HEBERLE FAMILY SALMON FISHING HISTORY DOUBTFUL ISLAND BAY WEST AUSTRALIA VOLUME 2 1962 ONWARDS

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The full paper consists of histry93.doc, figures 1-13 (not in computer), sarec60s.xls, sarec70s.xls, sarec80s.xls, sarec90s.xls, appendices 1a, 1b, 5, 6a, 6b, 7, (not in computer), photos (not in computer),.fapp2-12.xls (app 2, 3, 4, 8, 10, 12), salcatch.xls (app 9a, 9b, 9c), salmwind.xls (app 11a, 11b, 11c).

HEBERLE FAMILY SALMON FISHING HISTORY DOUBTFUL ISLAND BAY VOLUME 2 - 1962 ONWARDS

INDEX

1. INTRODUCTION

Volume 1 of Heberles salmon fishing history was prepared in 1985. Some of the copies have been updated by addition of one page summaries for salmon seasons since then.

Volume 2 presents some additional data which has come available between 1985 and 1993. Revised one page summaries are included for 1962 onwards, which are the seasons covered by Fishermens log books. The new one page season summaries include some additional information such as wind direction and strength and details of other salmon schools sighted but not caught. All salmon weights are in tonnes whole weight. Pre 1979 cleaned weights, which refer to salmon bodies excluding heads and guts, have been converted to whole weight by multiplying by 1.42. Some additional comments have been added to the one page summaries.

Heberles fish on Reef Beach at Doubtful Island Bay, which is some 15km due ENE of Bremer Bay and about 150km due ENE of Albany. The beach is about 2.3km long and curved, with the middle facing ENE. The beach is protected from NW, W, SW, S and SE winds. The beach is exposed to NE and N winds and partly to E winds. Heberles average salmon catch is about 73 tonnes whole weight per year, which is about 4.5% of the West Australian commercial catch.

2. RESEARCH AND FISH CATCH DATA

The following is mainly new information since 1985.

Latest salmon research

Cappo (1987) reviewed recent research findings and reported on the most recent South Australian salmon tagging (1984-1986). Tagging has shown that Western salmon is a single interbreeding population with a spawning area in southern West Australia.

The time and place of spawning is not precisely known. It is thought to occur from March to late April (and May) from areas east of Albany to Busselton. Spawning may be so timed to enable larvae and juveniles to catch the eastward flowing Leeuwin current. If spawning is intended to catch the Leeuwin current then some of it could occur some kilometres out to sea. The Leeuwin current flows close to the coast near Cape Naturaliste and Cape Leeuwin but some kilometres out to sea, along the eastern south coast as shown in Figure 1.

Very few female salmon have ever been sampled in an immediate spawning condition as the last stages leading up to spawning are accomplished rapidly (Malcolm 1960). There is a tendency for females to produce under duress, so it is likely that many ripe eggs are shed shortly after capture.

During the spawning period, female roes are ripe for 4 - 6 weeks and apparently each female extrudes a few eggs at a time many times over during the period. This is probably connected with the behaviour of some schools remaining stationary for days, often swimming circularly in a doughnut shaped formation. This is probably spawning behaviour.
Juvenile salmon (0+ age group) arrive in :

- South Australia in July - September
- Tasmania in August - September
- Victoria in August - October

Some juveniles develop in the Esperance area and in estuaries south of Perth. Juvenile salmon are 5 - 8 cm in total length when first recorded in nursery areas.

The life cycle is completed when maturing salmon migrate to spawn in W.A. Migration is of 3+ year and older fish, mainly 4+ and 5+. Migration is rapid and can occur close to the start of the spawning season, as shown by tagging. Some salmon have been caught in W.A. six weeks after tagging in S.A. Salmon tagged about January 21 have been caught in W.A. in early March of the same year.

The occurrence of salmon is probably out to about the Continental shelf, which is at about 200 metres depth. Pilchard, Western salmon's main prey, occurs in the same area. Most of the salmon population is usually near to the coast rather than near the shelf. See Appendices 1A and 1B for water depth information.

