

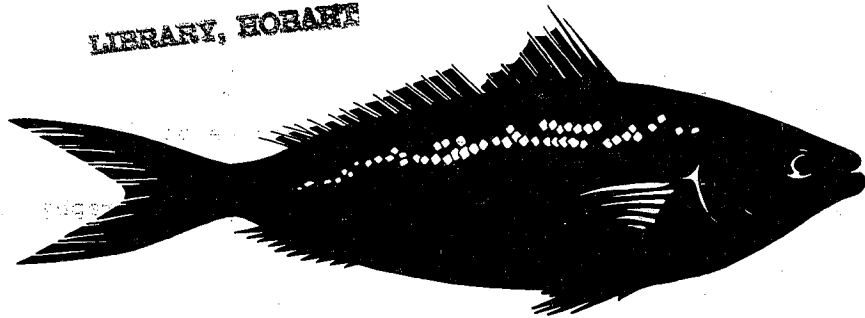
Australian Salmon

Fishery situation report 5

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FISHERY SITUATION REPORT 5. AUSTRALIAN SALMON

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CSIRO Division of Fisheries and Oceanography

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INTRODUCTION
SOUTH EASTERN FISHERIES COMMITTEE

The South Eastern Fisheries Committee, a committee of the Standing Committee on Fisheries of the Australian Fisheries Council, was set up in 1969 as one of three regional management and research committees.

The South Eastern Fisheries Committee co-ordinates interstate fisheries management and research activities in waters adjacent to New South Wales, Victoria, Tasmania and South Australia. In addition to its co-ordinating role, it also provides a forum for discussion in fisheries science and management, and advises management authorities on problems referred to it by member organisations.

The members of the Committee are:-

Mr A.J. Harrison, Chairman, Tasmania
Mr E.A. Purnell-Webb, Department of
Primary Industry
Mr D.J. Rochford, CSIRO
Dr D.D. Francois, New South Wales
Mr J.C.F. Wharton, Victoria
Mr R.A. Stevens, South Australia
Mr A. White, Secretary,
Department of Primary Industry

Mr A.J. Harrison has been Chairman of the Committee since 1973.

A number of fisheries in the area are of such importance as to warrant special attention by a group of experts. These Research Groups constantly monitor the state of the fisheries and discuss current research.

FISHERY SITUATION REPORTS

To assist the Committee in its management role, the Research Groups prepare and maintain a situation report on the fishery for which they are responsible. This report outlines the present state of the fishery, its history and the management measures controlling it. In addition, it outlines the current state of knowledge on the biology of the species and the population dynamics of the exploitable stocks.

To broaden public knowledge of the fisheries of south eastern Australia, these situation reports are now being published as a series by the Committee.

A.J. HARRISON
Chairman
South Eastern Fisheries Committee

SITUATION REPORT FOR AUSTRALIAN SALMON

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Abstract

The biology of and fishery for Australian salmon *Arripis trutta* (Arripidae) in southern Australian waters are described. Management measures and research in the fishery are also given. There are two sub-species, eastern and western, constituting a fishery of 2-9,000 tonnes per year. The fishery is regarded as fully exploited and stable in the long term.

SITUATION REPORT - AUSTRALIAN SALMON

SUMMARY

Annual catch (weight)	-	W.A.	800 -4000 tonnes
	-	S.A.	500 -1900 tonnes
	-	Vic.	200 - 800 tonnes
	-	Tas.	70 - 800 tonnes
	-	N.S.W.	300 -1400 tonnes
	-	Total	1870 -8900 tonnes
Value to fishermen	-		\$900,000 - \$4,400,000
Markets	-		90% canned for domestic consumption; some sold as fresh fish; heads sold as bait to the rock lobster fishery.
Number of fishing units	-		about 40 beach seine teams; 20 boats (20 m plus); 350 small boats (about 7 m).
Number of men in fishery	-		about 1000
Value of boats and gear	-		about \$3,000,000
Present status	-		fully exploited

1.0 Introduction

The Australian salmon, a sea perch, is a member of the family Arripidae. However, the precise relationship of the Arripidae to other sea perch is uncertain. The family contains the single genus *Arripis*, which consists of only two species - the Australian salmon (*Arripis trutta* (Bloch and Schneider)) and the Australian herring or tommy ruff (*Arripis georgianus* (Cuvier and Valenciennes)). There are no other close relatives.

Although recorded cases of Australian salmon date back to the early 1900's, the development of fisheries in all States was hampered by a lack of acceptance in the fresh fish market and in many States by the lack of land access to fishing areas. The establishment of a series of canneries from 1936 onwards and the building of access roads resulted in a large increase in catches. In most areas the long term catch has been relatively stable since the late 1940's, and the species is regarded as being fully exploited.

