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A COMMERCIAL CATCH
OF
ALBACORE IN NEW ZEALAND

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A COMMERCIAL CATCH OF ALBACORE (*THUNNUS ALALUNGA* (BONNATERRE)) IN NEW ZEALAND

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TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

SUMMARY

An account is given of the modification of a New Zealand crayfishing boat for operation as an albacore trolling vessel. The gear and method of fishing are described in detail.

Between 21 January and 28 March 1968, the vessel completed five fishing trips in the region of East Cape and made catches of 6,750; 5,200; 5,100; 8,200; and 4,600lbs weight of albacore in 38, 66, 39, 70, and 33 fishing hours respectively. The average numbers of fish caught per hook hour in the five trips were 0.73, 0.40, 0.65, 1.30, and 0.80 with an average for all trips of 0.80.

This catch rate of 0.80 albacore per hook hour or 80 per 100 hook hours is compared with an average catch rate of 73 albacore per 100 line (= hook) hours in the California fishery between 1950-1961, indicating a relatively similar index of abundance between the two fisheries.

The concentrations of striking albacore were associated with water temperatures in the range 63° - 68°F (17.2° - 20.0°C) with best catches being made at fronts between blue oceanic and inshore waters discoloured by freshwater run-off.

A COMMERCIAL CATCH OF ALBACORE (THUNNUS ALALUNGA) (BONNATERRE 1788) IN NEW ZEALAND

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INTRODUCTION

Interest in the possibility of commercial exploitation of tuna resources in New Zealand waters dates from about 1960 when the Marine Department initiated biological and technological studies. McKenzie (1961) outlined the biology of the group and gave a key for identification of the species known to be available to a New Zealand fishery. She prepared charts, based on the presumed preferences of the different species for water of certain temperature ranges, to indicate the likely areas of occurrence of each species around the coasts of New Zealand. Sampson (1962) described the fishing methods currently employed in Australia for taking tuna, with particular attention to live bait and pole fishing for Southern Bluefin Tuna, Thunnus maccoyi, with some mention of trolling or line fishing, and discussed their applicability to New Zealand conditions. McKenzie (1964) gave an account of a hydrographic programme combined with trolling for tuna to establish relationships between sea temperatures and fishable concentrations of tuna.

York (1965, 1966, 1967) prepared a series of reports describing fishing trials in the Gisborne and Bay of Plenty areas, using monofilament gill nets and trolled lures to establish possible catch rates for skipjack, Euthynnus pelamis, and albacore, Thunnus alalunga. The emphasis in this programme was on gill netting and a relatively small part of the fishing time was devoted to trolling; the catches of albacore in 1965, 1966, and 1967 were 21, 619 and 399 respectively, taken in corresponding trolling periods of 287, 190 and 577 hours; the average rate of catch over the three years in terms of fish caught per hook hours of trolling was 0.16.

During 1968, a commercial fisherman, Mr Dave Baker, working out of Whitianga, informed me that he was making catches at rates very much higher than those reported by York and offered to make his results available for publication. The area worked, which was across the Bay of Plenty, around East Cape, and southward to the locality of Gisborne, is shown in Fig. 1.

References to tunas in this paper are to Thunnus alalunga (Bonnaterre), Thunnus maccoyi (Castelnau), Euthynnus pelamis (Linnaeus) and Thunnus albacares (Bonnaterre), well known by the common names albacore, southern bluefin, skipjack and yellowfin tuna respectively. The nomenclature follows Gibbs and Collette (1966).

METHODS AND OBSERVATIONS

SEA SURFACE TEMPERATURES - were measured with an alcohol in glass thermometer graduated in degrees Farenheit. Water from the deck hose, the uptake to which was approximately five feet below the sea surface, was allowed to run into and overflow out of a bucket at the rate of 20 gallons per minute. The thermometer was allowed to reach a steady state in the running water in the bucket and read to the nearest degree. The deck hose system was separate from the engine cooling system and the sea temperature at five feet below the surface was recorded within probable accuracy limits of $\pm$ 0.5°F.

FISHING LOGS - were kept by the skipper in which a daily record was kept of the track of the boat and of sea surface temperatures along the track, particularly where visible fronts were encountered and where strikes of tuna were obtained. The state of the sea and changes in wind speeds and directions and other elements in the weather situation were recorded as they occurred. A record was kept of fish strikes, the number of fish caught during each hour of each fishing day, and of the localities where the catches were made. Observations on bird life and other biota were entered in the log.

FISHING UNIT -

The fishing unit comprises a single 45 foot wooden line-and-crayfish boat, the "Sea Bee" (Fig. 2) fitted with a pair of wooden outriggers or fishing poles, to which are attached the fishing line assemblies terminating in the fishing lures. Each pole is

swivel mounted at the base of the mainmast and is stayed fore and aft as well as upwards to the mainmast and downwards to the gunwales. The stay to the mast passes through a block and then as a downhaul halyard to the base of the mast and thus forms a topping lift by which the angle of the pole can be adjusted according to the state of the sea. In calm weather an angle with the sea of about 30° is suitable but in rougher weather this angle must be increased to about 45°. The length of the pole is 48 feet and the main fore, aft and top stays are attached at half this length along it. A hydrodynamic stabiliser may also be suspended from the outrigger at this position along its length. Additional lighter stays may be attached to the tip of the pole. The bottom stay is taken off perpendicularly above the gunwale to which it is attached and is in the form of a length of chain. Adjustments to the vertical angle of the outrigger can be made by easing off on the topping lift and fastening the chain at an appropriate link before hauling tight on the topping lift again. The poles are slanted a little forward of a right angle with the boat.

