



FISHERIES DEPARTMENT
WESTERN AUSTRALIA

REPORT No. 76

Published by the Director of Fisheries, Perth,
under the authority of the Hon. Minister for Fisheries



The Australian Herring Fishery in Western Australia, 1973-1985

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PERTH
WESTERN AUSTRALIA

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WESTERN AUSTRALIA, 1973-1985

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ABSTRACT

The Australian herring (Arripis georgianus) is a pelagic, largely marine, species which is relatively abundant in the south western waters of Western Australia. It is a close relative of the Australian salmon with a similar life history and habits which includes migrating for the purpose of spawning. The Australian herring is keenly sought both as a food fish and for bait. This report documents the fishery for this species as it has developed during the period 1973 to 1985.

The professional fishery developed as an adjunct to the Australian salmon beach seine fishery which operates from Geographe Bay on the west coast to the Doubtful Is. Bay area east of Albany. The method of capture for Australian herring was initially beach seine but this method is being replaced, in most areas, by the larger more efficient set trap nets. Trap netts are becoming more popular as they can be operated on beaches previously unsuitable for beach seining. Many trap nets have been modified to suit specific sites. The catch from the professional fishery is largely utilised as rock lobster bait.

The Australian herring is a very popular amateur/recreational fish species being abundant and readily caught using hand lines or rod and line.

The professional fishery was unregulated until recently, but as the fishery has grown, rules have now been introduced (December 1982). These regulations include a ban on trap netting during the main part of the Australian salmon season to allow the migration of this species and the priority and times for the setting of nets. The introduction of regulations had the effect of increasing interest, and therefore pressure, in this fishery and it is now almost an all year operation.

Data analysed showed that the total catch of Australian herring has increased during the years 1973 to 1985. Fluctuations that have occurred are not necessarily related to abundance as effort in this fishery is influenced by other factors including the state of the Australian salmon fishery, the price paid for salmon compared with herring, the introduction of new fishing methods and environmental conditions.

The south coast herring fishery is divided into three areas with the central (Area II) and eastern (Area I) being the prominent catching areas. Area I is becoming more important due to the influx of new non-salmon fishermen into this area.

Cumulative catch data indicate that for most years, in the period considered, very few catches are made until mid to late March and that the main catching month is April.

The number of beaches fished and the number of fishermen involved in this fishery fluctuate from year to year, but have shown a marked increase in recent years which is consistent with more catch being taken.

The catch per unit of effort (CPUE) measurements of catch per beach and catch per fishing unit were calculated, either being suitable measures, and considered by area and for the overall south coast fishery. When total catch is considered with either measure of effort, up until 1981 there is an obvious relationship. Beyond 1981, the relationship does not hold as total catch is still increasing while CPUE is being maintained reflecting the increases in efficiency and effort. The Australian herring stock would therefore appear to be in a fairly good state despite increases in effort, but would need to be closely monitored for any changes in the future.

I BRIEF HISTORY OF THE WESTERN AUSTRALIAN HERRING FISHERY

The Australian herring has been recognized in Western Australia as a useful food fish species since the early days of colonial settlement in Albany by Captain James Stirling. It is an abundant, easily caught marine pelagic species which occurs in southern W.A. waters from south of Shark Bay to the South Australian border. The species also is distributed eastwards in South Australian and Victorian waters where it is usually known as Tommy ruff. The Australian herring Arripis georgianus (Valenciennes, 1831) is a close relative of the Australian salmon Arripis trutta esper Whitley, 1951, with a similar life history and habits. It is commonly encountered in Western Australian waters to a size of 25 cm whereas the Australian salmon averages 60-70 cm in length.

Small professional catches have been made historically since these colonial times using set and haul nets both in estuaries such as Oyster Harbour (Albany), Leschenault Inlet (Bunbury), Peel and Harvey estuaries (Mandurah) and Swan Estuary (Perth) and in the sea at Albany, Bunbury, Mandurah, Fremantle and at Rottnest Island (Figure 1). Such catches were usually sold to the public as fresh fish and historically there has always been a market for small quantities of herring. The marketing of larger quantities has generally been difficult with the price paid being susceptible to oversupply.

Australian herring has always been readily identified by professional fishermen as a pelagic, largely marine species which migrates throughout south west W.A. The species migrates westwards along the south coast and then northwards up the west coast towards Rottnest Is. for spawning. This predominantly occurs during the months of April and May directly following the similar migration of the Australian salmon. After spawning, herring become largely resident throughout the south west of W.A. The stock is dependent upon the migration of recruit fish, as resident fish, after spawning, are depleted in terms of number by natural mortality and fishing pressure.

A professional beach seine fishery has operated upon Australian salmon since the mid 1940's between Bremer Bay on the south coast (Figure 1) and Perth on the west coast (Walker, 1982). This fishery has always taken herring with varying degrees of enthusiasm which depended upon the salmon catch e.g. more interest in poor salmon catch years, less interest in good years; the demand; market; and price paid for herring. In the early years i.e. 1950's and 1960's, the herring catch was canned, (approximately 95%), with the remainder being sold as fresh whole fish and a small proportion as fillets. Fremantle waters had always provided the greatest quantity of fresh fish. Canneries existed in Albany and Mandurah and the quantities canned averaged around 200 tons, although in 1962, 500 tons were canned. The demand for herring for canning purposes in these years thus largely controlled the herring catch, most being caught to order from beaches such as Cheynes Beach, Cape Riche, Perkins Beach, Pallinup, Doubtful Island, Wilson's Inlet and Albany Harbour. The majority of the catch was caught at Cheynes Beach, largely with a herring trap net which had been in use there since around 1953. This trap net was set at sunset and was 400 yards in length, 1 3/4" mesh, 18 ply and 30

ft deep in the bunt. For a time a fisherman attended the net all night in a boat and initiated the hauling procedure when he judged that sufficient herring for the factory's handling capacity was inside it.

During the 1950's, rock lobster fishermen began to catch herring for their own rock lobster bait requirements predominantly in the Rottnest Island area. There are no formal records of the quantities taken as such catches were not required to be reported on monthly returns. Catches were frozen and stored for use with undoubtedly small quantities being sold as fresh fish. This operation, with time, led to conflict with the recreational group and from 1964 was restricted to the months of May-July the peak of the Rottnest Island herring season. Conflict between the two groups, however, continued and in 1973 a total all year ban was placed on net fishing at Rottnest. By this time herring was well established as a rock lobster bait and a market existed accordingly. Opportunity thus existed for the south coast herring fishery to expand in terms of both catching and processing. This occurred over several seasons from 1974. Prior to this in reality, only one processor received herring in Albany and handled around 90% of the entire W.A. herring catch.

A second processor commenced operations in a small way in 1976 and over the next few years increased capacity to handle herring. The original processor also began to take more herring for the bait market correspondingly becoming less interested in canning herring, of which in the past they had canned up to 200 tons. In 1977 the west coast salmon processor commenced operations on the south coast in terms of salmon and also took herring. Thus by 1980 there were three outlets for herring and the demand for it as rock lobster bait had increased considerably. The gear utilized in this period to take herring was both beach seines and trap nets left set overnight. The usage of trap nets had increased very gradually over this period.

Salmon fishermen prior to the 1970's were required to clean their fish on the beaches in order to sell them to the processors. This cleaning process, which included heading and gutting, was both time and labour consuming. During the early part of the 1970's processors began to receive fish in the whole/round condition and clean them in the factory. For a time differing prices were offered for whole and cleaned fish. Therefore financial incentive existed which encouraged the cleaning of small salmon catches e.g. below 2 tonnes which could be cleaned easily and quickly. With time and competition between processors, towards the end of the 1970's the price incentive to clean fish disappeared as did the cleaning of salmon on beaches. With the abandonment of this cleaning process, in later years, more time was available for herring fishing, particularly with trap nets.

The herring fishery until the 1983 season was unregulated in terms of gear, entry, etc. Increases in price and demand for herring which occurred in the 1980's led to a corresponding increase in conflict between professional fishermen. This was in regard to access to the resource, use of traps, etc., both

during and outside salmon and herring migrations and fishing seasons. This eventually led to the Hon. Minister and the Department of Fisheries and Wildlife in 1981-83 establishing some regulations concerning herring trap usage, entry of further fishermen into the trap fishery and movement of fishermen after the salmon migration to take herring, etc. These factors, together with an increase in price paid for herring at the same time as a decrease in the price paid for salmon, increased interest in the use of trap nets which subsequently led to an increase in fishing effort for the 1984 and 1985 seasons.

During the 1982 and 1983 fishing seasons several additional fishermen, who did not hold authorizations to catch Australian salmon, began to catch herring in locations previously unfished or had moved onto salmon fishing beaches to take herring as salmon fishing teams vacated them. This historically produced some conflict and led to the regulations as outlined. With time some of these fishermen began to use trap nets outside the traditional herring fishing season i.e. April/May to the extent that in latter years the trap fishery is a year-round operation, dependent upon good weather conditions. The exception is the period 10 February to 24 March during which herring traps cannot legally be set i.e. the peak of the salmon run. Peak catches occur during the migrating herring run. Catches outside this period are interpreted as large resident pre or post-spawning fish. Non-salmon fishermen tended to operate in a different manner, in terms of fishing method and approach, to the traditional salmon fishermen who fished for herring. Thus innovations in the mode of operation were introduced into the herring fishery by the entry of this group of fishermen not holding salmon authorizations.

The increased price paid for herring and number of operators taking herring has also encouraged, since 1983, the entry of two further smaller processors. Processing herring involves freezing and packaging for rock lobster bait. In 1985 there were 6 processing establishments in Albany, of varying capacity.

Recreational fishing, which utilizes the catch of herring for food, has grown in order of importance, with time, as more leisure time has become available to people. This has been assisted by technological and economic changes which has made 4 wheel drive vehicles, boats and fishing gear more accessible to, and efficient for, the recreational group. A creel census was conducted by the W.A. Department of Fisheries and Wildlife in 1973 to investigate the amateur recreational fishery for herring between Two Rocks and Mandurah and at Rottnest Island (Lenanton and Hall, 1976). This census obtained a rough estimate of the amateur catch at that time of 140 tons of herring, a substantial catch. W.A. boasts one of the highest power boat ownerships per head of population in the world and clearly herring is of major importance to this group in terms of fishing activities. A household survey conducted in 1976 into the seafood eating habits of Australians discovered for the Perth metropolitan area that the highest score for a fish species eaten during the survey period went to herring. The herring eaten had either been caught by a family member or

received as a gift from a recreational fisherman (Working Group on Mercury in Fish, 1979).

