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Checklist of the Coastal Fishes of Lord Howe, Norfolk, and Kermadec Islands, Southwest Pacific Ocean[1]

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ABSTRACT: A checklist of coastal fishes includes 433 species from Lord Howe Island, 254 from Norfolk Island, and 145 from the Kermadec Islands. Tropical and subtropical species dominate all three faunas, but the proportion of tropical species decreases, and the proportion of subtropical species increases, from west to east. Subtropical species are the most abundant individual fishes at all three islands. Only 4.6% of the combined fauna is endemic, with individual island endemism even lower (1.2–2.1%). The fish faunas of the three islands appear to have originated mainly by larval dispersal from Australia and the Coral Sea. Evidence for present-day dispersal is discussed. Faunal relationships among the subtropical islands of the western, central, and eastern South Pacific are examined. In the South Pacific as a whole, there is a high positive correlation between coastal fish diversity and hermatypic coral diversity.

IN THE SOUTH PACIFIC OCEAN, a band of widely spaced island groups stretches from Australia to South America between the latitudes of 24° S and 32° S. From west to east, these island groups are Lord Howe, Norfolk, Kermadec, Rapa, Pitcairn, Easter, and San Felix islands. The San Felix group is bathed by the cold Peru Current and is not considered further in this paper. The remaining six island groups are subtropical, and, as might be expected from the large expanses of ocean separating them, they differ significantly in faunal composition. However, they also have some interesting faunal similarities. Some species of molluscs and coastal fishes are distributed across most of the South Pacific, and some genera are represented by sister species in the western and eastern South Pacific (Rehder 1980, Randall et al. 1990).

Recent studies have been made of the fish faunas of Rapa, Pitcairn, and Easter Island groups (Randall and Cea Egaña 1984, DiSalvo et al. 1988, Randall et al. 1990; J. E. Randall, Bishop Museum, Honolulu, pers. comm.). Checklists of coastal fishes also exist for Lord Howe, Norfolk, and Kermadec islands (Allen et al. 1976, Paulin and Stewart 1985, Hermes 1986), but they are now out of date because of recent additions to the faunas (Schiel et al. 1986, Francis et al. 1987, Francis 1991, Francis and Randall 1993) and numerous name changes arising from reexamination of specimens and taxonomic revisions. Furthermore, the Norfolk Island checklist (Hermes 1986) is difficult to obtain outside Norfolk Island. Consequently, it is difficult to make biogeographic comparisons among the faunas of the South Pacific islands.

The aims of this paper are to present a complete current checklist of the coastal fishes of Lord Howe, Norfolk, and Kermadec islands (hereafter called collectively the SWP Islands); to provide a biogeographical analysis of the coastal fish faunas of the SWP Islands; and to discuss the faunal relationships between the SWP Islands and the subtropical islands of the central and eastern South Pacific (hereafter called collectively the SEP Islands). Attention is focused on coastal fishes (defined in Materials and Methods section) because oceanic and deep-water species have been poorly documented in this region, and their biogeographic patterns are likely to be quite different from those of coastal fishes.

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Geography, Geology, and Coral Reef Development

The Lord Howe, Norfolk, and Kermadec island groups are each situated on one of a series of ridges that trend approximately northward from New Zealand (Carter 1980, Eade 1988; Figure 1). These ridges are separated by ocean basins over 3000 m deep. All three groups are located on the Indo-Australian Plate, but the Kermadec Islands lie just west of the Kermadec Trench, which forms the western boundary of the Pacific Plate.

The three groups are volcanic and relatively young. The Lord Howe group was formed during the late Miocene (6.9–6.4 million years ago; McDougall et al. 1981), the Norfolk group during the Pliocene (3.1–2.3 million years ago; Jones and McDougall 1973), and the Kermadec group during the Pleistocene (< 2.0 million years ago; Lloyd and Nathan 1981). However, the presence of shallow-water foraminifera of early Miocene age at Norfolk Island indicates that shoals were present in the area before the Pliocene (Jones and McDougall 1973).

The Lord Howe Island group lies on a small plateau on the western side of Lord Howe Rise (Van der Linden 1968; Figure 1). The group consists of Lord Howe Island (31°33′ S, 159°04′ E), a number of small nearby islets, and Ball's Pyramid, a pinnacle 549 m high 24 km to the southeast. Lord Howe Island is about 11 km long by 1–2 km wide and has precipitous mountains that rise to 875 m. A fringing coral reef formed on the western side of Lord Howe Island between the late Miocene and the Pleistocene (McDougall et al. 1981). Since formation, it has probably undergone repeated exposure, erosion, and resubmersion as a result of glacio-eustatic sea level changes. Currently, a coral reef 6 km long fringes about 25% of the Lord Howe Island coastline. However, in recent times, reef growth has occurred only within the lagoon along the inner margin of the fringing reef and down to depths of 9–12 m in reef passes. Small patch and fringing reefs are also present in some shallow (< 6 m depth) sheltered areas on the northeast coast (Veron and Done 1979; F. J. Brook, Department of Conservation, Whangarei, New Zealand, pers. comm.). Lord Howe Island has the Pacific's southernmost coral reefs (Veron 1986). Hermatypic corals are abundant, and 70 species have been recorded (Veron and Done 1979, Veron 1986; J. E. N. Veron, Australian Institute of Marine Science, Townsville, pers. comm.).

The Norfolk Island group lies on a plateau 100 km long on the Norfolk Ridge, which runs from New Zealand to New Caledonia (Carter 1980, Main and McKnight 1981, Eade 1988; Figure 1). It consists of Norfolk (29°05′ S, 167°57′ E), Phillip, and Nepean islands. Norfolk Island is the largest of the three (8 by 5 km, 315 m high). The coastlines of the Norfolk group are mainly volcanic, and there are no true coral reefs. However, a limestone reef was formed by accumulation of calcareous sand during the late Pleistocene. This reef was subsequently eroded to form the present lagoon at Kingston (Brook 1990). It is about 1 km long, and its protecting reef fringes about 3% of the Norfolk Island coastline. Coral patch reefs are present inside the lagoon and locally elsewhere. Hermatypic corals are abundant and locally luxuriant both inside the lagoon and elsewhere. Thirty-nine species of hermatypic corals have been recorded (Brook 1990).

The Kermadec Islands group consists of a chain of islands spread over about 250 km of ocean from 29°14′ S, 177°52′ W to 31°24′ S, 178°50′ W (Francis et al. 1987). From north to south, the four main island subgroups are Raoul Island and Herald Islets, Macauley Island, Cheeseman and Curtis Islands, and L'Esperance and Havre Rocks. Raoul Island is the largest in the group (10 by 7 km, 516 m high). Coral reefs are not present, but hermatypic coral colonies are common (Schiel et al. 1986, Brook 1989). Uplifted marine sequences at Raoul Island and the Herald Islets contain fossil coral patch reefs whose species diversity exceeds that of the current fauna (Brook 1989). Only 16 species of hermatypic corals are known from the current fauna (Brook 1989).

In the remainder of this paper, the three island groups will be called Lord Howe, Nor-

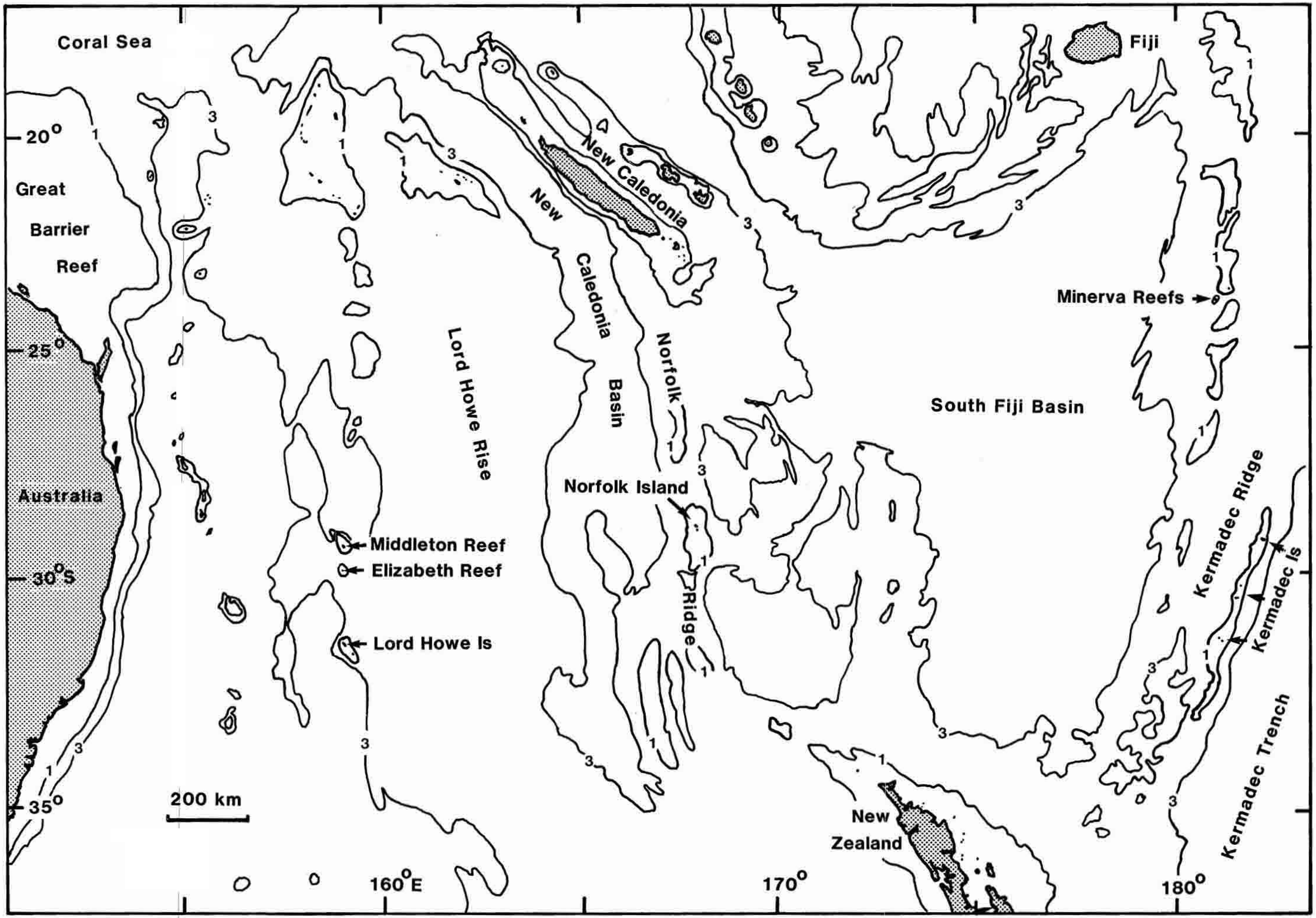

FIGURE 1. Map of the Southwest Pacific Ocean showing the location of Lord Howe, Norfolk, and Kermadec islands in relation to other land masses and islands, and submarine ridges. Depth contours are at 1 and 3 km.

folk, and the Kermadecs for simplicity (unless a specific island within a group is being discussed).

Hydrology

Oceanic circulation in the Southwest Pacific is complex and, despite extensive study, poorly understood. A large anticyclonic gyral dominates the overall pattern of water movement. In low latitudes, the Trade Wind Drift (TWD) generates a westward flow toward the Coral Sea and northwestern Australia (Wyrtki 1960). From there, water flows south along the east coast of Australia as the East Australian Current (EAC). The EAC diverges from the coast at about 30–33° S, producing a complex system of eddies, and then continues northeast across the Tasman Sea as a meandering current (Nilsson and Cresswell 1981, Mulhearn 1987) in the return flow of the subtropical gyre.

Near the southern end of the Norfolk Ridge, a combination of seabed topography and current meanders generates a strong northward flow on the western side of the Ridge (Stanton 1976, 1979). The main flow then continues eastward across the South Fiji Basin (Roemmich and Cornuelle 1990). A branch of this flow veers southeast past the northern tip of New Zealand, forming another smaller anticyclonic gyral that turns northeast along the Kermadec Trench (Ridgway and Heath 1975, Heath 1985).

The west-flowing TWD and northeast-flow return meet at the Tropical Convergence (Wyrtki 1960, Stanton 1969, Donguy and Henin 1977). The Tropical Convergence varies seasonally and annually in both position and strength. Its mean latitude is about 22° S in winter and 30° S in summer, but interyear variability is high. Temperature changes across the convergence are in the range 1.6–2.3°C (Stanton 1969, Roemmich and Cornuelle 1990).

LORD HOWE

The Tropical Convergence is poorly developed in the Lord Howe region (Wyrtki 1960). The hydrology is dominated by the EAC and the eddies and meanders that propagate across the Tasman Sea (Mulhearn 1987). The complex nature of the EAC means that currents may approach Lord Howe from almost any direction (for example, see drift buoy tracks presented by Cresswell and Greig 1979 and Metso et al. 1986). Nevertheless, the predominant flow seems to be from west to east. Lord Howe may at times also receive direct EAC input from the north and TWD input from the north or northeast (Wyrtki 1960, Hoggett and Rowe 1988). Mean sea surface temperatures at Lord Howe have an annual range of about 19 to 25°C (Allen et al. 1976, Edwards 1979, Tate 1988).