FISHING GEAR -

The gear used is that which evolved in the California troll fishery; a detailed account of this has been given by Scofield (1956). Some of the California terminology has been introduced into New Zealand and a list of terms for the major gear components is given below: (Figs. 3-5)

Shock — An abbreviation for shock absorber, is a section of elastic material or a wire spring, introduced into the trolling line to take the initial shock when a fish strikes the lure. In the system adopted in New Zealand the attachment to the pole is by a 4 foot length of braided terylene, No. 42, or equivalent cord, fastened at its other end to a brass ring of 2" diameter. The shock absorber is fashioned from strips of motor car tyre inner tube which are introduced across a loop in the terylene.

Safety loop — Is the loop of the line across which the shock absorber lies and which takes the stress when the elastic has stretched out to equal the length of line in the loop.

Tag line — This is the part of the line which comes immediately after the shock absorber. It may also be called the shock line, pole line or standing line. A major requirement for this section of the line is that it should offer low resistance to the wind. Plastic coated steel wire as used in big game fishing has been found very suitable for this section of the line.

Main line — The main line commences shortly before the point of entry into the water and is a braided terylene line No. 42 or equivalent synthetic line; its outer end is attached to a single barrel swivel to the other eye of which is fastened a quick release stainless steel clip.

Inhaul line — A short line, from the gunwale of the boat near the stern, to the junction of the main and tag lines which is used to pull the main line into the side of the boat before hauling in the fish after a strike.

Two Pole Swivel — This is a piece of gear, developed in the live bait and pole fishery, which allows two poles, each handled by one fisherman, to be attached to a single fishing trace. Thus, although called a two pole swivel, this gear consists of three barrel swivels attached to a uniting ring. Used in the trolling rig it allows the tag line to be attached to one swivel, the inhaul line to another, whilst to the third is attached the main fishing line. When the main line is pulled into the side of the boat, the ring of the two pole swivel is slipped over a hook in the gunwale so that the

tag line is held taut and does not flap or trail in the water when the tension is taken up by the fisherman in hauling in the catch. It follows that the length of tag line to the two pole swivel on each line assembly must be exactly calculated so that on pulling in the lines, each ring of the "two-poles" can be just slipped over its appropriate hook. All the hooks on one side are positioned so that a single fisherman can operate all lines without having to alter his position.

Leader or Trace — A short length of 150 to 200 lbs breaking strength nylon monofilament into which small brass eyes are spliced at each end by small lead splices. Stainless steel split rings of 1 cm. diameter are passed through the brass eyes and then brazed at the split to form complete rings. One end of the trace is attached by its ring to the quick release clip at the end of the main line; this method of attachment allows rapid replacement of a trace should one break or be bitten through by a fish.

Lure — The device which attracts the fish; it may be combined with or be separate from the hook. All the lures used in the present commercial trials were of a single type known as "ruby-eyes". The monofilament trace is passed through a central hole in the metal head of these lures before splicing in the terminal brass eye and brazing on the ring. To the ring is attached the final part of the fishing assembly, the hook. In the case of the ruby-eye lure the hook is separate from the lure. The metal head of the lure is of chromed brass in the approximate shape of the head of a clupeoid fish; it is 2.5 cms. long and weighs 1½ oz.; an artificial ruby of red glass is inserted in each side and gives the lure its name. The hole through which the monofilament trace passes is too small to allow the eyed splice to be pulled back again so that during fishing, the hook

is pulled up tight against the head of the lure. The rear of the head has a small projecting neck around which is tied a bundle of approximately 30 feathers of 12 cms average length. Three feathers are dyed green, the remainder being pure white. A photograph of the trace, lure and hook assembly is shown in Fig 3. It can be seen that the hook is two pronged and barbless for easy unhooking of the fish as soon as they are hauled aboard; the hook is called a Garwood albacore hook and is made of stainless steel.

Whiskey Line — A single long fishing line assembly made fast to the mast so that it fishes in the centre of the trolling pattern; it is the longest line fished so that it cannot entangle with any of the other lines; it is not expected to be a heavy catching line but is fished in the hope that it will keep the crew in whiskey.

Stern Lines — These are complete fishing assembly lines made fast to the gunwale at the stern and are the shortest lines in the pattern so that during turns they follow in the immediate wake of the boat and do not cross the track of other lines.

Pole Lines — The four fishing lines on each side of the boat, of varying length but arranged so that the pattern is symmetrical about the long axis of the boat.

It is an obvious practical requirement for working the gear that the boat should have ready manoeuvreability and be able to turn without the lines fouling each other. It is also essential that any line on which a strike is obtained should be capable of being pulled into the boat without either it or its inhaul line becoming entangled with any of the others. An arrangement of lines on the boat which satisfies these requirements is illustrated in Fig. 5. In this pattern the whiskey line is 22 fathoms long and

the stern lines 6 fathoms long measured from the stern of the boat. Of the lines attached to the outrigger, the outermost is the longest, 20 fathoms, the next but one inwards is 18 fathoms and the inner-most pole line is 8 fathoms long. This general pattern is approximately that of a V but the outermost line but one is shorter than those on either side of it. In the pattern shown it is 4 fathoms long.

In addition to the sideways spacing of the lines a spatial separation vertically also assists in keeping them free from entanglement. To obtain this, advantage is taken of the angle of the outrigger poles which gives each line a different slant angle down to the water line and a further effect is obtained by attaching leaden weights to some of the lines. The weights vary in shape from cigarlike for the lighter ones to lemon-like or spherical for heavier ones. They are introduced into the main lines shortly after these enter the water and the placement is determined by trial and error to suit different configurations of the fishing ensemble. In the arrangement shown advantage is taken of the high origin of the outermost line, and its long length, to recover this line by an inhaul which passes over all other gear inboard of it. The next line is weighted heavily with a 4 lb weight so that this line has the steepest descent from the pole and is recovered by pulling it in under the two lines inside it. Of the remaining lines the next inward is unweighted and is recovered over the shorter innermost pole line which is lightly weighted by an 8 oz. lead; this weight is just sufficient to keep it below the previous line but above that carrying the 4lb. weight during recovery of the latter. The innermost pole lines and the stern lines are the easiest to work as these come in without crossing the track of any other line.

