

## 山口県響灘における小型定置網の漁獲物

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

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**Abstract:** Aquatic animals fished by 297 operations of a set net at the Hibiki-nada Sea off Yamaguchi Prefecture, Japan, were investigated in all seasons from 2002 through 2010. A total of 410 species including 3 reptiles, 1 chordate, 294 fishes (FS) and 112 invertebrates (IV) were caught. Among them, 242 FS and 100 IV were judged as rare (caught in less than 60 times), 28 FS and 8 IV as occasional (60 to 118 times), 9 FS and 2 IV as often (119 to 178 times), 8 FS and 1 IV as frequent (179 to 237 times), and 7 FS and 1 IV as general (more than 237 times) species. One hundred and one (101) FS and 29 IV were caught in all seasons, 170 FS and 78 IV were in spring, 201 FS and 77 IV were in summer, 207 FS and 55 IV were in autumn, and 185 FS and 64 IV were in winter. From distributional point of view, 118 FS and 43 IV were subtropical species, 108 FS and 60 IV were temperate region species, and 68 FS and 9 IV were large areal (widely distributed) species.

**Key words:** set net fishery, fish, invertebrate, rare species, by-catch, seasonal change

### 緒言

定置網や底びき網は、釣り漁業や特定の魚群を狙った巻網漁業などより漁獲選択性が比較的に低く、低利用魚介類の混獲を免れない一方で生物相の調査等では有効な手段といえる<sup>1,2)</sup>。響灘を含む山口県日本海域に出現した魚類は39目197科870種<sup>3)</sup>、特記生物として魚類245種、無脊椎動物140種、脊索動物4種、爬虫類4種におよぶことがすでに知られているが<sup>4,5)</sup>、実際に漁獲される魚類の季節的変動や多寡については必ずしも明らかとは言えない。そこで著者らは山口県の響灘で操業される小型底びき網の漁獲生物調査を実施し、脊索動物、魚類および無脊椎動物合計

317種の出現と季節変動を明らかにした<sup>2)</sup>。しかし、漁獲選択性が低いとは言えその結果はあくまでも底びき網操業水域の範囲内のことであり、他の漁法の結果も検討する必要がある<sup>2)</sup>。本調査研究は、8年以上にわたって同海域に設置された小型定置網漁に同乗し、漁獲される魚介類の周年変動等に関する基盤データを得、小型底びき網の漁獲生物と合わせて本海域の水産資源の特徴を明らかにすることを目的とした。

### 材料及び方法

本調査の定置網は、下関市豊浦町室津地先 (Fig. 1, 北

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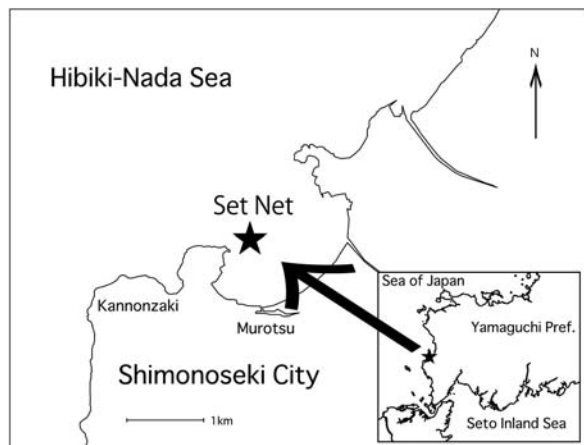


Fig. 1. Map showing the Hibiki-nada Sea area where set net fishing was operated (star,  $34^{\circ}8'38''\text{N}$ ,  $130^{\circ}53'20''\text{E}$ ).

緯  $34^{\circ}8'38''$ , 東経  $130^{\circ}53'20''$  の水深 12m から 16m に設置された一段落網である。垣網の長さは約 300m (200 間), 垣網の目合は約 18–30cm (6 寸目から 1 尺), 運動場の目合は約 12cm (4 寸目), 箱網は縦約 37.5m (25 間) 横約 22.5m (15 間), 箱網の目合は約 4.3cm (8 節) と約 2.7cm (12 節) の 2 種類であった。操業日に漁船一隻 (総トン数 4.0 トン) に同乗して日の出前後に漁場に到着するように出港し, 網揚げは午前中に実施した。

調査は 2002 年 1 月から 2010 年 3 月の間の周年にわたり, 春期 84 回, 夏期 78 回, 秋期 69 回, 冬期 66 回の合計 297 回実施した (Table 1)。

漁獲物は可能な限り船上で同定し, おおよその漁獲量を記録したが, 同定困難な種は持ち帰り, 分類群ごとに凶鑑等の専門書<sup>6-17)</sup>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*, クロメバル *S. ventricosus*, シロメバル *S. cheni* に区別されているが<sup>6)</sup>, 船上で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. として扱うこととした。

大雨による増水のあとに河川から流され, 定置網に入網したものと考えられる淡水魚類のギンブナ *Carassius* sp., ドジョウ *Misgurnus anguillicaudatus*, ブルーギル *Lepomis macrochirus macrochirus*, オオクチバス *Micropterus salmoides* および金庫網内のアジ類, イワシ類を捕食するために魚網内に入り, 脱出できなかったものと考えられる鳥類のウミウ *Phalacrocorax filamentosus*, ウミアイサ *Mergus serrator* は解析から除外した。

資料の整理・解析方法は概ね前報<sup>2)</sup>と同様である。すなわち, 出現したそれぞれの種について, 既報<sup>2, 18)</sup>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 網揚げ時の漁獲数を 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。また, 調査回数 297 回に対する出現頻度は, 稀 (rare, 59 回以下), やや稀 (occasional, 60–118 回), 普通 (often, 119–178 回), やや頻繁 (frequent, 179–237 回), 頻繁 (general, 238 回以上) の 5 段階に区分した。さらに, 分類群ごとの専門書<sup>6-17)</sup>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<sup>7, 19)</sup>, 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。

調査期間約 8 年間にわたる魚種組成の変化を知る目的で, 前期 (2002–2005) と後期 (2006–2010) に分けて種数を比較した。さらに前期と後期の調査回数から出現期待回数を求めることにより, 各種の出現回数を前期と後期で比較した ( $\chi^2$  検定)。

調査期間における水温比較には, 下関市立しものせき水

Table 1. Sampling numbers at a set net in Hibiki-nada Sea, Yamaguchi Prefecture, from 2002 through 2010

	Winter		Spring			Summer			Autumn			Winter	Total
	JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.	
2002	2	1	3	4	3	3	3	3	4	3	3	3	35
2003	3	3	3	3	4	4	3	3	3	3	3	3	38
2004	3	3	3	3	3	3	3	3	3	3	3	3	36
2005	3	3	3	3	0	4	3	3	3	3	3	3	34
2006	3	3	3	3	3	3	3	3	3	3	3	3	36
2007	4	4	3	6	4	3	4	3	4	3	3	2	43
2008	2	3	3	3	6	4	3	4	4	3	0	0	35
2009	0	3	3	5	6	6	1	3	2	3	1	2	35
2010	2	2	1	0	0	0	0	0	0	0	0	0	5
Total	22	25	25	30	29	30	23	25	26	24	19	19	297

族館において測定している関門海峡の水温資料を用いた。

結果及び考察

2002年から2010年にかけての水温は、2006年2月が平均水温10.0℃と最も低く、2009年8月が平均水温28.3℃と最も高く、年間の平均水温は18.7℃であった (Fig. 2)。

漁獲された生物は、魚類294種 (複合種1種含む)、無脊椎動物112種、脊索動物1種、爬虫類3種であった (Appendix 1)。無脊椎動物の内訳は、刺胞動物18種、有櫛動物6種、軟体動物42種、環形動物2種、節足動物28種、棘皮動物16種であった。

稀種は魚類242種、無脊椎動物100種、やや稀種は魚類28種、無脊椎動物8種、普通種は魚類9種、無脊椎動物2種、やや頻繁種は魚類8種、無脊椎動物1種、頻繁種は魚類7種、無脊椎動物1種であった (Table 2)。多くの種が稀にしか漁獲されず、逆に頻繁種は、アカエイ

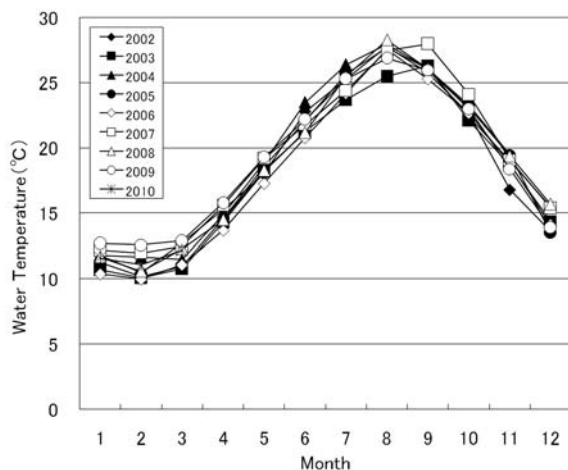


Fig. 2. Monthly change of average water temperature at the Kanmon Strait from 2002 through 2010, monitored by the Shimonoseki Marine Science Museum.

Table 2. Numbers of species collected by the set net fishing in Hibiki-nada Sea from 2002 through 2012, shown by the occurrence frequency from rare to general and by the distribution area from subtropical to large areal species

Distribution area	Occurrence frequency				General	Total
	Rare	Occasional	Often	Frequent		
FISH						
Subtropical sp.	104	9	3	1	1	118
Temperate sp.	85	12	2	4	5	108
Large areal sp.	53	7	4	3	1	68
INVERTEBRATE						
Subtropical sp.	41	0	2	0	0	43
Temperate sp.	54	6	0	0	0	60
Large areal sp.	5	2	0	1	1	9

*Dasyatis akajei*, マアジ *Trachurus japonicus*, マダイ *Pagrus major*, ヒラメ *Paralichthys olivaceus*, カワハギ *Stephanolepis cirrhifer*, ヒガンフグ *Takifugu pardalis*, コモンフグ *Takifugu poecilonotus*, アオリイカ *Sepioteuthis lessoniana* の8種で、いずれも重要な漁獲対象種であった。生物地理学的には、魚類では、南方系118種 (40.2%), 温帯性108種 (36.7%), 広域分布68種 (23.1%) であった。無脊椎動物では、南方系43種 (38.4%), 温帯性60種 (53.6%), 広域分布9種 (8.0%) であった。

魚類47種、無脊椎動物14種、爬虫類2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。魚類は、シロザメ *Mustelus griseus*, ホコサキ *Carcharhinus macloti*, ホシエイ *Dasyatis matsubarae*, イセゴイ *Megalops cyprinoides*, ソトイワシ *Albula* sp., アミウツボ *Gymnothorax minor*, オオイワシ *Thryssa baelama*, サケ *Oncorhynchus keta*, チゴダラ *Physiculus japonicus*, ヤリヒゲ *Coelorinchus multispinulosus*, ワヌケフウリュウウオ *Malthopsis annulifera*, トゲヨウジ *Syngnathoides biaculeatus*, ハナタツ *Hippocampus sindonis*, タケノコメバル *Sebastes oblongus*, ハナミノカサゴ *Pterois volitans*, ソコホウボウ *Pterygotrigla hemisticta*, オニカナガシラ *Lepidotrigla kishinouyei*, キホウボウ *Peristedion orientale*, オオクチイシナギ *Stereolepis doederleini*, ヒメスミクイウオ *Synagrops philippiensis*, スジシモチ *Apogon cookii*, アカアマダイ *Branchiostegus japonicus*, リュウキュウヨロイアジ *Carangoides hedlandensis*, リュウグウノヒメ *Pterycombus petersii*, ゴマフエダイ *Lutjanus argentimaculatus*, マツダイ *Lobotes surinamensis*, ヒゲソリダイ *Hapalogenys nigripinnis*, ハマフエフキ *Lethrinus nebulosus*, ヨメヒメジ *Upeneus tragula*, チョウチョウウオ *Chaetodon auripes*, オキゴンベ *Cirrhichthys aureus*, アカタチ *Acanthocephala krusensternii*, ツバメコノシロ

