~++	+~+++	++	frequent (23)	temperate
	<i>Decapterus maruadsi</i> (Temminck and Schlegel)	Maruaji		+~++	+~++	++	occasional (11)	subtropical
	<i>Alectis ciliaris</i> (Bloch)	Itohikiaji		+	+		rare (2)	large area
	<i>Kaiwarinus equula</i> (Temminck and Schlegel)	Kaiwari	+	+~+++	+~++	++	often (21)	large area
	<i>Nuchequula nuchalis</i> (Temminck and Schlegel)	Hiiragi	+	++	++	+	rare (7)	temperate
Leiognathidae	<i>Equulites rivulatus</i> (Temminck and Schlegel)	Okihiragi	+	+~++	+~++		often (15)	temperate
	<i>Lutjanus ophuysenii</i> (Bleeker)	Yokosujifuedai			1		rare (1)	subtropical
Haemulidae	<i>Parapristipoma trilineatum</i> (Thunberg)	Isaki		+	+~++		rare (5)	temperate
	<i>Diagramma picta</i> (Thunberg)	Korodai	1		+~++	1	occasional (9)	subtropical
	<i>Plectorhinchus cinctus</i> (Temminck and Schlegel)	Kosyoudai			1~+	1	rare (5)	subtropical
Nemipteridae	<i>Nemipterus virgatus</i> (Houttuyn)	Itoyoridai	++	++~+++	+~++	+~++	often (17)	subtropical
Sparidae	<i>Acanthopagrus schlegelii</i> (Bleeker)	Kurodai	+	1	1~+	+	rare (5)	large area
	<i>Pagrus major</i> (Temminck and Schlegel)	Madai	+~++	+~+++	+~+++	1~+++	general (34)	temperate
	<i>Evynnis tumifrons</i> (Temminck and Schlegel)	Chidai		++	++	+	rare (3)	large area
	<i>Dentex hypselosomus</i> Bleeker	Kidai			+++		rare (1)	subtropical
	<i>Lethrinus genivittatus</i> Valenciennes	Itoufufuki			+~++		rare (3)	subtropical
Sciaidae	<i>Pennahia argentata</i> (Houttuyn)	Shiroguchi	+	1~+	1~++	+~++	general (30)	temperate
Sillaginidae	<i>Sillago japonica</i> Temminck and Schlegel	Shirogisu	1~+	1~+	+~++	+~++	frequent (24)	temperate
Mullidae	<i>Upeneus japonicus</i> (Houttuyn)	Himeji	+~++	+~++	+~++	+~++	frequent (27)	temperate
Chaetodontidae	<i>Heniochus acuminatus</i> (Linnaeus)	Hatatatedai			1		rare (1)	subtropical
	<i>Heniochus diphreutes</i> Jordan	Murehatatatedai			+		rare (1)	subtropical
	<i>Roa modesta</i> (Temminck and Schlegel)	Genrokudai	+	+	1~+	+	occasional (9)	subtropical
Pomacanthidae	<i>Chaetodontoplus septentrionalis</i> (Temminck and Schlegel)	Kinchakudai		+	+	+	rare (6)	temperate
Cheilodactylidae	<i>Goniistius zonatus</i> (Cuvier)	Takanohadai		+			rare (2)	temperate
	<i>Goniistius quadricornis</i> (Günther)	Yudachitakanoha		++	1		rare (2)	temperate
	<i>Goniistius zebra</i> (Döderlein)	Migimaki		+			rare (1)	temperate
Cepolidae	<i>Capola schlegelii</i> Bleeker	Sumitsukiakatachi		+		1	rare (2)	temperate
	<i>Acanthocephala limbata</i> (Valenciennes)	Ittenakatachi	+	+	1~+	+	occasional (8)	temperate
	<i>Acanthocephala krusensternii</i> (Temminck and Schlegel)	Akatachi	1~+	1~++	1~+	1	often (20)	temperate