The "cues" that send maturing juveniles migrating to W.A. and "clues" that these salmon follow when on migration (Harden-Jones 1984) are unknown. The timing of the migration, or at least the time of arrival on W.A. beaches is quite regular from year to year, varying only by a week or two, at least at Doubtful Is. Bay over the last 40 years, as shown by catch data in Appendices 9B and 9C.

The latest West Australian salmon research opinions are presented in the Western Fisheries autumn 1993 issue, as reported by Cribb (1993). Preliminary modelling of the W.A. fishery suggests that salmon abundance and the annual catch depends mainly on the level of annual recuitment (Lenanton et al 1991). Major peaks in the annual catch are thought to be mainly due to strong

recruitment from the western Bight and Esperance areas, topping up the Eastern States migration. The strength of the Leeuwin current (3-5 years previously) is thought to be the main factor affecting annual recruitment, rather than fishing pressure. Some of the latest opinions are :

- The Leeuwin current may be the primary cause of spawning behaviour, with salmon seeking out the warm current.
- Water temperature may act as the spawning trigger.
- Spawning may occur (during the annual migration) where-ever the water conditions are right, anywhere along the south and west coast range.
- In strong Leeuwin current years typically most of the salmon dont go far up the west coast. In weak Leeuwin current years more salmon go further north.

Leeuwin current, El Nino

The following information is mainly from Pearce (1991).
The Leeuwin current flows down the West Australian coast around Cape Leeuwin and into the Great Australian Bight, as shown in Figure 1. This current exists throughout the year but is strongest between April and October. It is a low nutrient, low salinity, warm (2 degrees warmer than local seas) current which typically flows near the edge of the continental shelf. The shelf is located at about 200 metre depth, in this area.

By comparison with other Southern hemisphere west coastal currents (Humbolt off South America, Benguela off West Africa) the Leeuwin flows the opposite way, that is south rather than north. These other currents are associated with upwellings rich in nutrients, which stimulate plankton blooms and support prolific food chains of plankton eating bait fish such as pilchards, which in turn provide food for larger predatory species such as salmon.

Figures in Pearce (1991) indicate that the waters off West Australia produce less than half as much plankton as off S. Africa and S. America. Consequently unlike the the great pelagic (sea surface) fisheries of South America and Southern Africa, West Australia's commercial fisheries are dominated by bottom dwelling species such as rock lobster and prawns. Figures in Lenanton et al (1991) suggest that the fish catch off W. Australia is only about 0.1% of that off S. Africa and S. America.

There is evidence that the strength of the Leeuwin current fluctuates in response to El Nino Southern Oscillation events. ENSO events are the result of complex interactions between the ocean and the atmosphere in the tropical Pacific ocean and have been associated with climatic and environmental anomalies around the world. During ENSO years the Leeuwin current is generally weak. Pattiaratchi & Buchan (1991) have shown that coastal sea levels at Fremantle (which are affected by the strength of the Leeuwin current) are related to ENSO events, as shown in Figure 2.

Water temperature

Figure 3 from Pearce (1991) shows sea surface temperatures for summer and winter. The northwards deflection of the isotherms off Southern Africa and South America indicate northwards flow of cold water and upwelling of cold water. Off West Australia the isotherms indicate a southwards flow of warm water, with no upwelling.

The strength of the warm Leeuwin current is thought to influence how far north the cold water species Australian salmon will travel during the annual spawning run. There is also evidence that during strong current flow, salmon schools may move offshore to avoid patches of warmer water. The strength of the current is also thought to determine how many salmon turn up in nursery areas in the eastern states. Western salmon apparently occurs in water of mean surface temperatures in the range 10 to 18 degrees C. in winter and 14 to 22 in summer.

Pilchard (Mulie) research

Pilchard (mulies) are the main diet of W.A. salmon. Excessive fishing pressure on pilchard within the range of the Western salmon could therefore affect salmon stocks. W. Fletcher (1990-91) has reviewed pilchard research data. Pilchard is distributed along Southern Australia and part the way up the west and east coasts, out to about the edge of the Continental shelf. Western salmon occurs within this same range, see Figures 4A and 4B. Pilchard occurs in water of mean annual temperatures between 12 and 20 degrees C. and mean winter surface temperatures between 9 and 21 degrees C.

