

THE 1975-76 PURSE SEINE SKIPJACK FISHERY

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The skipjack is in life a steel blue colour above and whitish yellow below with 4 to 6 conspicuous dark stripes on each side of the body. It has the typical bullet shape of the tunas with numerous streamlining features. This highly mobile and gregarious species grows to over 90 cm (36 in.) long and 18 kg (40 lb) in weight, though in New Zealand waters skipjack are usually about 50 cm (20 in.) long and 2.5 kg (5.5 lb) in weight. Skipjack occur throughout the oceans of the world between latitudes 40° N and 40° S.

During summer skipjack migrate into New Zealand waters from the north, usually moving as far south as Cook Strait. Surveys in earlier years, for example, the Paramount surveys, have shown that the number of fish in this migration can be considerable. These surveys also showed that skipjack in New Zealand waters can be caught in quantity by purse seine. At the completion of the Paramount surveys it was concluded that further fishing trials on a commercial basis were desirable to prove the extent and resilience of the skipjack resource and to determine the best and most economic fishing unit for the New Zealand situation.

Subsequently four fishing companies jointly financed a development company [See P.N. Vela's paper on page ??] to carry out trials by arranging for three large Californian purse seiners to operate in New Zealand as New

Zealand registered vessels for the 1975-76 season. These were: Michelangelo, 62 m (202 ft) long, with a 12.8-m (42-ft) beam, 5.4-m (17.8-ft) draught, gross weight of 967 t, cruising speed of 14.5 knots, and a carrying capacity of about 1270 t; Kerri M, 53 m (175 ft) long, with a 11-m (35-ft) beam, 5.5-m (18-ft) draught, gross weight of 837 t, cruising speed of 15 knots, and a carrying capacity of 740 t; and South Pacific, 68 m (223 ft) long, with a beam of 12.8 m (42 ft), a 5.8-m (18.7-ft) draught, gross weight of 1089 t, cruising speed of 16 knots, and a carrying capacity of 1100 t. The locally owned purse seiners Lindberg, 23.5 m (77 ft) long, with a 7.3-m (24-ft) beam, 3.3-m (11-ft) draught, gross weight of 159 t, cruising speed of 10.5 knots, and a carrying capacity of 90 t and Marine Countess, 23.5 m (77 ft) long, with a 6.7-m (22-ft) beam, 3.3-m (11-ft) draught, gross weight of 109 t, cruising speed of 11 knots, and a carrying capacity of 80 t also fished skipjack during the season.

The Fisheries Divisions of the Ministry of Agriculture and Fisheries placed observers aboard these vessels to record catch and effort data for analysis in relation to time of season, time of day, position (that is, latitude and longitude), moon phase, bottom depth, water temperature, and sea condition. In addition, a continuous log was kept of vessel movements, environmental conditions, and school sightings. Each catch was sampled and data were collected on fish length, weight, sex, gonad condition, stomach contents, and other biological factors.

Data collected on catch and effort have been combined and analysed to yield figures which describe in general terms the 1975-76 purse seine fishery for skipjack.

### Definitions

In the following analyses a season day is defined as any day that a purse seiner spent in activity related to the skipjack fishery. This includes days spent fishing and searching, days in port, days spent drifting or at anchor because of poor weather or mechanical breakdown, and days spent travelling. Days fished are days on which the net was set or searching activity occurred with the aim of setting. A set is defined as any time the net was released into the water to entrap school fish and then retrieved; a successful set was one where at least 2 t of skipjack were caught. Time of day has been divided into the 6-hour periods 12 midnight to 5.59 a.m., 6.00 a.m. to 11.59 a.m., 12 noon to 5.59 p.m., and 6.00 p.m. to 11.59 p.m. Moon phase periods run from the day that a phase began to the day before the following phase began. Finally, the ranges given with mean catch effort data refer to the ranges of means of catch per unit of effort as recorded for all the purse seine vessels.

### Catch and Effort

The season was about 5 months long, beginning in early November and finishing <sup>in</sup> early April. During this time the purse seine fleet worked a total of 496 season days (Fig. 1). Of these

there were 224 days fished (46%), 113 days spent in port (23%), 90 days spent travelling (19%), 51 days lost through poor weather (10%), and 8 days lost through breakdowns (2%). The large number of days spent travelling resulted mainly from the larger vessels travelling to Pago Pago in American Samoa to offload. Over half of the days spent in port were by the smaller vessels which were often weatherbound. Three-quarters of the days lost through poor weather were by Michelangelo and Kerri M between November and early January.