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Appendix 1. Continued

	Species	Japanese name	Spring	Summer	Autumn	Winter	frequency (actual times)	Distribution area
Pomacentridae	<i>Chromis fumeus</i> (Tanaka)	Matsubasuzumedai		+	+	++	rare (5)	subtropical
Teraponidae	<i>Terapon theraps</i> Cuvier	Himekotohiki		+	+	+	rare (3)	temperate
	<i>Rhynchopelates oxyrhynchus</i> (Temminck and Schlegel)	Shimaisaki				+	rare (1)	temperate
Microcanthidae	<i>Microcanthus strigatus</i> (Cuvier)	Kagokakidai		1			rare (1)	subtropical
Centrolophidae	<i>Psenopsis anomala</i> (Temminck and Schlegel)	Ibodai		+	1~+	+	occasional (11)	large area
Stromateidae	<i>Pampus punctatissimus</i> (Temminck and Schlegel)	Managatsuo		+	1~+	1~+	rare (7)	temperate
Labridae	<i>Choerodon azurio</i> (Jordan and Snyder)	Ira	+	1~+	1~+	1~+	occasional (12)	subtropical
	<i>Pseudolabrus sieboldi</i> Mabuchi and Nakabo	Hoshisanohabera	+	+	1~+	+	occasional (11)	temperate
	<i>Parajulis poecileptera</i> (Temminck and Schlegel)	Kyuusen		+	1		rare (2)	temperate
	<i>Halichoeres tenuispinis</i> (Günther)	Honbera		+			rare (3)	temperate
Liparidae	<i>Liparis tanakae</i> (Gilbert and Burke)	Kusauo	+		+	+	rare (5)	large area
Pholidae	<i>Pholis nebulosa</i> (Temminck and Schlegel)	Ginpo	1~+	1~+	+	+~++	occasional (10)	temperate
Pinguipedidae	<i>Parapercis pulchella</i> (Temminck and Schlegel)	Toragisu	1~+	+~++	+	+~++	occasional (10)	temperate
	<i>Parapercis sexfasciata</i> (Temminck and Schlegel)	Kurakaketoragisu	+	+	+~++	+~+++	frequent (29)	temperate
	<i>Parapercis multifasciata</i> Döderlein	Okitoragisu				+	rare (1)	temperate
Champsodontidae	<i>Champsodon snyderi</i> Franz	Wanigisu		+			rare (1)	temperate
Uranoscopidae	<i>Uranoscopus japonicus</i> Houttuyn	Mishimaokoze		1~+	++		rare (4)	temperate
	<i>Uranoscopus chinensis</i> Guichenot	Kibiremishima	+	1~+	+	1~+	occasional (13)	temperate
	<i>Uranoscopus bicinctus</i> Temminck and Schlegel	Meganeuo		1~+	+		rare (5)	subtropical
Callionymidae	<i>Calliurichthys japonicus</i> (Houttuyn)	Yomegochi	+	+	++	+	occasional (11)	temperate
	<i>Repomucenus huguenini</i> (Bleeker)	Yarineri	+	++	+		rare (7)	temperate
	<i>Repomucenus valenciennesi</i> (Temminck and Schlegel)	Hatatatenumeri	+			+	rare (3)	temperate
	<i>Repomucenus curvicornis</i> (Valenciennes)	Nezumigochi	+	++	+~++	1~+	occasional (14)	temperate
	<i>Repomucenus beniteguri</i> (Jordan and Snyder)	Tobinumeri	+	+~++			rare (5)	temperate
Gobiidae	<i>Amblychaeturichthys scistius</i> (Jordan and Syder)	Komochijako	+				rare (1)	temperate
	<i>Amblychaeturichthys hexanema</i> (Bleeker)	Akahaze	+~++	+	1~+	1~+	occasional (12)	temperate
	<i>Pterogobius virgo</i> (Temminck and Schlegel)	Nishikihaze		+	1		rare (3)	temperate
	<i>Acanthogobius flavimanus</i> (Temminck and Schlegel)	Mahaze				+	rare (1)	temperate
	<i>Lubricogobius exiguus</i> Tanaka	Mijinbenihaze		1~+	1~+		occasional (9)	subtropical
	<i>Glossogobius olivaceus</i> (Temminck and Schlegel)	Urohaze			+		rare (1)	temperate
	<i>Cryptocentrus filifer</i> (Valenciennes)	Itohikihaze	1~+	1~+	1~+	+	occasional (10)	temperate
Siganidae	<i>Siganus fuscescens</i> (Houttuyn)	Aigo			+		rare (1)	large area
Sphyraenidae	<i>Sphyraena forsteri</i> Cuvier	Oomekamasu			+~++	+	rare (3)	large area
	<i>Sphyraena pinguis</i> Günther	Akakamasu	+	+	1~++		occasional (13)	temperate
	<i>Sphyraena japonica</i> Bloch and Schneider	Yamatokamasu	+	+	+~++	++	rare (6)	subtropical
Trichiuridae	<i>Trichiurus japonicus</i> Temminck and Schlegel	Tachiuo		+	1~++	+	often (18)	large area
Scombridae	<i>Scomber japonicus</i> Houttuyn	Masaba			1		rare (1)	large area
	<i>Scomberomorus niphonius</i> (Cuvier)	Sawara		1			rare (1)	large area