DESCRIPTION OF THE HERRING FISHERY IN 1985

A. Gear and mode of operation - Professionals

Three basic types of gear are used to take herring as follows:

- (a) Set nets of varying mesh size usually 54-58 mm. Nets are usually set overnight in sheltered waters. Sometimes set nets are run around herring schools at sea to mesh some herring.
- (b) Beach seines shot from the shore from aluminium or timber dinghies usually rowed rather than under power. Netting teams either wait for schools to move into a predetermined position to be netted or are mobile travelling along beaches in 4 wheel drive vehicles looking for schools and carrying boats and nets with them. Beach seines vary in length from 200-500 metres and in depth according to areas fished. Ring nets which are used in Geographe Bay are in reality simply beach seines which are set and hauled onto a boat. Ring netting units travel along the shore in the sheltered waters of Geographe Bay and fish are netted over sand or seagrass beds.
- (c) Trap nets are made of netting material, as used in beach seines, and are set out from the shore at night in a configuration which contains a 'hook' at one end. Most nets are designed and built for a specific beach. Setting configurations vary with G and No. 6 configurations being most commonly used (Figure 2). Dimensions of some trap nets are given (Table 1). Some trap nets consist of floats and anchoring systems placed in the water for the period of the herring migration onto which netting material is clipped when a set is required. Sometimes boats or pontoons are used as floats often on the corners or curves of the netting configuration. Always one end of the net is anchored to the shore. Nets are set towards sunset and hauled after sunrise. Nets can only be set in good weather and sea conditions as they are liable to be damaged, lost or rolled with a subsequent loss of catch in poor conditions. Thus trap settings are not everyday occurrences, in fact sometimes only 10-20 settings are achievable for a two to three month season. Trap nets were not usually set after mid May because weather and sea conditions are approaching a winter pattern even though herring are still migrating past netting beaches. Regulations have existed since 1983 which control setting times. Herring are taken from trap nets either by hauling the whole net onto the beach, by removal of a pocket which is hauled onto the beach, or by seining fish out from the net with a smaller beach seine. In many cases the quantities of fish taken in a net are excessive and therefore prevent hauling the net directly onto the beach. The entry of non-salmon fishermen into herring trapping has led to the introduction of innovations in recent years in terms of trap net construction, mode of operation, and

location compared to what was the experience of the past. Previously a net was set in a No. 6 or G configuration in the middle of an easily accessible sandy beach. Pockets have been introduced to trap nets often not centrally located but rather at one end. Hauling of such a net from the other end to the pocket occurs and eventually fish are driven into the pocket which is tied off and hauled ashore either detached or attached to the net. Such innovations have been introduced to allow fishing on small sandy beaches not previously possible to fish efficiently with trap nets. They also allow fishing over rocky bottom which was previously impossible.

Fishermen operate their gear in teams usually under the control of a fisherman who in most cases also holds a salmon authorization. It is possible for one man to operate a set net by himself but this is not possible with beach seines, ring nets and trap nets. Usually it takes two men to operate a ring net, two and more men for a beach seine and from 4-6 men and sometimes more for a trap net. In this report the term fisherman is used to apply to the leader of the team as the fishing unit rather than to an individual within that unit.

B. Gear and mode of operation - Amateurs

Recreational fishermen fish for herring from boats with handlines, by trolling a spinner/lure or using gill nets. When fishing from the shore they use rod and reel and a variety of rigs (Figure 3). Prawns, whitebait, blue sardines, blow fly maggots (known as wogs) and sometimes just coloured plastic or silver coloured material are used as bait. Shore fishing is undertaken off seaweed banks on the beach, from rocky shores and from jetties, wharves and groynes. Usually a 'streak' of fish oil, preferably whale oil in the past, is used to attract schools of herring close in to shore or to a boat.

C. Disposal of the professional catch

The herring catch is removed from trap nets with the aid of front end loaders or conveyors and loaded into trucks for transport to processors. The herring catch is basically utilized as rock lobster bait.

Processors wash the catch, freeze and pack it into 20 kg cartons for rock lobster bait. Cartons are transported to Perth, Geraldton and other rock lobster fishery centres where they are stored in commercial and private freezers until required. The present market for herring, as rock lobster bait, is of the order of 700-1000 tonnes. In the past, once this catch level had been obtained, processors abandoned buying herring and consequently the trap fishery closed. Since 1983, some fishermen have regularly operated trap nets successfully outside the herring migration season i.e. March-May. Constraints to this operation are their other fishing activities and weather. This catch is also utilized as rock lobster bait and for food.

Smaller herring catches are made with beach seines and set nets, and are sold to processors for bait or marketed either

directly or indirectly for food. Some fishermen, especially on the lower west coast, market their catch directly to the public from small establishments attached to their homes. Such establishments, in some cases, are licensed and controlled by local Shires as retailing outlets and consist of facilities such as brick buildings with concrete floors, stainless steel benches, coolrooms and small freezers. In many cases being able to buy fresh herring is an attraction to tourists and local people alike and thus important to the community of the south west. Catches made include both migrating and resident herring with resident fish being as important as migrating fish for they enable fishermen to service a demand for herring outside the migrating season.

D. Regulation of the professional fishery - background, development and current status

There has been conflict over Australian herring amongst professional fishermen and between professionals and amateurs since the early 1940's.

Power to endorse a professional fisherman's licence with conditions to assist in management and control of any fishery was introduced as an amendment to the Fisheries Act in 1946 (published in Government Gazette (No. 22, Sect. 3). This power was used in 1947 to set up some operating rules for a haul net fishery for herring which existed at the Bunbury breakwater. Up to 4 netting teams operated there at the time and had come into conflict. Rules introduced as a condition of licence concerned the priority of netting (shots) and the operation of shots, etc.

Herring had been taken at Rottnest Is. by professional fishermen since at least the 1930's. They either marketed their catch as fresh fish and/or retained it for their rock lobster bait requirements. Conflict has traditionally existed at Rottnest between this group and recreational fishermen, as a consequence of which a partial netting ban was introduced (published Government Gazette 3 July 1964, 23 August, 1969) to prevent professional fishermen from disturbing amateur anglers. This ban applied from 1 August to 30 April and thus allowed professionals to take herring, which would otherwise be lost to the public, during the peak of the herring run at Rottnest i.e. May, June and July. The conflict and controversy continued, fuelled by expansion in the professional catch until 1973 when a total netting ban was introduced. This was well received by the recreational group but not by the professionals. The ban exists today.

The Fisheries Department controls fishing generally on salmon beaches during the period 15 February to 30 April by a proclaimed fishing zone legislation (amendment to the Fisheries Act 1964, published in Government Gazette 29 August, 1975). All salmon beaches have been declared proclaimed fishing zones and published as such in the Government Gazette. Prior to 1982 the great majority of herring was caught on salmon beaches largely within the proclaimed fishing period. This gave the Fisheries Department regulatory powers over the herring fishery as an ancillary to the principal intent of the legislation to protect salmon fishing operations.

The Fisheries Act, Section 17(3) which relates to the granting of licences, gives power to the Hon. Minister and the Fisheries Department to regulate types of fishing gear used, including herring trap nets.

Prior to 1982 herring was taken on salmon beaches basically, by salmon fishermen after the salmon run was almost complete, with trap nets and beach seines. The herring fishery unlike the salmon fishery, was not managed by limited entry, although many salmon authorization holders regarded it as so, in practice if not in principle. They also expected the same protection of their herring fishing activities, under the terms of the proclaimed fishing zone legislation, as occurred with salmon fishing. In the period 1980-82 a number of fishermen applied for permission to use some salmon beaches, whether occupied or not, to fish for herring when the salmon run was mostly finished. This was allowed for two beaches with a consequent conflict being produced. The Fisheries Department introduced rules to regulate priority of netting (shot), and setting times. Also in response to a decreased abundance of salmon and an increasing demand and price paid for herring, herring trap nets had tended with time, over the past ten years, to be set earlier and earlier in the salmon and herring fishing season. Consequently trap nets were being used before the salmon migrating run had commenced, before the run was complete and even during the main part of the run. The setting of herring traps while salmon were migrating especially from mid-February and in March was unacceptable to many salmon fishermen. They pointed out to the Fisheries Department and to the Hon. Minister at a South Coast Licensed Fisherman's Association meeting (11.9.81) that these herring traps acted as a barrier and as such interfered with the movement of salmon and also sometimes caught salmon. Therefore, the practice of using trap nets prejudiced their salmon fishing operations, especially if they operated westwards of the traps i.e. further along the migration path. The setting of such nets while salmon were migrating, they pointed out, was illegal under legislation (Government Gazette 21 January 1966) "which prevents the taking of Australian salmon within W.A. waters with a net which when set in the water prevents or is intended to prevent the free passage through such water of fish" which was commonly known as a "set block net". The Hon. Minister undertook to review the situation concerning the use of herring traps generally which included meeting with fishermen, individually and collectively at a specially convened meeting in Albany 24.11.82, to discuss their views. Following the November 1982 meeting, the Hon. Minister, in a letter to the South Coast Licensed Fishermen's Association (6.12.82) set down rules concerning the operation of herring traps and the herring fishery generally, as follows:

- (1) To prohibit the use of herring trap nets on the south coast during the period 10 February and 24 March (dates inclusive).
- (2) To reserve the capture of herring on a specific salmon beach to the salmon authorization holder only, until 20 April.
- (3) To allow other fishermen to move onto a proclaimed beach on or after 20 April, subject to approval.

- (4) If approved, conditions of operation by both the applicant and the resident fishermen would be set out.

The Hon. Minister stated that to allow undue competition on beaches over the capture of herring had the potential to return to a conflict situation and that the historical pattern of fishing should prevail until 20 April.

Subsequent to this decision the Hon. Minister decided to continue to allow the movement of one fisherman to a particular beach earlier than this date, as had occurred since 1980. The date allowed was 10 April or earlier if both teams i.e. moving and resident chose to operate as a single unit. If not operating as a single unit the date 10 April was to apply and setting was to be on a day by day basis.

In regulating approved movement and operation of teams the Fisheries Department has developed the following rules regarding setting:

- (i) If a team which has the authority to fish on an allocated night decides not to do so, they lose the right of that set, and any of the remaining team/s may set without losing the authority to set on their allocated night, thus gaining an extra night's fishing.
- (ii) The herring net shall not be set prior to 1600 hours.
- (iii) Daytime beach hauls up to 1600 hours may be carried out without the loss of the allocated night set.

The Department has also established additional rules pertaining to both new entrants into the fishery in terms of trap operation and new locations in which traps may be operated. New entrants must be licensed south coast estuarine fishermen and new beaches must have the approval of local Shires and other Government bodies which might have jurisdiction in, for example, National Parks.

The introduction of regulations, concerning the catching of herring with trap nets, focussed attention on the fishery with the result that the usage of traps increased, particularly out of season. This phenomenon of increased effort as a result of the introduction of regulations, is a common observation of many other managed fisheries.

III WESTERN AUSTRALIAN HERRING CATCHES 1975/76 - 1983/84 AS INDICATED BY AUSTRALIAN BUREAU OF STATISTICS DATA

Professional fishermen's monthly returns are coded by the Fisheries Department and processed by the Australian Bureau of Statistics (ABS). ABS returns this information to the Department as processed data on computer tape. Two summaries of herring catches were produced from these data (Tables 2 and 3): catches in live weight by fishing method; and catches in live weight by locality. Both summaries were for the 9 year period 1975-76 to 1983-84 and were for the whole State.