#### Catch and Effort by Month

During the 224 days fished, 4715 $\frac{1}{2}$  lb of skipjack were caught (Fig. 2). Quantities of fish taken by month were 18 $\frac{1}{2}$  lb in November (0.4%), 307 $\frac{1}{2}$  lb in December (6.5%), 1590 $\frac{1}{2}$  lb in January (33.8%), 2192 $\frac{1}{2}$  lb in February (46.4%), and 608 $\frac{1}{2}$  lb in March (12.9%). The average catch per month was 786 $\frac{1}{2}$  lb. The number of season days per month were 29 in November (6%), 63 in December (13%), 129 in January (26%), 145 in February (30%), 117 in March (24%), and 5 in April (1%). The average number of season days per month was 81. Mean catch per season day ranged from 0.6 $\frac{1}{2}$  lb in November to a high of 15.1 $\frac{1}{2}$  lb in February. Number of days fished, number of sets, and number of successful sets all followed the same pattern as number of season days, with a rapid build-up of effort through January to peak in February and drop away to April. Some 60% of days fished, 70% of sets, and 74% of successful sets were recorded during January and February. The amount of effort and size of catch per month were directly related. Mean catch per day fished ranged from 6 $\frac{1}{2}$  lb in November to a high of 30 $\frac{1}{2}$  lb in February. South Pacific registered a remarkable 59.5 $\frac{1}{2}$  lb per day fished in February. Mean catch per set ranged from  $\frac{3}{4}$  lb (November) to 19 $\frac{1}{2}$  lb (January), and

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mean catch per successful set <sup>ranged</sup> from  $3\frac{1}{t}$  (November) to  $3\frac{1}{t}$  (February). Obviously the number of vessels fishing (<sup>one</sup> in November, ~~two~~ in December, ~~five~~ in January and February, ~~four~~ in March, and ~~one~~ in April), the relative performances of the vessels, and their activities during the month affected the averages and totals for each month. However, the effects of this fluctuating effort were overcome by calculating the various units of catch in relation to effort (Fig. 2, right-hand axis).

#### Catch and Effort by Time of Day

Purse seine catch and effort has also been analysed by time of day (Fig. 3). Over half of the skipjack ( $2526\frac{1}{t}$ ) were caught during the afternoon, one-quarter ( $1216\frac{1}{t}$ ) in the morning, and the remainder ( $973\frac{1}{t}$ ) in the evening. Effort was similarly apportioned with a little over half the sets being made in the afternoon, one-third in the morning, and the rest during the evening. However, the highest catches per set and per successful set were made in the evening (means of  $23.2\frac{1}{t}$  per set,  $36.0\frac{1}{t}$  per successful set). The means for morning were slightly below, and those for the afternoon slightly above, the season's means of  $15.5\frac{1}{t}$  per set and  $26.2\frac{1}{t}$  per successful set. No fish were caught between midnight and 6 a.m.

#### Catch and Effort by Moon Phase

Analysis of catch and effort in relation to moon phase showed once again that quantity of skipjack caught and amount of effort expended were directly related (Fig. 4). As examples, during full moon 25% of all sets were made (76), 39 of these were successful (22% of all successful sets) and 25% ( $1192\frac{1}{t}$ ) of the season's catch was taken; during the last quarter 8%

(365~~t~~) of the skipjack was caught in 9% of all sets (26) and 8% of successful sets (15). More than 40% of the fish were caught during the period new moon to first quarter. The greatest amount of effort for any moon phase was expended at these times, with 40% of all available new moon days fished, and 36% of all sets and 39% of the successful sets yielding over 2000~~t~~ of skipjack. The highest mean catch per set was during new moon and per successful set during full moon. It is probable that the predominance of the new moon period in the skipjack purse seine fishery was directly related to the availability of skipjack in quantity on the fishing grounds at these times. [See I.T. Clement's paper on page ??]

