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REPORT 1

FLUCTUATIONS IN CATCH OF THE YELLOW-EYE MULLET *ALDRICHETTA FORSTERI* (CUVIER AND VALENCIENNES) (MUGILIDAE)

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FLUCTUATIONS IN CATCH OF THE YELLOW-EYE MULLET (ALDRICHETTA FORSTERI (CUVIER & VALENCIENNES))

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Summary

Adequate statistics of yellow-eye mullet catches are available only from Western Australia and Victoria. Annual fluctuations may be rather more than 100 per cent. from the lowest to highest yields. The stocks seem to be in good condition, there being no long-term trend towards a decreased or increased catch. The level of catch in Victoria since 1931 has been higher than in the years 1917-1930, but the increase in yield was already apparent before the change in legal minimum length made in 1935. The graphs of catch do not suggest that the alterations in minimum legal length in Victoria have had any persisting effect on the stocks. Some of the annual variation in catch is due to varying numbers of men being employed, but variation in the catch per man indicates natural variation in stock level or in availability. The catch is high in mid to late summer and low in winter and spring, presumably due to the movement of the fish into and out of the estuaries.

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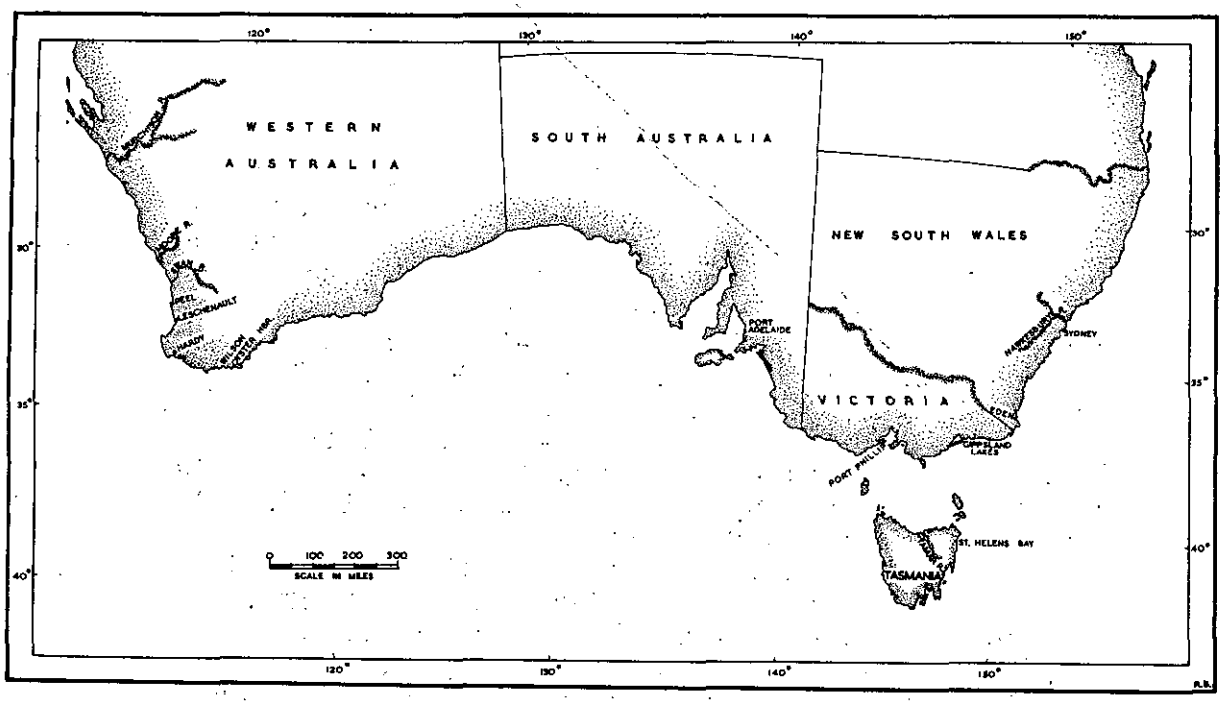

Fig. 1. Southern Australia indicating place names mentioned in the text.