+, 2–19 individuals: ++, 20–99: +++, 100 or more.

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Appendix 1. Continued

	Species	Japanese name	Spring	Summer	Autumn	Winter	frequency (actual times)	Distribution area
Pleuronectiformes								
Paralichthyidae	<i>Paralichthys olivaceus</i> (Temminck and Schlegel)	Hirame	1~+	+	1~+	+~++	frequent (27)	temperate
	<i>Tarphops oligolepis</i> (Bleeker)	Aramegarei	1				rare (1)	temperate
	<i>Pseudorhombus pentophthalmus</i> Günther	Tamaganzoubirame	+~++	++~+++	+~+++	+~++	general (33)	temperate
	<i>Pseudorhombus oligodon</i> (Bleeker)	Nanyougarei	1~+	+	+~++		rare (6)	temperate
	<i>Pseudorhombus cinnamoneus</i> (Temminck and Schlegel)	Ganzoubirame			+	+	rare (3)	temperate
Bothidae	<i>Engyprosopon grandisquama</i> (Temminck and Schlegel)	Darumagarei		+	+~++	+	rare (7)	subtropical
	<i>Engyprosopon mulisquama</i> Amaoka	Chikamedarumagarei		+	+	+	rare (5)	temperate
	<i>Arnoglossus tenuis</i> Günther	Nagadarumagarei		+		+	rare (3)	subtropical
Pleuronectidae	<i>Pleuronichthys cornutus</i> (Temminck and Schlegel)	Meitagarei	1~+	+~++	+	1~++	general (31)	temperate
	<i>Hippoglossoides pinetorum</i> (Jordan and Starks)	Souhachi	+			1~+	rare (3)	temperate
	<i>Pleuronectes yokohamae</i> Günther	Makogarei	+			+~++	rare (4)	temperate
Soleidae	<i>Heteromycteris japonica</i> (Temminck and Schlegel)	Sasaushinoshita	+	+	+~++	++	occasional (11)	temperate
	<i>Aseraggodes kobensis</i> (Steindachner)	Tobisasaushinoshita	+	++	+	+~++	occasional (11)	temperate
	<i>Pseudaesopia japonica</i> (Bleeker)	Setoushinoshita	+	1~+	1~+	1~+	often (17)	temperate
	<i>Aesopia cornuta</i> Kaup	Tsunoushinoshita			+		rare (1)	subtropical
	<i>Zebrias zebrius</i> (Temminck and Schlegel)	Shimaushinoshita	1	+	+	++	rare (6)	temperate
Cynoglossidae	<i>Paraplagusia japonica</i> (Temminck and Schlegel)	Kuroushinoshita		+	+	1	rare (5)	temperate
	<i>Cynoglossus interruptus</i> Günther	Genko	+~+++	+~+++	+~+++	++~+++	often (17)	temperate
	<i>Cynoglossus arel</i> (Bloch and Schneider)	Tenjikuinunoshita			+		rare (1)	subtropical
	<i>Cynoglossus robustus</i> Günther	Inunoshita			+		rare (1)	temperate
	<i>Cynoglossus itinus</i> (Snyder)	Minamiakashitabireme			+		rare (1)	temperate
	<i>Cynoglossus abbreviatus</i> (Gray)	Kouraiakashitabirame	+				rare (1)	temperate
	<i>Cynoglossus joyneri</i> Günther	Akashitabirame		+			rare (4)	temperate
	<i>Cynoglossus nigropinuatus</i> Ochiai	Hiregurogenko			+		rare (1)	subtropical
Tetraodontiformes								
Triacanthodidae	<i>Triacanthodes anomalus</i> (Temminck and Schlegel)	Benikawamuki	1				rare (1)	temperate
Balistidae	<i>Canthidermis maculata</i> (Bloch)	Amimongara			+		rare (1)	large area
Monacanthidae	<i>Aluterus monoceros</i> (Linnaeus)	Usubahagi			+	1	rare (2)	large area
	<i>Rudarius ercodes</i> Jordan and Fowler	Amimehagi	+	+			rare (2)	temperate
	<i>Thamnocanus modestus</i> (Günther)	Umazurahagi	1~++	+~++	1~++	+~+++	frequent (23)	temperate
	<i>Thamnoconus hypargyreus</i> (Cope)	Sarasahagi		1			rare (1)	subtropical
	<i>Stephanolepis cirrhifer</i> (Temminck and Schlegel)	Kawahagi	+~++	+~++	+~+++	+~++	general (32)	temperate
	<i>Paramonacanthus oblongus</i> (Temminck and Schlegel)	Yosogi	+	1~+	+	1~++	often (17)	subtropical
Ostraciidae	<i>Ostracion immaculatum</i> Temminck and Schlegel	Hakofugu			1		rare (1)	temperate