Examination of the catches made by fishing method (Table 2) shows that the major proportion of the herring catch was made

by haul net and beach seine, averaging 90.6% of the State's total and ranging from 87.3% to 92.8%. This was followed by mesh set and gill net, averaging 8.4% and ranging from 5.5% to 11.2%. Smaller amounts of herring were taken by the methods of purse seining, lampara netting, trapping, poling and with pot and drop nets. Such methods would have been targetting on other species in addition to herring, e.g. pilchard with purse seining and lampara netting, and thus these catches must be in the by-catch category and of relative unimportance to the herring fishery. The ABS data set does not allow separation of the herring catch in terms of set herring trapping and beach seining.

Analysis of catches made by locality (Table 3) show that for the period 1975-76 to 1983-84, clearly the most important herring catching localities were those grouped in this table as Doubtful Island to Windy Harbour taking for the 9 year period 6 203 479 kg, averaging 86.2% of the W.A. herring catch and ranging from 82.5% to 90.5%. This area is the area of the W.A. salmon fishery and since 1983 the regulated area for the taking of herring with set herring traps. ABS data are listed for this area according to the following localities:- Doubtful Island, Bremer Bay, Pallinup Estuary, Boat Harbour East, Cheynes Beach, Cape Riche, Two People Bay, Betty's Beach, Nannarup, Albany, Wilson's Inlet, Lights Beach, Parry's Inlet, Boat Harbour West, Irwin Inlet, Nornalup, Peaceful Bay, Walpole, Broke Inlet and Windy Harbour. They were grouped as Doubtful Island - Windy Harbour by the authors because the Fisheries Department holds factory receival data for this area which are more specific in terms of localities and because the purpose of this examination was to identify the relative importance of other localities outside Doubtful Island - Windy Harbour.

Other localities in order of importance for the 9 year period were: Bunbury, taking 384 460 kg, averaging 5.3% of the total W.A. catch and ranging from 1.9% to 9.2%; Fremantle, taking 209 313 kg, averaging 2.9% of the total and ranging from 1.4% to 6.5%; Busselton, taking 98 150 kg, averaging 1.4% of the total and ranging 0.4% to 2.9%, Quindalup, in Geographe Bay, taking 94 808kg, averaging 1.3% of the total, ranging 0.9% to 1.7%; and Mandurah, taking 49 915 kg, averaging 0.7% of the total and ranging 0.3% to 2.2%.

Catches of herring for the 9 year period of less than 21 tonne were made at Fremantle, Augusta, Esperance, Margaret River, Green Island/Cervantes, Eagle Bay, Whitfords, Rockingham, Safety Bay, Lancelin/Wedge Is., Jurien Bay, Wreck Point and Hamelin Bay (Table 3). Small catches of less than 2 500 kg for the 9 year period were also recorded for 12 other localities (Table 3).

Catches from the south coast herring fishery i.e. Doubtful Is - Windy Harbour predominantly are sold for rock lobster bait whilst from other localities most are sold as food. Catches from many areas such as Bunbury, Quindalup, Mandurah and Busselton are often sold direct to the consumer. Undoubtedly some catches from such sources are never recorded on fishermen's monthly returns and thus figures given are underestimates of their importance. The importance of such

catches however, although small compared with the south coast herring fishery, should not be underestimated in terms of the income they generate to fishermen, and the provision of fresh fish to residents of, and visitors to, such areas.

Catches which are made north of Perth are much less than those discussed but are also likely to be underestimated on returns and are sold for food or bait. They also generate income of importance to small fishing operations.

IV SOUTH COAST PROFESSIONAL CATCHES DERIVED FROM FACTORY RECEIVAL DATA , 1973-1985

Factory receival data were collected from processing establishments and coded for computer processing. Processing establishments give a receipt for each load of herring received and record daily catches (kg - total weight) as received by fishermen and by location and forward such data to the Fisheries Department on request. This is a statutory condition of their processing licence, as well as the provision of monthly processing figures.

Once coded and computerized the data were checked against original receival data and, when correct, summaries produced using the variables: date, fisherman, beach, area and total weight (kg).

Total herring catches for the south coast by month for the years 1973 to June 1985 are shown in Table 4. Total south coast herring catches by year are shown in Figure 4. These data show the increase in south coast catch which occurred in 1974 as a result of the 1973 total netting ban imposed for Rottneest Island. A decline in catch then occurred to the previous levels for the next 4 years, and then increased, with some fluctuations, to the level attained in 1985 of approximately 990 tonnes. The catch attained in a season has always been influenced by the price paid, the previous salmon catch and its price paid, and the weather rather than the abundance of herring available. Before the 1983 season the majority of the catch was taken during the months of March and April, with the major catching month usually being April. Smaller catches occur outside of these months. Catches from June to February are thought mostly to involve resident schools of fish, rather than migrating schools as is the case in March, April and May. During the non-migrating months, smaller catches are also sold to the public as fresh fish, but these only appear in ABS monthly fisherman's return data and not in factory receivals. Herring delivered to factories is usually frozen and packed for rock lobster bait. In the past up to 200 tonnes of herring were canned in Albany, but this has not occurred for some years now.

From the 1982 season onwards the major catching month was April with more significant catches being made in other months than had previously occurred. This can be largely attributed to the closure to herring traps of February 10 to March 24 (inclusive). In spite of this closure in 1984, 202 tonnes of herring were caught during March i.e. after 24 March. Receival data after 1983 demonstrate the influence of new entrants into the fishery, often non-salmon fishermen, who fish all year

round with herring traps. Prior to the introduction of a closure in 1983 this did not occur to a large degree, at least not with herring traps. Other factors such as the increase in price paid for herring compared with a decrease for salmon, has lead to herring becoming more valuable to fisherman than salmon. This has encouraged salmon fishermen to become more interested in catching herring which previously was secondary to the catching of salmon. The increase in use of herring traps produced a subsequent increase in catch thereafter.

Total south coast herring catches grouped into 3 areas (Figure 1) and expressed as percentages of the total south coast catch are shown (Table 5, Figure 5): Area I, Pt Charles to Cape Riche; Area II, Cheynes Beach to Albany east; Area III, Albany west to Windy Harbour. Prior to 1978 the total catch was mainly divided between area I and area II. From 1978 onwards, area III increased in importance although at a much lower level than areas I and II. These changes are attributed generally to the introduction of herring traps to beaches previously unfished by this method. The distribution of herring schools varies to some degree between areas from year to year as is the case with Australian salmon. Schools appear to prefer certain locations each year. It is likely that water temperature and salinity may be important environmental factors which influence this.

Cumulative catch data and daily catch totals derived from factory receivals for the years 1973-1985 are shown (Figures 6,7). The cumulative catch data for the years preceding the recent closure, i.e. up to 1983 show that the season did not commence until the herring migration began in March i.e. very little catch was taken during the months of January and February.

For the years 1973 and 1974 small catches were made beginning early in March until by the end of that month 29% and 26% of catches had been taken respectively. The years 1975 to 1979 took almost no catch before mid-March, taking between 16 and 43% of their respective total catches by the end of March (1973 - 43%, 1976 - 21%, 1977 - 16%, 1978 - 22%, 1979 - 24%). Insignificant catches were made up to the end of March for the years 1980 and 1981 (13% and 15%), with 1982 obtaining 30% of its total catch, mainly in the latter stages of the month.

The majority of the catch was taken during the month of April for the years 1973 to 1982. In the case of the years 1973 to 1977 the total catch i.e. 100% was attained by the end of April. The years 1978 to 1982 had taken between 80-98% of their catch in April, with 1979 to 1982 achieving their total catch (100%) by early May. 1978 attained 100% catch by the end of June. For all these years, i.e. 1973 to 1982, insignificant catches were sometimes made in the months June to December but these were of insufficient magnitude to affect the total percentage.

In the years of 1983 to 1985 since the seasonal herring trap closure (10 Feb - 25 Mar) there have been some minor changes in the nature of the fishery. In 1983 and 1984, as with previous years, only minimal catches were recorded up to 10 February but 1985 achieved some good early catches amounting to 14% of the total catch at this time. Small catches, the result of beach

seine operations, were made in all three years (1983, 84, 85) during the period of the closure up to 25 March resulting in the percentage totals of 4%, 12% and 15%. By the end of March the cumulative catch percentages had reached 9%, 32% and 18% for the years 1983 to 1985 respectively. The years 1983 to 1985 followed a similar pattern to previous years with the majority of the catch being taken in April i.e. 94%, 98% and 92%. These years, again following a similar pattern to years prior to the closure, achieved total catch percentages by early to mid May.

It should be noted however, that more consistent small catches were made in the months following the season i.e. June to December, but again these were not of the magnitude to change the overall percentages. During the years 1983 and 1984 (1985 data are incomplete) herring catches were made in almost every month of the year, although for most months catches were minimal.

V EFFORT AND CATCH PER UNIT OF EFFORT IN THE PROFESSIONAL FISHERY 1973-1985

The number of beaches fished per area per year and the number of fishermen (fishing teams or fishing units) per area per year were calculated by extraction from computer summaries of factory receival data (Table 6).

The number of beaches fished varied between 6 and 12 in the period 1973-1980 and increased from 1981 onwards to as high as 21 beaches in 1984. A similar trend can be seen with the number of fishermen/ teams operating, varying between 9 and 19 in the period 1973-1981 with a marked increase from 1982 to the highest of 30 teams in 1984. This illustrates the increase in effort which has occurred since 1981, especially during the period 1983-1984 from the lower levels of the previous years 1973-1980. Some of the reasons for this increase in effort, as previously discussed, were: the price; the status of the salmon fishery; weather; and the demand for herring as rock lobster bait.

These measures of effort were considered together with catch to produce indices of catch per unit of effort (CPUE) by beach and by fishing unit in terms of fishing area and the total south coast herring fishery (Table 7, Figures 8,9,10).

Area II (Cheynes Beach - Albany east) achieved a higher CPUE where the unit of effort was a beach, than area I (Bremer Bay - Cape Riche) or area III Albany west - Windy Harbour (Table 7, Figure 8). This was largely attributable to Cheynes Beach which provides the best operating and catching conditions to take herring with a trap net. For area II CPUE fluctuated dramatically from year to year. Area I when compared with area II remained reasonably constant in terms of CPUE while area III increased from lower levels in earlier years to higher levels in 1979-85, but lower than the other two areas.

In terms of CPUE, where the unit of effort was a fishing unit or team (Table 7, Figure 9), areas I and II followed a similar pattern from 1973 to 1982. As from 1982 onwards, area I improved upon area II. The reason for this was that new entrants into the

trap fishery, who fished new beaches and/or introduced innovations, etc., moved into area I. This area usually first encounters migrating herring schools and therefore increased effort here would affect the areas westwards i.e. Areas II and III. It would appear that their activities subsequently reduced the CPUE for area II slightly. Fishermen in this area (Area I) clearly have become more efficient at taking herring. The same increase in CPUE, from lower levels in earlier years, for area III occurred as seen previously when the unit of effort was beach rather than fishing unit. With the increased price paid for herring, demand, etc. more effort was also devoted to area II. Some of this effort involved traps and some beach seines. Overall such effort did not produce a great increase in efficiency as it appeared to previously for area II.