I. INTRODUCTION

The yellow-eye mullet is one of the principal estuarine fish marketed in Victoria, South Australia, and Tasmania; and is equally as important as the sea mullet, Mugil cephalus Linnaeus, in the estuarine catches of south-western Australia. It is known vernacularly as yellow-eye mullet in Western Australia and New South Wales; as sea mullet in Victoria, South Australia, Tasmania, and New Zealand; as pilchard or "pilch" in Western Australia; as herring in New Zealand; and as estuary mullet or conmuri in South Australia. The name "yellow-eye mullet" has been adopted as the "official" Australian name (see Supplement to Australian Fisheries Newsletter, Vol. 6, No. 3, June 1949). The species occurs around the south coast of Australia from the Hawkesbury River in New South Wales to the Murchison River in Western Australia (Fig. 1).

II. THE FISHERY

(a) Methods and Management

Commercially the species is obtained almost wholly by beach seines and mesh (set) nets as described by Kesteven (1942) for the fishery for sea mullet. The laws relative to the types of gear permissible and the management methods adopted, such as minimum legal lengths and closure of waters, have been explained by Kesteven (1942); for strictly speaking there are not separate fisheries for sea mullet and yellow-eye mullet, but an estuarine fishery in which these two species are important elements. No statement can be made of the waters which are closed to fishing for these vary from time to time, but in general no waters above tidal influence may be fished. Some of the smaller inlets are closed as sanctuaries or angling preserves though they may be opened to commercial fishing for brief periods when stocks are obviously over-abundant (e.g. Irwin's Inlet, Western Australia).

The minimum legal length of yellow-eye mullet in the various States is as follows:-

New South Wales	9 inches
Western Australia	9 "
South Australia	7 "
Victoria	9½ "
Tasmania	8 "

This species is also taken by anglers for it takes a bait much more readily than the related sea mullet.

(b) The Catch

Catch figures are available for varying periods from the various States. The reliability of such records has been discussed by Thomson (1950, 1953).

(i) Annual Yield

Since 1941 the Australian commercial yield of yellow-eye mullet has averaged rather less than 1,300,000 lb. per annum, fluctuating between 800,000 lb. and 2,100,000 lb. In most years the catch of yellow-eye mullet in Victoria has exceeded that of the other States combined (Fig. 2). The average annual yield in Victoria since 1910 has been 700,000 lb., fluctuating between 360,000 lb. in 1913 and 1,100,000 lb. in 1941. After 1916 there was a period of sixteen years when the catch was below the 44-year average; during the subsequent 14 years there were only six occasions when the annual yield was lower than the average. In Table 1 the average district catches in Victoria over 5 year periods are shown.

The complete annual data, too voluminous for inclusion here, are on file at the C.S.I.R.O. Marine Laboratory in Cronulla, or may be procured from the Victorian Department of Fisheries and Game. As suggested by Figure 2, the catches were low during the period 1920-1930, but the greatest catches in various districts occurred at different times.

The Gippsland Lakes supply from 60 to 75 per cent. of the yellow-eye catch in Victoria. The much larger area of Port Phillip Bay provides only a fraction of this amount (Fig. 3). Most of the remaining catch comes from the inlets between Port Phillip Bay and Gippsland Lakes; small, very variable amounts come from Lake Tyers and Mallacoota Inlet to the east of the Gippsland Lakes; but very little yellow-eye is marketed from west of Port Phillip Bay.

Estimates of catch in Tasmania and South Australia also show considerable fluctuations (Fig. 2). In Tasmania this is undoubtedly due to fluctuating demand. The greatest production was in the war years when there was an unusually great demand for fish. The large variations in South Australia are probably due to management policies in the State where netting is forbidden along many parts of the coast, but has been allowed for brief periods.