1.1 Species and Distribution

Salmon are found as schools close inshore around the southern seaboard of Australia, the general northern limits being Perth in the west and Sydney in the east. Occasionally some fish are found as far north as Geraldton and the New South Wales/Queensland border. Stocks are also present around Lord Howe Island and New Zealand (where it is called the kahawai) and its presence has been noted in the Norfolk and Kermadec Island areas.

Within Australia there are two subspecies, the eastern *A. trutta marginata* (Cuvier and Valenciennes), and western *A. trutta esper* (Whitley), (Fairbridge, 1950; Malcolm 1959).

Western fish are known to spawn only in the south west of Western Australia. Larvae drift eastwards in surface currents and although young fish are found locally in Western Australia, they occur mainly in South Australia, Victoria (as far east as Lakes Entrance) and the north and west coasts of Tasmania. Occasional western fish have been reported from New South Wales. As they grow older they return to Western Australia and the bulk of adult fish appear to be restricted to this State.

The pattern for eastern fish is similar. The spawning area is in the southern area of New South Wales and the eastern area of Victoria. Young fish are found predominantly in Tasmania and Victoria (as far west as Port Phillip Bay) and adult fish appear to be restricted to New South Wales and western Victoria (Stanley 1978). Occasional fish have been reported from South and Western Australia.

The movements of tagged fish within and between States have been summarised by Malcolm, 1960 (all States), Stanley, 1978 (eastern States) and Stanley, 1979 (western States).

In all States both subspecies intermingle in the same schools. In Tasmania most of the young western fish start moving back to Western Australia at an early age and are thus only occasionally caught commercially. In Victoria young eastern and western fish are typically found in mixed schools in Port Phillip Bay, Western Port Bay and the Gippsland Lakes. Older western fish are found on the open coastline from Lakes Entrance west to the South Australian border, with the greatest number being found to the west of this area. Also the percentage of western fish in mixed schools progressively increases towards the west. Overall about 40% of the total number or 30% of the total weight of fish caught in Victoria are western subspecies (Stanley 1978).

1.2 Biology

The subspecies can be distinguished by counting the number of gill rakers on the first gill arch. These rakers are stiff bony bars which can be seen projecting into the gullet on the inside of the gills. Eastern fish have from 33 to 40 rakers, and western fish from 25-31 (Malcolm, 1959). This difference is connected with feeding habits. Eastern fish feed predominantly on plankton, and in particular on the euphausiid *Nyctiphanes australis*, about 12mm long. The greater number of rakers is thought to provide a more efficient straining mechanism for these small items of food. Western fish feed predominantly on the pilchard *Sardinops neopilchardus* and do not need so fine a straining mechanism (Malcolm, 1966). Many other items of food are also taken by both subspecies, including anchovy, planktonic Crustacea and small squid.

The rate of growth decreases from west to east Australia (Nicholls, 1973). Thus the average maximum weights attained decrease from about 8½ kg for adult western fish in Western Australia to about 3½ kg for adult eastern fish in New South Wales. For both subspecies the maximum age attained is about 10 years, and sexual maturity occurs after about 4 years.

Typical average annual age compositions of catches of each subspecies in each State are listed in Table 1. Few fish are caught after their fifth year and for both subspecies most fish are caught when they are 3 or 4 years old. Overall about the same number of eastern and western fish are caught, but because of the higher growth rate of western fish, the catch weight of this subspecies is much higher.

TABLE 1

Typical age composition of fish caught in each State between 1963 and 1968 (Numbers of fish in thousands)

State	A G E					Total number	Average annual catch weight (tonnes)			
	0	1	2	3	4			5	6	7
Eastern fish										
Tasmania		2	120	178	82	15		397	414	
Victoria	1	78	81	178	74	18		430	470	
New South Wales			11	93	207	77	6	1	395	647
Total	1	80	212	449	363	110	6	1	1222	1531
Western fish										
Victoria	3	133	99	75	5				315	182
South Australia (1963-68)	15	75	83	109	75	14			371	669
Western Australia (south coast)				104	280	39	6	1	430	1865
Western Australia (west coast, 1964-68)				18	54	10	2		84	338
Total	18	208	182	306	414	63	8	1	1200	3054

There is evidence that in New Zealand maximum ages of about 20 years are attained (Eggleston, 1975). The stock there is largely unfished, and under this condition older fish will occur in the stock.

