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SOUTH PACIFIC COMMISSION

TWELFTH REGIONAL TECHNICAL MEETING ON FISHERIES
(Noumea, New Caledonia, 17-21 November 1980)

A FOLIO OF LENGTH FREQUENCY AND FEMALE MATURITY STAGE DISTRIBUTIONS
FOR TUNA CAUGHT BY THE SKIPJACK PROGRAMME POLE-AND-LINE VESSEL

(Paper Prepared by the Skipjack Programme)

1.0 INTRODUCTION

Measurement of size and maturity for tunas caught by pole-and-line gear gives some insight into movement patterns, recruitment patterns and spawner distribution, which in turn are important to the understanding of population structure. Such data were collected by the Skipjack Survey and Assessment Programme, for subsamples of fish caught but not tagged by the Programme's survey vessel, the Hatsutori Maru.

This background document to the Twelfth South Pacific Commission Regional Technical Meeting on Fisheries presents length frequency distributions for skipjack, yellowfin, bigeye and albacore, maturity stage frequency distributions for female skipjack, and sex ratios for skipjack for samples from each country that was surveyed between October 1977 and August 1980. Length and maturity frequency distributions for each survey visit to each country are presented in the order shown in Table 1. For some countries, data are further subdivided geographically.

2.0 LENGTH FREQUENCY DISTRIBUTIONS

The Programme's primary biological objective is assessment of migration and stock structure for skipjack in the western and central Pacific Ocean through tagging (Anon, 1975), thus most fish captured were tagged and released. However, from many schools there were at least five tuna that were unsuitable for tagging for a variety of reasons, e.g. hook injuries, out of water too long, etc. A maximum of 50 of these fish per school per species were measured for fork length (tip of nose to fork in the tail) after fishing on the school had ended. Measurements were made to the nearest millimetre, using a measuring board containing a 120mm graduated steel rule.

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Each length frequency graph presents numbers of fish measured on the vertical axis and "fork length of fish" (in cm) on the horizontal axis. Each graph represents all fish sampled for length within the waters of a particular country or area within a country. Separate graphs are presented for each country visited by the Programme's vessel. Total numbers of fish measured (N) and survey period are indicated at the top of each graph. For bigeye and albacore, sufficient samples for graphing were only available from French Polynesia (bigeye), and Australia and New Zealand (albacore).

When examining these data it should be borne in mind that size frequency of the catch may not be representative of size frequency of the total population, since factors such as size related vulnerability to the fishing gear may bias the catch sample. As well, there are many cases where the numbers (and distribution) of samples are too small to permit generalizations.

3.0 MATURITY FREQUENCY DISTRIBUTIONS

After fishing each school, a maximum of 20 skipjack which were unsuitable for tagging were sampled for sex and maturity. We assigned one of seven stages of sexual maturity to each female skipjack gonad examined, based on criteria briefly described below (adapted from various sources in the literature, e.g. Marr, 1948; Schaefer and Orange, 1956; Raju, 1964).

<u>FEMALE GONAD STAGE</u>	<u>DESCRIPTION</u>
1 Immature	Ovary small and slender. Cross-section round.
2 Early maturing	Enlarged, pale yellow ovaries. Ova not visible.
3 Late maturing	Enlarged, turgid, orange yellow ovaries. Ova opaque.
4 Mature	Enlarged, richly vascular, orange ovaries, losing turgidity. Ova translucent.
5 Ripe	Greatly enlarged ovaries, not turgid. Ova easily dislodged and extruded by pressure.
6 Spent	Flaccid, vascular ovaries. Most ova gone. Often dark orange-red coloration.
7 Recovering	Vascular ovaries. Next batch of ova developing.

Most gonads of less than one gram in weight could not be sexed and thus were termed "sex indeterminate". Gonads from female yellowfin were invariably classified as "sex indeterminate" or stage 1, since the vast majority of the yellowfin catch were small fish (< 70cm). Maturity graphs for yellowfin have not been included.

Graphs of total numbers of skipjack (vertical axis) with gonads of a particular maturity stage (horizontal axis) are presented to the left of the appropriate skipjack length frequency graph for each country and time period. Total numbers of females sampled (N) and survey period are indicated at the top of each graph. Table 2 presents the percentages of females, males and fish with indeterminate sex for skipjack biological samples from each country.

As was the case with the size frequency data, factors such as gear selectivity may render catch samples less than fully representative of the total population.

4.0 REFERENCES

ANON (1975). A proposal for a skipjack survey and assessment programme in the central and western Pacific Ocean. South Pacific Commission, Noumea, New Caledonia. 10 pp.

MARR, J.C. (1948). Observations on the spawning of oceanic skipjack (Katsuwonus pelamis) and yellowfin tuna (Neothunnus macropterus) in the northern Marshall Islands. U.S. Fish. Wildl. Serv., Fish. Bull. 51:201-206.

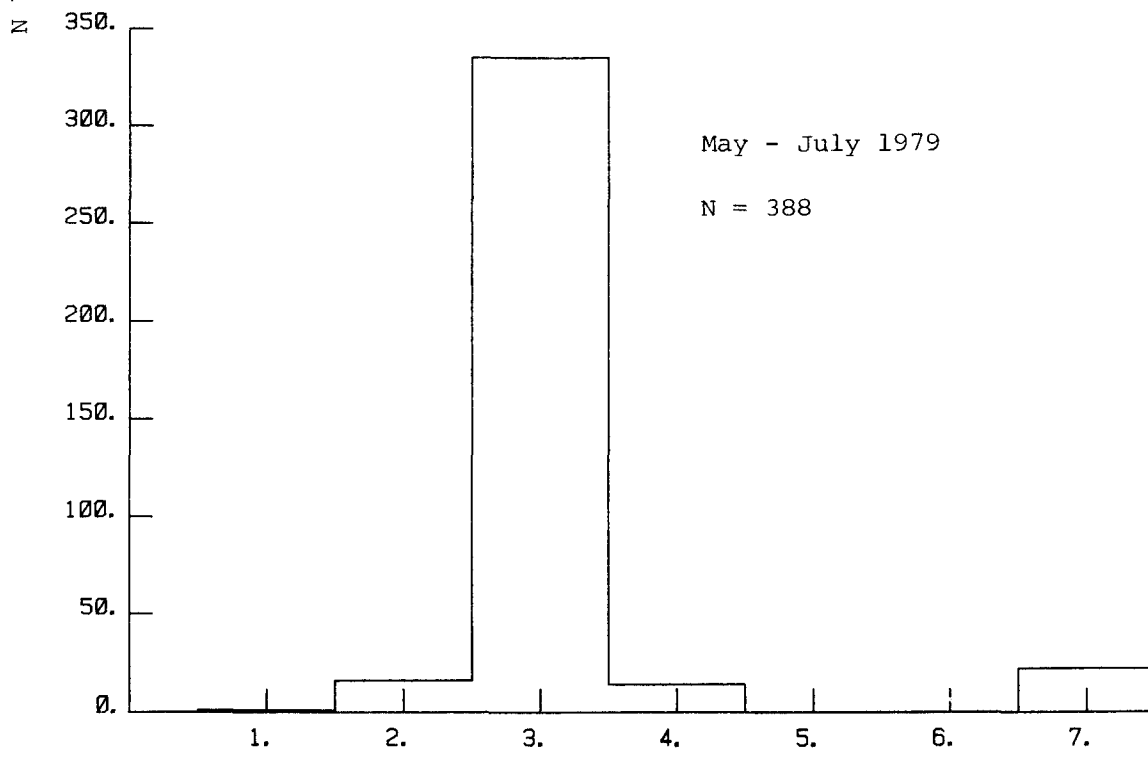
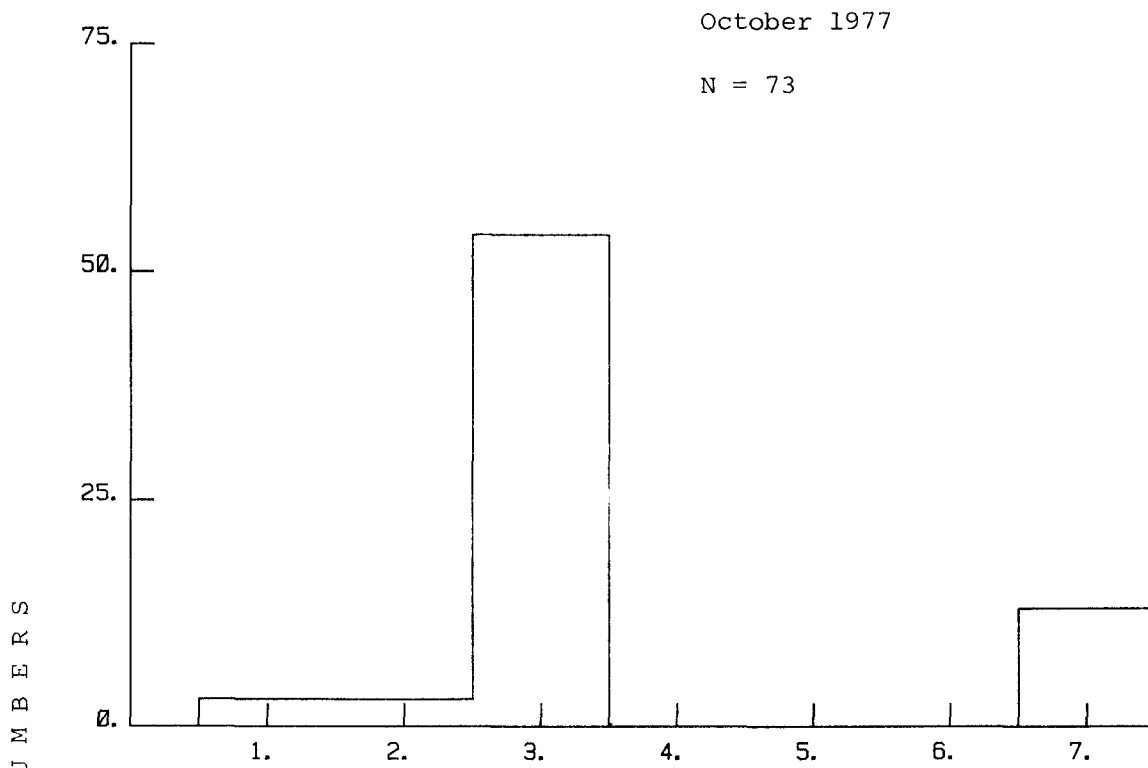
RAJU, G. (1964). Fecundity of the oceanic skipjack Katsuwonus pelamis (Linnaeus) of Minicoy. Proc. Symp. Scrombroid Fishes, Part 2. Mar. Biol. Assoc. India, Symp. Ser. 1:725-732.

SCHAEFER, M.B. and C.J. ORANGE (1956). Studies on sexual development and spawning of yellowfin tuna (Neothunnus macropterus) and skipjack (Katsuwonus pelamis) in three areas of the eastern Pacific Ocean, by examination of gonads. Inter-Am. Trop. Tuna Comm. Bull. 1:283-349.

TABLE 1 - ORDER OF COUNTRY/AREA DATA

<u>Country/Area</u>	<u>Survey Period</u>	<u>Page number</u>
Papua New Guinea	October 1977	2 - 5
Papua New Guinea	May - July 1979	2 - 5
Solomon Islands	November - December 1977	6 - 9
Solomon Islands	May - June 1980	6 - 9
Vanuatu	December 1977 - January 1978	10 - 11
New Caledonia	December 1977 - January 1978	12 - 13
Fiji	January - April 1978	14 - 17
Fiji	April 1980	14 - 17
Tonga	April - May 1978	18 - 19
Tonga	March 1980	18 - 19
Wallis and Futuna Islands	May 1978	20 - 23
Wallis and Futuna Islands	May 1980	20 - 23
American Samoa	May - June 1978	24 - 25
American Samoa	February 1980	24 - 25
Western Samoa	June 1978	26 - 29
Western Samoa	February 1980	26 - 29
Tuvalu	June - July 1978	30 - 33
Tuvalu	June - July 1980	30 - 31
Kiribati	July 1978	34 - 37
Kiribati	November 1979	34 - 37
Kiribati - Phoenix Islands	December 1979	38 - 39
Marshall Islands	November 1978	40 - 43
Marshall Islands	November 1979	40 - 43
Federated States of Micronesia -		
Kosrae	July, August, November 1978	44 - 47
Kosrae	November 1979	44 - 47
Ponape	July, October, November 1978	48 - 51
Ponape	November 1979	48 - 51
Ponape	July 1980	48 - 51
Truk	August 1978	52 - 53
Truk	November 1979	52 - 53
Commonwealth of the N. Mariana Islands	July, October 1978	54 - 55
Commonwealth of the N. Mariana Islands	November 1979	54 - 55
Federated States of Micronesia -		
Yap	October 1978	56 - 57
Republic of Palau	October 1978	58 - 59
Republic of Palau	August 1980	58 - 61
Japan - Bonin Island	October 1978	62 - 63
Tokelau	November 1978	64 - 65
Cook Islands	November, December 1978	66 - 69
Cook Islands	December 1979	66 - 67
French Polynesia -		
Society Islands	December 1978, January, February 1979	70 - 73
Society Islands	February 1980	73
Tuamotu Archipelago	December 1978 - January 1979	74 - 77
Tuamotu Archipelago	February 1980	74 - 77
Marquesas Islands	January 1979	78 - 81
Marquesas Islands	December 1979 - January 1980	78 - 81
Gambier Islands	February 1980	82 - 83, 87
Pitcairn Islands	February 1980	84 - 85, 87
New Zealand	February - March 1979	88 - 89, 95
New Zealand	March 1980	88 - 89
Australia -		
New South Wales	April 1979	90 - 91, 95
Queensland	April - May 1979	90 - 93
Niue	February - March 1980	96 - 97
Norfolk Island	March 1980	98 - 99
Nauru	July 1980	100 - 101

