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**The Fishing Ventures of the
Great Australian Bight: with a Resume
of Known Potential Resources and Review
of Trawling Surveys on the
South Western Australian Continental Shelf**

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The title of this series is to be changed. The last *CSIRO Division of Fisheries and Oceanography Report* will be number 136. Subsequent Reports will be issued as *CSIRO Marine Laboratories Report*, the first one being number 137.

THE FISHING VENTURES OF THE GREAT AUSTRALIAN BIGHT:
WITH A RESUME OF KNOWN POTENTIAL RESOURCES AND REVIEW
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CONTINENTAL SHELF

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Abstract

All attempts to establish a commercial fishery in the Great Australian Bight since the early part of this century have been unsuccessful. Although most of the ventures indicated a small demersal resource, and more recently the possibility of a seasonal pelagic resource, the results have generally not justified a continued attempt at exploitation. The reasons for this, apart from the small size of the resource, include the use of vessels in poor mechanical condition, lack of suitable refrigeration and crews untrained in the handling and processing of a variety of species. An additional contributing factor is the often ill placed optimism of potential trawling results based on a comparison of catch rates with trawl grounds in other parts of the world, with dissimilar trawling conditions and faunal community dynamics.

INTRODUCTION

The history of fisheries development in the Great Australian Bight and along the south western coast of Western Australia (Fig.1) is hardly auspicious. Several attempts have been made to establish commercial demersal fishing ventures, principally in the Great Australian Bight, with no sign of viability to encourage perseverance longer than an average of about a year. In 1977 Southern Ocean Fish Processors Pty Ltd of Albany, Western Australia entered a joint venture with British United Trawlers. This latest venture ceased to operate early in 1979 and went into receivership later that year after following the usual pattern for such ventures. It would appear that there are some fundamental problems conspiring to thwart the development of such fisheries development and it is opportune to examine some

of the data available from such ventures in an attempt to explain the difficulties experienced by the commercial fisherman.

This report covers events prior to and including the latest venture and presents some hitherto unpublished information (in an edited form) from CSIRO archive material that should be of interest to those concerned with fishing the Great Australian Bight. An assessment is also made of the possible fishing potential on the basis of what is known of the demersal and pelagic fish stocks in the region.

DEMERSAL RESOURCES

Trawling ventures

Several accounts of the trawling potential of the Great Australian

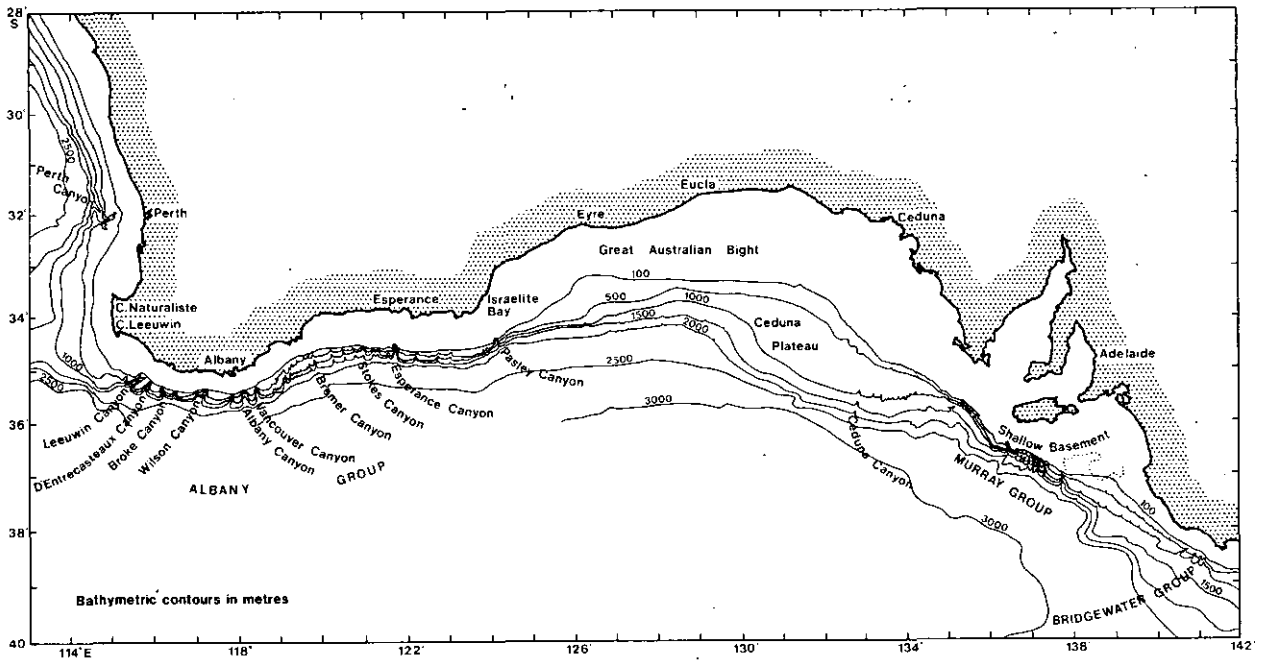


Figure 1: Location of the Great Australian Bight with general topographic and geographic features.

Bight have been published (Dannevig 1913; Houston 1954; Kesteven & Stark 1967; Highley & Stark 1968) and while each was limited by the available data they concluded that the demersal resource was worth exploitation:

The successive failures to establish such a fishery in the region suggest that there are factors contributing to make such development impractical on the basis that has been hitherto attempted. Reports on these operations (Appendices 1-4) indicate the problems encountered and make it clear that biological factors were not solely responsible for the failure of the fishery to develop.

The demersal fishing effort in the Bight is generally confined to a narrow strip of fishable ground defined as early as 1913 by Dannevig (1913) as being at the continental shelf break at the western end of the Bight (Figs 2a, b, c). These grounds are described in some detail (Appendices 2 and 3) from the account of the operation by the side trawlers *Ben Dearg* and *Commi'les*.

The first vessel to make an attempt at fishing the Bight commercially was the steam trawler *Bonthorpe* and the venture was unsuccessful for a number of reasons with the trawl data from the operation only of limited value (Serventy 1937; Appendix 1 Table A 1.1).

The results of subsequent attempts to establish demersal fishing in the Great Australian Bight (Tables 1-5) show a general similarity in levels of performance (Figs 3a, b; 4a, b).

In the early venture, the *Ben Dearg* and *Commi'les* made average catches of 540kg/haul and 404kg/haul respectively (Tables 2a-c, Figs 3a, b), with averages of 2.3 t/day and 2.0 t/day fished on the grounds throughout the period of operation.

The investigation by the *Southern Endeavour* of 1960-61 was of interest as detailed trawl records were kept by the CSIRO (Table 3) and the venture closely monitored (Kesteven & Stark 1967; Highley & Stark 1968; Appendix 4). The results of the trawling were variable throughout the period of operation with a marked decline in the catch rate during 1961 (Figs 3a, b). This reduction in performance was attributed by Kesteven & Stark (1967) to the difference in fishing efficiency after cruise 16 due to change of Captain and alterations in the fishing gear.

The most promising attempts to exploit the demersal fishing grounds were made by three English side trawlers, *Saxon Onward*, *Saxon Progress* and *Saxon Ranger*, during 1975-76 (Tables 4a-d). Even allowing for the generally inefficient *Saxon Ranger* (Fig. 3b) the overall catch rates for the three vessels were 1.38 t/haul or 4.72 t/day on the fishing grounds (Table 4d; Figs 3a, b). On an individual basis the *Saxon Onward* provided the best results so far obtained in the Bight with an average trawl of 1.42 t/haul or 5.33 t/day on the fishing grounds (Table 4a, Fig. 3b).

The most recent fishing venture in the Bight was by a consortium between British United Trawlers of the United Kingdom and the Australian Southern Ocean Fish Processors Pty Ltd operating from Albany in Western Australia. The three 68.3m *Othello* class factory freezer stern trawlers, the *Othello*, *Orsino* and *Cassio* employed in this venture represented the largest vessels to attempt to fish the Bight commercially. Unfortunately, as with previous attempts to develop the fishery, payable quantities of fish could not be obtained regularly. The problems experienced by previous ventures were magnified by the higher daily throughput necessary for these vessels to prove economically viable.

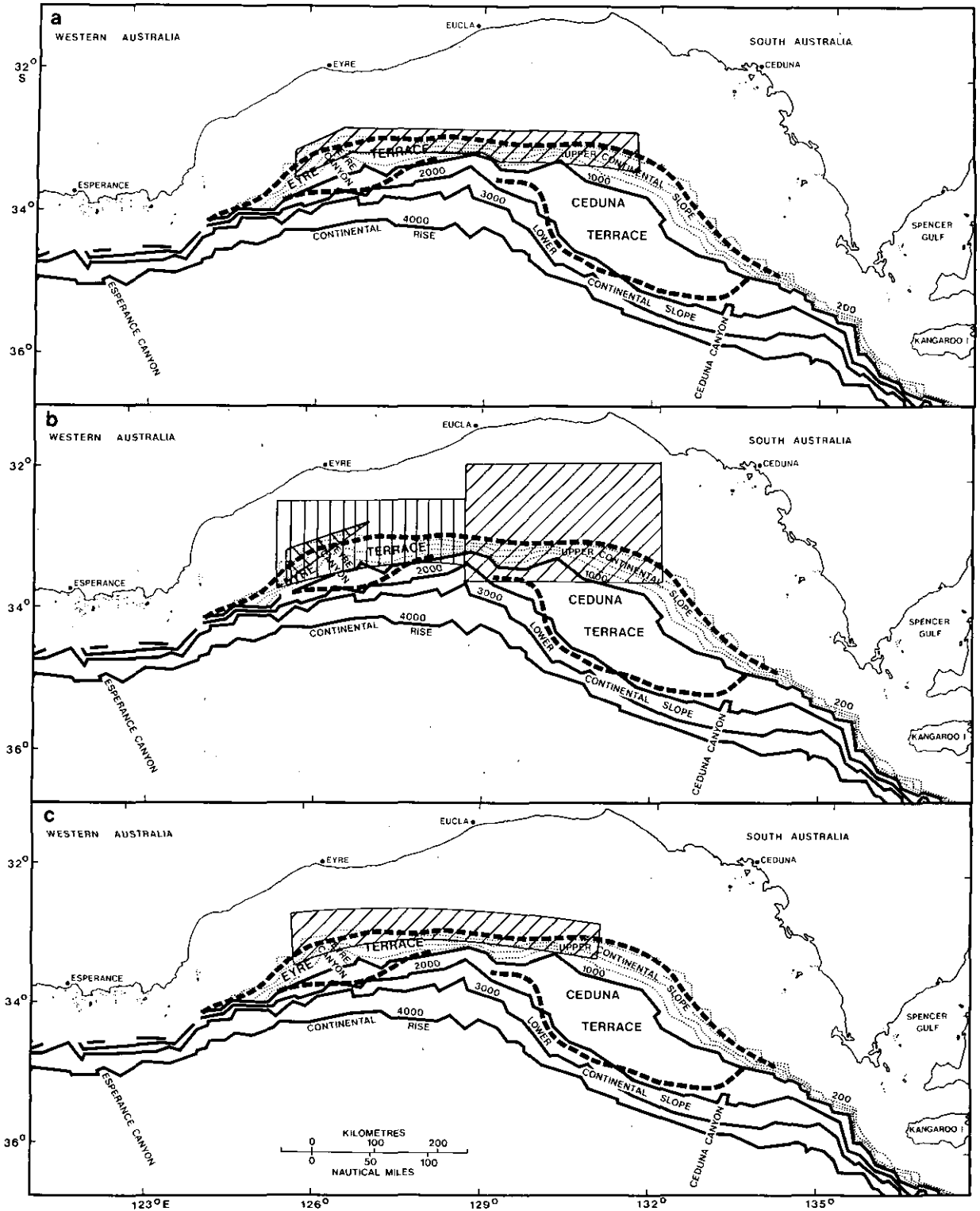
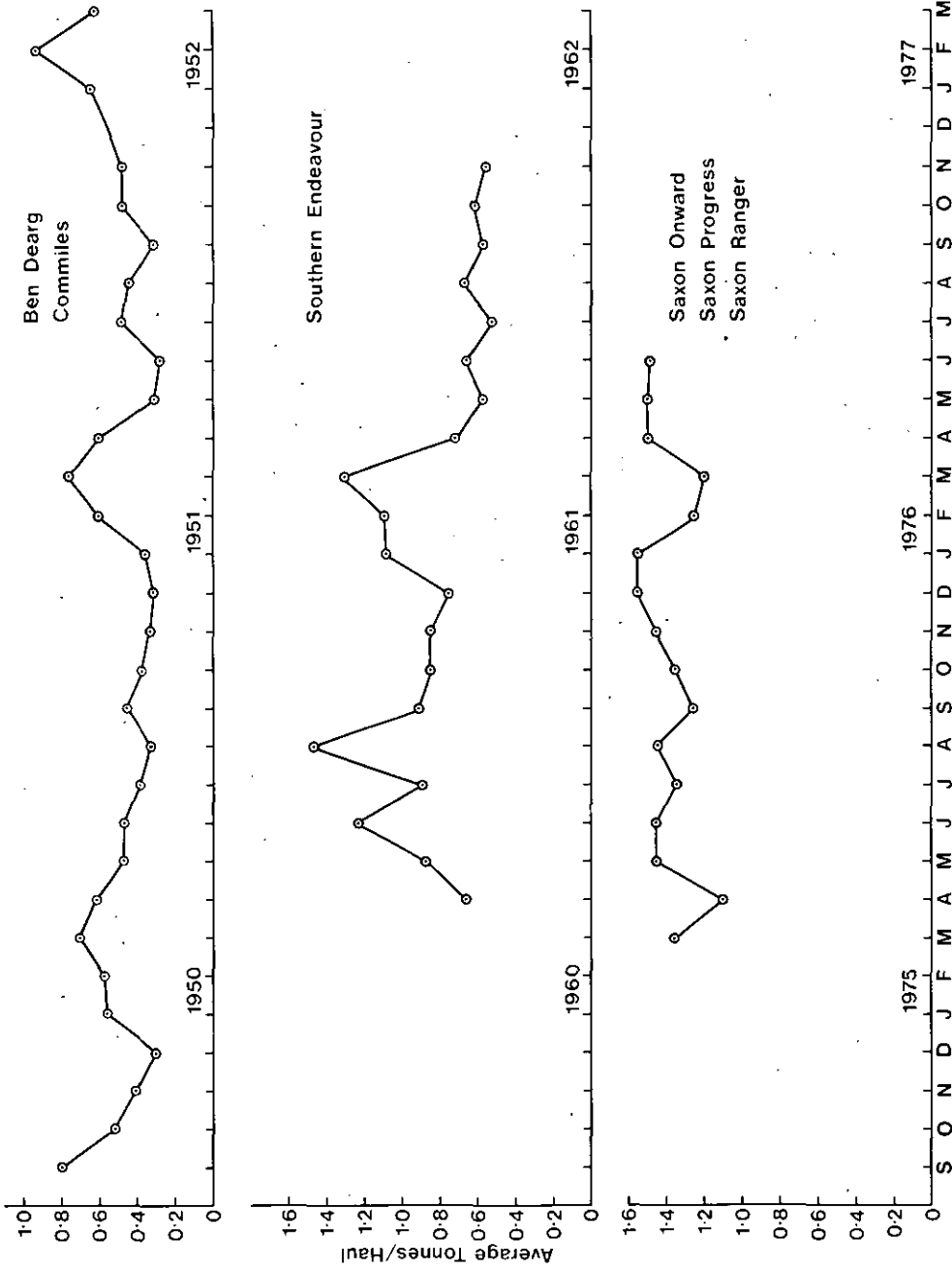


Figure 2a: *F.I.S. Endeavour*, 1912-13, general trawl survey area in the Great Australian Bight (from Houston 1954).

Figure 2b: Areas trawled by early commercial fishing ventures in the Great Australian Bight. ||||| - area surveyed by the *Ben Dearg* and *Commiles*, 1949-52, with // the general fishing area. / outlines the area of test fishing carried out by the *Simplon* (from Houston 1954).

Figure 2c: The area of concentrated fishing effort by the *Southern Endeavour*, 1960-61, (from Houston 1954), the three Saxon side trawlers, 1975-76, and the three *Othello* class stern trawlers, 1977-79.