W.A. catches of pilchard were very small until about 1975. The South coast catch is now about 7,000 tonnes per year and possibly at about the sustainable level. In recent years, pilchard sightings near the coast at Doubtful Island Bay, during the salmon season, have been rare. This is in marked contrast with the numerous pilchard sightings which were made in the years when the resource was only slightly utilised. It seems that the main pilchard stock has either moved off shore in this area, or is greatly diminished. Either way, some effect on salmon catches is possible.

Catch data for salmon, herring, pilchard

Australian and New Zealand pilchard catch data is presented in Appendix 2. Commercial salmon catch data for W.A., the Eastern states and New Zealand is in Appendix 3. It should be noted that catches in Victoria and Tasmania are partly western and partly eastern subspecies salmon. The W.A. catch figures are graphed in Figure 5. Reliable estimates of catches split by subspecies are not available, my guesses are below :

Rough estimates of annual Commercial salmon catches in recent years

	Western subspecies			Eastern subspecies		
	Tonnes	Average kg/fish	Number of fish	Tonnes	Average kg/fish	Number of fish
West Australia	1,200	4.3	280,000	0	N/A	0
South Australia	500	1.8	280,000	0	N/A	0
Victoria	100	1.0	100,000	150	1.0	150,000
Tasmania	100	1.0	100,000	600	1.0	600,000
New South Wales	0	N/A	0	350	2.0	175,000
TOTALS	1,900	2.5	760,000	1,100	1.2	925,000

Stanley (1978) considered that all commercially caught salmon in Tasmania were eastern subspecies. This is hard to accept, given his distribution map showing western subspecies Tasmanian occurrence nearly the same as eastern subspecies. Stanley suggested that about 40% of the Victorian salmon catch and 1% of the NSW catch was western subspecies. He also considered that Tasmanian and Victorian salmon moved into South Australian waters, for a period, before joining the westerly migration from South Australia, rather than migrating directly from Tasmania or Victoria to West Australia.

New Zealand salmon (Kahawai) catches were small until 1975/76. The New Zealand catch has exceeded Australia's catch probably almost every year since 1978/79. The New Zealand catch in recent years has probably been about 7,000 tonnes/year. Average weight per fish is probably about 2.5kg, so the annual catch is about 2,800,000 fish.

It appears that small annual catches in South Australia (under 500t) have little effect on W.A. catches. Consistent large annual catches in S.A. do appear to reduce W.A. catches. Figure 6, which shows W.A. and S.A. salmon catches suggests this. If so then catches of Western salmon in Victoria and Tasmania will have a similar effect. There is some evidence for this in comparing Victorian, Tasmanian and W.A. catch figures for individual years, even though the proportion of Western and Eastern salmon caught is not known. The Victorian catch has typically been too small to have any effect on W.A. catches, but the Tasmanian catch may have had some effect. Good Tasmanian catch years in 1961/62, 1974/75, 1976/77, 1977/78 and possibly 1985/86 were followed by relatively poor catches the year afterwards in W.A.

The early tagging of Victorian and Tasmanian salmon suggested that very few of those fish migrated to W.A. but this was also the case with the earliest S.A. tagging also, since shown to be misleading.

Salmon stock assessment

Cappo (1987) presented some stock assessment figures for part of the S.A. fishery, based on aerial spotting. This assessment which was for 1984-86 was between 3,600 and 6,200 tonnes. Cappo considered this to be an under-estimate due to numerous small schools missed. Also there are some areas not included. Maybe a better estimate would be between 5,000 and 9,000 tonnes. The population is likely to fluctuate markedly from from year to year, if the commercial catch is any indication.

Possibly of the order of 3,000 tonnes of S.A. salmon migrate to W.A. each year. This would be so, if S.A. stock contributes about 1000 tonnes/year to the W.A. commercial catch and about 30% of the spawning stock are caught each year. This would be balanced by annual growth of non-migrating stock of ages 0+, 1+, 2+, 3+ etc and the annual recruitment of spawn 0+ from W.A. but with considerable variation from year to year.