+, 2–19 individuals: ++, 20–99: +++, 100 or more.

Rare, less than 8 times: occasional, 8–14: often, 15–22: frequent, 23–29: general, 30 or more.

Appendix 1. Continued

	Species	Japanese name	Spring	Summer	Autumn	Winter	frequency (actual times)	Distribution area
Tetraodontidae	<i>Takifugu pardalis</i> (Temminck and Schlegel)	Higanfugu	+		+	1~+	rare (7)	large area
	<i>Takifugu snyderi</i> (Abe)	Syousaifugu	+	+	+	1~++	occasional (12)	temperate
	<i>Takifugu vermicularis</i> (Temminck and Schlegel)	Nashifugu	1	+	1	+	rare (5)	temperate
	<i>Takiugu poecilonotus</i> (Temminck and Schlegel)	Komonfugu	+	+	1~+++	+~++	frequent (27)	temperate
	<i>Takiugu nipobles</i> (Jordan and Snyder)	Kusafugu			+		rare (1)	large area
	<i>Takifugu rubripes</i> (Temminck and Schlegel)	Torafugu	+	1~+	1~+	1~+	occasional (11)	temperate
	<i>Lagocephalus spadiceus</i> (Richardson)	Shirosabafugu		1~++	1~+		occasional (14)	large area
Diodontidae	<i>Diodon holocanthus</i> Linnaeus	Harisenbon	+		1		rare (2)	subtropical
INVERTEBRATE								
SCYPHOZOA								
Semaestomeae								
Pelagiidae	<i>Chrysaora pacifica</i> (Goette)	Akakurage	+~++	+		1~+++	occasional (8)	temperate
	<i>Pelagia noctiluca</i> (Forskal)	Okikurage	++	+			rare (2)	subtropical
Ulmariidae	<i>Aurelia aurita</i> (Linne)	Mizukurage	++~+++	+~+++	+++		occasional (9)	large area
Phizostomeae								
Rhizostomidae	<i>Nemopilema nomurai</i> (Kishinouye)	Echizenkurage		1	+	+	rare (5)	temperate
Cepheidae	<i>Netrostoma setouchianum</i> (Kishinouye)	Ebikurage			+		rare (1)	temperate
CUBOZOA								
Cubomedusae								
Carybdeidae	<i>Carybdea brevipedalia</i> Kishinouye	Andonkurage		+++			rare (1)	subtropical
HYDROZOA								
Anthomedusae								
Eudendriidae	<i>Spirocodon saltator</i> (Tilesius)	Kamikurage	+			+++	rare (2)	temperate
Leptomedusae								
Aequoreidae	<i>Aequorea coerulescens</i> (Brandt)	Owankurage	+				rare (1)	temperate
Limnomedusae								
Olindiasidae	<i>Olindias formosa</i> (Goto)	Hanagasakurage	++~+++	+~++	1		occasional (10)	temperate
ANTHOZOA								
Ceriantharia								
Cerianthidae	<i>Pachycerianthus magnus</i> (Nakamoto)	Himehanaginchaku			+		rare (1)	temperate
Actiniaria								
Actiniidae	<i>Dofleinia armata</i> Wassilieff	Sunaisoginchaku			1		rare (1)	temperate
Anthopatharia								
Antipathidae	<i>Antipathes japonica</i> Brook	Umikaramatsu		1			rare (1)	temperate