The best speed for trolling for albacore is about 6 to 7 knots and it is important to maintain constant engine revolutions. Albacore are sensitive to sudden changes in engine and transmission noises. Low frequency noises from rudder pintles or vibrations in transmission shafts also appear to reduce the likelihood of the fish to strike the lures. "Chumming" behind the boat with live or fresh bait fish is not usually practised during trolling but during

the trials here described it was found that chumming with anchovies, regurgitated by fish landed on deck, brought the albacore close in behind the boat and greatly increased the catches taken on the shorter lines.

With the gear rigged in the manner described and illustrated above, catch rates considerably higher than those obtained by York were obtained although a strict comparison is not justified in the light of the different objectives of the two fishing teams. That of York was to survey a relatively wide area and to evaluate the relative efficiency of different fishing methods, whilst that of the fishermen was to use the most effective lure and stay in the localities of greatest concentration of fish. It is significant that the lure York found to be most effective, a feathered jig, was the one which most closely resembled the ruby-eye lure used by the commercial team.

FISHING OPERATIONS

The fishing logs cover five fishing tours during 1968 extending over the period January 20 to March 27. Some further fishing was carried out sporadically until April 19, but operations after March were much interrupted by unsuitable weather and only one full day's fishing was possible during this period. The fishing was conducted within the region covered by the chart shown in Fig. 1 and was a true commercial enterprise, the criterion for commencing or ceasing operations being profitability relative to crayfishing in the same area. Lures were, however, trolled on the way to crayfishing grounds to supplement information on the seasonality of tuna occurrences, and catches of albacore were made as early as 28 October 1967 and as late as 8 June 1968 respectively. Temperatures of surface water were measured where catches were made and data thus collected indicated that albacore were seldom caught in water of surface temperature higher than 68°F (20.0°C). Thus the general pattern of the albacore fishing tours was that after leaving base at Whitianga the boat would sail for the East Cape area with surface temperatures being taken at intervals until

readings of 68°F (20.0°C) or under were obtained. During all trips in the period January to March inclusive 1968, offshore temperatures in the Bay of Plenty were stable and remained within the range 69-71°F (20.6 - 21.7°C). Although lures were trolled during passages through the Bay, this was not regarded as fishing time for albacore and in fact no strikes were obtained. On each of the five fishing tours a temperature front was encountered at, or shortly after rounding, East Cape and it was between East Cape and Tolaga Bay that the greater part of the fishing was conducted. The majority of the catches were made in relatively shallow water of between 30 and 75 fathoms depth usually just beyond the limit of visible run-off from streams or rivers. Of these, the Waiapu River seemed to have the greatest influence. The position of the boundary between the discoloured and clear water varied according to the direction and strength of the wind and on the set of the inshore current. Trolling runs were usually made on reciprocal courses parallel to the front of discoloured water just outside the discoloured zone. Temperatures in the clear water just outside the front with the discoloured water appeared to be lowered by several degrees and this was attributed by the fishermen to the influence of the river water. They repeatedly observed that water at the 30 fathom contour off the Waiapu River was two or three degrees lower than at the 60 fathom contour and on moving into deeper water temperatures rose to approximately the same as those recorded offshore in the Bay of Plenty.

Study of the fishing logs throughout the fishing periods does not indicate any particular circumstances under which catch rates are better than others, given the basic requirement of a temperature front associated with an area discoloured by river water. The magnitude of the temperature change across the front does not appear to be important, nor does the actual temperature in the front; catches were made with the temperature difference across the front of as little as 1° or as much as 5° and in water of temperatures as low as 63°F (17.2°C) and as high as 68°F (20.0°C).

Catches were obtained in localities where flocks of feeding sea-birds were encountered but equally good catches were made where no birds were working. The fishermen preferred to work in fine, calm weather but continued to make catches on overcast rainy days and in wind speeds up to 25 knots. Albacore appear to feed and to take lures mainly during the hours of daylight. Poor catches were obtained in the early hours after sunrise and in the hour preceeding sunset. A record of the catches taken during each hour of the fishing days is given in Appendix 1.

RECORD OF CATCHES

A full range of data extracted from the fishing logs is presented in Tables 1 to 5, corresponding respectively to the five fishing trips.

TABLE 1

TRIP 1 - FISHING DAYS 21-24 JANUARY

Date	Wind Range Knots	Weather	Sea Temp Range at Front °F	Locality Fished	Hours Fished	Albacore Caught	Hourly Catch	
							By Boat	By Hook
Jan 21	5-10	Fine	64-66	Off Waiapu	13	43	3.3	0.30
Jan 22	5-10	Fine	63-66	" "	9	73	8.1	0.74
Jan 23	5-15	Fine	63-66	" "	10	120	12.0	1.10
Jan 24	5-10	Fine	63-67	" "	6	72	12.0	1.10

TABLE 2

TRIP 2 - FISHING DAYS JAN 30 - FEB 8

Date	Wind Range Knots	Weather	Sea temp range at front °F	Locality Fished	Hours Fished	Albacore Caught	Hourly Catch	
							By Boat	By Hook
Jan 30	5-19	Fine	63-66	Off Waiapu	10	84	8.4	0.77
Jan 31	10-20	Fine	63-66	" "	10	18	1.8	0.16
Feb 1	10-30	Overcast	63-66	" "	6	11	1.8	0.16
Feb 2	10-25	Fine	63-65	Off Tolaga	10	29	2.9	0.26
Feb 3 & 4		Gale						
Feb 5	25-15	Fine	63-64	Off Tolaga	10	44	4.4	0.40
Feb 6	10-5	Overcast	63-64	" "	12	50	4.2	0.38
Feb 7	5-10	Fine	63-64	Off Tokomaru	6	45	9.0	0.82
Feb 8	1-20	Fine	64-67	Off Waiapu	2	8	4.0	0.36