Both subspecies appears to be partial spawners. During the spawning period the female roes are ripe for 4 to 6 weeks and apparently each female extrudes a few eggs at a time many times over this period.

This is probably connected with the behaviour reported in Western Australia where schools remain stationary for many days and take up a characteristic doughnut shaped formation. The fish swim circularly around a clear space in the centre of the school, and this behaviour probably represents spawning activity.

Eastern fish spawn in the Lakes Entrance-Bermagui area between November and February, the time of spawning varying with locality (Stanley and Malcolm 1977). The spawning area for western fish seems to be between Geographe Bay and Albany and spawning probably occurs from mid March to April (Malcolm, 1960).

These are the only known spawning areas. Spawning fish have not been found in Tasmania or South Australia.

2.0 The Fishery

Total annual catches for both subspecies range between 2,000 and 9,000 tonnes, worth between 1 and 4 million dollars to fishermen. By weight salmon rank between the second and fourth most important fishery in Australia, although in terms of value it ranks only between the sixth or seventh.

A total of about 1,000 fishermen catch salmon, although some are only part time. Fishing units include about 40 beach seine teams, 20 large boats (20 m plus) and 350 small boats (about 7 m).

The value of boats and gear used is estimated to be about 3 million dollars.

2.1 Fishing Localities

Eastern fish are caught in New South Wales, Victoria and Tasmania. In the former State the major fishing area is between Jervis Bay and the Victorian border. In Victoria the Lakes Entrance area is the most important centre; fish also being caught in Gippsland Lakes, Port Phillip Bay and Western Port Bay. The main Tasmanian fishery is based along the northern coastline.

The main fishing seasons are from April to July and November to February in New South Wales, and from March to May and November to January in Victoria, with younger fish being caught all throughout the year. The Tasmanian fishery operates throughout the year.

Western fish are caught predominantly in Western Australia, South Australia and Victoria. In Western Australia the fishery extends from about Bremer Bay to Geographe Bay. Practically all fish are caught during the spawning period, February to April. In South Australia and Victoria fish are caught throughout the year. Most South Australian fish are caught along the open coastline, with smaller amounts coming from St Vincent's and Spencer's Gulf. The main Victorian fishing areas are Western Port Bay, Port Phillip Bay and the open western coastline.

2.2 Fishing Methods

Because of the strong inshore schooling habit the species is accessible to beach seining, which is the most common method of capture. Aircraft are often used to locate schools.

In Western Australia fishing teams occupy set beaches determined by tradition and regulation. Jet boats are often used to enable the nets to be shot quickly. The nets used are between 135 m and 360 m long, and are between 200 and 250 meshes deep in the bunt.

In New South Wales beach seines between 135 m and 1100 m long are used in conjunction with carrier vessels. The nets in this fishery usually have a funnel and detachable bag.

In Victoria a few vessels sometimes use a type of purse seine operation and in South Australia vessels introduced about 1966 also use this technique. Fish schools that are often close inshore in sandy bays are sighted from aircraft which direct the vessel to the areas. The vessel waits until the school starts to move offshore and is outside the surf zone and then a net skiff is used to shoot a purse net around the school. As the fishing areas are in shallow water, the net rings often lie on the bottom and divers are used to lift the rings clear of any obstructions. Calm weather is needed for the operation.

A typical net is about 350 m long, 18 m deep (65 in the centre section) and has 10 cm purse rings. Hauling is carried out without the use of power blocks and fish are brailed from the closed net.

Small amounts of fish are also caught by trolling (Western Australia and South Australia), Danish seining (Victoria), gill netting (South Australia and Victoria) and ring netting (South Australia).

2.3 Production

Recent production figures for each State are given in Table 2. Catches in all States have been reasonably stable in the long term. Exceptions have included the decline in the Western Australian fishery since 1967-68, which was partly reversed in 1976/77, and an increase in the South Australian fishery since 1966/67.

2.4 The Market

About 90% of the commercial catch is canned for domestic consumption. The remainder represents small fish sold through markets, especially in Melbourne. A considerable number of Australian salmon heads are supplied as bait to the rock lobster fishery.

Shortage of supplies has limited the growth of canned sales. Over the past decade consumption has declined in contrast to increases in other major canning varieties, either domestically produced or imported.

Prices to fishermen range from \$200 to \$500 a tonne, depending on location.

3.0 Management

The fishery is regarded as being in the fully exploited category. Some increase in production in the eastern subspecies may be possible (Stanley, 1978), but if this occurs, especially in juvenile areas, control measures may be required to sustain yields.