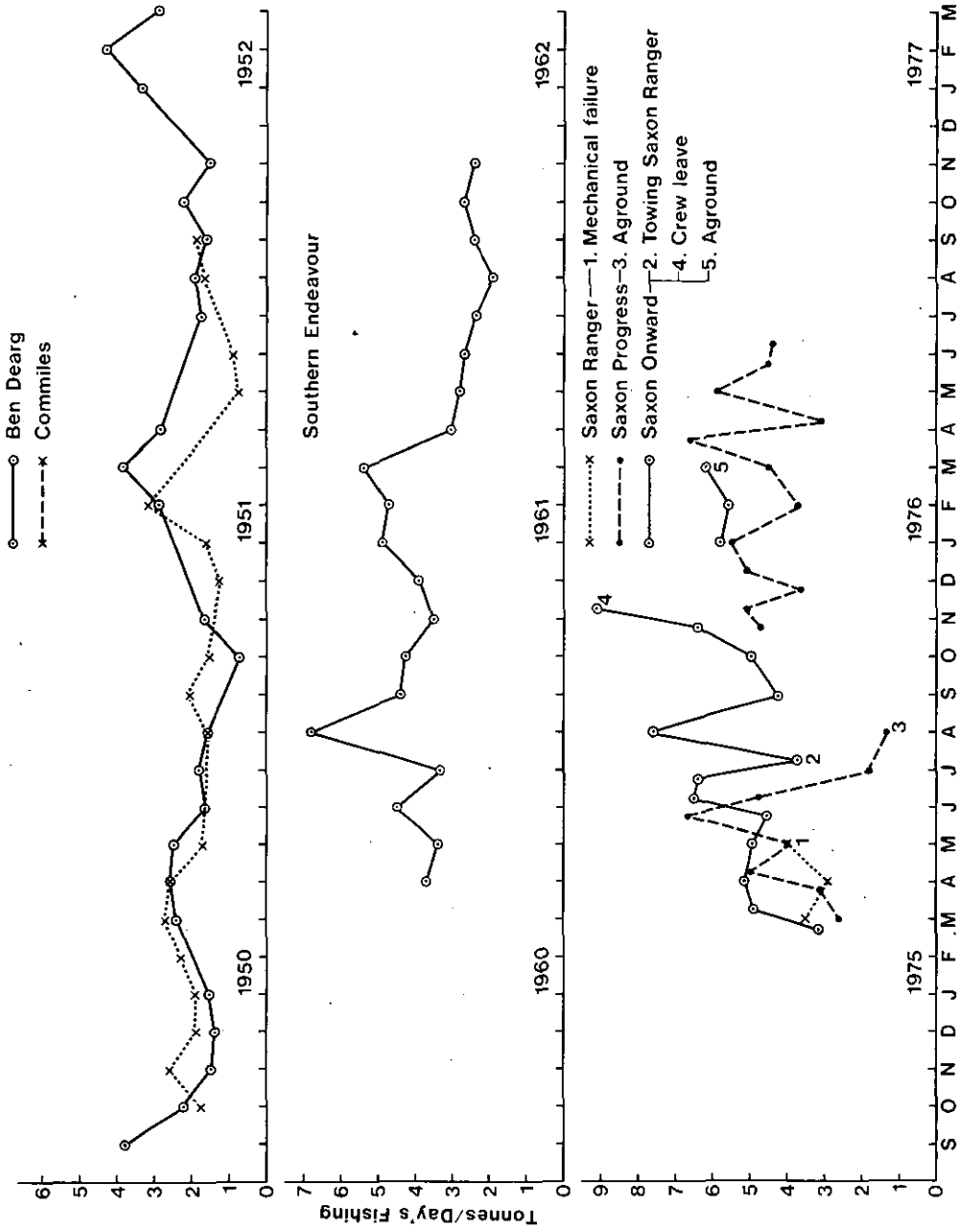


Figure 3b: Monthly average of daily catch (tonnes/day) while on the fishing grounds for vessels in Figure 3a.

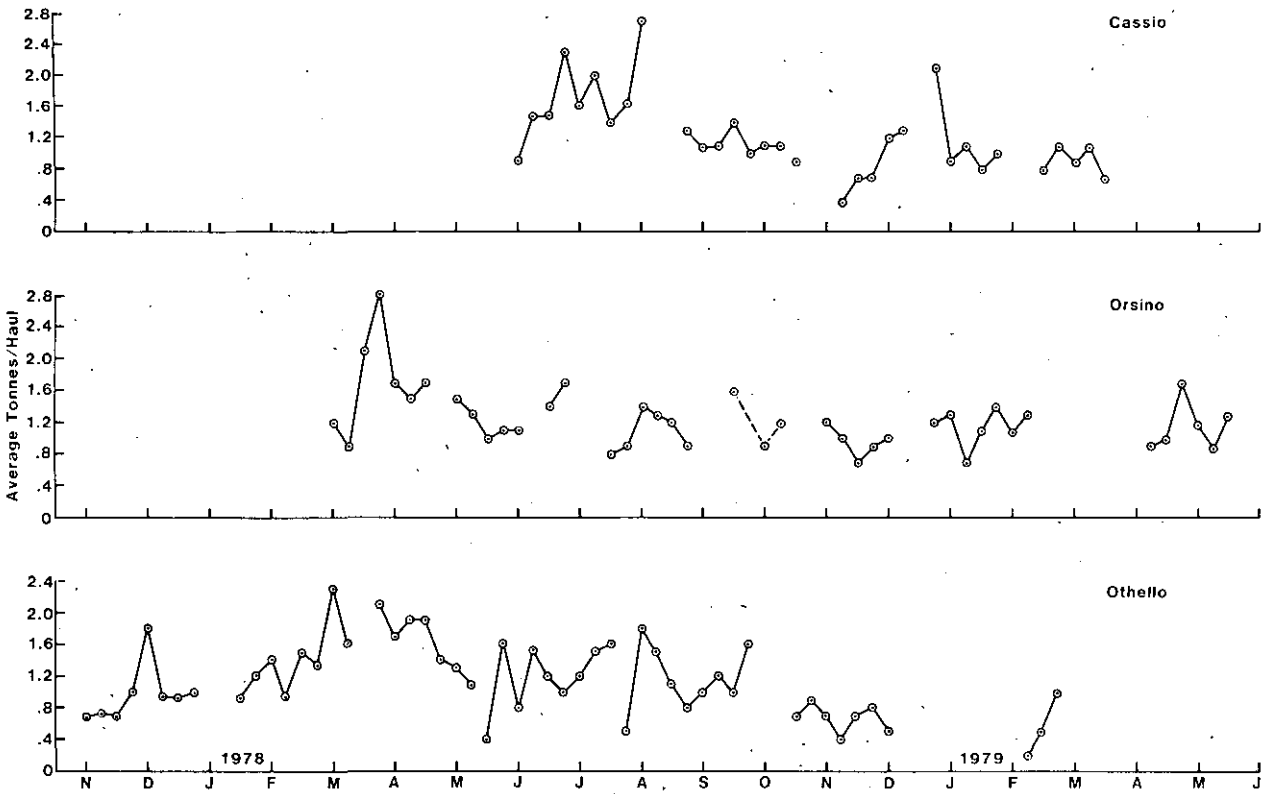


Figure 4a: Weekly averages of trawl hauls (tonnes/haul) by the *Cassio*, *Orsino*, and *Othello* in the great Australian Bight.

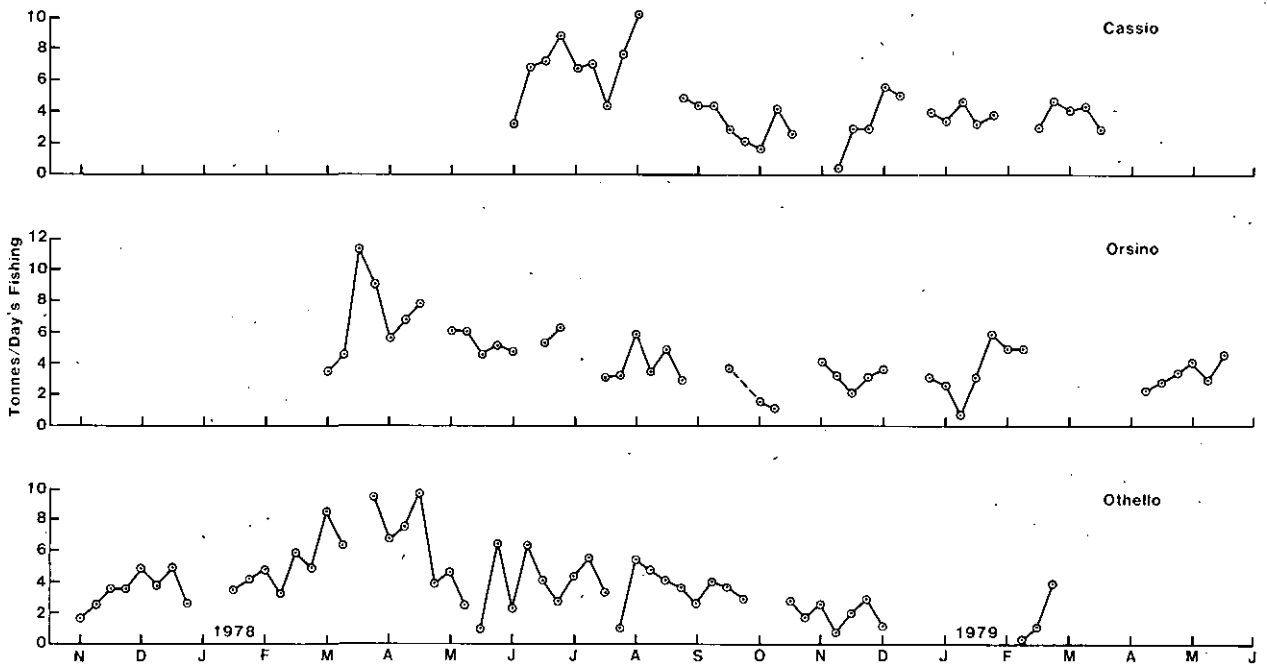


Figure 4b: Weekly averages of daily catch (tonnes/day) while on the fishing grounds for *Cassio*, *Orsino* and *Othello*.

Other difficulties arose from the tendency for the vessels to alter their fishing tactics for different target species at short notice while at sea because of changing market demands. For these reasons a detailed breakdown, species by species, is not warranted and instead a brief description of the overall landing and catch statistics (Figs 4a,b; Tables 1, 5a-c) can serve to illustrate the trends of the shortlived operation.

The *Othello*, the first of the three vessels to start fishing, showed poor results initially (Figs 4 a,b) which gradually improved in the late summer of 1977-1978. This was possibly as a result of experience and the increase in efficiency of operation when the *Orsino* entered the fishery in March 1978 and the vessels could, to a certain degree, cooperate. This slight improvement was not maintained and *Othello* and *Orsino* consistently returned less than 2 t/haul and less than 6 t/day fishing (on the grounds) (Tables 5 a,b) with a general trend of declining catch rates throughout the winter of 1978.

The *Cassio*, which spent the least time at sea (Table 1), had no better success. Although the poor catch rates may be due in part to the fact that the vessels, in particular the *Orsino*, directed some of their effort into an attempt to catch pelagic fish. However, the overall returns are consistent with the results of the previous ventures and are not commercially viable for vessels of this type.

Important demersal species

The trawling operations in the Bight indicate that three species are of primary importance to the demersal fishery: Bight redfish - *Trachichthodes gerrardi*, Jackass fish - *Nemadactylus macropterus*, Deepwater

flathead - *Neoplatycephalus speculator*. From the documented accounts of trawls the order of dominance in the catches is as given here. By comparison, in the early days of the demersal fishery in New South Wales, that fishery was dominated by one species, the tiger flathead (*Neoplatycephalus richardsoni*) while the Bight catches always consisted of a number of species (Houston 1954).

There is little published literature on the principal trawl species of the Bight though some information of a general nature, useful enough to establish a general impression of their reproductive and migratory habits, is given by Serventy (1937) and Kesteven and Stark (1967).

Discussion

From an examination of data available on the trawling operations (Tables 2-5), summarised in Table 1, it is clear that some vessels performed reasonably well. Even the best however, the *Saxon Onward*, returning 5.3 t/day spent on the grounds, did not show sufficient promise to warrant the introduction of vessels as large as the *Othello* class stern trawlers. A number of factors such as mechanical failure, inexperienced crew, inadequate refrigeration and marketing difficulties conspired to make an already marginal operation uneconomic.

The distance of the main fishing grounds from Albany and Adelaide also detracted from the profitability. It can be seen from the comparison in Table 1 that the average catch per day at sea was often less than half the average catch per day on the grounds. It was only in the final venture that this factor was less important as the larger vessels were able to stay at sea for an average of 40 days, thus improving the ratio

of days engaged in fishing to those steaming to and from the grounds.

A contributory problem to the development of a fishery in the Bight is the limited extent of the fishing grounds (Dannevig 1913; Appendices 2 and 3). Kesteven & Stark (1967) in the account of the *Southern Endeavour's* operation substantiate the limited nature of the trawl grounds with the observation that: "The operations were confined largely to ground between depths of 76-110fm covering an area of 2000 square n. miles, which is less than 4% of the total area". In the light of this statement it is difficult to know what Highley & Stark (1968) meant when they said: "One of the most important features of the Bight trawling grounds is their great extent". As has been indicated this is clearly not the case and the very limited nature of the grounds a handicap to their development.

None of the trawling ventures has continued for long enough to obtain catch and effort and biological data to determine the impact of trawling on the fishing grounds. It is however noteworthy that since the first commercial fishing venture in 1949-1952 by the *Ben Deary* and the *Commiles* only 5700 t of fish have been landed by 9 vessels for a total of 22 196 hours fishing in 5 522 trawls with a general average of little over 1 t/trawl.

PELAGIC RESOURCES

The Australian 'salmon' *Arripis trutta espei* which forms the basis of a beach seining industry on the southern coast of Western Australia shows no evidence of having large unutilized stocks available for exploitation. Of the tunas, the southern bluefin (*Thunnus maccoyii*) supports industries at Albany and Esperance in Western Australia, at

Port Lincoln in South Australia and at Eden in New South Wales. The indications are that this resource is fully utilized (Murphy 1979). By contrast, the skipjack or striped tuna (*Katsuwonus pelamis*) is not presently the subject of a major fishing effort largely because of its smaller size and lower price (per kg) than the former species. It is thought that a considerable resource of this species could exist and be a valuable future development.

Three other pelagic species often cited as of potential are: Blue or slimy mackerel, Jack mackerel or horse mackerel, and pilchard.

Blue mackerel (Scomber australasicus)

Very little is known about this species apart from the observation that it occurs in the Bight (Whitley 1964). Nothing is known about its reproductive or migratory habits and no data is available to allow yield estimates to be made.

Experience of trawlers working in the Great Australian Bight suggests that this species may occur in large numbers and also that its distribution is very seasonal. It is a highly valued food fish but it is uncertain if this species could be fished in commercial quantities on a regular basis.

Jack mackerel (Trachurus declivis)

Data are not available on distribution and concentrations of the species on the south west coast so a potential yield cannot be given. In the Great Australian Bight where this species forms concentrations (Shuntov 1969) some moderate success was had by the three British United trawlers when fishable concentrations were located. The main stocks of this species are, however, centred on the eastern seaboard of Tasmania (Maxwell

1979) and the occurrence in the Bight is likely to be seasonal and subject to considerable fluctuation in location and abundance.

Pilchard (Sardinops neopilchardus)

In comparison to the species mentioned previously there is a considerable amount of information available regarding the potential resource from studies undertaken by the CSIRO (Blackburn 1941, 1950a,b; Rapson 1953).

Surface schooling is the most common observation made on this species (Whitley 1946; Blackburn 1950a) and such sightings have continued to the present day by aerial spotting. Sightings obtained by the West Australian Department of Fisheries and Wildlife in April 1978 are presented in Appendix 5, Table A 5.1, Fig. A 5.1. From these it is seen that the greatest number of schools observed at that time were east of Esperance in the area around Cape Arid. This distribution is interesting in conjunction with the observation of Blackburn (1950a, p. 244) in a discussion of the area between Pt Culver to (but not including) Doubtful Island Bay when he says: "Aerial reconnaissances in May and June revealed the presence of abundant shoals over much of the area, especially east of Cape Arid. In this locality, 10 000 shoals (minimum estimate) were seen in a single day. This was the greatest concentration of any fish seen from the air in Australian waters."

Blackburn's statement is derived from Whitley's (1946) account of an aerial survey conducted north and north east of the Eastern Group when he reported: "I considered that after twenty minutes we had passed 60 000 schools of fish along the strip of say, fifty miles over which we had flown".

Both Blackburn (1950a) and Rapson (1953) explain that the surface shoals of pilchard are often very thin and dispersed and that estimates of tonnage could be misleading. Blackburn & Rayner (1951) comment: "The Western Australian pilchard shoals are not usually dense nor do they appear to have any great solid depth. Their surface display is often misleading, giving an appearance of more fish than are actually present. The fish may escape the net, either sounding before the door is closed or passing out through the large meshes of the wings".

Despite the caution needed when assessing the density of surface schools, it is known that some surface schools can be large enough to offer a reasonable prospect for purse seining.

It is the more deeply schooling phase which produces denser aggregations and perhaps offers a better opportunity for significant catches. Rapson's echosounding survey conducted between Albany and Esperance indicated that schools were concentrated in the bays and inlets with a slightly greater number recorded per mile in Esperance Bay than King George Sound. He estimates a total quantity of pilchard from Albany to Doubtful Island as 19 800 tonnes and in Esperance Bay of 7 410 tonnes. These are very crude estimates and must be treated with caution. It is also difficult to justify his claim that: "the total quantity will not be many times the amount calculated from the sound record but it may be several times, and twice the quantity is suggested as a good working hypothesis for the total available supplies." This statement requires substantiation.

From the data available it is not possible to say where fishable concentrations are likely to be found - a fact noted by Natarov and Pashkin (1968) who said: "According

to Roughley, from 10 000 to 60 000 schools of pelagic fish were observed during some years in a limited sea area on the south west coast of Australia during the autumn-winter period of the Southern Hemisphere. A possibility of considerable fluctuations in the number of schools during years is noted in the literature. Unfortunately the causes influencing fluctuation in numbers of commercial fish, particularly the oceanographic characteristics determining conditions of formation and distribution of concentrations in time and space, are not brought under scrutiny."

Makarov and Pashkin (1968) make a generalised attempt to assess the hydrobiological character of the waters of the region and its influence on the seasonal distribution of commercial fish though it adds little to Natarov and Pashkin's general conclusion that: "The numerical strength and area of habitat of pelagic as well as demersal fish changes in accordance with the perennial changes of conditions of environment in these regions".

The fish resources of the south coastal shelf region between Cape Leeuwin and the Recherche Archipelago have not been thoroughly investigated. Houston (1954) records the failure of the *Ben Dearg* to make payable catches of demersal fish in this area and more recently the Russian expeditions have encountered problems in operating in the region.

Natarov and Pashkin (1968) reported that: "The principal task of the SRTR *Orlik* expedition was to investigate the whole complex of oceanographic and biological conditions influencing the formation of concentrations of sardine and other commercial fish in waters adjoining south and west Australia, as well as

the possibilities of expanding our own fishing activities into those parts of the world".

One part of their study centred on the shelf region between Albany and the Recherche Archipelago about which they report: "cyclonic whirls are conducive to enrichment of waters with nutrient substances, while the zone of convergence creates favourable conditions for concentrations of pelagic fish. However it is not possible to work in this region at present, due to complicated bottom profile, numerous rocks, great velocities of little known currents and, mainly, absence of navigational safety installations." This supports Houston's view of the lack of potential for demersal fishing in the region and also highlights potential problems for commercial fishing for surface or deep schools of pilchard.

