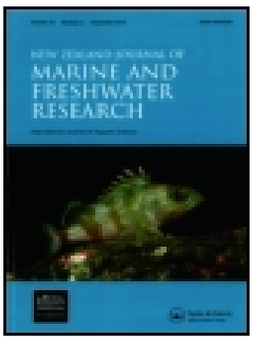

New Zealand Journal of Marine and Freshwater Research

ISSN: 0028-8330 (Print) 1175-8805 (Online) Journal homepage: http://www.tandfonline.com/loi/tnzm20

Fishes from Porirua and Pauatahanui inlets: Occurrence in gill nets

J. B. Jones & J. D. Hadfield

To cite this article: J. B. Jones & J. D. Hadfield (1985) Fishes from Porirua and Pauatahanui inlets: Occurrence in gill nets, New Zealand Journal of Marine and Freshwater Research, 19:4, 477-484, DOI: 10.1080/00288330.1985.9516112

To link to this article: https://doi.org/10.1080/00288330.1985.9516112

Published online: 30 Mar 2010.

New Zealand Journal of Marine and Freshwater Research, 1985, Vol. 19: 477–484
0028–8330/85/1904–0477$2.50/0

Fishes from Porirua and Pauatahanui Inlets: occurrence in gill nets

J. B. JONES
J. D. HADFIELD
Fisheries Research Division
Ministry of Agriculture and Fisheries
P. O. Box 297, Wellington
New Zealand

Abstract From June 1983 to July 1984, gill nets were set at intervals of approximately one month in the Porirua and Pauatahanui Inlets, Wellington. During this period, 24 species of fish were caught, bringing the total number of species known from the two inlets to 43. The inlets are a nursery area for juvenile *Callorhynchus milii, Mustelus lenticulatus, Rhombosolea plebeia*, and *Arripis trutta*.

Keywords Porirua; Pauatahanui; estuary; fish; occurrence; nursery area; gill nets; species list

INTRODUCTION

There have been relatively few published multi-species studies on the fishes of New Zealand estuaries. Webb (1972) studied the fish fauna of the Avon-Heathcote Estuary and Kilner and Ackroyd (1978) described the fish fauna of the Ahuriri Estuary, Napier.

From 1973 to 1976 Pauatahanui Inlet was the subject of a multidisciplinary study co-ordinated by the Department of Scientific and Industrial Research. As part of that project the fish resources of both inlets were studied between May 1975 and November 1976, by students from Victoria University of Wellington, and a summary of those results was published in Healy (1980). They recorded 30 species, categorised by abundance and seasonal occurrence, together with brief notes on the habitat of yellow-eyed mullet, sand flounder, spotty, sole, kahawai, trevally, yellowbelly flounder, and rig.

Received 1 February 1985; accepted 28 March 1985
Fisheries Research Publication 512

The Porirua and Pauatahanui Inlets form the two arms of an estuary located on the south-west coast of the North Island, near the entrance to Cook Strait (Fig. 1). The estuary has a combined area of about 15 km^2. Porirua Inlet (the southern arm) is fed by the Porirua Stream at its southern end. The Horokiwi and Pauatahanui Streams feed the Pauatahanui Inlet (the eastern arm of the estuary). Both inlets are shallow and have extensive areas of mudflat exposed at low tide.

The present study did not begin with the objective of surveying what fish would be caught by gill netting. Instead the results are the outcome of an attempt to obtain specimens of blue mackerel (*Scomber australasicus*), using gill nets set in the Porirua and Pauatahanui Inlets from June 1983 to July 1984. Although only one juvenile *Scomber* was caught, the study provided serendipitous information on the seasonal occurrence of fish in the estuary, and on the growth of rig (*Mustelus lenticulatus*), elephant fish (*Callorhynchus milii*), flounder (*Rhombosolea plebeia*), and kahawai (*Arripis trutta*).

METHODS

Because the original intention was to catch *Scomber australasicus* rather than to systematically sample the estuary fish fauna, only gill-nets were used and these were set overnight once every two weeks. By alternating the nets between the two inlets, each inlet was sampled at least once in every four week period. The nets used are described in Table 1.