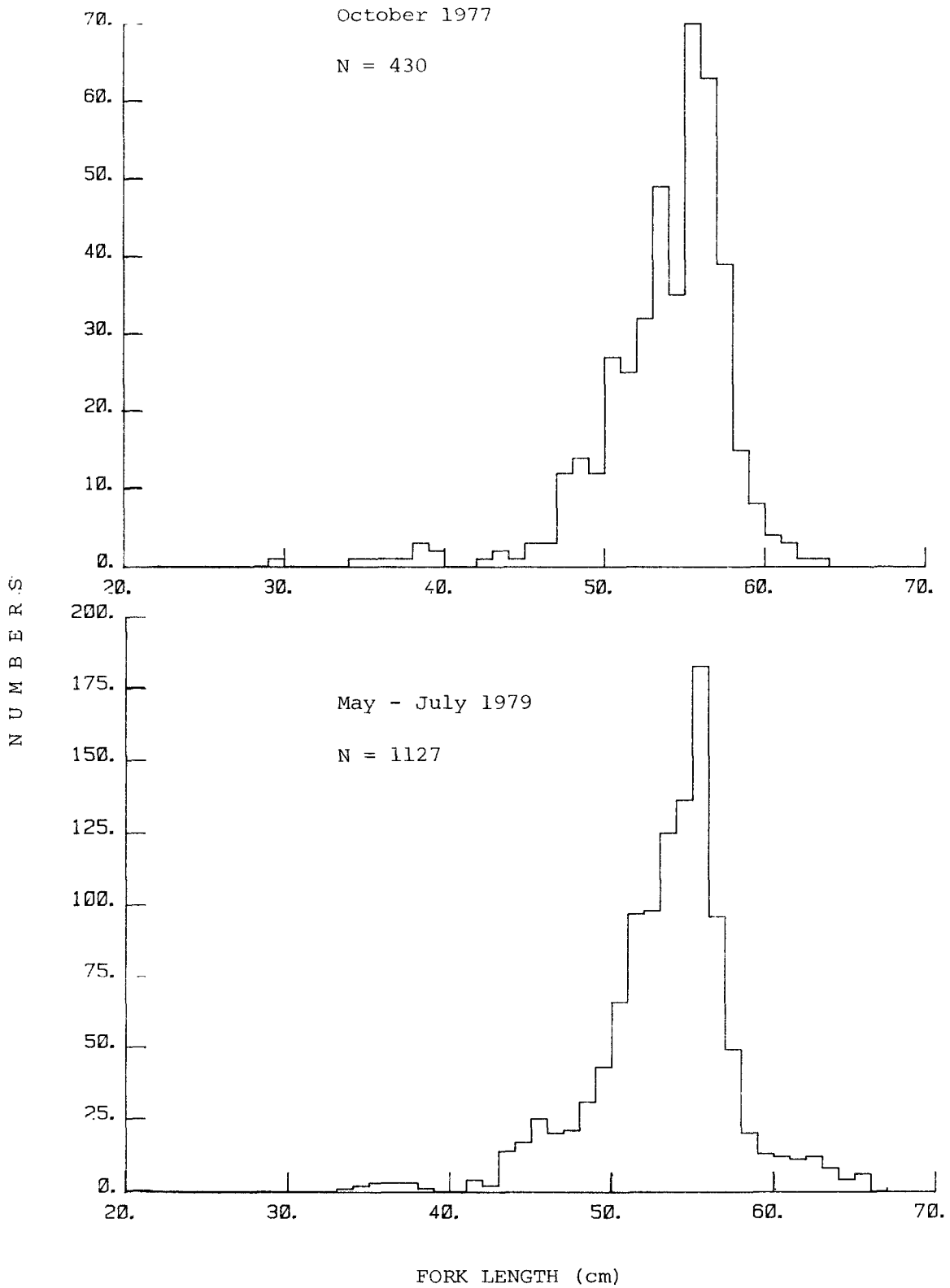
PAPUA NEW GUINEA



FEMALE SKIPJACK GONAD MATURITY STAGE

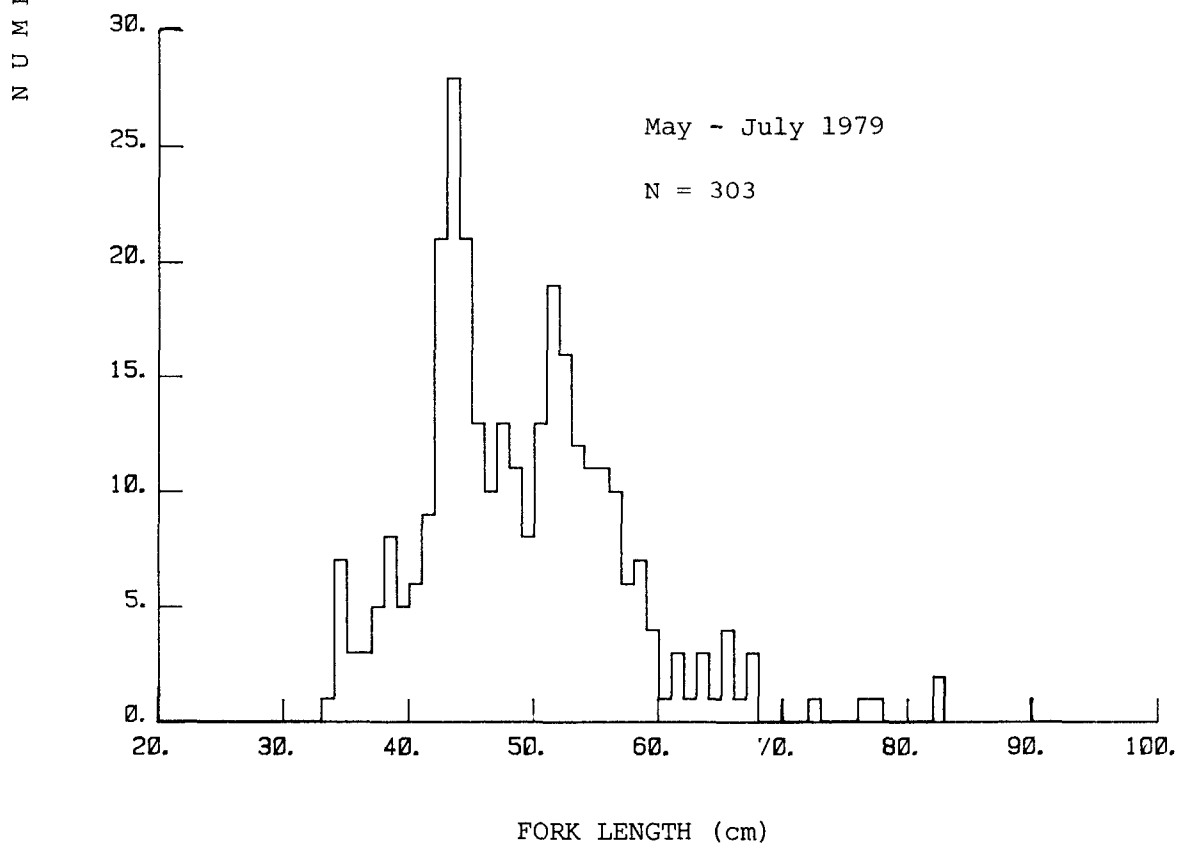
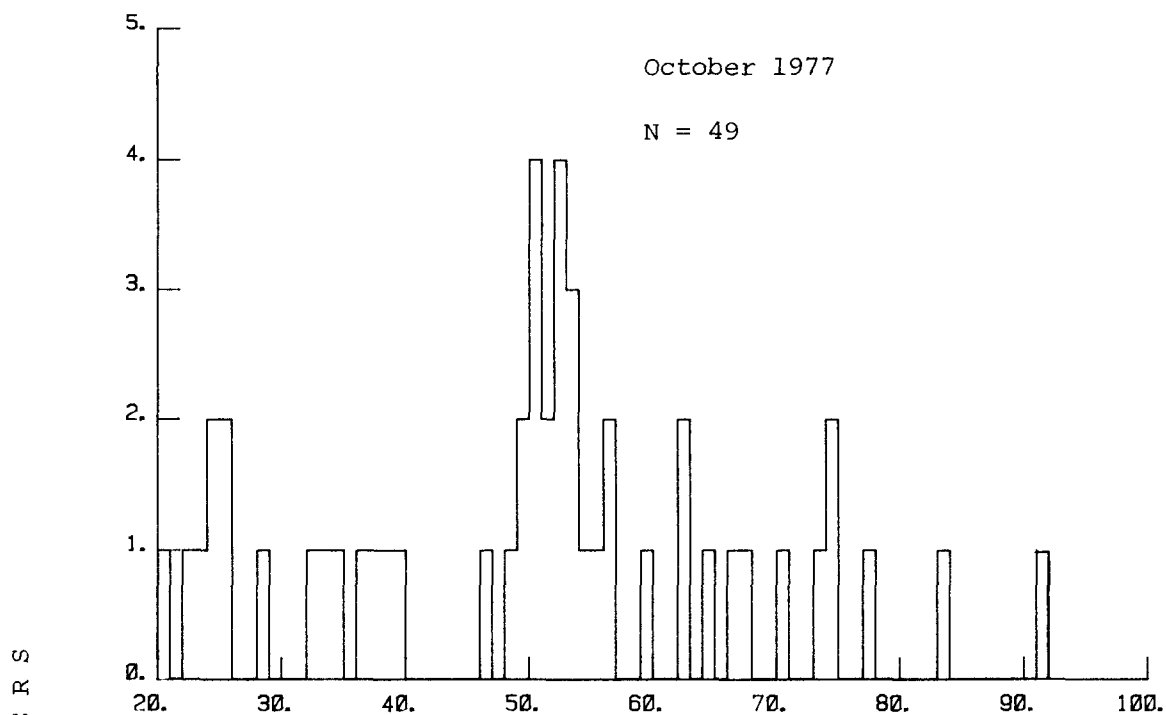
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SKIPJACK

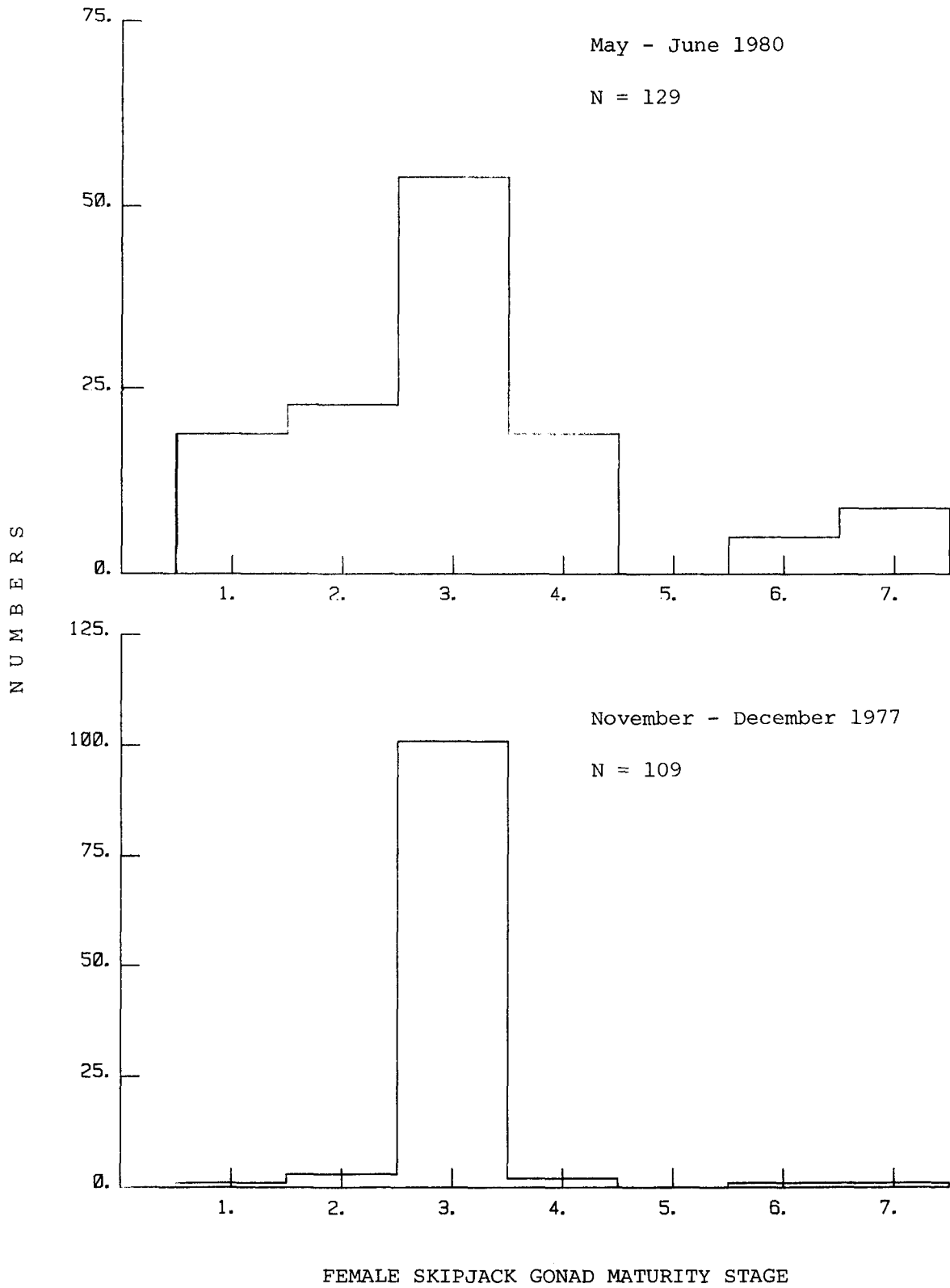


PAPUA NEW GUINEA

YELLOWFIN

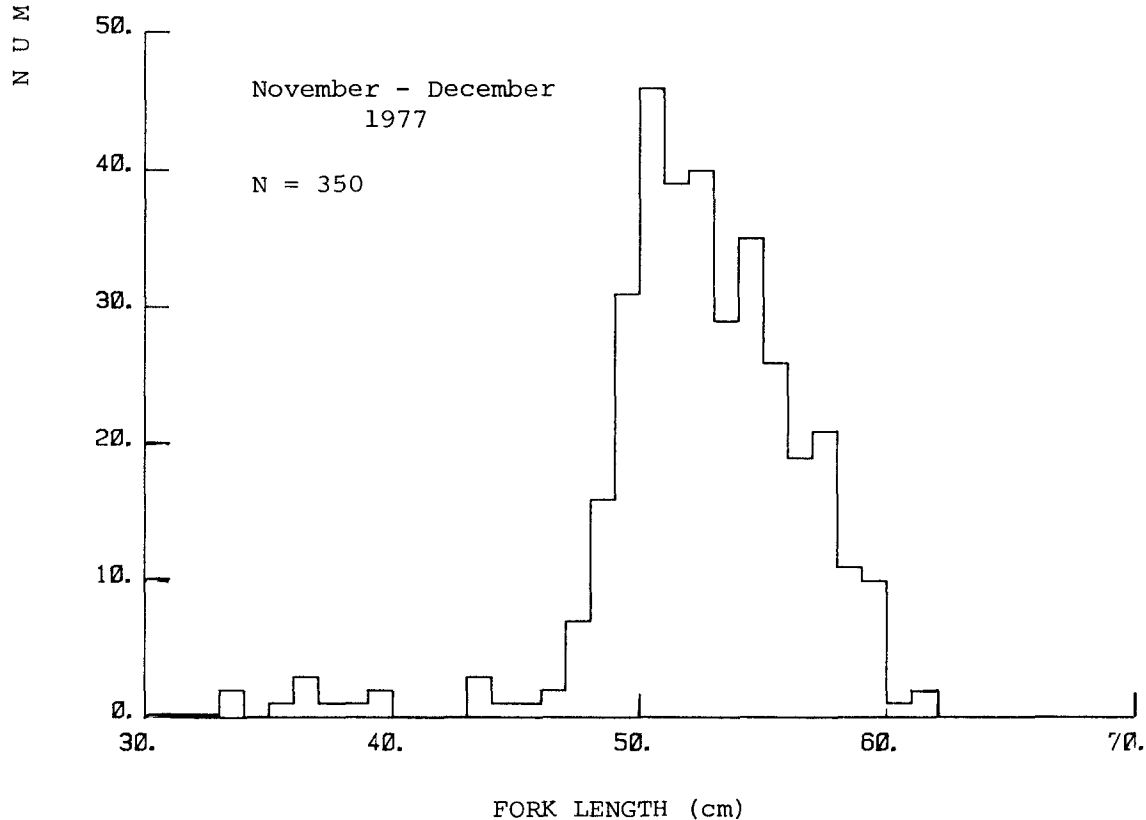
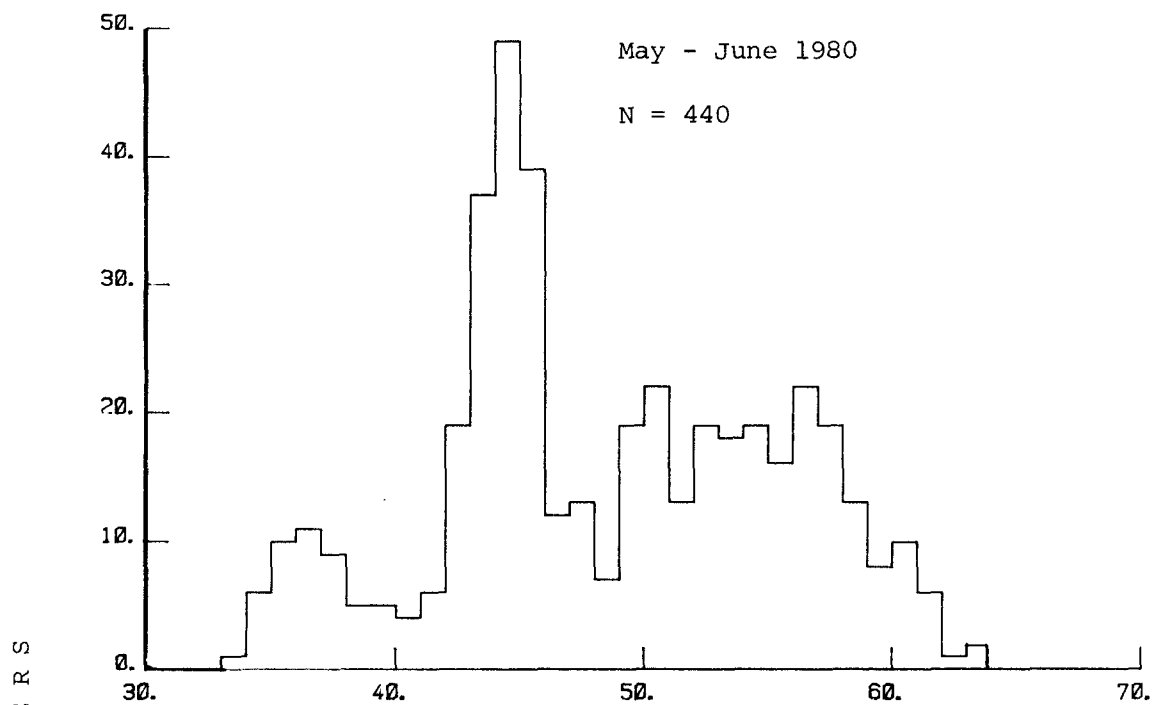