#### Catch and Effort by Area

Seining was carried out in <sup>eight</sup> areas on the North Island coast (Fig. 5, Table 1). These were the eastern areas: A North Cape to Cavalli Island, B north-east of Great Barrier Island, C east of Mercury Bay, D Mayor Island to Waikawa Point, and E east of Gisborne; and the western areas: F in South Taranaki Bight, G west of New Plymouth, and H north-west of Reef Point. Three-quarters of all skipjack were caught in area A (3556~~t~~), and about half of all sets (57%) and two-thirds of the successful sets (62%) were made in this area. These large amounts of catch and effort are consistent with the observation that the largest quantities of purse-seinable fish were sighted in this area during the season. Catches per set (20.6~~t~~) and per successful set (31.7~~t~~) were high by world standards, <sup>an</sup> indication that this area could support a viable fishery, at least for a limited number of vessels, provided that the costs of pursuing such a fishery in New Zealand are not prohibitive. About one-quarter of the fishing effort (83 sets or 27.3% of all

sets, 43 successful sets or 23.9% of all successful sets) was expended in the Bay of Plenty (area D). One-fifth of the season's catch was taken here (870<sup>t</sup>) at catch rates of 10.5<sup>t</sup> per set and 20.2<sup>t</sup> per successful set. Similar catch rates were recorded in area B where 146<sup>t</sup> were caught. All the fish taken in area C (82<sup>t</sup>) were <sup>taken</sup> by the smaller seiners. Skipjack schools in this area were generally small (<sup>less than</sup> 30<sup>t</sup>) and moved about over shallow ground, factors which suited the smaller vessels. Catch rates were low, as they were

in all other areas where skipjack were taken. Area H is of particular interest. Catches were made here in November 1975. A large quantity of skipjack (<sup>more than</sup> 1000<sup>t</sup>) was present at the surface in this area during this period. However, low catch rates prevailed because schools were difficult to catch. Some were too large (<sup>over</sup> 100<sup>t</sup>), many were too mobile, and most were too "spooky".

#### Analysis of Set Failures

Of the 304 sets made during the season 180 (59%) were successful and 124 unsuccessful (41%). Analysis of the reasons for set failure yielded the results shown in Fig. 6. In 45 (36%) unsuccessful sets, the school swam out under the net during pursing, and in 18 (14%) the school dived under the net before the net was completely set. In 16 (13%) of <sup>the</sup> unsuccessful sets the school swam out under the boat during pursing, <sup>in</sup> 12 (10%) the school swam out behind the boat and under the towline, in 11 (9%) the school outraced the boat while it was setting the net, in 7 (5%) the school escaped because there was a net rip, <sup>in</sup> 5 (4%) the school swam out of the net by the skiff during setting, in 4 (3%) the school escaped because the boat or skiff experienced

mechanical trouble during the set, <sup>in</sup> 2 (2%) there was a net roll-up, <sup>in</sup> 2 (2%) a set was made on the wrong species, in 1 (1%) the school escaped because the bow ortza had to be released, and in another (1%) the school swam out over the corkline, which had sunk.

### Summary

The 1975-76 purse seine fishery for skipjack was pursued by five vessels, which <sup>ranged</sup> from 23 to 68 m in length and 109 to 1089t in weight.

Skipjack migrated into New Zealand waters from the north, beginning in November, and were present in purse-seinable quantities until early April.

The purse seine fleet worked 486 season days, 224 of which were spent fishing, 113 in port, 90 travelling, 51 sheltering from bad weather, and 8 making mechanical repairs.

During the 224 days fished 4715t of skipjack were caught. More than three-quarters of this was caught in January and February, with peaks in catch, effort, and catch per unit of effort in February.

Over half of the skipjack were caught in the afternoon, one-quarter in the morning, and the remainder in the evening. However, the highest catches per unit of effort were made in the evening.

Fishing was most productive in the moon phase new moon to first quarter, when 43% <sup>over</sup> (2000t) of the fish were caught.

Three-quarters of all skipjack (3556t) were caught off the north-east coast between Cavalli Island and North Cape, with the balance being taken from seven other areas around the North Island.