Blackburn and Tubb (1950) outlined the problem when discussing the catchability of the pilchard when they said: "the opportunities for using large purse seines (i.e. about 200 x 20 fathoms or more) in the offshore waters will probably be somewhat limited, at least on the eastern Australia coast, because of weather conditions, "wildness" of shoals (at least the daytime ones which are on the whole the more conspicuous, ...), and the depth of water However, payable operations might still result if the individual catches were large".

Local knowledge would be necessary if attempts were to be made to exploit a resource between Albany and the Recherche Archipelago as the potential hazards were sufficient for the *Orlik* expedition (Natarov and Pashkin 1968) to decide that: "no systematic investigations were carried out in this region due to conditions of navigation".

Zmiyevskiy (1968) comments that the "Australian scientists have not

Densities of the pilchard (*Sardinops neopilchardus*) and catch rates by SRTR *Orlik* 1965-67 in the Great Australian Bight from Zmiyevskiy (1968).

Area	Schools per nautical mile	Maximum catch rate kg/hr	Average
1. Top of Bight from shore to 32° south and 130°-131° 30' east	7 - 25	5 000	2 100 kg/haul
2. 129°30'-130°30' E. to 32°-32°30'S	7 - 20	4 000	1 800 kg/haul
3. Western Bight 125°-126°00' east to 33°30' south	10 - 15	6 000	4 500 kg/haul

studied the pilchard of the Great Australian Bight" and presents the results of the *Orlik* in that region for that species.

Catch rates obtained for pilchard with conventional bottom gear according to three basic areas distributed: "in zones of higher biological productivity" are given in table above.

From the results he concludes that "if commercial concentrations" of pilchard are available then they will be found in the Great Australian Bight during the winter months or in early spring. This conclusion is also reiterated by Natarov and Pashkin (1968).

During the summer Zmiyevskiy reports that "In December-January the pilchard is very active and less likely to stay near the bottom; it spends most of the time, including daylight hours, in the pelagic zone. During this period, catches with bottom and mid-water trawls ranged from 10-50kg and only sometimes weighed about 600 kg per hour of trawling".

Blackburn (1950a) also reports a winter (May-June) optimum for fishing the pilchard though his conclusion refers to surface schools off Albany.

Stocks of the pilchard (sardine) *Sardinops neopilchardus* would appear to be available for exploitation on a seasonal basis though there is insufficient data to estimate a potential yield from such a fishery. The data also suggest that the densest concentrations of the species are possibly to be found to the east of the Recherche Archipelago in the Great Australian Bight.

DISCUSSION

Of the three species considered only one - the pilchard - has been the subject of biological studies in Western Australia. The studies on the pilchard suggest that exploitable stocks may exist - especially to the east of the Recherche Archipelago. Little is known about the jack mackerel in Western Australia but the evidence suggests that the main stocks are to be found in the Great Australian Bight.

Despite the fact that the B.U.T. trawlers caught blue mackerel in the Bight during the winter of 1978 it is still uncertain if a stock suitable for exploitation exists. Elsewhere in the world, *Scomber* shows marked fluctuations from year to year (Anon. 1979), has a distinct seasonality in distribution and abundance (Bigelow

& Schroeder 1953; Abe & Takashima 1958) and its fishery is prone to collapse under heavy exploitation (Parrish & McCall 1978).

The differences, noted by the English fishing Captains, in the behaviour of the Australian blue mackerel (*S. australasicus*) while being trawled compared to the European common mackerel (*S. scombrus*) can probably be explained in part by the fact that the former species has a swimbladder while the latter does not (Matsui 1967). The blue mackerel is more closely related to the cosmopolitan chub mackerel (*Scomber japonicus*) (Matsui 1967), which also has a swimbladder and inhabits the warm waters of the Atlantic, Pacific and Indian Oceans (Fischer 1973). *S. japonicus* is of minor commercial value in the Atlantic Ocean compared with *S. scombrus* which has a distribution in colder water, and it is only in the Pacific that *S. japonicus* assumes commercial significance. In the western Pacific there is a major fishery for this species around Japan and to a lesser extent for *S. australasicus* (= *S. tapeinocephalus*, Matsui 1967), the latter species having a more southerly distribution in warmer waters (Abe & Takashima 1958; Tomiyama & Hibiya 1976). In the eastern Pacific, *S. japonicus* formed the basis of an important fishery which collapsed in the 1960's as a result of recruitment overfishing. This fishery having had a complete moratorium placed on it in 1972, may, despite continued problems, be showing signs of recovery (Parrish & MacCall 1978). The occasional sighting in Australian waters of concentrations of *S. australasicus*, from a group known to be prone to erratic fluctuations of seasonal and annual distribution and abundance, should not be interpreted as an indication of a major pelagic resource.

As a general rule in evaluating the potential steady state yield from

these stocks the catch rate at the maximum sustainable yield will be about half that on the unexploited stock and the annual yield about twenty five percent of the unexploited standing stock. Thus the rational utilisation of these stocks, which are not in themselves extensive or consistent, in a marginal fishery situation such as the Great Australian Bight becomes increasingly difficult. Trawlers working out of Albany have not landed regular quantities of these species though bulk landings at certain times should be possible if they are specifically sought. All the indications however suggest that difficulties would be encountered in supplying a large volume of fish at a constant rate from the coastal waters between Cape Leeuwin to Cape Catastrophe.

While it may be considered preferable that future fishery development should concentrate on supplying the demand for fish for human consumption, pelagic fisheries, which by their typical large volume monospecific composition, lend themselves to fish meal production. However the outlook for such a development from pelagic resources of the Bight and associated areas is unlikely at present as can be exemplified by the view of the Department of Primary Industry (Anon. 1974 page 48) who state that "Generally, it could be concluded that despite sightings of large quantities of pelagic fish, there is currently insufficient knowledge of fish stocks and the potential yield to support a year round fish meal operation at one location in Australia".

With the limited extent of demersal fishing grounds and the uncertain nature of the occurrence and abundance of pelagic species the development of a commercial fishery in the Great Australian Bight has hitherto proved uneconomic.

One of the pitfalls that is apparent in previous accounts of the fishability

of the Bight waters, which also commonly applies to analysis of the east coast fishery, is the repeated comparison of catch rates with other fishing grounds, usually in the North Sea, Iceland etc. (Dannevig 1913; Fowler 1978). Differences in the physical and biological environments between the areas are usually so great as to preclude any useful comparative assessment based on values open to so much variation as catch rates. As Houston (1954) observed, there appeared to be a basic difference in the catch composition between the east coast fishery and the Bight and this fact alone should point to the difficulties of such comparative evaluation. It is clear from the lack of fishing activity on the continental shelf of the Great Australian Bight that the general oceanographic conditions necessary for such shelf fisheries are absent (Highley & Stark 1968). The demersal shelf ecosystem of the Bight from the coast to the edge of the continental shelf is characterized by a long established benthic faunal community of sponge, coral, associated cryptic invertebrates and demersal fish. The nutrient levels and zooplankton biomass of the water column on the shelf are low (Motoda *et al.* 1978) and the relatively poor catches of demersal fish on the shelf is a reflection of these characteristics.

With commercial concentrations of demersal fish restricted to a number of small fishing grounds on the continental shelf break of the western Bight, a fact established by successive fishing operations, the estimation of a total allowable catch (T.A.C.) for these demersal stocks at 3 000 t/year on the basis of evidence available at this time seems reasonable. The overall yield from these stocks would not be expected to be as great as, for instance, that obtained from the fishery of the south-east Australian coast as a consequence of the comparatively poor nutrient status of the region (Motoda *et al.* 1978;

Newell 1961, 1966; Rochford 1962). Only when a time series of fishing data is available over several years will it be possible to predict what yield can be expected to be returned for a given effort on these grounds. The ventures to the present day have not lasted long enough to allow an equilibrium to be reached in terms of yield for effort and as has been mentioned previously the comparison of catch rates from a virgin fishery in the Bight with catch rates from long established temperate water fisheries are not considered particularly useful or valid.

It is difficult to predict the future of the Great Australian Bight in terms of an Australian fishery. However it is possible that a number of small modern trawlers (c. 30m) fitted with suitable refrigeration systems and access to nearby ports could overcome the problems that have hitherto prevented profitable exploitation of the demersal resources. They could also be equipped to fish in the pelagic mode to take advantage of components of this resource as availability makes it a practical proposition.

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Great Australian Bight Trawling Catch Statistics
Tabulated data

- Table 1: Summary of catch statistics of demersal trawling ventures in the Great Australian Bight.
- Table 2a: Catch statistics of *Ben Dearg* 1949-1952 while fishing in the Great Australian Bight.
- Table 2b: Catch statistics of *Commiles*, 1949-1951 while fishing in the Great Australian Bight.
- Table 2c: Summary comparison of average monthly trawl hauls for *Ben Dearg* and *Commiles*.
- Table 3: Catch statistics of *Southern Endeavour*, 1960-61 while fishing in the Great Australian Bight.
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- Table 4d: Summary comparison of overall catch statistics for *Saxon Onward*, *Saxon Progress* and *Saxon Ranger*.
- Table 4e: Summary comparison of combined average monthly catch statistics for *Saxon Onward*, *Saxon Progress* and *Saxon Ranger*.
- Table 5a: Catch statistics of *Othello*, 1977-1979 while fishing in the Great Australian Bight.
- Table 5b: Catch statistics of *Orsino*, 1978-1979 while fishing in the Great Australian Bight.
- Table 5c: Catch statistics of *Cassio*, 1978 while fishing in the Great Australian Bight.
- Table 5d: Summary comparison of overall catch statistics for *Othello*, *Orsino* and *Cassio*.

Notes on Tables

1. Catch data in Tables 2, 3 and 4 has been converted from imperial to metric units from the original reported catch landing data. The conversion factor used is: $2.241b = 1kg$.

2. Catch data in Table 5 has been converted from the original catch data reported in the vessels' log books as blocks (frozen) to metric units. Block weight throughout the British United Trawlers operation was found to be 45.5 kg. The conversion factor used to convert the vessels' reported catch in blocks to metric units is: 1 block = 45kg.

3. Catch data reported in the Tables is for demersal trawling. In the early ventures (Tables 2, 3 and 4) demersal trawling was the only method attempted while in the British United Trawling venture (Table 5) some time

was spent pelagic trawling. These pelagic trawls, and the time engaged fishing the pelagic trawl, have been omitted from the calculations as the time spent in the search for pelagic fish is not known, making it difficult to obtain a true catch/effort statistic for this operation. The pelagic fish trawled were principally, jack mackerel (*Trachurus declivis*) blue mackerel (*Scomber australasicus*) pilchard (*Sardinops neopilchardus*) and silver trevally (*Caranx georgianus*). In summary, 2245 tonnes of fish were taken for 1328 hours pelagic trawling. However as the total effort spent on the pelagic operation i.e. trawling + searching, is not known, a comparison with the demersal catch of 3010 tonnes of fish taken for 9893 hours fishing makes pelagic trawling appear deceptively efficient.

TABLE 1: Summary of catch statistics of demersal trawling ventures in the Great Australian Bight

Vessel	Trips	Hauls	Hours fished	Catch total (kg)	Days at sea	Days on grounds	Catch per sea day (kg)	Catch per grounds day (kg)	Catch kg/haul	Catch kg/hour	Tonnes/trip
(1) <i>F.I.S. Endeavour</i>	8		266	19273						72.45	2.41
(2) <i>S.T. Bonthorpe</i>	3	57	242	20049	39	15	514	1336.6	351.7	82.85	6.68
(3a) <i>Ben Dearg</i>	31	1098	3730	592710	414	155.9	1431.67	3801.86	539.8	159	19.75
(3b) <i>Commie Lee</i>	22	352	2535	326613	282	105.4	1158.2	3908.8	404.15	129	14.85
Totals & Averages (3a & 3b)	53	1450	6265	919323	696	261.3	1320.87	3518.27	634.02	147	17.35
(4a) <i>Southern Endeavour</i>	27	1007		863416	352.35	242.43	2450.45	3561.5	857.4		31.98
(4b) <i>Southern Endeavour</i>	27	942	3808	742131	353.77	239.80	2097.78	3094.79	787.8	194.89	27.48
(5a) <i>Saxon Onward</i>	16	357	1106	506556	176	95	2878.2	5332.0	1418.9	458.0	31.65
(5b) <i>Saxon Progress</i>	19	350	1044	468892	201	109	2332.8	4301.8	1339.7	449.1	24.67
(5c) <i>Saxon Ranger</i>	3	32	80	49262	25	13	1970.5	3789.4	1539.4	615.8	16.42
Totals & Averages 5(a - c)	38	739	2230	1024710	402	217	2549.0	4722.2	1386.6	459.5	26.97
(6a) <i>Othello</i>	7	935	3820.5	1162314	304	267	2823	4353	1243	304	166.1
(6b) <i>Orsino</i>	8	758	3010.1	978062	278	207	3510	4725	1290	325	122.3
(6c) <i>Cassio</i>	5	698	3062.6	869276	206	184	4211	4724	1245	284	173.9
Total & Averages 6(a - c)	20	2391	9893.2	3009652	788	658	3819	4574	1259	304	150.5
Overall Total & Averages (3,4,5, & 6)	138	5522	22196	5695816	2240	1376	2543	4139	1031	257	41.3

(1) Dannevig (1913)

(2) Data from Serventy in Appendix 1, cruises 5, 6 & 7, catch total edible fish only.

(3a) Data from Table 2a with totals excluding experimental trips and cruise of 18.10.50.

(3b) Data from Table 2b with totals excluding experimental trips.

(4) Data from log sheet summaries.

(5) Data from Kesteven and Stark (1967) Table 2, (excluding cruises 1, 2 and 3) and Table 6.

(6) Data from vessel monthly returns.

TABLE 2a: Catch statistics of *Ben Deang* 1949-1952 while fishing in the Great Australian Bight

Trip	Landed catch kg	Days at sea	Days on grounds	Hauls	Catch/sea day kg	Catch/day on grounds kg	Catch/hour kg	Catch/haul kg	Lat.	Position Long.	Hours Fishing	Av. Trawl duration (hours)
<u>1949</u>												
1. Sept	15 157	9	4.0	19	1 684	3 789	303	798	23 14 33 19	126 14 126 19	50	2.63
2. Oct	10 152	11	4.5	20	923	2 256	175	508	33 29 33 12	126 06 127 09	58	2.90
3. Nov	(17 426)	15	10.0	37	1 162	1 743	171		33 13 33 28	126 03 126 16	102	2.76
4. Nov	(14 247)	16	11.0	41	890	1 295	152		33 18 32 50	128 29 126 17	94	2.29
Experimental	31 673	31	21.0	78	1 021	1 508	102	406			196	2.51
5. Dec	(464)	7	6.0	-	66	77	29		34 30 35 24	116 30 120 20	16	
6. Dec	(11 217)	14	8.0	39	801	1 402	140		33 12 33 20	125 57 126 24	80	2.05
	11 681	21	14.0	39	556	834	122	299			96	2.46
<u>1950</u>												
7. Jan	14 035	14	9.0	25	1 002	1 559	115	561	33 15 33 35	125 45 126 40	122	4.88
8. Feb	22 642	12		40				566	33 35 33 19	125 50 126 08		
9. Mar	(28 558)	16	11.5	43	1 785	2 483	182		33 30 33 20	126 00 125 50	157	3.65
10. Mar	(25 347)	16	11.0	33	1 584	2 304	128		33 19 33 34	125 11 125 56	198	6.00
	53 935	32	22.5	76	1 685	2 397	152	710			355	4.67

Table 2a (contd)

Trip	Landed catch kg	Days at sea	Days on grounds	Hauls	Catch/ sea day kg	Catch/day on grounds kg	Catch/ hour kg	Catch/ haul kg	Lat.	Position	Long.	Hours Fishing	Av. Trawl duration (hours)
<u>1950</u>													
11 Apr	(23 269)	14	9.5	46	1 662	2 449	124		33 30 33 30	126 10 125 30		187	4.07
12 Apr	(22 945)	13	8.5	30	1 765	2 699	264		34 34	123 19		87	2.90
	46 214	27	18.0	76	1 712	2 567	169	608				274	3.61
13 May	31 566	16	12.5	59	1 973	2 525	175	535	33 40 33 27	125 38 125 55		180	3.05
14 Jun	(16 532)	14	9.0	37	1 181	1 837	127	447	33 20 33 35	126 20 125 40		130	3.51
15 Jun	(17 288)	16	11.0	36	1 080	1 572	13	480	33 20	126 00		133	3.69
	33 820	30	20.0	73	1 127	1 691	129	463				263	3.60
16 July	19 220	16	10.5	50	1 201	1 830	110	384	33 10	126 35		174	3.48
17 Aug	13 566	15	8.5	38	904	1 596	128	357	33 15 33 46	126 40 125 25		106	2.79
18 Oct	3 638	10	4.5		364	808	50		33 46	125 25		73	
19 Nov	16 245	15	9.5	48	1 083	1 710	92	338	33 12 33 40	128 00 125 40		176	3.67
<u>1951</u>													
20 Feb	28 033	15	9.5	50	1 869	2 951	160	561	33 22 33 35	126 10 125 47		175	3.50
21 Mar	35 458	13	9.0	46	2 727	3 940	206	771	33 16	126 30		172	3.74
22 Apr	(28 024)	13	8.5	39	2 156	3 297	188	719	33 15 33 17	126 30 126 20		149	3.82
23 Apr	(18 000)	12	7.5	36	1 500	2 400	133	500	33 42	125 38		135	3.75
	46 024	25	16.0	75	1 841	2 876	162	614				284	3.79

Table 2a (contd)