SOLOMON ISLANDS



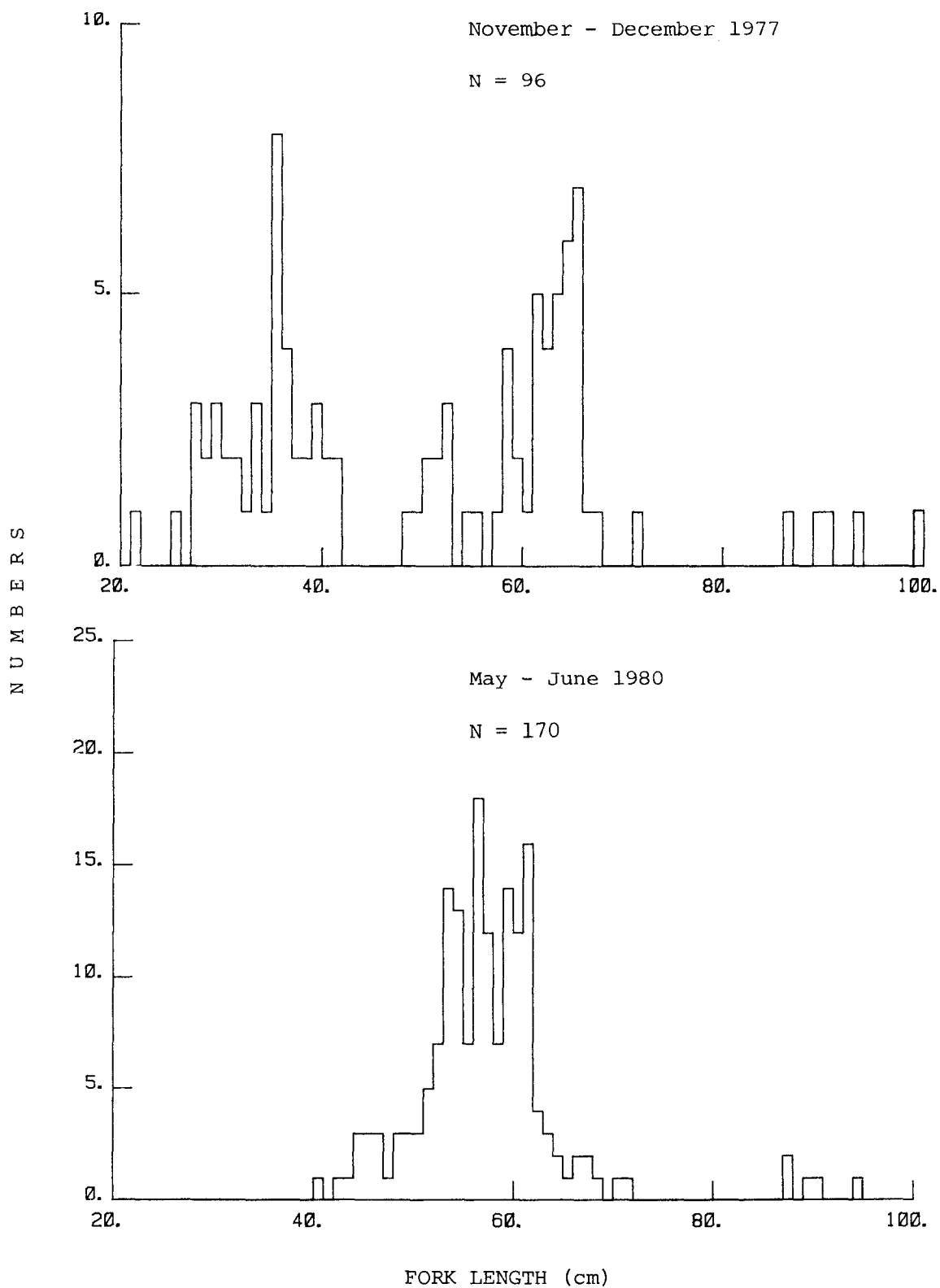
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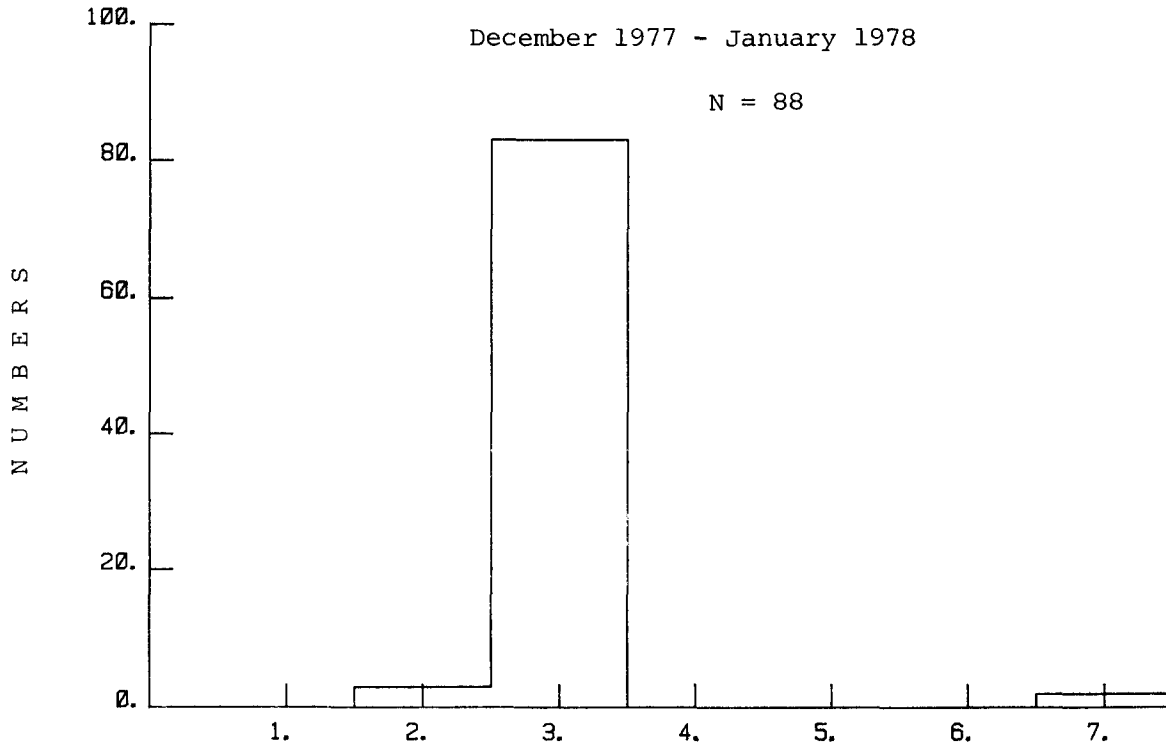


SOLOMON ISLANDS

YELLOWFIN



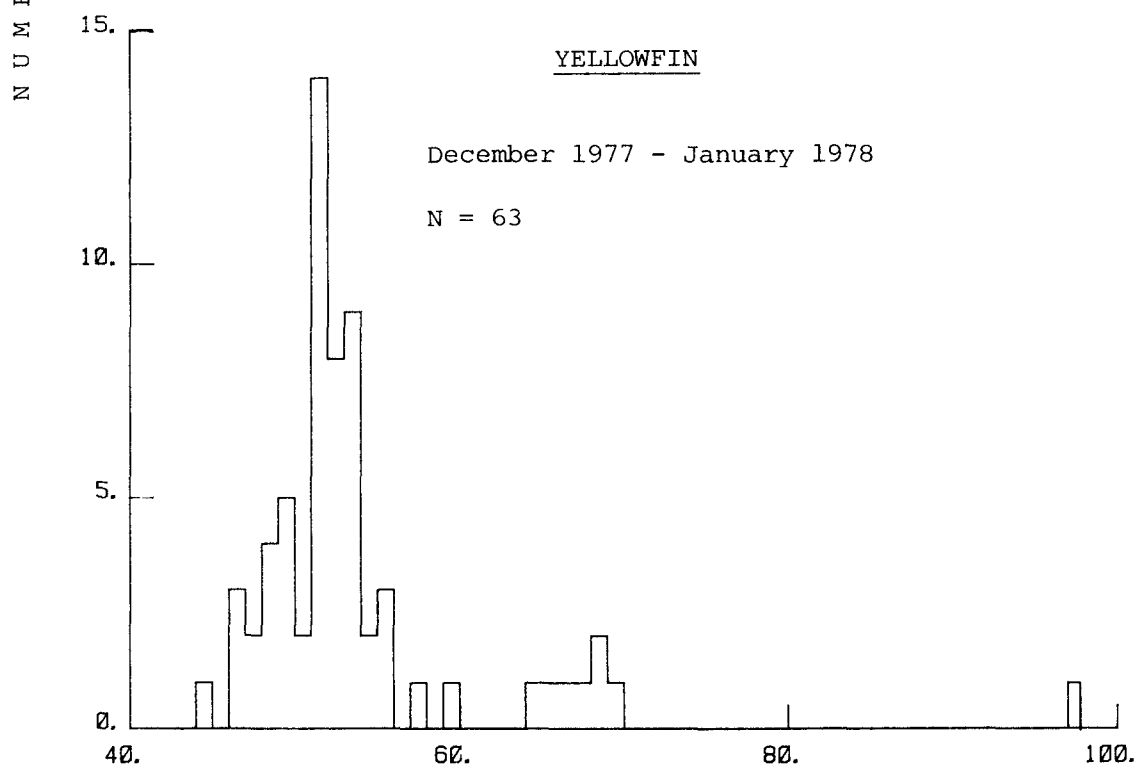
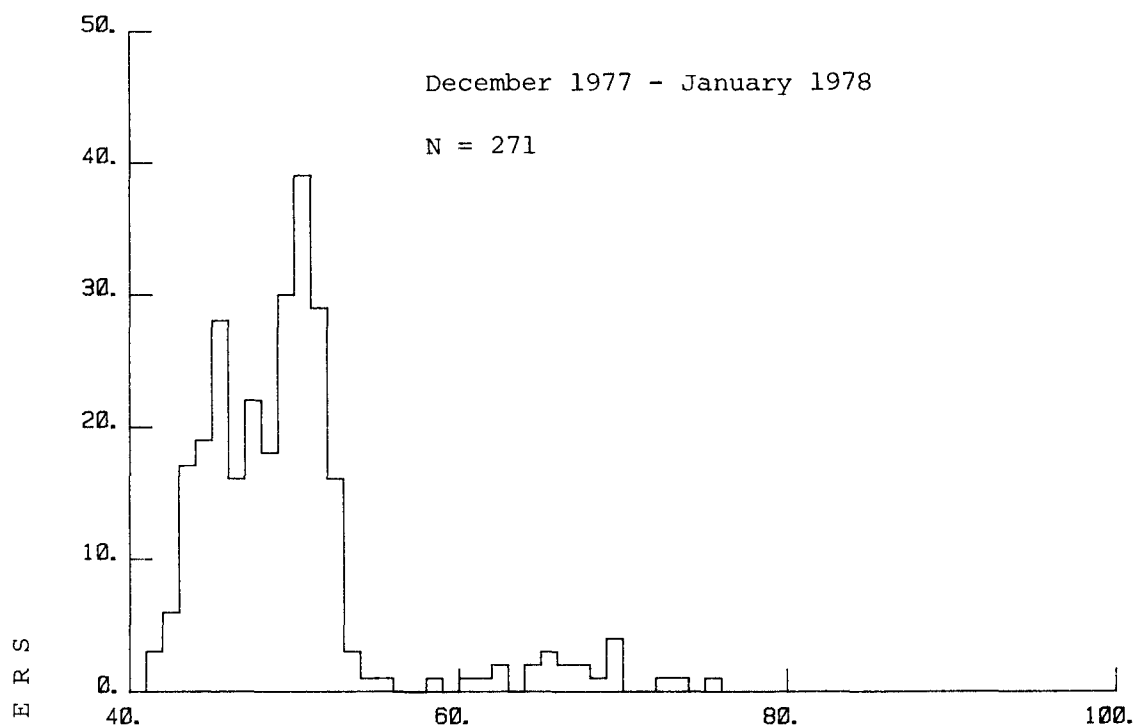
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FEMALE SKIPJACK GONAD MATURITY STAGE

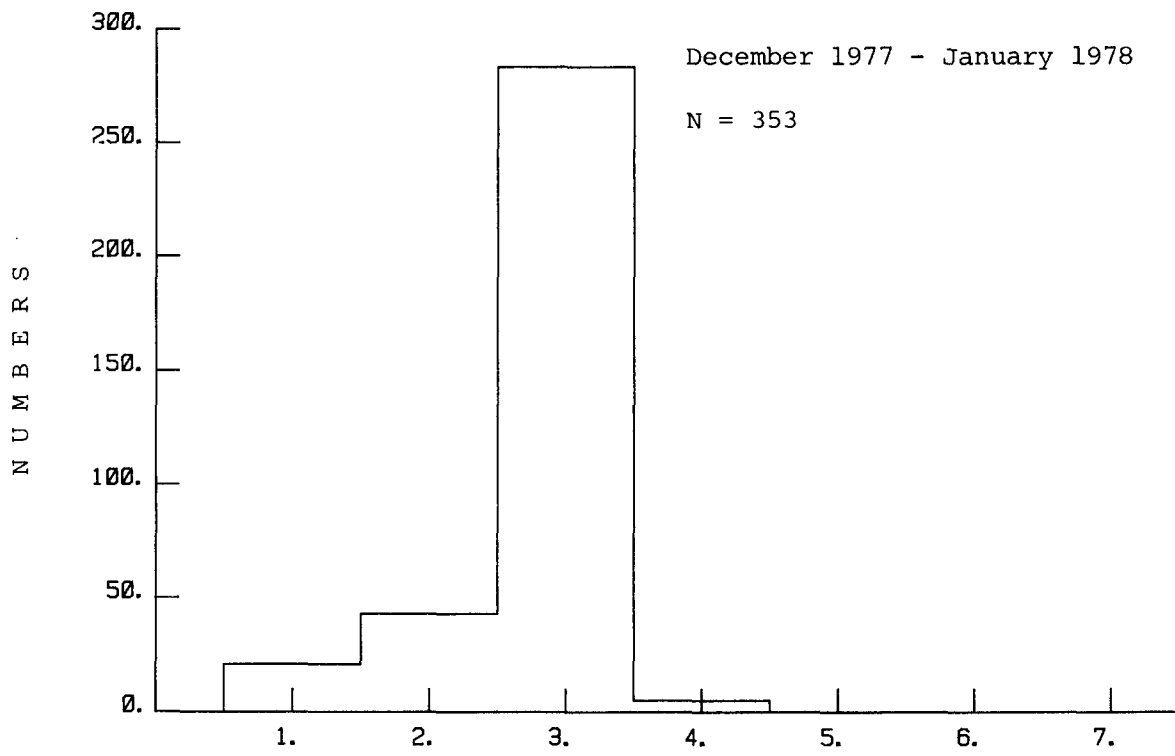
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SKIPJACK



FORK LENGTH (cm)