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TABLE 1

5 year averages of yield, Victorian waters

District	1910-14	1915-19	1920-24	1925-29	1930-34	1935-39	1940-44	1945-49
Gippsland Lakes	460,133	477,130	340,643	453,104	555,212	493,238	488,973	455,397
Port Phillip Bay	43,802	35,485	37,748	37,824	32,452	35,723	26,029	26,516
Western Victoria*	1,497	803*	700	1,480	1,926	1,479	3,243	327
Westenport	43,033	26,408	35,097	28,977	18,138	24,146	22,631	20,336
Tamboon		1,680	6,846	2,972	18,428	21,312	44,619	9,696
Shallow Inlet						4,316	2,134	1,840
Port Albert	20,454	47,834	36,107	26,513	42,659	47,240	38,137	35,042
Lake Tyers		2,450	4,004	787	1,620	7,884	4,739	3,360
Mallacoota		5,723	7,736	8,688	17,591	28,456	23,217	45,037
Anderson's Inlet	26,157	30,984	17,465	17,929	18,353	20,318	29,957	18,117
Corner Inlet	53,489	57,326	54,966	92,511	42,243	39,919	46,832	102,760

* 2 years only

* Includes all fishing districts west of Port Phillip Bay

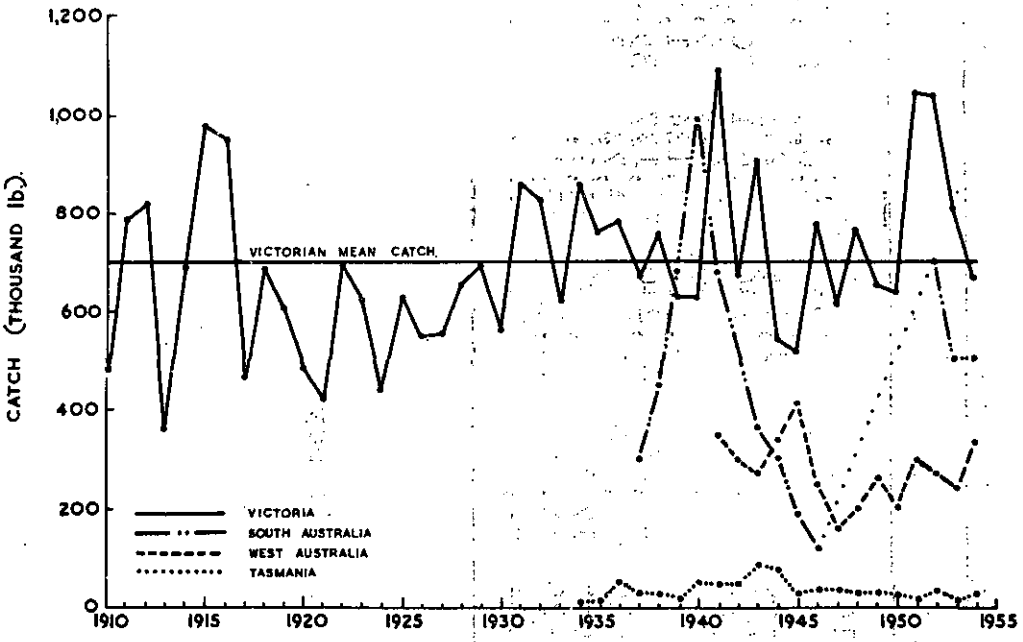

Fig. 2. Annual catch of yellow-eye mullet. Source: State departmental reports and Fisheries Newsletter (Australia).