TABLE 3

TRIP 3 - FISHING DAYS FEB 13 - 18

Date	Wind Range Knots	Weather	Sea temp range at front °F	Locality Fished	Hours Fished	Albacore Caught	Hourly Catch	
							By Boat	By Hook
Feb 13	5-30	Fine	64-65	Off Waiapu	6	47	7.9	0.72
Feb 14		Gale						
Feb 15	10-25	Fine	64-65	" "	7	62	8.9	0.81
Feb 16	10-15	Fine	63-64	" "	11	103	9.4	0.86
Feb 17	15-15	Fine	63-65	" "	11	59	5.4	0.49
Feb 18	15-30	Fine	65-66	" "	4	8	2.0	0.19

TABLE 4

TRIP 4 - FISHING DAYS MARCH 11-16

Date	Wind Range Knots	Weather	Sea Temp Range at Front °F	Locality Fished	Hours Fished	Albacore Caught	Hourly Catch	
							By Boat	By Hook
Mar 11	5-10	Fine	66-68	Off Waiapu	13	92	7.1	0.65
Mar 12	5-10	Fine	66-68	Off Tokomaru to off Tolaga	11	70	6.4	0.58
Mar 13	5-10	Fine	66-67	Off Tolaga	10	202	20.2	1.84
Mar 14	5-10	Overcast Rain	66-67	Off Tokomaru	12	226	18.8	1.71
Mar 15	5-10	Fine	65-67	" "	13	261	20.1	1.83
Mar 16	5-10	Fine	66-67	" "	11	153	13.9	1.26

TABLE 5

TRIP 5 - FISHING DAYS MAR 20-23 AND 26-28

Date	Wind Range Knots	Weather	Sea Temp Range at Front °F	Locality Fished	Hours Fished	Albacore Caught	Hourly Catch	
							By Boat	By Hook
Mar 20	20-25	Fine	66-67	Off Waiapu	4	40	10.0	0.91
Mar 21	20-25	Fine	65-67	" "	4	23	5.7	0.52
Mar 22	20-25	Fine	65-67	" "	4	68	17.0	1.55
Mar 23	20-30	Overcast	64-65	Off Tolaga	12	69	5.8	0.53
Mar 24 & 25		Gale						
Mar 26	25-30	Overcast	64-65	Off Tatapouri (Gisborne)	4	59	14.7	1.40
Mar 27		Gale						
Mar 28	25-30	Overcast	65-67	Between Gisborne and East Cape	5	30	6.0	0.55

The number of hours fished on each trip, total fish caught, the weight of the catch, average weight of the fish and catch rates per boat hour and hook hour are summarised in Table 6.

TABLE 6

TOTALS AND AVERAGES FOR TRIPS 1-5

Trip No.	Hours Fished	Total No. Fish Caught	Total Weight of Catch lbs	Av. Weight per Fish	Average catch per boat hour		Average catch per hook hour	
					No. of Fish	Wt of catch lb	No of Fish	Wt of Catch lb
1	33	308	6,750	21.9	8.1	140.7	0.73	12.7
2	66	289	5,200	18.0	4.4	78.8	0.40	7.2
3	39	279	5,100	18.3	7.2	130.8	0.65	11.9
4	70	1004	8,200	8.2	14.3	117.1	1.30	10.6
5	33	289	4,600	16.0	8.8	139.3	0.80	12.6
All Trips	246	2,169	29,850	13.6	8.8	121.3	0.80	11.0

The table shows that the fish caught during the first trip were considerably larger on average than those caught in subsequent trips. On Trip 4 there was a predominance of a younger age group in the catch.

To be economic, commercial operations require a combination of adequate catch rates per hour with adequate average weights of the fish caught. Thus Trips 1 and 5 with average catches of fish per boat hour of 8.1 and 8.8 and with average weights per fish of 21.9 and 16.0 lbs respectively yielded the best commercial results with weight of catch per hour of fishing at approximately 140 lbs per boat hour each. In Trip 4 a high rate of fish caught per hour, 14.3, was offset by a low average weight per fish, 8.2 lbs, so that the catch per boat hour was reduced to 117.1 lbs. Results in Trip 2 were poorer still owing to a low rate of fish caught. A good average weight of 18.0 lbs could not compensate for the low catch rate of 4.4 fish per hour and the resulting catch weight per boat hour, 78.8 lbs, was the lowest rate for all trips.

Taking the five trips together, 2,169 fish weighing collectively 29,850 lbs were taken in 246 fishing hours at an average catch per boat hour of 8.8 fish and 121.3 lbs weight. As the number of hooks fished was 11 throughout, corresponding average hourly hooking rates were 0.80 and 11 lbs weight.

DISCUSSION

COMPARISON WITH HOOKING RATES IN THE CALIFORNIAN FISHERY

Since the fishing gear and methods in the present operations are identical with those used in California it is interesting to compare the hooking rates in the two fisheries. Californian catch effort is measured in terms of boat days, with a boat day being approximately equivalent to 100 hook hours, Clemens and Craig (1965).

In similar effort units the catch rates during the five fishing trips summarised in Table 6ranged from 40 (Trip 2) to 130 (Trip 4) with a mean of 80 albacore per 100 hook hours.