Total catch per unit of effort for the south coast for years 1973-1985, whether the unit of effort was beach or fishing unit, showed identical trends with time (Table 7, Figure 10); indicating that either is equally suitable as a measure of fishing effort. Average CPUE was slightly down since 1981 on previous higher levels. When compared with total catch for the years 1973-1985, up until 1981, total catch compared well with CPUE. After this period i.e. from 1982 onwards, increases in effort and efficiency occurred as outlined, and the comparison did not hold. These data document the increases in effort and efficiency that have occurred for the herring fishery. They do not indicate at this stage, that such efficiency and effort has reached a level that is adversely affecting the migrating herring stock. Thus it would appear that the south coast herring fishery, at this stage, is in a good state and can be justifiably maintained in its present state in terms of effort management.

VI SUMMARY AND CONCLUSIONS

Historically, Australian herring has been taken in southern W.A. waters, in small amounts, for food and as an adjunct to the southwest Australian salmon fishery. Both as a consequence of the closure of Rottnest Island waters to netting and an increasing price paid for herring as rock lobster bait the fishery has expanded since 1973.

As a consequence of this expansion of the fishery and as a means of protecting the salmon fishery, regulations were introduced in 1983 in terms of a closure to trap netting during the period 10 February - 25 March, which coincides with the main migration of Australian salmon. The herring trap nets were thought by most fishermen, professional and amateur, to hamper the natural migrational movement of salmon schools along the shore. Regulations were also introduced concerning the operation of the trap nets by way of time of day, place and by whom.

The migrating and resident herring resource is important to amateur/recreational fishermen. It possibly represents the most important amateur species in terms of ease of capture and availability, both from boats and the shore. Usage of the resource has grown with time as more recreational time has

become available and as access to beaches and the shoreline generally has improved.

The professional fishery operates with set nets, beach seines and trap nets. Trap nets account for the greatest proportion of the professional catch. They are now designed specifically for the beach on which they are set and have undergone changes in terms of size, design and mode of operation with time, especially since 1983. A team of fishermen is required to operate a trap net, and in most cases, this unit is the salmon fishing team. Australian herring migrate along the south and south west coasts immediately following the Australian salmon migration.

Examination of professional fishermen's monthly returns, summarised by the Australian Bureau of Statistics, illustrates that the major proportion of the W.A. catch comes from the south coast fishery. The data also show that smaller catches occur throughout the distributional range of herring in W.A. These catches although of much less significance in terms of magnitude, compared with the south coast, are however important to the fishermen who make them. It can be assumed that a proportion of these smaller catches are utilized for food rather than rock lobster bait.

A closer analysis of the south coast catch can be obtained by examination of the factory receival data. Such data show a gradual expansion in the south coast fishery during the period 1973-1981 and a more rapid expansion from 1982 onwards. The majority of the catch is taken during the months of March and April with the major month being April. Historically, most of the catch occurred in the central and eastern area of the south coast. In recent years the western area has contributed to the total catch more so than in the past. Generally the decreased price paid for salmon and increased price for herring has necessitated salmon/herring teams throughout the fishery devoting more attention to herring fishing.

The closure to the use of herring traps in the period 10 Feb - 25 March does not appear to have affected the total catch. However, an apparent consequence of this closure is that more consistent herring catches have occurred outside the main months of the herring fishery than was the case previously. Such catches are small compared with catches made during the major months.

Examination of the units of effort i.e. fishing beaches and fishing units/teams along with catch suggests that either is a suitable measure of effort. The level of effort has increased together with fishing efficiency with time, especially since 1982. Such increases however, do not appear to have had an impact on the migrating stock. Further increases in effort in terms of more beaches/fishing teams should be carefully monitored for their impact on the stock. Further increases in efficiency overall, can be anticipated in the next few years and should be considered along with effort increases.



1. Australian herring Arripis georgianus.

2. Typical herring fishing scene showing boats and gear.





3. Final stages of setting a herring trap net - evening.

4. Initial stages of hauling a herring trap net - early morning.





5. Hauling a herring trap net onto a beach.

6. Re-sorting and stacking the net after hauling in preparation for re-setting.





7. Removing herring from the pocket of a herring trap net.



8. Loading herring onto a conveyor.



9. Loading herring into vehicle for transport to factory.

VII ACKNOWLEDGEMENTS

We would like to thank the following personnel for provision and assistance with factory receival catch data and this report generally: Mr R. Hunt, Mr R. Welshman and Mrs G. Smith (Hunts Canning Company); Mr V. Kailis, Mr E. Robertson and Mr M. Benson (West Ocean Canning Company); Mr and Mrs E. Colley (Albany Bait Producers); Senior Fisheries Officer J. Kelly, Mr S. Blight, Mr E. Gallasch, Mr R. Gibbons, Mr B. Kelly, Mr I. Lethbridge, Mr E. Barker and Mr K. Bowden (Fisheries Department, W.A.).

We thank herring fishermen for their free exchange of information concerning their personal operations and their fishery.

Mr N. Hall is thanked for his assistance with computer analyses and Dr D. Hancock for his review of the manuscript.

Mrs M. Isaacs typed the report and Mr P. Edsall drafted the figures.

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TABLE 1

DIMENSIONS OF SOME HERRING TRAP NETS IN THE PERIOD 1982-1985
(Imperial measures)

MEAN SIZE	1 1/8-1 3/4"	1 1/2"	1 1/4-1 1/2"	1 7/8"	1 1/2"	1 1/2"
LENGTH	700 yds	400 yds	800 yds	300 yds	600 yds	300 yds
GREATEST DEPTH	25 ft	35 ft	40 ft	30 ft	45 ft	25 ft
POCKET/BUNT	Bunt	Pocket	Bunt	Pocket	Pocket	Bunt
MEAN SIZE	1 1/2"	1 1/4-1 1/2"		1 3/4"		
LENGTH	350 yds	400 yds		500 yds		
GREATEST DEPTH	30 ft	30 ft		40 ft		
POCKET/BUNT	Bunt	Pocket		Pocket		

TABLE 2: AUSTRALIAN HERRING CATCHES BY METHOD 1983/84 - 1975/76 LIVE WT IN KG AND PERCENTAGE

METHOD	1983-84	1982-83	1981-82	1980-81	1979-80	1978-79	1977-78	1976-77	1975-76	TOTAL	
PURSE SEINING	4 554	0.4 5 923	0.6 619	0.1 336	0.1 33 746	4.4 3 750	0.4 1 090	0.1 1 949	0.4 176	52 143	0.7
POT, DROP NETS	150	- 150	-	50	-	-	1 367	0.2	-	1 717	-
HAUL NET, BEACH SEINE	943 703	87.3 863 471	92.4 712 938	89.6 676 663	90.9 697 460	89.8 826 718	90.6 752 356	92.8 461 724	91.7 590 643	92.4 6 525 676	90.6
LAMPARA NETTING	9 277	0.9 40	-	-	-	-	-	-	-	9 317	0.1
TRAPPING	2 025	0.2 -	-	-	-	-	-	-	1 500	3 525	0.1
HANDLINING	322	- 823	0.1 201	- 577	0.1 39	- 393	- 133	- 45	- 323	0.1 2 856	-
MESH SET, GILL NET	120 898	11.2 64 292	6.9 82 629	10.4 67 013	9.0 42 783	5.5 81 731	9.0 56 026	6.9 39 704	7.9 46 753	7.3 601 829	8.4
POLING	-	-	-	-	2 297	0.3	-	-	-	2 297	-
TOTAL	1 080 929	934 699	796 387	744 639	776 325	912 592	810 972	503 422	639 397	7 199 362	

SOURCE: ABS MONTHLY RETURNS

TABLE 31 AUSTRALIAN HERRING CATCHES BY LOCALITY 1983/84 - 1975/76 LIVE WT IN KG AND PERCENTAGE

LOCALITY	1983-84	1982-83	1981-82	1980-81	1979-80	1978-79	1977-78	1976-77	1975-76	TOTAL
ESPERANCE	1 543	501	2 401	2 496	688	2 258	2 900	2 720	1 232	16 739
HOPEFOUN	37	490	0.1	0.3	319					846
DOUBTFUL IS.-										
WINDY HARBOUR	932 382	797 987	85.4	83.4	663 879	806 869	733 796	415 199	537 561	6 203 479
AUGUSTA	1 295	1 989	0.2	0.1	345	9 492	1 718	1 462	2 407	19 771
HAMELIN BAY					2 580				814	3 454
MARGARET RIVER	1 023	4 999	0.5	0.2	1 288	589	1 688	3 459	921	15 382
EAGLE BAY	1 200	3 782	0.4	0.5	800	600	714	1 650	2 100	14 346
QUINDALUP	17 522	8 150	0.9	1.0	9 499	12 090	8 835	8 651	9 334	94 808
BUSSELTON	12 084	10 973	1.2	1.4	11 827	3 559	6 823	8 539	18 780	98 150
BUNBURY	61 304	56 078	6.0	5.9	68 392	44 698	17 334	37 191	37 698	384 460
MANDURAH	7 133	11 940	1.3	0.3	1 866	3 778	17 607	1 633	1 597	49 915
SAFETY BAY	2 700	0.3	115	0.2	1 476	452	73	166	811	6 473
ROCKINGHAM	1 026	2 969	0.3	0.2	498	44	45	174	287	8 296
PERTH	1 996	1 516	0.2	0.2	2 804	246	2 146	3 295	5 190	20 351
FREMANBLE	36 550	30 707	3.3	6.5	23 086	15 288	10 057	14 963	8 854	209 313
WHITFORDS BCH					205	2 672	1 628	1 047	4 185	9 937
QUINNS ROCK	450				1 340				764	1 214
WRECK POINT	259				5				122	4 526
CAPE LESCHENAULT									100	500
LANCELIN/WEDGE	247	1 165	0.1	0.1	3 732	61	2 369	2 224	1 671	5 513
GREEN IS./CERVANTES	117	273			50	3 352	2 010	2 224	2 149	14 832
JURLEN BAY	1 846	0.2			298	611	1 145	379	119	4 547
GREEN HD - BEAGLE IS	55	614	0.1	0.1	34	337	54			2 040
FORT DENISON	28	43			2	101		8	28	371
SEVEN MILE BCH								140		140
GERALDTON		8	75		117		30	42		272
ABROLHOS IS		360			230				23	833
DRUMMOND COVE			120						750	750
FORT GREGORY		40								75
CARNARVON								380		797
OTHERS	132					5 495			1 500	7 127
TOTAL	1 080 929	934 699	796 387	744 639	776 325	912 592	810 972	503 422	639 397	7 199 362

SOURCE: ABS MONTHLY RETURNS.

NOTE: DOUBTFUL ISLAND-WINDY HARBOUR INCLUDES ALL SOUTH COAST HERRING FISHING LOCALITIES
 ESPERANCE INCLUDES STOKES INLET, AUGUSTA INCLUDES HARDY INLET
 GREEN HEAD-BEAGLE ISLAND INCLUDES SWAG ISLAND AND DESPERATE BAY
 OTHERS INCLUDES EXMOUTH GULF AND BROOME, INCORRECTLY CODED - PROBABLY WERE GIANT HERRING OR OILY HERRING.