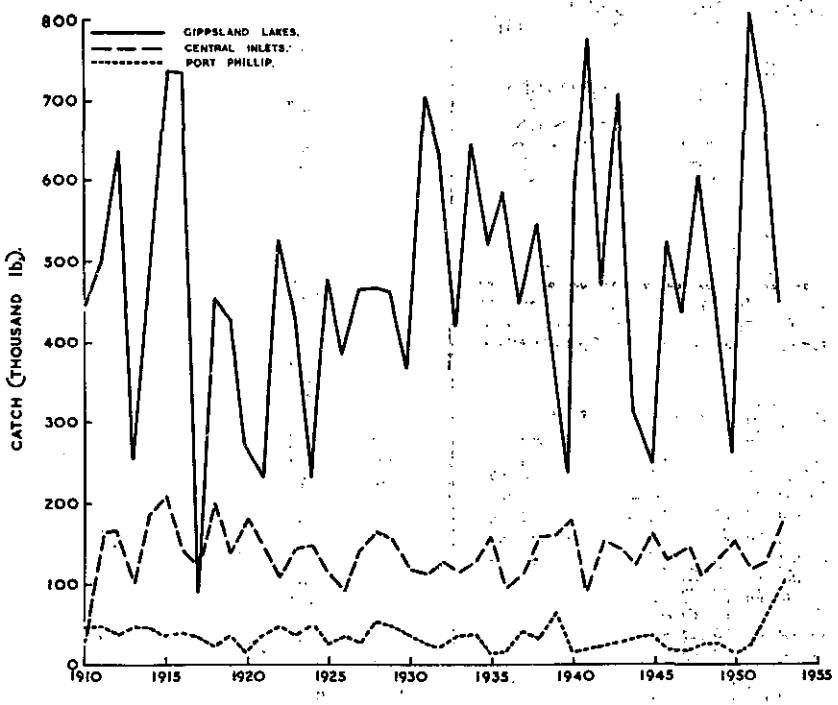

Fig. 3. Annual district catch Victoria. "Central Inlets" sum the catches of Anderson Inlet, Corner Inlet, Port Albert, Westernport, Apollo Bay, Barwon Heads, Lorne, Torquay.

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TABLE 2

Western Australian Yellow-eye mullet catch 1941-1951

Source: Fishermen's Returns - State Fisheries Department. Units: Pounds avoirdupois

Area	Block No.	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951
Irwin's Inlet	5	5,650	5,913	2,560	1,883	5,153	15,446	1,467	2,949	3,661		1,983
Oyster Harbour	6	7,263	13,695	11,008	9,830	13,953	6,741	9,984	3,604	9,311	13,266	15,434
Salmon Rocks	7			294	167							
Recherche	12							900	176	48		
Esperance	13	255		750				740				
Hopetoun	14	390				2,156			454			
Bremer Bay	15		1,324		1,052	8,315	1,683	589	11,315	14,577		1,645
Frenchman's Bay	16	280	1,442	1,260	435	2,113	521	311	203	5,525	953	61
Wilson's Inlet	17	90,223	49,383	22,210	41,531	107,229	24,472	35,802	36,989	61,370	27,576	13,610
Nornalup	18	2,628	2,832	5,637	2,012	7,712	7,529	523	2,416	68	600	
Hardy Inlet	19	10,534	13,436	7,935	8,590	13,797	22,241	16,752	3,779	29,313	9,986	5,608
Busselton	26	1,101	1,892	2,883	3,045	1,345	1,637	1,848	3,151	11,135	8,505	5,104
Leschenault	27	23,195	73,175	70,471	56,527	67,467	49,666	28,634	54,171	48,034	40,233	46,526
Peel Inlet	28	187,723	128,618	139,537	186,311	167,623	109,042	88,242	98,701	117,432	108,962	231,740
South Beaches	29	8,328	2,291	2,221	1,877	3,791	3,053	1,755	1,711	2,280	1,894	2,438
North Beaches	36	114	164	48	90	510	50	192	168			
Swan River	37	12,523	2,545	3,334	3,855	16,732	8,876	6,893	10,415	2,461	5,570	5,635
Moore River	38					9	15	109				500
Total		350,207	297,660	270,248	318,435	417,902	250,972	194,471	230,202	305,185	217,185	330,284

Catch figures for Western Australia are available only from 1941 (Fig. 2). Even in this brief period considerable fluctuations have occurred. The district totals in Western Australia for the years 1941-51 are set out in Table 2. The blocks referred to are those used by the Western Australian Fisheries Department and have been figured in Thomson (1950).