Cappo (1987) provides details of salmon population modelling work and estimates of rates of fishing mortality (F) and natural mortality (M). Figure 7 shows the relative salmon numbers at each age if F = 0.2 and M = 0.5 . The true values of F and M are unknown but they are possibly of that order, F could be higher and M lower. Based on this figure, in an unfished population the number of 4 year olds is more than double and 6 year olds about 10 times that in a fished population. Data on fish of each age caught can be used to validate the model and estimate the actual mortality levels.

Estimates of the W.A. stock made in The 1960s (Nichols & Malcolm, 1965) were of the order of 4,000 to 19,000 tonnes (including S.A. recruits). If the annual exploitation of the spawning stock in W.A. is about 30% and virtually the whole W.A. stock is spawning stock, then the population would be between 4,200 and 12,600 tonnes, based on a commercial catch between 1,000 and 3,000 tonnes and an amateur catch of 400 to 1,200 tonnes.

One estimate of salmon (Kahawai) stocks in New Zealand (Egglestone 1978) was in the range 100,000 to 150,000 tonnes with a suggested catch of 7,500 to 15,000 tonnes/year. As in Australia, the amateur catch is estimated to be about 30% of the total.

Fish prices

Appendix 4 shows typical salmon and herring prices at Albany since 1946. Salmon prices are graphed in Figure 8. It is likely that W.A. prices are affected by the quantities of salmon caught and prices per can of salmon caught in the Eastern States and New Zealand. Current prices are almost the lowest on record in real terms and about one third of 1981 prices.

3. BREMER BAY NATURAL HISTORY

Plant and animal species lists

Species lists are provided in :

- Jenkins (1980).
- Jerramungup Coastal District management plan (1984).
- Hodgkins & Clark (1987).

Whale strandings

Major whale strandings in the Doubtful Is area since the 1950s are listed in Mell (1988) as follows.

- Sept 1962 33 *Physeter catadon* (Sperm whales) Reef Beach
- May 1964 34 *Pseudorca crassidens* (False killer whales) Reef Beach
- Oct 1976 17 *Physeter catadon* (Sperm whales) Trigelow
- Aug 1979 13 *Orcinus orca* (Killer whales)
- Sept 1979 22 *Physeter catadon* (Sperm whales) near Gordon Inlet

Live strandings of whales almost exclusively occur where lines of the earth's magnetic field cross the coast or are blocked by islands and where whales typically use this magnetic field for navigation, as discussed in Klinowska (1985). Certainly repeated strandings occur in some areas and rarely elsewhere.

Bush fires

The effects of bushfires can be detected on aerial photos. The Fitzgerald national park management plan shows data on bushfires based on aerial photo interpretation. The most recent bushfire near Reef Beach was in Christmas 1981. The Christmas 1989 bushfires in the Fitzgerald national park burnt nearly 40% of the park and have been described by McCaw et al (1992).

Wellstead estuary (Bremer River) inventory

The paper by Hodgkin and Clark (1987) provides information about the geology, soils, climate, vegetation, fauna and waters in the area. Included is data on the opening and closing of the bar between 1954 and 1986, see Figure 9.

Contour maps

Appendix 5 is a contour map of the Bremer Bay area.

Water depth charts

Appendices 1A and 1B show water depths in the Bremer Bay area and Southern Australia.

4. BREMER BAY HUMAN HISTORY, LEGAL ASPECTS

Land tenure maps

Appendix 6A shows the private property location and reserve numbers in the Doubtful Is. Bay area. Appendix 6B shows the purple title blocks.

Purple title land

Based on a study of land title documents and Company annual reports, it appears that Empell Pty Ltd purchased Kent location 1307 of 405 ha (adjoining House and Reef Beaches) from MP Lenegan Pty Ltd for $20,000 on 6.3.1974. From 1974 until 1980 shares of the property were sold to over 200 persons for a total of over $300,000. Similarly, a related company, West Coast Waterfront Investments Pty Ltd, purchased Kent location 1325 of 1095 ha at Peppermint. This property is divided into 2745 shares, some of which have been sold since 1974. Some further information is in the season summary for 1974.