*Polydactylus plebius*, コブダイ *Semicossyphus reticulatus*, カミナリベラ *Stethojulis interrupta terina*, シロウオ *Leucopsarion petersii*, ニセカンランハギ *Acanthurus dussumieri*, オオメカマス *Sphyrnaea forsteri*, ホソカマス *Sphyrnaea helleri*, スマ *Euthynnus affinis*, ツノウシノシタ *Aesopia cornuta*, ギマ *Triacanthus biaculeatus*, キタマクラ *Canthigaster rivulata*, マフグ *Takifugu porphyreus*,

シッポウフグ *Torquigener brevipinnis*, カナフグ *Lagocephalus inermis*, ネズミフグ *Diodon hystrix* であった。無脊椎動物は, ヒゼンクラゲ *Rhopilema hispidum*, フサウミコップ *Clytia languida*, ツヅミクラゲ *Aegina rosea*, カズラガイ *Phalium (Bezoardicella) flammiferum*, ホウズキフシエラガイ *Berthellina citrina*, ミヤコウミウシ *Dendrodoris denisoni*, ミミイカダマシ *Sepiadarium kochii*, タコブネ *Argonauta hians*, ウミケムシ *Chloeia flava*, ヒダビル *Trachelobdella okae*, クマエビ *Penaeus (Penaeus) semisulcatus*, ヤマトホンヤドカリ *Pagurus japonicus*, トラフカラッパ *Calappa lophos*, コンダカウニ *Mespilia globulus* であった。爬虫類では, アカウミガメ *Caretta caretta* とヒロオウミヘビ *Laticauda laticaudata* であった。

季節を通じて周年出現した種は魚類 101 種, 無脊椎動物 29 種におよんだ。春期に出現した魚類は 170 種, 無脊椎動物 78 種, 夏期に出現した魚類は 201 種, 無脊椎動物 77 種, 秋期に出現した魚類は 207 種, 無脊椎動物 55 種, 冬期に出現した魚類は 185 種, 無脊椎動物 64 種で, 魚類は秋期が最も出現種数が多く, 無脊椎動物では春期が最も多かった。逆に出現種数が少なかった季節は魚類では春期, 無脊椎動物では秋期であった。秋期はアジ類, タチウオなどの魚類がまとまって大量に入網することが多く, 箱網が回遊性の魚種で満杯となるといっぽうで無脊椎動物の入網が減じた可能性も考えられる。

春期のみ出現は魚類 18 種と無脊椎動物 11 種, 夏期のみ出現は魚類 22 種と無脊椎動物 10 種, 秋期のみ出現は魚類 21 種と無脊椎動物 6 種, 冬期のもの出現は魚類 16 種と無脊椎動物 6 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, 冬期のクロメジナ *Girella leonine*, 冬期のカツオ *Katsuwonus pelamis*, 夏期のオヨギイソゴンチャク *Blotceroides memurrichi*, 春期のドフラインクラゲ *Nemopsis dofleini*, ヤクチクラゲ *Sugiura chengshanense* およびヘンゲクラゲ *Lampea pancarina*, 秋期のツノクラゲ *Leucothea japonica*, 春期のベイカ *Loliolus beka* が挙げられる。

山口県日本海域に出現が確認されている魚類 870 種<sup>3)</sup>のうち, 約 34%に相当する種が本調査で確認された。特記的な魚類 245 種<sup>4,5)</sup>のうち約 42%に相当する 103 種, 無脊椎動物

**Table 3.** Numbers of species collected by the set net and trawl net<sup>2)</sup> fishings in Hibiki-nada Sea, and common and total species numbers of both nets, shown by the distribution area from subtropical to large areal species

Distribution area	Set net	Trawl net <sup>2)</sup>	Common	Total
FISH				
Subtropical sp.	118	70	40	148
Temperate sp.	108	91	58	141
Large areal sp.	68	43	31	80
INVERTEBRATE				
Subtropical sp.	43	42	24	61
Temperate sp.	60	62	30	92
Large areal sp.	8	7	4	11

2) Doi et al. (2014).

140 種<sup>4,5)</sup>のうち, 約 16%に相当する 22 種が本調査で確認された。それ以外の種は, 定置網には入網しにくいもののこの海域でも生息する種が多いものと考えられる。

定置網および底びき網<sup>2)</sup>における総出現種数および共通出現種数の地理的区分の内訳を Table 3 に示した。総出現種数は魚類 369 種 (複合種 1 種含む), 無脊椎動物 166 種 (複合種 1 種含む), 脊索動物 2 種, 爬虫類 3 種であった。魚類の地理的区分による内訳は, 南方系 148 種 (40.1%), 温帯性 141 種 (38.2%), 広域分布 80 種 (21.7%) であった。総出現種の無脊椎動物の地理的区分による内訳は, 南方系 61 種 (37.2%), 温帯性 92 種 (56.1%), 広域分布 11 種 (6.7%) であった。定置網, 底びき網の共通種は魚類 129 種 (複合種 1 種含む), 無脊椎動物 58 種であった。共通種の魚類の地理的区分による内訳は, 南方系 40 種 (31%), 温帯性 58 種 (45%), 広域分布 31 種 (24%) となった。共通種の無脊椎動物の地理的区分による内訳は, 南方系 24 種 (41.4%), 温帯性 30 種 (51.7%), 広域分布 4 種 (6.9%) であった。

本調査結果を鳥取県浦富<sup>19)</sup>, 九州北部沿岸の津屋崎<sup>20)</sup> および長崎県野母崎<sup>21)</sup>と比較してみると, 北から南にかけて南方系魚類の割合が漸次的に増加することが示された (Table 4)。この傾向は定置網と底びき網の種数を合算しても同様であった。広域分布魚種が他の海域では 10%未

**Table 4.** Coastal fish species composition in % as shown by the distribution area from subtropical, temperate, and large areal species, from Nagasaki (Nomozaki<sup>21)</sup>), Fukuoka (Tsuyazaki<sup>20)</sup>), Yamaguchi (Hibiki-nada), and Tottori (Tottori<sup>19)</sup>) Prefectures

Distribution area	Nomozaki <sup>21)</sup>	Tsuyazaki <sup>20)</sup>	Hibiki-nada			Tottori 19)
			Set net	Trawl net <sup>2)</sup>	Total	
Subtropical sp.	63.0	49.8	40.2	34.3	40.1	37.9
Temperate sp.	28.7	42.2	36.7	44.6	38.2	53.1
Large areal sp.	8.3	8.0	23.1	21.1	21.7	9.0

2) Doi et al. (2014); 19) Wada et al. (2014); 20) Nishida (2008); 21) Tawa and Takegaki (2009).



**Table 5.** Comparison of collected times in the set net fishing at Hibiki-nada Sea, Yamaguchi Prefecture, between the former (2002–2005) and latter (2006–2010) halves of the surveyed period from 2002 through 2010 (total 297 samplings) in the species that showed significant difference between the former and latter halves ( $\chi^2$  test)

Scientific name	Japanese name	Collected times		Expected times		Total times	$\chi^2$ value	p	Distribution area
		Former half	Latter half	Former half	Latter half				
FISH									
Former half < Latter half									
<i>Urolophus aurantiacus</i>	Hirataei	4	19	11.1	11.9	23	8.715	0.003	subtropical
<i>Myliobatis tobijei</i>	Tobiei	38	81	57.3	61.7	119	12.533	0.000	subtropical
<i>Cypselurus hiraii</i>	Hosotobiuo	20	38	27.9	30.1	58	4.338	0.037	large area
<i>Lateolabrax japonicus</i>	Suzuki	77	114	92.0	99.0	191	4.695	0.030	temperate
<i>Girella punctata</i>	Mejina	35	58	44.8	48.2	93	4.118	0.042	temperate
<i>Pleuronectes yokohamae</i>	Makogarei	3	11	6.7	7.3	14	4.004	0.045	temperate
Former half > Latter half									
<i>Sphyrna zygaena</i>	Shirosyumokuzame	13	3	7.7	8.3	16	7.022	0.008	large area
<i>Ophisurus macrorhynchus</i>	Dainanumihebi	13	4	8.2	8.8	17	5.462	0.019	subtropical
<i>Konosirus punctatus</i>	Konoshiro	75	24	47.7	51.3	99	30.228	0.000	large area
<i>Saurida elongata</i>	Tokageeso	53	13	31.8	34.2	66	27.333	0.000	temperate
<i>Trachinocephalus myops</i>	Okieso	13	1	6.7	7.3	14	11.209	0.001	subtropical
<i>Fistularia petimba</i>	Akayagara	31	18	23.6	25.4	49	4.485	0.034	large area
<i>Fistularia commersonii</i>	Aoyagara	30	11	19.7	21.3	41	10.283	0.001	temperate
<i>Chelidonichthys spinosus</i>	Houbou	31	15	22.1	23.9	46	6.823	0.009	large area
<i>Onigocia spinosa</i>	Onigochi	13	5	8.7	9.3	18	4.179	0.041	subtropical
<i>Priacanthus macracanthus</i>	Kintokidai	24	6	14.4	15.6	30	12.191	0.000	temperate
<i>Rachycentron canadum</i>	Sugi	17	7	11.6	12.4	24	4.947	0.026	large area
<i>Parapristipoma trilineatum</i>	Isaki	40	17	27.4	29.6	57	11.078	0.001	temperate
<i>Pemahia argentata</i>	Shirogisu	48	29	37.1	39.9	77	6.210	0.013	temperate
<i>Pempheris schwenkii</i>	Minamihatanpo	19	2	10.1	10.9	21	15.071	0.000	subtropical
<i>Abudefduf vaigiensis</i>	Oyabichya	25	8	15.9	17.1	33	10.076	0.002	subtropical
<i>Kyphosus vaigiensis</i>	Isuzumi	21	10	14.9	16.1	31	4.767	0.029	temperate
<i>Parajulis poecileptera</i>	Kyuusen	41	24	31.3	33.7	65	5.803	0.016	temperate
<i>Parablennius yatabei</i>	Isoginpo	9	2	5.3	5.7	11	4.995	0.025	temperate
<i>Petroscirtes breviceps</i>	Nijiginpo	49	32	39.0	42.0	81	4.945	0.026	subtropical
<i>Prionurus scalprum</i>	Nizadai	59	38	46.7	50.3	97	6.244	0.012	temperate
<i>Auxis thazard thazard</i>	Hirasouda	16	3	9.1	9.9	19	9.897	0.002	large area
<i>Heteromycteris japonica</i>	Sasaushinoshita	13	2	7.2	7.8	15	8.914	0.003	temperate
<i>Aluterus monoceros</i>	Usubahagi	30	17	22.6	24.4	47	4.630	0.031	large area
<i>Paramonacanthus oblongus</i>	Yosogi	44	26	33.7	36.3	70	6.066	0.014	subtropical
<i>Lagocephalus spadiceus</i>	Shirosabafugu	39	23	29.9	32.1	62	5.407	0.020	large area
INVERTEBRATE									
Former half < Latter half									
<i>Bolinopsis mikado</i>	Kabutokurage	20	41	29.4	31.6	61	5.766	0.016	temperate
<i>Aplysia kurodai</i>	Amefurashi	4	29	15.9	17.1	33	17.156	0.000	temperate
<i>Dolabella auricularia</i>	Tatsunamigai	1	16	8.2	8.8	17	12.164	0.000	temperate
<i>Plocamopherus tilesii</i>	Hikariumiushi	13	41	26.0	28.0	54	12.536	0.000	temperate
<i>Sepia (Doratosepion) kobeensis</i>	Himekouika	0	20	9.6	10.4	20	18.571	0.000	temperate
<i>Loliolus japonica</i>	Jindouika	0	12	5.8	6.2	12	11.143	0.001	temperate
<i>Moroteuthis loenbergi</i>	Kagiika	0	16	7.7	8.3	16	14.857	0.000	temperate
<i>Liocarcinus corrugatus</i>	Shiwagazami	0	13	6.3	6.7	13	12.071	0.001	subtropical
<i>Astropecten polyacanthus</i>	Togemomijigai	6	17	11.1	11.9	23	4.4838	0.0342	subtropical
Former half > Latter half									
<i>Nemopilema nomurai</i>	Echizenkurage	23	12	16.9	18.1	35	4.326	0.038	temperate
<i>Fisinus perplexus ferrugineus</i>	Konaganishi	64	37	48.6	52.4	101	9.369	0.002	temperate
<i>Thysanoteuthis rhombus</i>	Sodeika	12	3	7.2	7.8	15	6.096	0.014	subtropical
<i>Dardanus aspersus</i>	Akaboshiyadokari	23	12	16.9	18.1	35	4.326	0.038	subtropical
<i>Diogenes edwardsii</i>	Togetsunoyadokari	26	12	18.3	19.7	38	6.256	0.012	temperate