Trip	Landed catch kg	Days at sea	Days on grounds	Hauls	Catch/sea day kg	Catch/day on grounds kg	Catch/hour kg	Catch/haul kg	Position		Hours Fishing	Av. Trawl duration (hours)
									Lat.	Long.		
<u>1951</u>												
Experimental 24 May	92	5	-	-	18	-	-	-	34 40 34 40	119 00 122 00		
Experimental 25 Jun	845	9	9.0	33	94	94	56	-	Albany area		15	
Experimental 26 July	(1 465	16	11.5	36	92	127	44	-	34 33	121 01	33	
27 July	(17 530	15	10.0	36	1 169	1 753	145	487	33 40 33 20	125 34 127 40	121	3.36
28 Aug	18 995	31	21.5	33	613	883	123	500	33 20	127 12	154	3.21
29 Sept	15 386	14	9.5	36	1 178	1 620	139	427	Bight area		138	3.83
30 Oct	19 225	15	9.5	40	1 099	2 024	122	481	33 42 33 16	125 28 127 31	158	3.95
31 Nov	(5 934	11	5.5	18	539	1 079	85	330	33 30 33 17	125 38 127 12	70	3.89
32 Nov	(12 729	11	6.5	21	1 157	1 958	141	606	33 16 33 29	127 07 125 48	90	4.29
	18 663	22	12.0	39	848	1 555	116	478			160	4.10
<u>1952</u>												
33 Jan	(25 629	12	7.5	39	2 136	3 417	175	657	33 40 33 16	125 35 126 38	146	3.74
Experimental 34 Jan	(346	10	8.0		35	43	49		Doubtful Bay		7	
	25 975	22	15.5		1 181	1 676	170				153	
35 Feb	34 789	13	8.0	37	2 676	4 349	247	940	33 43 33 18	125 34 126 15	141	3.81
36 Mar	16 066	11	5.5	26	1 460	2 921	173	618	33 18	126 15	93	3.58
Totals excluding experimental trips and trip 18.	592 710	414	259.0	1 098	1 432	2 288	159	540			3 730	3.40

TABLE 2b: Catch statistics of *Comméles*, 1949-1951 while fishing in the Great Australian Bight

Trip	Landed catch kg	Days at sea	Days on grounds	Hauls	Catch/ sea day kg	Catch/day on grounds kg	Catch/ hour kg	Catch/ haul kg	Lat.	Position Long.	Hours fishing	Av. Trawl duration (hours)
<u>1949</u>												
1. Oct	(5 962	11.0	4.0		542	1 490	124				49	
2. Oct	(11 858	9.5	6.0		1 248	1 976	174				68	
	17 820	20.5	10.0		869	1 782	152				117	
3. Nov	(9 452	12.0	6.0		788	1 575	86				110	
4. Nov	(27 276	11.5	8.0		2 372	3 409	255				107	
	36 728	23.5	14.0		1 563	2 623	169				217	
5. Dec	13 678	12.0	7.0		1 140	1 954	182				75	
<u>1950</u>												
6. Jan	9 576	14.5	5.0		660	1 915	192				50	
7. Feb	(18 137	14.0	9.0		1 295	2 015	101		33 30	126 00	180	
	(33 30	125 30	194	
8. Feb	(22 794	14.0	9.0		1 628	2 533	117		33 30	126 30		
	40 931	28.0	18.0		1 462	2 274	109				374	
9. Mar	24 310	13.5	9.0		1 801	2 701	128		33 12	126 00	190	
10. Apr	(22 803	14.0	9.0		1 629	2 534	135		33 20	126 00	169	
11. Apr	(18 505	12.0	7.0		1 542	2 644	143		33 20	126 00	129	
	41 308	26.0	16.0		1 589	2 582	139				298	
12. May	17 849	15.0	10.0	45	1 190	1 785	114	397	33 40	125 00	157	3.49
									33 20	126 00		
13. Aug	9 442	13.0	6.0	30	726	1 574	86	315	33 35	125 40	110	3.67
									33 15	126 10		

Table 2b (contd)

Trip	Landed catch kg	Days at sea	Days on grounds	Hauls	Catch/sea day kg	Catch/day on grounds kg	Catch/hour kg	Catch/haul kg	Lat.	Long.	Hours fishing	Av. Trawl duration (hours)
14. Sept	(4 646	9.0	3.5	15	516	1 327	101	310	33 15 33 20	126 44 128 09	46	3.07
15. Sept	(21 441	14.0	9.0	42	1 531	2 382	155	510	33 35 33 00	125 30 126 10	138	3.29
	26 087	23.0	12.5	57	1 134	2 087	142	458			184	3.23
16. Oct	14 096	14.0	9.0	38	1 007	1 566	114	371	33 15	125 44	124	3.26
17. Dec	9 949	12.0	8.0	33	829	1 244	86	301	33 30 33 20	125 50 126 25	116	3.52
<u>1951</u>												
18. Jan	13 025	13.0	8.0	35	1 002	1 628	112	372	33 29 33 39	126 03 125 42	116	3.31
19. Feb	30 169	15.0	9.5	46	2 011	3 176	183	656	33 18	126 13	165	3.59
20. May	6 173	13.0	7.5	20	475	823	64	309	33 12 33 40	125 34 126 48	96	4.80
21. June	8 514	15.0	9.5	30	568	896	100	284	33 19 33 52	125 15 126 14	85	2.83
Experimental 22. July	742	10.0	7.0	12	74	106	18	62	34 35	121 25	42	3.50
23. Aug	6 958	11.0	4.0	18	632	1 739	114	387	33 20 33 20	126 30 127 00	61	3.39
Experimental 24. Sept	7 066	6.0	4.0	34	1 178	1 766	97	208	34 29	121 29	73	2.15
Totals excluding experimental trips.	326 613	282	163.0	352	1 158	2 004	129	*404			2 535	* 3.45

* Calculated only from those cruises for which haul numbers are available

TABLE 2c: Summary comparison of average monthly trawl hauls for *Ben Dearg* and *Commiles*

Month 1949	<i>Ben Dearg</i> Kg	<i>Commiles</i> Kg	Av. Catch/haul/month Kg
Sept	798	-	798
Oct	508	-	508
Nov	406	-	406
Dec	299	-	299
<u>1950</u>			
Jan	561	-	561
Feb	566	-	566
Mar	710	-	710
Apr	608	-	608
May	535	397	466
June	463	-	463
July	384	-	384
Aug	357	315	336
Sept	-	458	458
Oct	-	371	371
Nov	338	-	338
Dec	-	301	301
<u>1951</u>			
Jan	-	372	372
Feb	561	656	608
Mar	771	-	771
Apr	614	-	614
May	-	309	309
June	-	284	284
July	487	-	487
Aug	500	387	443
Sept	427	208	317
Oct	481	-	481
Nov	478	-	478
Dec	-	-	-
<u>1952</u>			
Jan	657	-	657
Feb	940	-	940
Mar	618	-	618

Table 3: Catch statistics of *Southern Endeavour*, 1960-1961
while fishing in the Great Australian Bight

	Trip 1960	Landed catch Kg	Days at sea	Days on grounds	HAULS	Catch/day at sea Kg	Catch/day on grounds Kg	Catch/ haul Kg
4.	13/4 - 23/4	15 272	9.00	4.16	23	1697	3671	664
5.	28/4 - 13/5	30 545	13.37	9.11	35	2285	3353	873
6.	19/5 - 28/5	19 155	9.25	5.54	22	2071	3458	871
		49 700	22.62	14.65	57	2197	3392	872
7.	8/6 - 19/6	27 173	10.79	6.08	22	2518	4469	1235
8.	8/7 - 22/7	30 704	13.93	9.04	34	2204	3396	903
9.	27/7 - 12/8	59 055	16.00	8.66	40	3691	6819	1476
10.								
11.	5/9 - 17/9	34 459	11.71	7.70	38	2943	4475	907
12.	22/9 - 7/10	45 627	14.71	9.58	49	3102	4763	931
13.	13/10 - 25/10	27 905	12.33	7.51	37	2263	3716	754
		73 532	27.04	17.09	86	2719	4302	855
14.	31/10 - 11/11	33 600	11.00	7.13	34	3055	4712	988
15.	15/11 - 21/11	4 677	6.35	2.00	11	736	2338	425
		38 277	17.35	9.13	45	2206	4192	850
16.	23/11 - 9/12	44 991	15.81	11.51	59	2846	3909	763
	1961							
17.	6/1 - 20/1	44 355	14.02	8.87	41	3164	5001	1082
18.	24/1 - 5/2	36 909	11.94	7.50	30	3091	4921	1230
19.	9/2 - 24/2	46 772	14.99	10.29	47	3120	4545	995
		83 681	26.93	17.79	77	3107	4704	1087
20.	4/3 - 17/3	53 200	13.00	9.80	41	4092	5429	1298
21.	22/3 - 7/4	47 055	16.00	10.77	52	2941	4369	905
22.	12/4 - 28/4	20 109	16.38	11.27	41	1228	1784	490
		67 164	32.38	22.04	93	2074	3047	722
23.	3/5 - 12/5	15 309	9.33	5.40	27	1641	2835	567
24.	9/6 - 23/6	27 141	13.88	9.38	41	1955	2893	662
25.	29/6 - 14/7	25 136	15.40	11.10	48	1632	2264	524
26.	20/7 - 5/8	33 759	16.05	12.08	50	2103	2795	675
27.	10/8 - 26/8	24 850	15.89	12.77	38	1564	1946	654
		58 609	31.94	24.85	88	1835	2358	666
28.	31/8 - 12/9	28 095	15.97	12.65	49	1759	2221	573
29.	22/9 - 6/10	29 877	14.31	10.83	49	2088	2759	610
30.	11/10 - 26/10	32 232	14.92	11.88	52	2160	2713	620
		62 109	29.23	22.71	101	2125	2735	615
31.	2/11 - 17/11	25 454	15.02	9.82	46	1695	2592	553

TABLE 4a: Catch statistics of *Saxton Onward*, 1975-1976 while fishing in the Great Australian Bight

Trips 1975	Landed catch (kg)	Days at sea	Days on grounds	Hauls	Catch per sea day (kg)	Catch per Day on grounds (kg)	Catch/haul (kg)
March	19 000	13	6	18	1461.5	3166.6	1055.5
March	24 716	13	5	14	1901.2	4943.2	1765.4
April	41 596	14	8	36	2971.1	5199.5	1155.4
May	44 825	14	9	32	3201.7	4980.5	1400.8
June	32 887	12	7	26	2740.5	4698.1	1264.9
June	45 684	12	7	30	3807.0	6526.3	1522.8
July	32 417	12	5	22	2701.4	6483.4	1473.5
July	25 585	12	7	20	2132.0	3655.0	1279.3
August	22 874	7	3	9	3267.7	7624.7	2541.6
Sept	25 575	10	6	20	2557.5	4262.5	1278.8
Oct	35 210	11	7	26	3201.0	5030	1354.2
Nov	38 225	10	6	24	3822.5	6370.8	1592.7
Nov	18 356	6	2	9	3059.3	9178	2039.6
<u>1976</u>							
Jan	34 854	11	6	24	3168.5	5809.0	1452.3
Feb	39 992	10	6	26	3399.2	5665.3	1307.4
Mar	30 761	9	5	21	3417.9	6152.2	1464.8
<u>TOTALS</u>							
16	506 556	176	95	357	2878.2	5332.2	1418.9

TABLE 4b: Catch statistics of *Saxon Progress*, 1975-1976
while fishing in the Great Australian Bight

Trips 1975	Landed catch (kg)	Days at sea	Days on grounds	Hauls	Catch per day on sea day (kg)	Catch per day on grounds (kg)	Catch per haul (kg)
March	13 000	13	5	10	1,000	2,600	1,300
April	21 724	13	7	26	1671.1	3103.4	835.5
April	35 217	14	7	27	2515.5	5031	1304.3
May	32 726.8	13	8	20	2517.5	4090.9	1636.3
June	33 237.5	12	5	18	2769.8	6647.5	1846.5
June	33 658	13	7	24	2589.1	4808.3	1402.4
July	16 236.6	13	9	15	1,249	1804.1	1802.4
Aug.	7 851	10	6	12	785.7	1309.5	654.8
Nov.	23 787	9	5	20	2 643	4 751	1189.4
Nov.	20 438	8	4	15	2554.8	5109.6	1362.6
Dec.	3663.4	5	1	2	732.7	3663.4	1831.7
Dec.	25 103.6	9	5	16	2789.3	5020.7	1569.0
<u>1976</u>							
Jan.	33 068.8	11	6	20	3006.3	5511.5	1653.4
Feb.	22 383.0	11	6	18	2034.8	3730.5	1243.5
Mar.	35 759.8	12	8	33	2980.0	4470.0	1083.6
April	46 553.6	11	7	30	4232.1	6650.5	1551.8
April	3 151.8	5	1	3	630.4	3151.8	1050.6
May	34 836.6	10	6	23	3483.7	5806.1	1514.6
June	26 488.4	9	6	18	2943.2	4414.7	1471.6
Totals							
19	468 891.96	201	109	350	2332.8	4301.8	1339.7

TABLE 4c: Catch statistics of *Saxon Ranger* 1975, while
fishing in the Great Australian Bight

Trips 1975	Landed catch (kg)	Days at sea	Days on grounds	Hauls	Catch per day on sea day (kg)	Catch per day on grounds (kg)	Catch per haul (kg)
March	7 000	6	2	5	1166.6	3500	1400
April	5 824.1	6	2	3	970.7	2912.1	1941.4
May	36 437.5	13	9	24	2802.9	4048.6	1518.2
Totals							
3	49 261.6	25	13	32	1970.5	3789.4	1539.4

TABLE 4d: Summary comparison of overall catch statistics for *Saxon Onward*, *Saxon Progress* and *Saxon Ranger*

Vessel	Trips	Hauls	Hours fished	Catch total (kg)	Days at sea	Days on grounds	Catch per sea day (kg)	Catch per grounds day (kg)	Catch kg/haul	Catch kg/hour	Tonnes/ trip
<i>Saxon onward</i>	16	357	1 106	506 556	176	95	2878.2	5332.0	1418.9	458.0	31.65
<i>Saxon progress</i>	19	350	1 044	468 892	201	109	2332.8	4301.8	1339.7	449.1	24.67
<i>Saxon ranger</i>	3	32	80	49 262	25	13	1970.5	3789.4	1539.4	615.8	16.42
TOTALS	38	739	2 230	1 024 710	402	217	2549.0	4722.2	1386.6	459.5	26.97

TABLE 4e: Summary comparison of combined average monthly catch statistics for *Saxon Onward*, *Saxon Progress* and *Saxon Ranger*

Total (3 vessels) by month	Trips	Hauls	Hrs fished	Catch total (kg)	Days at sea	Days on grounds	Catch per sea day (kg)	Catch per grounds day (kg)	kg/haul	Tonnes/ trip
<u>1975</u>										
March	4	47	63716	45	18	1415.9	3539.8	1355.7	15.9	
April	4	92	104361.1	47	24	2220.5	4348.4	1134.4	26.1	
May	3	76	113989.3	40	26	2849.7	4384.2	1499.9	38.0	
June	4	98	145466.5	49	26	2968.7	5594.9	1484.4	36.4	
July	3	57	74238.6	37	21	2006.5	3535.2	1302.4	24.8	
August	2	21	30731.0	17	9	1807.7	3414.6	1463.4	15.4	
Sept	1	20	25575	10	6	2557.5	4262.5	1278.8	26.6	
October	1	26	35210	11	7	3200.9	5030.0	1354.2	35.2	
November	4	68	100806.9	33	17	3054.8	5930.0	1482.5	25.2	
December	2	18	28767	14	6	2054.8	4794.5	1598.2	14.4	
<u>1976</u>										
January	2	44	67922.8	22	12	3087.4	5660.2	1543.7	34.0	
February	2	44	56375	21	12	2684.5	4697.9	1281.3	28.2	
March	2	54	66520.8	21	13	3167.7	5117.0	1231.9	33.3	
April	2	33	49705.4	16	8	3106.6	6213.2	1506.2	24.9	
May	1	23	34836.6	10	6	3483.7	5806.1	1514.6	34.8	
June	1	18	26488.4	9	6	2943.2	4414.7	1471.6	26.5	
TOTAL	38	739	1 024 710	402	217	2549.0	4722.2	1386.6		26.97

Table 5a: Catch statistics for *Othello*, Demersal trawling in the Great Australian Bight

Trip	Dates	Total landed catch kg	Valid landed catch kg	Days at sea	Days on grounds	No. hauls	Catch/day at sea kg	Catch/day on grounds kg	Catch/haul kg	Hours fished	Catch/hr trawling	Av. trawl duration hours
1. 1977												
	19-24/11	10 800	9 855	6	6	14	1 642	1 642	703	36.5	270	2.61
	25/11-1/12	17 932	17 932	7	7	24	2 562	2 562	747	62.25	288	2.59
	2-6/12	17 617	17 617	5	5	25	3 523	3 523	705	76.25	230	3.05
	9-14/12	25 807	21 037	6	6	21	3 506	3 506	1 002	72.08	292	3.43
	20-22/12	18 112	14 692	3	3	8	4 897	4 897	1 836	27.75	529	3.47
	23-29/12	26 910	26 910	7	7	28	3 844	3 844	961	101.85	264	3.64
	30-31/12	9 742	9 742	2	2	10	4 871	4 871	974	42.00	232	4.20
	1-3/1/78	8 797	7 920	3	3	8	2 640	2 640	990	32.77	242	4.10
	TOTAL	135 717	125 705	39	39	138	3 223	3 223	910	451.45	278	3.27
1. 1978												
	22-27/1	19 440	17 370	6	5	19	2 895	3 474	914	69.58	250	3.66
	28/1-3/2	27 495	25 380	7	6	21	3 626	4 230	1 209	80.08	317	3.81
	4-10/2	40 590	33 547	7	7	24	4 792	4 792	1 398	103.42	324	4.31
	11-15/2	20 272	16 582	5	5	17	3 316	3 316	975	73.08	227	4.30
	18-24/2	51 412	40 297	7	7	27	5 757	5 757	1 492	96.43	418	3.57
	25/2-3/3	46 395	33 727	7	7	25	4 818	4 818	1 349	91.33	369	3.65
	4-10/3	66 060	59 490	7	7	26	8 499	8 499	2 288	101.63	585	3.91
	11-17/3	45 292	43 920	7	7	28	6 274	6 274	1 569	109.33	402	3.90
	TOTAL	316 956	270 313	53	51	187	5 100	5 300	1 445	728.88	373	3.88
2.												
	2-7/4	53 460	47 722	6	5	23	7 954	9 544	2 075	103.75	460	3.71
	8-14/4	51 165	46 732	7	7	28	6 676	6 676	1 669	127.00	368	4.54
	15-21/4	61 267	52 582	7	7	27	7 512	7 512	1 947	109.08	482	4.04
	22-28/4	69 862	67 882	7	7	36	9 697	9 697	1 886	140.75	482	3.91
	29/4-5/5	24 570	19 710	7	5	14	2 816	3 942	1 408	59.92	329	4.28
	6-12/5	35 955	32 692	7	7	26	4 670	4 670	1 257	119.50	274	4.60
	13-15/5	9 427	7 605	3	3	7	2 535	2 535	1 086	34.22	222	4.89
	TOTAL	305 706	274 925	44	41	161	6 248	6 705	1 708	694.22	396	4.31