For the seasons 1950 through 1961 the Californian fleet averaged 73 albacore per day (or per 100 line hours), whilst the range in catch rate during this period was 50 to 132 albacore per day. Between 1961 and 1968 the catch rate has continued to fluctuate around a mean of 70 albacore per day (Craig, (pers. comm)).

COMMERCIAL EXPLOITATION

The southern Pacific stock has been exploited in a long line fishery by Korean long liners operating out of Samoa and the New Hebrides, and Japanese long liners have taken albacore in oceanic waters both to the east and west of New Zealand down to about 40°S latitude.

Shirakuma and Cowper (pers. comm.) during a cruise of the Onahama Fisheries High School training vessel "Fukushima Maru", off New Zealand in June-July 1965 recorded catches of albacore by longline in an area between 177°E and 177°W and between the 35th and 40th parallels, with a peak catch between 178° and 179°W and 36° and 37°S. The albacore were taken incidentally during a fishing survey for Southern bluefin tuna Thunnus maccoyi.

Koto (1966) gives a map of the albacore fishing grounds of the South Pacific in which he shows the North Island of New Zealand to lie within an albacore longlining area extending from the East Coast of Australia to 120°W longitude. On this map, a coastal area extending from about Napier around North Cape and down to about New Plymouth is marked as a pole and live bait fishing ground. A coastal area extending from Tasmania to the approximate latitude of Port Macquarrie is similarly marked on the Australian south-east coast. Roughley (1961) has recorded that a catch of 6,282 lbs of albacore was taken off the coast of New South Wales by trolling between September 1949 and February 1950. Koto's map extends across the South Pacific to Chile where a coastal live bait fishing ground is also shown.

The level of research has been much lower in the south than in the north Pacific and there is no evidence yet of long range trans-Pacific migrations comparable to those which have been established between North America and Japan.

Shorter range migrations are almost certain to take place and if a commercial fishery for albacore is to be developed in New Zealand, the relationship between this coastal fishery and the offshore Japanese long line fishery must be established. Management of the fishery will require international cooperation.

POTENTIAL FOR DEVELOPMENT

There would appear to be good prospects for the development of an albacore fishery in New Zealand. Such an industry developed from small beginnings in California subsequent to the failure of the sardine fishery. In the early days the commercial fishermen netted sardines and salted them for bait. They located albacore schools by trolling and then scattered the salted bait upon the sea to attract and hold the albacore within reach of handlines. When the school ceased biting, trolling was resumed and the process was repeated. After World War I trolling vessels started carrying tanks and the bait was kept alive. Japanese immigrants introduced pole fishing to the industry and the live bait method became associated mainly with this pole fishing. Pole fishing has the advantage that much larger fish can be landed than by troll fishing.

The fishermen in the present fishing tours noted greatly increased catches when they used regurgitated anchovies to "chum up" the albacore behind their boat and the possibility of introducing live bait in New Zealand requires careful study. It is advantageous both in trolling and pole fishing, but if the fish respond readily to live bait, development of pole fishing is indicated. In the present fishing, numerous strikes of yellowfin tuna Thunnus albacares were obtained, but few of these fish were landed as they were too heavy to haul on board and they frequently broke the lines; on one occasion all eleven lines were lost when the boat ran into a school of yellowfin. A pole fishing boat would have taken both albacore and yellowfin.

There is a complicated relationship between boat size and economic efficiency. Breekveldt (1969) has outlined the factors which have to be considered. The boat must not only be seaworthy and sea kindly but such factors as overall dimensions, the shape and division of the hull into fish hold, engine room, fuel tanks and accommodation spaces, the deck space and the gear must be in full harmony with the conditions it is to operate under, such as the duration of the trips, the type of weather and seas it may meet, distances to fishing grounds, catching rates and size of catches, disposal of the catch and the ratio between receipts obtained and

operating expenses. Information on all these matters is required to indicate what type of boat and fishing method would be most suitable for use in a New Zealand fishery for albacore.

Basically, operators in pelagic fisheries have two main options. They may employ relatively small boats for a short season, during which the migrating fish are within their limited operational range, and convert to another type of fishing outside the season for the migratory species. Alternatively they may use larger boats and follow the centre of fishing activity as this moves along the coastline, working out a series of bases as the season progresses. A classical example of the latter type of operation was the movement of the North Sea herring drift net fleet from port to port as the centre of herring schooling shifted with the seasons. In the California albacore fishery some fishermen have chosen the first alternative; others have adopted the second.

The present operations with the "Sea Bee" have shown that it is possible for a 45 foot boat of this class to operate along the east coast of the North Island to a distance of 200 miles from its home port provided anchorages can be found in which to spend the night or ride out bad weather. During the period January 21 to March 28, Mr Baker was exclusively engaged in trolling for albacore and found this operation at least as rewarding as crayfishing conducted over a similar period in previous seasons. It is possible that he could have commenced fishing for albacore to the north of Whitianga earlier in the season had more information been available on the seasonal distribution of this migratory fish. A ready and unsatisfied demand for the catch was found on an export market. A good opportunity therefore seems to exist for the establishment of an albacore fishery in New Zealand but if its full potential is to be realised an expanded biological and hydrographic programme will be required to establish where the migrating fish first approach the New Zealand coastline and how they move along it in commercially exploitable concentrations.