NORFOLK

Norfolk is situated near the southern limit of the Tropical Convergence and is therefore influenced by it, during summer, in some years but not in others. In years when the convergence lies south of Norfolk, warm currents approach from the north or east during the first half of the year and from the west or south during the second half of the year (Wyrtki 1960, Cresswell 1989). In other years, the flow is mainly from the west or south throughout the year. Drift buoys released off the Australian coast tend to approach Norfolk from the west or southwest and depart to the north or northwest after remaining in the vicinity for up to 2 months (Metso et al. 1986, Cresswell 1989). Current meters installed off Norfolk Island in October 1988 indicated a northward flow past the island, though satellite images taken at the same time showed a tongue of warm water extending south from New Caledonia (Cresswell 1989). Mean surface temperatures have an annual range of about 18 to 24°C (Edwards 1979, Tate 1988, Cresswell 1989). Norfolk temperatures are therefore virtually the same as those at Lord Howe, despite Norfolk's more northerly location, because of the east-northeast orientation of isotherms in the Tasman Sea (Tate 1988).

THE KERMADECS

EAC water reaches the Kermadecs indirectly as a northeasterly flow from New Zealand and directly as an easterly flow from the Norfolk Ridge (Ridgway and Heath 1975, Greig and Cresswell 1982, Heath 1985, Roemmich and Cornuelle 1990). Intrusion of tropical water from the northeast also occurs (Ridgway and Heath 1975), suggesting that the Tropical Convergence extends south to the Kermadecs during some summers at least (see also Stanton 1969). Seeds, logs, flotsam, and drift algae that probably or definitely originated from New Zealand have been found at Raoul and Macauley islands, providing further evidence for a current from New Zealand (Oliver 1910, Sykes and Godley 1968, Nelson and Adams 1984). Seeds of four tropical plant species were also reported from Raoul Island beaches by Sykes and Godley (1968). All four species are widespread in the tropical South Pacific, suggesting that currents from a northerly quarter reach the Kermadecs, though two of the four species might also have originated from Norfolk Island (Hermes 1986). Mean surface temperatures have an annual range of 18 to 24°C at Raoul Island and 17 to 23°C at L'Esperance Rock (Francis et al. 1987).

Ichthyological History

Despite their remoteness, the SWP Islands have received considerable attention from ichthyologists over the last century. A brief account of the major milestones in our knowledge of their fish faunas is given below.

LORD HOWE

The first list of Lord Howe fishes was published in 1889 and included 88 species (Ogilby 1889). During the following 15 yr, studies by Ogilby, E. R. Waite, and A. R. McCulloch (see references in Allen et al. 1976) substantially increased the known number of fishes, enabling Waite (1904) to publish an updated list of 180 fishes. McCulloch and Waite (1916) added further fishes to the fauna. Then followed a period of more than 50 yr during which ichthyologists, particularly G. P. Whitley from the Australian Museum in Sydney, collected fishes at Lord Howe and identified or described specimens presented by Lord Howe residents (see Allen et al. 1976). Nevertheless, by the end of 1972 the number of Lord Howe fishes had risen to only 208 species (Allen et al. 1976). In 1973, a party of ichthyologists from the Australian Museum, and the Bishop Museum in Honolulu, spent 1 month at Lord Howe Island. They used many fishing methods to collect over 6000 fish specimens. As a result of that expedition and the examination of unreported museum specimens, a comprehensive checklist containing 447 species was published (Allen et al. 1976). Randall (1976) compared fish endemism at Lord Howe, Easter, and the Hawaiian islands, and gave a detailed historical account of ichthyological studies at Lord Howe. Recent visits to Lord Howe in 1988, 1989, 1991, and 1992 added 46 fishes to the fauna, resulting in a total coastal fish fauna (after allowing for recent taxonomic revisions and reidentification of some specimens) of 433 species (Francis 1991, Francis and Randall 1993).

NORFOLK

Bleeker (1855) published the first list of Norfolk fishes, but it contained only eight species. Waite (1910, 1916) increased the fauna to 72 species, and in the latter paper he noted which of the species ranged to other parts of Australasia. A Japanese research vessel made five trawl tows on the Norfolk plateau in 1976 (Fisheries Agency of Japan 1976). Unfortunately, the results are not very useful because fishes were frequently identified only to family or genus, Norfolk plateau catches were grouped with those from the southern end of Norfolk Ridge, and most of the tows were in deep water (the shallowest was at 79 m). Consequently, their results are not included here. In 1975, ichthyologists from the Australian Museum spent 3 weeks at Norfolk collecting fishes. A report on their expedition listed 163 species (Hoese et al. 1978). Hermes (1986) reproduced Hoese et al.'s (1978) list and added eight new records, bringing the total to 171 species. Recent expeditions to Norfolk in 1988, 1989, and 1991 added a further 99 new records, bringing the number of coastal fishes (after revisions and reidentifications) to 254 (Francis 1991, Francis and Randall 1993). Quantitative data on reef fish populations are limited to a survey of the Kingston Lagoon in 1989 (Francis et al. 1990).

THE KERMADECS

Waite (1910, 1912) produced the first Kermadecs fish lists, totaling 40 species. A Japanese research vessel carried out eight trawl tows on the Kermadec Ridge in 1976, but all were deeper than 100 m and only 15 species were reported caught (Fisheries Agency of Japan 1977). Paulin and Stewart (1985) reported 111 Kermadecs fishes in their list of New Zealand teleosts, but many of them were from deep water. Other deep-water species were reported to occur "throughout the [New Zealand] EEZ," which includes the Kermadecs, making it difficult to obtain a complete tally of Kermadecs fishes. Schiel et al. (1986), Francis et al. (1987), and Francis (1991) added 54 new records, and in this paper I report 17 more new records, bringing the total number of coastal fishes (after revisions and reidentifications) to 145. Estimates of the abundance of Kermadecs fishes were provided by Schiel et al. (1986), Francis et al. (1987), and Cole et al. (1992).

MATERIALS AND METHODS

For the purposes of this paper, coastal fishes are defined as those species likely to be encountered within 1 km of shore and 50 m of the surface. This definition excludes freshwater and oceanic pelagic species, but includes neritic pelagic species. The numbers of coastal fishes occurring elsewhere in the South Pacific were calculated from published and unpublished species lists using the same definition. Because classification of some species involves some subjectivity, my totals do not necessarily agree with those calculated by the original authors.

The checklists published previously for Lord Howe, Norfolk, and the Kermadecs form the starting points for the checklist given here. The sources for most of the listed species may be found in the following papers—Lord Howe: Allen at al. (1976), Francis (1991), Francis and Randall (1993); Norfolk: Hermes (1986), Francis (1991), Francis and Randall (1993); the Kermadecs: Paulin and Stewart (1985), Francis et al. (1987), Francis (1991), this paper. In other cases, details of the sources are given as footnotes to the checklist. Most of the specimens collected from the SWP Islands are held at AMS, BPBM, and NMNZ (acronyms follow Leviton et al. 1985), and details of them can be found in the papers listed above.

Many names have changed since the above papers were published, because of reidentification of specimens and taxonomic revisions. Generic assignments follow current usage. Footnotes to the checklist link current specific names (this paper) with previously reported names. Changes to specific names are based on published literature, personal communications with specialists (listed in Acknowledgments), and in a few cases my own decisions (in which case full justification is provided). Family allocation and order follow Nelson (1984), except for changes justified by other recent studies, especially that of Johnson (1984).

The geographical distributions of checklist species were determined from published and unpublished literature, and personal communications with specialists. Each species was classified into one of a number of geographical categories. Most are self-explanatory, but several require definitions. The Pacific Ocean was divided into three zones: West, Central, and East, using the boundaries of the Pacific Plate (sensu Springer 1982). The "Pacific" and "Indo-Pacific" categories include all three Pacific zones; in other cases the individual zone(s) is (are) listed. Species that occur along the eastern margin of the Indian Ocean (i.e., Indonesia to Western Australia) but not farther west are treated as Pacific rather than Indo-Pacific species. "Australasia" refers to Australia and New Zealand plus at least one of the SWP Islands.

RESULTS

A checklist of the coastal fishes of Lord Howe, Norfolk, and the Kermadecs is given in the Appendix. The numbers of species currently recorded from the three island groups are 433, 254, and 145, respectively. The Kermadecs total includes 17 previously unreported species (Table 1).

TABLE 1

NEW RECORDS OF FISHES FOR THE KERMADEC ISLANDS

FAMILY	SPECIES	BASIS FOR RECORD
Carcharhinidae	*Carcharhinus amblyrhynchos*	Sighting, M.P.F.
Carcharhinidae	*Galeocerdo cuvier*	Photo, R. Singleton, Raoul I., March 1982
Sphyrnidae	*Sphyrna zygaena*	CMC 2134, Raoul I., 1944
Muraenidae	*Gymnothorax eurostus*	NMNZ P.28581
Ophichthidae	*Myrichthys maculosus*	NMNZ P.28591
Congridae	*Conger wilsoni*	NMNZ P.28617
Congridae	*Poeciloconger* sp.	NMNZ P.28614
Apogonidae	*Apogon kallopterus*	NMNZ P.28576
Pomacentridae	*Chromis vanderbilti*	Photo, M.P.F.
Sphyraenidae	*Sphyraena acutipinnis*	NMNZ P.3685, 1961
Labridae	*Halichoeres margaritaceus*	NMNZ P.28569
Labridae	*Thalassoma jansenii*	Photo, G. Carlin, May 1991
Scaridae	*Scarus* sp.	NMNZ P.28618 (2)
Uranoscopidae	*Kathetostoma* sp.	NMNZ P.13447, Sept. 1976
Blenniidae	*Cirripectes castaneus*	NMNZ P.28599
Gobiidae	*Priolepis* sp.	NMNZ P.28583 (3), NMNZ P.28612
Monacanthidae	*Parika scaber*	Photo, M.P.F., Macauley I.

NOTE: Records are based on specimens, photographs, and a sighting obtained at the Raoul Island group during June 1992, unless otherwise stated. Photos are available from the author on request.

TABLE 2

DISTRIBUTIONS OF LORD HOWE, NORFOLK, AND KERMADEC ISLANDS FISHES IN RELATION TO WATER TEMPERATURE ZONES

	LORD HOWE I.		NORFOLK I.		KERMADECS IS.	
REGION	NO.	%	NO.	%	NO.	%
Tropical	292	67.4	142	55.9	59	40.7
Subtropical	112	25.9	86	33.9	66	45.5
Temperate	17	3.9	13	5.1	18	12.4
Unknown	12	2.8	13	5.1	2	1.4
Total	433	100.0	254	100.0	145	100.0

NOTE: Values given in columns are numbers of species and percentages of each island's fauna.

Although sampling effort has been greater at Lord Howe than at Norfolk and the Kermadecs, species diversity clearly decreases from west to east. Tropical and subtropical species dominate the faunas of all three groups, and both categories decrease in numbers from west to east (Table 2). However the relative importance of tropical and subtropical species reverses: tropical species compose 67% of the Lord Howe fauna, 56% of the Norfolk fauna, and only 41% of the Kermadecs fauna. Conversely, the percentage of subtropical species increases from 26% at Lord Howe to 46% at the Kermadecs. Diversity of temperate species is low at all three groups.

Examination of distributional data (Table 3) reveals that all faunas are dominated by widespread species. For example, species that are distributed at least throughout the West Pacific (the first seven categories in Table 3) compose 69, 63 and 52% of the Lord Howe, Norfolk, and Kermadecs faunas, respectively. Species found throughout the Indo-West-Central Pacific dominate the Lord Howe and Norfolk faunas, whereas at the Kermadecs,

TABLE 3

BIOGEOGRAPHIC DISTRIBUTIONS OF LORD HOWE, NORFOLK, AND KERMADEC ISLANDS FISHES

	LORD HOWE I.		NORFOLK I.		KERMADECS IS.	
REGION	NO.	%	NO.	%	NO.	%
Worldwide	20	4.6	17	6.7	14	9.7
Indo-Pacific	39	9.0	29	11.4	20	13.8
Indo-West-Central Pacific	160	37.0	73	28.7	25	17.2
Indo-West Pacific	32	7.4	10	3.9	3	2.1
Pacific	1	0.2	1	0.4	2	1.4
West-Central Pacific	27	6.2	15	5.9	7	4.8
West Pacific	20	4.6	15	5.9	4	2.8
South Pacific	9	2.1	6	2.4	6	4.1
South-West-East Pacific	0	0.0	0	0.0	1	0.7
South-West-Central Pacific	7	1.6	5	2.0	2	1.4
South-West Pacific	24	5.5	15	5.9	5	3.4
Central Pacific	—	—	—	—	1	0.7
Australasia[a]	23	5.3	23	9.1	25	17.2
Australia-Lord Howe-Norfolk-Kermadec	2	0.5	2	0.8	2	1.4
Australia-Lord Howe-Norfolk[a]	10	2.3	12	4.7	—	—
Australia-Lord Howe	24	5.5	—	—	—	—
Lord Howe-Norfolk-Kermadec-New Zealand[a]	5	1.2	4	1.6	5	3.4
Norfolk-Kermadec-New Zealand	—	—	4	1.6	4	2.8
Kermadec-New Zealand	—	—	—	—	7	4.8
Endemic[b]	18	4.2	10	3.9	8	5.5
Unknown	12	2.8	13	5.1	4	2.8
Total	433	100.0	254	100.0	145	100.0

NOTE: Values given in columns are numbers of species and percentages of each island's fauna. —, combination not possible.
[a] Some species not recorded from one or more intervening islands.
[b] Includes species endemic to only one island, plus regional endemics. See Table 4 for detailed distributions of endemic species.