Table 5a (contd)

Trip	Dates	Total landed catch kg	Valid landed catch kg	Days at sea	Days on grounds	No. hauls	Catch/day at sea kg	Catch/day on grounds kg	Catch/haul kg	Hours fished	Catch/hr trawling	Av. trawl duration hours	
3.	29/5-2/6	3 757	3 712	5	4	10	742	928	371	31.50	118	3.15	
	3-9/6	49 252	44 660	7	7	27	6 377	6 377	1 653	115.92	385	4.29	
	10-16/6	26 145	19 395	7	7	23	2 342	2 342	843	96.82	200	4.21	
	17-23/6	45 472	44 392	7	7	29	6 342	6 342	1 531	131.42	338	4.53	
	24-30/6	22 410	21 015	7	5	17	3 002	4 203	1 236	74.57	282	4.39	
	1-7/7	8 865	8 122	7	3	8	1 160	2 707	1 015	34.17	238	4.27	
	8-14/7	22 410	21 510	7	5	18	3 073	4 302	1 195	78.90	273	4.38	
	15-21/7	41 715	38 970	7	7	26	5 567	5 567	1 499	116.10	336	4.47	
	22/7	3 622	3 262	1	1	2	3 262	3 262	1 631	9.75	335	4.88	
	TOTAL		223 648	205 018	55	46	160	3 727	4 457	1 281	689.15	297	4.31
	4.	8/8	1 102	1 102	1	1	2	1 102	1 102	551	7.33	150	3.67
		13-18/8	41 535	32 647	6	6	18	5 441	5 441	1 814	94.92	384	4.72
		19-25/8	38 812	33 615	7	7	22	4 802	4 802	1 528	108.33	310	4.92
26/8-1/9		18 562	16 245	7	4	15	2 321	4 061	1 083	72.68	223	4.85	
2-8/9		25 740	25 177	7	7	30	3 597	3 597	839	126.15	200	4.21	
9-15/9		11 857	10 282	7	4	10	1 469	2 570	1 028	40.42	254	4.04	
16-22/9		24 660	23 827	7	6	19	3 404	3 971	1 254	78.92	302	4.15	
23-29/9		23 355	22 635	7	6	23	3 234	3 772	984	104.33	217	4.54	
30/9-6/10		15 750	14 445	7	5	9	2 064	2 889	1 605	43.28	334	4.81	
7-13/10		0	0	7	0	0	0	0	0	0	0	0	
TOTAL			201 373	179 975	63	47	148	2 857	3 829	1 216	666.36	270	4.50
5.		4-10/11	16 717	14 130	7	5	19	2 019	2 826	744	86.68	163	4.56
		11-17/11	13 882	12 330	7	7	14	1 761	1 761	881	58.33	211	4.17
	18-20/11	7 807	7 807	3	3	11	2 602	2 602	710	42.58	183	3.87	
	30/11-1/12	1 597	1 597	2	2	4	798	798	399	17.42	92	4.36	
	2-8/12	15 367	14 917	7	7	21	2 131	2 131	710	88.17	169	4.20	
	9-15/12	21 622	21 375	7	7	27	3 054	3 054	792	113.77	188	4.21	
	16-18/12	3 555	3 555	3	3	7	1 185	1 185	508	30.42	117	4.35	
	TOTAL		80 547	75 711	36	34	103	2 103	2 227	735	437.37	173	4.25

Table 5a. (contd)

Trip	Dates	Total landed catch kg	Valid landed catch kg	Days at sea	Days on grounds	No. hauls	Catch/day at sea kg	Catch/day on grounds kg	Catch/haul kg	Hours fished	Catch/hr trawling	Av. trawl duration hours
1.	1979											
	20-22/2	720	720	3	2	4	240	360	180	9.83	73	2.46
	27/2-3/3	5 917	5 917	5	5	11	1 183	1 183	538	44.00	134	4.00
	4-9/3	24 030	24 030	6	6	23	4 005	4 005	1 045	103.27	233	4.49
	TOTAL	30 667	30 667	14	13	38	2 190	2 359	807	157.10	195	4.13
1.	1977	135 717	125 705	39	39	138	3 223	3 223	910	451.45	278	3.27
1.	1978	316 956	270 313	53	51	187	5 100	5 300	1 445	724.88	373	3.88
2.		305 706	274 925	44	41	161	6 248	6 705	1 708	694.22	396	4.31
3.		223 648	205 018	55	46	160	3 727	4 557	1 281	689.15	297	4.31
4.		201 373	179 975	63	47	148	2 857	3 829	1 216	666.36	270	4.50
5.		80 547	75 711	36	34	103	2 103	2 227	735	437.37	173	4.25
1.	1979	30 667	30 667	14	13	38	2 190	2 359	807	157.10	195	4.13
	TOTAL	1 294 614	1 162 314	304	267	935	3 823	4 353	1 243	3820.53	304	4.09

Table 5b: Catch statistics for *Onchino*, 1977-1979, Demersal trawling in the Great Australian Bight

Trip	Dates	Total landed catch kg	Valid landed catch kg	Days at sea	Days on grounds	No. hauls	Catch/day at sea kg	Catch/day on grounds kg	Catch/haul kg	Hours fished	Catch/hr trawling	Av. trawl duration hours
1978												
1.	11/3-17/3	25 281	24 583	7	7	21	3 512	3 512	1 171	83.08	296	3.96
	18/3-24/3	35 685	31 599	7	7	36	4 514	4 514	878	106.33	297	2.95
	25/3-31/3	78 961	78 961	7	7	37	11 280	11 280	2 134	136.87	577	3.70
	1/4-7/4	46 138	45 090	7	5	16	6 441	9 018	2 818	65.42	689	4.09
	8/4-14/4	44 109	39 465	7	7	23	5 638	5 638	1 716	96.95	407	4.22
	15/4-21/4	43 920	40 936	7	6	27	5 848	6 823	1 516	103.53	395	3.83
	22/4/-28/4	58 734	55 170	7	7	32	7 881	7 881	1 724	129.25	427	4.04
	TOTAL	332 828	315 804	49	46	192	6 445	6 865	1 645	721.43	438	3.76
2.	12/5	0	0	1	1	2	0	0	0	4.27	0	2.14
	13/5-19/5	44 347	36 630	7	6	24	5 233	6 105	1 526	76.82	477	3.20
	20/5-26/5	43 470	42 232	7	7	32	6 033	6 033	1 320	118.77	356	3.71
	27/5-2/6	35 199	31 509	7	7	30	4 501	4 501	1 050	116.35	271	3.88
	3/6-9/6	36 720	35 919	7	7	33	5 131	5 131	1 088	135.50	265	4.11
	10/6-11/6	9 666	9 666	2	2	9	4 833	4 833	1 074	38.50	251	4.28
	TOTAL	169 402	155 956	31	30	130	5 031	5 198	1 200	490.21	318	3.77
3.	24/6-30/6	37 305	37 305	7	7	27	5 329	5 329	1 382	82.02	455	3.04
	1/7-7/7	21 667	18 832	7	3	11	2 690	6 277	1 712	45.00	418	4.09
	8/7-14/7	0	0	7	0	0	0	0	0	0	0	0
	15/7	0	0	1	0	0	0	0	0	0	0	0
	TOTAL	58 972	56 137	22	10	38	2 552	5 614	1 477	127.02	442	3.34
4.	27/7-28/7	6 448	6 246	2	2	8	3 132	3 132	781	31.00	201	3.88
	29/7-4/8	24 421	22 599	7	7	26	3 228	3 228	869	106.50	212	4.10
	5/8-11/8	43 537	41 184	7	7	29	5 883	5 883	1 420	117.05	352	4.04
	12/8-18/8	10 318	10 318	7	3	8	1 474	3 439	1 290	36.02	286	4.50
	19/8-25/8	19 935	19 935	7	4	17	2 848	4 983	1 173	74.17	269	4.76
	26/8	2 871	2 871	1	1	3	2 871	2 871	957	13.67	210	4.56
	TOTAL	107 530	103 153	31	24	91	3 327	4 298	1 134	378.41	273	4.16

Table 5b (contd)

Trip	Dates	Total landed catch kg	Valid landed catch kg	Days at sea	Days on grounds	No. hauls	Catch/day at sea kg	Catch/day on grounds kg	Catch/haul kg	Hours fished	Catch/hr trawling	Av. trawl duration hours
5.	30/9 - 6/10	14 728	14 728	7	4	9	2 104	3 682	1 636	40.52	363	4.5
	7/10-13/10	0	0	7	0	0	0	0	0	0	0	0
	14/10-20/10	2 970	2 970	7	2	3	424	1 485	990	15.00	198	5.0
	21/10-27/10	1 215	1 215	7	1	1	174	1 215	1 215	5.00	243	5.0
	28/10	0	0	1	0	0	0	0	0	0	0	0
	TOTAL	18 913	18 913	29	7	13	652	2 702	1 455	60.52	312	4.66
6.	11/11-17/11	29 011	29 011	7	7	24	4 144	4 144	1 209	96.62	300	4.03
	18/11-24/11	12 060	9 945	7	3	10	1 421	3 315	994	40.00	249	4.00
	25/11- 1/12	8 145	8 145	7	4	11	1 164	2 036	740	40.00	204	3.64
	2/12- 8/12	28 777	21 667	7	7	25	3 095	3 095	867	95.58	227	3.82
	9/12-11/12	11 970	10 980	3	3	11	3 660	3 660	998	39.67	277	3.61
	TOTAL	89 963	79 748	31	24	81	2 572	3 323	984	311.87	256	3.85
1.	5/1- 6/1	0	0	2	0	0	0	0	0	0	0	0
	7/1-13/1	15 907	15 907	7	5	13	2 272	3 181	1 224	59.78	184	4.60
	14/1-20/1	19 282	19 282	7	7	15	2 639	2 639	1 285	56.05	344	3.74
	21/1-27/1	2 992	2 002	7	3	3	286	667	667	12.67	158	4.22
	28/1- 3/2	21 532	21 532	7	7	20	3 076	3 076	1 077	93.55	230	4.68
	4/2-10/2	42 637	41 062	7	7	30	5 866	5 866	1 369	124.08	331	4.14
	11/2-17/2	34 267	34 267	7	7	32	4 895	4 895	1 071	129.98	264	4.06
	18/2-23/2	29 610	29 610	6	6	22	4 935	4 935	1 346	96.65	306	4.39
	TOTAL	166 227	163 662	50	42	135	3 257	3 897	1 212	572.76	286	4.24

Table 5b (contd)

Trip	Dates	Total landed catch kg	Valid landed catch kg	Days at sea	Days on grounds	No. hauls	Catch/day at sea kg	Catch/day on grounds kg	Catch/haul kg	Hours fished	Catch/hr trawling	Av. trawl duration hours
2.	23/4-28/4	12 622	9 517	6	4	10	1 586	2 379	952	46.93	203	4.69
	29/4- 4/5	5 895	5 895	6	2	6	982	2 947	982	31.57	187	5.26
	6/5-12/5	6 885	6 885	7	2	4	984	3 442	1 721	17.97	383	4.49
	13/5-19/5	33 480	29 610	7	7	25	4 230	4 230	1 184	103.05	287	4.12
	20/5-26/5	23 310	23 310	7	7	26	3 140	3 140	896	122.18	191	4.70
	27/5-28/5	9 472	9 472	2	2	7	4 736	4 736	1 353	26.17	362	3.74
	TOTAL	91 664	84 689	35	24	78	2 382	3 529	1 086	347.87	243	4.46
1.	1978	332 828	315 804	49	46	192	6 445	6 865	1 645	721.43	438	3.76
2.		169 402	155 956	31	30	130	5 031	5 198	1 200	490.21	318	3.77
3.		58 972	56 137	22	10	38	2 552	5 614	1 477	127.02	442	3.34
4.		107 530	103 153	31	24	91	3 327	4 298	1 134	378.41	273	4.16
5.		18 913	18 913	29	7	13	652	2 702	1 455	60.52	312	4.66
6.		89 963	79 748	31	24	81	2 572	3 323	984	311.87	256	3.85
1.	1979	166 227	163 662	50	42	135	3 257	3 897	1 212	572.76	286	4.24
2.		91 664	84 689	35	24	78	2 382	3 529	1 086	347.87	243	4.46
	TOTAL	1 035 499	978 062	278	207	758	3 510	4 725	1 290	3 010.09	325	3.97

Table 5c: Catch statistics for *Cassio*, 1977-1979, Demersal trawling in the Great Australian Bight

Trip	Dates	Total landed catch kg	Valid landed catch kg	Days at sea	Days on grounds	No. hauls	Catch/day at sea kg	Catch/day on grounds kg	Catch/haul kg	Hours fished	Catch/hr trawling	Average trawl duration hours
1978												
1.	10/6-16/6	24 196	23 386	7	7	26	3 341	3 341	899	112.25	208	4.32
	17/6-23/6	48 793	48 186	7	7	31	6 884	6 884	1 554	138.57	348	4.47
	24/6-30/6	51 570	50 724	7	7	33	7 246	7 246	1 537	140.18	362	4.25
	1/7-7/7	35 176	35 176	7	4	15	5 025	8 794	2 345	66.20	531	4.41
	8/7-14/7	29 047	27 000	7	4	17	3 857	6 750	1 588	73.95	365	4.35
	15/7-21/7	50 670	48 757	7	7	24	6 965	6 965	2 031	113.40	430	4.73
	22/7-28/7	30 375	30 375	7	7	21	4 339	4 339	1 446	98.08	310	4.67
	29/7-4/8	54 472	53 550	7	7	33	7 650	7 650	1 623	133.50	401	4.05
	5/8-11/8	72 360	71 145	7	7	26	10 164	10 164	2 736	112.90	630	4.34
	TOTAL	396 659	388 299	63	57	226	6 146	6 812	1 718	989.03	393	4.38
2.	9/9-15/9	33 952	33 952	7	7	26	4 850	4 850	1 306	104.32	325	4.01
	16/9-20/9	22 050	22 050	5	5	20	4 410	4 410	1 102	87.18	253	4.36
	24/9-29/9	26 370	26 370	6	6	23	4 395	4 395	1 146	102.12	258	4.44
	30/9-6/10	20 002	20 002	7	7	14	2 857	2 857	1 429	70.82	282	5.06
	7/10-13/10	8 257	8 257	7	4	8	1 180	2 064	1 032	40.30	205	5.04
	14/10-20/10	3 465	3 465	7	2	3	495	1 732	1 155	11.95	290	3.98
	21/10-27/10	20 857	20 857	7	5	19	2 980	4 171	1 098	89.92	232	4.73
	28/10-31/10	10 800	10 440	4	4	11	2 610	2 610	949	54.70	191	4.97
	TOTAL	145 753	145 393	50	40	124	2 908	3 635	1 172	561.31	259	4.53
3.	19/11-24/11	382	382	6	1	1	64	382	382	2.58	148	2.58
	25/11-1/12	22 207	17 820	7	6	24	2 546	2 970	742	89.17	200	3.72
	2/12-8/12	26 775	21 307	7	7	28	3 044	3 044	761	104.42	204	3.73
	9/12-15/12	38 857	38 857	7	7	31	5 551	5 551	1 253	133.75	290	4.31
	16/12-19/12	20 250	20 250	4	4	16	5 062	5 062	1 266	60.08	337	3.75
	TOTAL	108 471	98 616	31	25	100	3 181	3 945	986	390.00	253	3.90

Table 5c (contd)

Trip	Dates	Total landed catch kg	Valid landed catch kg	Days at sea	Days on grounds	No. hauls	Catch/day at sea kg	Catch/day on grounds kg	Catch/haul kg	Hours fished	Catch/hr trawling	Av. trawl duration hours
1979												
1.	13/1	4 140	4 140	1	1	2	4 140	4 140	2 070	8.25	502	4.12
	14/1-20/1	24 210	24 210	7	7	27	3 459	3 459	897	112.33	215	4.16
	21/1-27/1	33 525	32 782	7	7	29	4 683	4 683	1 130	113.23	289	3.90
	28/1-3/2	23 805	23 805	7	7	30	3 400	3 400	793	136.68	174	4.56
	4/2-10/2	28 980	26 865	7	7	28	3 838	3 838	959	123.83	217	4.42
	TOTAL	114 660	111 802	29	29	116	3 855	3 855	964	494.32	226	4.26
1978												
2.	27/2-3/3	14 445	14 445	5	5	19	2 889	2 889	760	86.75	166	4.57
	4/3-10/3	33 030	32 467	7	7	29	4 638	4 638	1 119	129.00	252	4.45
	11/3-17/3	28 350	28 350	7	7	30	4 050	4 050	945	141.43	200	4.71
	18/3-24/3	31 365	30 307	7	7	28	4 330	4 330	1 082	140.27	216	5.01
	25/3-31/3	19 777	19 597	7	7	26	2 800	2 800	754	130.52	150	5.02
	TOTAL	126 967	125 166	33	33	132	3 793	3 793	948	627.97	199	4.76
1979												
1.		396 659	388 299	63	57	226	6 146	6 812	1 718	989.03	393	4.38
2.		145 753	145 393	50	40	124	2 908	3 635	1 172	561.31	259	4.53
3.		108 471	98 616	31	25	100	3 181	3 945	986	390.00	253	3.90
1.		114 660	111 802	29	29	116	3 855	3 855	964	494.32	226	4.26
2.		126 967	125 166	33	33	132	3 793	3 793	948	627.97	199	4.76
	TOTAL	892 510	869 276	206	184*	698	4 211	4 724	1 245	3 062.63	284	4.39

Table 5d: Summary comparison of overall catch statistics for *Othello*, *Orsino* and *Cassio*

Vessel	Total landed catch Kg	Valid landed catch Kg	Days at sea	Days on grounds	No. hauls	Catch/day at sea Kg	Catch/day grounds Kg	Catch/haul Kg	Hours fished	Catch/hr trawling Kg	Av. Trawl duration hrs
<i>Othello</i>	1 294 614	1 162 314	304	267	935	3 823	4 353	1 243	3820.53	304	4.09
<i>Orsino</i>	1 035 499	978 062	278	207	758	3 510	4 725	1 290	3010.09	325	3.97
<i>Cassio</i>	892 510	968 276	206	184	698	4 211	4 724	1 245	3062.63	284	4.39
TOTAL	3 222 623	3 009 652	788	658	2 391	3 819	4 574	1 259	9893.25	304	4.14

APPENDIX: 1 Summary of trawling investigations in the Great Australian Bight by D.C. Serventy (1945) (edited).

