WP 17

A PRELIMINARY ANALYSIS OF THE STOMACH CONTENTS OF ALBACORE, *Thunnus alalunga*, FROM THE SUBTROPICAL CONVERGENCE ZONE EAST OF NEW ZEALAND

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Summary

The stomach contents of 112 albacore from two regions of the subtropical convergence zone east of New Zealand were examined. In both regions albacore had fed primarily on fish, in particular myctophids and saury over the Chatham Rise, and jack mackerel in offshore water further to the east. Crustaceans and squid occurred in low volumes but were of more importance in the nearshore rather than offshore region. The average volume of food in the stomachs from the two regions appears to be different. While the range of stomach fullness was greatest over the Chatham Rise, fullness was consistently higher in deeper water. This may be due to heavy feeding on concentrations of Peruvian jack mackerel along the northern boundary of the subtropical convergence zone.

Introduction

In February 1986 the New Zealand fisheries research vessel *Kaharoa* and the U.S. National Oceanic and Atmospheric Agency (NOAA) research ship *Townsend Cromwell* undertook coincident cruises to map the extent of the subtropical convergence zone (STCZ) east of New Zealand and to determine the potential for exploitation of albacore within the convergence zone. These cruises are part of a joint effort by the U.S., New Zealand, France and South Pacific island nations to determine the size and distribution of the albacore stock in the South Pacific Ocean.

During the cruises, biological samples were obtained from albacore that were too damaged for tagging. Samples included otoliths and caudal vertebrae for aging, heads and viscera for parasite fauna, fillets for proximate biochemical analysis and gonads for reproductive studies. Stomachs were collected to investigate the feeding habits of albacore in the STCZ.

Previous studies in the South Pacific have shown that albacore are opportunistic predators although epipelagic and mesopelagic fishes are usually more important prey items than cephalopods and planktonic crustaceans (Argue, Conand and Whyman, 1983; Bailey, 1983; Bailey and Habib, 1982; Fourmanoir, 1971; Ichikawa, 1981; Iversen, 1962; Iwasa, Habib and Clement, 1982 and Koga, 1958).

Methods

The *Kaharoa* and *Townsend Cromwell* usually trolled between 9 and 11 feathered jigs, depending on weather conditions. Trolling speed was kept to 6-7 knots when fish were striking but increased to 10 knots to cover the distance between hydrographic stations when fishing activity ceased. The trolling lines were hauled by hand.

Stomachs were removed from the fish as soon as they were landed or when time permitted if fishing was intense. The stomachs were injected with 10% buffered formalin to arrest digestion, individually bagged and frozen. In the laboratory food items were dissected from the stomachs, sorted into categories and their numbers recorded and displacement volumes measured. As this is a preliminary analysis, many of the less important food items and those partly digested have not been identified beyond class or order.

Results and Discussion

The stomach contents of 72 albacore caught by the *Townsend Cromwell* between 38°-40°S, 146°30'-177°30'W (the offshore region), and of 40 albacore caught by the *Kaharoa* between 42°20'-45°S, 176°E-177°W (the nearshore region), were examined. Their capture positions are shown in Figure 1. Fish from the *Townsend Cromwell* (cruise TC 86-01) measured from 50-86 cm fork-length ($\bar{x}$ = 70.8, s = 6.3), with half the sample in the 68-73 cm range. Albacore from the *Kaharoa* cruise (cruise K03/86) ranged from 45-89 cm ($\bar{x}$ = 63.5, s = 9.9), with fish between 63-72 cm predominating. The length frequency distributions for both samples are shown in Figure 2.

Food was found in 65 of the 72 *Townsend Cromwell* stomachs and occupied volumes of 2-115 ml, with an average of 41.1 ml (s = 27.9). Thirty-one of the 40 *Kaharoa* stomachs contained food, ranging between 0.5-254 ml with a mean fullness of 35.8 ml (s = 62.8). Table 1 shows the frequency distribution of food volume in the samples.

Table 2 details the types and quantities of food consumed by albacore. The percentage occurrence and percentage volume of the major food categories are shown in Figures 3 and 4, respectively.

Albacore from the Townsend Cromwell had fed almost exclusively on a single species of the family Carangidae, tentatively identified as the Peruvian jack mackerel *Trachurus murphyi*. The jack mackerel occurred in 93.8% of the sample and comprised 88.4% of the diet by volume. Over two hundred mackerel from 32 stomachs were measured to the nearest mm of fork length, as shown in Figure 5. The length range was 41-90 mm ($\bar{x}$ = 59.0 mm, s = 10.3 mm). Other fish species and fish remains comprised a further 10.7% of the volume, making teleosts the major component of the diet.