Nets were set along transect lines in each inlet (Fig. 1). With the exception of the 62 mm mesh net, the order in which the individual nets were set along the transects was not constant. The 62 mm mesh net was used from August 1983, and in February 1984 the braided portion of the net was replaced by the 91 mm net. This fine mesh net was always set in the same location where reasonable catches of juvenile fish could be expected.

A local fisherman (T. Whitt) kept a diary of catches from his gill net (100 m of 118 mm mesh) which he set in Porirua Inlet from 24 May 1983 to 28 November 1983. His data is included in Fig. 3.

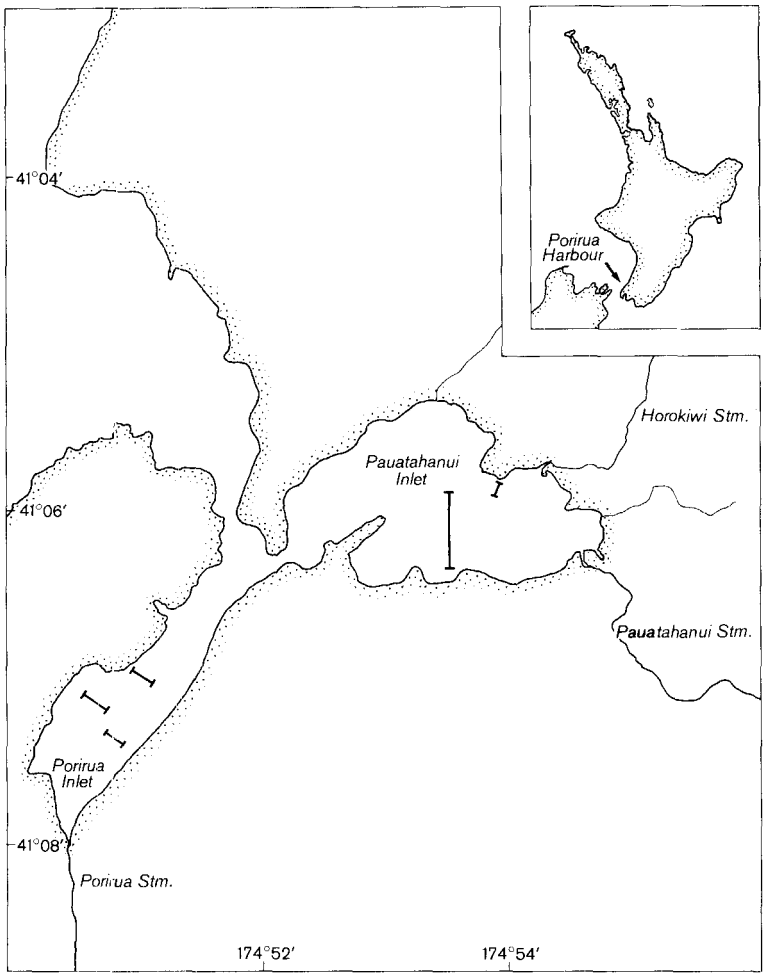

Fig. 1 Porirua and Pauatahanui Inlets. Insert: Northern New Zealand, showing locality of estuary.

RESULTS AND DISCUSSION

Catch rates

Gill-nets are selective both for species and for fish size, and catches of schooling fish can be very variable depending on the movements of the schools in relation to the nets. Because of these factors, it is not possible from our data to assess the relative abundance of fish in the estuary. However, even with the pelagic fish catches (kahawai, pilchards, anchovies, mackerels, yellow-eyed mullet) and the rig (which are known to be seasonal) excluded, the catch per set of the other species still shows an increase over the summer months (Fig. 2).

Species caught

Over the sampling period a total of 24 fish species were caught, and a list of species and their occurrence in the nets is given for each inlet (Fig. 3, 4). Catches by Whitt have been included in Fig. 3. Because his net was set almost daily, the occurrence of many fish in the estuary could be extended by including this data. Conger eels (*Conger* sp.) were not caught by us but attacked the fish in the nets leaving characteristic twisted tangles in the mesh. Their presence in the harbour has been confirmed by local fishermen and is recorded in Healy (1980).