By far the most important source of yellow-eye in Western Australia is Peel Inlet (Table 2). Wilson's Inlet and Leschenault Inlet vie for second place. Occasional large hauls are made on the sea beaches and in the smaller inlets and bays which, however, do not provide a steady annual catch. The yield from the main estuaries fluctuates considerably from year to year.

(ii) Seasonal Catch

Seasonal data are available only from Western Australia where there are large seasonal fluctuations in the catch of yellow-eye mullet. Most yellow-eye are taken during the later summer months, whereas catches are poor in spring and early summer. The sequence of events is later in more southern waters. In Peel Inlet the best catches are made in March, April and May; in Leschenault not far to the south, May and June are the best months; in Wilson's Inlet on the south coast the period of greatest catches is still later, usually June and July. Poor catches are made in Peel Inlet from September to February; in Leschenault from October to March; and in Wilson's Inlet from September to March. Occasionally exceptional catches disrupt this pattern, but the variations as described appear to be usual. Hardy Inlet on the south coast and the Swan River on the west coast show similar fluctuations but with more prolonged periods of low catches.

III. THE SIGNIFICANCE OF THE FLUCTUATIONS

(a) Variability

The catch of yellow-eye mullet fluctuates by rather more than 100 per cent. from recorded low to high values, but this is small compared with the degree of variation in many fisheries (Blackburn 1956).

Variation in the catch either annually or seasonally has significance in economic considerations. There is need to discriminate between the evidence which

the curves of catch provide on the state of the fishery, and on the population abundance (Thomson 1953). In the majority of Australian estuaries there are only small areas where fishing is impossible so that the catch per man-hour, and to a lesser extent the catch per man, may also describe the abundance of the fish, provided weather and other conditions have not influenced the "fishability" of the waters. The annual catch of yellow-eye per man is shown for two important fishing districts in Victoria in Figure 4, and for the fishing districts of Western Australia in Table 3.

TABLE 4

Average catch per man in various fishing districts

W.A. Block Nos.	lb. per man *	Victoria	lb. per man **
5	1312	Port Phillip Bay	61
6	839	Gippsland Lakes	2518
7	20	Corner Inlet)	
12	228	Port Albert)	561
13	233	Westernport)	
14	323		
15	1440		
16	270		
17	4279		
18	1201		
19	1533		
26	566		
27	2940		
28	3493		
29	263		
36	21		
37	940		
38	5		

*The mean of 11 years 1941-1951

**The mean of 31 years 1910-1940

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These figures reflect the availability of the fish more truly than the annual catch figures. The density of the fish stock varies considerably not only in time in one district, but also from one district to another. Although the Gippsland Lakes produce a greater total of yellow-eye mullet than all Western Australian waters, the density of fish, as revealed by the catch per man, is greater in Wilson's, Peel, and Leschenault Inlets (Table 4) (Block

TABLE 3

Western Australian yellow-eye mullet catch per man 1941-1951
Units: pounds per man

Block No.	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951
5	2825	2986	160	992	644	1931	763	641	964	2046	481
6	330	734	786	664	1073	293	886	516	773	1132	2061
7			98	42							
12							450		6		
13	51		375				274				
14	195				534			240			
15		662		210	1663	187	75	1199	6598		934
16	40	206	420	108	352	65	26	93	1408	232	20
17	5639	6166	7403	3195	6702	1631	3265	3464	5883	2374	1354
18	1314	1416	2818	1006	1928	684	261	1364	23		
19	1756	2687	1983	2147	1379	1483	1331	300	1447	1346	1002
26	52	105	144	507	112	273	804	318	990	1883	1039
27	1364	1493	7830	2975	3373	1342	2004	2919	2456	2139	2451
28	3831	2999	4983	4333	4088	2097	2320	2194	2795	2992	5793
29	88	7	117	208	421	436	478	179	376	202	276
36	2		5	9	25	5	84				15
37	659	170	370	303	796	6392	426	468	173	337	246
38					3	7					