Squid and crustaceans made up only 0.9% of the volume. Hyperiid amphipods, particularly *Phrosina semilunata* and *Lanceola* sp., occurred in 15 stomachs but in small quantities.

Fish were also dominant in the diet of albacore sampled from the Chatham Rise area, occupying 91.8% of the volume. A single species of the family Myctophidae made up 63.8% but only occurred in four fish. The saury *Scomberesox saurus scombroides* was found in 11 stomachs but were relatively small (FL 76-122 mm) and comprised 4.7% by volume. The albacore feeding on saury had all been caught over the 200 m isobath to the west of Chatham Island whereas those consuming myctophids were caught in 1200 m of water. Other fish species and fish remains comprised a further 23.3% by volume.

Squid occurred in 41.9% of the sample but only comprised 3.1% of the volume. Crustaceans occupied 5.1% of the volume, dominated by euphausiids, although one fish had consumed 95% of the euphausiid volume, and crab megalopae.

The present data suggests that albacore are opportunistic feeders, with a preference for epipelagic and mesopelagic fishes. It would appear that crustaceans and squid are more important in the nearshore region as evidenced by the diet of larval stomatopods, crab megalopes and juvenile arrow squid (*Nototodarus s. sloani*) in a number of albacore. The absence of many of these groups in the offshore sample is assumed to be a reflection of decreasing abundance with distance from land. Bailey (1983) reported similar results for albacore taken by purse-seine over the continental shelf of New Zealand and in deeper water. Iversen (1962) and Nishimoto and Laurs (1974) noted large quantities of squid in the stomachs of offshore albacore. The virtual absence of squid in the *Townsend Cromwell* samples may be due to heavy feeding on concentrations of Peruvian jack mackerel along the northern boundary of the subtropical convergence zone rather than a reflection of squid abundance. Isaac-Kidd midwater trawls in this area by the *Townsend Cromwell* revealed between 0.8-2.3 squid per 1000 m^3 of water filtered but failed to show significant quantities of the mackerel (Laurs, Bliss and Wetherall, 1986).

The presence of the Peruvian jack mackerel requires further investigation. If it is seasonally abundant in the convergence zone or along the northern boundary it may prove useful in a pole and live bait fishery for albacore. In many cases, albacore landed on the *Townsend Cromwell* vomited fresh or live jack mackerel onto the deck. Argue and Kearney (1983), however, noted problems with *Trachurus* spp. as potential baitfish in the New Zealand region. Apart from a size problem that doesn't appear to be relevant here, they found that jack mackerel seldom schooled after chumming and often sounded, taking the target species with them.

The volume of food in the stomachs from the two regions appears to be different. This may be due in part to the wide range of volumes in the nearshore sample and the consistently high volumes of jack mackerel encountered in the offshore sample. In comparison Laurs and Nishimoto (1973) working in the North Pacific found that stomach fullness differed little between nearshore and offshore areas, averaging 15 and 16.3 ml, respectively.

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TABLE 1: Frequency distribution of food volume in albacore stomachs.

Volume of Food (ml)	K03/86 % Occurrence (n = 40)	TC8601 % Occurrence (n = 72)
0	22.5	9.7
<1.0	2.5	0.0
1.0- 4.9	20.0	9.7
5.0- 9.9	22.5	2.8
10.0-24.9	10.0	15.3
25.0-49.9	10.0	29.2
50.0-99.9	0.0	30.5
>100.0	12.5	2.8
	100.0	100.0

TABLE 2: The food of albacore sampled from the subtropical convergence east of New Zealand.

Food Item	Number	% No.	Occurrence	% Occ.	Volume (ml)	% Vol.
1. K03/86 (n = 31)						
Crustacea						
Stomatopoda	9	2.9	4	12.9	1.5	0.1
Hyperiidea	11	3.5	5	16.1	1.2	0.1
Euphausiacea	-	-	5	16.1	42.1	3.8
Natantia	2	0.6	2	6.4	1.1	0.1
Reptantia	171	54.3	8	25.8	12.7	1.0
Cephalopoda						
Decapoda	37	11.8	13	41.9	33.9	3.1
Teleostei						
Gonorynchidae	2	0.6	2	6.4	2.0	0.2
Myctophidae	54	17.1	3	9.7	454.0	40.9
(and remains)	-	-	1	3.2	254.0	22.9
Hemirhamphidae	1	0.3	1	3.2	22.0	2.0
Scomberesocidae	22	7.0	11	35.5	52.0	4.7
others	6	1.9	2	6.4	2.0	0.2
Unidentified remains	-	-	12	38.7	231.7	20.9
Totals:	315	100.0	(31)		1110.2	100.0