Australasian and Indo-West-Central Pacific species co-dominate. Similar numbers of Australasian species occur at all three groups.

The number of species that each island group has in common with Australia declines markedly from west to east, though the proportion varies little (89, 87, and 77% at Lord Howe, Norfolk, and the Kermadecs, respectively). By contrast, the number of species each island group has in common with New Zealand varies little from west to east, but the proportion increases markedly (18, 30, and 54% at Lord Howe, Norfolk, and the Kermadecs, respectively).

One Kermadecs species, the pomacentrid *Chrysiptera rapanui*, is otherwise known only from Easter Island in the East Pacific. However, the two populations differ dramatically in color (Allen 1987, 1991) and are probably genetically distinct. Another Kermadecs species, the blenniid *Entomacrodus cymatobiotus*, is a Pacific Plate endemic (Springer 1982), so its presence at the Kermadecs (which are on the western margin of the Pacific Plate) and absence from Norfolk and Lord Howe (which are on the Indo-Australian Plate) is not surprising.

The numbers of endemic species are insignificant at all three groups. The SWP Islands have a combined total of 24 endemic species, or 4.6% of the total fauna (Table 4). Individual island groups have very low endemism (1.2–2.1%). Furthermore, several of the endemics listed in Table 4 are undescribed, or small and cryptic, and may prove to be more widespread with further collecting elsewhere.

DISCUSSION

The fish faunas of the SWP Islands have all been moderately well studied, but remain

TABLE 4

LIST OF COASTAL FISHES ENDEMIC TO LORD HOWE, NORFOLK, AND KERMADEC ISLANDS

FAMILY SPECIES	LORD HOWE ISLAND	NORFOLK ISLAND	KERMADEC ISLANDS
Muraenidae			
Gymnothorax annasona[a]	+	+	
Ophichthidae			
Muraenichthys nicholsae	+	+	
Gobiesocidae			
Undescribed genus and species	+		+
Atherinidae			
Atherion maccullochi	+		
Scorpaenidae			
Cocotropus altipinnis	+		
Scorpaena cookii[a]	+	+	+
Girellidae			
Girella fimbriata[b]			+
Pomacanthidae			
Genicanthus semicinctus[a]	+		+
Pomacentridae			
Amphiprion mccullochi[a]	+		
Parma kermadecensis			+
Teixeirichthys sp.		+	
Chironemidae			
Chironemus microlepis	+	+	+
Labridae			
Novaculops sp.[a]	+		
Percophidae			
Enigmapercis sp.	+		
Pinguipedidae			
Parapercis sp.		+	
Tripterygiidae			
Enneapterygius rufopilea[a]	+	+	+
Enneapterygius sp.	+	+	
Blenniidae			
Parablennius serratolineatus		+	
Gobiidae			
Eviota sp.	+	+	
Eviota sp.	+		
Eviota sp.			+
Priolepis sp. 3	+		
Priolepis sp. 4	+		
Bothidae			
Crossorhombus sp.	+		

Lord Howe Island endemism = 9/433 = 2.1%
Norfolk Island endemism = 3/254 = 1.2%
Kermadec Islands endemism = 3/145 = 2.1%
Lord Howe/Norfolk/Kermadec Islands regional endemism = 24/521 = 4.6%

[a] Also recorded from Elizabeth and Middleton Reefs.
[b] Francis et al. (1987) incorrectly reported that Kermadec Is. *G. fimbriata* and Easter I. *G. nebulosa* Kendall & Radcliffe were synonymous; the two are valid sister species (Orton 1989).

incompletely known. Small, cryptic, and deep reef species are probably underrepresented, especially at Norfolk and the Kermadecs. Furthermore, 14 species in the checklist have been reported from Lord Howe and the Kermadecs, but not at intervening Norfolk. They will probably be found there with further collecting and observation.

Many records of tropical species from the SWP Islands are based on a few "strays" (see below), and further strays will continue to be recorded at all islands. Because of the haphazard nature of larval dispersal and recruitment, it is unlikely that a complete checklist will ever be possible.

Endemism

The degree of endemism reported from any region depends on the definition of endemism used, the geographic area included, and sampling intensity. In the strict sense, endemic species occur at the location of interest and nowhere else. A problem arises over how to classify species that have also turned up elsewhere as strays. This problem results from low-probability dispersal events and is related to sampling intensity and size of the area included—more strays will be located with more effort, and more endemics will be included as the area increases.

Randall (1976) highlighted the latter problem for Lord Howe fishes. When he included species that also occurred at Norfolk, and Elizabeth and Middleton Reefs, he found 12% of the fishes to be endemic. When species that ranged to eastern Australia, northern New Zealand, and New Caledonia were included, this jumped to 30%. Since Randall's (1976) analysis, many of the species included in the 12% figure have been discovered on the east coast of Australia or at the Kermadecs.

In this paper I have treated extralimital records as a true indication of a species's distribution and excluded them from the list of endemics. I have also treated the three SWP Islands as the region of interest. A further problem arises with the fauna of Elizabeth and Middleton Reefs, which shares a large number of species with Lord Howe and should probably be included with it. Unfortunately, the most recently published account of the fish fauna is very incomplete (Whitley 1937); recent work there by AMS staff and J. E. Randall has increased the known fauna to over 340 species, with the total fauna likely to be in the range of 400–500 (A. C. Gill, USNM, pers. comm.).

In Table 4, I have treated species that also occur at Elizabeth and Middleton Reefs as Lord Howe endemics, and it is likely that more of the listed species, particularly small and cryptic species, will eventually be recorded from the Reefs. It is also likely that some of the newly recorded and undescribed Reef species (A. C. Gill, pers. comm.) will eventually be added to the Lord Howe endemic list. Despite these problems, I conclude that the degree of endemism at all three SWP Islands, separately and combined, is very low.

Larval Dispersal and the Origin of the Fauna

Although the SWP Islands are geologically young, many older structures existed in the Southwest Pacific before their formation. There are two parallel north-south chains of seamounts on the western margin of Lord Howe Rise and in the trough between Lord Howe Rise and Australia (Figure 1). These seamounts are thought to have developed over hotspots as the crustal plate moved northward (McDougall et al. 1981, Sutherland 1983). Shallow water also apparently existed in the vicinity of Norfolk Island before the Pliocene (Jones and McDougall 1973), and pre-Pleistocene landmasses may have existed in the Kermadecs region (Brook 1989). The geological history of the Southwest Pacific therefore provides a complex background to any discussion of the origins of the fish faunas.

The young age of the currently emergent islands does not necessarily imply that their faunas are young, because of the possibility that fishes may have dispersed to them from nearby older, now submerged, structures. However, the low rate of endemism among the fishes and evidence for present-day larval dispersal suggest that gene flow from outside the SWP Islands is significant and that long-distance dispersal has been an important factor in the origin of their fish faunas. The same conclusion was reached for Lord Howe echinoderms (Hoggett and Rowe 1988) and Lord Howe and Kermadecs corals (Veron and Done 1979, Veron 1986, Brook 1989).

Current populations of SWP Islands regional and local endemics are obviously maintained by self-recruitment (because there are no outside sources of larvae). Many of the common subtropical species that are rare or absent upstream (especially along the eastern Australian coast) probably also fit into this category. However, dispersal of fishes to and among the SWP Islands is probably substantial. Evidence for present-day dispersal, particularly of tropical fishes, comes from four sources:

1. A large number of species have been recorded from the SWP Islands on the basis of only a few (often only one) strays (Allen et al. 1976, Francis et al. 1987, Francis 1991, Francis and Randall 1993). The same is true for many tropical echinoderms at Lord Howe (Hoggett and Rowe 1988).

2. Many species recorded from the SWP Islands in early studies have not been located again in subsequent studies. Despite a very intensive period of fieldwork at Lord Howe, Allen et al. (1976) managed to collect or record only 65% of the total fauna known at that time. They attributed the "dynamic nature of the faunal composition ... to the dependence of recruitment from other areas for certain species ...." Populations of species relying on larval dispersal for replenishment are likely to be ephemeral or to show extreme fluctuations in abundance (see also Choat et al. 1988, Francis and Evans in press).

3. Juvenile fish have been recorded at islands where adults of the species were previously absent or very rare. For example, in early 1990 there was a simultaneous influx of juvenile *Acanthurus dussumieri* into Kingston Lagoon, Norfolk Island (J. Marges, Norfolk Island, pers. comm.), and northern New Zealand (Francis and Evans in press). During extensive diving at Norfolk in July 1988 and November 1989, I saw only one juvenile *A. dussumieri* and no adults. The New Zealand influx represents the first record of the species there. The juveniles almost certainly arrived at both locations as larvae via the East Australian Current from an upstream source.

4. The presence of certain species of labrids and pomacentrids at the SWP Islands, and the absence of others, is generally consistent with what is known about their larval durations. If dispersal depends on larval duration, we can make two predictions about its influence. First, the number of species reaching the islands should attenuate from west to east, as the distance downstream from major populations (Great Barrier Reef and the Coral Sea) increases. This effect is apparent in the fish diversity data for tropical species presented here (Table 2) and also for hermatypic corals (Table 5) and echinoderms (Hoggett and Rowe 1988). However, such attenuation might also result from west-to-east clinal variation in postarrival survival. Second, species with long larval durations should predominate over species with short larval durations and be found further eastward. Because remote locations are colonized by larvae that have spent an extended time in the plankton, extreme rather than modal larval durations are important (Victor 1986). *Thalassoma* spp. have the longest maximum larval durations (55–121 days) in the Labridae (Victor 1986). Of the six species of *Thalassoma* present at the Capricorn-Bunker Group (CBG) of the southern Great Barrier Reef, all have been reported from Lord Howe and Norfolk and five from the Kermadecs (Table 6).

Razorfishes (*Cymolutes*, *Novaculichthys* and *Xyrichtys* spp.) also have long larval durations and are well represented, particularly at Lord Howe (Appendix). *Cheilinus*, *Halichoeres*, and *Macropharyngodon* spp. have short larval durations and are poorly represented (Table 6). *Cheilinus bimaculatus*, which has a notably longer larval duration than other members of its genus (Victor 1986), is the only species reported from the SWP Islands (Appendix). (*C. bimaculatus* has not been reported from CBG, so the genus is not represented in the Lord Howe column of Table 6.)

Pomacentrids have short to moderate larval durations that do not exceed 47 days and are usually less than 30 days (Thresher et al. 1989, Wellington and Victor 1989). The genera with the best species representation at Lord Howe and Norfolk are *Abudefduf*, *Dascyllus*, *Plectroglyphidodon*, and *Stegastes* (Table 6). The last three genera have longer planktonic durations than average for the family. *Abudefduf* has a shorter than average duration but its species are well represented in the SWP Islands and wide-ranging in general. Wellington

TABLE 5

COASTAL FISH AND HERMATYPIC CORAL DIVERSITY DATA PLOTTED IN FIGURE 2 AND THEIR SOURCES

	FISHES		CORALS	
LOCATION	NO.	SOURCES	NO.	SOURCES
Easter I.	123	Randall & Cea Egaña (1984), DiSalvo et al. (1988)	10	Wells (1972), DiSalvo et al. (1988)
Kermadec Is.	145	This paper	16	Brook (1989, pers. comm.)
Norfolk I.	254	This paper	39	Brook (1990)
Rapa Is.[a]	260	Laboute & Richer de Forges (1986), Randall et al. (1990)	61	Faure (1985)[b]
Pitcairn I.[c]	300	J. E. Randall (unpublished data)	53	Paulay (1989)
Lord Howe I.	433	This paper	70	Veron (1986, unpublished data)
French Polynesia	745	Randall (1985), Laboute & Richer de Forges (1986)	158	Pichon (1985)
Capricorn-Bunker, Great Barrier Reef	873	Russell (1983), Lowe & Russell (1990)	237	Veron (1986)
Samoa	896	Wass (1984)	163	Veron (unpublished data)
New Caledonia	1,377	Rivaton et al. (1989, unpublished data)	300	M. B. Best (unpublished data)

[a] Includes Marotiri I. and MacDonald Seamount.
[b] May include a few ahermatypic scleractinian corals.
[c] Includes Henderson, Ducie, and Oeno atolls.

and Victor (1989) suggested that this apparent anomaly was due to the ability of many species of *Abudefduf* to metamorphose into juveniles while drifting beneath floating debris, thus increasing the effective duration of their dispersal stage. *Chromis* spp. have longer than average larval durations, but are not well represented in the SWP Islands.

For both labrids and pomacentrids, the degree of representation declines from west to east, with few species occurring at the Kermadecs (Table 6).

TABLE 6

PERCENTAGES OF THE CAPRICORN-BUNKER GROUP (CBG) SPECIES OF THE FAMILIES LABRIDAE AND POMACENTRIDAE THAT HAVE BEEN REPORTED FROM LORD HOWE, NORFOLK, AND KERMADEC ISLANDS

			% OF CBG SPECIES AT		
FAMILY	GENUS	NO. OF SPECIES AT CBG	LORD HOWE	NORFOLK	KERMADECS
Labridae	*Cheilinus*	7	0	0	0
	Choerodon	8	13	0	0
	Coris	6	33	0	0
	Halichoeres	10	20	20	10
	Macropharyngodon	4	25	0	0
	Thalassoma	6	100	100	83
Pomacentridae	*Abudefduf*	6	83	67	0
	Amphiprion	4	0	0	0
	Chromis	12	33	8	0
	Chrysiptera	10	10	10	0
	Dascyllus	4	75	0	0
	Plectroglyphidodon	4	75	50	0
	Pomacentrus	14	21	7	0
	Stegastes	4	50	50	25

NOTE: Only genera with four or more CBG species are included. Data sources for CBG are given in Table 5.