TABLE 4: SOUTH COAST PROFESSIONAL AUSTRALIAN HERRING CATCH BY MONTH, 1973-1985, IN KG.

YEAR	JAN	FEB	MARCH	APRIL	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	TOTAL
1973		4 216	119 506	299 683									423 405
1974		2 690	189 168	556 310									748 168
1975			203 140	264 811	1 790								469 741
1976			83 310	319 600									402 910
1977			37 280	189 330					400	157			227 167
1978			102 530	270 205	82 385	13 332	4 214	3 057	2 771		450	120	479 064
1979	24 786	22 452	112 600	456 518	44 776								661 132
1980	3 381	2 497	93 232	621 382	27 501				238	78			748 309
1981		10 106	78 794	468 058	17 559				1 503	412	98	1 228	577 758
1982	8 186	25 678	180 004	511 005	76 329								801 202
1983	9 270	11 527	36 738	535 801	33 676	2 268	2 048	1 054	1 389	2 033	1 931		637 735
1984	29 565	7 812	202 054	552 491	22 731	2 162	2 289	616	843	4 455	3 562	1 889	830 469
1985	100 772	45 047	29 315	738 618	76 804	100							990 656

TABLE 5: SOUTH COAST PROFESSIONAL AUSTRALIAN HERRING CATCH IN KG,
GROUPED BY AREA WITH PERCENTAGE COMPOSITION, 1973-1985

YEAR	AREA I	% TOTAL	AREA II	% TOTAL	AREA III	% TOTAL
1973	210 168	49.6	213 237	50.4		
1974	387 234	51.8	340 835	45.5	20 099	2.7
1975	246 021	52.4	223 720	47.6		
1976	165 455	41.1	237 455	58.9		
1977	129 412	57.0	97 755	43.0		
1978	325 283	67.9	133 739	27.9	20 042	4.2
1979	288 302	43.6	251 830	38.1	121 000	18.3
1980	417 771	55.8	265 515	35.5	65 023	8.7
1981	310 928	53.8	166 425	28.8	100 405	17.4
1982	268 836	33.6	406 528	50.7	125 838	15.7
1983	256 183	40.2	271 790	42.6	109 762	17.2
1984	338 914	40.8	228 297	27.5	263 258	31.7
1985	491 217	49.6	375 094	37.9	124 345	12.5

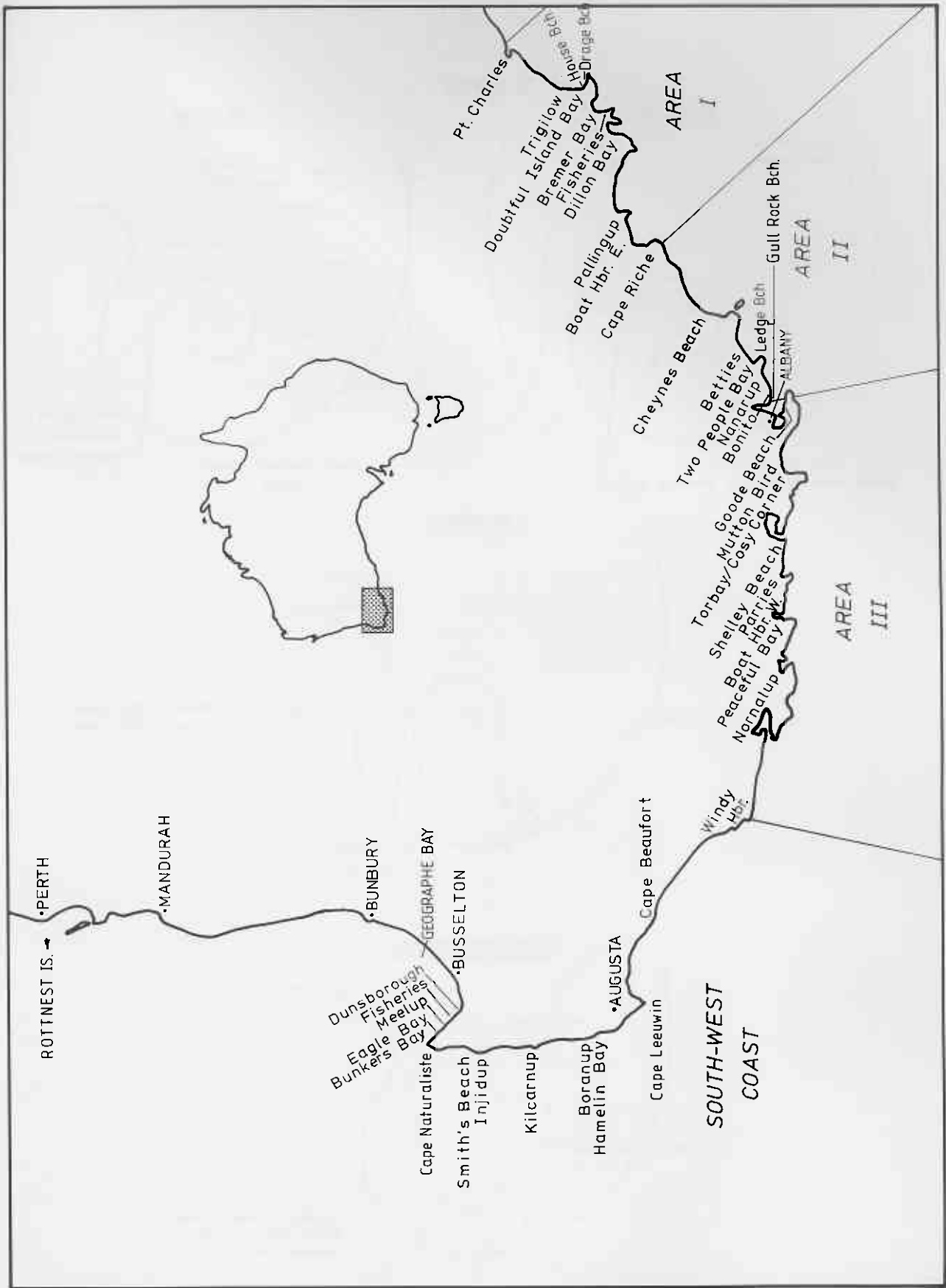
TABLE 6: NUMBERS OF BEACHES FISHED AND FISHING UNITS, ALSO TOTAL CATCH BY AREA FOR THE SOUTH COAST PROFESSIONAL HERRING FISHERY, 1973-1985

NUMBER OF BEACHES	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
AREA I	5	6	5	4	6	6	5	6	6	6	7	8	8
AREA II	2	3	3	2	2	3	2	3	3	4	5	6	4
AREA III	-	2	-	-	-	3	4	2	4	5	7	7	6
TOTAL	7	11	8	6	8	12	11	11	13	15	19	21	18
NUMBER OF FISHING UNITS													
AREA I	7	7	6	5	7	8	6	8	8	8	8	9	9
AREA II	5	6	7	4	4	6	4	5	4	11	12	14	12
AREA III	-	2	-	-	-	2	4	2	4	5	7	7	6
UNKNOWN					3			1					
TOTAL	12	15	13	9	11	19	14	16	16	24	27	30	27
CATCH (kg)													
AREA I	210 168	387 234	246 021	165 455	129 412	325 283	288 302	417 771	310 928	268 836	256 183	338 914	491 217
AREA II	213 237	340 835	223 720	237 455	97 755	133 739	251 830	265 515	166 425	406 528	271 790	228 297	375 094
AREA III	"	20 099	-	-	-	20 042	121 000	65 023	100 405	125 838	109 762	263 258	124 345
TOTAL	423 405	748 168	469 741	402 910	227 167	479 064	661 132	748 309	577 758	801 202	637 735	830 469	990 656

TABLE 7: CATCH PER BEACH AND CATCH PER FISHING UNIT BY AREA FOR SOUTH COAST PROFESSIONAL HERRING FISHERY, 1973-1985, IN KG.

CATCH/BEACH	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
AREA I	42 034	64 539	49 204	41 364	21 569	54 214	57 660	69 629	51 821	44 806	36 598	42 364	61 402
AREA II	106 618	113 612	74 573	118 728	48 876	44 580	125 915	88 505	55 475	101 632	54 358	38 050	93 774
AREA III	-	10 050	-	-	-	6 681	30 250	32 512	25 101	25 168	15 680	37 608	20 724
ALL AREAS	60 486	68 015	58 718	67 152	28 396	39 922	60 103	68 028	444 443	53 413	33 365	39 546	55 036
CATCH/FISHING UNIT													
AREA I	30 024	55 319	41 004	33 091	18 487	40 660	48 050	52 221	38 866	33 604	32 023	37 657	54 580
AREA II	42 647	56 806	31 960	59 364	24 439	22 290	62 958	53 103	41 606	36 957	22 649	16 307	31 258
AREA III	-	10 050	-	-	-	10 021	30 250	32 512	25 101	25 168	15 680	37 608	20 724
ALL AREAS	35 284	49 878	36 134	44 768	20 652	25 214	47 224	46 769	36 110	33 383	23 620	27 682	36 691

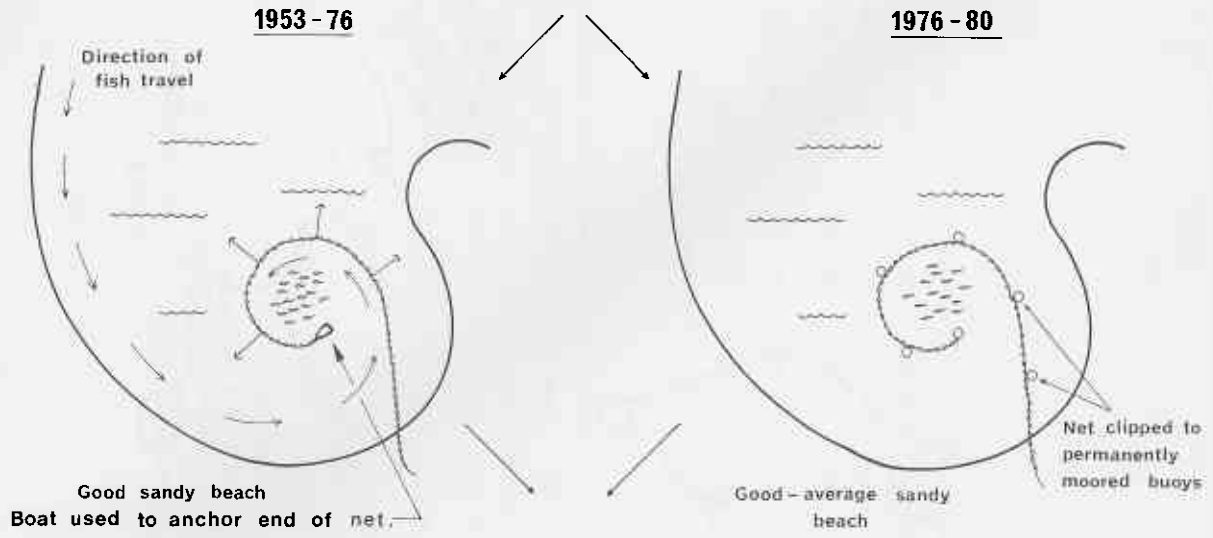
1. Herring fishery beaches and the areas to which they belong in southern W.A.