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ALBACORE CATCH BY HOUR OF THE DAY

	No. of Albacore Caught in the Hour Ending												
Date	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900
Jan 21													
Jan 22		7	2	7	24	8	8	8	10				
Jan 23		15	10	5	2	41	15	10	2	10	10		
Jan 24		5	10	10	21	5	21						
Jan 30		9	13	8	10	9	9	16	7	2	1		
Jan 31	2	3	0	0	1	2	4	6	0	0			
Feb 1	4	2	2	1	2	0							
Feb 2	1	0	7	6	0	2	0	3	10	0			
Feb 5	2	2	2	1	1	0	11	10	10	5			
Feb 6	2	11	16	0	0	0	2	0	5	8	1	5	
Feb 7	3	5	5	10	11	11							
Feb 13		2	10	15	11	6	3						
Feb 16		16	3	4	15	18	9	1	8	8	18	3	
Feb 17		5	2	2	3	4	12	13	2	7	6	3	
March 11	8	2	3	5	2	6	16	16	14	8	5	5	2
March 12	2	7	4	2	11	12	2	5	10	13	2		
March 13		10	13	23	22	30	22	28	24	20	10		
March 14	0	25	26	24	33	24	15	12	14	13	26	14	
March 15	0	16	36	15	27	12	28	11	35	36	23	22	0
March 16		4	12	20	31	15	25	8	9	25	4	0	
March 20		0	2	8	10	20							
March 21		4	3	15									
March 22								9	14	33	12		
Averages	2.4	7.1	8.6	8.6	11.8	11.2	11.7	9.8	10.9	12.5	9.8	7.4	1

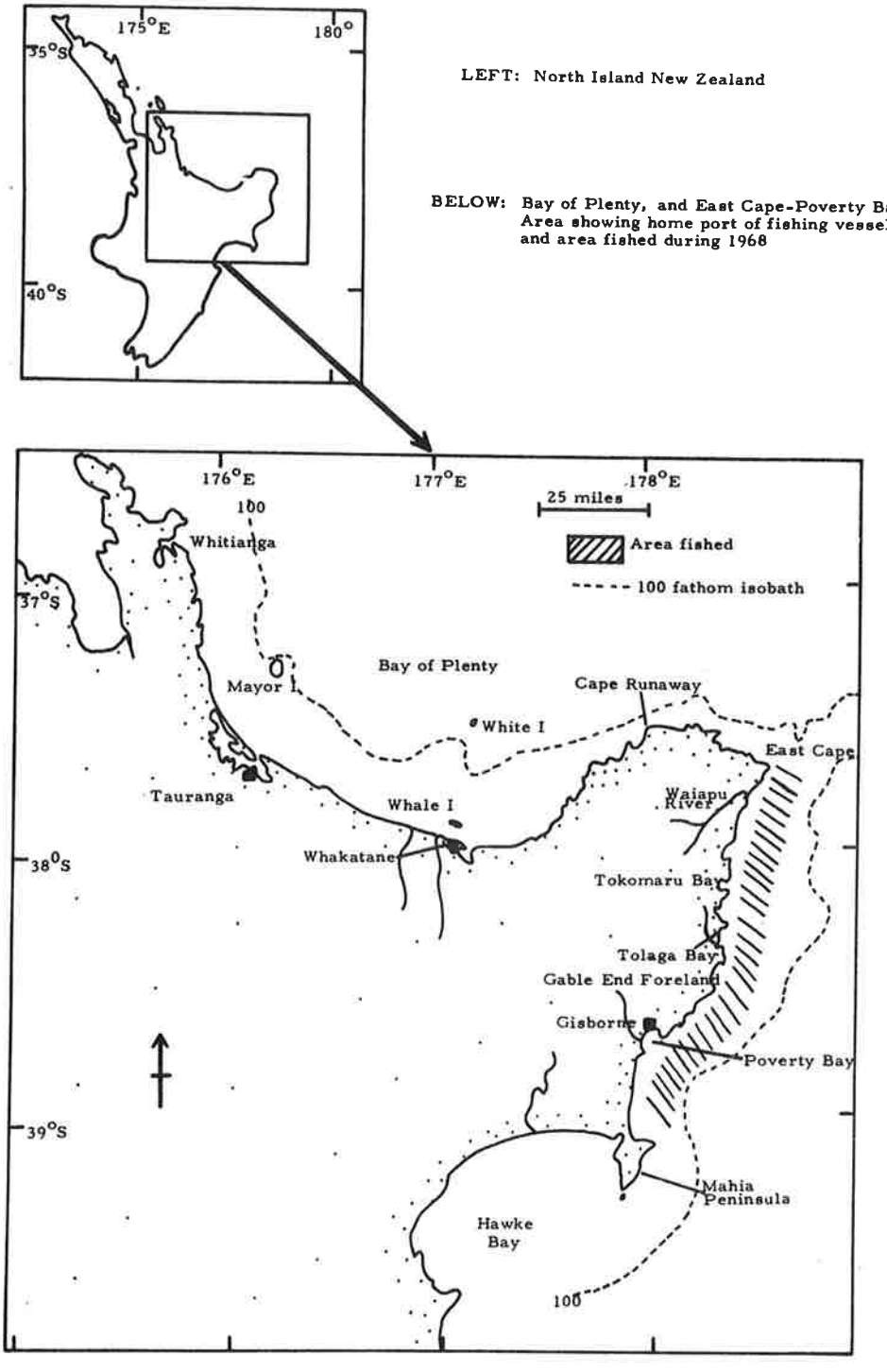

Figure 1 - Chart of the area where fishing was conducted, with place names.

Figure 2 - The "Sea Bee" leaving Whitianga.