	H	Totals
1	18	4 715
0.2	0.4	
3	7	304
1.0	2.3	
3.67	2.57	
1	3	180
0.6	1.7	
11.00	6.00	

TABLE 1: Catch and effort by area in the 1975-76  
skipjack fishery in New Zealand

	Area						
	A	B	C	D	E	F	G
Catch (t)	3 556	146	82	870	24	8	11
Percentage of total catch	75.4	3.1	1.7	18.5	0.5	0.2	0.1
Number of sets	173	22	13	83	2	1	3
Percentage of total sets	56.9	7.2	4.3	27.3	0.7	0.3	1.0
Catch per set (t)	20.55	6.64	6.31	10.48	12.00	8.00	3.7
Number of successful sets	112	8	10	43	2	1	1
Percentage of all successful sets	62.2	4.4	5.5	23.9	1.1	0.6	0.1
Catch per successful set (t)	31.75	18.25	8.20	20.23	12.00	8.00	11.0

A - North Cape to Cavalli Island

E - East of Gisborne

B - North-east of Great Barrier Island

F - South Taranaki Bight

C - East of Mercury Bay

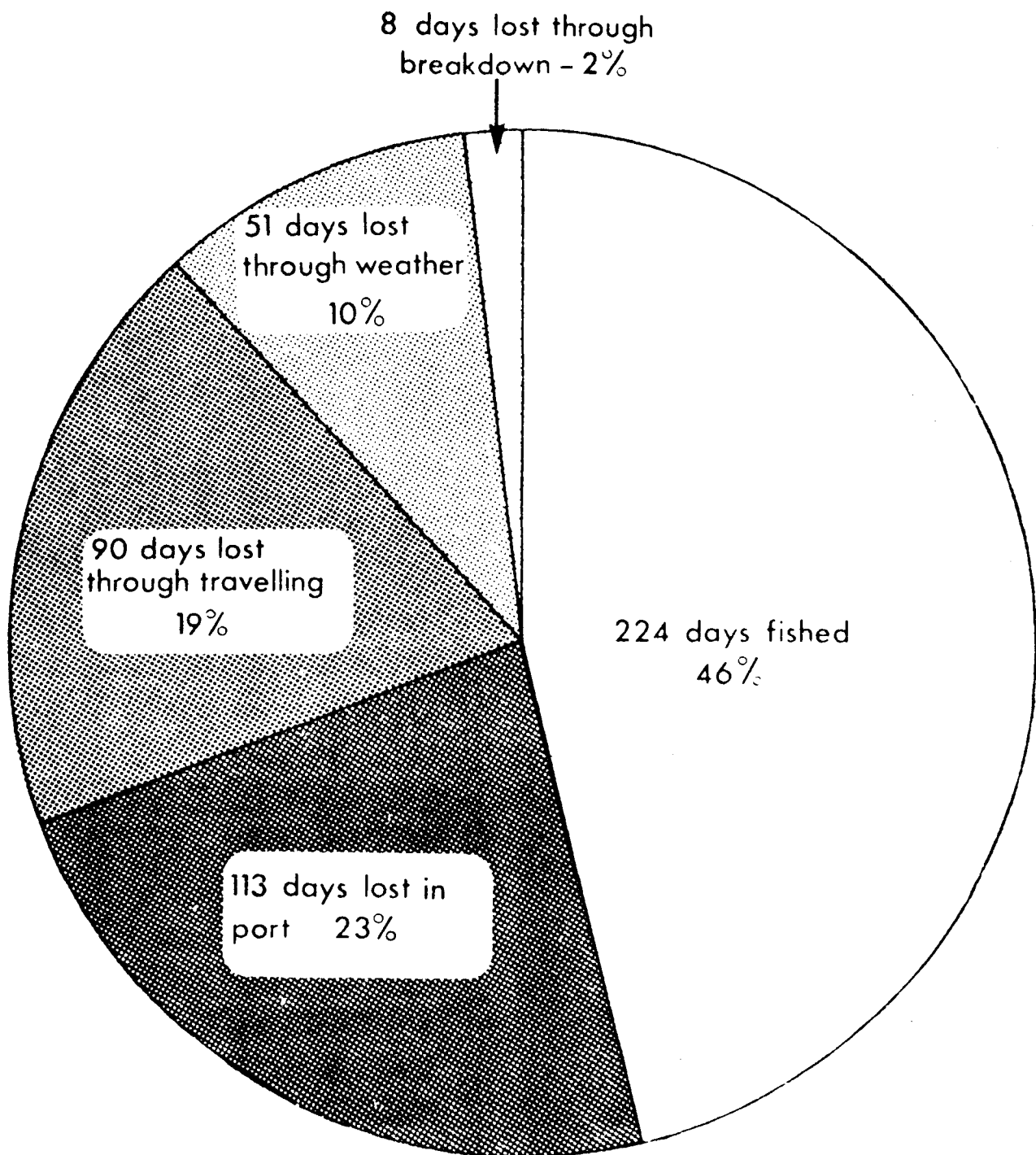
G - West of New Plymouth

D - Mayor Island to Waikawa Point