Healy lists 30 species, collected by gill net, dip net, and otter trawl, but 14 of those species were not caught by us. Fish caught by us but not on the

1980 list are: *Scomber australasicus* (blue mackerel); *Nemadactylus macropterus* (tarakihi); *Thyrsites atun* (barracouta); *Latridopsis ciliaris* (blue moki); *Pseudolabrus fucicola* (banded parrotfish); *Myliobatis tenuicaudatus* (eagle ray); *Geotria australis* (lamprey), and *Salmo trutta* (brown trout).

In addition, the following freshwater fish are known to occur in the streams feeding the estuary, and must migrate through the estuary: *Anguilla australis, A. dieffenbachii* (eels) and *Galaxias argenteus, G. fasciatus, G. maculatus* (whitebait) (FRD unpub. data). All of these are transient members of the estuary population but bring the total number of species up to 43 (Table 2).

This figure is relatively high since the Ahuriri Estuary has 29 recorded fish species (Kilner & Ackroyd 1978), the Avon-Heathcote Estuary (7.7 km²) has 28 (Webb 1972), and Wellington Harbour (which is over seven times the size of the Porirua/Pauatahanui Estuary, is much deeper, and opens to deep ocean) has 56 species (Healy 1980).

Growth of species

All fish caught were measured and from these records growth of four of the species could be deduced.

ELEPHANT FISH *Callorhynchus milii*

The length (from proboscis to tail tip) of elephant fish caught plotted against time is shown in Fig. 5 (n = 42).

Elephant fish have not been recorded from the Avon-Heathcote or Ahuriri Estuaries, but are known to breed in Wellington Harbour (pers. obs.). Elephant fish were studied by Gorman (1963) from trawl caught samples in Canterbury Bight. He found that the fish moved inshore in September to lay eggs from the surfline to 20 fathoms (36 m) on a sand or mud substrate. Spawning was completed in December or January and the adults moved out into deep water. Incubation took 5 to 8 months prior to hatching at 100 m fork length.

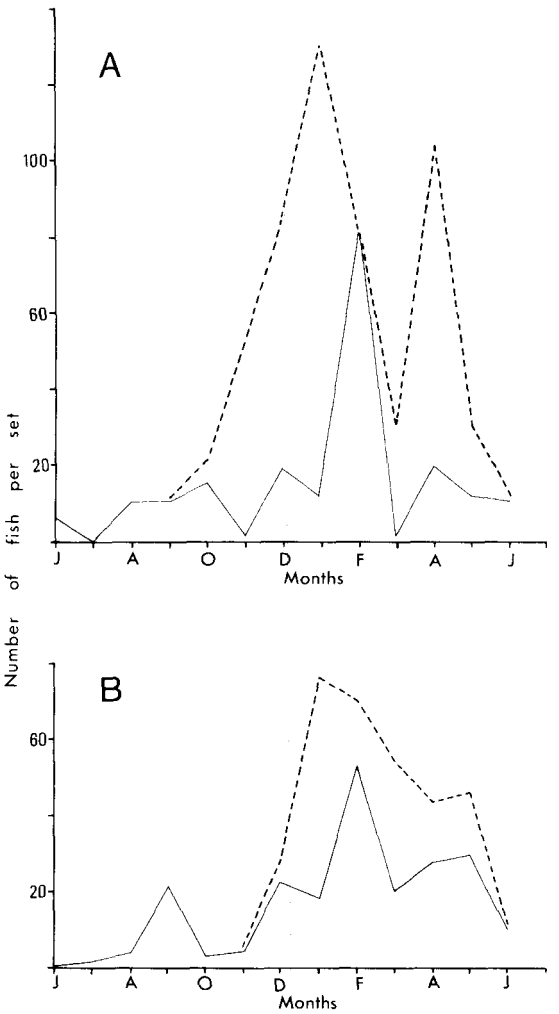

Fig. 2 Catch per set by month. **A**, Pauatahanui Inlet. **B**, Porirua Inlet. Broken line = total catch excluding pelagic fish; solid line = total catch excluding pelagic fish and rig.

Table 1 Description of gill nets set in Porirua and Pauatahanui Inlets from June 1983 to July 1984.

Stretched mesh size	Length of net (m)
62 mm braided nylon (2½")	100
62 mm monofilament nylon (2½")	50 (Joined together)
90 mm monofilament nylon (3½")	50
118 mm monofilament nylon (4½")	130
137 mm monofilament nylon (5¼")	100
157 mm monofilament nylon (6¼")	85
91 mm multifilament nylon (3½") (replaced braided nylon)	50 (from March 1984)

Table 2 Fish species known from Pauatahanui and Porirua Inlets, based on our records and Healy (1980).