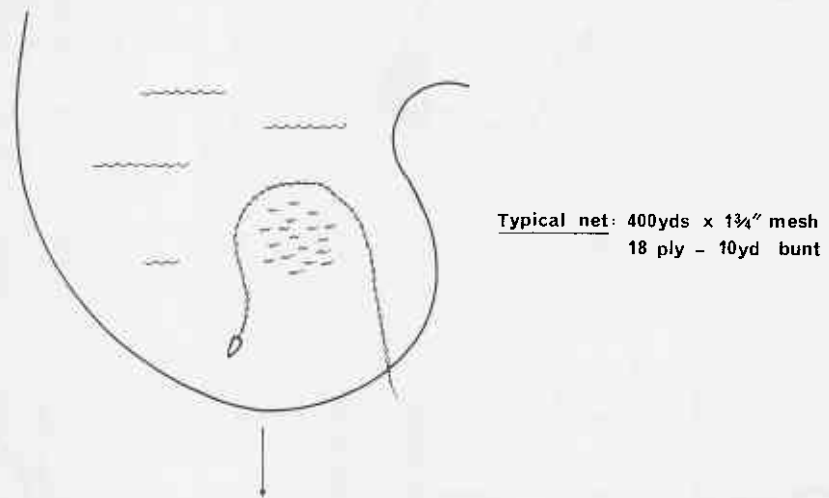
2. Design and configurations of herring trap nets, southern W.A.

TRAP NETS

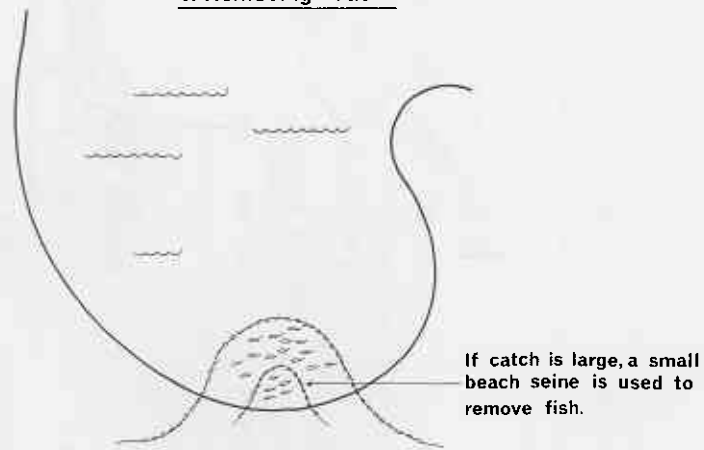
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b. Hauling