**Table 6.** Number of increased or decreased species from the former samplings (2002–2005) to the latter samplings (2006–2010) of the surveyed period from 2002 through 2010 collected by the set net fishing in Hibiki-nada Sea, Yamaguchi Prefecture, shown by the distribution area from subtropical to large areal species

	Subtropical sp.	Temperate sp.	Large areal sp.	Total
FISH				
Increased	2	3	1	6
Decreased	7	10	8	25
INVERTEBRATE				
Increased	2	7	0	9
Decreased	2	3	0	5

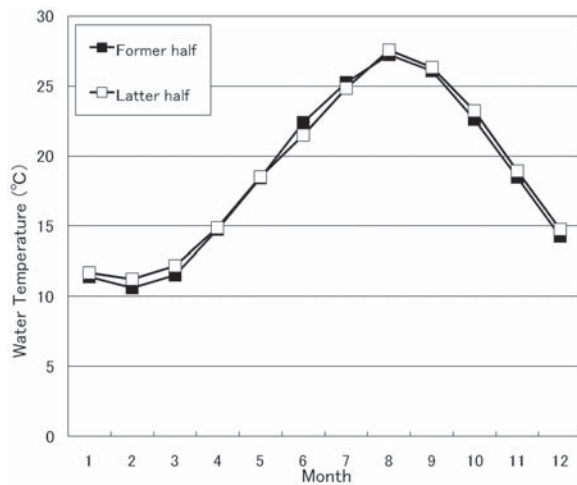


Fig. 3. Comparison of monthly change of average water temperature between 2002-2005 and 2006-2010, calculated from the data in Fig. 2.

満であるのに対して本調査では、約 23%と高い値を示した。これは、ほかの調査が沿岸の潜水調査等に基づいていることに対して、本調査の定置網や前報<sup>2)</sup>の底びき網等の漁獲特性にも起因するものと考えられる。

調査期間のうち 2002 年から 2005 年までを前期、2006 年から 2010 年までを後期とし、種数を比較すると、魚類では前期 264 種、後期 236 種、無脊椎動物では前期 87 種、後期 91 種であった。さらに出現回数を前期と後期で比較した ( $\chi^2$ 検定,  $p < 0.05$ )。有意差が認められた種は魚類では 31 種、無脊椎動物では 14 種であった (Table 5)。その内訳は、魚類では 6 種が後期に有意に増加、25 種が減少、無脊椎動物では 9 種が増加、5 種が減少しており (Table 6)、全体の種数の増減を反映していた。前期と後期の月別の平均気温を比較すると (Fig. 3)、温度差は有意ではないものの 6、7 月以外では後期の方が若干高水温の傾向にあった。しかし、特に亜熱帯性種の増加や温帯性種の減少などの傾向は無く、全体的に魚類が減少し、無脊椎動物が増加していた。広島湾と安芸灘の境界に位置する鹿島では 8 目 24 科 50 種の魚類を確認されているが<sup>22)</sup>、瀬戸内海の浅海魚類相調査においても魚類群集における亜熱帯性種への移行が必ずしも進行しているわけではないと報告されている。

今後、同様の調査を巻網や籠漁などの他漁法においても行い、さらに幼魚や成魚の出現動向について踏み込んだ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いくものと考えられる。また、本海域において定置網や底びき網によって漁獲される生物の多くは稀に漁獲されるものであった。そのほとんどは食

用に適さないか通常の流通経路には載らない種であろうと思われる。今後、そのような低利用資源の有効利用を図ることや、そもそもそれらの漁獲を避ける漁法の開発は、資源を無駄にしないためにも益々重要となるであろう。

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Appendix 1. Continued

Family	Scientific name	Japanese name	Collected times												Frequency (total times)	Distribution area			
			Spring	Summer	Autumn	Winter	2002	2003	2004	2005	2006	2007	2008	2009			2010		
Salmoniformes																			
PlecoGLOSSIDAE	<i>Plecoglossus ativelis ativelis</i> (Temminck and Schlegel)	Ayu	++																temperate
Salmonidae	<i>Oncorhynchus keta</i> (Walbaum)	Sake		1															temperate
	<i>Oncorhynchus masou masou</i> (Brevoort)	Sakuramasu	1	1															temperate
Stomiiformes																			
Stemtophychidae	<i>Maurolicus japonicus</i> Ishikawa	Kyurrieso	+	1															large area
Aulopiformes																			
Synodontidae	<i>Saurida elongata</i> (Temminck and Schlegel)	TokageSSO	1~+	1~++															temperate
	<i>Saurida macrolepis</i> Tanaka	Maesso	1	1~++															subtropical
	<i>Saurida wanieso</i> Shindo and Yamada	Wanieso	1~++	+															subtropical
	<i>Trachinocephalus myops</i> (Forster)	Okieso	1~+	1~+															subtropical
Lampridiformes																			
Trachipteridae	<i>Desmodema polystratum</i> (Ogilby)	Furisodeto	1~+	1~+															large area
	<i>Trachipterus ishikawae</i> Jordan and Snyder	Sakegashira	+	1~+															temperate
Regalecidae	<i>Regalecus russellii</i> (Cuvier)	Ryugunotsukai	1																large area
Gadiformes																			
Moridae	<i>Physiculus japonicus</i> Hilgendorf	Chigodara	1																large area
Macrouridae	<i>Coelorinchus multispinulosus</i> Kaayama	Yarihige	1																large area
Lophiiformes																			
Lophidae	<i>Lophius litulon</i> (Jordan)	Kiankou	1																large area
Antemarridae	<i>Histirio histrio</i> (Linnaeus)	Hanaokoze	1~+	+															subtropical
	<i>Antemarius striatus</i> (Shaw)	Kaerankou		+															large area
Ogcocephalidae	<i>Malhopsis annulifera</i> Tanaka	Wanuketuuruuo		+															subtropical
Beryciformes																			
Holocentridae	<i>Ostichthys japonicus</i> (Cuvier)	Ebisudai	1																subtropical
Monocentridae	<i>Monocentris japonica</i> (Houtuyun)	Matsukasao		1~+															large area
Zeiformes																			
Zeidae	<i>Zenopsis nebulosa</i> (Temminck and Schlegel)	Kagamidai	1	1															large area
	<i>Zeus faber</i> Linnaeus	Matoudai	1~+	1~+															subtropical
Gasterosteiformes																			
Fistulariidae	<i>Fistularia petimba</i> Lacépède	Akayagara	1	+	1~++														large area
	<i>Fistularia commersonii</i> Ruppell	Aoyagara		+	1~+++														temperate
Macroramphosidae	<i>Macroramphosus sagifae</i> Jordan and Starks	Sagifue	1	1															large area
Syngnathidae	<i>Syngnathus schlegelii</i> Kaup	Youjuto	1	1															temperate
	<i>Syngnathoides biaculeatus</i> (Bloch)	Togeyouji	1																subtropical
	<i>Hippocampus coronatus</i> Temminck and Schlegel	Tatsunootoshigo	1	1															temperate
	<i>Hippocampus sindonis</i> Jordan and Snyder	Hanataitsu	1																temperate
Mugiliformes																			
Mugilidae	<i>Mugil cephalus cephalus</i> Linnaeus	Bora	1~+	1~+++	1~++														large area
Atheriniformes																			
Atherinidae	<i>Hypoatherina valenciennei</i> (Bleeker)	Tougorouiwashi	1	1															subtropical
Belontiiformes																			
Hemirhamphidae	<i>Hyporhamphus sajoi</i> (Temminck and Schlegel)	Sayori	1~+++	1~+															temperate
Exocoetidae	<i>Hirundichthys oxycephalus</i> (Bleeker)	Hosooatobi		+															subtropical
	<i>Cypselurus hiraii</i> Abe	Hosotobuo	+	+															large area
	<i>Cypselurus doederleini</i> (Steindachner)	Tsukushitobono	1~+++	+															large area
	<i>Ablemes hians</i> (Valenciennes)	Hamadatsu	1~+	1~+															large area
Belontiidae	<i>Strongylura anastomella</i> (Valenciennes)	Datsu	1	1~+															large area
	<i>Tylosurus crocodilus crocodilus</i> (Peron and Lesueur)	Okizayori	1~+	1~+															large area
	<i>Cololabis saira</i> (Brevoort)	Sanna	1	1															subtropical
Scomberesocidae																			
																			large area

+, 2-19 individuals; ++, 20-99; +++, 100 or more.  
 Rare, less than 60 times; occasional, 60-118; often, 119-178; frequent, 179-237; general, 238 or more.