Species	Common name	Source[1]		
Geotria australis	Lamprey		†	‡
Mustelus lenticulatus	Rig	*	†	‡
Callorhynchus milii	Elephant fish	*	†	‡
Myliobatis tenuicaudatus	Eagle ray		†	
Arripis trutta	Kahawai	*	†	‡
Adrichetta forsteri	Yellow-eyed mullet	*	†	‡
Sardinops neopilchardus	Pilchard	*	†	
Engraulis australis	Anchovy	*	†	
Hemirhamphus ihi	Garfish	*		
Retropinna retropinna	Smelt	*		
Syngnathus norae	Pipefish	*		
Stigmatophora longirostris	Long-snout pipefish	*		
Hippocampus abdominalis	Seahorse	*		
Scomber australasicus	Blue mackerel		†	
Trachurus novaezelandiae	Jack mackerel	*	†	‡
Thyrsites atun	Barracouta		†	
Caranx georgianus	Trevally	*	†	‡
Nemadactylus macropterus	Tarakihi		†	
Chrysophrys auratus	Snapper	*		
Latridopsis ciliaris	Blue moki		†	‡
Seriolella brama	Warehou	*	†	
Mugil cephalus	Grey mullet	*	†	‡
Pseudophysis bacchus	Red cod	*	†	
Lotella rachinus	Rock cod	*		
Cheilidorichthys kumu	Gurnard	*		
Pseudolabrus celidotus	Spotty	*	†	‡
Pseudolabrus fucicola	Banded parrotfish		†	
Rhombosolea plebeia	Sandflounder	*	†	‡
Rhombosolea leporina	Yellowbelly flounder	*	†	‡
Peltorhamphus novaezeelandiae	New Zealand sole	*	†	‡
Peltorhamphus latus	Dwarf common sole	*		
Leptoscopus macropygus	Striped stargazer	*		
Genyagnus novaezelandiae	Spotted stargazer	*		
Forsterygion varium	Cockabully	*		
Trypterygion robustum	Robust blenny	*		
Grahamichthys radiatus	Graham's gudgeon	*		
Salmo trutta	Brown trout		†	
Conger verrauxi	Conger eel	*		
Anguilla australis	Shortfin eel	§		
Anguilla dieffenbachii	Longfin eel	§		
Galaxias argenteus	Whitebait	§		
Galaxias fasciatus	Whitebait	§		
Galaxias maculatus	Whitebait	§		

[1]* = Healy 1980, † = This study, ‡ = Whitt diary, § = Unpublished Fisheries Research Division records.

Graham (1956) recorded that on hatching, juveniles were 6" (15 cm) in length (measured to the tail tip). This is the size at which they were first netted in the Porirua/Pauatahanui Inlets.

Gorman (1963) found that the fish stayed in shallow water until they reached maturity, for males at 52 cm (fork length), and 70 cm for females. Gorman suggested that the age at first maturity was likely to be two years for males and either the same or one year older for females 'both ages could, however, be underestimated by one year' (Gorman 1963). Sullivan (1977) aged elephant fish, from the South Island, by counting the rings formed in the dorsal spine. He confirmed that males matured at 3 years old at approximately 50 cm fork length; females at 4.5 years and 70 cm.