+, 2–19 individuals: ++, 20–99: +++, 100 or more.

Rare, less than 8 times: occasional, 8–14: often, 15–22: frequent, 23–29: general, 30 or more.

Appendix 1. Continued

	Species	Japanese name	Spring	Summer	Autumn	Winter	frequency (actual times)	Distribution area
TENTACULATA								
Lobata								
	Bolinopsidae	<i>Bolinopsis mikado</i> Moser			+	+	rare (4)	temperate
		<i>Beroe cucumis</i> Fabricius			++		rare (2)	temperate
GASTROPODA								
Discopoda								
	Xenophoridae	<i>Onustus exutus</i> (Reeve)	1~+	1~+	+	+	rare (7)	subtropical
	Naticidae	<i>Glassaulax vesicalis</i> (Philippi)			+		rare (2)	temperate
	Cassidae	<i>Semicassis bisulcata persimilis</i> Kira			+		rare (1)	temperate
	Ficidae	<i>Ficus subintermedia</i> (d'Orbigny)	++	+	++	+	occasional (10)	subtropical
	Tonnidae	<i>Tonna sukosa</i> (Philippi)	1				rare (1)	subtropical
Neogastropoda								
	Melongenidae	<i>Hemifusus tuba</i> (Gmelin)	+	+	1~+		rare (5)	subtropical
	Fascioliariidae	<i>Fusinus perplexus ferrugineus</i> Kuroda et Habe	+		++		rare (2)	temperate
Cephalaspidea								
	Philinidae	<i>Philine argentata</i> Gould	++	+	+	+	occasional (10)	temperate
Pleurobranchomorpha								
	Pleurobranchaeidae	<i>Pleurobranchaea japonica</i> Thiele	+	+	+		rare (6)	temperate
Nudibranchia								
	Triophidae	<i>Kalinga ornata</i> Alder & Hancick		+	1~+	1	rare (4)	subtropical
		<i>Plocamopherus tilesii</i> Bergh		+			rare (1)	temperate
	Dendrodoiridae	<i>Dendrodoris denisoni</i> (Angas)	++	1			rare (2)	temperate
	Tethydidae	<i>Mebibe japonica</i> Eliot	1~+	1~++	1~+		occasional (11)	temperate
	Arminidae	<i>Armina semperi</i> Bergh		1			rare (1)	subtropical
BIVALVIA								
Ostreoida								
	Pectinidae	<i>Pecten albicans</i> (Schröter)	1~+	+	1~+		occasional (10)	temperate
		<i>Amusium japonicum japonicum</i> (Gmelin)	1~+	+	1~++	1~+	often (20)	temperate
Veneroida								
	Cardiidae	<i>Fulvia mutica</i> (Reeve)	+		++		rare (2)	temperate
CEPHALOPODA								
Sepioida								
	Sepiidae	<i>Sepia (Acanthosepion) lycidas</i> Gray	+	1~+	++		rare (6)	subtropical
		<i>Sepia (Platysepia) esculenta</i> Hoyle	++	++	++	++	frequent (24)	subtropical
		<i>Sepia (Doratosepion) kobeensis</i> Hoyle	1				rare (1)	temperate
		<i>Sepia (Doratosepion) misakiensis</i> Wülker	+			+	rare (3)	temperate
		<i>Metasepia tullbergi</i> Appellöf	1~+	1	1	+	occasional (9)	subtropical
		<i>Sepiella japonica</i> Sasaki			+	1~+	rare (3)	subtropical