Family	Scientific name	Japanese name	Round number of individuals										Frequency (total times)	Distribution area				
			Spring	Summer	Autumn	Winter	2002	2003	2004	2005	2006	2007			2008	2009	2010	
Perciformes Sebastidae	<i>Sebastes marmoratus</i> (Cuvier)	Kasago	1~+	1~+	1~+	1~+	3	2	4	0	2	1	3	5	0	rare (20)	temperate	
	<i>Sebastes schlegelii</i> Hilgendorf	Kurosoi	1	1	1	1	0	2	1	0	0	1	1	0	0	0	rare (5)	temperate
	<i>Sebastes</i> spp.	Mebaru	+~+++	1~+++	1~+	+~+++	15	22	20	15	23	31	19	22	5	0	often (172)	temperate
	<i>Sebastes oblongus</i> Günther	Takenokomebaru	1	1	1	1	0	1	0	0	0	0	0	0	0	0	rare (1)	temperate
	<i>Pterois tumulata</i> Temminck and Schlegel	Minokasago	1~+	1~+	1~+	1~+	16	14	17	14	11	21	17	13	1	0	often (124)	subtropical
	<i>Pterois volitans</i> (Linnaeus)	Hanaminkasago	1	1	1	1	0	0	1	0	0	0	0	0	0	0	rare (1)	subtropical
	<i>Apistus carinatus</i> (Bloch and Schneider)	Hachi	1	1	1	1	1	1	4	1	2	0	0	0	0	0	rare (9)	subtropical
	<i>Hypodites rubripinnis</i> (Temminck and Schlegel)	Haokoze	1~+	1~+	1~+	1~+	4	7	5	1	3	3	0	4	1	4	rare (31)	subtropical
	<i>Inimicus japonicus</i> (Cuvier)	Onokoze	1	1	1	1	0	2	1	0	1	3	0	4	0	0	rare (13)	subtropical
	<i>Minois monodactylus</i> (Bloch and Schneider)	Himeokoze	1	1	1	1	0	1	0	1	0	1	1	1	1	0	rare (6)	subtropical
	<i>Pterygopterygia hemisticta</i> (Temminck and Schlegel)	Sokohoubou	1	1	1	1	1	0	0	0	0	0	0	0	0	0	rare (1)	subtropical
	<i>Chelodactylus spinosus</i> (McClelland)	Houbou	1	1~+	1~+	1~+	5	12	8	6	5	4	1	5	0	0	rare (46)	large area
<i>Lepidotrigla kishinouyei</i> Snyder	Onkanagashira	1	1	1	1	1	0	0	0	0	0	0	0	0	0	rare (1)	subtropical	
<i>Lepidotrigla microptera</i> Günther	Kanagashira	1	1	1	1	0	0	2	0	0	0	0	1	0	0	rare (3)	large area	
<i>Peristodion orientale</i> Temminck and Schlegel	Kihoubou	1	1	1	1	0	1	0	0	0	0	0	0	0	0	rare (1)	temperate	
<i>Platycephalus</i> sp.2	Magochi	1	1	1	1	0	1	0	1	0	1	0	1	0	0	rare (4)	temperate	
<i>Rogadius asper</i> (Cuvier)	Matsubagochi	1	1	1	1	0	0	2	0	0	0	0	0	0	0	rare (3)	subtropical	
<i>Inegocia japonica</i> (Cuvier)	Tokagagochi	1~+	1~+	1~+	1~+	1	0	3	2	0	2	0	0	0	0	rare (8)	subtropical	
<i>Ratabulus megacanthus</i> (Tanaka)	Hanamegochi	1	+	1	+	5	0	0	1	0	0	0	0	0	0	rare (6)	temperate	
<i>Onigocia spinosa</i> (Temminck and Schlegel)	Onigochi	+	1~+	1	1	3	6	0	4	2	1	1	1	1	0	rare (18)	subtropical	
<i>Thysanophrys celibica</i> (Bleeker)	Celebusgochi	1	1	1	1	0	0	0	0	0	0	0	0	1	1	rare (2)	subtropical	
<i>Lateolabrax latius</i> Katayama	Hirarusuki	1~+	+	1~+	1~+	5	6	3	3	4	6	10	5	0	0	rare (42)	temperate	
<i>Lateolabrax japonicus</i> (Cuvier)	Suzuki	1~+	1~+	1~+	1~+	23	19	18	17	24	36	29	23	2	0	frequent (191)	temperate	
<i>Lateolabrax maculatus</i> (McClelland)	Tairikusuzuki	1~+	+	1~+	1~+	0	4	2	0	0	0	0	2	0	0	rare (8)	subtropical	
<i>Stereolepis doederleini</i> Lindberg and Krasnyukova	Ookuchishinagi	1	1	1	1	1	0	0	0	0	0	0	0	0	0	rare (1)	large area	
<i>Synagrops philippensis</i> (Günther)	Himesumukituo	1	1	1	1	0	1	0	0	0	0	0	0	0	0	rare (1)	subtropical	
<i>Epinephelus septemfasciatus</i> (Thunberg)	Mahata	1~+	1~+	1~+	1~+	5	2	6	5	3	2	10	4	0	0	rare (37)	subtropical	
<i>Epinephelus akaara</i> (Temminck and Schlegel)	Kijihata	1	1	1	1	1	0	0	0	0	2	0	0	1	0	rare (4)	large area	
<i>Epinephelus bruneus</i> Bloch	Kue	1	1	1	1	1	3	1	2	1	2	0	1	0	0	rare (11)	subtropical	
<i>Epinephelus awoara</i> (Temminck and Schlegel)	Aohata	1	1	1	1	1	0	1	0	1	0	2	0	0	0	rare (5)	subtropical	
<i>Cookeolus japonicus</i> (Cuvier)	Chikamekintoki	1	1	1	1	0	0	0	0	0	0	2	0	0	0	rare (2)	subtropical	
<i>Priacanthus macracanthus</i> Cuvier	Kindokidai	1	+	1~+	1~+	0	0	0	0	0	0	0	0	0	0	rare (30)	temperate	
<i>Apogon semilineatus</i> Temminck and Schlegel	Nenbusudai	+~+++	+~+++	+~+++	+~+++	26	30	25	22	24	33	25	25	0	0	frequent (210)	temperate	
<i>Apogon doederleini</i> Jordan and Snyder	Oosujishimochi	1	1	1	1	0	0	1	1	1	0	0	0	0	0	rare (2)	subtropical	
<i>Apogon cookii</i> Macleay	Sujishimochi	1	1	1	1	0	1	0	0	0	0	0	0	0	0	rare (1)	subtropical	
<i>Apogon niger</i> Döderlein	Kuroishimochi	1	1	1	1~+	3	0	0	3	0	1	3	1	1	1	rare (12)	subtropical	
<i>Apogon lineatus</i> Temminck and Schlegel	Tenjikuudai	1	1	1	1	0	0	0	0	0	2	1	0	0	0	rare (3)	large area	
<i>Branchiostegus japonicus</i> (Houttuyn)	Akaamadai	1~+++	+~+++	+~+++	+~+++	26	31	28	24	22	25	21	21	0	0	rare (1)	temperate	
<i>Scombrops boops</i> (Houttuyn)	Mutsu	1	1	1	1	1	1	1	1	1	1	1	1	0	0	rare (7)	large area	
<i>Echeneis naucrates</i> Linnaeus	Kobanzame	+	1~+	1~+	1~+	1	1	1	1	1	1	1	0	0	0	rare (24)	large area	
<i>Rachycentron canadum</i> (Linnaeus)	Sugi	+	1~+	1~+	1~+	1	6	8	2	4	2	1	0	0	0	rare (14)	large area	
<i>Coryphaena hippurus</i> Linnaeus	Shira	1	+~+++	+~+++	+~+++	3	0	1	5	0	2	1	2	0	0	rare (14)	large area	
<i>Elagatis bipinnulata</i> (Quoy and Gaimard)	Tsumuburi	+	1	1	1	1	1	2	0	1	0	0	0	0	0	rare (6)	subtropical	
<i>Seriolina nigrofasciata</i> (Rüppell)	Aburi	+	1~+	1~+	1~+	3	0	1	2	0	1	0	0	0	0	rare (7)	subtropical	
<i>Seriola quinqueradiata</i> Temminck and Schlegel	Buri	1~+++	1~+++	1~+++	1~+++	29	25	23	23	31	25	19	27	5	0	frequent (207)	temperate	
<i>Seriola lalandi</i> Valenciennes	Hiramasa	1~+++	1~+++	1~+++	1~+++	4	8	3	1	6	17	10	5	0	0	rare (54)	large area	
<i>Seriola rivoliana</i> Valenciennes	Hiranaagakanpachi	1~+	+~+++	+~+++	+~+++	16	6	18	15	10	13	11	12	0	0	rare (4)	subtropical	
<i>Seriola dumerilii</i> (Risso)	Kanpachi	+~+++	+~+++	+~+++	+~+++	33	37	36	28	36	44	35	34	5	0	occasional (101)	temperate	
<i>Trachurus japonicus</i> (Temminck and Schlegel)	Maaji	+~+++	+~+++	+~+++	+~+++	2	1	1	0	0	1	1	0	0	0	general (288)	temperate	
<i>Megalaspis corcyola</i> (Linnaeus)	Onaji	+	1~+	1~+	1~+	0	1	1	1	0	0	1	0	0	0	rare (6)	subtropical	
<i>Scomberoides tol</i> (Cuvier)	Minamikekatsuo	1	1	1	1	0	1	1	1	1	0	0	0	0	0	rare (3)	subtropical	

+ , 2-19 individuals: ++, 20-99; +++, 100 or more.  
 Rare, less than 60 times; occasional, 60-118; often, 119-178; frequent, 179-237; general, 238 or more.