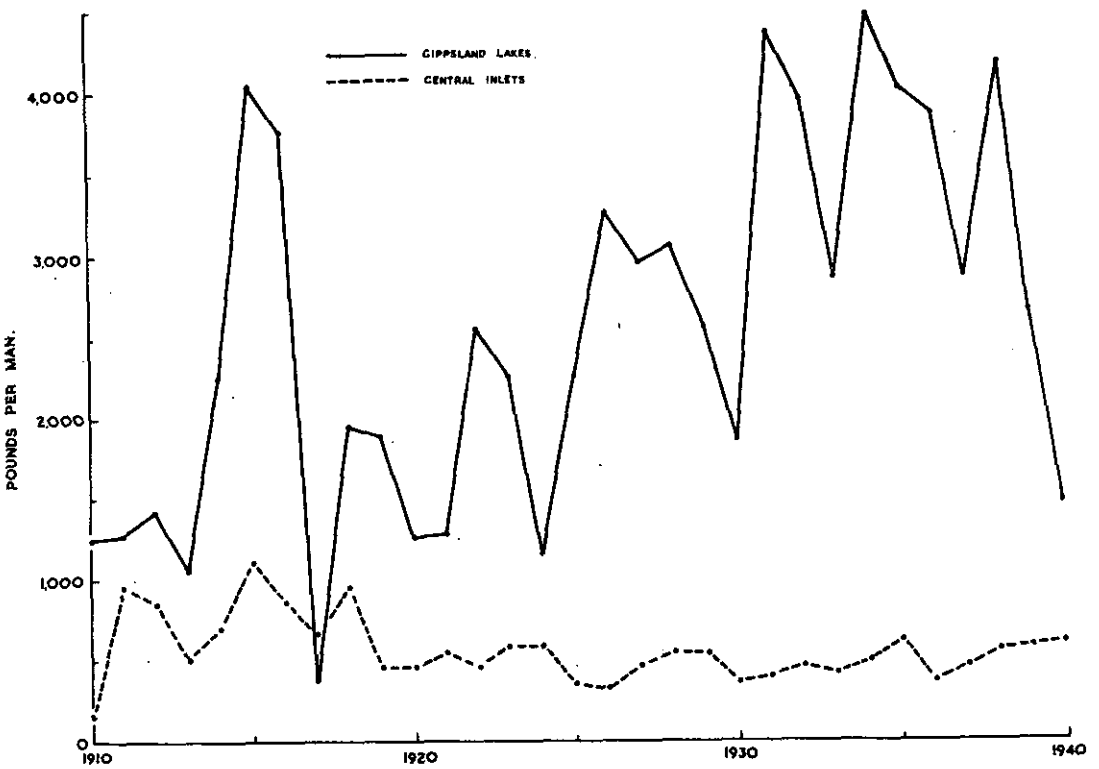

Fig. 4. Catch per man Gippsland Lakes and Central Inlets, Victoria. Scale too small to show variation in other districts.