+, 2–19 individuals: ++, 20–99: +++, 100 or more.

Rare, less than 8 times: occasional, 8–14: often, 15–22: frequent, 23–29: general, 30 or more.

Appendix 1. Continued

	Species	Japanese name	Spring	Summer	Autumn	Winter	frequency (actual times)	Distribution area
Sepiolidae	<i>Euprymna morsei</i> Verrill	Mimiika	+~++	+	+~++	+~++	often (21)	temperate
Teuthoida								
Loliginidae	<i>Sepioteuthis lessoniana</i> (Lesson)	Aoriika			+		rare (3)	large area
	<i>Loligo</i> (<i>Heterololigo</i>) <i>bleekeri</i> Keferstein	Yariika	+				rare (2)	temperate
	<i>Loligo</i> (<i>Photololigo</i>) <i>edulis</i> Hoyle	Kensakiika	+	+			rare (4)	subtropical
Ommastrephidae	<i>Todarodes pacificus</i> Steenstrup	Surumeika	+~++				rare (2)	temperate
Octopoda								
Octopodidae	<i>Octopus vulgaris</i> Cuvier	Madako	1~+	+~++	+~++		occasional (13)	large area
	<i>Octopus minor</i> Sasaki	Tenagadako	1~+	1~+	1	1~+	occasional (8)	temperate
	<i>Octopus ocellatus</i> Gray	Iidako	1~+	+~++	+	+	occasional (12)	temperate
	<i>Amphioctopus areolatus</i> De Haan	Yotsumedako	+	+			rare (3)	temperate
POLYCHAETA								
Amphinomida								
Amphinomidae	<i>Chloeia flava</i> (Pallas)	Umikemushi	1~++	1~+	1~++	1	occasional (11)	subtropical
MALACOSTRACA								
Stomatopoda								
Odontodactylidae	<i>Odontodactylus japonicus</i> (de Haan)	Hanashako		+			rare (1)	subtropical
Harpiosquillidae	<i>Harpiosquilla harpax</i> (de Haan)	Togeshako	1~+	+~++	+~++	+	occasional (8)	temperate
Squillidae	<i>Oratosquilla oratoria</i> (de Haan)	Shako	+	1~++	+~++	1~+	occasional (12)	temperate
Decapoda								
Penaeidae	<i>Penaeus</i> (<i>Marsupenaeus</i>) <i>japonicus</i> Bate	Kurumaebi	1~+	1~+	+	+	occasional (13)	large area
	<i>Penaeus</i> (<i>Melicertus</i>) <i>latisulcatus</i> Kishinouye	Futomizoebi	1~+	+~++	+~++		rare (7)	subtropical
	<i>Penaeus</i> (<i>Penaeus</i>) <i>semisulcatus</i> De Haan	Kumaebi	1~+	+	+~++	+~++	often (18)	subtropical
	<i>Metapenaeus intermedius</i> (Kishinouye)	Tosaebi			+		rare (2)	subtropical
	<i>Trachypenaeus curvirostris</i> Stimpson	Saruebi		++	+~++	++	rare (4)	large area
	<i>Metapenaeopsis</i> spp.	Akaebi	+	++~++	++		rare (6)	-
Sicyonidae	<i>Sicyonia cristata</i> (de Haan)	Ishiebi		1	1		rare (3)	subtropical
Alpheidae	<i>Alpheus japonicus</i> Miers	Tenagateppouebi	+	+		+	rare (3)	temperate
Palinuridae	<i>Ibacus ciliatus</i> (von Siebold)	Uchiwaebi		+	1	+	rare (6)	subtropical
	<i>Ibacus novemdentatus</i> Gibbes	Oobauchiwaebi	+	1~+	1~+	+	occasional (9)	subtropical
Diogenidae	<i>Dardanus arrosor</i> (Herbst)	Kesujiyadokari	+	1~+	1~+	+~++	occasional (11)	subtropical
	<i>Dardanus aspersus</i> (Berthold)	Akaboshiyadokari	+	+	1~++		occasional (10)	subtropical
	<i>Diogenes edwardsii</i> (De Haan)	Togetsunoyadokari	+	1~++	+~++		rare (7)	temperate
Paguridae	<i>Spiropagurus spiriger</i> (De Haan)	Zenmaiadokari	+~++	+~++	+~++	+~++	occasional (13)	temperate
Porcellanidae	<i>Porcellanella picta</i> (Stimpson)	Umierakanidamashi		+	+		rare (2)	subtropical
Dromiidae	<i>Dromidiopsis dormia</i> (Linnaeus)	Ookaikamuri	1				rare (1)	subtropical
	<i>Dromia dehaani</i> Rathbun	Kaikamuri	1	1~+	+		rare (5)	subtropical
Latreilliidae	<i>Latreillia valida</i> De Haan	Sanadamizuhikigani		+			rare (2)	large area