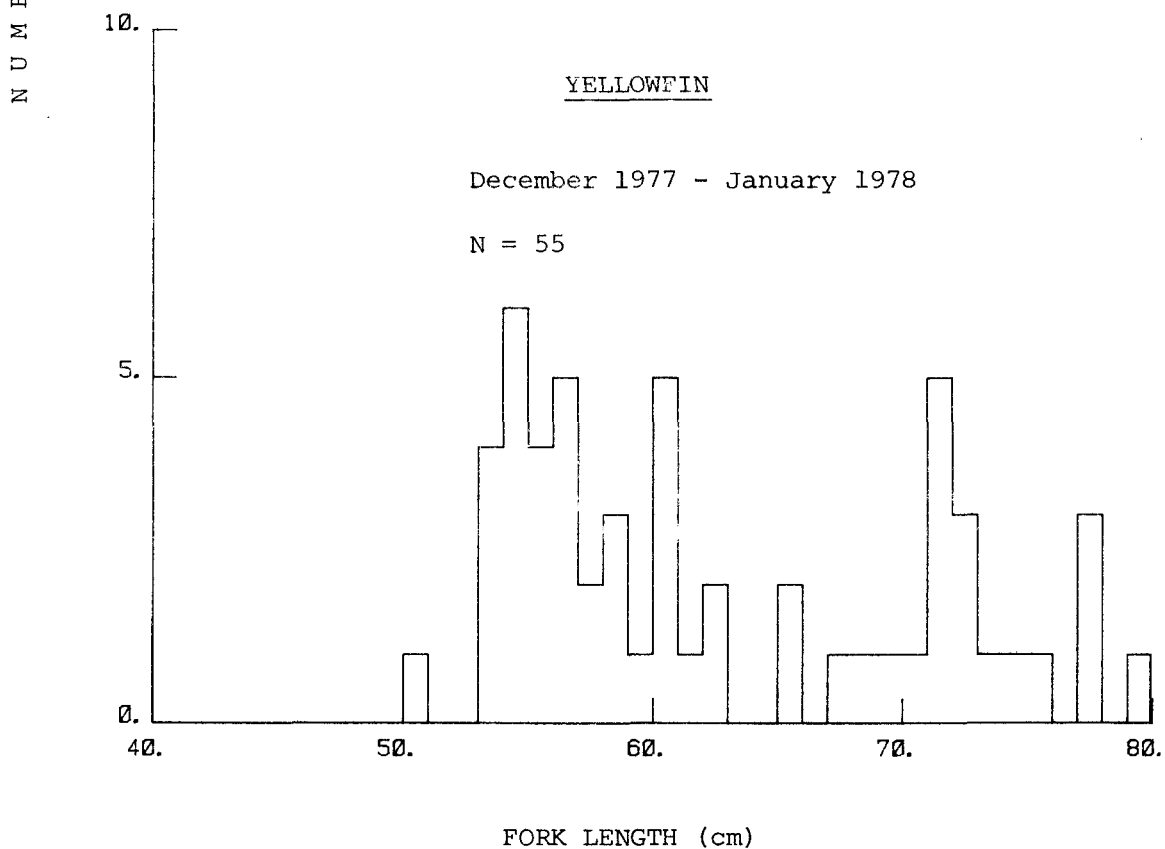
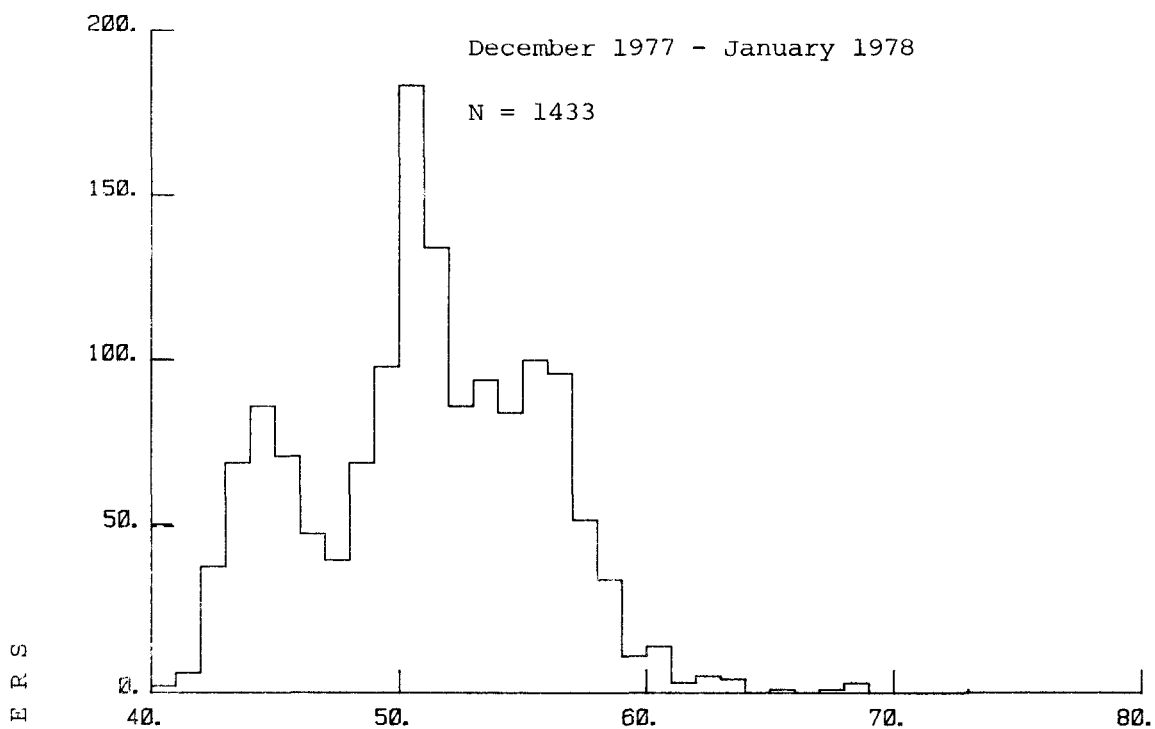
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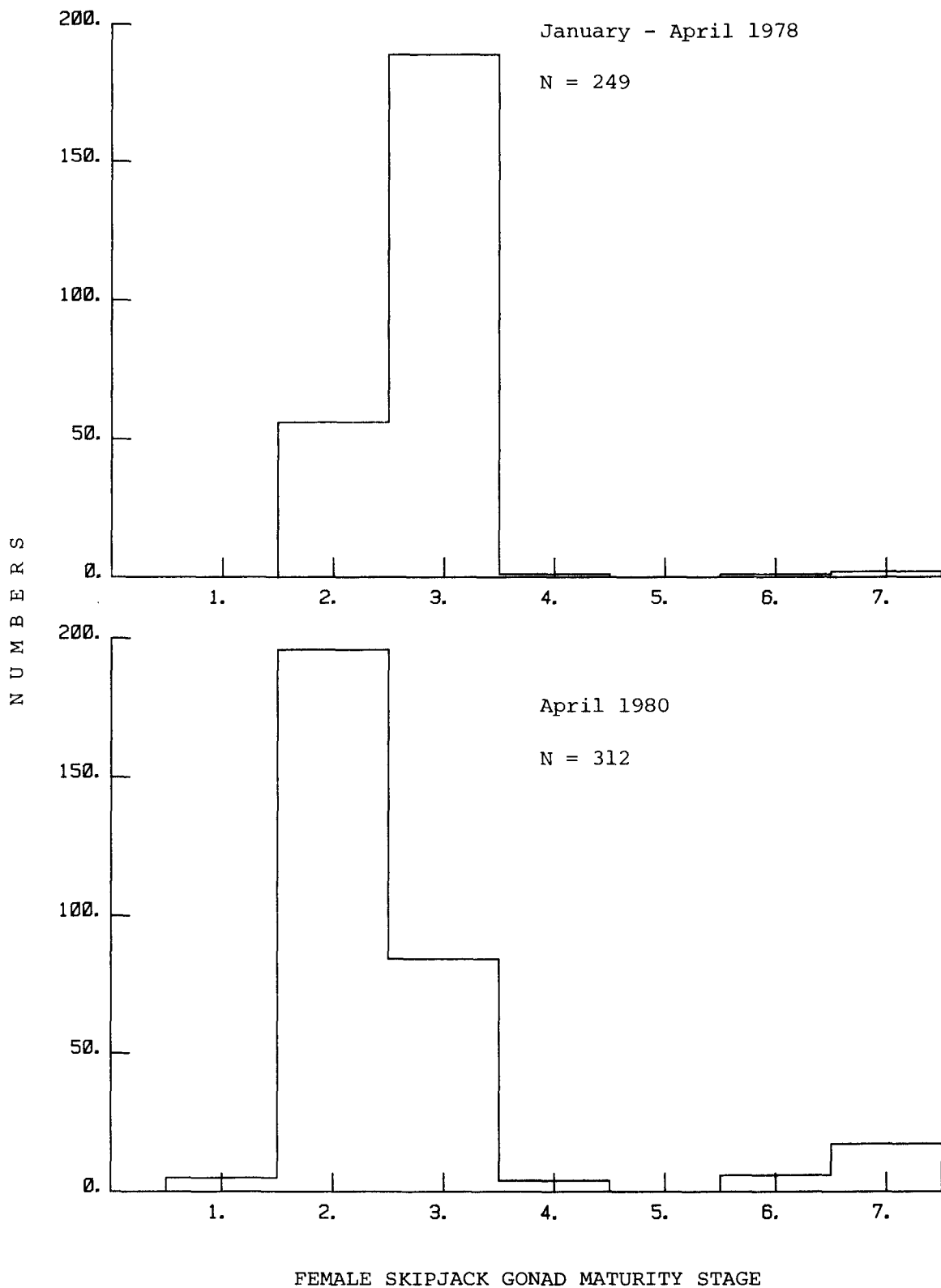
FEMALE SKIPJACK GONAD MATURITY STAGE

NEW CALEDONIA

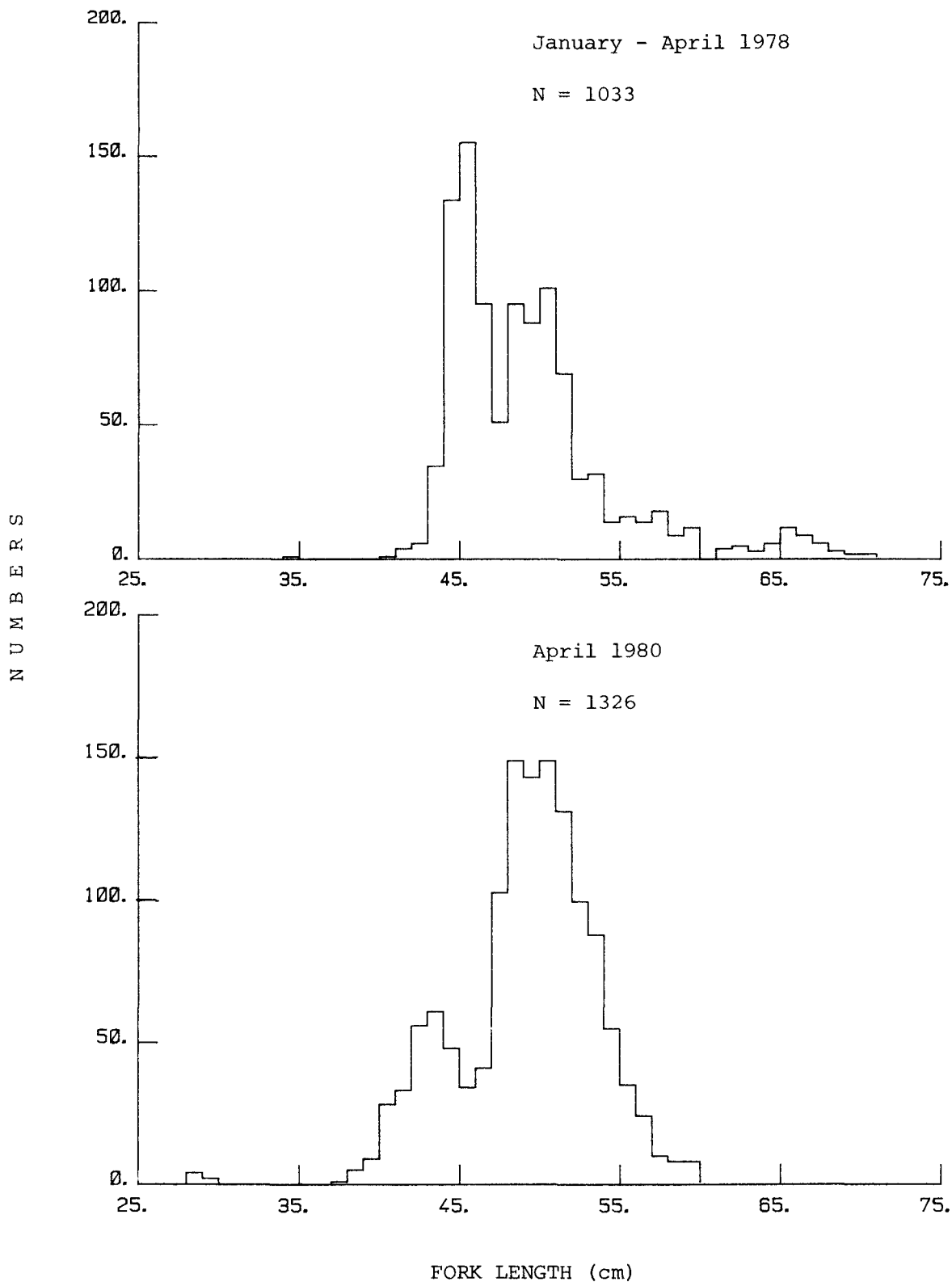
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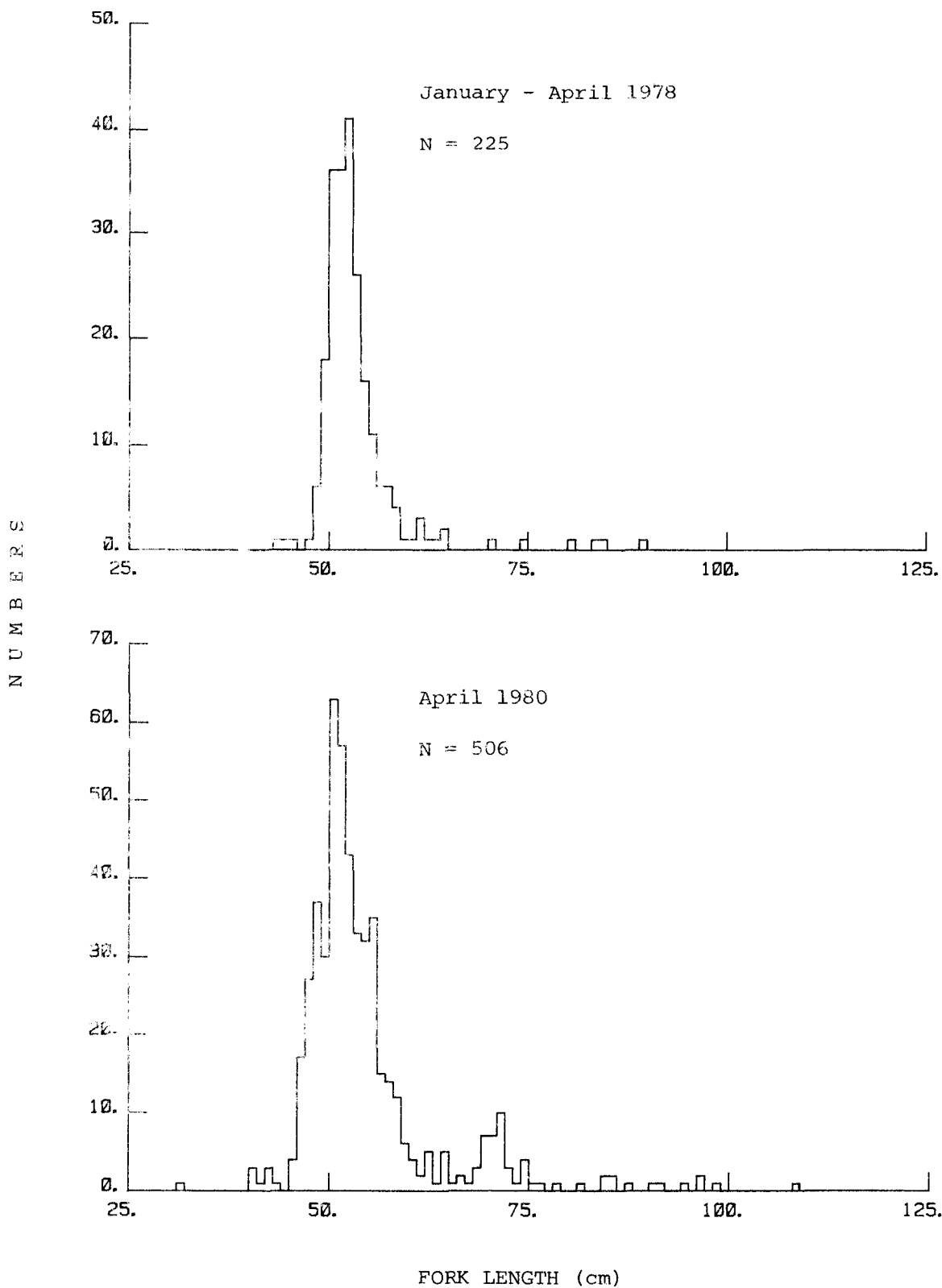
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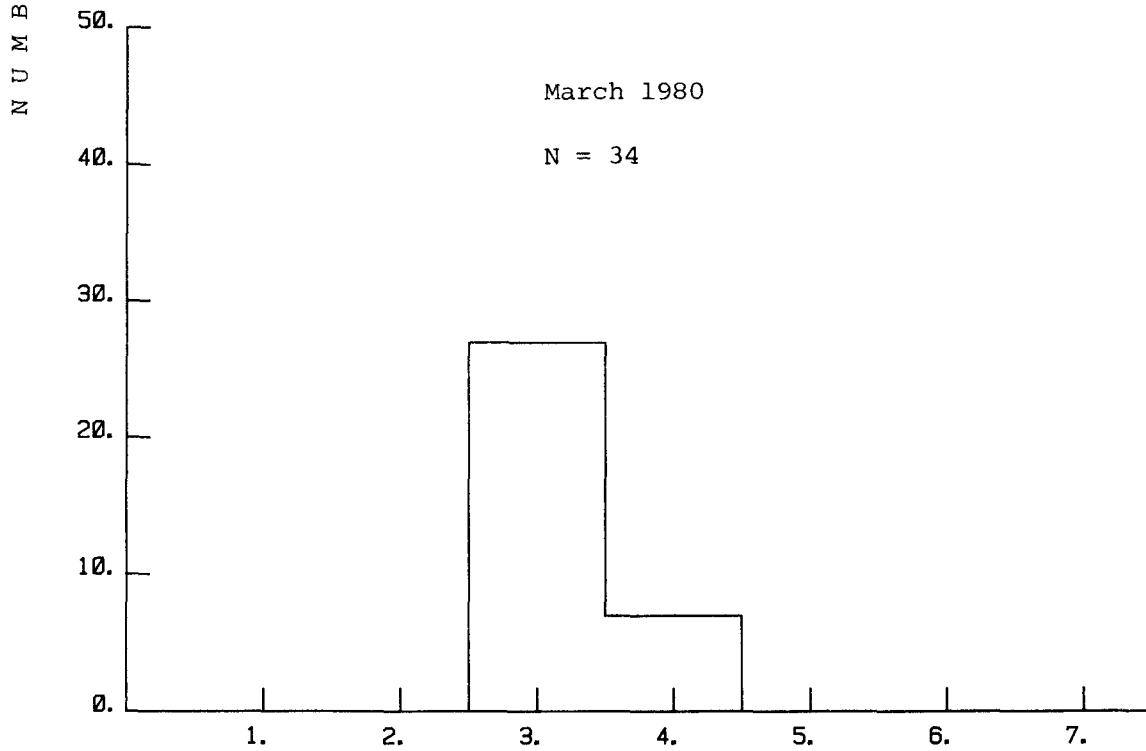
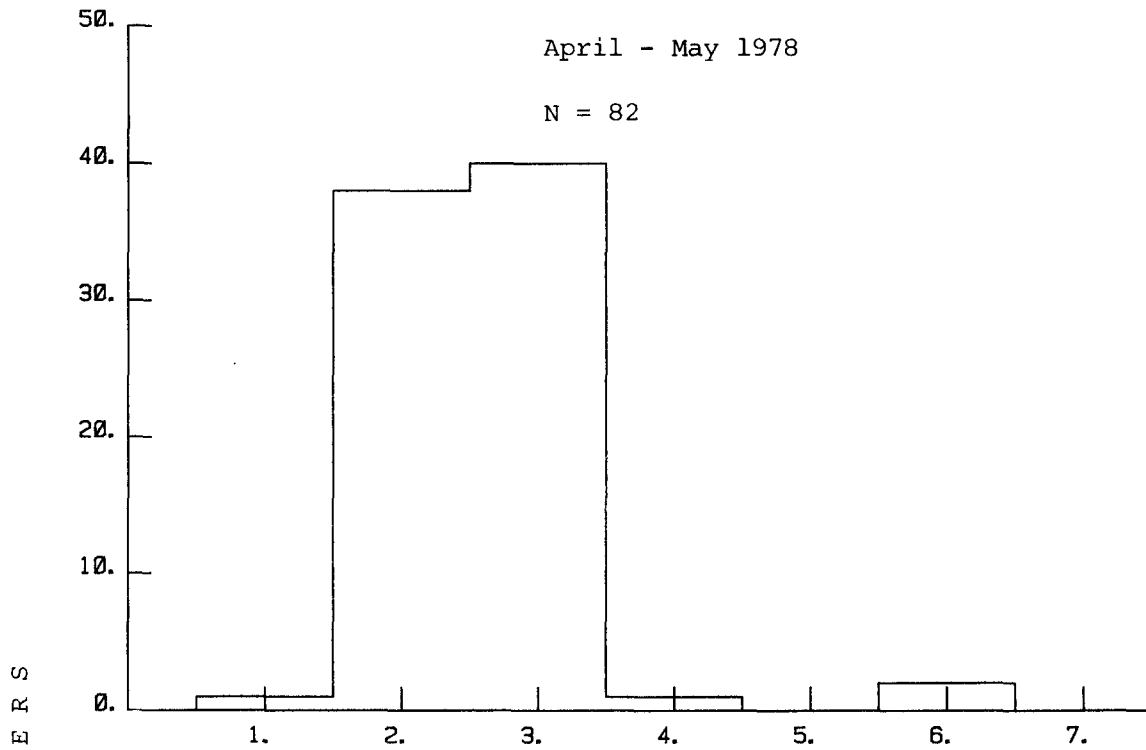
FIJI
SKIPJACK