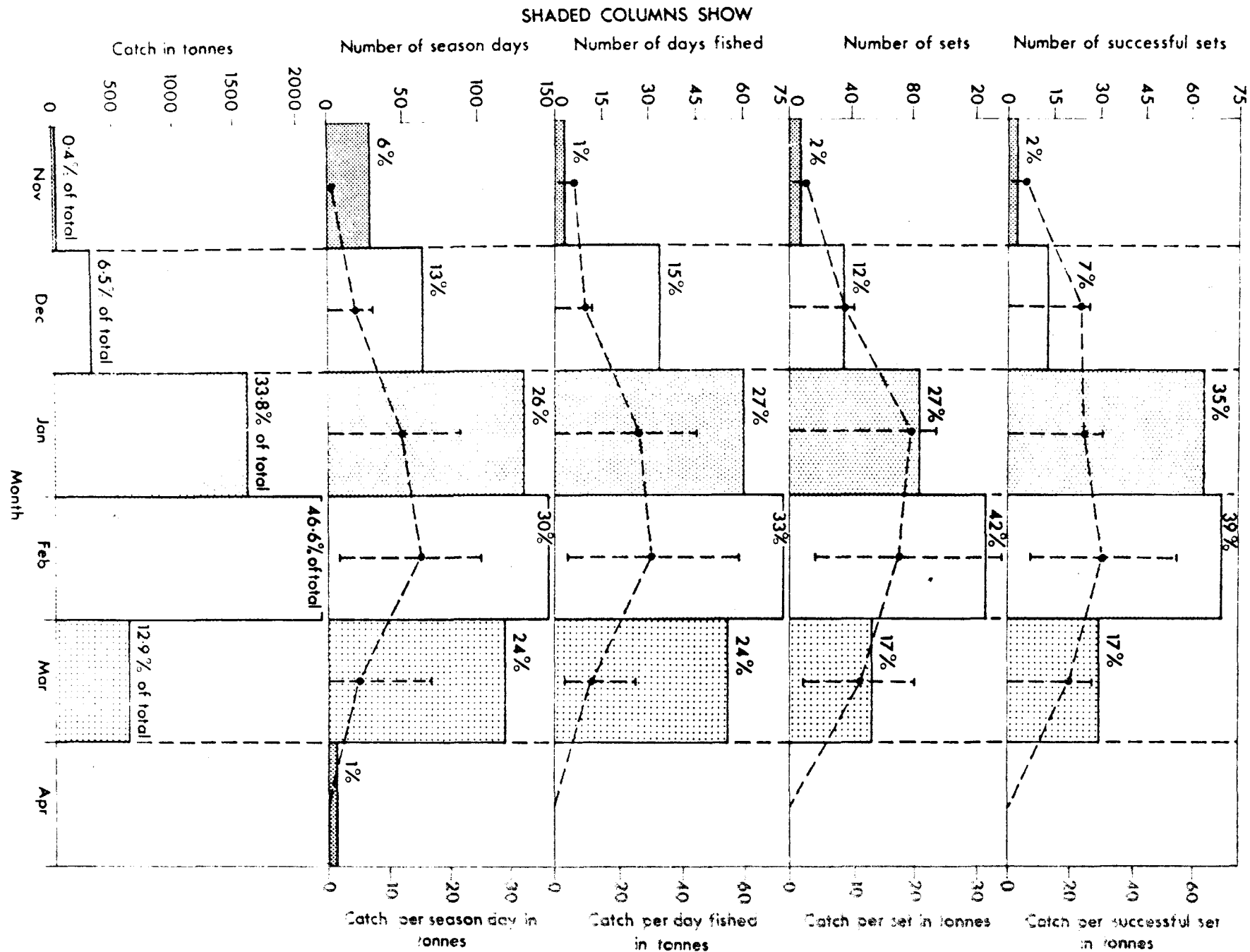
H - North-west of Reef Point

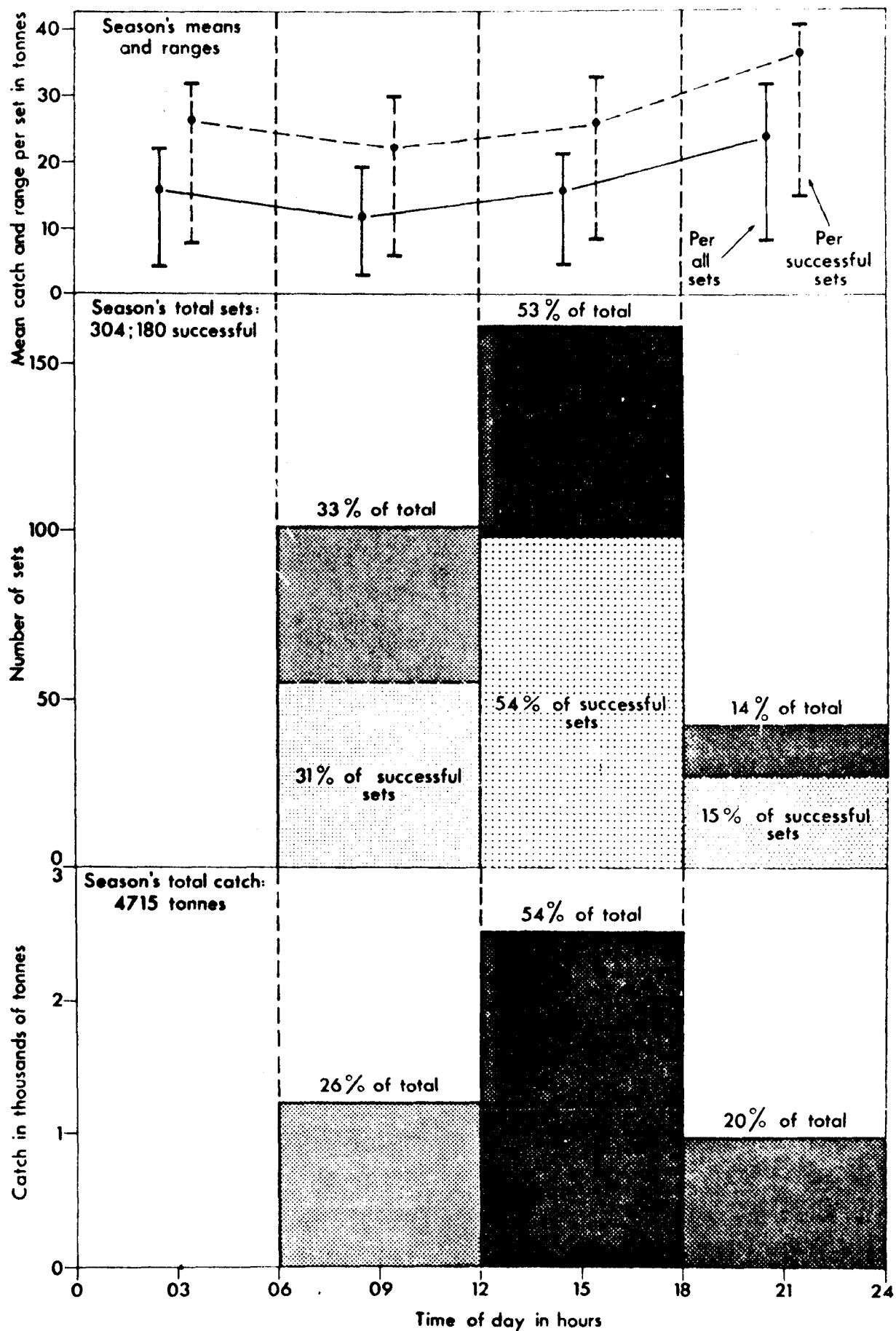
## FIGURE CAPTIONS

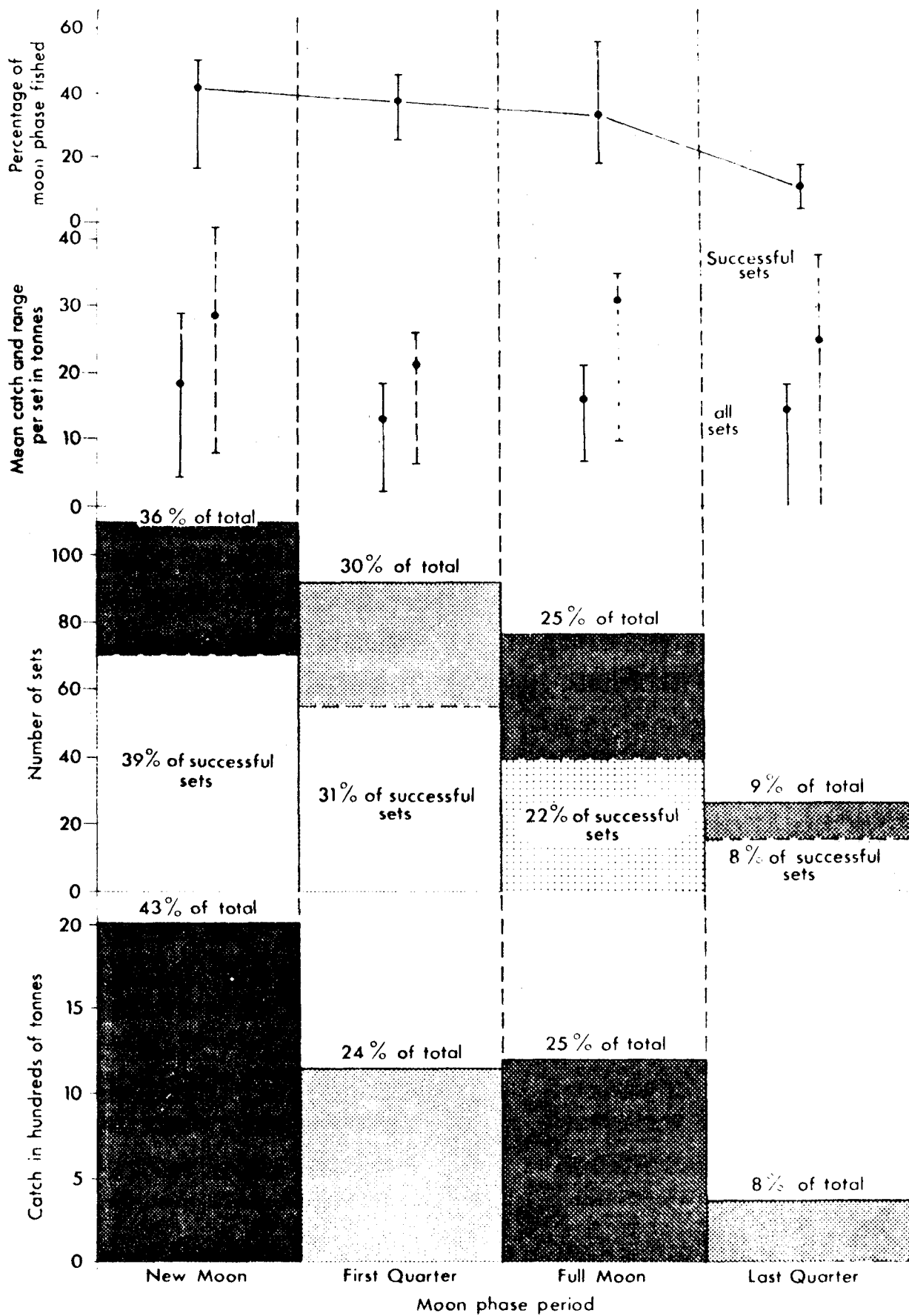
- Fig. 1: Days fished and days lost in the 1975-76 purse seine skipjack fishery in New Zealand (total number of season days 486).
- Fig. 2: Monthly catch, effort, and catch per unit of effort in the 1975-76 purse seine skipjack fishery in New Zealand.
- Fig. 3: Catch, effort, and catch per unit of effort by time of day in the 1975-76 purse seine skipjack fishery in New Zealand.
- Fig. 4: Catch, effort, and catch per unit of effort by moon phase in the 1975-76 purse seine skipjack fishery in New Zealand.
- Fig. 5: Set positions and areas of fishing in the 1975-76 purse seine skipjack fishery in New Zealand.
- Fig. 6: Reasons for set failure in the 1975-76 purse seine skipjack fishery in New Zealand.