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Appendix 1. Continued

	Species	Japanese name	Spring	Summer	Autumn	Winter	frequency (actual times)	Distribution area
Dorippidae	<i>Dorippe sinica</i> Chen	Kimengani	+~++	+~++	+~+++	1~++	often (18)	temperate
	<i>Paradorippe granulata</i> (De Haan)	Samehadaheikegani		1			rare (2)	temperate
Calappidae	<i>Calappa lophos</i> (Herbst)	Torafukarappa		+	+		rare (6)	subtropical
	<i>Calappa philargius</i> (Linnaeus)	Meganekarappa		1	+		rare (4)	subtropical
Leucosiidae	<i>Arcania undecimspinos</i> De Haan	Juuchitogekobushi		1~+			rare (2)	temperate
	<i>Myra fugax</i> (Fabricius)	Tenagakobushi	1~+	+	+~++	1~++	often (16)	temperate
	<i>Leucosia anatum</i> (Herbst)	Tsunonagakobushi			+		rare (1)	subtropical
	<i>Urnalana haematostica</i> (Adams & White)	Askahoshikobushi			1		rare (1)	subtropical
Majidae	<i>Phalangipus hystrix</i> (Miers)	Ashinagatsunogani	1~+	+~++	+	+	occasional (9)	subtropical
	<i>Hyastenus diacanthus</i> (De Haan)	Tsunogani	+	+~++	+	+	often (15)	subtropical
	<i>Leptomithrax edwardsii</i> (de Haan)	Koshimagani		+	+	1	rare (3)	temperate
Parthenopidae	<i>Parthenope (Platylambrus) valida</i> De Haan	Hishigani	+~++	+	+~++		occasional (11)	subtropical
Corystidae	<i>Jonas distincta</i> (De Haan)	Higegani		+	+		rare (3)	temperate
Portunidae	<i>Liocarcinus corrugatus</i> (Pennant)	Shiwagazami	1				rare (1)	subtropical
	<i>Ovalipes punctatus</i> (de Haan)	Hiratsumegani	+	+			rare (4)	temperate
	<i>Portunus (Portunus) trituberculatus</i> (Miers)	Gazami	1	+~++	1~+	1~+	rare (7)	temperate
	<i>Portunus (Portunus) pelagicus</i> (Linnaeus)	Taiwangazami			1~+		rare (3)	subtropical
	<i>Portunus (Portunus) sanguinolentus</i> (Herbst)	Janomegazami			+~++	+	rare (5)	subtropical
	<i>Portunus haani</i> (Stimpson)	Ibogazami	1	+~++	+~++		rare (7)	temperate
	<i>Charybdis (Charybdis) japonica</i> (A.Milne Edwards)	Ishigani			+		rare (2)	temperate
	<i>Charybdis (Charybdis) feriata</i> (Linnaeus)	Shimaishigani	1				rare (1)	subtropical
	<i>Charybdis (Charybdis) miles</i> (De Haan)	Akaishigani	+	+~++	+~++	++~+++	often (17)	temperate
	<i>Charybdis (Goniohellenus) truncata</i> (Fabricius)	Hirohaishigani	++~+++	+++	+~+++	++~+++	occasional (13)	temperate
	<i>Charybdis (Gonioeupanus) bimaculata</i> (Miers)	Futahoshiishigani		++~+++	++		rare (3)	subtropical
	<i>Thalamita sima</i> H.Milne Edwards	Futahabenitsukegani			+		rare (2)	temperate
Xanthidae	<i>Liagore rubromaculata</i> (De Haan)	Benihoshimanjugani	1~+	+~++	+		occasional (8)	temperate
	<i>Demania scaberrima</i> (Walker)	Urokoougigani		+	+	+	rare (4)	subtropical
Goneplacidae	<i>Carcinoplax vestita</i> (De Haan)	Kebukaenkougani	+			+	rare (4)	temperate
	<i>Carcinoplax longimana</i> (De Haan)	Enkougani	+	1~+	+	+	occasional (8)	large area
CRINOIDEA								
Comatulida								
Comasteridae	<i>Oxycomanthus japonicus</i> (Müller)	Nipponumishida			+		rare (2)	temperate
ASTEROIDEA								
Platyasterida								
Luidiidae	<i>Luidia maculata</i> Müller et Troschel	Yatsudesunahitode	+~++	+	+		occasional (8)	subtropical
	<i>Luidia quinaria</i> von Martens	Sunahitode	+	+	+	+	occasional (11)	temperate