FIJI
YELLOWFIN

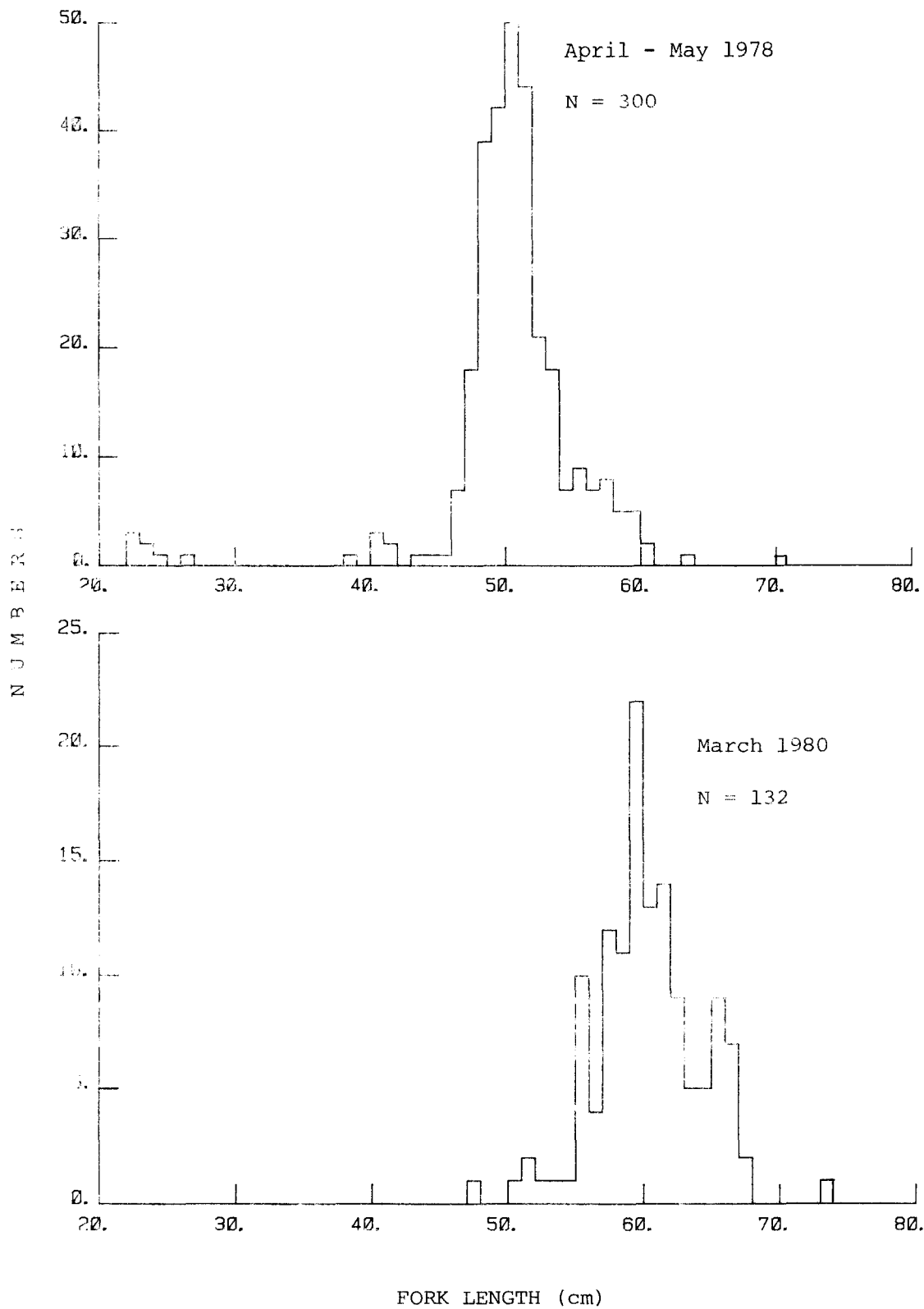


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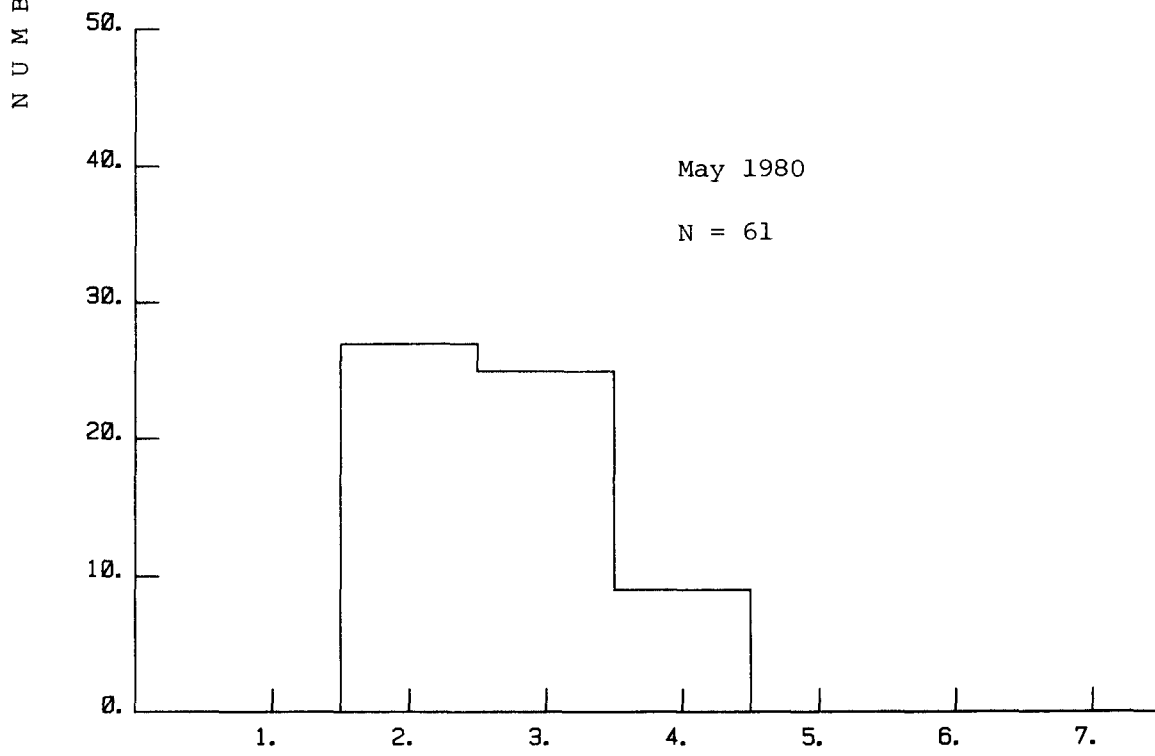
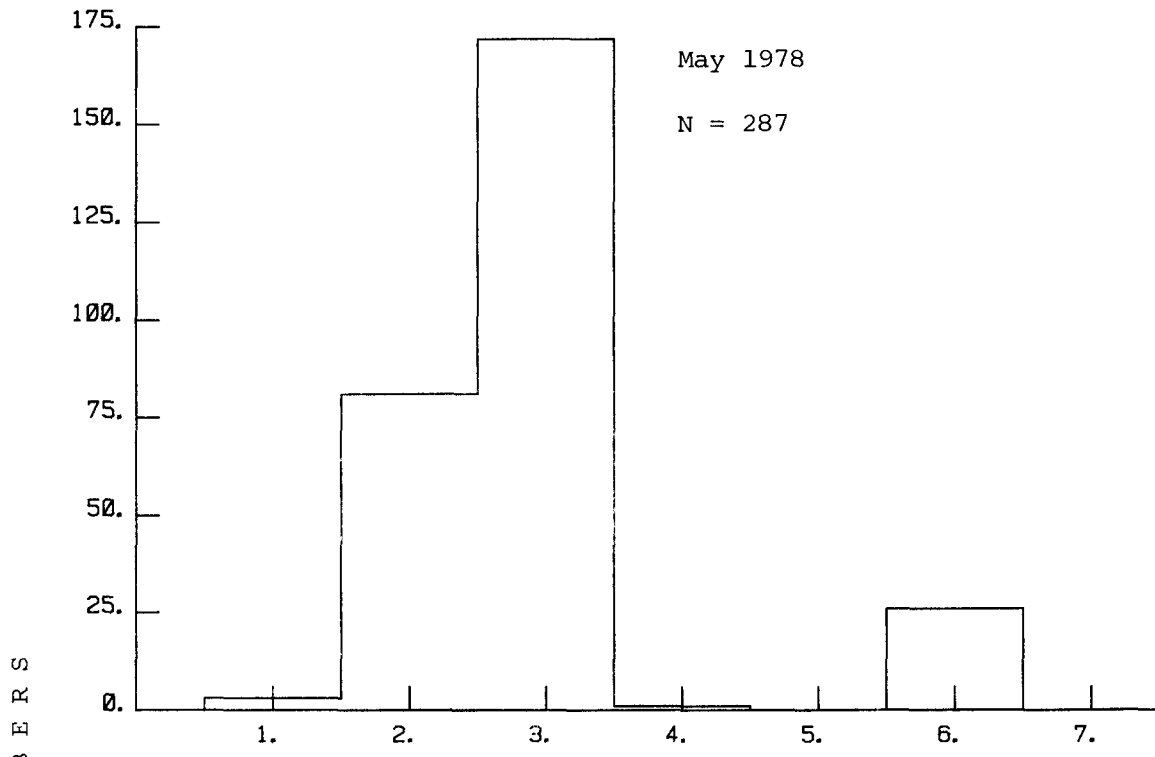