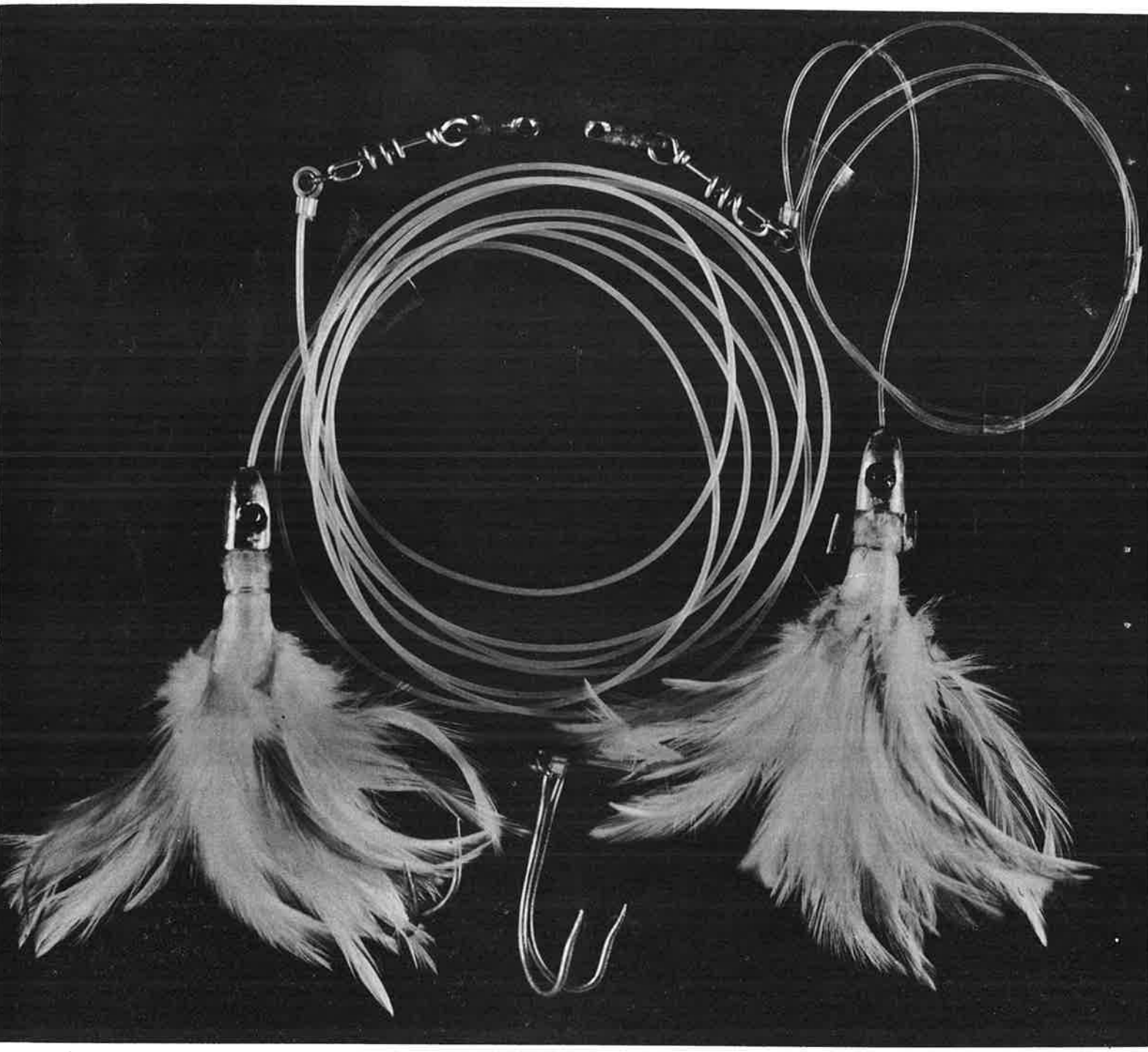

Figure 3 - Two complete lure assemblies, showing quick release swivels, nylon traces, "ruby-eye" lures and Garwood barbless albacore hooks.