Food Item	Number	% No.	Occurrence	% Occ.	Volume (ml)	% Vol.
2. TC8601 (n = 65)						
Crustacea						
Hyperiidea	32	3.4	15	23.1	15.0	0.6
Euphausiacea	4	0.4	1	1.5	0.6	+
Cephalopoda						
Decapoda	20	2.2	3	4.6	9.2	0.3
Teleostei						
Carangidae	863	92.3	52	80.0	2027.0	75.9
(and remains)	-	-	9	13.8	333.0	12.5
Others	16	1.7	6	9.2	194.0	7.3
Unidentified remains	-	-	4	6.2	91.0	3.4
Totals:	935	100.0	(65)		2669.8	100.0

(+ = <0.1)

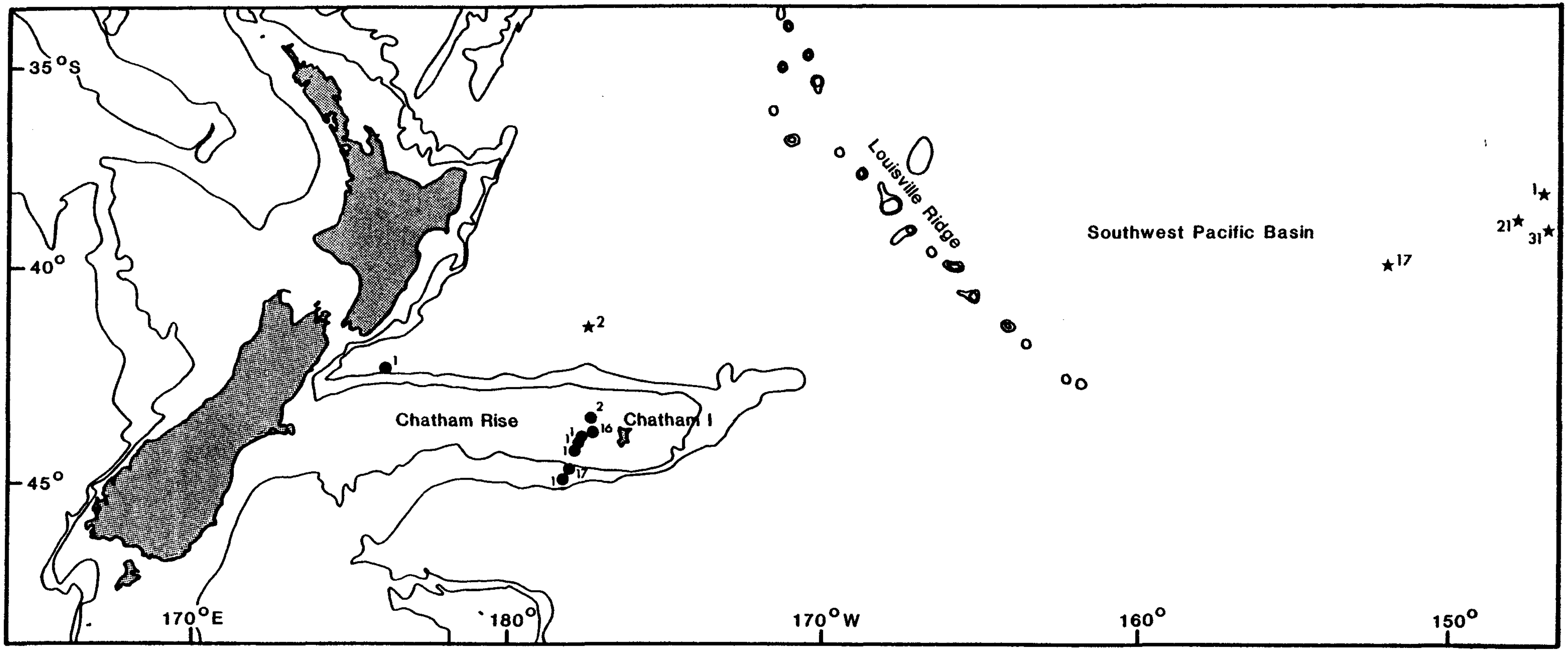


Figure 1: Capture positions and numbers of albacore from the Kaharoa (●) and Townsend Cromwell (★).
(Depth contours are 1000 and 2000m)

Figure 2: Length frequencies of albacore sampled for stomach contents.