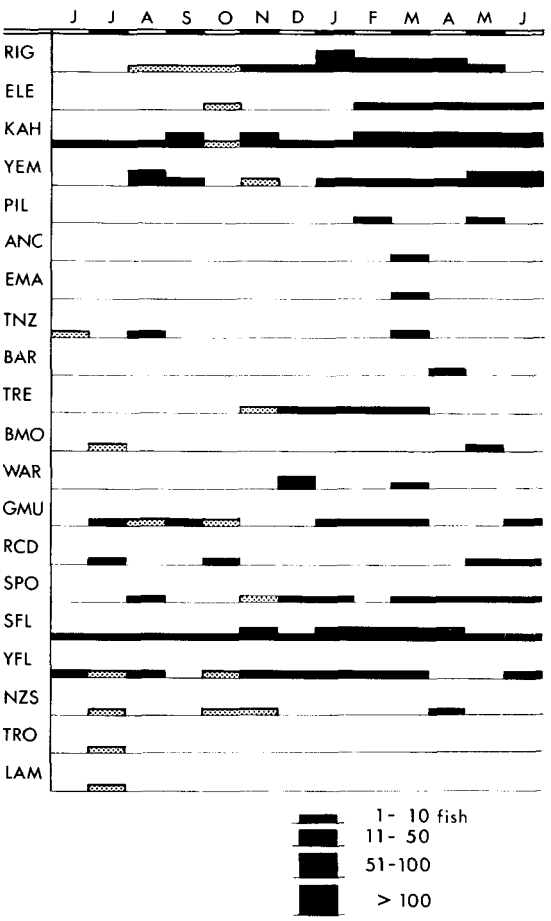

Fig. 3 Catch by species by month, Porirua Inlet. Solid bar represents catch in research nets, dotted bar from Whitt net. ANC, anchovy (*Engraulis australis*); BAR, barracouta (*Thyrsites atun*); BMO, blue moki (*Latridopsis ciliaris*); ELE, elephant fish (*Callorhynchus milii*); EMA, blue mackerel (*Scomber australasicus*); ERA, eagle ray (*Myliobatis tenuicaudatus*); GMU, grey mullet (*Mugil cephalus*); KAH, kahawai (*Arripis trutta*); LAM, lamprey (*Geotria australis*); NZS, New Zealand sole (*Peltorhamphus novaezeelandiae*); PIL, pilchard (*Sardinops neopilchardus*); RCD, red cod (*Pseudophycis bacchus*); RIG, rig (*Mustelus lenticulatus*); SFL, sand flounder (*Rhombosolea plebeia*); SPO, spotty (*Pseudolabrus celidotus*); TAR, tarakihi (*Nemadactylus macropterus*); TNZ, jack mackerel (*Trachurus novaezelandiae*); TRE, trevally (*Caranx georgianus*); TRO, trout (*Salmo trutta*); WAR, warehou (*Seriolella brama*); WRS, parrotfish (*Pseudolabrus fucicola*); YEM, yellow eyed mullet (*Aldrichetta forsteri*); YFL, yellowbelly flounder (*Rhombosolea leporina*).

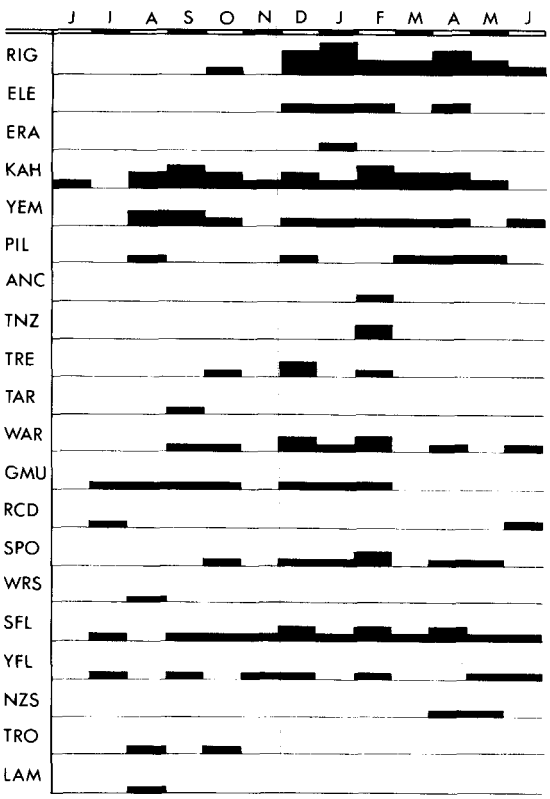

Fig. 4 Catch by species by month, Pauatahanui Inlet. Scale and key as for Fig. 3.