Current dispersal routes are determined by the hydrology of the region, which is complex. Dispersal routes of echinoderms to Lord Howe were described by Hoggett and Rowe (1988). I concur with their excellent description and refer readers to their paper for more details. A brief summary follows, with extension to include Norfolk and the Kermadecs.

Hypothesized dispersal routes are based on the seasonally varying current patterns of the Southwest Pacific and on evidence for the transport of flotsam whose origin is known or likely. Lord Howe probably receives dispersing larvae from eastern Australia (a minimum distance of 580 km), Elizabeth and Middleton Reefs (180 km), the Coral Sea, and possibly New Caledonia. Norfolk probably receives larvae from Lord Howe (900 km) and all its sources as well. Input from tropical regions to the north, especially New Caledonia (640 km), may be important in some years, depending upon the position of the Tropical Convergence (see also Rowe 1985). The Kermadecs probably receive most larval input from Norfolk (1350 km) and New Zealand (780 km), but with some coming directly from tropical regions to the north (e.g., Minerva Reefs [590 km], Fiji, Tonga) in some years (see also Marshall 1979).

Fish Abundance

Although tropical species form the largest element of the Lord Howe and Norfolk faunas and a significant element of the Kermadecs fauna (Table 2), subtropical species are the most abundant fishes at all the SWP Islands. Abundance data for the larger, mobile species at Norfolk and the Kermadecs illustrate this point. Nine of the 10 most abundant species in Kingston Lagoon at Norfolk Island are subtropical (Francis et al. 1990). At the Kermadecs, two different studies showed that eight of the 10 most abundant species are subtropical, though different species composed the top 10 in the two studies (Schiel et al. 1986, Cole et al. 1992). Schiel et al. (1986) placed the endemic *Girella fimbriata* in the top 10, and Cole et al. (1992) placed the endemic *Parma kermadecensis* and the restricted *Chrysiptera rapanui* in the top 10.

At all of the SWP Islands, subtropical species are the most abundant members of the Labridae, Pomacentridae, and Serranidae. The most abundant labrid and serranid at all three groups are *Pseudolabrus luculentus* and *Trachypoma macracanthus*, respectively. The most abundant pomacentrids are *Chromis dispilus* and *Chrysiptera rapanui* (at the Kermadecs) and *Neoglyphidodon polyacanthus* and *Chromis hypsilepis* (at Norfolk and Lord Howe) (Allen et al. 1976, Randall 1976, Schiel et al. 1986, Francis et al. 1990, Cole et al. 1992; pers. obs.). Subtropical species are also the most abundant fishes in the SEP Islands (Randall 1976, Russell and Randall 1980, DiSalvo et al. 1988, Randall et al. 1990).

Biogeographic Provinces

The SWP Islands have been placed either in their own separate biogeographic provinces or, in the case of Lord Howe and Norfolk, in a joint province (Whitley 1932, 1937, Knox 1963, Briggs 1974). More recently, Rehder (1980) emphasized trans-Pacific faunal links by creating a Kermadec-Pitcairn province.

I find the biogeographic province concept unsatisfactory for the SWP Islands for two reasons. First, it fails to deal adequately with clinal trends. Lord Howe has significant fish links with Australia; the Kermadecs have links with New Zealand; and the SWP Islands have links with each other. Deciding where to draw provincial boundaries is subjective and uninformative. Second, the degree of endemism is usually used as a major criterion when recognizing provinces. Unfortunately, endemism may vary widely across different taxa, and in that case it is not clear what decision should be made. The rate of endemism among the fishes of the SWP Islands is very low, but much higher rates have been reported for other taxa (e.g., Kermadecs echinoderms and molluscs [Knox 1963]). However, these high rates are almost certainly inflated by less intensive collecting elsewhere in the region.

Comparison of SWP and SEP Island Fish Faunas

The SWP and SEP Islands share a number of fish and mollusc species, a feature highlighted by Randall and McCosker (1975), Allen et al. (1976), Rehder (1980), and Randall et al. (1990). The updated checklist of fishes of the SWP Islands in this paper provides the opportunity to examine these trans-Pacific relationships in detail.

Tropical fish families dominate the fish faunas of both the SWP Islands and the SEP Islands. If colonization ability (which depends on ability both to disperse to an island and to survive after arrival) is family-specific, some families will be better represented in subtropical locations than others. To test this hypothesis, I determined the degree of representation of tropical families at both the SWP and SEP Islands. I did this by assuming that the nearest major tropical source supports a pool of "available" species, only some of which actually colonize the target subtropical islands.

I determined the number of species within a given family that occur at both source and target locations and expressed it as a percentage of the number of species at the source location. The source-target pairs were Capricorn-Bunker Group and Lord Howe; and Austral, Society, and Tuamotu groups of French Polynesia (FRP) and Rapa Island (including Marotiri Island and MacDonald Seamount). Such calculations are fraught with problems, such as variable sampling effort in different locations, variable distances from sources of larvae, and different current regimes. Nevertheless, major differences among families should be detectable.

The 11 most speciose families at CBG (excluding the Gobiidae because of taxonomic difficulties) were used in the comparisons. These families also include 9 of the 11 most speciose families in FRP. The family representation ranged from 12 to 65% for the Lord Howe–CBG comparison and from 9 to 67% for the Rapa-FRP comparison (Table 7). For 8 of the 11 families, the percentage representations were within 5% of each other in the western and eastern Pacific. The three families showing greater differences were Chaetodontidae (better representation in the western

TABLE 7

NUMBERS OF CAPRICORN-BUNKER GROUP (CBG) AND FRENCH POLYNESIA (FRP) SPECIES, AND PERCENTAGES OF THOSE SPECIES, THAT HAVE BEEN REPORTED FROM LORD HOWE AND RAPA, RESPECTIVELY

FAMILY	NO. OF SPECIES		% OF SPECIES	
	CBG	FRP[a]	LORD HOWE/CBG	RAPA[b]/FRP
Chaetodontidae	34	28	65	43
Scaridae	23	21	52	52
Acanthuridae	25	31	44	39
Labridae	70	57	40	35
Pomacentridae	69	36	33	33
Serranidae[c]	40	38	30	32
Carangidae[d]	22	15	29	67
Blenniidae	40	27	23	22
Apogonidae	34	23	21	52
Scorpaenidae	23	20	17	15
Muraenidae	25	44	12	9

NOTE: The 11 most speciose families at CBG (excluding Gobiidae) were analyzed. Data sources for CBG, FRP, and Rapa are given in Table 5.

[a] Austral, Society, and Tuamotu groups.

[b] Includes Marotiri I. and MacDonald Seamount.

[c] Excludes some deep-water species.

[d] Excludes some oceanic species.

Pacific), and Carangidae and Apogonidae (better representation in the eastern Pacific). The correlation between the western and eastern Pacific representations for all 11 families was 0.49, which is not significant at $P = 0.05$. However when the three outlier families were removed, the correlation rose to 0.98, which is significant at $P = 0.01$. The ability of tropical fishes to colonize remote subtropical islands is, in general, family-specific and highly variable among families. The three outlier families are notable exceptions to the general pattern, and further study is required to determine the reasons.

Of the 521 fish species reported from the SWP Islands, 26% occur at Rapa Island and 11% at Easter Island. The species in common represent large proportions of the faunas of Rapa (51%) and Easter (45%). Many of the species in common are widespread tropical species whose inclusion inflates the apparent similarity of the eastern and western faunas. If only subtropical species are considered, only 14 and 11% of the 140 species known from the SWP Islands occur at Rapa and Easter Islands, respectively. Again, the subtropical species in common form larger elements of the faunas of Rapa (ca. 38%) and Easter (ca. 27%) than they do of the SWP Islands. Thus species with trans-Pacific distributions compose a minor proportion of the fauna of the SWP Islands, but moderate proportions of the Rapa and Easter faunas. Similarly, Rehder (1980) reported 23 species of molluscs that ranged from the Southwest Pacific to Easter Island, and they represented 20% of the known Easter mollusc fauna.

Fish species with trans-Pacific distributions provide valuable material for historical biogeography studies. Although this is beyond the scope of this paper, a few comments are appropriate here. First, within the southern subtropical fish group, individual species exhibit a variety of different distributions. These include Australia to Easter Island (e.g., *Enchelycore ramosus*, *Anampses femininus*, *Cirripectes alboapicalis*), Australia to Pitcairn Island (*Scarus longipinnis*), Australia to Rapa Island (*Synodus similis*, *Labracoglossa nitida*, *Amphichaetodon howensis*), Lord Howe to South America (*Gymnothorax porphyreus*), Lord Howe to Easter Island (*Gymnothorax australicola*, *Aseraggodes bahamondei*), and the Kermadecs plus Easter Island (*Chrysiptera rapanui*). Second, some species have not been recorded from one or more islands between the distribution extremes. Although some of these "gaps" may be filled with further collecting, other absences seem to be real (e.g., *Trachypoma macracanthus* and *Chrysiptera rapanui* absent from Rapa but present at islands to the west and east). Third, evolutionary divergence of eastern and western populations into identifiable forms or species has occurred. As mentioned, *Chrysiptera rapanui* has distinct color forms at the Kermadecs and Easter Island. *Girella fimbriata*, endemic to the Kermadecs, and *G. nebulosa* Kendall & Radcliffe, endemic to Easter Island, are sister species (Orton 1989). A number of other closely related species pairs are also possible sister species: e.g., *Genicanthus semicinctus* (Lord Howe and the Kermadecs) and *G. spinus* Randall (Pitcairn, Raivavae) (Randall 1975); *Bathystethus cultratus* (Southwest Pacific) and *B. orientale* Regan (Rapa and Easter) (Randall et al. 1990); *Gymnothorax nubilus* (Southwest Pacific) and *G. bathyphilus* Randall & McCosker (Easter) (Randall and McCosker 1975). Gene flow across the South Pacific has clearly been interrupted in these cases.

Larval dispersal between the SWP Islands and Rapa Island in the central Pacific is plausible, because there is a strong west to east geostrophic flow between 20 and 30° S (Wyrtki 1975). However, the large distances involved (a minimum of 3300 km from the Kermadecs) suggest that dispersal is a rare event and limited to species with long larval durations. Dispersal between the SWP Islands and Easter Island is highly unlikely, because geostrophic flows near Easter are weak (Wyrtki 1975) and currents there appear to set mainly toward the south (DiSalvo et al. 1988). Seasonal and annual variability in current direction near Easter is probable considering the proximity of the Subtropical Convergence (Wyrtki 1966, fig. 2) and the influence of the El Niño cycle.

Comparative hydrological isolation of Easter Island is suggested by the very high

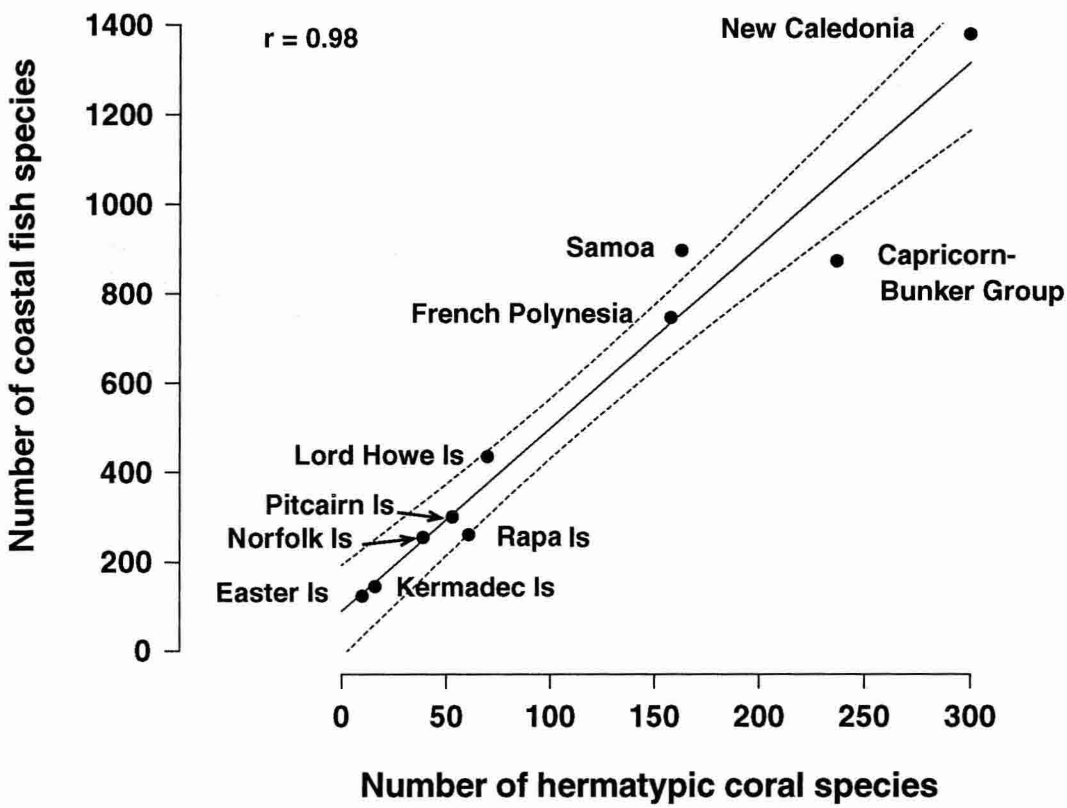

FIGURE 2. Relationship between coastal fish diversity and hermatypic coral diversity at 10 South Pacific locations. Data sources are given in Table 5. Dashed lines indicate 95% confidence limits.

degree of endemism among a variety of taxa, though strays still frequently reach the island (Rehder 1980, DiSalvo et al. 1988). Randall and McCosker (1975) suggested that Easter Island lay in a westerly current belt during the last ice age, thus permitting transport of larvae from the west via "way stations" such as Rapa and Pitcairn islands.