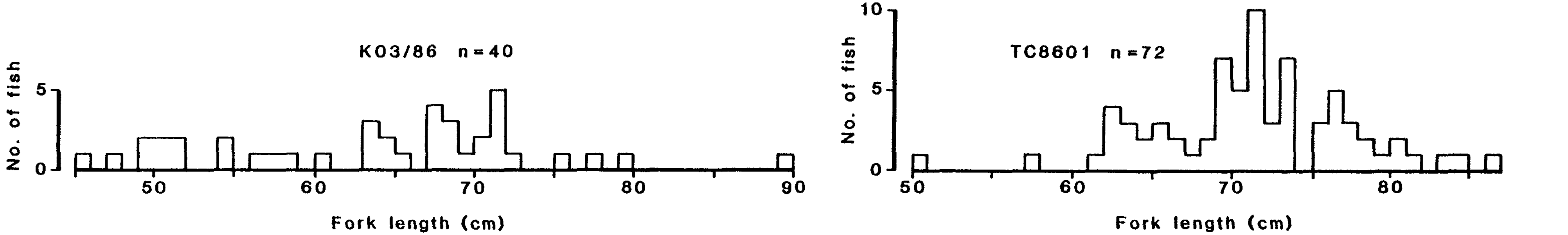


Figure 3: Percentage occurrence of the major food categories found in albacore stomachs.

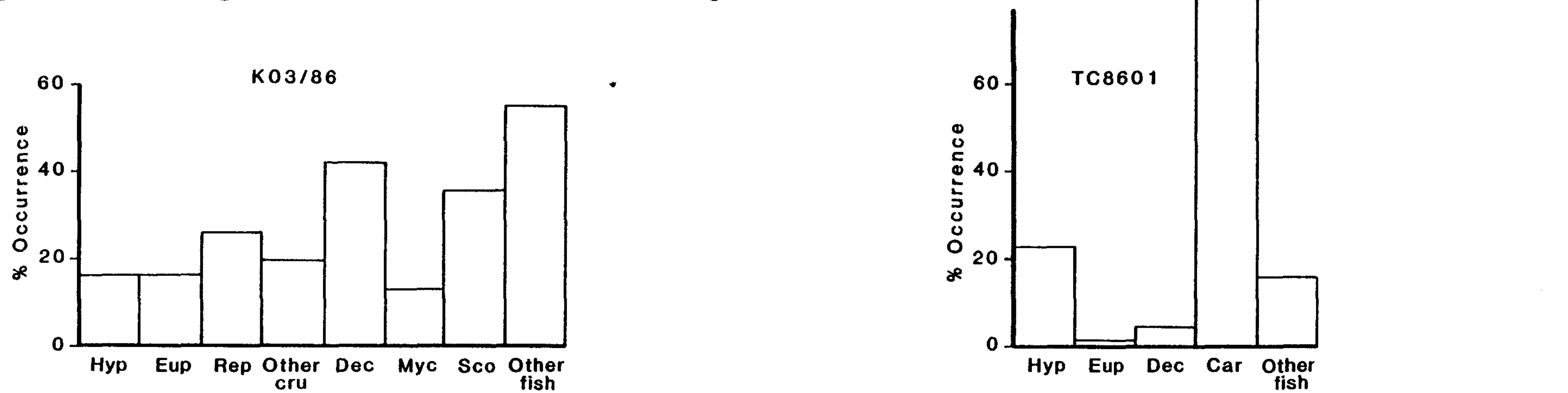
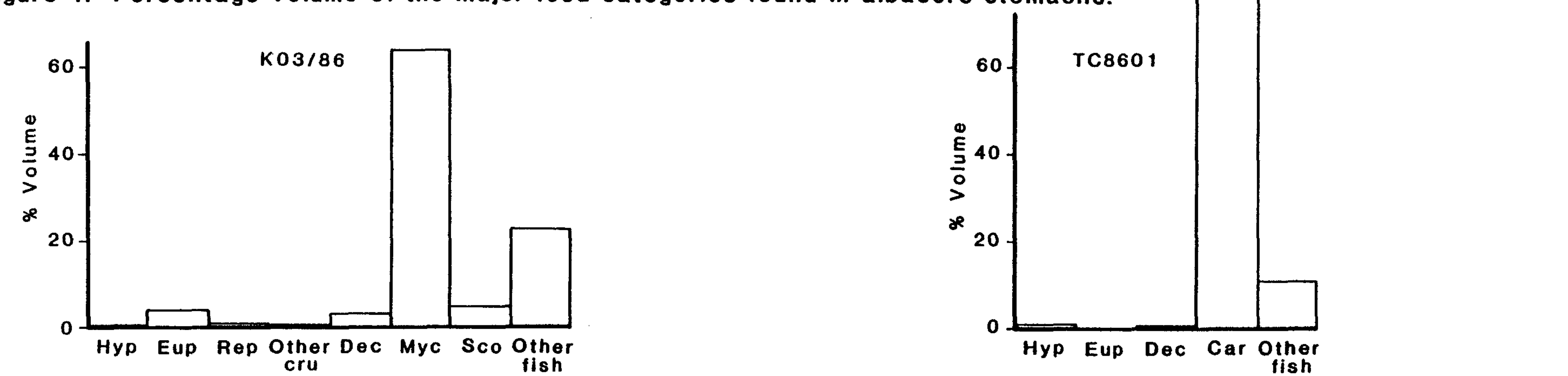


Figure 4: Percentage volume of the major food categories found in albacore stomachs.