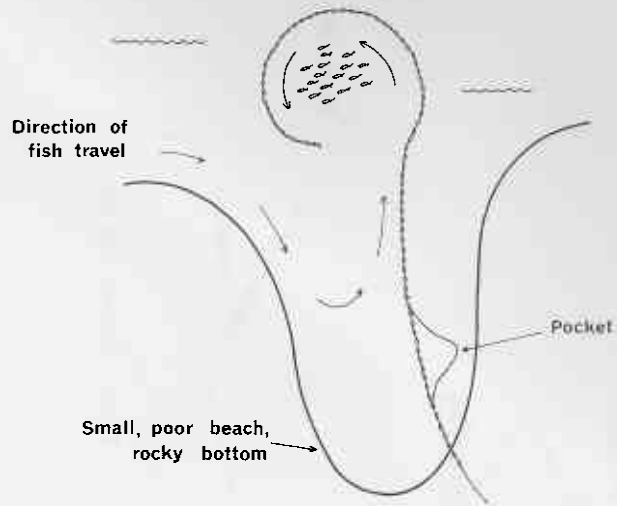


c. Removing Catch

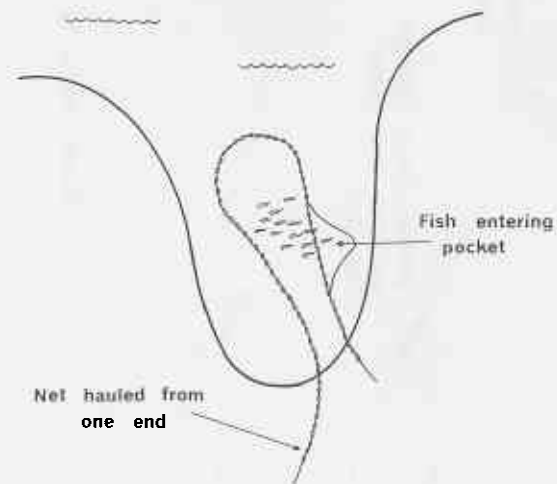


1982 Onwards

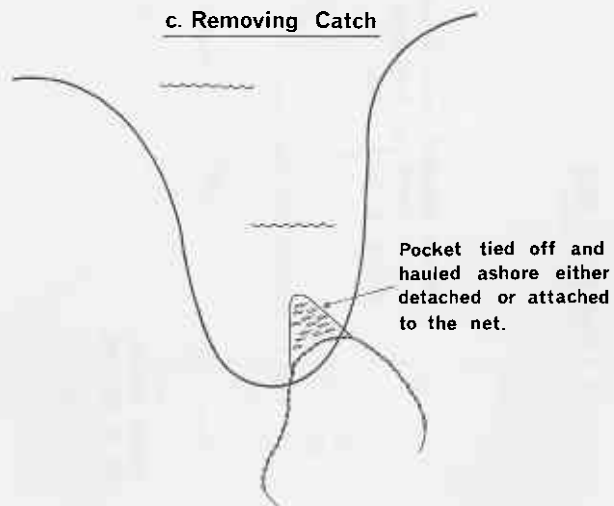
a. Setting



b. Hauling

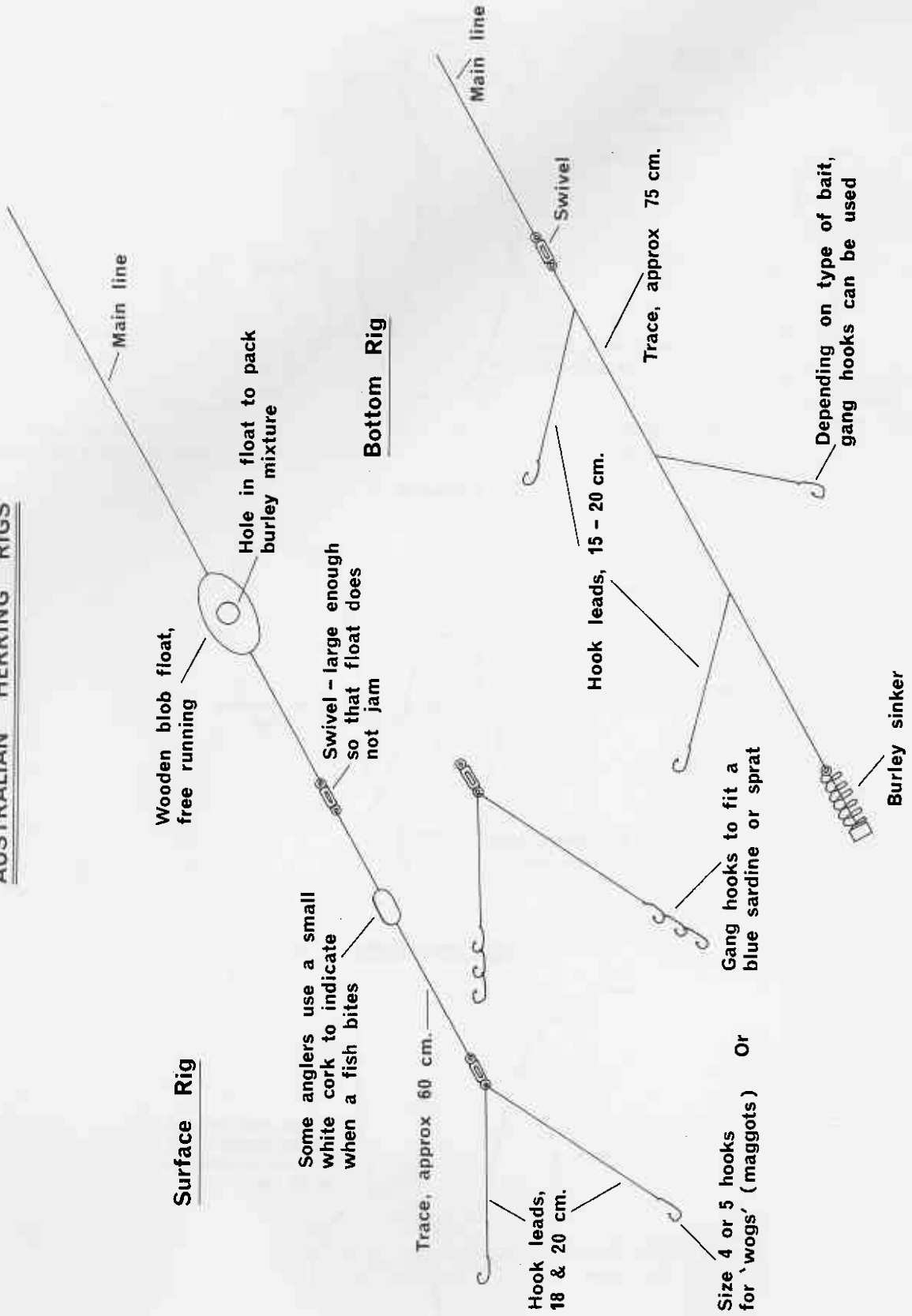


c. Removing Catch

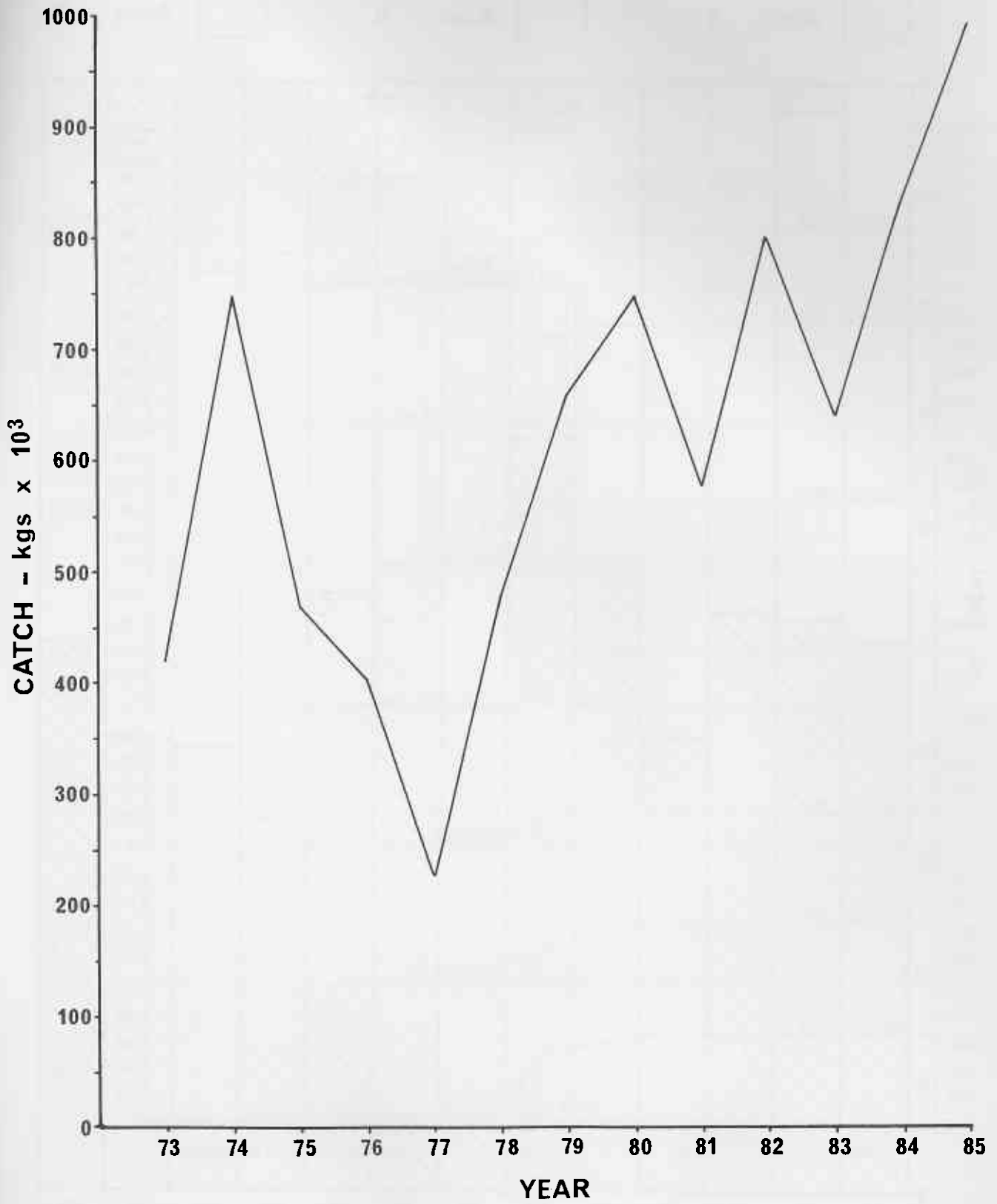


3. Typical amateur beach fishing rigs as used for herring in southern W.A.

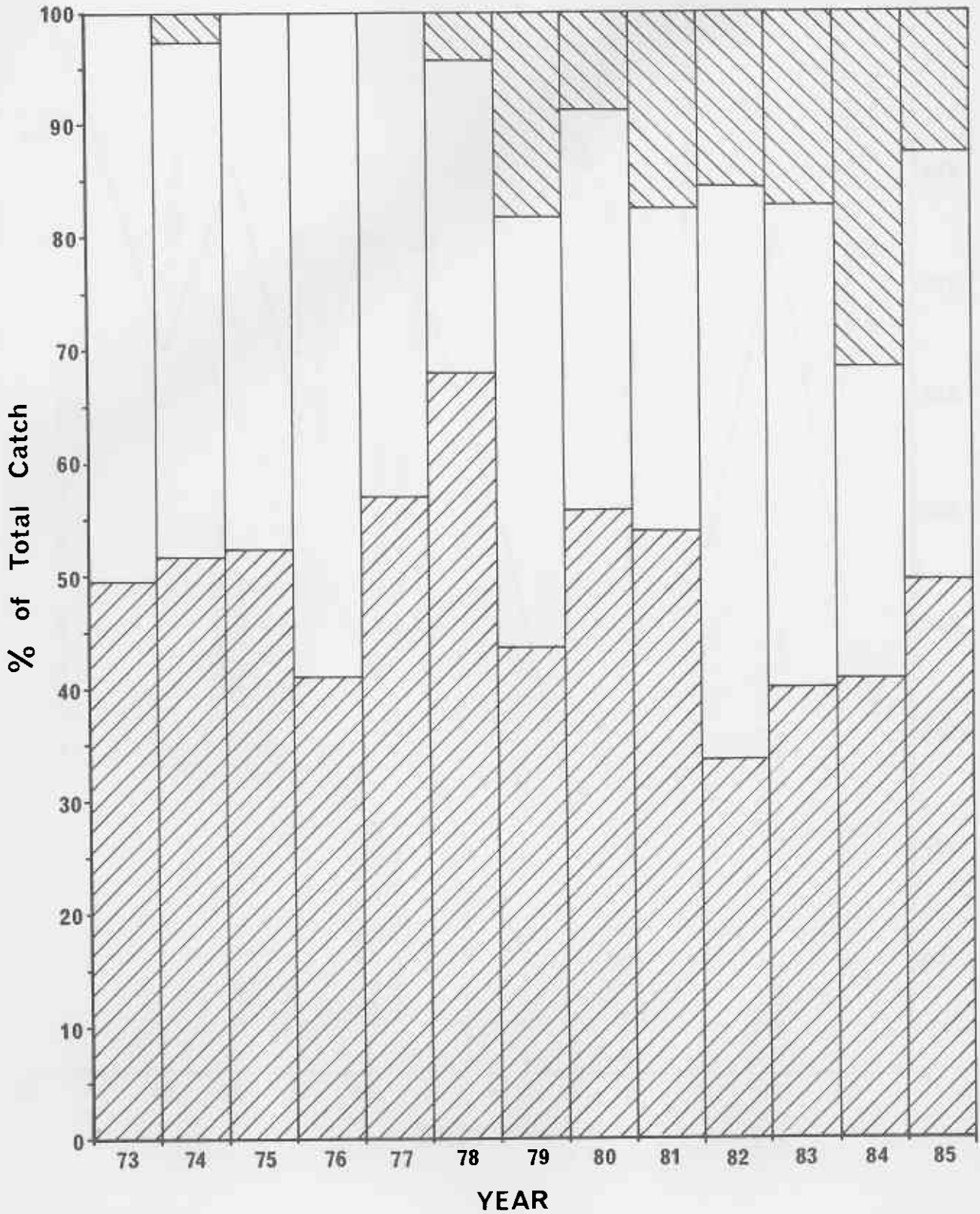
AUSTRALIAN HERRING RIGS



4. Total south coast herring catches by year, 1973-1985, factory receival data.

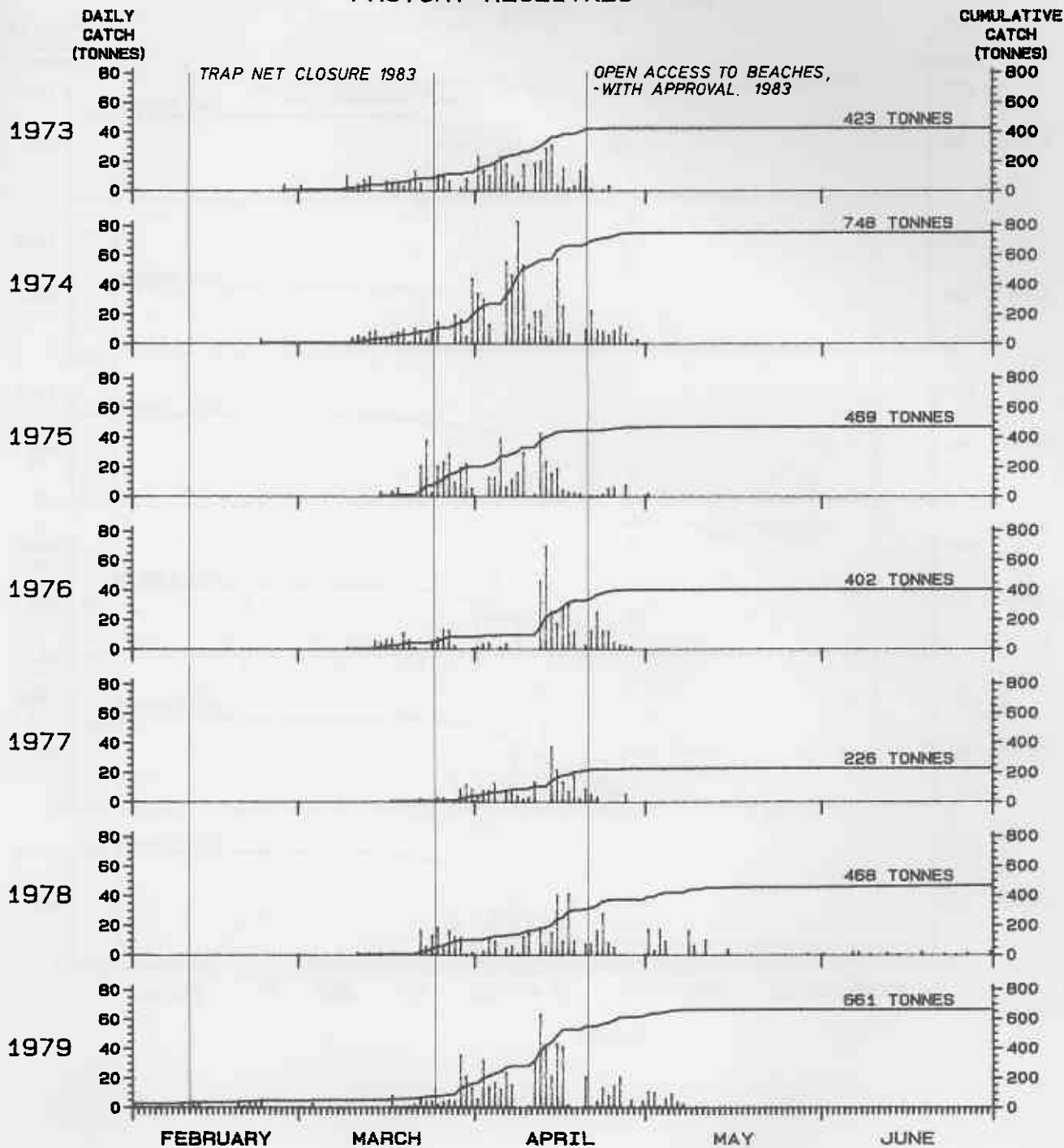


5. South coast herring catches by area, expressed as percentages, 1973-1985.



6. Cumulative catch graph, 1973-1979, factory receival data.