1. The operations of the ketch *Rip*, 1904.

A very detailed report of this venture is given in the *Annual Report of the Chief Inspector of Fisheries for 1904* (Anon. 1905). Further details are given in evidence by the Chief Inspector (Mr C.F. Gale) before the Joint Select Committee on the Fishing Industry, 1906, and a summary is provided in the *Map of Fisheries* prepared for the Australian Fisheries Conference in 1929.

The *Rip* was a ketch, unpowered, of 90 tons, its fishing gear comprising three otter trawls, one surface trawl, oyster dredges, longlines, and accessories, including a steam winch, etc. The operations were under the charge of Mr W.C. Oxley. Altogether 101 hauls were made with the otter trawl between January 23 and December 18, 1904, from Cape Mentelle in the south (between Capes Leeuwin and Naturaliste) and the northern part of Shark Bay.

The results are given fully in the official report briefly summarised in the *Map of Fisheries* which outlines the locations of Australia's principal fisheries. Besides the narrative description, the facts as to times, location, depth, nature of bottom and catches of various species (numbers only) are also summarised in tables. Maps are provided to show the location of the hauls.

2. Visit of the *F.I.S. Endeavour*, 1912.

In his *Report on the Fisheries of the State for 1912*, the Chief Inspector (Mr F. Aldrich) stated, p.7: -
"During April the Federal investigation ship *Endeavour* visited Fremantle.

Included in this vessel's equipment there are, as you are no doubt aware, all necessary machinery, nets and other gear for ground trawling. The main object of the *Endeavour's* visit was to assist in the search for the ill-fated *Koombana*, then missing after a hurricane, or 'willy-willy', on the North-West coast. As, prior to arrival at Fremantle, evidence going to show that the *Koombana* was not then afloat, the *Endeavour* did not journey to the North-West. Mr H.C. Dannevig, Director of Commonwealth Fisheries, did not accompany the vessel. During the short stay of the *Endeavour* in our waters, Captain Pym - the officer in command of the *Endeavour* - undertook several short cruises in our waters between Geraldton on the North, and Cape Naturaliste on the South, the object mainly being to secure data relative to soundings - nature of the bottom, etc. - currents and temperatures. At different parts the trawl was shot, but the results, with few exceptions, were not encouraging. Although during this visit nothing in the nature of promising trawling grounds was located, it is highly desirable that a complete survey of our off-shore fishing grounds should be undertaken by the *Endeavour* as early as possible ---".

Mr W.B. Alexander, Keeper of Biology at the W.A. Museum, accompanied the *Endeavour* on this cruise and some reference to the zoological specimens obtained is made by McCulloch (1914).

3. The *F.I.S. Endeavour*, 1912-13

This is the well-known survey, a resume of the results of which appeared in Dannevig (1913). He gives a sketch map of the trawling grounds discovered in the Bight (p.7) and the following summary:

"In the Great Australian Bight, five cruises were devoted to examination of the edge of the shelf - two during February and March, 1912, and the other three between February and April, 1913. The net was fishing for

144 hours, and resulted in a catch of 29,232 lbs of marketable fish, the average taken being 203 lbs per hour of fishing. The deeper section in the Bight was examined during three cruises in May and June this year; the net was fishing for 122 hours, and resulted in the capture of 13,939 lbs of marketable fish, or an average of 118 lbs per hour".

"The gross totals for the Bight experiments are -

No. of cruises - 8
 Total trawling time - 222 h -
 Total catch - 43 171 lbs
 Average per hour 150 lb "

In presenting these figures he explained:

"--- Great care is necessary in order to appreciate their value, for it must always be kept in mind that during a cruise the *Endeavour* has to make effort to cover as much ground as possible consistent with systematic work, and frequently she is compelled to leave rich areas and go on to others, either quite unexplored or known to be inferior".

Comparing these figures with those later obtained by the commercial trawler *Bonthorpe* - also to some extent exploratory at that stage - it will be seen that Dannevig's warning in interpreting the results was justified.

It should be remembered also that much of the *Bonthorpe's* 'offal fish' were gurnard, shark, etc., which would now find a ready market.

4. The trawler *Simplon*, 1914

Following on the discoveries of the *Endeavour* in the Great Australian Bight the South Australian Government chartered the trawler *Simplon* to make an investigation in 1914. I have not a detailed record of this expedition, but an account of the fishes obtained is given by Waite and McCulloch (1915).

Waite was on board the vessel and the following is extracted from the paper referred to above: "With a view to reaping some of the harvest there indicated; the South Australian Government chartered the trawler *Simplon* (Capt. W. Brown), and the senior author accompanied the vessel on her cruise in the interests of the South Australian Museum, while the Fisheries Department was represented by Inspector W.D. Bruce. Owing to extremely unfavourable weather and the consequent limitation of operations, together with unpayable catches of fish, one essay only was made. The cruise extended from September 16 to October 1, 1914 and embraced the area between lat. 32°36' and 34°50'S., and long. 128°45' and 133°12'E., the depths exploited ranging from 22 to 140 fathoms. Of the ten hauls made, eight were technically successful, but of these, two only were regarded as payable. The best haul produced ten baskets of fish, about 700 lbs in weight, composed almost wholly of swallowtails (*Trachichthodes lineatus*).

In the absence of a larger and faster vessel, it can scarcely be expected that trawling will be commercially profitable on grounds so far distant from the port of Adelaide as those prospected by the *Endeavour*. As regards the *Simplon*, it necessitated a voyage of 500 miles before the trawl was put over, and a similar distance had to be traversed when the fishing was concluded. The cost in coal, wages, etc., under these conditions is such a heavy item, that phenomenal catches would have to be made to recoup the outlay. The first step towards the institution of trawling in South Australia must undoubtedly be a systematic survey of our waters, to ascertain what trawling grounds we possess nearer market, their extent and capabilities."

A table is given also, enumerating the hauls and giving their locations and depths, with a list of the fish taken, but no quantities are given.

Further particulars of this expedition no doubt exist in the S.A. Fisheries Department and if you obtain them I would be glad to be supplied with a copy.

5. The W.A. Government Trawler *Penguin*, 1920

In the *Annual Report of the Chief Inspector of Fisheries for - 1920* Mr Aldrich stated: "During the year the SS *Penguin*, previously employed by the Harbour and Light Department, was taken over by the Fisheries Department and equipped with modern trawling gear, with a view to trawling and examining the extensive ocean bottoms off our coast for trawling grounds and "trawl" fish. During the initial voyage to waters east of Albany, owing to unfavourable weather, and to the fact that all the gear was new, operations were confined mainly to the shallower depths adjacent to the coastline, where although good trawling bottom was discovered, fish were not, at that period of the year, plentiful. During the second voyage a section of the deeper waters further east were being examined with very promising results indeed, when the *Penguin* was caught in the, as now known, "Renown gale". After battling through this, and when sheltering at Middle Island, she was blown ashore and became a total wreck!"

In his evidence before the Select Committee of the Legislative Council in 1922 (Report, p.1), Mr Aldrich stated that he was on board the *Penguin* on the first trip but not on the second. He said: "I think that when the gale hit the boat, there must have been a ton of fish in the net caught at one haul. They had to cut that catch adrift".

A zoological paper on some of the fish collected by the *Penguin* has been published by Glauert (1921).

6. The Operations of the *Bonthorpe*, 1929-30

The *Bonthorpe* was built in Ontario,

Canada in 1917, by the Collingwood Shipbuilding Co. Ltd, her specifications being as follows: gross tonnage, 272.86; net tonnage, 106.80; length 125.5 ft; breadth, 23.5 ft; depth in hold 12.75 ft; depth moulded 13.6 ft; speed 10 knots. The fish hold had capacity for 60 tons of fish packed in ice.

Fishing operations began at the end of September, 1929 and ended on February 23, 1930.

According to Press reports ("West Australian", October 22), the first cruise was conducted to the Great Australian Bight, and the ship returned to Fremantle on October 20, 1929, with a catch of 8 tons, comprised of "king snapper, bream, flathead and gurnard". Bad weather was experienced during most of the cruise, and the catch was made in a little more than two days' fishing. No details are available of the second cruise, other than that fishing was done in the Bight and Fremantle was the port of discharge. The fish caught were "red snapper, flathead, boarfish and jackass fish". Gurnard were very plentiful.

Concerning the third cruise, we have a rather detailed account in a report to the Board of Directors of the Company, by Captain Claxton; it reads as follows:

"Reporting on voyage 3 of the *S.T. Bonthorpe* from the 12th November until the 29th November, together with a short summary of results and conclusions arrived at from the work carried out during the past three months.

Leaving Fremantle at 1 p.m. on Thursday the 12th, we first shot the trawl 5 miles N.E. from Bathurst Island, in 16 fathoms, fine sand. The trawl had only been down a matter of twenty minutes when we "came fast", i.e. stopped through the net fouling an obstruction on the sea bed. Upon heaving the trawl up we found it

choked with large masses of seaweed, and about 20 lbs of small fish - whiting, stonefish, etc. - was among the weed.

We proceeded from there to a position 34 miles N.W. of Rottneest Island in Lat. $31^{\circ}34'S$, Long. $115^{\circ}6'E$, in 90 fathoms, fine sand. We shot the trawl there and towed for $1\frac{1}{4}$ hours N x E. The result was poor, yielding only about half a basket of various small fish.

We steamed north to a position 21 miles WNW from Green Island in Lat. $30^{\circ}34'S$, Long. $114^{\circ}44'E$ in 115 fathoms, coarse sand and broken shells. We towed there for one hour when the gear encountered a rough bottom. When we hauled, the net was undamaged but again the result was unsatisfactory, consisting of about 2 baskets of mixed fish, chiefly small rock cod.

Wishing to investigate the shallower water, we steamed in E. towards the land to a position 12 miles W & N $\frac{1}{2}$ N from Green Island in Lat. $30^{\circ}38'S$, Long. $114^{\circ}54'E$ in 55 fathoms, fine sand (according to the arming on the lead). Immediately the gear reached the bottom it came fast and we lost the net, but retained the trawl-boards and wires.

The prospects, so far, having been so unpromising in this direction, I have considered it advisable to turn our attention to the area south of Rottneest Island and accordingly steamed down to a position in 200 fathoms WSW of Rottneest Island in Lat. $36^{\circ}6'S$, Long. $115^{\circ}8'E$. A cast of lead, however, showed the bottom to be rock and wholly unsuitable for trawling, and we carried on to the southward to a position 40 miles NNW from Cape Naturaliste in Lat. $32^{\circ}58'S$, Long. $114^{\circ}38'E$ in 170 fathoms, again encountering a rocky bottom with the lead. I might here mention that indications go to show that the bottom in greater depths than 130

fathoms along the Continental Shelf on the West Coast, is in general, of a rough nature and not very suitable for trawling. This is not a sweeping assertion but just a conclusion arrived at after our limited experience.

From the above position we steamed in to a position 37 miles N x W $\frac{1}{2}$ W of Cape Naturaliste in Lat. $32^{\circ}58'S$, Long. $114^{\circ}46'E$ in 80 fathoms, fine sand. Here we found the results rather better getting from 6 - 10 baskets of leatherjackets per haul of 2 hours. We buoyed this position off and continued to work here for five hauls, until the fish thinned off to 1 - 2 baskets per haul.

We then steamed to a position 18 miles W x N from Cape Naturaliste in Lat. $33^{\circ}32'S$, Long. $114^{\circ}41'30'' E$. in 65 fathoms. A haul here resulted in a bag of sponge growth amounting to over a ton among which we obtained about $1\frac{1}{2}$ baskets of leatherjackets.

We then carried on to the Bight, signalling our intention to Eclipse Island on the way. The results on the West Coast have been far inferior to the catches obtainable in the Bight up to the present and I am convinced that only after considerable research work has been done on the West Coast will the full possibilities of this area be realised.

In the Bight we proceeded to the position where we obtained our previous catches in Lat. $33^{\circ}22'S$, Long. $126^{\circ}22'E$ in 77 fathoms, fine sand, and then got large quantities of mixed fish, nannygai, flathead, blackbreem, gurnard, boarfish, etc. Gurnard greatly predominated, in fact to such quantities that about 20 tons were thrown overboard, as the demand for this class of excellent fish is not yet sufficiently developed here.

We continued to work here until the catch was completed and proceeded back to Fremantle with about 15 tons of fish, arriving there at 2 pm Sunday, 30 November.

In summarising the work accomplished during the past few weeks I am of the opinion that the results obtained in the Bight have been quite satisfactory from a fishing point of view. In the first place, the results have shown a steady improvement in the three voyages. Our first voyage consisted of 8 tons, the second 12 tons and the last trip 15 tons. This improvement is quite commensurate with the increased knowledge and experience of the grounds here and the habits of the fish frequenting these waters. This knowledge and experience being still very incomplete one can reasonably expect that as we develop this knowledge we can look for increased results from the ground. Even at this stage I can confidently assert that the quantities of fish obtained in the Bight compare favourably, or even exceed, weight for weight per fishing time, with the results obtained in the North Sea and other recognised fishing grounds in European waters.

Distance is the greatest handicap that has to be overcome here. For example in the last three voyages, consisting of over 50 days sea time, our actual fishing time has only been 17 days. This long period lost in steaming to and from the fishing grounds has a serious effect on the fish also and any way by which this loss of time can be reduced will undoubtedly be invaluable to the whole scheme. The installation of refrigeration apparatus would also greatly increase the possibilities and prospects, enabling the ship to remain on the grounds during the hottest weather, until a really substantial catch had been obtained and also ensure the catch being in such an excellent condition as to be easily sent to inland areas such as Kalgoorlie, etc. and arrive there in

perfect condition. This, however, would most probably necessitate carrying a greater number of men on deck as the fish would have to be cleaned before it was refrigerated."

With cruise 4, there was a change of procedure. She left Fremantle about December 12 and it was arranged that thereafter Albany be the home port. No fishing details are available regarding this cruise but it appears that engine trouble forced the trawler home earlier than expected for repairs and no fishing was done.

The beginning of cruise 5 was delayed due to labour trouble.

In February, 1929, during the University vacation, I accompanied the *Bonthorpe* on cruise 7 and published a paper on the zoological results (Serventy 1937). A short analysis of the trawling results of cruises 5 and 6 is included and demonstrates that night hauling is the most productive in the Bight.

Cruise 7 ended suddenly owing to engine breakdown, after only one haul was made, the biggest ever made by the *Bonthorpe*.

A detailed log is available at the Fisheries Department of cruises 5-7, and Table A.1.1 is a summary of the data, together with what is available of the earlier cruises.

The reasons for the failure of the company appear to be primarily the defective engines of the one trawler operated. On almost every cruise something went amiss with the engines, valuable time being lost. Losses were also occasioned through the dumping of about 8 tons of fish through faulty storage.

7. Test by Cam and Sons Pty Ltd Olive Cam

In July 1942, I interviewed Captain

TABLE: A1.1 DATA IN RELATION TO CRUISE MADE BY THE *BONTHORPE*

Cruise	Date	Days absence	Days trawling	No. of hauls	Trawling hours	Results - lbs			Remarks
						Edible fish	Offal fish	Total	
1	Oct 1929	-	-	-	-	17 920	-	-	
2	Oct - Nov	-	-	-	-	26 880	-	-	
3	Nov 12-29	18	-	-	-	33 600	?	?	20 tons of gurnard, etc thrown overboard
4	Dec 12-19	-	-	-	-	-	-	-	
	Jan 9-21	12	7	30	122½	23 850	21 690	45 540	
6	Feb 1-13	?	7	26	118	18 360	11 925	30 285	
7	Feb 20 - Mar 5	14	1	1	2	2 700	45	2 745	

NOTE: Up to and including Cruise 3, Fremantle was the home port;
From Cruise 4 on, Albany was the port of discharge.

W. Reid and Mr J. Smith concerning the Cam trawling cruise in the Great Australian Bight.

I saw Captain Reid on July 27, 1942. He was skipper of the vessel which made the trip, the *Olive Cam*, and Mr C. Cam, head of the firm of Cam and Sons Pty was also on board. He had not consulted his logs recently and was uncertain of the date of the cruise, which was about August, either in 1932 or 1933.

Only 24 hours operations were conducted including about six drags of the trawl, covering both night and day work, and he felt this was insufficient to base any worthwhile opinion on the area. The total catch was 10 baskets of flathead. The locality was some 100 miles south of the highest point of the Bight (i.e. the head of the Great Australian Bight) and they shot the gear in from 70 to 90 fathoms. This area would be roughly 250 miles east of the grounds worked by the *Bonthorpe* in 1929-30. He said that the sea conditions were very good and they were fortunate in fair weather all the time. This was attributed to their being fairly high up in the Bight.