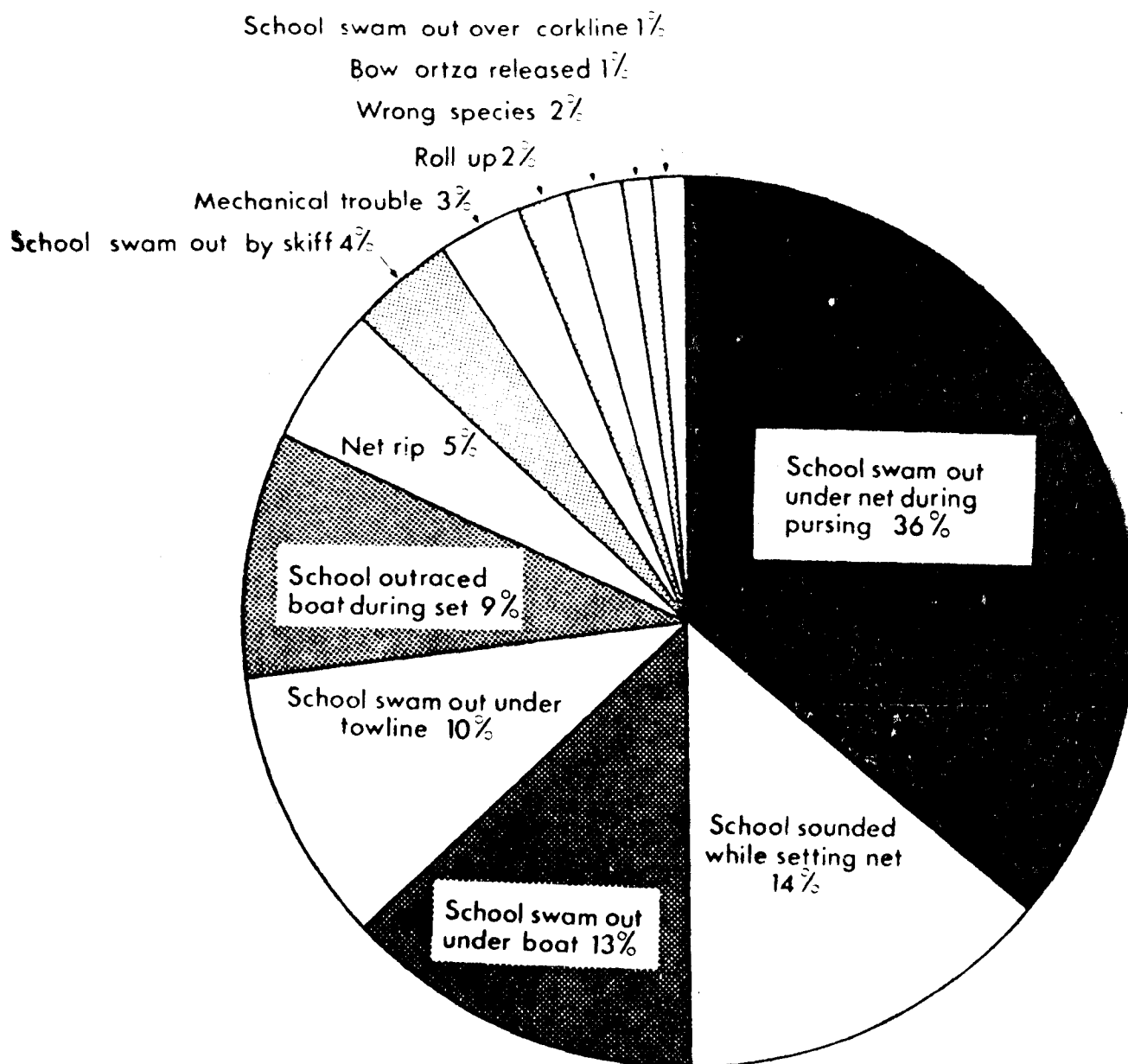


Days fished and days lost in 1975-1976 purse seine skipjack fishery  
Total number of season days = 486









Reasons for set failure during purse seine fishing for skipjack  
1975 76 season. 180 failed of 304 sets or 59 %.