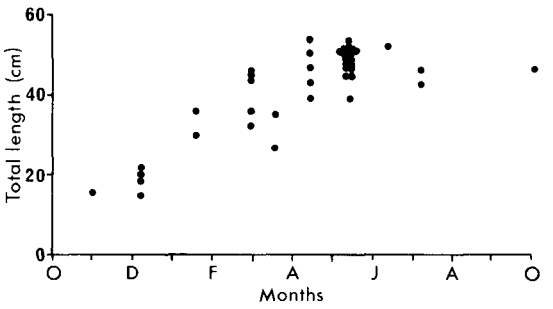

Fig. 5 Length (from proboscis to tail tip) of elephant fish (*Callorhynchus milii*) plotted against month of capture.

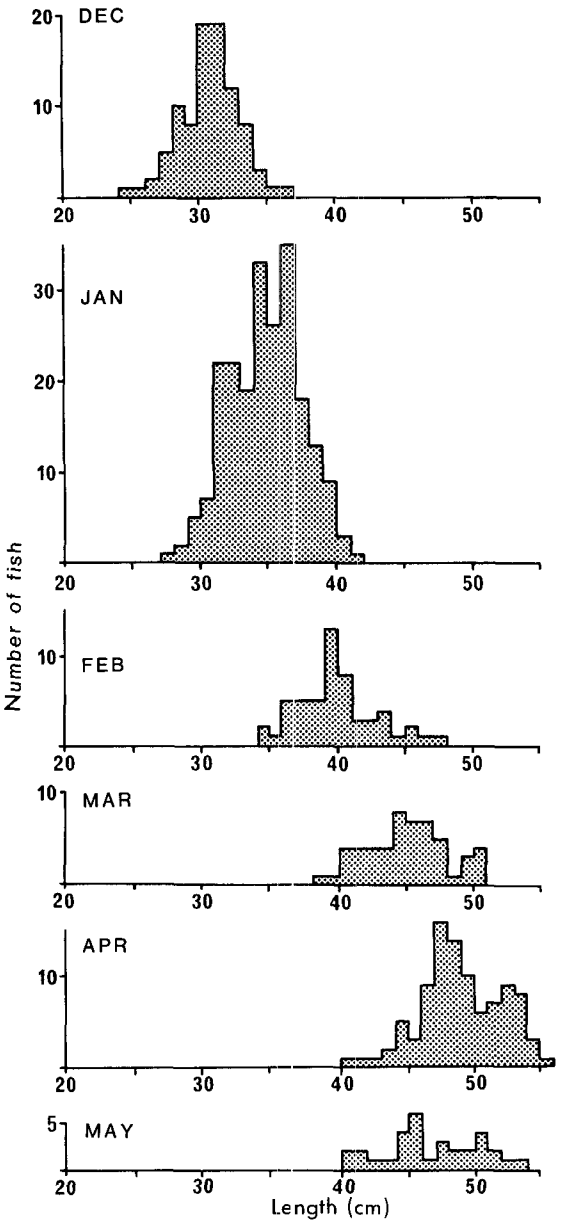

Fig. 6 Rig (*Mustelus lenticulatus*) < 60 cm length; length frequency by month. December 1983 to May 1984.

Although fish seem to be growing to 50 cm (total length) in about 200 days, examination of the spine of a 42 cm female elephant fish from Porirua Inlet using the method of Sullivan (1977) showed it to be a two year old fish. Therefore, the apparent growth rate in Fig. 5 is an artifact caused by the small sample size.

Table 3 Mean total lengths of *Rhombosolea plebeia* size groups.

	n	Mean (cm)	S.D.
January/February	32	16.3	0.75
	37	22.5	1.52
March/April	30	17.8	1.42
	26	23.2	1.36

The absence of fish from our nets over winter suggests that they either leave the estuary or are much less mobile over this period.

RIG *Mustelus lenticulatus*

In the Porirua/Pauatahanui Estuary, adult rig (both male and female) began to move into the inlets in September 1983 and were pupping by October. Of rig larger than 60 cm caught over the study period, 28 were female. The smallest caught (in September) was 80 cm and all but 5 were over 90 cm total length. What proportion was sexually mature is unknown, but Francis and Mace (1980) found that length at first maturity for females was 95 cm at Kaikoura and about 85 cm at Nelson.

Males were either more susceptible to capture than females, or were more abundant in the estuary, since many more adult males were caught than females (101 : 28). However, the sex ratio of the 0 year class did not differ significantly from 1 : 1.