Correlation between Fish and Coral Diversity

On an Indo-Pacific scale, patterns of generic and specific diversity are remarkably similar for coastal fishes, hermatypic corals, and other invertebrate taxa. Diversity reaches a maximum in the Philippines-Indonesia-Malaysia region and declines rapidly to the south, east, and north (Allen 1975, Springer 1982, Veron 1985, Rosen 1988, Best et al. 1989, Myers 1989).

In the SWP Islands, species diversity of both fishes and corals declines from west to east. To determine whether these parallel trends are general for the two taxa, I obtained diversity data for as many South Pacific locations as possible. There is a high positive correlation ($r = 0.98$, $n = 10$) between the number of fishes and the number of corals at any location (Figure 2, Table 5). There is also a positive relationship between the degree of coral reef development and coral species diversity. Easter, Kermadec, Norfolk, and Rapa islands, all at the bottom end of Figure 2, lack true coral reefs (Faure 1985, Schiel et al. 1986, DiSalvo et al. 1988, Brook 1989, 1990). The same is true of Pitcairn Island, but Ducie, Henderson, and Oeno islands, which are here considered part of the Pitcairn Group, are all atolls and presumably have true reefs (Rehder and Randall 1975, Paulay

1989). Reef accretion at Lord Howe is currently very limited (Veron and Done 1979; Brook, pers. comm.).

There may be a significant causal element underlying the fish-coral diversity relationship. Increased coral diversity and reef development provide greater habitat variety for fishes at both the micro level (branching and tabular corals provide a refuge for small fishes) and macro level (enclosed lagoons and reef flats provide shelter from wave action). Because of extreme adaptive radiation and niche specialization among tropical fishes, locations with high habitat diversity are more likely to support high fish diversity.

However, the presence or absence of an organism at a particular location is determined by the interactions among a number of factors, including historical processes, dispersal ability, and water temperature. It seems likely that the high correlation between fish and coral diversity results mainly from a similar response of the two taxa to a given set of factors; i.e., if conditions favor high fish diversity, they are also likely to favor high diversity of corals and probably other invertebrate taxa.

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APPENDIX

CHECKLIST OF COASTAL FISHES OF LORD HOWE, NORFOLK, AND KERMADEC ISLANDS

The "Australia" and "New Zealand" columns indicate which of the checklist species also occur around mainland Australia and New Zealand (these columns are not checklists of Australian and New Zealand fishes). +, species present; blank, species not recorded; ?, species uncertain.

FAMILY SPECIES	AUSTRALIA	LORD HOWE ISLAND	NORFOLK ISLAND	KERMADEC ISLANDS	NEW ZEALAND	FOOTNOTES
Odontaspididae						
Odontaspis ferox (Risso, 1810)	+			+	+	
Lamnidae						
Carcharodon carcharias (Linnaeus, 1758)	+		+		+	
Triakidae						
Mustelus lenticulatus Phillipps, 1932			+	+	+	1
Carcharhinidae						
Carcharhinus amblyrhynchos (Bleeker, 1856)	+	+	+	+		
Carcharhinus galapagensis (Snodgrass & Heller, 1905)		+	+	+		2
Carcharhinus plumbeus (Nardo, 1827)	+		?			
Galeocerdo cuvier (Peron & Le Sueur, 1822)	+	+	+	+	+	
Sphyrnidae						
Sphyrna zygaena (Linnaeus, 1758)	+		+	+	+	
Dasyatididae						
Dasyatis brevicaudata (Hutton, 1875)	+			+	+	
Dasyatis thetidis Waite, 1899	+	+			+	
Taeniura meyeni (Muller & Henle, 1841)	+	+	+			3
Urolophidae						
Urolophus sp.			+			
Myliobatididae						
Myliobatis tenuicaudatus Hector, 1877			+	+	+	
Albulidae						
Albula neoguinaica Valenciennes, 1846	+	+				4
Muraenidae						
Anarchias sp.	+	+	+			5
Echidna nebulosa (Ahl, 1789)	+	+	+			
Enchelycore ramosus (Griffin, 1926)	+	+	+	+	+	
Gymnothorax annasona (Whitley, 1937)		+	+			
Gymnothorax australicola Lavenberg, 1992		+				6
Gymnothorax chilospilus Bleeker, 1865	+	+	+			7
Gymnothorax eurostus (Abbott, 1860)	+	+	+	+		
Gymnothorax griffini Whitley & Phillipps, 1939				+	+	8
Gymnothorax meleagris (Shaw & Nodder, 1795)	+	+				
Gymnothorax nubilus (Richardson, 1848)		+	+	+	+	
Gymnothorax obesus (Whitley, 1932)	+		+		+	
Gymnothorax porphyreus (Guichenot, 1848)		+	+			
Gymnothorax sp. A		+				9
Gymnothorax sp. B		+				9
Gymnothorax sp. C		+				9
Siderea picta (Ahl, 1789)	+			+		
Ophichthidae						
Callechelys catostomus (Forster, 1801)	+	+				10
Callechelys marmoratus (Bleeker, 1853)	+	+				
Leiuranus semicinctus (Lay & Bennett, 1839)	+	+	+			
Leiuranus versicolor (Richardson, 1848)	+	+	+			11
Malvoliophis pinguis (Günther, 1872)	+	+				

APPENDIX (continued)

FAMILY SPECIES	AUSTRALIA	LORD HOWE ISLAND	NORFOLK ISLAND	KERMADEC ISLANDS	NEW ZEALAND	FOOTNOTES
Muraenichthys australis Macleay, 1881	+		+	+	+	12
Muraenichthys laticaudatus (Ogilby, 1897)	+	+				
Muraenichthys nicholsae Waite, 1904		+	+			
Myrichthys maculosus (Cuvier, 1817)	+	+	+	+		
Ophichthus sp.		+				
Congridae						
Ariosoma mauritianum (Pappenheim, 1914)	+	+				13
Conger cinereus Rüppell, 1830	+	+		+		
Conger wilsoni (Bloch & Schneider, 1801)	+	+	+	+	+	
Gnathophis umbrellabius (Whitley, 1948)	+	?		+	+	14
Poeciloconger sp.				+		
Clupeidae						
Spratelloides delicatulus (Bennett, 1831)	+		+			15
Spratelloides gracilis (Schlegel, 1846)	+	+				
Engraulididae						
Engraulis australis (White, 1790)	+	+		+	+	
Chanidae						
Chanos chanos (Forsskål, 1775)	+		+			
Gonorynchidae						
Gonorynchus greyi (Richardson, 1845)	+	+	+	+	+	16
Plotosidae						
Plotosus lineatus (Thunberg, 1787)	+	+	+			
Synodontidae						
Saurida gracilis (Quoy & Gaimard, 1824)	+	+	+			
Synodus dermatogenys Fowler, 1912	+	+	+			17
Synodus doaki Russell & Cressey, 1979	+	+	+	+	+	18
Synodus houlti McCulloch, 1921	+	+				
Synodus similis McCulloch, 1921	+	+	+		+	19
Synodus variegatus (Lacepède, 1803)	+	+	+	+		20
Trachinocephalus myops (Forster, 1801)	+	+	+	+		
Moridae						
Lotella phycis (Temminck & Schlegel, 1847)	+	+	+	+	+	21
Lotella rhacinus (Forster, 1801)	+	+		+	+	21
Ophidiidae						
Brotula multibarbata Temminck & Schlegel, 1846	+	+				
Carapidae						
Onuxodon fowleri (Smith, 1955)	+			+		22
Bythitidae						
Dermatopsis macrodon Ogilby, 1896	+		+		+	23
Diancistrus longifilis Ogilby, 1899	+	+				
Antennariidae						
Antennarius coccineus (Lesson, 1830)	+	+				
Antennarius commersoni (Latreille, 1804)	+	+				
~~*Antennarius nummifer* (Cuvier, 1817)~~	~~+~~	~~+~~			~~+~~	~~24~~
Antennarius pictus (Shaw & Nodder, 1794)	+	+	+			24
Antennarius rosaceus Smith & Radcliffe, 1912		+				24
Antennarius striatus (Shaw & Nodder, 1794)	+	+			+	24
Gobiesocidae						
Alabes parvulus (McCulloch, 1909)	+		+			
Conidens samoensis (Steindachner, 1906)		+				25
Lepadichthys caritus Briggs, 1969	+	+				
Lepadichthys frenatus Waite, 1904	+	+	+			
Undescribed genus and species		+		+		

APPENDIX (continued)

FAMILY SPECIES	AUSTRALIA	LORD HOWE ISLAND	NORFOLK ISLAND	KERMADEC ISLANDS	NEW ZEALAND	FOOTNOTES
Hemiramphidae						
Euleptorhamphus viridis (van Hasselt, 1823)	+	+	+	+	+	
Hyporhamphus australis (Steindachner, 1866)	+	+	+			
Belonidae						
Ablennes hians (Valenciennes, 1846)	+		+	+		
Platybelone argalus (Le Sueur, 1821)	+	+	+	+		
Atherinidae						
Atherion maccullochi Jordan & Hubbs, 1919		+				
Hypoatherina tropicalis (Whitley, 1948)	+	+				26
Isonidae						
Iso rhothophilus (Ogilby, 1895)	+	+				
Monocentrididae						
Monocentris japonicus (Houttuyn, 1782)	+			+	+	
Trachichthyidae						
Optivus elongatus (Günther, 1859)	+	+		+	+	
Berycidae						
Centroberyx affinis (Günther, 1859)	+		+	+	+	
Holocentridae						
Myripristis berndti Jordan & Evermann, 1903	+	+	+	+		27
Myripristis kuntee Cuvier, 1831	+	+				28
Neoniphon sammara (Forsskål, 1775)	+	+				
Plectrypops lima (Valenciennes, 1831)	+	+				
Pristilepis oligolepis (Whitley, 1941)	+	+		+		29
Sargocentron rubrum (Forsskål, 1775)	+	+				
Pegasidae						
Eurypegasus draconis (Linnaeus, 1766)	+	+				
Aulostomidae						
Aulostomus chinensis (Linnaeus, 1758)	+	+	+	+		
Fistulariidae						
Fistularia commersonii Rüppell, 1838	+	+	+	+	+	
Syngnathidae						
Cosmocampus howensis (Whitley, 1948)	+	+				
Halicampus boothae (Whitley, 1964)		+	+			
Hippocampus planifrons Peters, 1877	+	?				
Hippocampus sp. A		+				9
Hippocampus sp. B		+				9
Solegnathus dunckeri Whitley, 1927	+	+				
Dactylopteridae						
Dactyloptena orientalis (Cuvier, 1829)	+	+			+	
Scorpaenidae						
Ablabys taenianotus (Cuvier, 1829)	+	+	+			30
Cocotropus altipinnis Waite, 1903		+				
Dendrochirus brachypterus (Cuvier, 1829)	+	+				
Dendrochirus zebra (Cuvier, 1829)	+	+	+			
Maxillicosta raoulensis Eschmeyer & Poss, 1976				+	+	
Ocosia apia Poss & Eschmeyer, 1975				+		
Pterois antennata (Bloch, 1787)	+			+		
Pterois volitans (Linnaeus, 1758)	+	+	+	+	+	
Scorpaena cookii Günther, 1874		+	+	+		
Scorpaenodes guamensis (Quoy & Gaimard, 1824)	+		+			
Scorpaenodes parvipinnis (Garrett, 1864)	+	+				
Scorpaenodes scaber (Ramsay & Ogilby, 1886)	+	+	+	+	+	30A
Scorpaenopsis sp.		+				

APPENDIX (continued)