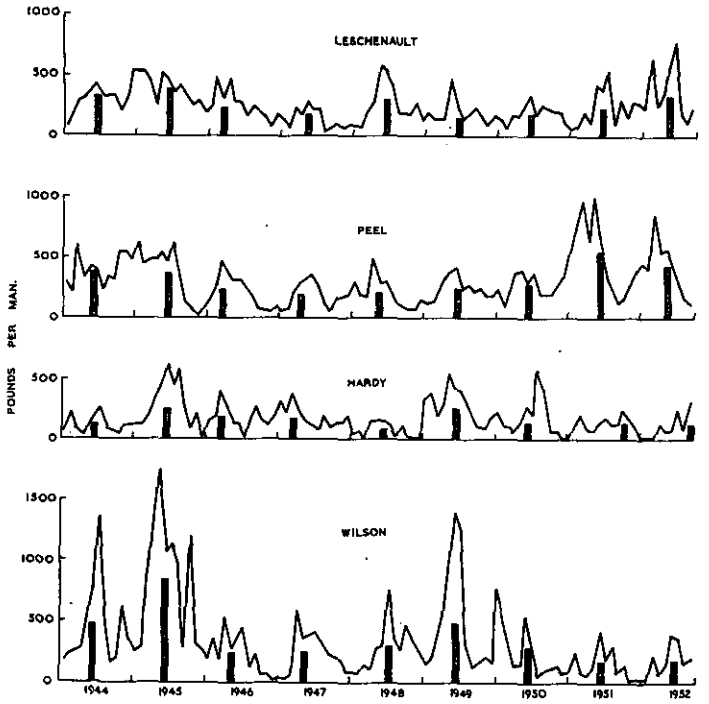

Fig. 5. Catch per man, 4 main Western Australian estuaries. Mean monthly catch per man for each year shown as a histogram.

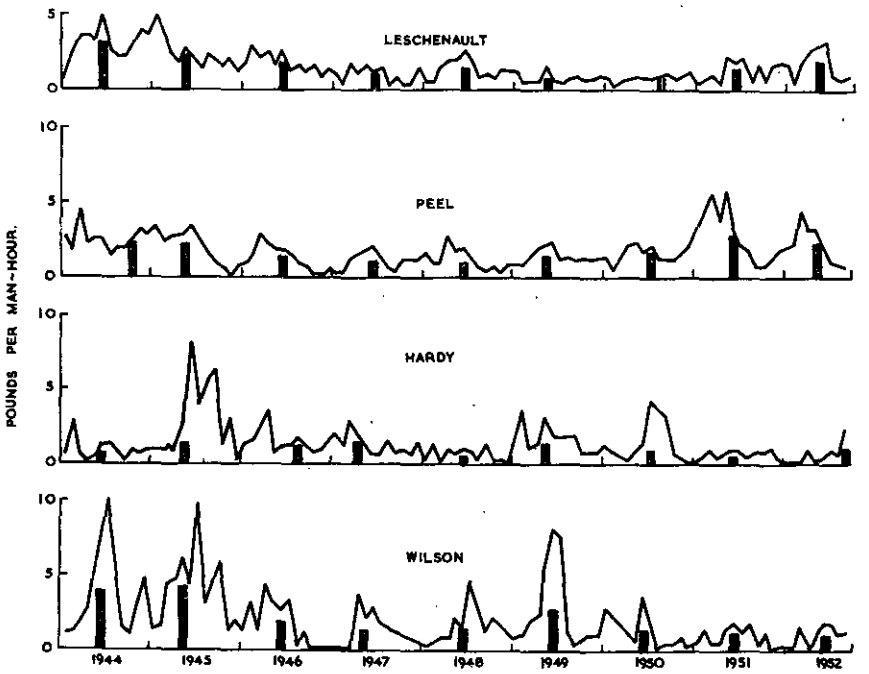

Fig. 6. Catch per man-hour, 4 main Western Australian estuaries. Mean monthly catch per man-hour for each year shown as a histogram.

Nos. 17, 27, 28 respectively). In interpreting the figures in this way it has to be assumed that the intensity of fishing effort is the same in all, or at least the important areas. Some check on this point is available in Western Australia through estimation of the catch per man-hours; but no record of time of fishing is available from Victorian waters.

Seasonal variation in catch per man and catch per man-hour for the four main producing estuaries of Western Australia are shown in Figure 5 and 6 respectively. A seasonal cycle is evident with less fish being taken in late winter and spring than in mid-summer and autumn indicating that the seasonal fluctuation in total catch is due to the availability of the stocks and not due to less activity on the part of the fishermen. However, the variation shown by the catch per man-hour is less than that indicated by the catch per man, which suggests that the fishermen do not spend as much time fishing in winter as they do in summer.

It is apparent also that the increase or decrease in availability is not synchronous along the coast, nor even in closely adjacent rivers.