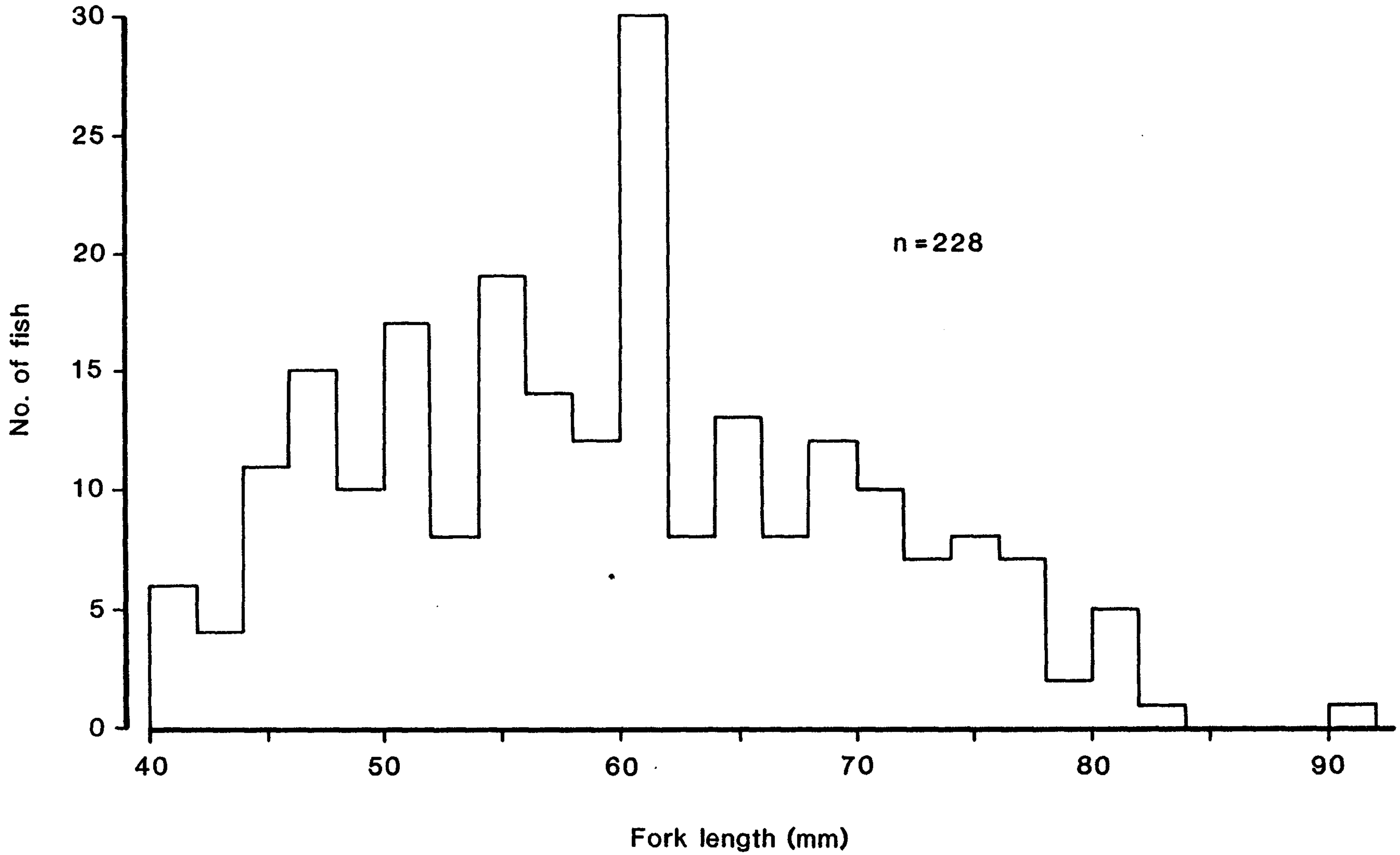


Figure 5: Length frequency of jack mackerel found in albacore stomachs.