FEMALE SKIPJACK GONAD MATURITY STAGE

TONGA
SKIPJACK



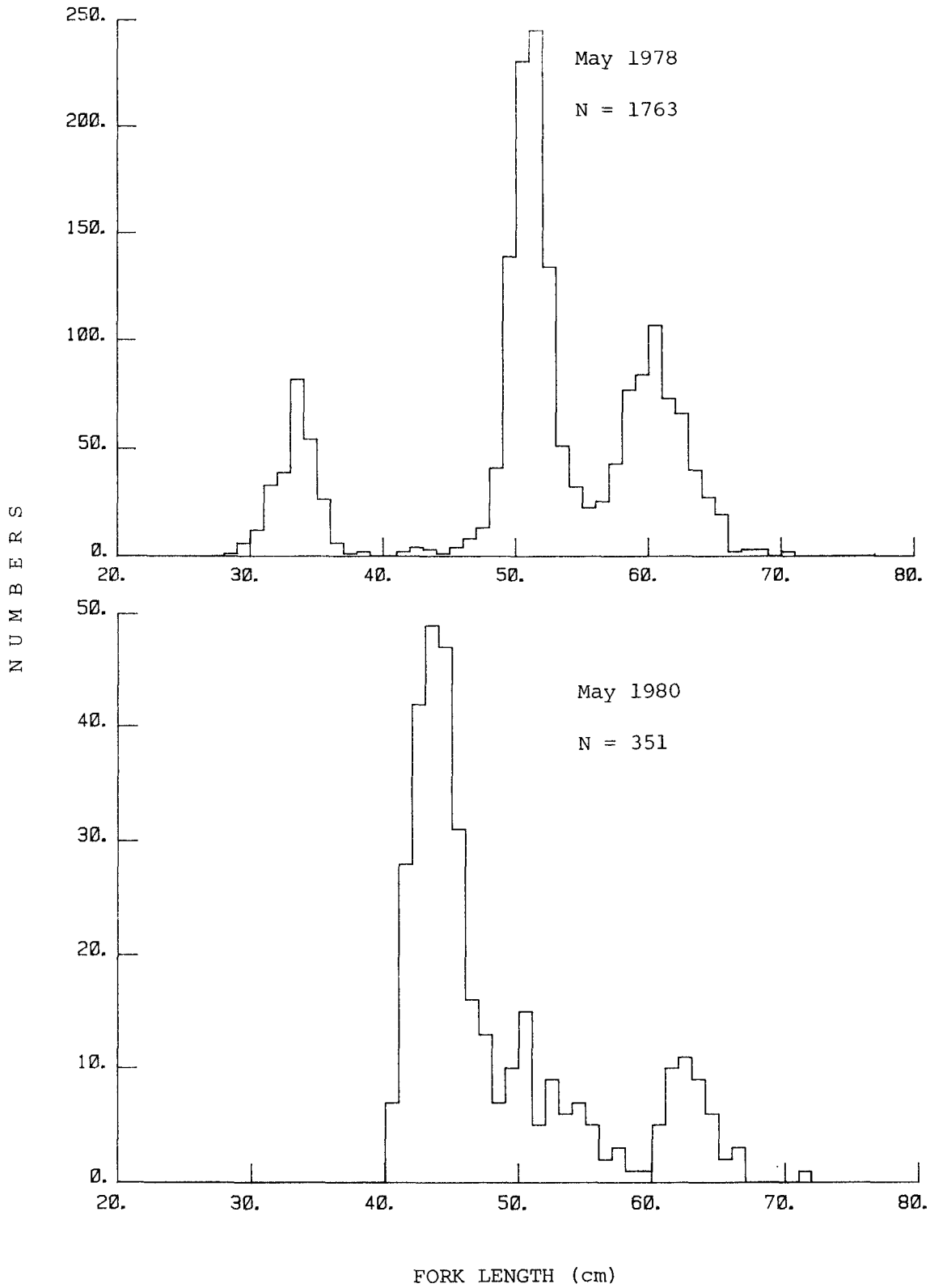
WALLIS AND FUTUNA ISLANDS



FEMALE SKIPJACK GONAD MATURITY STAGE

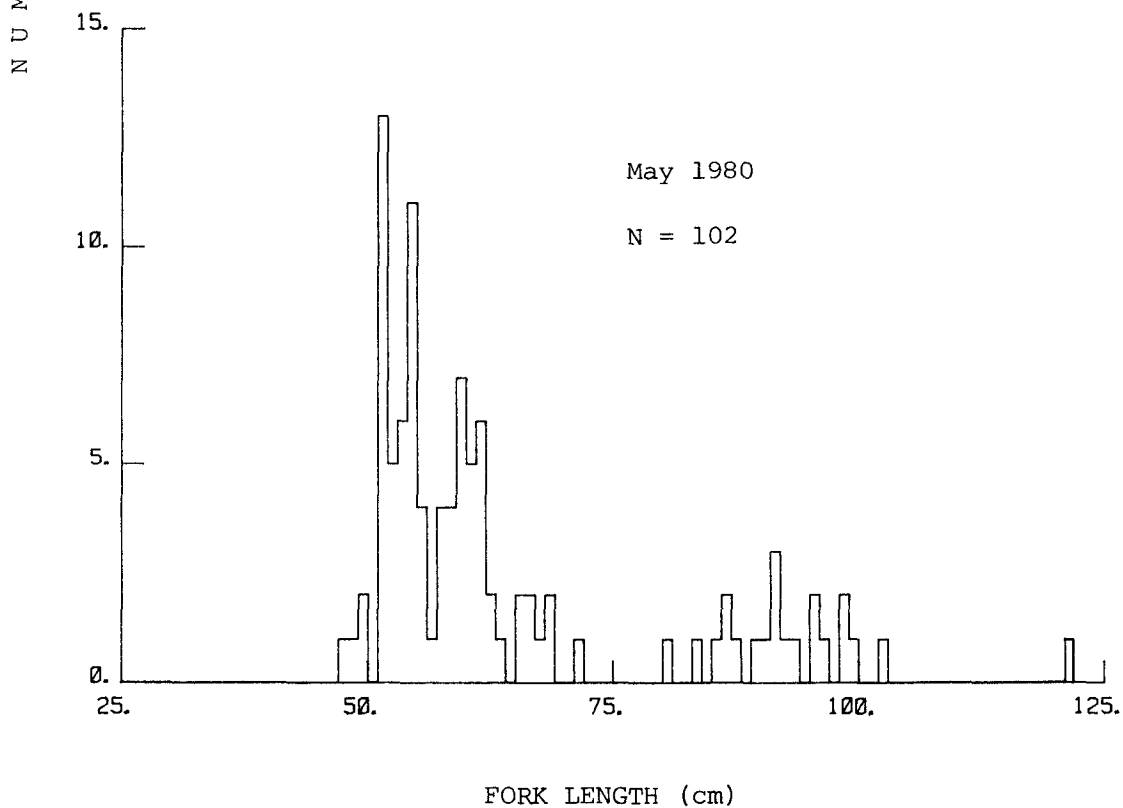
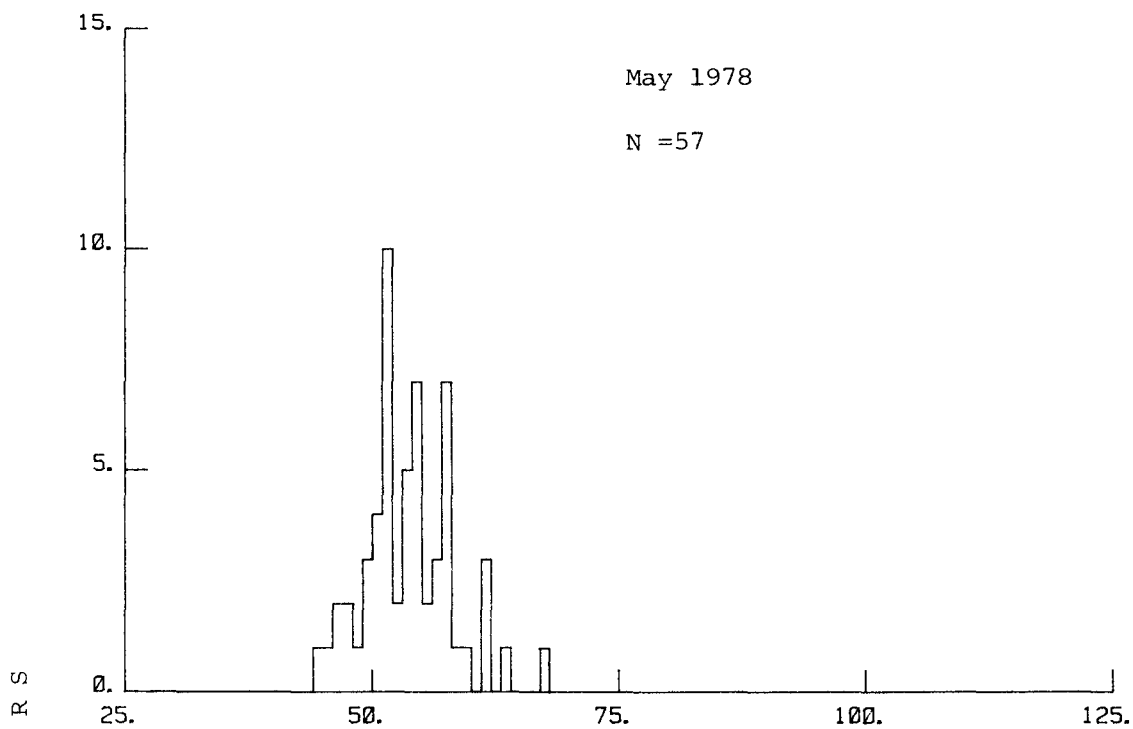
WALLIS AND FUTUNA ISLANDS

SKIPJACK

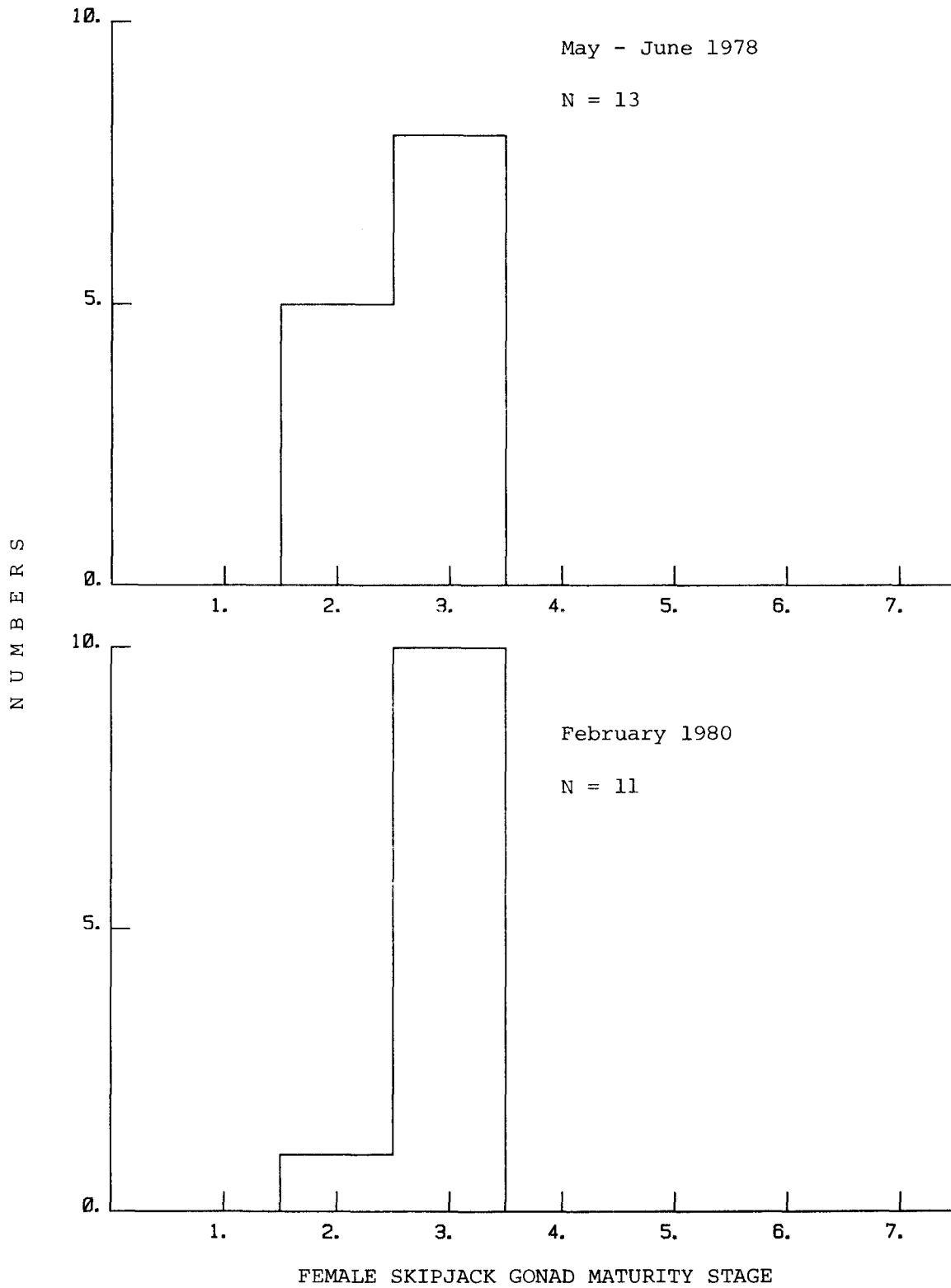


WALLIS AND FUTUNA ISLANDS

YELLOWFIN



AMERICAN SAMOA

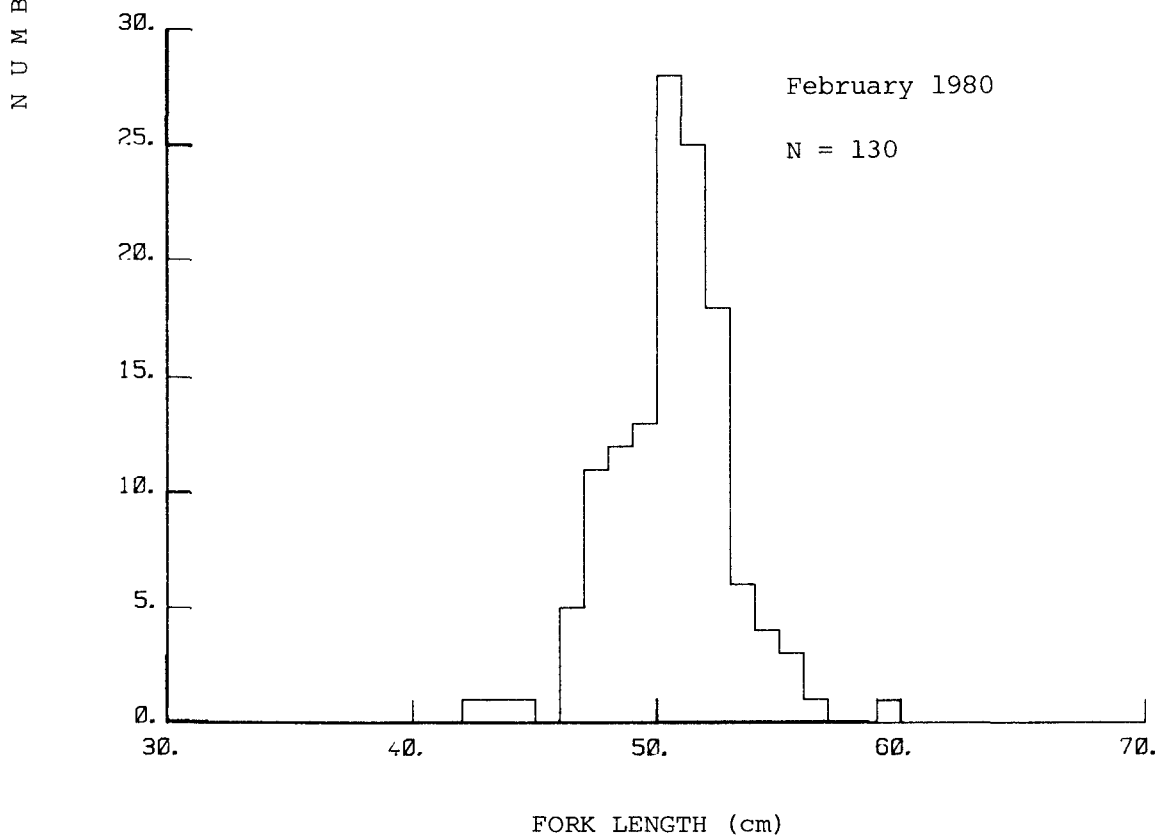
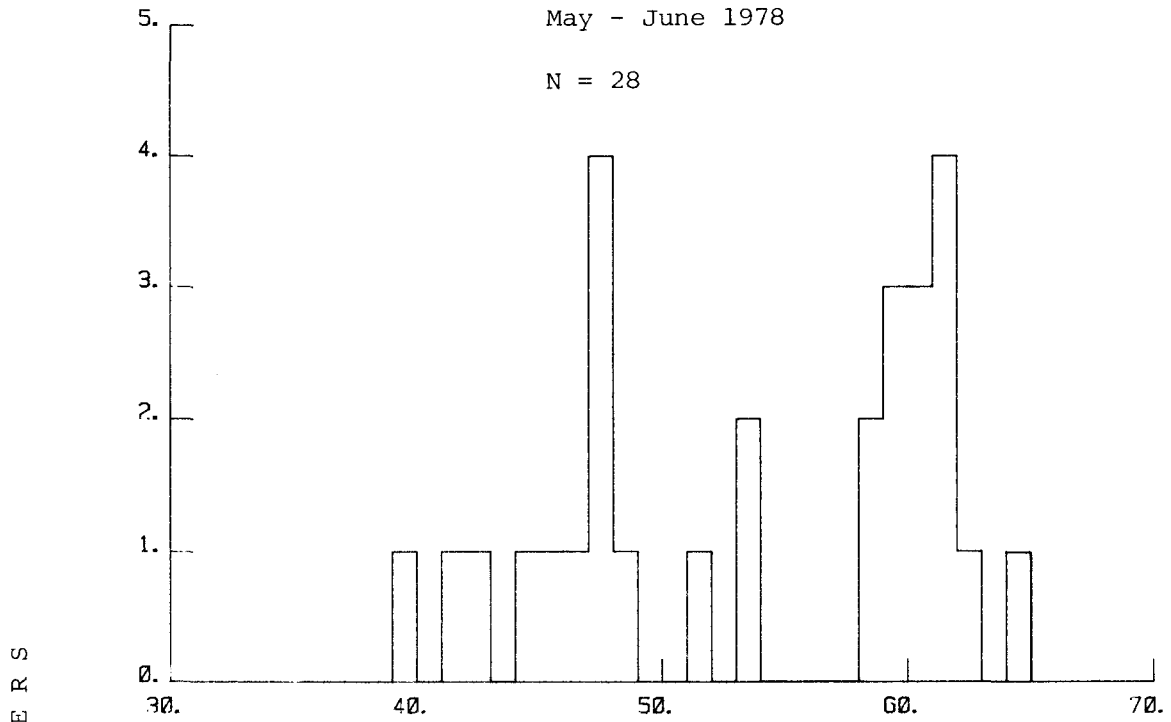


AMERICAN SAMOA

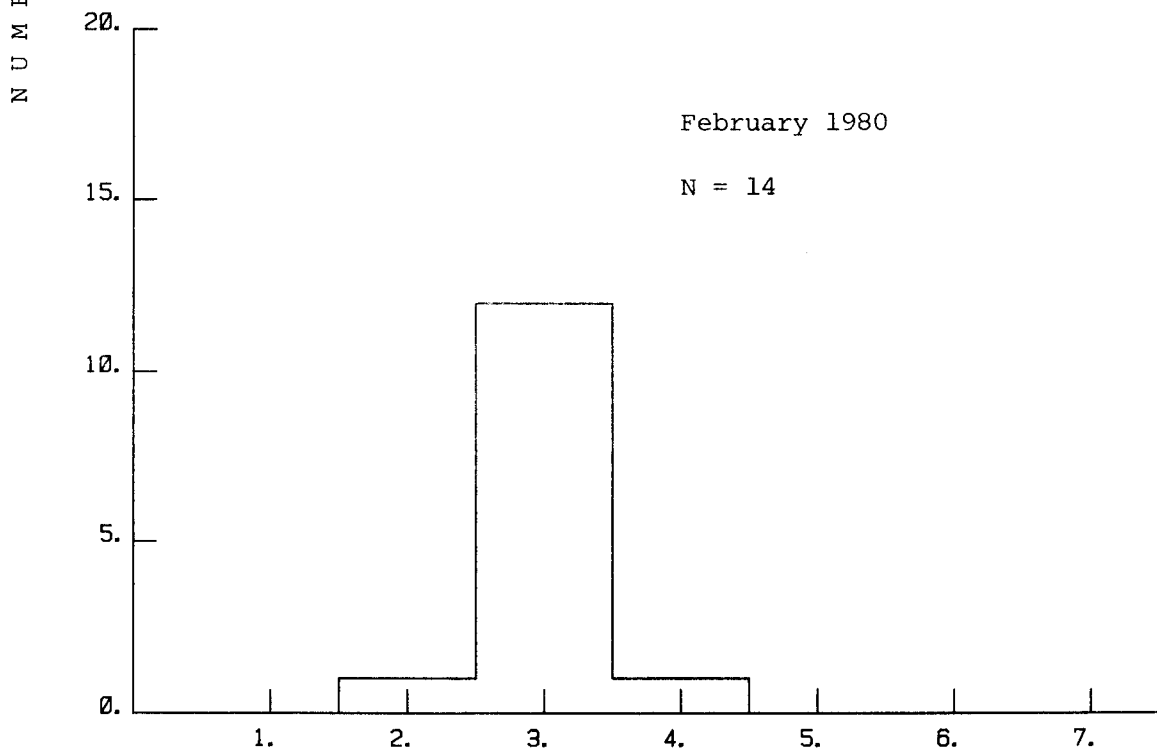
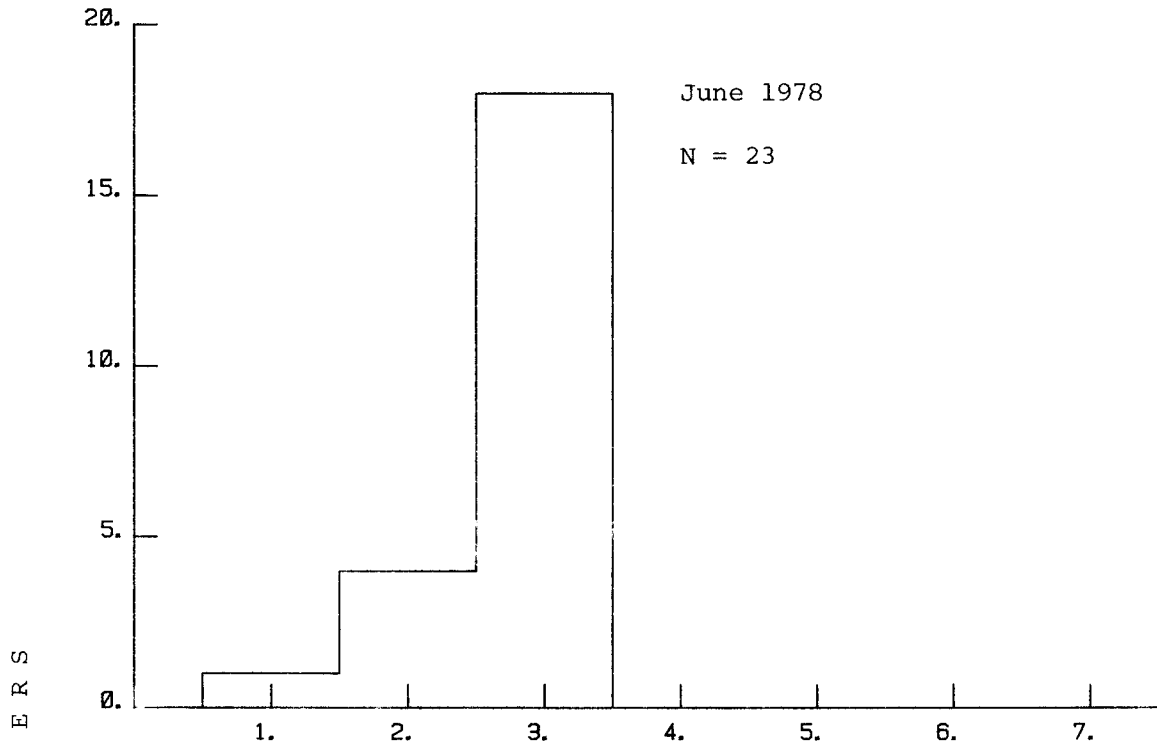
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May - June 1978