Management plans

At least three management plans have been published for the area :

- Jerramungup coastal district draft management plan (1974).
- Fitzgerald national park management plan 1991-2001.
- South Coast Region (of CALM) management plan 1992-2002.

All of the above plans have recommendations or prescriptions which may affect access to the Doubtful Is. Bay area. For example the Fitzgerald park plan provides for continued access by commercial fishermen through the national park, including transport of catches. This is subject to use of designated public access and the same road closures as applying to the general public.

Aerial photography

A photocopy of the latest aerial photo of the Doubtful Is. Bay area is provided as Appendix 7.

5. HEBERLE FAMILY FISHING SEASONS 1946-1961

Volume 1

Details of salmon seasons from 1946 to 1985 are provided in volume 1.

Country fish supply history

A history of the Country fish supply is provided in the Katanning Shire history (Heberle,1988).

W.A.F.I.C. paper on South-west fishing

Details about Heberle family fishing activities are included in the paper covering the south western fishing history, prepared by Wright (1988).

6. HEBERLE FAMILY FISHING SEASONS 1962 ONWARDS

Introduction

Volume 2 presents some additional data which has come available between 1985 and 1993. Revised one page summaries are included for 1962 onwards, which are the seasons covered by Fishermens log books. The new one page season summaries include some additional information such as wind direction and strength and details of other salmon schools sighted but not caught. All salmon weights are in tonnes whole weight. Pre 1979 cleaned weights, which refer to salmon bodies excluding heads and guts, have been converted to whole weight by multiplying by 1.42. Some additional comments have been added to the one page summaries.

Additional data is now presented for years such as 1965 and 1986-88 from Fisheries Dept copies of log books as our copies are missing. Catch and other records are from log books unless based on my own records eg of catch times, winds and other salmon sighted, for recent years.

Summary of salmon seasons since 1946

Appendix 8 summarises the main details of salmon seasons since 1946, including team members, boats, tractors, trucks and catches.

Catches related to day of the year

Appendices 9A, B and C provide details of average catches for each day of the year. This data is summarised in Figure 10. The main salmon season on Reef Beach generally runs from about February 26 until April 9, during which time an average of at least 0.5tonnes/day is caught. The best part of the season is from March 12 until March 27, when the average catch is typically at least 2 tonnes per day.

Catches related to time of day

Appendix 10 shows the number of salmon schools recorded as caught for each hour of the day. This data is summarised in Figure 11. The best catching hours are 10-11 and 11-12 AM, when about 31% of schools are caught. Only about 10% of schools are caught after 4 PM.

Catches related to wind direction and strength

Appendix 11A summarises recorded wind data on days when salmon were caught. Appendix 11B summarises the same data recorded on days when no salmon were caught. In earlier years wind details were often only recorded for days when salmon were caught. Appendix 11C summarises the wind data and the results are graphed in Figure 12.

The wind classes used are as follows :

- Light 0-10 knots
- Moderate 11-19 knots
- Strong 20+ knots

The best winds for catching salmon on this beach are :

- Light NW
- Moderate NE
- Moderate N
- Moderate E

The worst winds for catching salmon :

- Strong SE
- Strong E
- Strong NE
- Strong NW
- Moderate NW

These results can be explained as follows. On-shore winds (N,NE,E,) tend to push schools on to the beach, providing they are moderate or strong. However strong easterly winds are usually associated with difficult fishing conditions and poor visibility due to the water being stirred up and weed being washed in. When the winds are off-shore (NW,W,SW) they tend to push the schools away from the beach, if moderate or strong.

Water temperature

Sea water temperatures were recorded in 1965 and 1966. Only one reading was recorded in the log book. The time of the reading and whether taken at the same time every day, is not known. In 1993 two temperature readings were taken, typically at about 1000 and 1400 hours. From readings taken at various times during the day, it appears that the day-time shore surface water temperatures typically follow the same pattern as air temperatures and that the average of the 1000 and 1400 readings is about the average for the day.