FAMILY SPECIES	AUSTRALIA	LORD HOWE ISLAND	NORFOLK ISLAND	KERMADEC ISLANDS	NEW ZEALAND	FOOTNOTES
Triglidae						
Chelidonichthys kumu (Lesson, 1826)	+	+			+	
Lepidotrigla brachyoptera Hutton, 1872				+	+	
Platycephalidae						
Platycephalus caeruleopunctatus McCulloch, 1922	+	+				
Serranidae						
Acanthistius cinctus (Günther, 1859)	+	+	+	+	+	
Acanthistius ocellatus (Günther, 1859)	+	+				31
Aulacocephalus temmincki Bleeker, 1857	+		+	+	+	
Caprodon krasyukovae Kharin, 1983			?			
Caprodon longimanus (Günther, 1859)	+			+	+	
Cephalopholis argus Bloch & Schneider, 1801	+	+				
Cephalopholis miniata (Forsskål, 1775)	+	+				32
Cephalopholis sexmaculata (Rüppell, 1830)	+	+				
Diploprion bifasciatum Cuvier, 1828	+	+				
Epinephelus cyanopodus (Richardson, 1846)	+	+	+			33
Epinephelus daemelii (Günther, 1876)	+	+	+	+	+	
Epinephelus fasciatus (Forsskål, 1775)	+	+	+			
Epinephelus howlandi (Günther, 1873)	+	+				
Epinephelus maculatus (Bloch, 1790)	+	+				34
Epinephelus merra Bloch, 1793	+	+	+			
Epinephelus octofasciatus Griffin, 1926	+		+	+	+	35
Epinephelus polyphekadion (Bleeker, 1849)	+	+				36
Epinephelus rivulatus (Valenciennes, 1830)	+	+	+		+	37
Epinephelus tauvina (Forsskål, 1775)	+	+				38
Grammistes sexlineatus (Thunberg, 1792)	+	+		+		
Hypoplectrodes sp.		+		+	+	39
Pseudanthias pictilis (Randall & Allen, 1978)	+	+	+			40
Pseudanthias squamipinnis (Peters, 1855)	+	+	+			
Pseudogramma polyacantha (Bleeker, 1856)	+	+				
Trachypoma macracanthus Günther, 1859	+	+	+	+	+	
Variola louti (Forsskål, 1775)	+	+				
Pseudochromidae						
Pseudoplesiops howensis Allen, 1987	+	+				41
Plesiopidae						
Belonepterygion fasciolatum (Ogilby, 1889)	+	+				
Plesiops insularis Mooi & Randall, 1991		+	+			42
Terapontidae						
Terapon jarbua (Forsskål, 1775)	+	+				
Kuhliidae						
Kuhlia mugil (Forster, 1801)	+	+	+	+		
Priacanthidae						
Heteropriacanthus cruentatus (Lacepède, 1801)	+	+	+			
~~*Priacanthus hamrur* (Forsskål, 1775)~~	~~+~~	~~+~~				
Apogonidae						
Apogon crassiceps Garman, 1903	+	+	+			43
Apogon doederleini Jordan & Snyder, 1901	+	+	+	+		44
Apogon kallopterus Bleeker, 1856	+	+	+	+		
Apogon norfolcensis Ogilby, 1888		+	+			
Apogon sp. B		+	+			9
Archamia leai Waite, 1916	+		+			
Cheilodipterus macrodon (Lacepède, 1802)	+	+				

APPENDIX (continued)

FAMILY SPECIES	AUSTRALIA	LORD HOWE ISLAND	NORFOLK ISLAND	KERMADEC ISLANDS	NEW ZEALAND	FOOTNOTES
Cheilodipterus quinquelineatus Cuvier, 1828	+	+				
Fowleria marmorata (Alleyne & Macleay, 1877)	+	+				45
Vincentia chrysura Ogilby, 1889	+	+				
Sillaginidae						
Sillago ciliata Cuvier, 1829	+	+				
Malacanthidae						
Malacanthus brevirostris Guichenot, 1848	+	+			+	
Echeneididae						
Echeneis naucrates Linnaeus, 1758	+	+	+	+	+	
Remora remora (Linnaeus, 1758)	+	+	+	+	+	
Carangidae						
Alectis ciliaris (Bloch, 1788)	+	+				
Carangoides orthogrammus Jordan & Gilbert, 1881	+	+	+			
Caranx melampygus Cuvier, 1883	+		+			
Caranx sexfasciatus Quoy & Gaimard, 1824	+		+			
Decapterus muroadsi (Temminck & Schlegel, 1844)	+	+	?	?	+	46
Elagatis bipinnulata (Quoy & Gaimard, 1825)	+	+	+		+	
Pseudocaranx dentex (Bloch & Schneider, 1801)	+	+	+	+	+	47
Seriola dumerili (Risso, 1810)	+	+	+			
Seriola hippos Günther, 1876	+		+		+	
Seriola lalandi Valenciennes, 1833	+	+	+	+	+	
Seriola rivoliana Valenciennes, 1833	+	+	+	+		
Trachinotus baillonii (Lacepède, 1801)	+	+	+			
Trachinotus blochii (Lacepède, 1801)	+		+			
Trachinotus coppingeri (Günther, 1884)	+	+				48
Trachurus declivis (Jenyns, 1841)	+			+	+	
Trachurus novaezelandiae Richardson, 1843	+	+	?		+	49
Arripidae						
Arripis trutta (Bloch & Schneider, 1801)	+	+	+	+	+	
Arripis sp.			+	+	+	50
Lutjanidae						
Aprion virescens Valenciennes, 1830	+	+				
Lutjanus adetii (Castelnau, 1873)	+	+				51
Lutjanus bohar (Forsskål, 1775)	+	+				
Lutjanus fulviflamma (Forsskål, 1775)	+	+				
Lutjanus fulvus (Bloch & Schneider, 1801)	+		+			52
Lutjanus kasmira (Forsskål, 1775)	+	+	+	+		
Lutjanus quinquelineatus (Bloch, 1790)	+	+				
Paracaesio xanthura (Bleeker, 1869)	+	+	+	+		53
Caesionidae						
Pterocaesio digramma (Bleeker, 1865)	+		+			
Pterocaesio trilineata Carpenter, 1987	+		+			54
Haemulidae						
~~*Diagramma labiosum* Macleay, 1883~~	~~+~~	~~+~~				~~55~~
Plectorhinchus gibbosus (Lacepède, 1802)	+		+			56
Plectorhinchus picus (Cuvier, 1830)	+	+				57
Plectorhinchus sp.	+	+				58
Sparidae						
Pagrus auratus (Forster, 1801)	+	+	+		+	
Lethrinidae						
Gnathodentex aurolineatus (Lacepède, 1802)	+		+			
Gymnocranius euanus Günther, 1879	+	+	+			59

APPENDIX (continued)

FAMILY SPECIES	AUSTRALIA	LORD HOWE ISLAND	NORFOLK ISLAND	KERMADEC ISLANDS	NEW ZEALAND	FOOTNOTES
Lethrinus atkinsoni Seale, 1909	+	+				
Lethrinus miniatus (Forster, 1801)	+	+	+			60
Lethrinus nebulosus (Forsskål, 1775)	+	+				
Nemipteridae						
Scolopsis bilineatus (Bloch, 1793)	+	+				
Mullidae						
Mulloidichthys flavolineatus (Lacepède, 1801)	+	+	+			
Mulloidichthys vanicolensis (Valenciennes, 1831)	+	+	+	+		
Parupeneus barberinus (Lacepède, 1801)	+	+				
Parupeneus ciliatus (Lacepède, 1801)	+	+	+			61
Parupeneus heptacanthus (Lacepède, 1801)	+	+				62
Parupeneus multifasciatus (Quoy & Gaimard, 1825)	+	+	+			63
Parupeneus pleurostigma (Bennett, 1830)	+	+	+			
Parupeneus spilurus (Bleeker, 1854)	+	+	+	+	+	64
Upeneichthys lineatus (Bloch & Schneider, 1801)	+		+	+	+	65
Upeneus francisi Randall & Guézé, 1992			+	+	+	66
Monodactylidae						
Monodactylus argenteus (Linnaeus, 1758)	+		+			
Pempherididae						
Parapriacanthus ransonneti Steindachner, 1870	+	+	+			67
Pempheris analis Waite, 1910	+	+	+	+		
Pempheris oualensis Cuvier, 1831	+	+				
Pempheris vanicolensis Cuvier, 1831	+	+				
Girellidae						
Girella cyanea Macleay, 1881	+	+	+	+	+	
Girella elevata Macleay, 1881	+	+				
Girella fimbriata (McCulloch, 1920)				+		
Kyphosidae						
Kyphosus bigibbus Lacepède, 1801	+	+	+	+	+	68
Kyphosus cinerascens (Forsskål, 1775)	+	+	+			
Kyphosus sydneyanus (Günther, 1886)	+	+	+		+	
Kyphosus vaigiensis (Quoy & Gaimard, 1825)	+		+			
Microcanthidae						
Atypichthys latus McCulloch & Waite, 1916		+	+	+	+	
Atypichthys strigatus (Günther, 1860)	+	+				
Microcanthus strigatus (Cuvier, 1831)	+	+	+			
Scorpididae						
Bathystethus cultratus (Forster, 1801)	+	+	+	+	+	
Labracoglossa nitida McCulloch & Waite, 1916	+	+	+	+	+	
Scorpis lineolatus Kner, 1865	+	?	?		+	
Scorpis violaceus (Hutton, 1873)	+	+	+	+	+	
Ephippididae						
Platax teira (Forsskål, 1775)	+		+			
Chaetodontidae						
Amphichaetodon howensis (Waite, 1903)	+	+	+	+	+	
Chaetodon auriga Forsskål, 1775	+	+	+	+		
Chaetodon bennetti Cuvier, 1831	+	+				
Chaetodon citrinellus Cuvier, 1831	+	+	+			
Chaetodon flavirostris Günther, 1873	+	+	+			
Chaetodon guentheri Ahl, 1913	+	+				
Chaetodon kleinii Bloch, 1790	+	+				
Chaetodon lineolatus Cuvier, 1831	+	+	+			
Chaetodon lunula (Lacepède, 1803)	+	+	+			

APPENDIX (continued)

FAMILY SPECIES	AUSTRALIA	LORD HOWE ISLAND	NORFOLK ISLAND	KERMADEC ISLANDS	NEW ZEALAND	FOOTNOTES
Chaetodon melannotus Bloch & Schneider, 1801	+	+	+			
Chaetodon mertensii Cuvier, 1831	+	+	+			
Chaetodon ornatissimus Cuvier, 1831	+	+				
Chaetodon pelewensis Kner, 1868	+	+	+			
Chaetodon plebeius Cuvier, 1831	+	+	+			
Chaetodon rainfordi McCulloch, 1923	+	+				
Chaetodon speculum Cuvier, 1831	+	+				
Chaetodon tricinctus Waite, 1901	+	+	+			
Chaetodon trifascialis Quoy & Gaimard, 1824	+	+	+			
Chaetodon trifasciatus Park, 1797	+	+	+			
Chaetodon ulietensis Cuvier, 1831	+	+				
Chaetodon unimaculatus Bloch, 1787	+	+				
Chaetodon vagabundus Linnaeus, 1758	+	+	+			
Forcipiger flavissimus Jordan & McGregor, 1898	+	+	+	+		
Heniochus acuminatus (Linnaeus, 1758)	+	+				
Heniochus diphreutes Jordan, 1903	+			+		
Heniochus monoceros Cuvier, 1831	+		+			
Pomacanthidae						
Centropyge bispinosus (Günther, 1860)	+	+	+			
Centropyge tibicen (Cuvier, 1831)	+	+	+			
Centropyge vroliki (Bleeker, 1853)	+	+				
Chaetodontoplus conspicillatus (Waite, 1900)	+	+	+			
Chaetodontoplus meredithi Kuiter, 1990	+	+				
Genicanthus semicinctus (Waite, 1900)		+		+		
Pomacanthus imperator (Bloch, 1787)	+	+				
Pomacanthus semicirculatus (Cuvier, 1831)	+	+				
Pentacerotidae						
Evistias acutirostris (Temminck & Schlegel, 1844)	+	+	+	+	+	
Pomacentridae						
Abudefduf bengalensis (Bloch, 1787)	+	+				
Abudefduf sexfasciatus (Lacepède, 1802)	+	+	+			69
Abudefduf sordidus (Forsskål, 1775)	+	+	+			
Abudefduf vaigiensis (Quoy & Gaimard, 1825)	+	+	+			70
Abudefduf whitleyi Allen & Robertson, 1974	+	+	+			
Amphiprion latezonatus Waite, 1900	+	+	+			
Amphiprion mccullochi Whitley, 1929		+				
Chromis atripectoralis Welander & Schultz, 1951	+	+				
Chromis dispilus Griffin, 1923				+	+	
Chromis flavomaculata Kamohara, 1960	+	+	+			71
Chromis fumea (Tanaka, 1917)	+		+		+	72
Chromis hypsilepis (Günther, 1867)	+	+	+		+	
Chromis margaritifer Fowler, 1946	+	+				
Chromis nitida (Whitley, 1928)	+	+				
~~*Chromis vanderbilti* (Fowler, 1941)~~	~~+~~	~~+~~	~~+~~	~~+~~		
Chrysiptera glauca (Cuvier, 1830)	+	+	+			
Chrysiptera notialis (Allen, 1975)	+	+	+			
Chrysiptera rapanui (Greenfield & Hensley, 1970)				+		
Dascyllus aruanus (Linnaeus, 1758)	+	+				
Dascyllus reticulatus (Richardson, 1846)	+	+				
Dascyllus trimaculatus (Rüppell, 1828)	+	+				
Neoglyphidodon polyacanthus (Ogilby, 1889)	+	+	+			
Parma alboscapularis Allen & Hoese, 1975		+	+	+	+	
Parma kermadecensis Allen, 1987				+		

APPENDIX (continued)