Rig larger than 60 cm finally moved out of the estuary by January 1984, only the 0 year class remained. The shift in length frequency modes of the netted juveniles (Fig. 6) showed that growth was rapid until April (when they were observed to move into the deeper channels and then presumably left the estuary). Comparison of the length frequencies (Fig. 6) suggests that the time of leaving is influenced by size.

Embryo rig grow to 20 cm total length in 7 months (Francis & Mace 1980), and are born at about 30 cm after a 10–11 month gestation period (Francis pers. comm.). The present study shows that this rapid growth continues through the first summer of independence.

There is a shrinkage of up to 2 cm in length from fresh to frozen and thawed rig. The length frequencies by month shown in Fig. 6 are for fresh rig, except for December 1983 when the state of the fish when measured is uncertain. A regression line fitted to juvenile rig lengths plotted against the time (in days) has a slope of length = 30.8 + 0.13 days, with a correlation of r^2 = 83.2%.

Rig were not found in the Ahuriri Estuary (Kilner & Akroyd 1978) and were rare (only one found) in the Avon-Heathcote Estuary (Webb 1972).

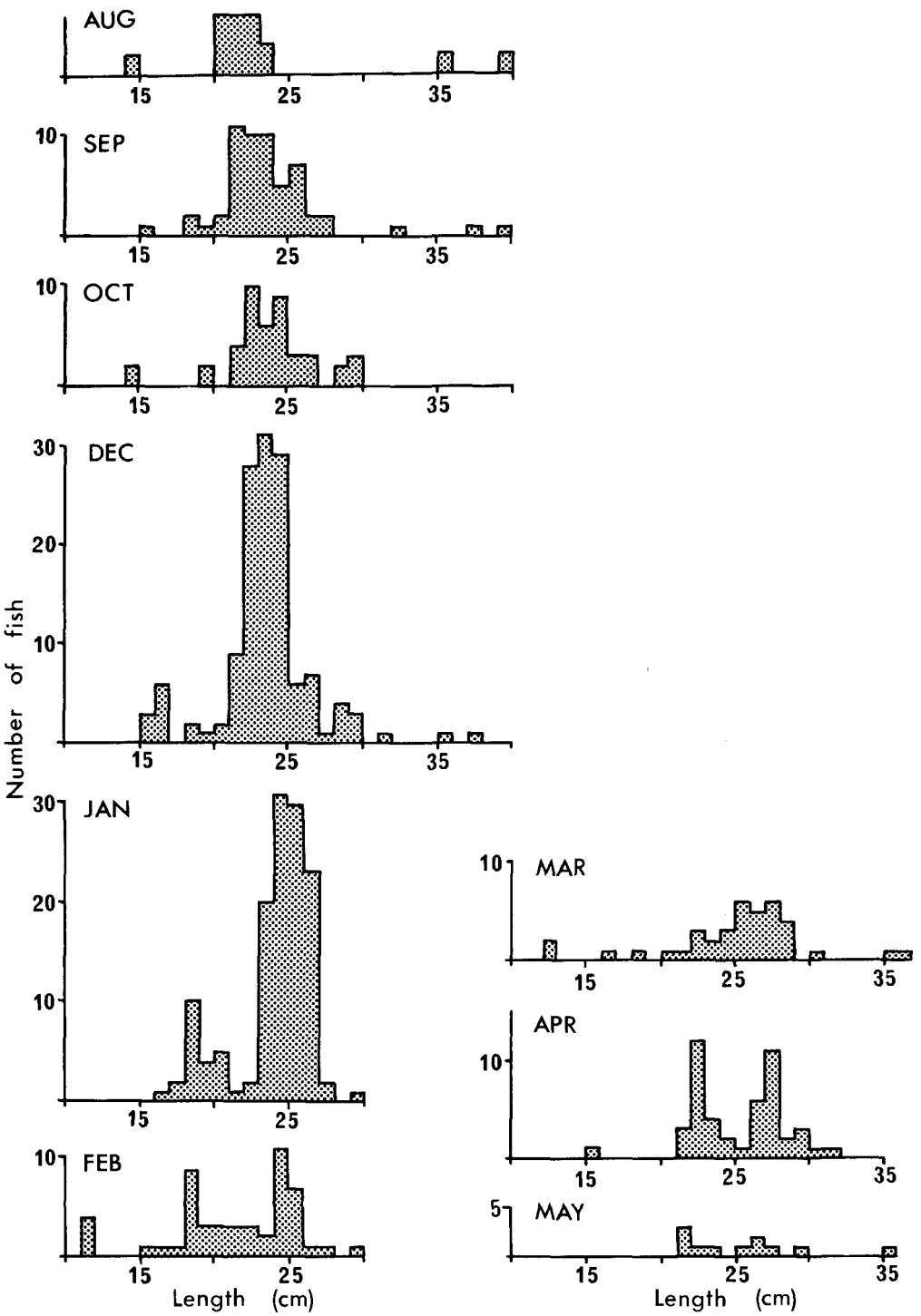

Fig. 7 Kahawai (*Arripis trutta*), length frequency by month, August 1983 to May 1984 (only 4 caught in November 1983, frequencies not plotted).

SAND FLOUNDER *Rhombosolea plebeia*

As with the Avon-Heathcote and Ahuriri Estuaries, the Porirua/Pauatahanui Estuary is a nursery area for *R. plebeia*. Although smaller flounder were seen, the smallest landed in the 62 mm mesh nets were 10 cm, and the largest 40 cm (total length). Only from January to April were any modes apparent in the length frequencies. The cumulated two monthly mean total lengths and standard deviations for these modes are shown in Table 3.

Coleman (1974) found that in the Hauraki Gulf, two year old sand flounder reach mean total lengths of 17 cm for males and 23 cm for females. Similar modes (14.1; 20.0 cm) were observed during January/February in the Avon-Heathcote Estuary by Webb (1972). The length frequency modes observed in the present study coincide with these expected modes, but our flounder were neither sexed nor aged.

KAHAWAI *Arripis trutta*