I asked him why such a short time was spent on the work and he said that they were out on a commercial fishing cruise and because of such unpromising results from the hauls put down Mr Cam decided to return.

Mr J. Smith (boatswain on the *M.V. Warreen*), who was in the Company's employ at the time and is a personal friend of Captain Reid, discussed this point with me the following day. He said that the reason for the hasty departure from the Bight was news received by wireless of good flathead catches off Eden. Mr Cam made the decision and on returning to N.S.W. took some 400 to 600 boxes of flathead from the Eden area.

APPENDIX: 2 Report by Fishery Inspector Stathy (1950) (edited)

During past years several attempts have been made by various companies to establish a trawling industry on the south coast of Western Australia. Ships have operated from Albany and fished in the Great Australian Bight - I refer now to the *Bonthorpe* and the *Endeavour* - but both of these ventures were unsuccessful for various reasons.

In 1948 the Westralian Trawling Company was formed, and a ship was brought over from Sydney for the purpose of engaging in Purse Seining, Danish Seining and Spanish Trawling. Unfortunately this ship was not suitable for the purpose, and as trawling was falling off to some extent in the Eastern States, it was decided to "import" one of the Eastern States Trawlers to take over, and in September, 1948, the *Trusan* arrived in Albany from Sydney.

Trusan refitted and made a trip to the Bight in December of that year, but results were not up to expectation.

It was then decided to interest some of the trawlers of the English or Scottish fleets, and in due course, the Anglo-Australian Fisheries Co.Pty Ltd was formed. Two trawlers, *Ben Dearg* and *Commiles* left England in July, 1949, and arrived at Fremantle during mid-September.

These two ships, which are each 127 feet long, are powered by steam. They each bunker about 160 tons of coal and burn from 9 to 10 tons per day during operations, and steam at about 8 knots. They have cold storage capacity of approximately 50 tons of fish and carry a crew of 14 or 15.

They are not refrigerated, but when putting to sea, they carry from 40 to 50 tons of crushed ice. Their ages are:

Ben Dearg - 30 years; *Commiles* - 28 years.

I received instructions from Head Office to accompany the *Ben Dearg* on her initial trip for the purpose of identifying the various fish that would be taken in the trawl.

On the run to Cape Leeuwin slight engine trouble developed and we lay for half an hour or so for repair.

Further delay was experienced after passing the Leeuwin and shortly after we ran into a stiff south-easterly gale, but fortunately we were standing well out to sea. I say fortunately, because when we were approximately south of Nornalup, the engine again broke down at 12.15am, and we wallowed broadside on in the gale for almost six hours while temporary repairs were effected.

From then on we steamed at a slow pace of about 4 knots, and it was decided to call at Albany for repairs. We eventually arrived at 7.15p.m. on the 25th, but were under a quarantine until the Doctor came aboard and cleared us next morning. Immediately after I left the ship, *Ben Dearg* sailed from Albany again on the 27th, but my place was taken by a member of Seafoods' staff, who reported to me that conditions had not improved in any way during the trip.

Returning to the actual trawling itself, I would say that results to date have been reasonably satisfactory; considering that the industry is still only in the experimental stage, as it were. Naturally, there has been heavy expenditure and consequent loss, but this must be expected for a time until all obstacles are overcome, and the ships and crews get into their 'stride'.

On January 26, 1950 I joined the *Ben Dearg* at Albany as "passenger observer" to observe the workings and general conditions on board

Before leaving Albany, the old trawl, which had been used on the previous trip, was taken ashore and a new one put aboard. This new trawl was of the Peter Carey type otter trawl, similar in most respects to the usual type used, except that it had been fitted with a sponge trap, i.e. a special trap inserted to trap the sponge etc., before it went into the codend. The dimensions of the trawl are as follows: Length from wing to wing 62 ft, depth 11 ft at the wings and widening out to 16 ft deep at the bellies. The codend or bag sets at 60 ft long and the trawl is capable of holding up to 8 or 10 tons. The trawl is made up of varying meshes, it being 6 inches at the wings and gradually working down to 3 inch mesh in the codend in about five stages. When in operation, the trawl, although 60 ft wide, only covers a strip of ground or bottom about 30ft wide.

A course was set from Albany to take us well south of the Recherche Archipelago, which was passed during the night, and from then on we steered about north-east until we arrived at a position approximately 126°17'E longitude and 33°17' south latitude during the early hours of Sunday 29.

There was a slight delay then, owing to a fault which developed with the main pump of the engine, and we eventually shot the trawl at 9 am on the 29th. Depth was 75 fathoms, the weather fine and sea calm.

This first shot was of 2½ hours duration, steaming at approximately 3 knots and resulted in only 4 baskets of fish and a considerable quantity of sponge and other duff.

The second haul was of a similar period, but in slightly less depth (70 fathoms) and we netted only 3 baskets. It was noticeable here that the sponge trap was not working as it should have done, and so the trap was taken out and a new section of net made in.

Three more hauls were made that day to midnight for 14, 14 and 16 baskets respectively, making a total of 50 baskets for the day. A basket is approximately 5 stone or 70 lbs.

We gradually worked into shallower water and found that from 60 to 65 fathoms was the best water for the following two reasons: (1) There was as much fish there and possibly a little more than the deep. (2) The ground was comparatively clean and free from duff.

On the 30th, 8 hauls were made for 116 baskets, being 19, 23, 7, 9, 8, 5, 40, and 5. The last haul of only 5 baskets was only of 25 minutes duration, as the net fouled the bottom and had to be taken aboard. Only slight damage was done.

By now, the duration of the trawl had been increased to $2\frac{1}{2}$ and 3 hours, giving a strip of bottom approximately 6 to 8 miles long by 30 feet wide for a shot.

The weather during the first two days was calm with very little wind, but on the night of the second day, the wind freshened from the south-east and made conditions very unpleasant. So much so, in fact, that Skipper Duthie was considering laying-to until the weather eased. Fortunately, this was not done and we worked right through.

We were trying out new grounds as had been done on almost every other trip, and on this occasion we operated well to the west of all previous trips and in shallower water, the depth being 60 to 80 fathoms. Out from the 80 fathoms the shelf is very irregular and drops away very suddenly to the deeps.

Following are the results of our next six days' work, and here it will be noticed that the hauls that were made during the hours of darkness, were definitely the best, but it will also

be noticed that from here on, the number of hauls per day decreases. This was due to two factors - (1) minor breakdowns in the steam pump, and (2) repairs to the trawl, which was by this time becoming chaffed and, at times, ripped.

On the 31st we made 6 hauls for 30, 37, 9, 7, 17, 31 baskets;

On the 1st - 6 hauls for 33, 20, 14, 20, 14, 32 baskets;

On the 2nd - 5 hauls for 38, 17, 7, 36, 26 baskets;

On the 3rd - 5 hauls for 34, 10, 7, 21, 28 baskets;

On the 4th - 5 hauls for 20, 7, 15, 28, 38 baskets;

On the 5th - 1 haul for 37 baskets; making a total of 41 hauls and 800 baskets for the trip.

Ice started to run low on February 4, and it was evident that we would not be able to take very much more fish, and eventually our last haul was completed at 3 a.m. on Sunday, 5th February, leaving only sufficient ice to top-up for the home trip. Had the ice held out, I feel sure that we would have been able to take at least another 8 or 10 tons of fish without any trouble, as we were on good ground.

The following are the figures for the catch:

Red snapper	24	975	lbs
Jackass fish	6	086	"
Boarfish	6	578	"
Leatherjacket	3	454	"
Flathead	1	896	"
Sweep	3	256	"
Queen fish	2	774	"
Ruby fish		451	"
Perch		489	"
Shark		608	"
Gurnard		91	"
Eels		30	"
John Dory		31	"
Total		50	719 "

The bulk of the catch it will be seen was Red snapper, and most of this was taken during the night-time.

After the last haul was made, the course was set for home, and we made good time, as we were assisted greatly on our way by a following sea and wind.

Several schools of mackerel were sighted whilst we were out on the grounds, which, incidentally, covered only a very small area between the positions of $125^{\circ}43'E$ to $126^{\circ}17'E$ longitude and $33^{\circ}17'S$ to $33^{\circ}40'S$ latitude. The sighting of these mackerel may open up further research on these fish.

During the morning of February 6 at approximately 7 a.m. when we were about 40 miles west by south from Termination Island, I sighted the first salmon for the trip. This was a large school of fish and they were definitely salmon. The school covered an area of about 2 acres, and we passed within about 70 to 75 yards of them at the most.

Later that day, at about 2.30pm, and about 45 miles south of Cape Knob, the ship ran through a very large school of salmon. This was one of the largest schools of fish I have seen on any occasion, and I estimate that it covered an area of at least 6 acres and possibly 8 acres.

About 20 miles further west another school was sighted, but this was only small by comparison and would not be more than, possibly, one-eighth of an acre.

As I stated earlier in this report, it was distinctly noticeable that the best catches were made during the hours of dark, and they fell off during the day.

Actually, we hardly touched the area at all, and my firm opinion is that there is a vast wealth to be gained

from these waters, as the workable area is so very extensive, and it has been proven beyond doubt that the fish are there to be taken and put on the market.

One big thing, however, is evident, the ships that are operating at present are very old and almost obsolete. What is required is a ship or ships, possibly a little larger and more modern, and powered by diesel or oil-burning engines, and they need to be refrigerated.

If this could be done, there is a great future for the industry, as the cost of production will be at least halved, and, whereas it now takes 20 to 25 tons of fish to make a trip pay, a trip of 15 tons or more would pay handsomely.

Commiles has already had her fish holds insulated and *Ben Dearg* is being done at present.

APPENDIX: 3. Report of Interview with Skipper Duthie of the *Ben Dearg* (1950) (edited)

Introduction

Fishing operations were carried out by the steam trawlers *Ben Dearg* and *Commiles*. These observations were made on board the S.T. *Ben Dearg* by the master J.B. Duthie (Tables A3.1, A3.2).

The grounds covered are mainly an area between Lat. $33 \text{ deg. } 45'S$. Long. $125 \text{ deg. } 30'E$, and Lat. $33 \text{ deg. } 20'S$, Long. $127 \text{ deg. } 50'E$.

The depth of water varied between 60 fathoms and 130 fathoms.

There were many factors contributing to the failure of the vessels to return profitable catches in the limited time they were in operation.

I will endeavour to point out those factors in this report.

Table: A3.1.

S.T. BEN DEARG

YEARLY

	Arrived Fishing grounds	Left fishing grounds	Hauls	Baskets	Average per haul	Hauls	Baskets	Average per haul
<u>1949</u>								
1.	Sept 29	Oct 3	19	565	29.7			
2.	Oct 15	Oct 25	20	365	18.2			
3.	Oct 31	Nov 9	37	705	19.0			
4.	Nov 18	Nov 29	41	548	13.3			
5.	Experimental							
6.	Dec 17	Dec 26	39	368	9.4	156	2 551	16.38
<u>1950</u>								
7.	Jan 13	Jan 17	25	359	14.3			
8.	Jan 28	Feb 4	40	800	20.0			
9.	Mar 2	Mar 12	43	914	21.2			
10.	Mar 21	Mar 27	33	454	13.7			
11.	Apr 7	Apr 15	46	744	16.2			
12.	Apr 24	May 2	30	734	24.2			
13.	May 10	May 21	59	994	16.8			
14.	June 12	June 18	35	436	12.4			
15.	June 26	July 8	36	540	15.0			
16.	July 16	July 25	48	628	13.0			
17.	Aug 5	Aug 14	38	382	10.0			
18.	Adelaide trip							
19.	Nov 14	Nov 24	48	480	10.0	481	7 465	15.52
<u>1951</u>								
20.	Feb 19	Feb 27	50	850	17.0			
21.	Mar 9	Mar 17	46	998	21.7			
22.	Apr 1	Apr 9	39	870	22.3			
23.	Apr 19	Apr 27	37	605	16.3			
24.	Experimental							
25.	Experimental							
26.	Experimental							
27.	July 21	July 30	38	595	15.7			
28.	Aug 16	Aug 24	32	519	16.2			
29.	Sept 14	Sept 24	31	480	15.5			
30.	Oct 5	Oct 15	40	648	16.2			
31.	Nov 1	Nov 4	18	183	10.1			
32.	Nov 24	Nov 29	23	418	18.1	354	6 166	17.41
<u>1952</u>								
33.	Jan 10	Jan 18	39	846	21.7			
34.	Experimental							
35.	Feb 29	Mar 6	37	1 121	30.3			
36.	Mar 17	Mar 22	26	529	20.3	102	2 496	24.47

Table : A3.2 A SHORT SUMMARY OF THE TRIPS
(For reference with previous table A3.1)

Trip No.	Remarks
1.	Fishing good - weather fair - conditions good
2.	Trouble with feed heater. Chief Eng. requested to return to harbour
3.	Quite good fishing generally - Some foul work
4.	Good fishing but lots of sponge
5.	Experimental
6.	A poor trip - coal not the best - trawl not fishing
7.	Fair fishing - Skipper Allen
8.	Good fishing - no log available
9.	Good fishing - weather bad
10.	Poor fishing - over 80 fathoms not successful, inexperienced crew hampered fishing.
11.	Had to return short of ice. Fishing fair
12.	" " " " fresh meat. Fishing very good
13.	59 hauls - good crew - good conditions
14.	Skipper Allen - fishing fair
15.	Bad weather - fishing not so good
16.	Skipper Allen - nothing to report
17.	Very poor fishing. Ships bottom very dirty. Weather bad.
18.	Experimental trip to Adelaide.
19.	Trip messed up by using utility 48 ft trawl made in store
20.	48ft trawl used. Coal very bad NSW - fishing good
21.	Very good fishing using 48ft net
22.	" " " " " " and Peter Carey
23.	Fishing not so good, using P.C. net throughout
24.	Experimental
25.	Experimental - Skipper Allen
26.	Experimental
27.	Tried grounds to the eastward - fair fishing - Capt Johnston's light net
28.	Tried grounds to the eastward - weather bad - " " " "
29.	Part experimental Doubtful Island area no fish. "Bight" fair fishing
30.	Bad coal and weather - fishing fair
31.	Very light foot-ropes tried - unsuccessful
32.	Good fishing using a normal rigged 48ft trawl
33.	Good fishing conditions very good
34.	Experimental. Very bad coal
35.	Very good fishing - good conditions
36.	Engine defects and bad coal, leaking tubes

It is also my intention to set out a scheme (at a later date) for successful trawling in the "Bight", which, will include suggestions for overcoming the difficulties experienced on these cruises.

CURRENTS, etc.

It is regrettable that, during the whole of these operations, no scientific instruments were available for recording sea temperature etc. as it is a well established fact in trawling circles, that valuable information can be gained from such data, it being born in mind that sea temperatures do affect the fishing possibilities.

To and from the fishing grounds a strong easterly going set was encountered during the nine months February to October inclusive. For example using a Walker's patent log, the distance recorded from Breaksea Island to a position 5 miles south of Termination Island varied between 180 miles and 190 miles while the distance recorded on the return journey varied from 200 miles to 210 miles. The actual charted distance is 199.5 miles.

For the remaining three months of the year, there appeared to be very little set in any direction, apart from the drift caused by the winds.

On the fishing grounds, a strong set was observed running in a north easterly direction almost parallel to the contours of the ledge.

There was one exception, it refers to a position latitude 33 deg. 22'30S. longitude 126 deg. 00'00" E. (hereinafter this position will be referred to as "The Corner"). In this vicinity there was practically no tide. The set being always controlled by the direction of the wind.

A. FISHING (GENERAL)

The best fishing grounds were found to be just east of "The Corner". The ground here has been well cleared of sponge, and although a little sponge is still to be found on these grounds, it is so small in quantity that it does not now hamper fishing operations. On the other hand the grounds to the southwest of "The Corner" are still heavy with sponge which gives rise to much waste of time and gear.

These latter grounds should ultimately prove the best fishing grounds, as first indications of fish on these grounds proved better than the first indications on the former grounds.

The best fishing season was during the months of January, February, March and April.

The best fishing period was during the hours of darkness, although good hauls were sometimes made during the afternoon. It appeared the hours from 6 a.m. to noon were not very profitable.

The ideal length of tow was found to be three hours. It was inadvisable to tow any longer as there was always the possibility of picking up large quantities of sponge.

Between 70 fathoms and 75 fathoms of water was found to be the best depth of water for good fishing.

The ledge (Continental Shelf) was found to be very sharp on main fishing grounds.

B. THE FISHING

Fishing was commenced on 29 September 1949.

The first results, although good, were not so good as had been expected.

It was then thought the fishing grounds in the "Bight" would be knee deep in fish as these waters had not been fished for quite a number of years.

The fishing area had not been charted and it was then impossible to define the contours of the different fathom lines with any accuracy.

As later events proved we were then on or near the best fishing grounds.

On the first trip we gutted all the fish but this was found to be a very unsound practice as much valuable fishing time was lost through having to lay and clear the decks of fish. Also, the gutting of the fish was very hard on the crew's hands. After the first trip gutting of fish was discontinued except for the larger species (queen snapper, shark, etc.)

Some hauls included large quantities of heavy sponge in the trawl and, as we were not properly rigged for handling such heavy weights, we occasionally lost gear and tackle trying to get the trawl on board. After a while we fixed a "lazy deckie" to the codend of the trawl.

We later tried the grounds to the Eastward but found sponge in great quantities until we had towed to the Eastward of a position 126 deg 30'00 East. In fact it was found possible to tow to the south east for many miles on a gradual slope between 100 fathoms on these later grounds. Fish were not very plentiful on these grounds although it was almost barren of sponge. The absence of fish on these grounds gave rise to the belief that there must be some feeding for fish amongst the small animal life contained in the sponge.

The fishing possibilities to the south west of "The Corner" were good but they were marred by the existence of large quantities of sponge on the grounds. Near the area of "The Corner"

a limestone ridge extends north and south across the fishing grounds making it impossible to tow from east to west, or vice versa, without the trawl coming fast to the sea bottom. When the trawl did come fast to this limestone ridge it was often necessary to steam the ship full speed up through the tide in order to save the fishing gear.