FAMILY SPECIES	AUSTRALIA	LORD HOWE ISLAND	NORFOLK ISLAND	KERMADEC ISLANDS	NEW ZEALAND	FOOTNOTES
Parma polylepis Günther, 1862	+	+	+		+	
Plectroglyphidodon dickii (Liénard, 1839)	+	+	+			
Plectroglyphidodon johnstonianus Fowler & Ball, 1924	+	+	+			
Plectroglyphidodon lacrymatus (Quoy & Gaimard, 1824)	+	+				
Plectroglyphidodon leucozonus (Bleeker, 1859)	+	+				
Pomacentrus coelestis Jordan & Starks, 1901	+	+				
Pomacentrus moluccensis Bleeker, 1853	+	+				
Pomacentrus pavo (Bloch, 1787)	+	+	+			
Stegastes fasciolatus (Ogilby, 1889)	+	+	+	+		
Stegastes gascoynei (Whitley, 1964)	+	+	+		+	
Teixeirichthys sp.			+			
Cirrhitidae						
Cirrhitus pinnulatus (Schneider, 1801)	+			+		
Cirrhitus splendens (Ogilby, 1889)	+	+	+	+		
Paracirrhites arcatus (Cuvier, 1829)	+		+			
Paracirrhites forsteri (Schneider, 1801)	+	+	+			
Chironemidae						
Chironemus marmoratus Günther, 1860	+	+			+	
Chironemus microlepis Waite, 1916		+	+	+		
Aplodactylidae						
Aplodactylus etheridgii (Ogilby, 1889)		+	+	+	+	
Cheilodactylidae						
Cheilodactylus ephippium McCulloch & Waite, 1916	+	+	+	+	+	
Cheilodactylus fuscus Castelnau, 1879	+	+			+	
Cheilodactylus vestitus (Castelnau, 1879)	+	+	+			73
Cheilodactylus vittatus Garrett, 1864		+		+		73
Nemadactylus douglasii (Hector, 1875)	+			+	+	
Nemadactylus macropterus (Bloch & Schneider, 1801)	+		+		+	
Latrididae						
Latridopsis ciliaris (Bloch & Schneider, 1801)	+			+	+	
Mugilidae						
Crenimugil crenilabis (Forsskål, 1775)	+	+				
Mugil cephalus Linnaeus, 1758	+		+		+	74
Myxus elongatus Günther, 1861	+	+	+			
Valamugil seheli (Forsskål, 1775)			+			
Sphyraenidae						
Sphyraena acutipinnis Day, 1876	+	?	+	+	+	75
Sphyraena barracuda (Walbaum, 1792)	+	+	?			
Labridae						
Anampses caeruleopunctatus Rüppell, 1829	+	+		+		
Anampses elegans Ogilby, 1889	+	+	+	+	+	
~~*Anampses femininus* Randall, 1972~~	~~+~~	~~+~~				
Anampses geographicus Valenciennes, 1840	+	+				
Anampses neoguinaicus Bleeker, 1878	+	+				
Bodianus axillaris (Bennett, 1831)	+	+				
Bodianus perditio (Quoy & Gaimard, 1834)	+	+	+			
Bodianus unimaculatus (Günther, 1862)	+	+	+	+	+	76
Cheilinus bimaculatus Valenciennes, 1840	+	+				
Cheilio inermis (Forsskål, 1775)	+	+	+			
Choerodon fasciatus (Günther, 1867)	+	+				77
Cirrhilabrus punctatus Randall & Kuiter, 1989	+	+				78

APPENDIX (continued)

FAMILY SPECIES	AUSTRALIA	LORD HOWE ISLAND	NORFOLK ISLAND	KERMADEC ISLANDS	NEW ZEALAND	FOOTNOTES
Coris aygula Lacepède, 1801	+	+				
Coris bulbifrons Randall & Kuiter, 1982	+	+	+			79
Coris gaimard (Quoy & Gaimard, 1824)	+	+				
Coris picta (Bloch & Schneider, 1801)	+	+	+	+	+	
Coris sandageri Phillipps, 1927	+	+	+	+	+	
Cymolutes praetextatus (Quoy & Gaimard, 1834)	+		+			
Cymolutes torquatus (Valenciennes, 1840)	+	+				
Gomphosus varius Lacepède, 1801	+	+	+			
Halichoeres margaritaceus (Valenciennes, 1839)	+		+	+		
Halichoeres nebulosus (Valenciennes, 1839)	+	+				80
Halichoeres trimaculatus (Quoy & Gaimard, 1834)	+	+	+			
Hemigymnus fasciatus (Bloch, 1792)	+	+				
Hemigymnus melapterus (Bloch, 1791)	+	+				
Hologymnosus doliatus (Lacepède, 1801)	+	+				
Labrichthys unilineatus (Guichenot, 1847)	+	+				
Labroides bicolor Fowler & Bean, 1928	+	+				
Labroides dimidiatus (Valenciennes, 1839)	+	+	+			
Labropsis australis Randall, 1981	+	+				
Macropharyngodon meleagris (Valenciennes, 1839)	+	+				
Notolabrus gymnogenis (Günther, 1862)	+	+				
Notolabrus inscriptus (Richardson, 1848)	+	+	+	+	+	
Novaculichthys macrolepidotus (Bloch, 1791)	+	+				
Novaculichthys taeniourus (Lacepède, 1801)	+	+	+			
Novaculops sp.		+				
Pseudocheilinus hexataenia (Bleeker, 1857)	+	+				
Pseudocoris yamashiroi (Schmidt, 1930)	+			+		
Pseudojuloides cerasinus (Snyder, 1904)	+	+				
Pseudojuloides elongatus Ayling & Russell, 1977	+		+		+	
Pseudolabrus luculentus (Richardson, 1848)	+	+	+	+	+	
Stethojulis bandanensis (Bleeker, 1851)	+	+	+	+		
Stethojulis interrupta (Bleeker, 1851)	+	+				
Stethojulis maculatus Schmidt, 1930			+			
Suezichthys arquatus Russell, 1985	+	+	+	+	+	81
Suezichthys aylingi Russell, 1985	+			+	+	
Thalassoma amblycephalum (Bleeker, 1856)	+	+	+	+	+	
Thalassoma hardwicke (Bennett, 1828)	+	+	+			
Thalassoma jansenii (Bleeker, 1856)	+	+	+	+		
Thalassoma lunare (Linnaeus, 1758)	+	+	+	+	+	
Thalassoma lutescens (Lay & Bennett, 1839)	+	+	+	+		
Thalassoma purpureum (Forsskål, 1775)	+	+	+	+		
Thalassoma quinquevittatum (Lay & Bennett, 1839)	+	+				
Thalassoma trilobatum (Lacepède, 1801)	+	+	+	+		82
Xyrichtys aneitensis (Günther, 1862)	+	+				
Xyrichtys jacksonensis (Ramsay, 1882)	+	+				83
Xyrichtys pavo Valenciennes, 1840	+	+				
Scaridae						
Leptoscarus vaigiensis (Quoy & Gaimard, 1824)	+	+			+	72
Scarus altipinnis (Steindachner, 1879)	+	+				84
Scarus chameleon Choat & Randall, 1986	+	+				85
Scarus frenatus Lacepède, 1802	+	+				86
Scarus ghobban Forsskål, 1775	+	+				
Scarus globiceps Valenciennes, 1840	+	+				
Scarus longipinnis Randall & Choat, 1980	+	+				87

APPENDIX (continued)

FAMILY SPECIES	AUSTRALIA	LORD HOWE ISLAND	NORFOLK ISLAND	KERMADEC ISLANDS	NEW ZEALAND	FOOTNOTES
Scarus microrhinos Bleeker, 1854	+	+				88
Scarus niger Forsskål, 1775	+	+				
Scarus psittacus Forsskål, 1775	+	+				89
Scarus rivulatus Valenciennes, 1840	+	+	+	?		
Scarus schlegeli (Bleeker, 1861)	+	+				
Scarus sordidus Forsskål, 1775	+	+				
Uranoscopidae						
Kathetostoma sp.				+		
Creediidae						
Limnichthys fasciatus Waite, 1904	+	+	+	+		
Percophidae						
Enigmapercis sp.		+				
Pinguipedidae						
Parapercis cylindrica (Bloch, 1797)	+	+				
Parapercis hexophtalma (Cuvier, 1829)	+	+				90
Parapercis sp.			+			
Tripterygiidae						
Enneapterygius rufopilea (Waite, 1904)		+	+	+		
Enneapterygius sp.		+	+			91
Norfolkia squamiceps (McCulloch & Waite, 1916)	+	+	+			
Clinidae						
Cristiceps aurantiacus Castelnau, 1879	+	+			+	
Heteroclinus roseus (Günther, 1861)	+	+	+			
Blenniidae						
Cirripectes alboapicalis (Ogilby, 1899)	+	+	+	+		
Cirripectes castaneus (Valenciennes, 1836)	+	+	+	+		92
Cirripectes chelomatus Williams & Maugé, 1983	+	+				93
Enchelyurus ater (Günther, 1877)		+				
Entomacrodus caudofasciatus (Regan, 1909)				+		
Entomacrodus cymatobiotus Schultz & Chapman, 1960				+		
Entomacrodus niuafoouensis (Fowler, 1932)			+	+		
Entomacrodus striatus (Quoy & Gaimard, 1836)	+	+	+			
Istiblennius dussumieri (Valenciennes, 1836)	+		+			
Istiblennius edentulus (Forster, 1801)	+	+	+			
Istiblennius lineatus (Valenciennes, 1836)	+		?			
Parablennius laticlavius (Griffin, 1926)	+			+	+	
Parablennius serratolineatus Bath & Hutchins, 1986			+			94
Petroscirtes lupus (De Vis, 1886)	+	+				
Plagiotremus laudandus (Whitley, 1961)	+	+				
Plagiotremus rhinorhynchos (Bleeker, 1852)	+	+				
Plagiotremus tapeinosoma (Bleeker, 1857)	+	+	+	+	+	
Stanulus talboti Springer, 1968	+	+				
~~*Xiphasia matsubarai* Okada & Suzuki, 1952~~		~~+~~				
Xiphasia setifer Swainson, 1839	+	+				
Ammodytidae						
Ammodytoides vaga (McCulloch & Waite, 1916)	+	+				
Callionymidae						
Callionymus calcaratus Macleay, 1881	+	+	+			
Diplogrammus goramensis (Bleeker, 1858)	+		+			
Gobiidae						
Amblygobius nocturnus (Herre, 1945)	+	+				95
Amblygobius phalaena (Valenciennes, 1837)	+	+				
Asterropteryx semipunctatus Rüppell, 1828	+	+				

APPENDIX (continued)

FAMILY SPECIES	AUSTRALIA	LORD HOWE ISLAND	NORFOLK ISLAND	KERMADEC ISLANDS	NEW ZEALAND	FOOTNOTES
Bathygobius aeolosoma (Ogilby, 1889)	+	+	+			
Bryaninops loki Larson, 1985	+	+				96
Callogobius sp. 3	+	+				97
Callogobius sp. 6	+	+	+			97, 98
Eviota albolineata Jewett & Lachner, 1983	+	+				99
Eviota prasina (Klunzinger, 1871)		+	+			100
Eviota smaragdus Jordan & Seale, 1906			+			101
Eviota sp.		+	+			102
Eviota sp.		+				
Eviota sp.				+		
Favonigobius lateralis (Macleay, 1881)	+	+			+	
Fusigobius neophytus (Günther, 1877)	+	+				
Gnatholepis inconsequens Whitley, 1958	+	+				
Istigobius decoratus (Herre, 1927)	+	+				103
Macrodontogobius wilburi Herre, 1936	+	+				
Paragobiodon lacunicolus (Kendall & Goldsborough, 1911)	+	+				
Paragobiodon modestus (Regan, 1908)	+	+				104
Paragobiodon xanthosomus (Bleeker, 1852)	+	+				
Pleurosicya mossambica Smith, 1959	+	+				
Priolepis semidoliatus (Valenciennes, 1837)	+		+			
Priolepis sp. 3		+				97, 105
Priolepis sp. 4		+				97, 105
Priolepis sp.				+		
Valenciennea strigata (Broussonet, 1782)	+	+				
Vanderhorstia ornatissima Smith, 1959	+	+				
Vanderhorstia sp.			+			
Microdesmidae						
Ptereleotris evides (Jordan & Hubbs, 1925)	+	+				
Ptereleotris zebra Fowler, 1938	+	+				
Acanthuridae						
Acanthurus blochii Valenciennes, 1835	+	+				106
Acanthurus dussumieri Valenciennes, 1835	+	+	+		+	107
Acanthurus nigrofuscus (Forsskål, 1775)	+	+	+			
Acanthurus olivaceus Forster, 1801	+	+				
Acanthurus triostegus (Linnaeus, 1758)	+	+	+	+		
Naso annulatus (Quoy & Gaimard, 1825)	+	+	+			108
Naso brevirostris (Valenciennes, 1835)	+	+				
Naso hexacanthus (Bleeker, 1855)	+	+				
Naso maculatus Randall & Struhsaker, 1981		+				
Naso unicornis (Forsskål, 1775)	+	+	+			
Prionurus maculatus Ogilby, 1887	+	+	+	+	+	
Prionurus microlepidotus Lacepède, 1804	+	+				
Zebrasoma scopas (Cuvier, 1829)	+	+	+			
Zanclidae						
Zanclus cornutus (Linnaeus, 1758)	+	+	+	+		
Siganidae						
Siganus fuscescens (Houttuyn, 1782)	+	+				109
Scombridae						
Sarda australis (Macleay, 1881)	+	?	+		+	
Scomber australasicus Cuvier, 1831	+	+			+	
Bothidae						
Bothus mancus (Broussonet, 1782)	+	+	+			
Bothus myriaster (Temminck & Schlegel, 1846)		+				

APPENDIX (continued)