Appendix 1. Continued

Family	Scientific name	Japanese name	Collected times											Frequency (total times)	Distribution area				
			Spring	Summer	Autumn	Winter	2002	2003	2004	2005	2006	2007	2008			2009	2010		
Leiognathidae	<i>Decapterus macrostoma</i> Bleeker	Moro	1	~	+	+												occasional (111)	subtropical
	<i>Decapterus maruadsi</i> (Temminck and Schlegel)	Maruaji	1	~	+	+												occasional (111)	subtropical
	<i>Decapterus muroadsi</i> (Temminck and Schlegel)	Muroaji	1	~	+	+												occasional (111)	subtropical
	<i>Selar crumenophthalmus</i> (Bloch)	Meaji	1	~	+	+												occasional (111)	subtropical
	<i>Alectis ciliaris</i> (Bloch)	Itohikaji	1	~	+	+												occasional (111)	subtropical
	<i>Caranx sexfasciatus</i> Quoy and Gaimard	Gingameaji	1	~	+	+												occasional (111)	subtropical
	<i>Pseudocaranx dentex</i> (Bloch and Schneider)	Shimaaji	1	~	+	+												occasional (111)	subtropical
	<i>Kawarimus equula</i> (Temminck and Schlegel)	Kawari	1	~	+	+												occasional (111)	subtropical
	<i>Carangoides ferdau</i> (Forsskål)	Kurohiraaji	1	~	+	+												occasional (111)	subtropical
	<i>Carangoides orthogrammus</i> (Jordan and Gilbert)	Nanyoukaiwari	1	~	+	+												occasional (111)	subtropical
Lethrinidae	<i>Carangoides heilandensis</i> (Whitley)	Ryukyuuyoroaji	1	~	+	+												occasional (111)	subtropical
	<i>Carangoides chrysophrys</i> (Cuvier)	Hishiyoroaji	1	~	+	+												occasional (111)	subtropical
	<i>Nuchequila nuchalis</i> (Temminck and Schlegel)	Hiiragi	1	~	+	+												occasional (111)	subtropical
	<i>Equulites rivulatus</i> (Temminck and Schlegel)	Okhiraaji	1	~	+	+												occasional (111)	subtropical
	<i>Brama dasumieri</i> Cuvier	Himeshimagatsuo	1	~	+	+												occasional (111)	subtropical
	<i>Brama japonica</i> Hilgendorf	Shimagatsuo	1	~	+	+												occasional (111)	subtropical
	<i>Pterocombus petersii</i> (Hilgendorf)	Ryugunohime	1	~	+	+												occasional (111)	subtropical
	<i>Enmeltichthys struhsakeri</i> Heemstra and Randall	Rousokuchibiki	1	~	+	+												occasional (111)	subtropical
	<i>Lutjanus ophanesii</i> (Bleeker)	Yokosujifuedai	1	~	+	+												occasional (111)	subtropical
	<i>Lutjanus argentimaculatus</i> (Forsskål)	Gomafuedai	1	~	+	+												occasional (111)	subtropical
Caesionidae	<i>Pterocaesio trilineata</i> Carpenter	Isentakasago	1	~	+	+												occasional (111)	subtropical
	<i>Pterocaesio diogramma</i> (Bleeker)	Takasago	1	~	+	+												occasional (111)	subtropical
	<i>Labotes surinamensis</i> (Bloch)	Matsudai	1	~	+	+												occasional (111)	subtropical
	<i>Gerres equulus</i> (Temminck and Schlegel)	Kurosagi	1	~	+	+												occasional (111)	subtropical
	<i>Parapristipoma trilineatum</i> (Thunberg)	Isaki	1	~	+	+												occasional (111)	subtropical
	<i>Haplogerys nigripinnis</i> (Schlegel in Temminck and Schlegel)	Higesoridai	1	~	+	+												occasional (111)	subtropical
	<i>Haplogerys seminii</i> Iwatsuki and Nakabo	Higedai	1	~	+	+												occasional (111)	subtropical
	<i>Diogramma picta</i> (Thunberg)	Korodai	1	~	+	+												occasional (111)	subtropical
	<i>Plectrohinchus cinctus</i> (Temminck and Schlegel)	Kosyoudai	1	~	+	+												occasional (111)	subtropical
	<i>Rhabdosargus sarba</i> (Forsskål)	Hedai	1	~	+	+												occasional (111)	subtropical
Lethrinidae	<i>Acanthopagrus schlegelii</i> (Bleeker)	Kurodai	1	~	+	+												occasional (111)	subtropical
	<i>Acanthopagrus latas</i> (Houttuyn)	Kichinu	1	~	+	+												occasional (111)	subtropical
	<i>Pagrus major</i> (Temminck and Schlegel)	Madai	1	~	+	+												occasional (111)	subtropical
	<i>Eymnis tauifrons</i> (Temminck and Schlegel)	Chidai	1	~	+	+												occasional (111)	subtropical
	<i>Gymnochranius griseus</i> (Temminck and Schlegel)	Metchidai	1	~	+	+												occasional (111)	subtropical
	<i>Lethrinus genivittatus</i> Valenciennes	Itofuifuki	1	~	+	+												occasional (111)	subtropical
	<i>Lethrinus nebulosus</i> (Forsskål)	Hamafuefuki	1	~	+	+												occasional (111)	subtropical
	<i>Nibea albiflora</i> (Richardson)	Koichi	1	~	+	+												occasional (111)	subtropical
	<i>Pennahia argentata</i> (Houttuyn)	Shiroguchi	1	~	+	+												occasional (111)	subtropical
	<i>Sillago japonica</i> Temminck and Schlegel	Shiragisu	1	~	+	+												occasional (111)	subtropical
Pempheidae	<i>Upeneus tragula</i> Richardson	Yomehimeji	1	~	+	+												occasional (111)	subtropical
	<i>Upeneus japonicus</i> (Houttuyn)	Himeji	1	~	+	+												occasional (111)	subtropical
	<i>Parupeneus ciliatus</i> (Lacepede)	Hourahimeji	1	~	+	+												occasional (111)	subtropical
	<i>Parapriacanthus ransonneti</i> Steindachner	Kimmemodoki	1	~	+	+												occasional (111)	subtropical
	<i>Pempheris japonica</i> Döderlein	Tsumagurohatampo	1	~	+	+												occasional (111)	subtropical
	<i>Pempheris schwenkii</i> Bleeker	Minamihatampo	1	~	+	+												occasional (111)	subtropical
	<i>Hemiochus acuminatus</i> (Linnaeus)	Hatatadai	1	~	+	+												occasional (111)	subtropical
	<i>Hemiochus diphyes</i> Jordan	Murehatadai	1	~	+	+												occasional (111)	subtropical
	<i>Chaetodon auripes</i> Jordan and Snyder	Chyouchyouo	1	~	+	+												occasional (111)	subtropical
	<i>Chaetodon septentrionalis</i> (Temminck and Schlegel)	Kinchyakudai	1	~	+	+												occasional (111)	subtropical
Pomacanthidae	<i>Exisias acinarostrius</i> (Temminck and Schlegel)	Tengudai	1	~	+	+												occasional (111)	subtropical
	<i>Cirrhitichthys anurus</i> (Temminck and Schlegel)	Okigombe	1	~	+	+												occasional (111)	subtropical
	<i>Goniistius zonatus</i> (Cuvier)	Takanohadai	1	~	+	+												occasional (111)	subtropical
	<i>Chelodactylidae</i>		1	~	+	+												occasional (111)	subtropical
	<i>Chelodactylidae</i>		1	~	+	+												occasional (111)	subtropical
	<i>Chelodactylidae</i>		1	~	+	+												occasional (111)	subtropical
	<i>Chelodactylidae</i>		1	~	+	+												occasional (111)	subtropical
	<i>Chelodactylidae</i>		1	~	+	+												occasional (111)	subtropical
	<i>Chelodactylidae</i>		1	~	+	+												occasional (111)	subtropical

+, 2-19 individuals; ++, 20-99; +++, 100 or more. Rare, less than 60 times; occasional, 60-118; often, 119-178; frequent, 179-237; general, 238 or more.

Appendix 1. Continued

Family	Scientific name	Japanese name	Round number of individuals				Collected times										Frequency (total times)	Distribution area	
			Spring	Summer	Autumn	Winter	2002	2003	2004	2005	2006	2007	2008	2009	2010				
Cephalidae	<i>Acanthocephala trawsoni</i> (Temminck and Schlegel)	Akakachi	1	1	1	1	0	0	0	1	0	0	0	0	0	0	0	occasional (76)	temperate
Embiotocidae	<i>Ditrema temminckii temminckii</i> Bleeker	Umitanago	1	1	1	1	1	12	11	8	9	25	4	6	0	0	0	rare (2)	subtropical
Pomacentridae	<i>Chromis fumens</i> (Tanaka)	Matsubasuzumedai	+	1	+		0	0	1	1	0	0	0	0	0	0	0	rare (5)	temperate
	<i>Chromis notata</i> (Temminck and Schlegel)	Suzumedai		1	+		0	2	1	0	2	0	0	0	0	0	0	rare (33)	subtropical
	<i>Abudofduf vaigiensis</i> (Quoy and Gaimard)	Oyabichuya		1	1	1	13	6	2	4	0	3	4	1	0	0	0	rare (3)	temperate
Teraponidae	<i>Terapon jarbua</i> (Forsskal)	Kotohiki		1	1	1	0	0	0	0	0	0	0	0	1	0	0	rare (2)	temperate
	<i>Terapon thersites</i> Cuvier	Himekotohiki		1	1	1	0	0	0	0	0	0	1	0	0	0	0	rare (23)	temperate
	<i>Rhynchoplatys oxyrinchus</i> (Temminck and Schlegel)	Shimatsaki		1	1	1	5	4	3	3	2	1	1	4	0	0	0	rare (18)	temperate
Scorpididae	<i>Labracoglossa argentiventris</i> Peters	Takabe		1	1	1	3	3	5	4	0	2	1	0	0	0	0	rare (23)	temperate
Oplegnathidae	<i>Oplegnathus fasciatus</i> (Temminck and Schlegel)	Ishidai		1	1	1	4	5	5	1	1	1	1	5	0	0	0	often (161)	subtropical
	<i>Oplegnathus punctatus</i> (Temminck and Schlegel)	Ishigakidai		1	1	1	18	20	17	17	23	23	24	19	0	0	0	rare (31)	temperate
Kyphosidae	<i>Kyphosus vaigiensis</i> (Quoy and Gaimard)	Isuzumi		1	1	1	7	4	2	8	3	2	4	1	0	0	0	rare (1)	temperate
	<i>Kyphosus bigibbus</i> Lacepède	Notosuzumi		1	1	1	1	0	0	0	0	0	0	0	0	0	0	rare (1)	temperate
Microcanthidae	<i>Microcanthus strigatus</i> (Cuvier)	Kagokakidai		1	1	1	5	5	3	1	2	2	0	2	0	0	0	rare (20)	subtropical
Girellidae	<i>Girella punctata</i> Gray	Mejina		1	1	1	5	6	11	13	16	18	17	7	0	0	0	occasional (93)	temperate
	<i>Girella leonina</i> (Richardson)	Kuromejina		1	1	1	0	2	0	0	0	1	0	0	0	0	0	rare (3)	temperate
Centrolophidae	<i>Hyperoglyphe japonica</i> (Döderlein)	Medai		1	1	1	2	0	4	0	0	1	0	0	0	0	0	rare (7)	large area
	<i>Psenopsis anomala</i> (Temminck and Schlegel)	Ibodai		1	1	1	4	8	3	1	8	2	3	3	0	0	0	rare (32)	large area
Stromateidae	<i>Pampus punctatissimus</i> (Temminck and Schlegel)	Managatsuo		1	1	1	0	1	0	1	0	0	0	0	0	0	0	rare (4)	temperate
Nomeidae	<i>Psenes pelliculatus</i> Lütken	Hanabirau		1	1	1	0	0	1	0	1	1	2	0	0	1	0	rare (6)	subtropical
Polynemoidae	<i>Polydactylus plebeius</i> (Broussonet)	Tsubamekonoshiro		1	1	1	0	0	0	0	0	1	0	0	0	0	0	rare (1)	subtropical
Labridae	<i>Choerodon azurio</i> (Jordan and Snyder)	Ira		1	1	1	0	0	0	0	0	1	0	0	0	0	0	rare (2)	subtropical
	<i>Semioscopelus reticulatus</i> (Valenciennes)	Kobudai		1	1	1	0	0	0	0	0	0	0	0	0	0	0	rare (1)	subtropical
	<i>Pteropogon aurigarius</i> (Richardson)	Ohagurobera		1	1	1	5	3	2	3	2	0	1	4	1	0	0	rare (21)	temperate
	<i>Pseudolabrus sieboldi</i> Mabuchi and Nakabo	Hoshisanohabera		1	1	1	3	2	0	2	1	0	1	4	0	0	0	rare (13)	temperate
	<i>Pseudolabrus eoehinus</i> (Richardson)	Akasanohabera		1	1	1	3	2	0	2	1	0	1	4	0	0	0	rare (3)	temperate
	<i>Suezichthys gracilis</i> (Steindachner and Döderlein)	Itobera		1	1	1	1	1	0	0	0	0	0	0	0	0	0	rare (1)	subtropical
	<i>Stethojulis interrupta</i> Jordan and Snyder	Kaminaribera		1	1	1	0	0	0	0	0	0	0	0	1	0	0	rare (1)	subtropical
	<i>Parajulis poecilepera</i> (Temminck and Schlegel)	Kyususen		1	1	1	13	9	9	10	9	5	5	5	0	0	0	occasional (65)	temperate
	<i>Halichoeres tenuispinis</i> (Günther)	Honbera		1	1	1	0	5	1	3	0	0	4	0	0	0	0	rare (13)	temperate
Scaridae	<i>Scarus oifrons</i> Temminck et Schlegel	Abudai		1	1	1	0	0	1	0	0	0	0	0	0	0	0	rare (3)	subtropical
Hexagrammidae	<i>Hexagrammos agrannus</i> (Temminck and Schlegel)	Kujime		1	1	1	2	1	0	4	0	2	0	1	0	0	0	rare (14)	temperate
	<i>Hexagrammos otakii</i> Jordan and Starks	Ainame		1	1	1	1	0	1	0	0	2	0	0	0	0	0	rare (4)	temperate
Cottidae	<i>Pseudoblennius cottoides</i> (Richardson)	Asahinahaze		1	1	1	0	0	1	5	3	1	6	3	0	0	0	rare (19)	temperate
	<i>Pseudoblennius percooides</i> Günther	Anahaze		1	1	1	7	10	8	10	8	5	7	5	3	0	0	occasional (63)	temperate
Liparidae	<i>Liparis tanakate</i> (Gilbert and Burke)	Kusauo		1	1	1	5	5	2	4	9	3	1	0	0	0	0	rare (29)	large area
Stichaeidae	<i>Chirolophus japonicus</i> Herzenstein	Fusugino		1	1	1	0	0	0	0	0	0	0	0	0	0	0	rare (2)	large area
	<i>Dichvosoma burgeri</i> van der Hoeven	Dainangino		1	1	1	0	5	1	3	0	0	4	0	0	0	0	rare (13)	temperate
	<i>Pholis nebulosa</i> (Temminck and Schlegel)	Ookazunagi		1	1	1	6	6	9	4	9	12	5	8	1	0	0	occasional (60)	temperate
Pholidae	<i>Paraperca pulchella</i> (Temminck and Schlegel)	Giropo		1	1	1	1	0	0	0	1	1	0	1	0	0	0	rare (4)	temperate
Pinguipedidae	<i>Ammodytes personatus</i> Girard	Ikanago		1	1	1	0	4	2	2	3	0	0	0	0	0	0	rare (11)	temperate
Anmodytidae	<i>Uranoscopus chinensis</i> Guichenot	Kibiremishima		1	1	1	0	1	3	1	0	0	0	1	0	0	0	rare (6)	temperate
Uranoscopidae	<i>Emmeperygus ethostomus</i> (Jordan and Snyder)	Hebigino		1	1	1	1	0	0	0	0	0	0	0	0	0	0	rare (1)	subtropical
Tripterygiidae	<i>Parablennius yatai</i> (Jordan and Snyder)	Isogino		1	1	1	3	0	3	3	0	0	0	0	0	0	0	rare (11)	temperate
Blenniidae	<i>Petroscirtes breviceps</i> (Valenciennes)	Nijigino		1	1	1	13	15	10	11	7	11	9	5	0	0	0	occasional (81)	subtropical
	<i>Reptomucenus lugenini</i> (Bleeker)	Yannumeni		1	1	1	2	6	5	1	6	1	3	1	2	0	0	rare (27)	temperate
Callionymidae	<i>Reptomucenus valenciennei</i> (Temminck and Schlegel)	Haataatenumeri		1	1	1	0	2	0	0	0	0	0	0	0	0	0	rare (4)	temperate
	<i>Reptomucenus curvicornis</i> (Valenciennes)	Nezumigochi		1	1	1	4	0	5	4	0	0	0	0	0	0	0	rare (22)	temperate
Gobiidae	<i>Lecocarpion petersii</i> Hilgendorf	Shirouo		1	1	1	0	0	1	0	0	0	0	0	0	0	0	rare (1)	temperate
	<i>Sagamia genionema</i> (Hilgendorf)	Sabihaze		1	1	1	3	5	3	6	8	10	2	1	0	0	0	rare (38)	temperate
	<i>Pterogobius virgo</i> (Temminck and Schlegel)	Nishikihaze		1	1	1	0	0	1	1	5	3	0	0	0	0	0	rare (10)	temperate
	<i>Pterogobius zonoleucus</i> Jordan and Snyder	Chiyagata		1	1	1	0	0	0	1	1	0	0	0	0	0	0	rare (2)	temperate