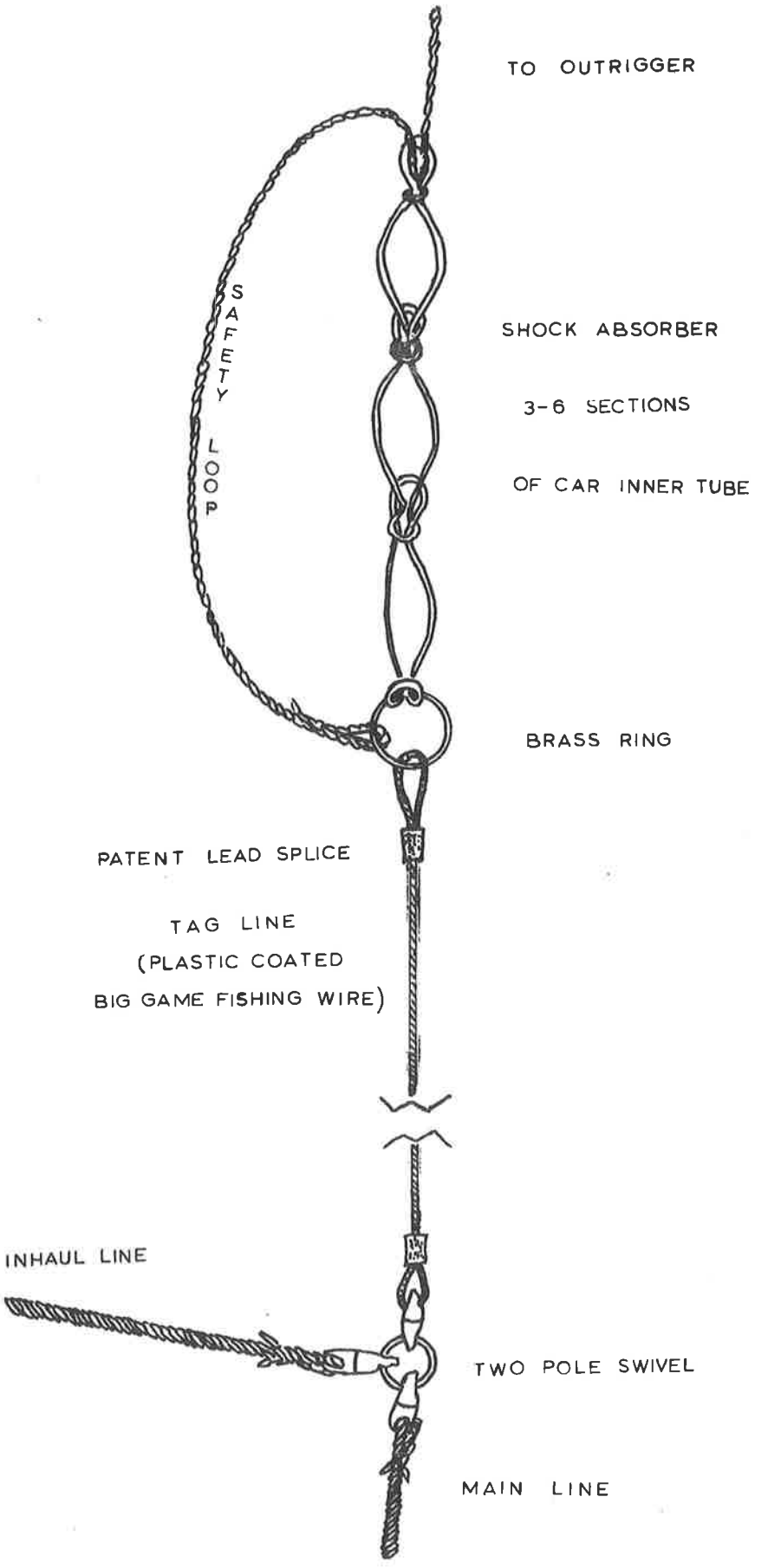

Figure 4 - Showing the main components of the line assembly at the boat.

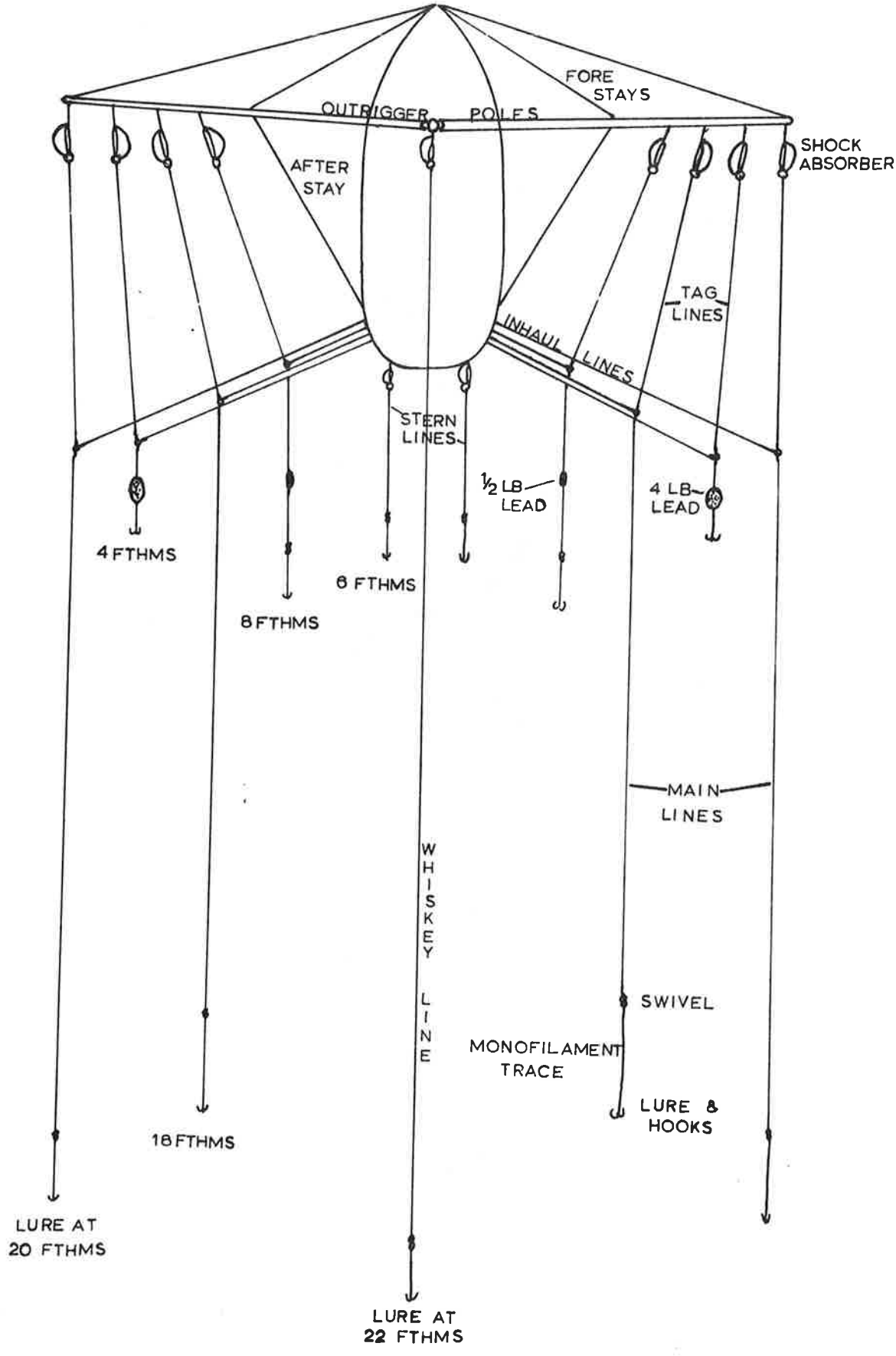

Figure 5 - The pattern of 11 lines employed on the "Sea Bee".