Kahawai were common in the estuary throughout the year, though schools of larger fish tended to avoid the nets. In December 1983 and January and April 1984, two modes were apparent in the length frequency data (Fig. 7). Otoliths from 10 kahawai in each mode were also collected, broken across the nucleus, and examined under paraffin oil. Eggleston (1975) determined that the otolith rings were annual and that fish 11–20 cm had one hyaline zone, 17–30 cm had 2 zones, and 20–35 cm had 3 zones. Counting the hyaline zones from our fish confirmed that the modes represented fish in their first and second summers.

ACKNOWLEDGMENTS

We acknowledge the help of Mr T. Whitt in providing diaries of his catches, and the staff of Fisheries Research Division, MAF, Wellington, who helped with the fishing or who commented on the manuscript.

REFERENCES

Colman, J. A. 1974: Growth of two species of flounders in the Hauraki Gulf, New Zealand. *New Zealand journal of marine and freshwater research 8*: 351–370.

Eggleston, D. 1975: Determination of age of kahawai *Arripis trutta* (Bloch & Schneider). *New Zealand journal of marine and freshwater research 9(3)*: 293–298.

Francis, M. P.; Mace, J. T. 1980: Reproductive biology of *Mustelus lenticulatus* from Kaikoura and Nelson. *New Zealand journal of marine and freshwater research 14(3)*: 303–311.

Gorman, T. B. S. 1963: Biological and economic aspects of the elephant fish (*Callorhynchus milii*, Bory) in Pegasus Bay and the Canterbury Bight. *New Zealand Marine Department technical report 8*: 54 p.

Graham, D. H. 1956: A treasury of New Zealand fishes. 2nd edition. Wellington, Reed. 424 p.

Healy, W. B. 1980: Pauatahanui Inlet — an environmental study. *New Zealand DSIR information series 141*: 198 p.

Kilner, A. R.; Ackroyd, J. M. 1978: Fish and invertebrate macro-fauna of Ahuriri estuary, Napier. *New Zealand Fisheries Management Division. Fisheries technical report 153*: 79 p.

Sullivan, K. J. 1977: Age and growth of the elephant fish *Callorhynchus milii* (Elasmobranchii: Callorhynchidae). *New Zealand journal of marine and freshwater research 11(4)*: 745–753.

Webb, B. F. 1972: Fish populations of the Avon-Heathcote Estuary. 1. General ecology, distribution, and length frequency. *New Zealand journal of marine and freshwater research 6(4)*: 570–601.