+, 2-19 individuals; ++, 20-99; +++, 100 or more.

Rare, less than 60 times; occasional, 60-118; often, 119-178; frequent, 179-237; general, 238 or more.

Appendix 1. Continued

Family	Scientific name	Japanese name	Collected times											Frequency (total times)	Distribution area						
			Spring	Summer	Autumn	Winter	2002	2003	2004	2005	2006	2007	2008			2009	2010				
Ephippidae	<i>Chaetogobius flavimans</i> (Temminck and Schlegel)	Mahaze																rare (2)	temperate		
	<i>Chaetogobius annularis</i> Gill	Agohaze																	rare (1)	temperate	
	<i>Platax teira</i> (Forsskal)	Tsubameuo	+	1	1	1	2	2	2	3	2	1	0	0	0	0	0	0	rare (17)	large area	
	<i>Scatophagus argus</i> (Linnaeus)	Kurohoshimaniyuidai																	rare (2)	subtropical	
	<i>Siganus fasciatus</i> (Houttuyn)	Algo	+	1	1	1	22	22	25	24	22	21	0	0	0	0	0	0	0	often (176)	large area
	<i>Priacanthus scapulrum</i> Valenciennes	Nizadai	+	1	1	1	16	18	14	9	5	10	0	0	0	0	0	0	0	occasional (97)	temperate
	<i>Naso unicornis</i> (Forsskal)	Tengubagi																		rare (2)	subtropical
	<i>Acanthurus dissimilis</i> Valenciennes	Nisekanranbahi																		rare (1)	subtropical
	<i>Istiphanus platypterus</i> (Shaw)	Basyoukajiki																		rare (7)	large area
	<i>Sphyræna forsteri</i> Cuvier	Oomekamasu																		rare (1)	large area
	<i>Sphyræna pinguis</i> Günther	Akakamasu																		occasional (113)	temperate
	<i>Sphyræna helleri</i> Jenkins	Hosokamasu																		rare (1)	subtropical
	<i>Sphyræna japonica</i> Bloch and Schneider	Yamatokamasu																		occasional (62)	subtropical
	<i>Trichiurus japonicus</i> Temminck and Schlegel	Tachiuo																		often (127)	large area
<i>Scomber japonicus</i> Houttuyn	Masaba																		often (127)	large area	
<i>Scomber australasicus</i> Cuvier	Gomasaba																		rare (1)	large area	
<i>Axiis thazard thazard</i> (Lacépède)	Hirasouda																		rare (19)	large area	
<i>Axiis rochei rochei</i> (Risso)	Marusouda																		rare (15)	large area	
<i>Thunnus orientalis</i> (Temminck and Schlegel)	Kuromaguro																		rare (3)	large area	
<i>Euthynnus affinis</i> (Cantor)	Suma																		rare (1)	subtropical	
<i>Katsuwonus pelamis</i> (Linnaeus)	Katsuo																		rare (2)	subtropical	
<i>Scomberomorus niphonius</i> (Cuvier)	Sawara																		occasional (102)	large area	
Pleuronectiformes																					
Paralichthyidae	<i>Paralichthys olivaceus</i> (Temminck and Schlegel)	Hirame																		general (240)	temperate
	<i>Egysproson grandisquama</i> (Temminck and Schlegel)	Darumagarei																		rare (2)	subtropical
Bothidae	<i>Pleuronichthys cornutus</i> (Temminck and Schlegel)	Meiagarai																		rare (18)	temperate
Pleuronectidae	<i>Hippoglossoides pinetorum</i> (Jordan and Starks)	Souhachi																		rare (4)	temperate
	<i>Kareius bicoloratus</i> (Basilewsky)	Isbigarei																		rare (11)	temperate
	<i>Pleuronectes yokohamae</i> Günther	Makogarei																		rare (14)	temperate
Soleidae	<i>Heteromycteris japonica</i> (Temminck and Schlegel)	Sasashinoshita																		rare (15)	temperate
	<i>Aesoplia cornuta</i> Kaup	Tsumoushinoshita																		rare (1)	subtropical
	<i>Zebrias zebrius</i> (Temminck and Schlegel)	Shinashinoshita																		rare (12)	temperate
Cynoglossidae	<i>Paraplagusia japonica</i> (Temminck and Schlegel)	Kuroushinoshita																		rare (15)	temperate
	<i>Cynoglossus litinus</i> (Snyder)	Minamiakashiabirame																		rare (10)	temperate
Tetraodontiformes																					
Triacanthidae	<i>Triacanthus biaculeatus</i> (Bloch)	Gima																		rare (1)	large area
Balistidae	<i>Canthidermis maculata</i> (Bloch)	Amimongara																		rare (2)	large area
Monacanthidae	<i>Aluterus monoceros</i> (Linnaeus)	Usubahagi																		rare (47)	large area
	<i>Aluterus scriptus</i> (Osbeck)	Soushahagi																		rare (9)	subtropical
	<i>Rudarius ercodes</i> Jordan and Fowler	Amimehagi																		occasional (85)	temperate
	<i>Thamnaconus modestus</i> (Günther)	Umazurahagi																		often (133)	temperate
	<i>Chaetoderms penicillifera</i> (Cuvier)	Higehagi																		rare (3)	subtropical
Ostraciidae	<i>Stephanolepis cirrhifer</i> (Temminck and Schlegel)	Kawahagi																		general (242)	temperate
	<i>Paramonacanthus oblongus</i> (Temminck and Schlegel)	Yosogi																		occasional (70)	subtropical
	<i>Lactoria cornuta</i> (Linnaeus)	Kongoufugu																		rare (2)	subtropical
	<i>Ostracion immaculatum</i> Temminck and Schlegel	Hakofugu																		occasional (105)	temperate
Tetraodontidae	<i>Canthigaster rivulata</i> (Temminck and Schlegel)	Kitamakura																		rare (1)	subtropical
	<i>Takifugu paradisi</i> (Abe)	Higanfugu																		general (240)	large area
	<i>Takifugu snyderi</i> (Abe)	Syousufugu																		general (240)	large area
	<i>Takifugu vermicularis</i> (Temminck and Schlegel)	Nashifugu																		rare (23)	temperate
	<i>Takifugu porphyreus</i> (Temminck and Schlegel)	Mafugu																		rare (1)	temperate
	<i>Takifugu poecilnotus</i> (Temminck and Schlegel)	Komofugu																		general (280)	temperate
	<i>Takifugu xanthopterus</i> (Temminck and Schlegel)	Shimafugu																		rare (5)	temperate

+ 2-19 individuals; ++, 20-99; +++, 100 or more.

Rare, less than 60 times; occasional, 60-118; often, 119-178; frequent, 179-237; general, 238 or more.