The Western Australian fishery is of a limited entry type. In view of recent declines in catch, preliminary consideration has been given to the introduction of some control measures, namely limited seasons and a ban on any future expansion of the area fished.

Legal minimum lengths are imposed in Victoria (21 cm), South Australia (21 cm) and Western Australia (30 cm).

4.0 Research and Development

A major cooperative research program is being carried out on the western subspecies fishery. Cooperative authorities are CSIRO, the Western Australian Department of Fisheries and Wildlife and the South Australian Department of Agriculture and Fisheries.

TABLE 2
Annual Production figures (tonnes, whole)

Source: Australian Fisheries

Year	N.S.W.	TAS.	VIC.	S.A.	W.A.	TOTAL
1963/64	1,317	386	749	565	2,093	5,110
1964/65	913	227	555	524	1,543	3,762
1965/66	470	196	819	637	2,952	5,074
1966/67	495	357	569	1,075	3,629	6,125
1967/68	325	276	592	1,080	4,082	6,355
1968/69	367	174	429	796	2,529	4,295
1969/70	639	67	519	1,404	2,122	4,751
1970/71	326	201	252	1,039	1,645	3,463
1971/72	516	508	586	1,881	1,730	5,221
1972/73	732	461	N.A.	797	1,630	-
1973/74	366	371	N.A.	1,881	1,485	-
1974/75	1,382	631	673	873	1,929	5,488
1975/76	850	473	379	680	1,116	3,498
1976/77	613	783	275	985	1,440	4,096
1977/78	467	611	228	1,056	770	3,133

The purpose of the program is to investigate possible causes for the recent decline in the Western Australian fishery. One such possible cause involves the increase in catch levels in South Australia since 1966. This is about the time the Western Australian catches began to decline. Young western fish live in South Australia and this State could be a major source of fish which enter the Western Australian fishery.

To investigate the situation over 9,000 tagged fish were released in South Australian waters in 1975 and 1976. The tags consist of a numbered plastic strip inserted into the belly cavity with a protruding coloured plastic streamer which indicates that a tag is inside the fish. Returns of these tags (about 25% to date) may allow the determination of stock magnitude, exploitation rate, growth rate and the numbers of South Australian fish which move to Western Australia. 300 tagged fish were also released in the Esperance area of Western Australia. Young fish are known to occur here, and they may also be of importance to the Western Australian fishery. Fish are also being tagged in Western Australia by State fisheries officers to provide further information on stock size and movements within this State. Sampling of commercial catches for length and age information at Albany, Busselton and Port Lincoln is providing further valuable information on the stock structure and annual changes in this in each area.

Preliminary results indicate that South Australian tagged fish move to Western Australia at ages of 3 to 6 years, predominantly 4 to 5 years. With more recent recaptures increasingly greater numbers of 5 year old fish are being returned. At all of these ages some fish remain in South Australia and do not take part in the movement to Western Australia (Stanley, 1979).

In contrast to this, all fish tagged in the Esperance area of Western Australia moved into the Western Australian fishing area at ages of 3 and 4 years, the major age groups represented in the catch of this state (see Table 1).

In addition, the percentage of tagged fish recovered in Western Australia from young fish released in areas progressively to the east declines, suggesting that there is a progressive decrease in recruitment to Western Australia from west to east (Stanley 1980).

It is thus increasingly doubtful if South Australian fish form a major contribution to the Western Australian catch. But a conclusive answer cannot be given until all South Australian tagged fish have become old enough to move to Western Australia and the final age composition of the fish that do so can be determined.

An alternative explanation for the decline in the Western Australian fishery is that it has been caused by environmental fluctuations affecting spawning success and larval survival. To investigate this the presence and spread of eggs and larval fish from the spawning area in the south western area of Western Australia have been followed. Many plankton tows were made in this area with a very fine meshed net (1/3 mm mesh) in order to determine in what areas and at what times eggs and larval fish were present.

Surface drifting red plastic cards (fish shaped) were also released and returns of these should give some indication of the surface current systems which may carry eggs and larval fish eastwards. Many cards have already been recovered in Western Australia, and a few in South Australia. Victorian and Tasmanian fishermen may also find some in their areas.

There are some indications from this work that changes in water salinity which occur about the time of spawning in Western Australia may affect both spawning and subsequent survival of larval fish. Hence the decline in catch may be connected with environmental fluctuations but once again more data are needed before a definite conclusion can be reached.

5.0

Prospects

The fisheries for both subspecies are regarded as being fully exploited and, in the long term, stable. Catches in individual States may fluctuate from year to year, but there is no persistent trend. The status of the Western Australian fishery is still unclear.

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