FAMILY SPECIES	AUSTRALIA	LORD HOWE ISLAND	NORFOLK ISLAND	KERMADEC ISLANDS	NEW ZEALAND	FOOTNOTES
Bothus pantherinus Rüppell, 1828	+	+	+			
Crossorhombus sp.		+				
Engyprosopon sp.				+	+	110
Lophonectes gallus Günther, 1880				+	+	
Pleuronectidae						
Peltorhamphus latus James, 1972			+		+	
Cynoglossidae						
Paraplagusia unicolor (Macleay, 1881)	+	+				
Soleidae						
Aseraggodes bahamondei Randall & Meléndez, 1987		+	+	+		111
Aseraggodes macleayanus (Ramsay, 1881)	+	+				
Aseraggodes ramsaii (Ogilby, 1889)	+	+				112
Balistidae						
Balistoides conspicillum (Bloch & Schneider, 1801)	+	+				
Rhinecanthus aculeatus (Linnaeus, 1758)	+	+				
Rhinecanthus rectangulus (Bloch & Schneider, 1801)	+	+	+	+		
Sufflamen chrysopterus (Bloch & Schneider, 1801)	+	+				
Sufflamen fraenatus (Latreille, 1804)	+	+	+			
Monacanthidae						
Aluterus monoceros (Linnaeus, 1758)	+	+			+	
Brachaluteres taylori Woods, 1966	+	+	?		+	113
Cantherhines dumerilii (Hollard, 1854)	+	+				
Cantherhines fronticinctus (Günther, 1867)	+	+				
Cantherhines pardalis (Rüppell, 1837)	+	+				
Cantheschenia longipinnis (Fraser-Brunner, 1941)	+	+	+			
Oxymonacanthus longirostris (Bloch & Schneider, 1801)	+	+				
Parika scaber (Bloch & Schneider, 1801)	+			+	+	
Pervagor alternans (Ogilby, 1899)	+	+	+			114
Pervagor janthinosoma (Bleeker, 1854)	+		+			
Thamnaconus analis (Waite, 1904)	+	+		+	+	
Ostraciidae						
Lactoria cornuta (Linnaeus, 1758)	+	+				
Lactoria diaphana (Bloch & Schneider, 1801)	+	+	+	+		
Lactoria fornasini (Bianconi, 1846)	+	+				
Ostracion cubicus Linnaeus, 1758	+	+	+	+	+	
Ostracion meleagris Shaw, 1796	+	+				
Tetrosomus concatenatus (Bloch, 1786)	+	+				115
Tetraodontidae						
Arothron hispidus (Linnaeus, 1758)	+	+				
Arothron meleagris (Bloch & Schneider, 1801)	+	+				
Arothron stellatus (Bloch & Schneider, 1801)	+	+			+	
Canthigaster bennetti (Bleeker, 1854)	+	+				
Canthigaster callisterna (Ogilby, 1889)	+	+	+	+	+	
Canthigaster janthinoptera (Bleeker, 1855)	+	+				
Canthigaster valentini (Bleeker, 1853)	+	+				
Tetractenos hamiltoni (Gray & Richardson, 1843)	+	+				
Torquigener altipinnis (Ogilby, 1891)	+	+	+	+	+	116
Torquigener pleurogramma (Regan, 1903)	+	+				
Diodontidae						
Cyclichthys orbicularis (Bloch, 1785)	+	+				
Diodon holocanthus Linnaeus, 1758	+	+				
Diodon hystrix Linnaeus, 1758	+	+	+	+		
Number of species (total = 521)	444	433	254	145	115	

APPENDIX (continued)

1. Reported from Norfolk I. as *M. antarcticus.*
2. Reported from Kermadec Is. by Garrick (1982).
3. Reported from Lord Howe I. as *T. brocki* and Norfolk I. as *T. melanospila.*
4. Reported from Lord Howe I. as *A. vulpes.*
5. Reported from Norfolk I. as *A. vermiformis* by Castle (1964).
6. Reported from Lord Howe I. as *G. panamensis.*
7. Report of *Gymnothorax chilospilus* from Kermadec Is. was based on a specimen of *G. nubilus.*
8. Possibly conspecific with *G. porphyreus.*
9. Lettered species follow Allen et al. (1976).
10. Reported from Lord Howe I. as *C. melanotaenia.*
11. Reported from Lord Howe I. as *Cyclophichthys cyclorhinus* and from Norfolk I. as *Elapsopis cyclorhinus.*
12. Reported from Norfolk I. by Castle (1964).
13. Reported from Lord Howe I. as *A. howensis.*
14. Reported from Kermadec Is. as *G. incognitus* by Castle (1964).
15. Reported from Norfolk I. as *S. gracilis.*
16. Reported from Kermadec Is. as *G. gonorynchus.*
17. Reported from Lord Howe I. and Norfolk I. as *S. variegatus.*
18. Reported from Lord Howe I. as *Synodus* sp. and from Norfolk I. as *Synodus* n. sp.
19. Reported from Lord Howe I. as *S. hoshinonis.*
20. Reported from Lord Howe I. and Kermadec Is. as *S. englemani.*
21. *Lotella phycis* and *L. rhacinus* from Lord Howe I. and Norfolk I. were previously combined under *L. callarias*, a synonym of *L. rhacinus* (Paulin 1983).
22. Reported from Kermadec Is. by Markle and Olney (1990).
23. Reported from Norfolk I. as *Dermatopsis* sp.
24. Lord Howe I. species of *Antennarius* were reviewed by Pietsch and Grobecker (1987).
25. Reported from Lord Howe I. as *Aspasmogaster tasmaniensis.*
26. Reported from Lord Howe I. as *H. lacunosa.*
27. Reported from Lord Howe I. as *M. murdjan.*
28. Correctly reported from Lord Howe I., but *M. borbonicus*, a synonym of *M. kuntee*, was also listed.
29. Reported from Lord Howe I. as *Ostichthys pilwaxii.*
30. Reported from Lord Howe I. as *A. slacksmithi.*
30A. Reported from Norfolk I. and Kermadec Is. as *S. littoralis.*
31. Reported from Lord Howe I. as *A. serratus.*
32. Reported from Lord Howe I. by Hutton (1986).
33. Reported from Lord Howe I. as *E. hoedti.*
34. Reported from Lord Howe I. as *E. medurensis.*
35. Reported from Norfolk I. and Kermadec Is. by Randall and Heemstra (1991).
36. Reported from Lord Howe I. as *E. microdon.*
37. Reported from Lord Howe I. and Norfolk I. as *E. rhyncholepis.*
38. Reported from Lord Howe I. as *E. melanostigma.*
39. Reported from Lord Howe I. as *Ellerkeldia huntii* and from Kermadec Is. as *Ellerkeldia* sp.
40. Reported from Lord Howe I. as *Pseudanthias* sp.
41. Reported from Lord Howe I. as *Pseudoplesiops* sp.
42. Reported from Lord Howe I. and Norfolk I. as *Plesiops* sp.
43. Reported from Lord Howe I. as *A. coccineus.*
44. Reported from Lord Howe I. and Norfolk I. as *Apogon* sp. A, and from Kermadec Is. as *A. chrysotaenia.*
45. Reported from Lord Howe I. as *F. aurita.*
46. Reported from Lord Howe I. as *D. leptosomus*, from Norfolk I. as *D. macarellus*, and from Kermadec Is. as *Decapterus* sp. No specimens are available from Norfolk I. or Kermadec Is. to allow positive identification.
47. Reported from Lord Howe I. as *Caranx (Pseudocaranx) nobilis*, and from Norfolk I. as both *Caranx nobilus* [*sic*] and *P. dentex.*
48. Reported from Lord Howe I. as *T. botla.*
49. Reported from Lord Howe I. as *T. mccullochi* and Norfolk I. as *Trachurus* sp.
50. Reported from Norfolk I. and Kermadec Is. as *Arripis ?esper.*
51. Reported from Lord Howe I. as *L. amabilis.*
52. Reported from Norfolk I. as *L. vaigiensis.*
53. Reported from Lord Howe I. as *P. pedleyi.*
54. Reported from Norfolk I. as *Caesio chrysozona* and *C. pisang.*
55. Reported from Lord Howe I. as *Spilotichthys pictus.*
56. Reported from Norfolk I. as *Pseudopristipoma nigra.*
57. Reported from Lord Howe I. as *P. punctatissimus.*
58. Reported from Lord Howe I. as *P. schotaf.*
59. Reported from Lord Howe I. as *Gymnocranius* sp.
60. Reported from Lord Howe I. and Norfolk I. as *L. chrysostomus.*
61. Reported from Lord Howe I. and Norfolk I. as *P. porphyreus.*
62. Reported from Lord Howe I. as *P. pleurospilos.*
63. Reported from Lord Howe I. as *P. trifasciatus.*

APPENDIX (continued)

64. Reported from Lord Howe I. and Kermadec Is. as *P. signatus*.
65. Reported from Norfolk I. by Hutchins (1990).
66. Reported from Norfolk I. as *Upeneus* sp. and *U. tragula* and from Kermadec Is. as *Upeneus* sp.
67. Reported from Lord Howe I. as *P. unwini*.
68. Reported from Lord Howe I. and Norfolk I. as *K. fuscus*.
69. Reported from Lord Howe I. as *A. coelestinus*.
70. Reported from Lord Howe I. and Norfolk I. as *A. saxatilis*.
71. Reported from Lord Howe I. as *C. kennensis*.
72. Deleted from Kermadec Is. fauna because no basis for Paulin and Stewart's (1985) record could be found.
73. *Cheilodactylus vestitus* and *C. vittatus* were reported from Lord Howe I. by Randall (1983); one of these species was previously reported as *Goniistius gibbosus*.
74. *Mugil georgii* was deleted from Kermadec Is. fauna because no basis for Paulin and Stewart's (1985) record could be found.
75. *Sphyraena waitii*? and *S. obtusata* were reported from Lord Howe I. Identification to species requires examination of specimens.
76. Reported from Lord Howe I. as *B. oxycephalus* and from Norfolk I. and Kermadec Is. as *B. vulpinus*.
77. *Choerodon* sp. was deleted from the Norfolk I. fauna because no basis for Hermes's (1986) record could be found.
78. Reported from Lord Howe I. as *Cirrhilabrus* sp.
79. Reported from Lord Howe I. as *Coris* sp. and from Norfolk I. as *Coris* n. sp.
80. Reported from Lord Howe I. as *H. margaritaceus*.
81. Reported from Lord Howe I. as *Pseudolabrus* sp., Norfolk I. as *Pseudolabrus* n. sp., and Kermadec Is. as *Suezichthys* sp.
82. Reported from Lord Howe I. and Norfolk I. as *T. fuscum*.
83. Reported from Lord Howe I. as *Hemipteronotus* sp.
84. Reported from Lord Howe I. as *S. chlorodon*.
85. Reported from Lord Howe I. as *S. lunula*.
86. Reported from Lord Howe I. as *S. sexvittatus*.
87. Reported from Lord Howe I. as *Scarus* sp.
88. Reported from Lord Howe I. as *S. gibbus*.
89. Reported from Lord Howe I. as *S. forsteri*.
90. Reported from Lord Howe I. as *P. polyophthalma*.
91. Reported from Lord Howe I. as Tripterygiid sp. and from Norfolk I. as *Vauclusella* sp.
92. Reported from Lord Howe I. and Norfolk I. as *C. filamentosus*.
93. Reported from Lord Howe I. as *Cirripectes* sp.
94. Reported from Norfolk I. as *Parablennius* sp. *Rhabdoblennius snowi* is probably also this species (Hoese et al. 1978) and was deleted from the Norfolk I. fauna.
95. Reported from Lord Howe I. as *Amblygobius* sp.
96. Reported from Lord Howe I. as *Cottogobius* sp.
97. Numbered gobiids follows D. F. Hoese's (AMS) terminology.
98. Reported from Norfolk I. as *Callogobius* sp.
99. Reported from Lord Howe I. as *Eviota* sp. 4.
100. Reported from Lord Howe I. and Norfolk I. as *E. viridis*.
101. Reported from Norfolk I. as *Eviota* sp. Norfolk I. endemic.
102. Reported from Lord Howe I. as *Eviota* sp. cf. *afelei*.
103. Reported from Lord Howe I. as *Acentrogobius* sp.
104. Reported from Lord Howe I. as *P. echinocephalus*.
105. Reported from Lord Howe I. as *Quisquillius* sp. 3 or sp. 4.
106. Reported from Lord Howe I. as *A. mata*.
107. Reported from Norfolk I. as *A. xanthopterus*.
108. *Naso herrei* reported from Lord Howe I. is a synonym of *N. annulatus*.
109. Reported from Lord Howe I. as *S. nebulosus*. *Siganus* sp., also reported from Lord Howe I., is based on an aberrant specimen of *S. fuscescens* (Woodland 1990).
110. Reported from Kermadec Is. as *Bothus constellatus*.
111. Reported from Lord Howe I. and Kermadec Is. as *A. haackeanus*.
112. Allen et al. (1976) treated this species as a synonym of *A. haackeanus*, but Randall and Meléndez (1987) showed it to be valid.
113. Reported from Lord Howe I. as *B. baueri*.
114. Reported from Lord Howe I. and Norfolk I. as *P. melanocephalus*.
~~115. Reported from Lord Howe I. as *Triorus reipublicae*.~~
116. Reported from Kermadec Is. by Schiel et al. (1986).