Family	Scientific name	Japanese name	Collected times												Frequency (total times)	Distribution area										
			Spring	Summer	Autumn	Winter	2002	2003	2004	2005	2006	2007	2008	2009			2010									
SCYPHOZOA	Semaestomeae	Pelagiidae	<i>Takifugu sictionotus</i> (Temminck and Schlegel)	1~+	1~+	1~+	1~+	1	5	5	6	6	3	0	0	0	0	rare (34)	temperate							
			<i>Takifugu niphobles</i> (Jordan and Snyder)	+~++	1~+++	1~+	1~+	14	29	27	24	26	29	22	33	2	0	0	0	frequent (194)	large area					
			<i>Takifugu rubripes</i> (Temminck and Schlegel)	1	1~+	1~+	1~+	1	4	5	0	1	4	1	1	0	0	0	0	0	rare (17)	temperate				
			<i>Torquigener brevipinnis</i> (Regan)			1		0	0	1	0	0	0	0	0	0	0	0	0	0	rare (1)	subtropical				
			<i>Arothron firmamentum</i> (Temminck and Schlegel)				1~+	0	1	3	1	2	3	0	1	0	0	0	0	0	0	rare (11)	subtropical			
			<i>Lagocephalus inermis</i> (Temminck and Schlegel)				1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	rare (1)	temperate			
			<i>Lagocephalus glovei</i> Abe and Tabata				1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	rare (2)	subtropical			
			<i>Lagocephalus spadiceus</i> (Richardson)				1	1~+	1~+	1~+	11	13	9	6	2	9	10	2	0	0	0	occasional (62)	large area			
			<i>Lagocephalus sceleratus</i> (Gmelin)				1	1	1	1	0	1	0	0	0	1	0	0	0	0	0	rare (2)	subtropical			
			<i>Diodon holocanthus</i> Linnaeus				+~+++	1	1~+	1~+	13	5	16	4	7	17	10	18	4	0	0	occasional (94)	subtropical			
			<i>Diodon hystrix</i> Linnaeus					1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	rare (1)	subtropical		
			CUBOZOA	Boleroiidae	Aciniaria	<i>Chrysaora pacifica</i> (Goette)	+~+++	+~+++	+~+++	+~+++		13	18	13	15	12	11	15	18	2	0	0	occasional (117)	temperate		
						<i>Pelagia noctiluca</i> (Forsk��l)	+~+++	+~+++	+~+++	+~+++	4	2	1	0	0	3	4	1	0	0	0	0	0	rare (15)	subtropical	
						<i>Aurelia aurita</i> (Linnaeus)	+~+++	+~+++	+~+++	+~+++	20	34	23	14	23	25	24	22	1	0	0	0	0	0	frequent (186)	large area
<i>Rhopilema hispidum</i> Vanh��ffen	1							0	0	0	0	0	1	0	0	0	0	0	0	0	0	rare (1)	temperate			
<i>Nemoptera nomurai</i> (Kishinouye)	+	+~+++				+~+		7	8	2	6	8	0	0	4	0	0	0	0	0	0	rare (35)	temperate			
<i>Rhopilema esculentum</i> Kishinouye	1~+	1~+				1		0	3	0	1	2	2	1	1	0	0	0	0	0	0	rare (10)	temperate			
<i>Nerosstoma setouchianum</i> (Kishinouye)	1~++	1~+				1~+		0	2	0	1	0	1	0	1	0	0	4	0	0	0	rare (8)	temperate			
<i>Bolocerooides memurichi</i> (Kvietniewski)	+++							0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	rare (2)	subtropical		
<i>Carybdea brevipedalia</i> Kishinouye	+~+++	+~+++				+~+++	1	7	7	2	9	8	6	1	3	0	0	0	0	0	0	0	rare (43)	subtropical		
HYDROZOA	Anthomedusae	Bougainvillidae				<i>Nempopsis dofleini</i> Mass	+~+++					0	1	0	1	0	0	0	0	0	0	0	0	rare (2)	temperate	
						<i>Spirocodon saltator</i> (Tilley)	+~+++				5	7	6	0	8	5	0	0	0	0	0	0	0	0	rare (31)	temperate
						<i>Porpita porpita</i> Linnaeus	+	+~+++			0	2	1	0	0	0	0	0	0	0	0	0	0	0	rare (3)	subtropical
						<i>Aequorea coerulescens</i> (Brandt)	+~+++				7	7	7	0	9	9	7	8	0	0	0	0	0	0	rare (54)	temperate
						<i>Aequorea macrodactyla</i> (Brandt)	1	+			0	0	0	0	0	0	0	0	2	0	0	0	0	0	rare (2)	temperate
			<i>Clytia languida</i> (A. Agassiz)	1				0	0	0	0	0	0	0	0	1	0	0	0	0	0	rare (1)	temperate			
			<i>Sugiyara chengshanense</i> (Ling)	+++				0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	rare (1)	temperate		
			<i>Olindeia formosa</i> (Goto)	+~+++	1~++	1	1	3	1	5	5	3	0	10	6	0	0	0	0	0	0	0	rare (33)	temperate		
			<i>Aegina rosea</i> Eschscholtz	1				0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	rare (1)	large area		
			TENTACULATA	Cestidae	Bolinopsidae	<i>Cestum veneris</i> Lesueur	+	+				1	0	0	0	0	2	0	3	0	0	0	0	rare (6)	large area	
						<i>Bolinopsis mikado</i> Moser	+++	+~+++	+++	+~+++	3	6	11	0	12	11	6	9	3	0	0	0	0	0	occasional (61)	temperate
						<i>Lampea paucirina</i> (Chun)	+++				0	0	2	0	0	0	0	0	0	0	0	0	0	0	rare (2)	temperate
						<i>Leucothea japonica</i> Komai			+++		0	0	0	0	0	0	0	1	0	0	0	0	0	0	rare (1)	subtropical
						<i>Ocyropsis maculata</i> (Rang)	+~+++		++		1	0	0	0	0	0	3	0	2	0	0	0	0	0	rare (6)	subtropical
<i>Beroe cucumis</i> Fabricius	+~+++	+~++				+~+++		5	6	6	6	7	8	7	1	0	0	0	0	0	0	0	rare (46)	temperate		

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Family	Scientific name	Japanese name	Collected times												Frequency (total times)	Distribution area				
			Spring	Summer	Autumn	Winter	2002	2003	2004	2005	2006	2007	2008	2009			2010			
GASTROPODA																				
Veigastropoda																				
Turridae	<i>Turbo cornutus</i> Lightfoot	Sezue	1~+	1~+	1~+	1~+	4	6	4	3	3	0	0	0	0	0	0	rare (20)	temperate	
Discopoda																				
Strombidae	<i>Strombus (Doxander) japonicus</i> Reeve	Shidorogai	1	1	1	1	1	0	1	0	1	0	0	0	0	0	0	0	rare (3)	temperate
Cassidae	<i>Phidium (Bezoardicella) flammiferum</i> (Roding)	Kazuragai	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	rare (1)	temperate
Ficidae	<i>Ficus subintermedia</i> (d'Orbigny)	Biwagai	1~+	1~+	1~+	1~+	0	0	0	2	0	0	0	0	0	0	0	0	rare (2)	subtropical
Neogastropoda																				
Melongenidae	<i>Hemifusus tuba</i> (Gmelin)	Tengunishi	+	1	1	1	0	1	0	2	0	0	0	0	0	0	0	0	rare (3)	subtropical
Fasciolaridae	<i>Fisius perplexus ferrugineus</i> Kuroda et Habe	Konaganishi	1~+	1~+	1~+	1~+	17	11	21	15	2	12	9	14	0	0	0	0	occasional (101)	temperate
Aplysiomorpha																				
Aplysiidae	<i>Aplysia juliana</i> Quoy & Gaimard	Amakusamefurashi	+~++	+	+	+	11	13	13	12	11	16	21	21	0	0	0	0	occasional (118)	large area
	<i>Aplysia karadai</i> (Baba)	Anefurashi	1~++	1~+	1~+	1~+	1	0	0	3	3	12	11	3	0	0	0	0	rare (33)	temperate
	<i>Bursatella leachii leachii</i> de Blainville	Fureitogeamefurashi	1~+	1~+	1~+	1~+	2	0	0	0	0	0	0	0	0	0	0	0	rare (2)	subtropical
	<i>Dolabella auricularia</i> (Lightfoot)	Tatsunamigai	1~+	1~+	1~+	1~+	0	1	0	0	0	3	2	10	1	0	0	0	rare (17)	temperate
Pleurobranchomorpha																				
Pleurobranchiidae	<i>Pleurobranchaea japonica</i> Thiele	Umifukurou	1~+	1~+	1~+	1~+	2	1	0	2	0	1	0	1	0	0	0	0	rare (7)	temperate
Pleurobranchiidae	<i>Berthellina citrina</i> (Ruppell & Leuckart)	Houzukiunieragai	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	rare (1)	subtropical
Thecosomata																				
Cymbulidae	<i>Corolla intermedia</i> (Tesch)	Uchiwakantenkamegai	+	+	+	+	1	0	0	0	0	0	0	0	0	0	0	0	rare (1)	subtropical
Nudibranchia																				
Triphidae	<i>Plocamopherus tilesii</i> Bergh	Hikariunishi	1~+	1~+	1~+	1~+	8	2	2	1	7	21	5	8	0	0	0	0	rare (54)	temperate
Dorididae	<i>Homodoris japonica</i> Bergh	Yamatounishi	+	+	+	+	0	0	0	0	0	6	0	0	0	0	0	0	rare (6)	temperate
	<i>Platydoris speciosa</i> (Abraham)	Kumogataunishi	1~+	1~+	1~+	1~+	1	0	0	1	0	1	0	1	0	0	0	0	rare (3)	subtropical
	<i>Dendrodoris arborescens</i> (Collingwood)	Kuroshitanashiumishi	+	+	+	+	2	1	0	1	0	0	0	1	0	0	0	0	rare (5)	large area
Dendrodorididae	<i>Dendrodoris denisoni</i> (Angas)	Miyakounishi	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	rare (1)	temperate
Tethydidae	<i>Melibe papillosa</i> (de Filippi)	Meribeunishi	1~+	+	+	+	0	1	1	1	1	2	3	0	0	0	0	0	rare (8)	subtropical
BIVALVIA																				
Ostreoida	<i>Amusium japonicum japonicum</i> (Gmelin)	Tsukhigai	1	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	rare (2)	temperate
Pectinidae																				
CEPHALOPODA																				
Sepioida																				
Sepiidae																				
	<i>Sepia (Acanthosepion) lycidas</i> Gray	Kaminarika	1~+	1~+	1	1	4	6	3	6	5	5	7	2	0	0	0	0	rare (38)	subtropical
	<i>Sepia (Platysepia) esculenta</i> Hoyle	Kouika	+~++	1~+	1~+	1~+	12	24	23	18	18	27	21	18	2	2	2	2	often (163)	subtropical
	<i>Sepia (Doratosepion) kobienis</i> Hoyle	Himekouika	1~+	1	1	1	0	0	0	0	0	12	3	4	1	1	1	1	rare (20)	temperate
	<i>Sepia (Doratosepion) misakiensis</i> Wulker	Misakikouika	1~+	1	1	1	0	0	0	0	0	1	1	2	1	2	1	1	rare (5)	temperate
	<i>Metasepia iulbergi</i> Appellöf	Hanaika	1	1~+	1	1	5	1	2	1	0	2	2	0	0	0	0	0	rare (13)	subtropical
	<i>Septella japonica</i> Sasaki	Shiryakeika	1~++	1~++	1~+	1~+	7	10	6	3	1	16	10	2	2	2	2	2	rare (57)	subtropical
Sepiadariidae	<i>Sepiadarium kochii</i> Steenstrup	Mimikadamaishi	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	rare (1)	subtropical
Sepiolidae	<i>Euprymna morsei</i> (Verrill)	Mimika	1~+	1~+	+	+	4	13	5	8	8	6	4	3	0	0	0	0	rare (51)	temperate
Teuthoidea																				
Loliginidae																				
	<i>Sepioteuthis lessoniana</i> Lesson	Aorika	1~++	+~++	1~++	+~++	26	32	35	28	30	39	35	30	1	1	1	1	general (256)	large area
	<i>Lololus japonica</i> Hoyle	Jindouika	+~++	1~+	1~+	1~+	0	0	0	0	0	8	3	1	0	0	0	0	rare (12)	temperate
	<i>Lololus beka</i> Sasaki	Beika	++	+	+	+	2	0	0	0	0	0	0	0	0	0	0	0	rare (2)	temperate
	<i>Loligo bleekeri</i> Keferstein	Yanika	+~++	+	+	+	5	16	9	8	14	16	9	9	4	4	4	4	occasional (90)	temperate
	<i>Loligo edulis</i> Hoyle	Kensakuika	+~++	1~++	1~++	1~++	16	27	16	27	22	30	18	20	1	1	1	1	often (177)	subtropical
Onychoteuthidae	<i>Moroteuthis loembergi</i> Ishikawa & Wakiya	Kagika	1~+	1~+	1	1	0	0	0	0	4	7	3	2	0	0	0	0	rare (16)	temperate
Thysanoteuthidae	<i>Todarodes pacificus</i> Steenstrup	Sodeika	+	1~+	1~+	1~+	6	2	3	1	0	2	0	1	0	0	0	0	rare (15)	subtropical
Onmastrephidae	<i>Ommastrephes bartramii</i> (Lesueur)	Surumeika	+~++	+~++	+	+	7	15	16	11	13	19	17	11	0	0	0	0	occasional (109)	temperate
		Akaika	+	+	+	+	0	0	0	0	2	0	0	0	0	0	0	0	rare (2)	subtropical
Octopoda																				
Octopodiidae																				
	<i>Octopus vulgaris</i> Cuvier	Madako	1~+	1~+	1~+	1~+	6	13	9	14	16	11	8	19	1	1	1	1	occasional (97)	large area
	<i>Octopus ocellatus</i> Gray	lidako	1~+	1~+	1~+	1~+	1	0	0	1	1	2	1	1	0	0	0	0	rare (7)	temperate

+ , 2-19 individuals; ++, 20-99; +++, 100 or more.  
 Rare, less than 60 times; occasional, 60-118; often, 119-178; frequent, 179-257; general, 258 or more.