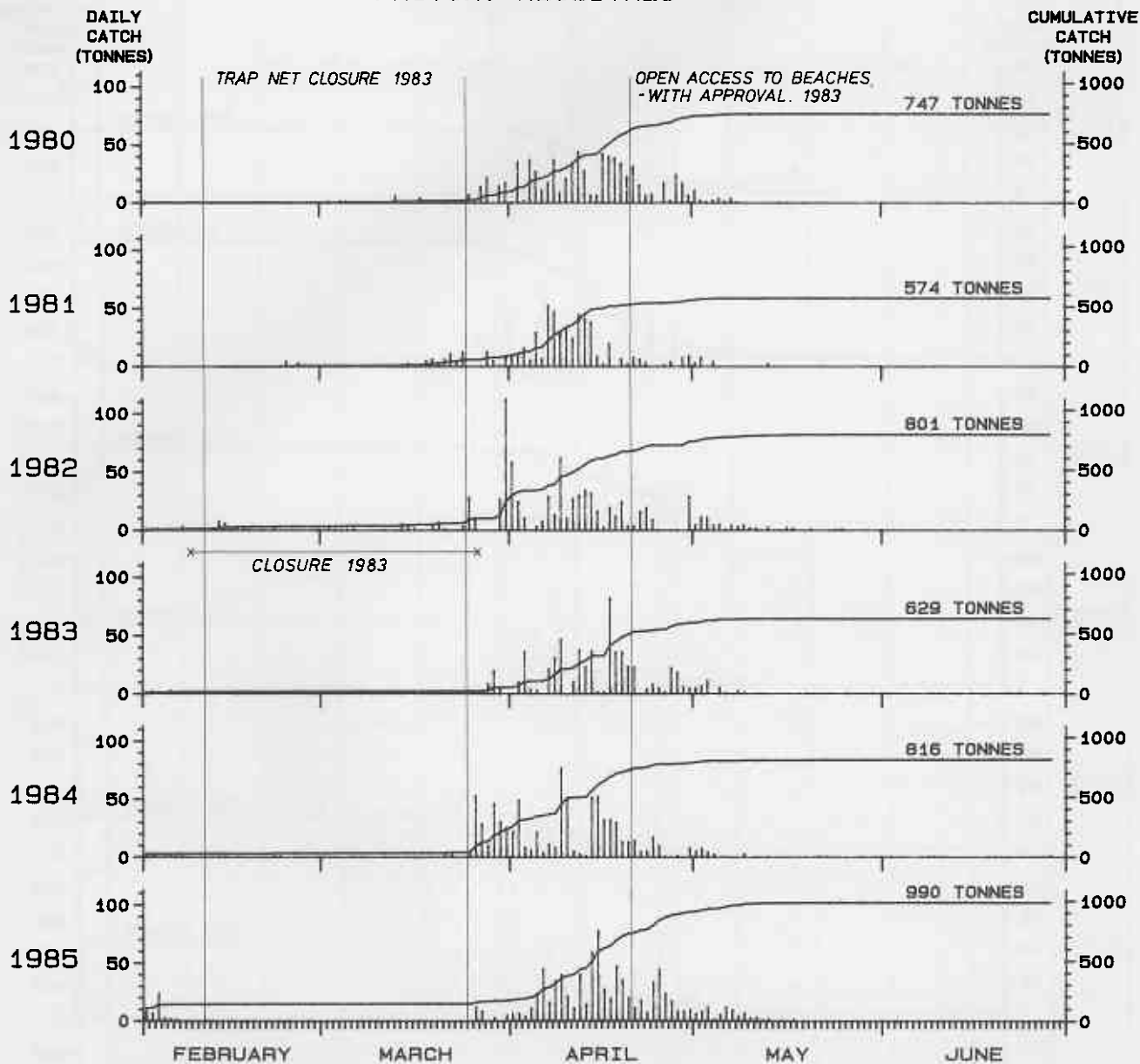
HERRING FACTORY RECEIVALS



NOTE: Total catch figures are for January to June only.

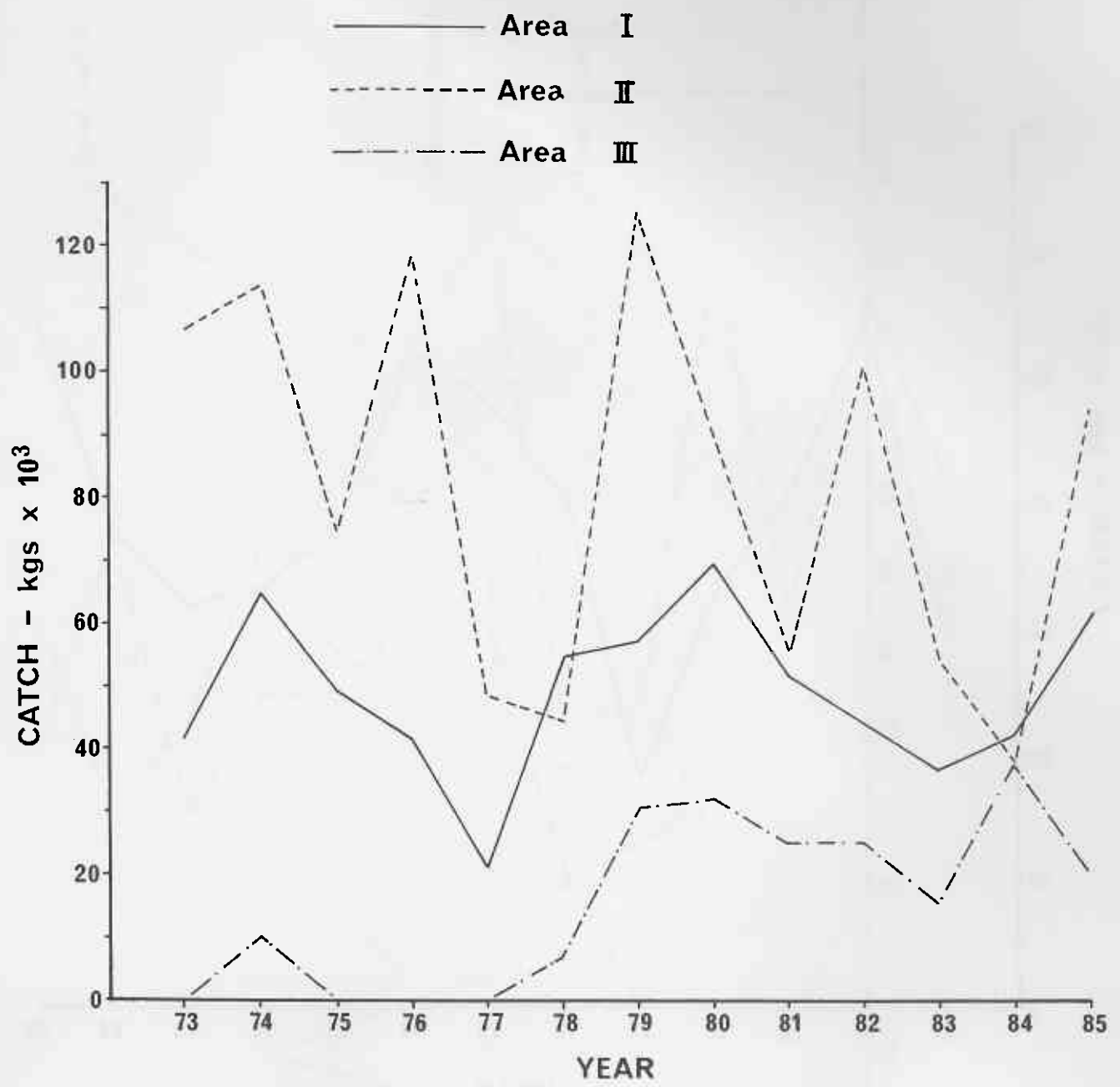
7. Cumulative catch graph, 1980-1985, factory receival data.

HERRING
FACTORY RECEIVALS

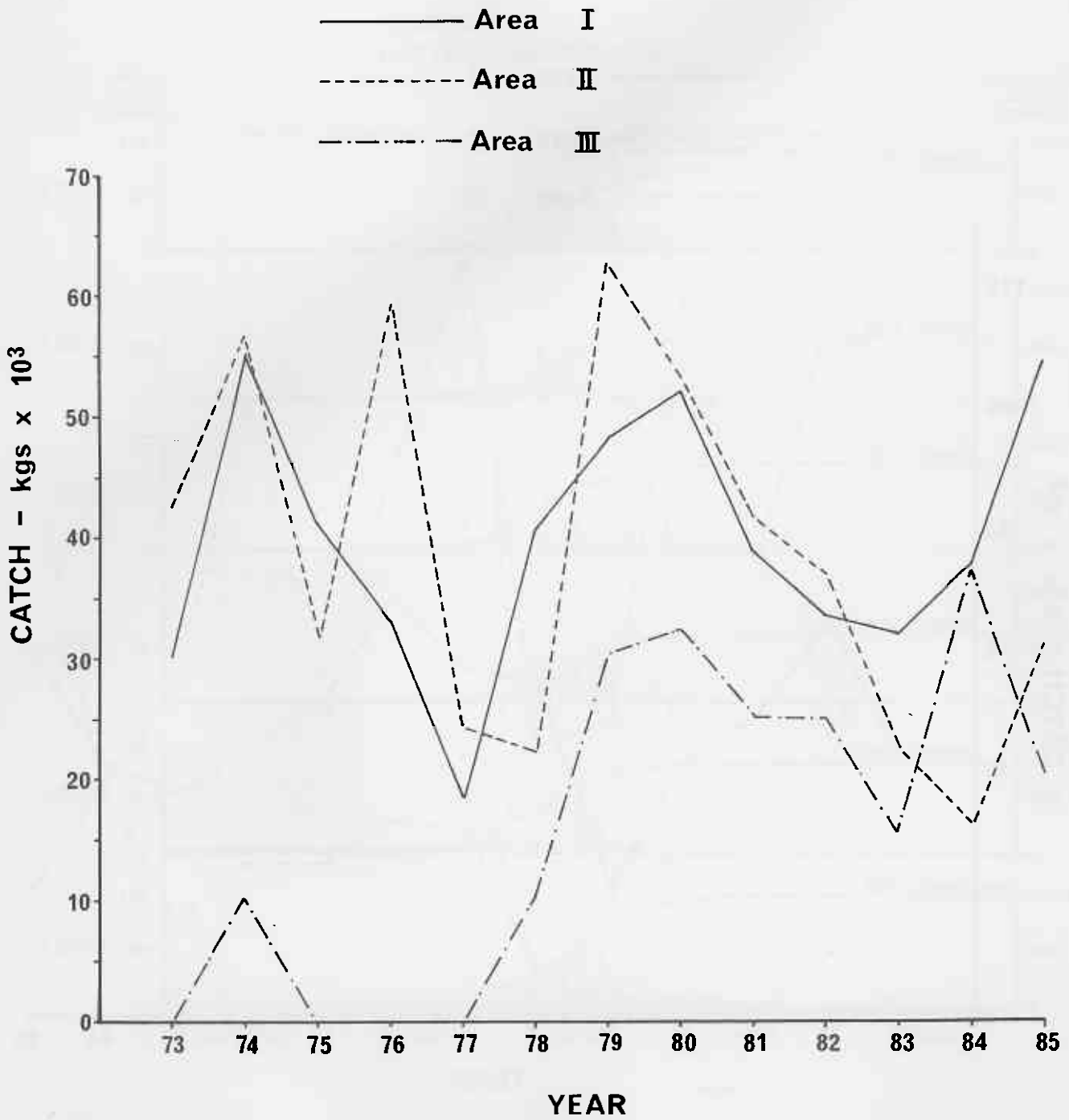


NOTE: Total catch figures are for January to June only.

8. Catch per beach by fishing area, south coast professional herring fishery, 1973-1985.



9. Catch per fishing unit (team) by fishing area, south coast professional herring fishery, 1973-1985.



10. Catch per beach, catch per fishing unit compared with total catch, south coast professional herring fishery, 1973-1985.