N = 28



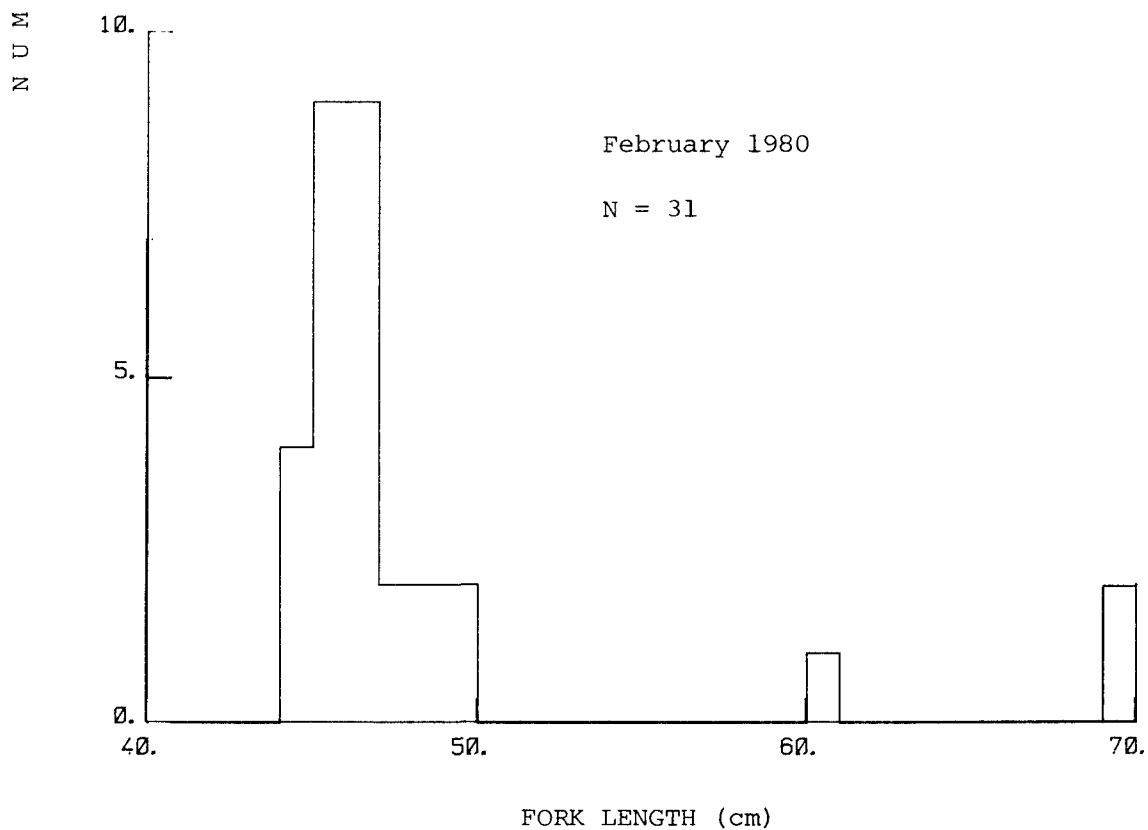
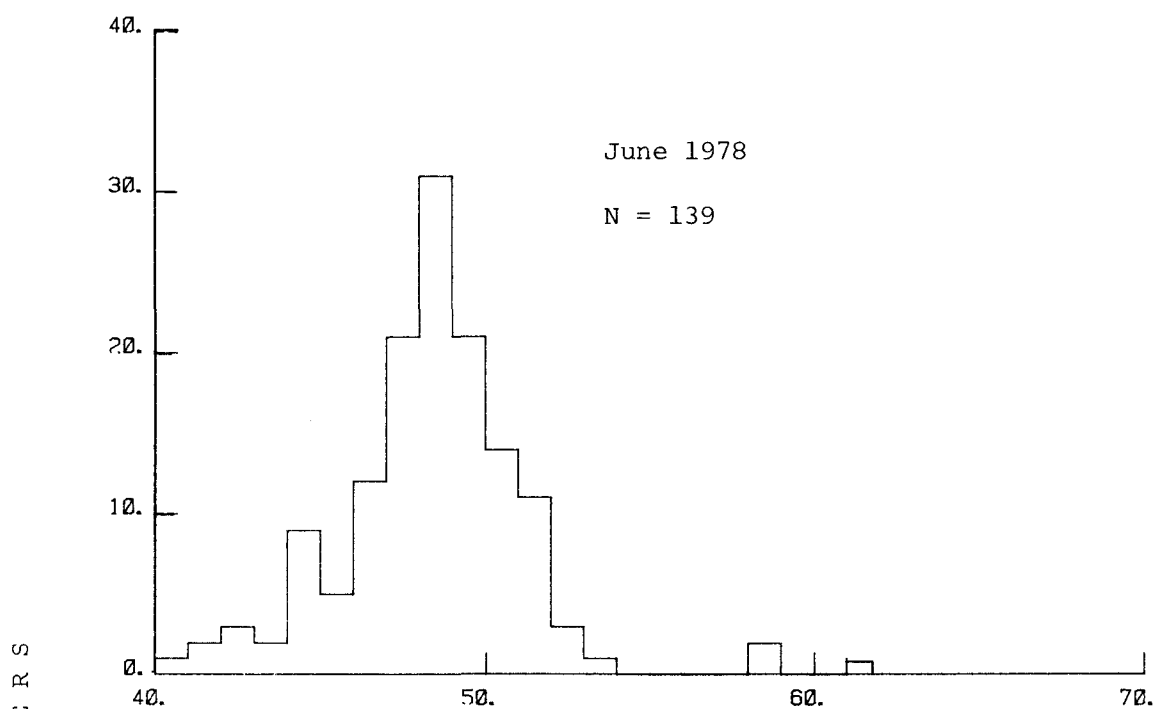
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FEMALE SKIPJACK GONAD MATURITY STAGE

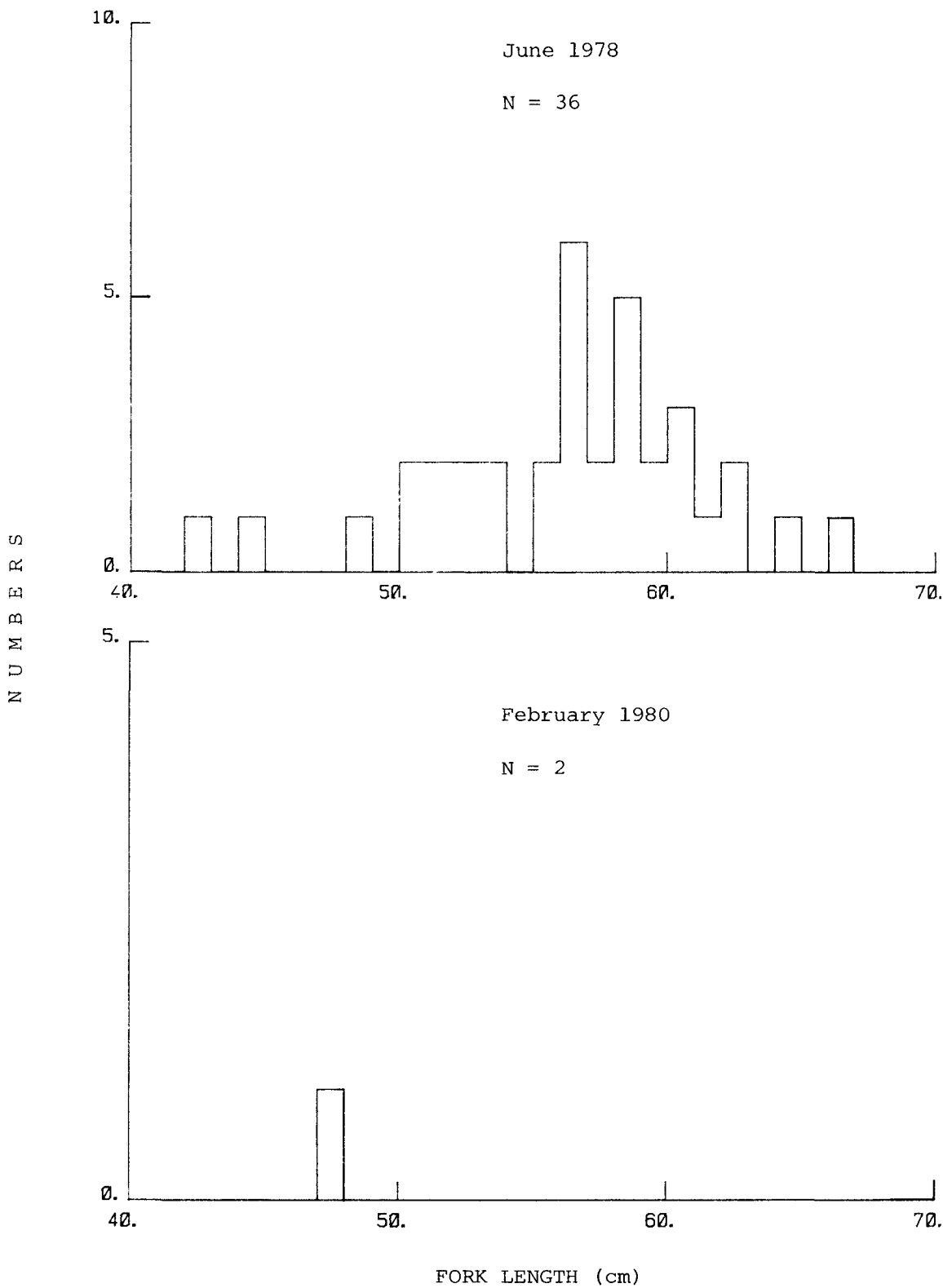
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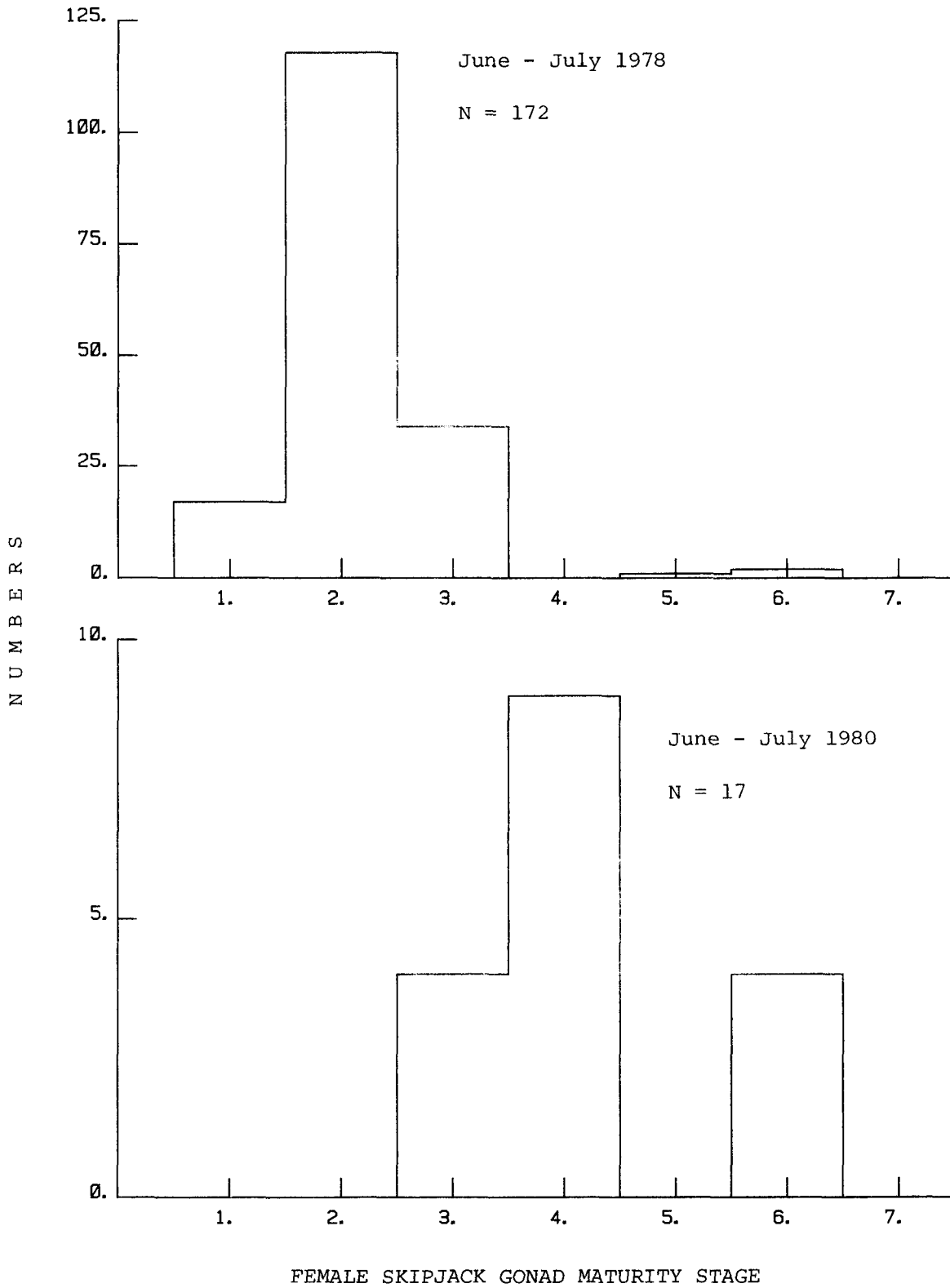