It was often found when working in less than 70 fathoms of water, large quantities of small, immature silver flounder were encountered and when over 80 fathoms it was found almost impossible to keep even soundings as the ledge fell away very steeply except when east of 127 deg. as previously mentioned. The ideal depth of water for the grounds adjacent to "The Corner" was 72 fathoms.

EXPERIMENTAL TRIPS

In December 1949, sixteen experimental hauls were carried out. On this occasion a few hauls were made south from Eclipse Island in depths of water varying from 40 fathoms to 145 fathoms. Other hauls were made along the Shelf towards Cape Leeuwin, and one, in the vicinity of Two People's Bay.

Large quantities of sponge were found to exist on most of the grounds and very few fish were caught on them. Even when the grounds were clear of sponge the fishing was very poor.

Towards the end of 1950, while on passage to Adelaide for refit, a number of experimental hauls were made on the Eastern Bight grounds. The results were very poor but this may have been due to the type of trawl used. The trawl used was a Peter Carey converted to a 48ft trawl. The dimensions of this trawl were not very satisfactory, therefore the information gained on this trip is not very reliable.

In May and June of 1951, three

experimental trips were made in the Doubtful Island area. There definitely was signs of good fishing in the area near the Continental Shelf but there was also great quantities of sponge. These grounds are well worth developing but it would take much time and patience before they showed profitable returns. The Continental Shelf in this area lies much further South than it is charted.

FISH TYPES

The types of edible fish landed and their approximate percentage of the catch were as follows:

Red snapper	42%
Flathead	7%
Jackass	15.5%
Queen Snapper	6.5%
Sea Perch	1%
Boarfish	11%
Shark	1.5%
Silver Flounder	5.5%
Others (Ruby Fish, swallowtails, guarnards etc.)	9%

In addition to the above, quantities of small Silver Flounder, Gurnard, ray (Skate), large stingray, carpet shark and sword shark, were caught but thrown overboard again as it was thought they were of no commercial value.

THE TRAWL

The Peter Carey trawl and its fixtures were very unsatisfactory for this type of grounds. It must be understood this type of net is almost entirely suited for fishing on foul grounds. Its catching capacity is therefore greatly reduced.

The 48ft trawl, which we latterly used on this venture was much more satisfactory. It covers a greater area of the sea-bed, and is much lighter and easier to handle. Its catching rate is therefore much greater than that of the Peter Carey.

It was found the net shrunk about 1" in every 12" and this should be allowed for when making up a trawl. The fishing squares were bolched before attaching to the headline. Sisal fishing lines 50ft in length (after allowing for shrinkage) were attached to the lower wings before fixing them to the foot-ropes. Belly-lines (sisal) were also fitted, one on either selvage, from the codends to the quarters. Six false bellies (overlapping) were fitted to the cod-end and this was again overlapped with a cow hide as an extra preventive against excessive chafing. It was also found advisable to fit a chafing piece to the other side of the codends, as it was noticed, when quantities of sword fish were caught they had a tendency to saw through some of the meshes. Phillip alloy floats were used throughout attached as follows - as many as possible on the square of the headlines, and one every eighth mesh on the wing headlines. This arrangement worked satisfactorily.

The ideal length of sweeps used were 40 fathoms long. 50 fathom sweeps could be used successfully providing they were very light. Long sweeps and heavy ones had a tendency to pick up more sponge. Various lengths of warp were tried and the most suitable was found to be 225 fathoms, or approximately three times the depth of water trawled in.

The trawl-doors (Bromptons 10'6") seemed to be on the heavy side for fishing these waters. A pair of lighter trawl doors would have been more suitable especially as we often had difficulty maintaining a full head of steam due to bad coal, inefficient firemen, etc. This lack of steam had a tendency to make the trawl gear sag when towing; therefore heavy doors could not be operated with the success wished for.

APPENDIX: 4 Report on the First Cruise made in *M.T. Southern Endeavour* - June 1960 - with a note on future research in the Bight by D.E. Kurth - (1960) (edited).

As the observations made during this, the first cruise in which CSIRO has taken part, fall into two categories, this report will be correspondingly divided into two main sections. The first will deal with the general fishing operations of the vessel and the second will contain matters relevant to the possibility of using the ship for the collection of scientific data.

Before considering these two sections, however, there are some details concerning the ship itself and the present cruise which are of useful interest and should precede presentation and discussion of the observations made.

THE VESSEL: The *Southern Endeavour* (launched in 1952 as *Princess Elizabeth*) is a British built deep-sea trawler with the following particulars: Dimensions, 150.5 x 29 x 14.5 ft. Fishroom capacity, 12 725 cu. ft. Propulsion, Diesel 1 200 h.p., 250 r.p.m. Auxiliary, Diesel 300 h.p., 500 r.p.m., driving a 165 kw generator delivering power to a 200 h.p. electric motor for hauling. Trawlwinch capacity, 1 200 fm (i.e. capable of trawling depths to 400 fm). Range, approximately 6 000 miles.

In common with many ships built for foreign sale, the *Southern Endeavour* lacks some of the refinements in equipment and appointments usually found in a trawler of its class built to owner's specifications. She is nevertheless a well-built and seaworthy vessel and whilst being underpowered and thereby inefficient in towing to windward in heavy weather, appears to be adequate for the task allotted to her.

ITINERARY AND AREA OF OPERATION:

The vessel sailed from Port Adelaide

on Wednesday, June 8, and returned on Sunday, June 19. The trip was necessarily shortened as the arrival of stores delayed sailing one day and the ship had to be back in port for survey by the latter date. Of the twelve days spent at sea, six were taken up by the passage to and from the fishing grounds.

The area fished lay along the edge of the shelf between 127°00' and 128°20'E. long. in latitude 33°20'S. depths ranged from 80 to 120 fathoms. Since the vessel commenced fishing the Bight more than four months ago, this ground has been visited constantly as hauls made there proved more successful than those in other areas, particularly towards the eastern end. Furthermore, the western grounds are relatively free of obstructions at the depths mentioned above, although the risk of coming fast increases in the shallower waters inshore. On previous trips a considerable amount of time was lost fishing in water less than 80 fathoms through becoming fast on apparently clean bottom. It is suspected that there may be outcrops of limestone in places large enough to impede the otter boards but too small to give a distinct echosounder trace. The heavy swell prevalent in the Bight makes accurate reading of the bottom extremely difficult. The ship is unable to fish deeper than 120 fathoms at the moment due to insufficient warp, but more has been ordered and is expected shortly.

PART I:

FISHING OPERATIONS

(a) Time Dissection

Time absent from port	288hrs
Time spent steaming	141 "
Time on fishing grounds	147 "
Time trawl on bottom	92 "
Time shooting and hauling	24 "
Time laid to for weather	31 "
Time fishing	116 "

(b) Haul and Catch Dissection

No. of hauls (each haul 4 hrs duration)	23
Catch per haul (based on 29 tons (580 cwt landed))	25.22 cwt
Catch per day's absence	48.33 "
Catch per hour's fishing (including shooting and hauling, but excluding 31 hrs laid to for weather)	5.00 "
Catch per hour spent on grounds	3.95 "
Catch per hour trawl on bottom	6.30 "

Catch dissection

<u>Species</u>	<u>Catch (lb)</u>	<u>% of Total Catch</u>
<i>Neoplatycephalus speculator</i> (Deep-water flathead)	30 628	47.15
* <i>Nemadactylus macropterus</i> (Morwong)		
<i>Plagiogenion macrolepis</i> (Ruby fish)	11 621	17.89
<i>Trachichthodes gerrardi</i> (King snapper)	8 977	13.82
Mixed species	8 451	13.01
<i>Nemadactylus carponemus</i> (Sea carp)	2 111	3.25
<i>Rexea solandri</i> (Hake)	2 111	3.25
Mixed shark	1 059	1.63
<hr/> Total landed	<hr/> 64 960	

* Morwong and deep-water flathead, *Neoplatycephalus speculator*, are not separated when boxed for Sydney market

In view of recent expressions of doubt as to the economic future of trawling in the Bight, it may be useful at this stage to examine the catching rate of the *Southern Endeavour* during the present cruise.

Providing there is an available fish population present on a fishing ground, the earnings or losses made by any fishing vessel depend on the time taken to fill its fishroom with marketable fish. A ship incurs running expenses which are virtually the same for every day she is away from port, whether fishing or simply moving from one point to another, so that the greater the proportion of time devoted to actually catching fish each trip, the greater the catch and the corresponding profit.

The time a vessel is absent from its home port may be broken down into four distinct periods, which are usually short enough to be considered in terms of "hours." They are: (1) The number of hours involved in travelling to and from port or from one fishing ground to another; (2) The number of hours the trawl or gear is on the bottom and fishing; (3) The number of hours taken up by hauling, emptying, and shooting the net; (4) The number of hours spent idle due to bad weather, mechanical defects, or damaged gear.

The period for which a vessel may stay away from port is usually governed by the length of time iced fish may be safely held without deteriorating in quality. If long distances are involved, fuel and water may be a factor, but with the modern trawler, which has a range of up to 6 000 miles and carries a month's supply of water, these limitations are secondary to fish storage.

If the number of fishing hours per trip is to be increased, this can only be accomplished by reducing periods (3), and to some extent, (4). Period (1) will always be more or less constant

unless grounds are discovered closer to the home port or, on the other hand, it becomes necessary to travel even further to load the vessel. Mechanical defects or damaged gear, although they can be guarded against, are unforeseen causes of delay, but in a well-run ship are not great contributors to loss of fishing time. Thus the only periods remaining from which fishing hours may be gained are those involving shooting and hauling and inclement weather.

This is where the need for a competent crew is most felt. Not only will an efficient crew reduce the time in between hauls considerably, but in addition will be able to work the gear in weather which would otherwise immobilize the ship.

An examination of some of the figures quoted in the preceding 'Time Dissection' will show to what extent it should be possible to improve the catch per trip of the *Southern Endeavour* if the ship were to be worked efficiently.

It will be noticed that out of the 288 hours the ship was absent, 147 hours, or 51.04 per cent., of the time allotted to the cruise, was spent on the fishing grounds. Of this time, however, the net was only fishing for a total of 92 hours with the balance of 55 hours occupied by shooting and hauling and laying-to because of bad weather. Altogether 23 hauls were made during the 92 hours with an average lapse of 63 minutes between hauls. If this latter time had been reduced to 35 minutes (the average time taken in trawlers working with British crews) more than ten additional hours fishing time would have been gained. In this time, two further four-hourly hauls could have been made. Again, allowing the total time taken to make one four-hour haul including shooting and hauling to be four hours 35 minutes, if the ship had continued working for the 18 hours of bad weather, four more hauls could

have been made, bringing the total number of additional hauls to six.

Taking the average catch per haul for the trip (25.22 cwt); six more hauls would, in all probability, have increased the total catch of 29 tons by 7.56 tons. This would represent a 20 per cent increase in the trawler's income for the trip.

If the rate of catch obtained during the present cruise, viz., 25.22cwt per haul, is taken as a conservative estimate of the expected average, the marketable catch of the vessel per year would total 21 790 cwt or 1 089 tons. The assumption that this rate would be sustained seems justifiable because: (a) It is apparent from the records of the *Ben Dearg* and *Commiles* that a seasonal fluctuation in abundance of fish occurs in the Bight. The average monthly catch per hour's fishing for both these vessels was reduced by 23 per cent during the spring and summer months. (b) the catch per unit of effort should rise commensurately with the accumulation of fish lore, the understanding of fish movements, and the modification of the gear to local requirements.

The commercial future of the Bight fishery will be dependent on: (1) An improvement in both the catching rate of the trawler and the yearly landed catch; (2) The reduction of costs associated with shore handling and the marketing of the fish caught.

PART II

THE RESEARCH PROBLEM

It is evident that some definite plan of operation will soon have to be adopted with regard to the venture itself. At present the trawler is making encouraging catches from a limited area of the Bight but due to marketing problems is operating at a substantial loss.

The present difficulties will have to be resolved in one of three ways: (1) Winding up the company and ending the venture at this stage; (2) Persist with the present method of fishing and selling fish in the hope that things will improve; (3) Use the vessel for exploratory fishing and research for a period until marketing difficulties are overcome.

The first suggestion has already been made by the Chairman of the company. The second will most likely be the recommended course of action. The third probably has not yet been considered although it is surely the most logical.

It seems that the development of the Bight fishery should be attempted in 3 stages: (1) An exploratory stage during which the distribution of the fish populations are studied for all areas of the Bight. This would result in the understanding of such factors as season fluctuations in population density, topography of the bottom and the modification of gear to local conditions. In addition shore facilities and public reaction to the species present could be tested by trial landings. (2) A development stage with a Government company exploring the problems associated with running a trawler commercially, and the disposal of the catch either as wet or processed fish. (3) A commercial stage at which point development of the industry is handed over to private enterprise as a sound investment.

The present venture has commenced at Stage 2 with the result that many problems that belong to Stage 1 are unsolved and a considerable trading loss has been sustained over the first few months of operation.

Appendix 5: Extract from aerial fish spotting log (Table A5.1) 4-27 April, 1978 covering continental shelf area along the south coast of Western Australia. (Original logs viewed from copies provided by the West Australian Department of Fisheries and Wildlife, the Fisheries Development Section of which undertook the survey). This data should be viewed in conjunction with the map given in Figure A5.1.

Table A5.1: Extract from aerial fish spotting log 4-27 April 1978

Date	Time flown		Area worked		Pilchard observations	
	Period	Hours	Minutes	Lat.		Long.
April 1978 16th	AM/PM	4	35	33	58	2 schools sighted
				33	52	
				32	57	
				32	58	
17th	AM	3	50	36	48	
				39	39	
				39	34	
				39	34	
18th	AM		45	41	34	Mission aborted
21st	AM	4	20	36	48	Large areas of bait fish Large areas of bait fish
				37	43	
				35	48	
				35	44	
				35	43	
				43	33	
22nd	AM	3	15	42	25	Some schools sighted, best 15 tonnes rest 8 to 1 tonne
				42	35	
				40	25	
				39	32	
	PM	3	5	35	44	
				40	39	
				39	34	
				38	37	
23rd	AM	3	25	41	34	"Plenty of bait fish in this area"
				39	34	
	PM	3	20	37	46	
				38	39	
				35	44	
				35	45	
24th	PM	2	10	35	44	Approx. 50 schools sighted
				39	35	
				38	36	
				32	58	
				35	44	
				35	45	
25th	AM	3	30	34	52	Pilchard schools sighted "Very large area pilchards sighted"
				35	57	
				32	58	
				33	66	
				33	49	
				33	52	
26th	AM	3	25	33	53	5 schools sighted 5 schools sighted 4 schools (some large) sighted
						Mission aborted
27th	AM	2	10	36	52	Small patch of pilchard observed
				34	64	
				35	57	
				32	58	
27th	AM	2	10	33	66	3 schools observed
				31	42	
				39	34	

Total hours flown 76hrs 5 min. Aborted flights 1hr 10 min. Total effective hrs 74hrs 55min.

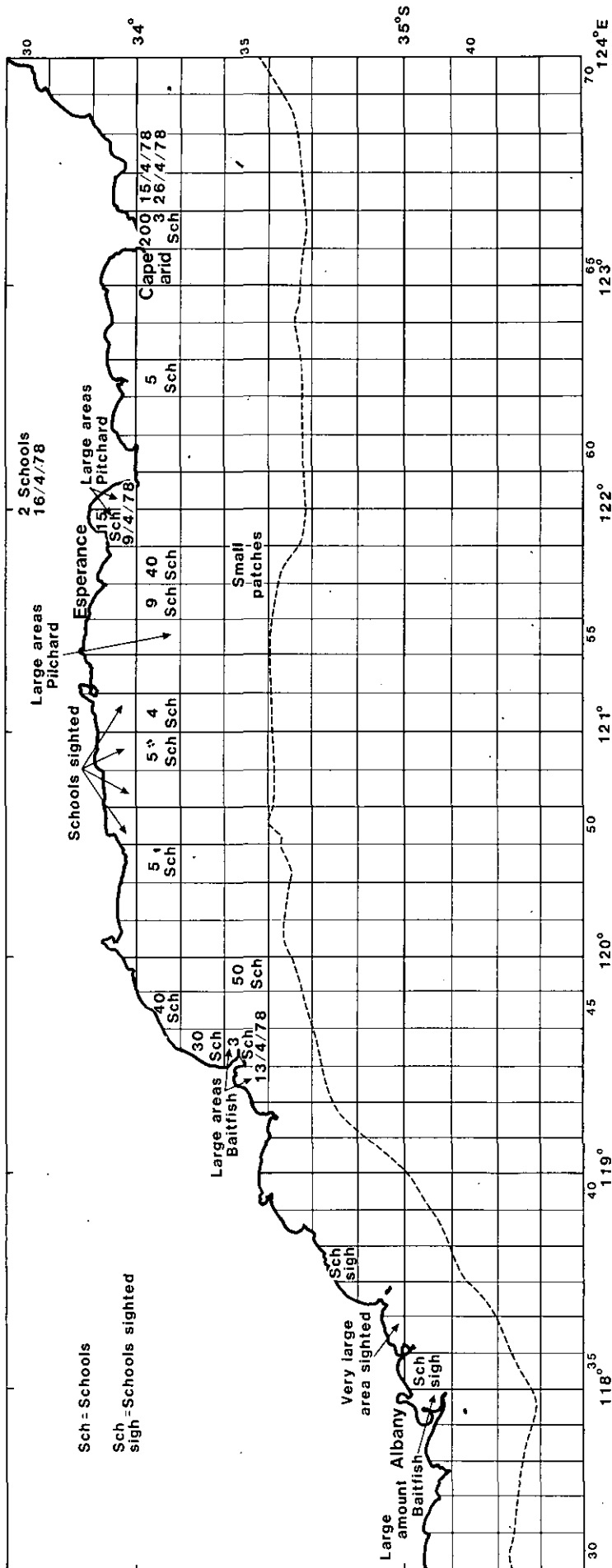


Figure A.5.1: Surface schools observed by aerial spotting by the West Australian Department of Fisheries and Wildlife in April 1978.

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