Family	Scientific name	Japanese name	Collected times												Frequency (total times)	Distribution area				
			Round number of individuals																	
			Spring	Summer	Autumn	Winter	2002	2003	2004	2005	2006	2007	2008	2009			2010			
Tremoctopodidae	<i>Tremoctopus violaceus gracialis</i> (Eydoux & Souleyet)	Murasakidako			1												rare (7)	subtropical		
Argonautidae	<i>Argonauta argo</i> Linnaeus	Aoigai	1~+	1	1	1	0	5	1	0	0	1	0	0	0	0	0	rare (14)	subtropical	
	<i>Argonauta hians</i> (Lightfoot)	Takobune			1			0	0	0	0	1	0	0	0	0	0	rare (1)	subtropical	
POLYCHAETA																				
Amphinomidae	<i>Chloelia flava</i> (Pallas)	Umikemushi		1															subtropical	
HIRUDINEA																				
Rhynchobdellida	<i>Trachelobdella okae</i> Moore	Hidabiru	1																temperate	
PISCICOLAE																				
MALACOSTRACA																				
Decapoda																				
Pennaeidae	<i>Penaeus (Marsupenaeus) japonicus</i> Bate	Kurumaebi			1			0	0	2	0	0	0	0	0	0	1	0	rare (3)	large area
	<i>Penaeus (Melicertus) latisulcatus</i> Kishinouye	Futomizoebi	+	1~+	1~+			0	1	3	0	3	2	1	2	0	0	0	rare (12)	subtropical
	<i>Penaeus (Penaeus) semisulcatus</i> de Haan	Kumaebi		1				0	0	0	0	1	0	0	0	0	0	0	rare (1)	subtropical
	<i>Metapenaeopsis mozimensis</i> (Rathbun)	Mogiebi	1~+	1~+				1	5	2	9	5	6	2	0	0	0	0	rare (30)	subtropical
	<i>Metapenaeopsis dalei</i> (Rathbun)	Kishiebi	+	1				0	0	0	0	2	0	0	0	0	0	0	rare (3)	temperate
	<i>Metapenaeopsis lamellata</i> (de Haan)	Hokkokuebi	1	1				0	0	0	1	0	0	0	0	0	0	0	rare (3)	temperate
Sicyoniidae	<i>Sicyonia cristata</i> (de Haan)	Ishiebi	1~+	+				1	2	0	1	2	1	0	1	0	0	0	rare (7)	subtropical
	<i>Isosujiebi</i>							1	0	0	0	0	0	0	0	0	0	0	rare (1)	large area
	<i>Palaeamon pacificus</i> (Simpson)	Akaboshiyadokari	1~+	1~+				10	3	6	4	3	4	3	2	0	0	0	rare (35)	subtropical
	<i>Dardanus asperus</i> (Berthold)	Togeitsunoyadokari	1~+	1~+				12	4	3	7	3	5	2	2	0	0	0	rare (38)	temperate
	<i>Diogenes edwardsii</i> (de Haan)	Yamatohonyadokari	1~+	1~+				0	0	0	1	0	0	0	0	0	0	0	rare (1)	temperate
	<i>Pagurus japonicus</i> (Simpson)	Benihonyadokari	+	+				1	1	0	1	0	0	0	0	0	0	0	rare (4)	temperate
	<i>Pagurus similis</i> (Ortmann)	Kimenigani						1	0	0	0	0	0	0	0	0	0	0	rare (2)	temperate
	<i>Dorippe sinica</i> Chen	Torafukarappa						1	0	0	0	0	0	0	0	0	0	0	rare (1)	subtropical
Dorippidae	<i>Calappa lophos</i> (Herbst)	Meganekarappa	1	1				1	1	0	0	1	1	0	0	0	0	0	rare (4)	subtropical
	<i>Calappa philaris</i> (Linnaeus)	Tenagakobushi	1	1				0	0	2	0	0	0	0	2	0	0	0	rare (4)	temperate
	<i>Myra fugax</i> (Fabricius)	Tsumonagakobushi	1	1~+				0	3	1	2	0	0	8	0	0	0	0	rare (17)	subtropical
Leucosiidae	<i>Leucosia anatum</i> (Herbst)	Mokuzushoi	+					1	0	0	0	0	0	0	0	0	0	0	rare (1)	subtropical
	<i>Camposcia retusa</i> Latreille	Yoisuhamoigani	+					2	0	0	1	0	0	0	0	0	0	0	rare (3)	temperate
	<i>Piguetta quadridens quadridens</i> (de Haan)	Konohagani	+					0	0	0	0	0	2	1	1	0	0	0	rare (4)	subtropical
	<i>Huenia proteus</i> de Haan	Tsumogani	1~+	1				4	3	0	1	0	1	1	0	0	0	0	rare (10)	subtropical
Parthenopidae	<i>Hyastenus diacanthus</i> (de Haan)	Hishigani						0	0	1	0	0	1	0	0	0	0	0	rare (2)	subtropical
	<i>Parthenope (Platylambrus) valida valida</i> de Haan	Shiwagazami	+	1~+				0	0	0	0	0	0	5	1	7	0	0	rare (13)	subtropical
Portunidae	<i>Liocarcinus corrugatus</i> (Pennant)	Gazami						0	0	0	0	0	0	0	0	1	0	0	rare (2)	temperate
	<i>Portunus trituberculatus</i> (Miers)	Taiwangazami	+	+				3	0	0	0	0	0	0	0	0	0	0	rare (3)	subtropical
	<i>Portunus pelagicus</i> (Linnaeus)	Janomegazami	+	+				3	5	2	0	0	0	0	0	0	0	0	rare (10)	subtropical
	<i>Portunus sanguinolentus</i> (Herbst)	Ibogazami	1	1				4	1	3	1	0	2	2	0	0	0	0	rare (13)	temperate
	<i>Portunus haani</i> (Simpson)	Akatshigani	1~+	1				0	1	1	0	0	0	0	0	1	0	0	rare (3)	temperate
	<i>Charybdis (Charybdis) miles</i> de Haan																			
CRINOIDEA																				
Comatulida	<i>Oxycomanthus japonicus</i> (Müller)	Nipponumishida	1~+	1				1	2	0	1	2	0	0	0	1	0	0	rare (7)	temperate
COMASTERIIDEA																				
ASTEROIDEA																				
Platyasterida	<i>Luidia maculata</i> Müller et Troschel	Yatsudesunahitode	1	1~+				2	1	1	0	0	0	0	0	1	0	0	rare (5)	subtropical
Luidiidae	<i>Luidia quinaria</i> von Martens	Sunahitode	1~+	1~+				0	0	0	1	0	1	0	1	7	5	0	rare (14)	temperate
	<i>Astropecten scoparius</i> Valenciennes	Momijigai	1~+	1~+				6	3	0	2	1	4	1	3	1	0	0	rare (21)	temperate
Paxillosida	<i>Astropecten polyacanthus</i> Müller et Troschel	Togemomijigai	1~+	1	1~+			0	3	3	0	0	2	9	6	0	0	0	rare (23)	subtropical
Astropectinidae																				
Valvatida	<i>Certonarctia semiregularis</i> Müller et Troschel	Akahitode	+	1				0	2	0	1	0	0	0	0	0	0	0	rare (3)	temperate
Ophiasteridae	<i>Ophiaster orbicularis</i> (Lütken)	Chatrouhokiboshi	1	1				0	2	1	1	2	2	0	0	0	0	0	rare (8)	temperate

+, 2-19 individuals: ++, 20-99; +++, 100 or more.  
 Rare, less than 60 times; occasional, 60-118; often, 119-178; frequent, 179-237; general, 238 or more.

Appendix 1. Continued

Family	Scientific name	Japanese name	Round number of individuals												Frequency (total times)	Distribution area		
			Spring	Summer	Autumn	Winter	2002	2003	2004	2005	2006	2007	2008	2009			2010	
Spilostoda																		
Asteriidae	<i>Asterina pectinifera</i> Müller et Troschel	Itomakihitode	1~+	1~++	1~+	1~+	11	10	7	9	7	5	15	12	2	occasional (78)	temperate	
Forcipulataida																		
Asteriidae	<i>Coscinasterias acutispina</i> (Stimpson)	Yatsudhitode		+			2	0	1	0	1	0	0	0	0		rare (4)	temperate
	<i>Asterias amurensis</i> Lütken	Mahitode	1	1	1	1	0	2	3	2	0	0	1	0	1		rare (9)	temperate
ECHINOIDEA																		
Echinoidea																		
Strongylocentrotidae	<i>Temnopleurus toreamaticus</i> (Leske)	Sanshouuni	1		1		0	0	0	0	0	0	2	0	0		rare (2)	temperate
	<i>Mespilia globulus</i> (Linnaeus)	Koshidakauri		1			0	0	1	0	0	0	0	0	0		rare (1)	subtropical
Echinometridae	<i>Hemicentrotus pulcherrimus</i> (A. Agassiz)	Bafununi			+		1	0	0	0	0	0	0	0	0		rare (1)	temperate
Spatangoida																		
Loveniidae	<i>Lovenia elongata</i> (Gray)	Hiratabumbuku	+	1~+	1~+	1~+	10	0	3	0	0	1	4	1	0		rare (19)	temperate
HOLOTHUROIDEA																		
Aspidochirotida																		
Holothuriidae	<i>Holothuria (Thymiosycia) decorata</i> von Marenzeller	Fujinamako			1		0	0	0	0	0	0	0	0	2		rare (2)	temperate
Stichopodidae	<i>Apostichopus japonicus</i> (Selenka)	Manamako	1~+		1~+		5	7	5	1	7	1	1	1	2		rare (29)	temperate
THALIACEA																		
Salpida																		
Salpidae	<i>Salpa fusiformis</i> Cuvier	Togarisarupa	++~+++		++		3	4	2	0	1	2	2	0	0		rare (14)	temperate
REPTILIA																		
Tesudinés																		
Cheloniidae	<i>Chelonia mydas</i> (Linnaeus)	Aoumigame		1	1		4	1	2	0	1	2	0	0	0		rare (10)	subtropical
	<i>Caretta caretta</i> Linnaeus	Akaumigame		1			0	0	0	0	0	0	0	1	0		rare (1)	subtropical
Squamata																		
Elapidae	<i>Laticauda laticaudata</i> Linnaeus	Hiroumihebi		1			0	0	1	0	0	0	0	0	0		rare (1)	subtropical

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Rare, less than 60 times; occasional, 60~118; often, 119~178; frequent, 179~237; general, 238 or more.