To determine whether water temperature has any effect on salmon catches on this beach, it may be necessary to take temperature readings for 6 to 10 seasons, including some good and bad seasons. At this stage there is no obvious correlation between water temperature and catches.

Tagged salmon caught

Appendix 12 lists details of tagged salmon caught since 1985, for which we have records.

Factors determining the annual catch

The factors which decide whether it will be a good or bad salmon season, in the W.A. fishery, or on a particular beach, would include :

- - The level of spawning and transport to nursery areas in the eastern states, Esperance-Bight-W.A. estuaries, some 3-5 years earlier.
- - The survival-mortality of pre-spawning age fish and the number taking part in the spawning run that year.
- - The number of resident spawning fish and where they are located at the start of and during the season.
- - The speed of travel to and through the W.A. fishery determining where the concentrations of salmon are when the season starts and proceeds.
- - The efficiency of the fishermen involved eg nets, boats, ability.
- - Wind conditions to push schools swimming past on to or away from the beach eg moderate to strong on-shore or off-shore winds.
- - Proportion of good and bad weather conditions for sighting and catching the fish.
- - Beach conditions eg rocks, gutters, reefs covered with sand, minimal weed, nothing panicking the fish (boats, seals, dolphins).
- - Water conditions eg temperature, salinity, lack of suspended silt, weed, plankton etc if these are avoided by salmon.

Why do salmon come on to beaches during the season ?

Some salmon schools are seeking beaches for spawning. Possibly in the past spawning occurred mainly in estuaries so spawning salmon instinctively seek out beaches which might have rivers. This probably is the reason for only a small proportion of schools arriving on Doubtful Is Bay Reef Beach, as most schools dont exhibit spawning behaviour.

A few schools, often very small, are wounded fish seeking an area, usually near the reef, to rest for a while before moving on.

Some schools rest up after feeding, before moving on.

Most schools appear to be just moving past to spawn further along the coast and they swim the beach. Some schools come in regardless of the wind, but more schools come on to the beach when the winds are moderate or strong on-shore (easterly) rather than off-shore. During strong on-shore winds, the schools are often very difficult to sight or catch.

Migrating salmon schools passing by

Some years most salmon schools swim along Trigelow and if not caught there, they move onto Reef beach. Other years many schools by pass Trigelow and arrive directly at Reef Beach, usually in the northern (Well) corner.

Probably a few thousand tonnes of salmon swim past the beach each season, but we usually sight or catch about 100 tonnes, often less. This suggests that most of the schools are at least a kilometre off the coast and not sighted even with binoculars. Big schools, say 10 or more tonnes usually show on the surface (flurry). Smaller schools are virtually impossible to see on the dark blue water (weedy bottom) from ground level. They may be visible from the air, or from a high hill.

It is likely that salmon schools move past swimming at various average distances from the coast, out to about the Contintental shelf, which is about 55 km off the coast at Point Ann. Pilchard, the main prey of the salmon are distributed out to about the Continental shelf. The salmon schools would probably move in closer to the coast and also away from the coast for various reasons such as chasing Pilchard (prey), seeking water of suitable temperature and salinity for spawning, to rest or recover from injuries, escape from predators and in response to strong winds or currents pushing them away or towards the coast.

Schools sighted and/or caught on Trigelow or Reef beaches may be mainly those those swimming at an average distance from the coast of 0-5 km, as shown in Figure 13. If the migrating salmon schools are more or less evenly distributed from the coast to the Continental shelf (about 200m depth) some 55km offshore in this area, then 5/55 = about 9% of the States' salmon catch could be expected from this area, which is the case.

Some years many of the schools probably swim at least a few kilometres off the coast so miss Trigelow but come on to Reef Beach, as shown in Figure 13.

When the Gardiner River is flowing strongly into the sea, most schools swimming close to the coast may go wider to miss the dirty water and not be sighted on Trigelow. When it is rough on Trigelow many schools are either uncatchable or go wider and either swim on to or go past Reef Beach.

7. ONE PAGE SALMON SEASON SUMMARIES

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