Besides the relatively few estuarine situations where it is impossible to fish, there are areas which are closed by regulation to commercial fishing. However, apart from some of the small minor inlets, the closed waters are mainly the upper fresh waters where it was found yellow-eye do not venture or in the entrance channels where schools of yellow-eye do not lie long as far as can be judged from surface observations.

The species moves to sea at times as is evidenced by the catches made on ocean beaches (Table 1). It is probably such movements to sea which lessen the seasonal availability. It is possible also that even if there were an apparent simultaneous drop in abundance in all the estuaries in a particular year, the real population might be as large as usual but the fish be at sea. Only a small catch repeated for several years could be taken reliably to indicate a real diminution of stock; but in fact the catch figures indicate irregular fluctuations which are not synchronous in all estuaries.

(b) <u>The Effect of Management</u>

The States of Western Australia and Victoria provide an opportunity to compare different management histories. In Western Australia the minimum legal length for yellow-eye

mullet has remained at 9 inches total length since 1905. Prior to 1915 the legal minimum size in Victoria was 2 ounce weight; but in 1915 it was changed to a minimum length of 8½ inches. In 1915 and 1916 the catches were high, but in 1917 they dropped and remained low until 1931 (see Fig. 2 and 3). Raising the legal length to 9 inches in 1935 does not seem to have had much effect on the catch, which declined slightly for some years but not to the low levels of the 1917-1930 period. In 1941 there was a greatly increased catch almost certainly as a result of the war-time demand. However, there was again a fall to a low level in 1944 and 1945. In 1947 the minimum length was raised to 9½ inches. A rise in catch followed in 1948, but not to the level of the catch in 1946 before the minimum length was changed. The catches fell again in 1949 and 1950. In 1951 and 1952 there were large increases but the yield dropped again in 1953 and 1954.

There is no evidence in the catch figures that the raising of minimum legal length has had any effect on the stocks. The rise in 1915 can be interpreted as part of an increasing cycle in population already apparent in 1914. The 1935 increase would appear, if anything, to have lowered the catch. It is true the catch rose in 1948 after the last rise in length, but this increase was not sustained and the greatest catch since was not as high as previous catches when the minimum length was less.

Raising the minimum length from 9 to 9½ inches would merely force a delay of approximately 6 to 8 weeks in the availability of the fish (Thomson, unpublished growth data).

It should be noted that the fluctuations in the catch of Victorian yellow-eye are similar in frequency and amplitude to those in the catch for Western Australia where the minimum length has not altered. As the alterations in minimum length have produced no enduring trend in the catches, and as the types of fluctuation are similar to those in an allied fishery where no change of length has taken place, it is suggested that the fluctuations must be ascribed mainly to natural variation in the number or availability of the stocks. The only effect of the size increase will have been to increase the size of the fish reaching market. As this appears to have been done without any increase in total weight (Fig. 2 and 3), it would imply that actually fewer fish are now being caught than formerly in Victoria.

In both Victoria and Western Australia where the species is probably fished wherever located by the fishermen, the stocks of yellow-eye mullet appear to be in

good condition. Whenever downward trends have appeared there has always been a later resurge in catch indicating that the earlier downswing was part of the inevitable oscillation about the mean which all natural populations show.

REFERENCES

Blackburn, M. (1956).- Real and apparent changes in size of marine animal populations during the Australian fisheries investigations. Journ. Con. Expl. Int. Mer. 21(3): 284-95.

Kesteven, G. L. (1942).- Studies in the biology of the Australian Mullet. 1. An account of the fishery and preliminary statement of the biology of Mugil dobula Gunther. Coun. Sci. Industr. Res. Bull. 157: 1-48.

Thomson, J. M. (1950).- The effect of a period of increased legal minimum length of sea mullet in Western Australia. Aust. J. Mar. Freshw. Res. 1: 199-220.

Thomson, J. M. (1953).- Status of the fishery for sea mullet (Mugil cephalus Linnaeus) in eastern Australia. Aust. Mar. Freshw. Res. 4: 41-81.