+, 2–19 individuals: ++, 20–99: +++, 100 or more.

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Appendix 1. Continued

	Species	Japanese name	Spring	Summer	Autumn	Winter	frequency (actual times)	Distribution area
Paxillosida								
Astropectinidae	<i>Astropecten scoparius</i> Valenciennes	Momijigai	++	+~++	+		rare (6)	temperate
	<i>Astropecten polyacanthus</i> Müller et Troschel	Togemomijigai	+~++	1~++	++		occasional (8)	subtropical
	<i>Ctenopleura fisheri</i> Hayashi	Nisemomijigai		+			rare (1)	temperate
Valvatida								
Ophidiasteridae	<i>Heteronardoa carinata</i> (Koehler)	Niseakahitode					rare (1)	subtropical
Goniasteridae	<i>Stellaster equestris</i> (Retzius)	Hoshihitode		1~+			rare (3)	temperate
Spinulosida								
Asterinidae	<i>Asterina pectinifera</i> Müller et Troschel	Itomakihitode	1~+	1~+	+~++		occasional (14)	temperate
ECHINOIDEA								
Echinoida								
Temnopleuridae	<i>Temnopleurus toreumaticus</i> (Leske)	Sanshouuni	+~++	1~+	+		rare (6)	temperate
Strongylocentrotida	<i>Pseudocentrotus depressus</i> (A. Agassiz)	Akauni				1	rare (1)	temperate
Echinometridae	<i>Anthocardis crassispina</i> (A. Agassiz)	Murasakiuni			+		rare (1)	temperate
HOLOTHUROIDEA								
Aspidochirotid								
Holothuriidae	<i>Holothuria (Selenothuria) moebii</i> (Ludwing)	Tetsuironamako	+			+	rare (2)	temperate
	<i>Holothuria (Thymiosycia) decorata</i> von Marenzeller	Fujinamako	1	+	+	1	rare (5)	temperate
Stichopodidae	<i>Apostichopus japonicus</i> (Selenka)	Manamako	1~++	+	+	+~+++	often (21)	temperate
ASCIDIACEA								
Pleurogona								
Pyruridae	<i>Halocynthia roretzi</i> (Drasche)	Maboya	+	+	+		rare (4)	temperate

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