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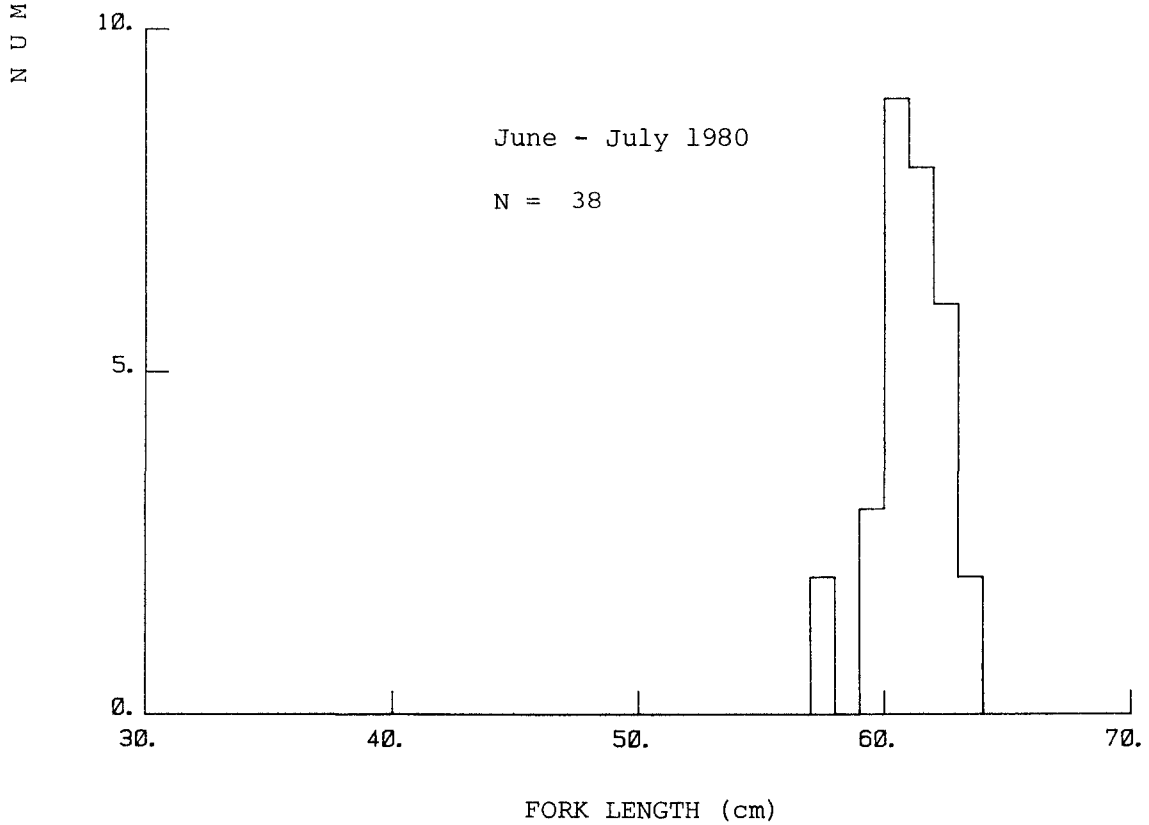
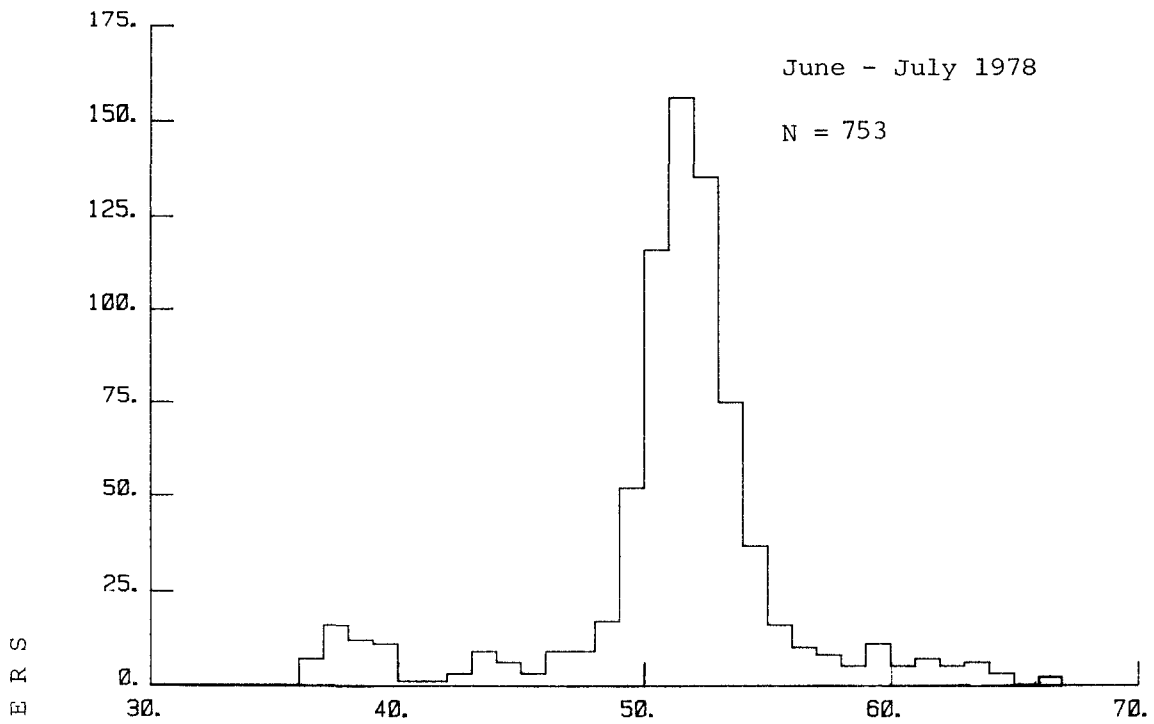
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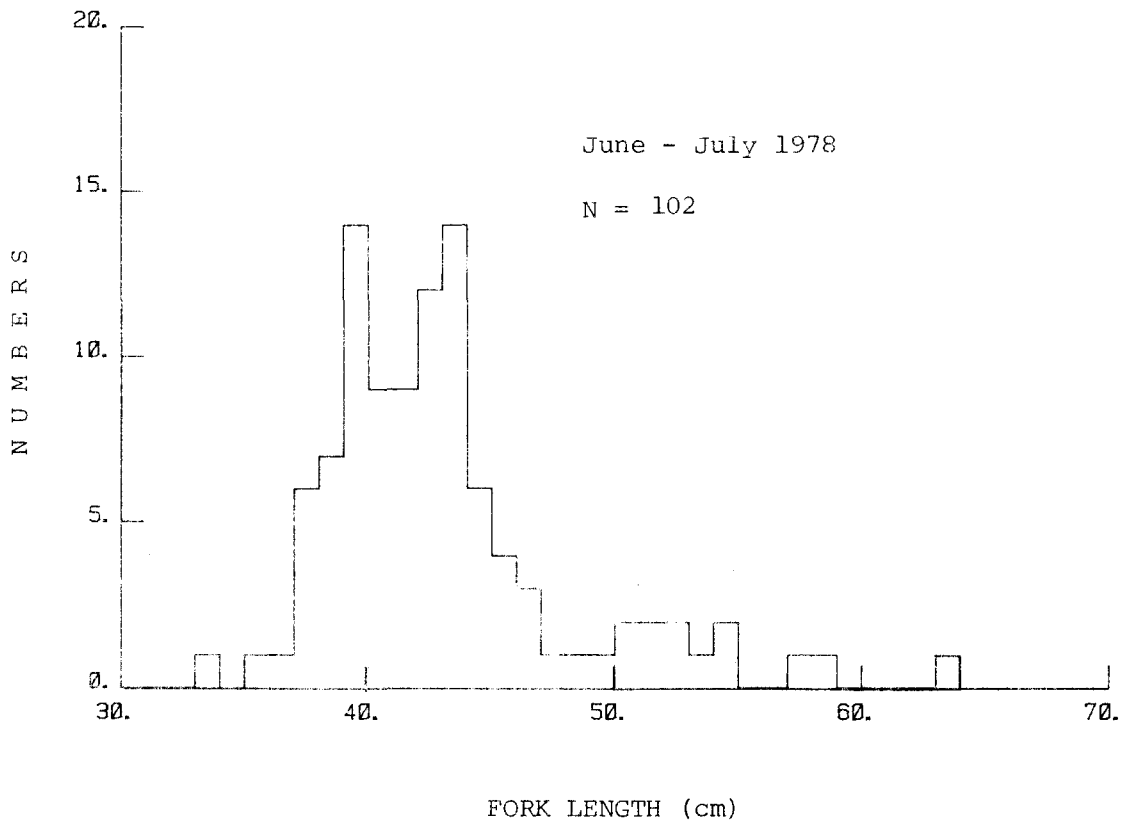
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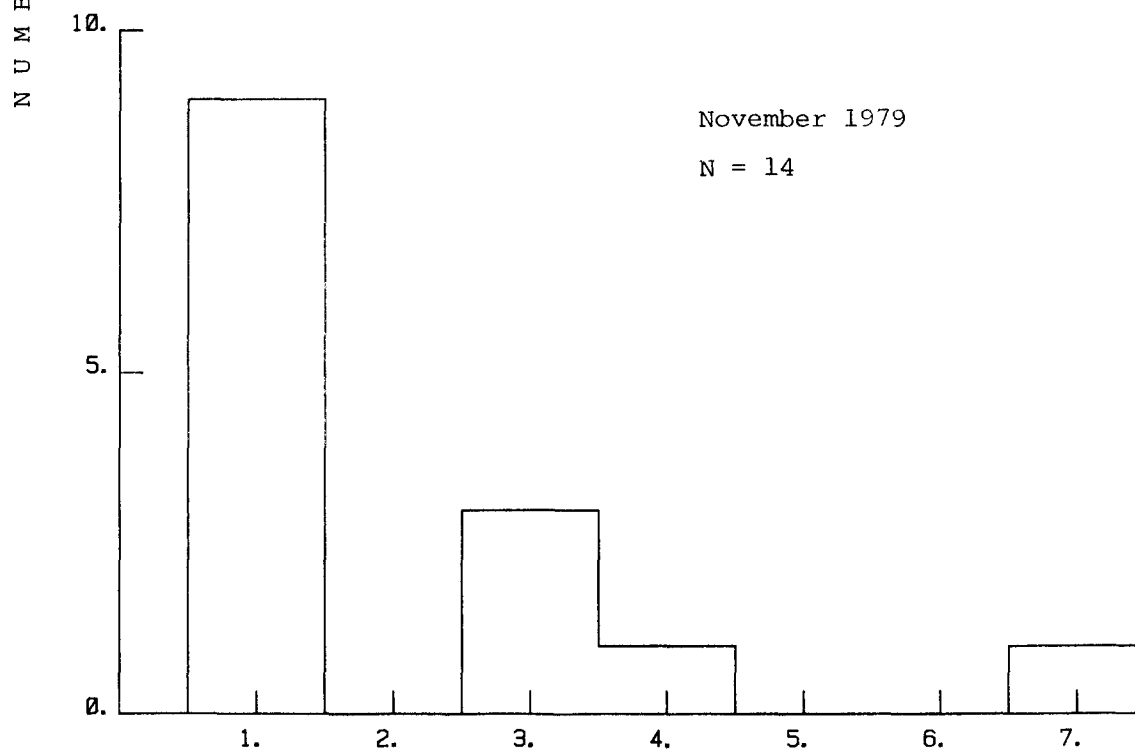
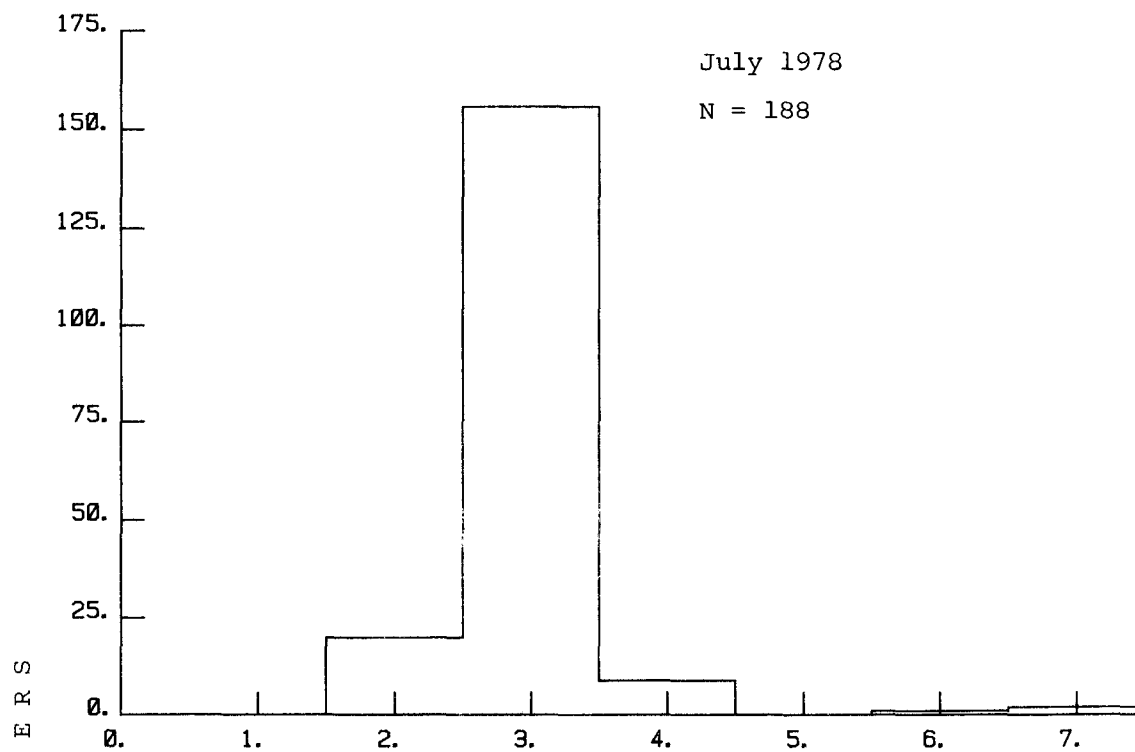
TUVALU
SKIPJACK



TUVALU
YELLOWFIN



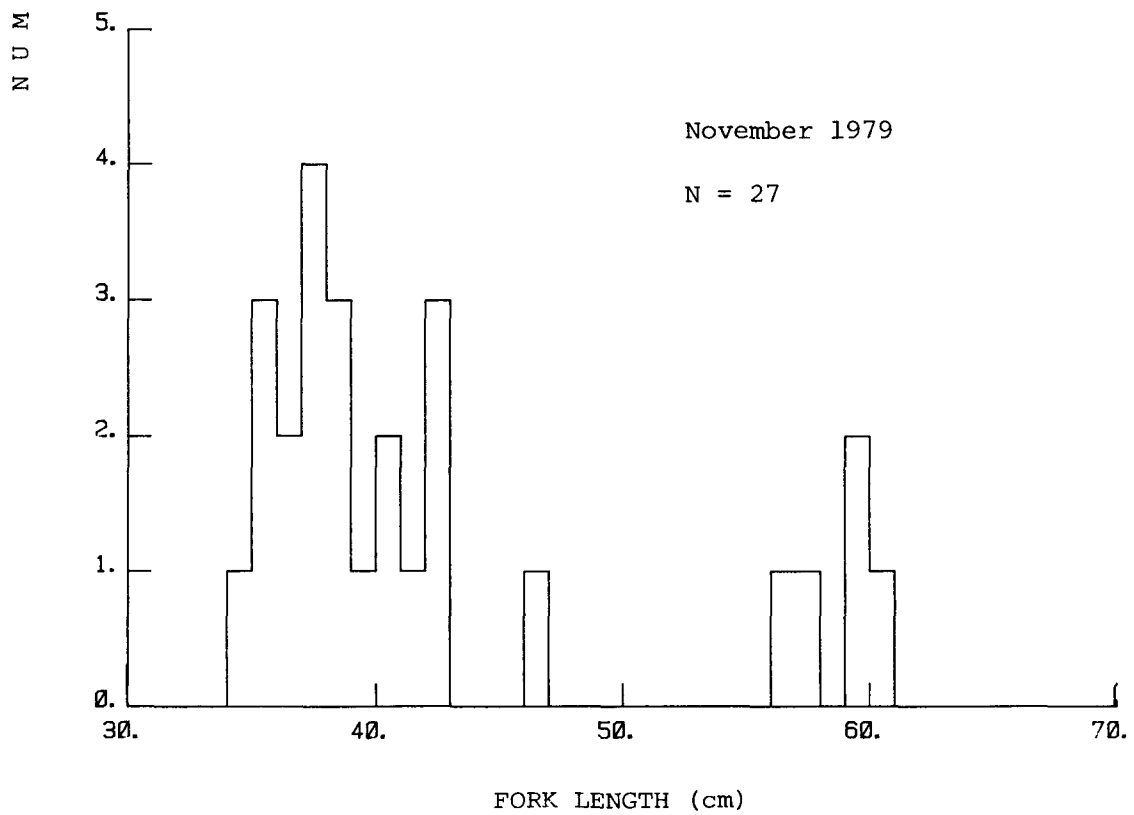
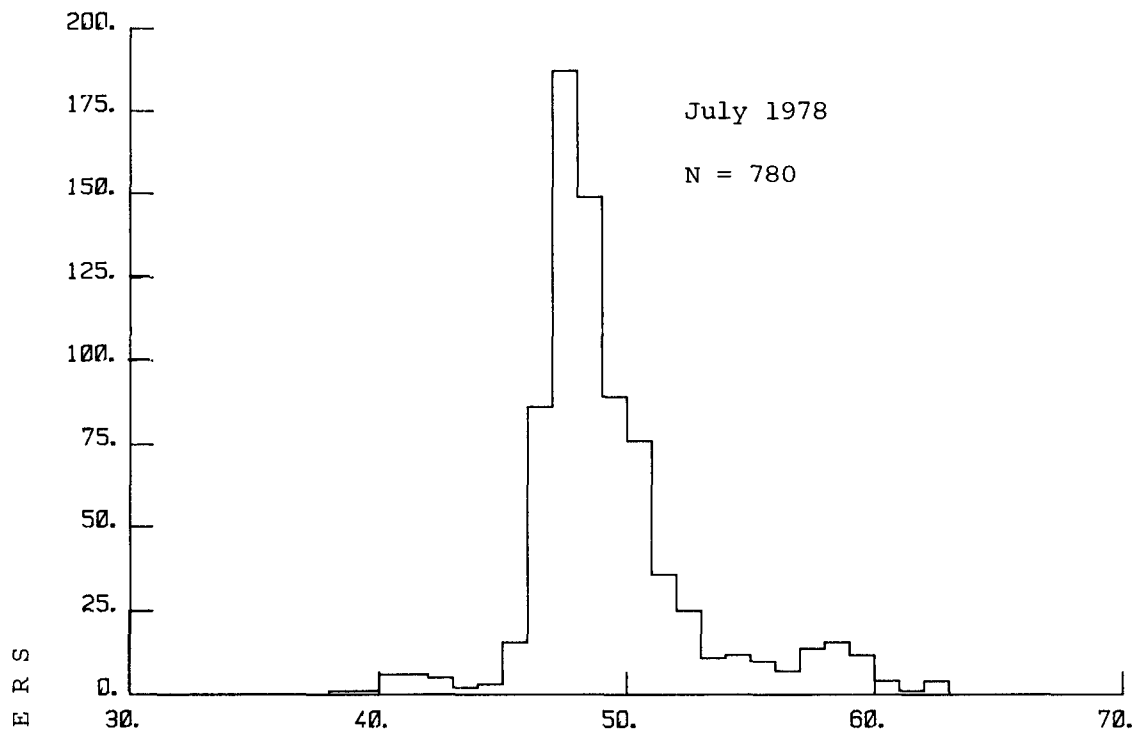
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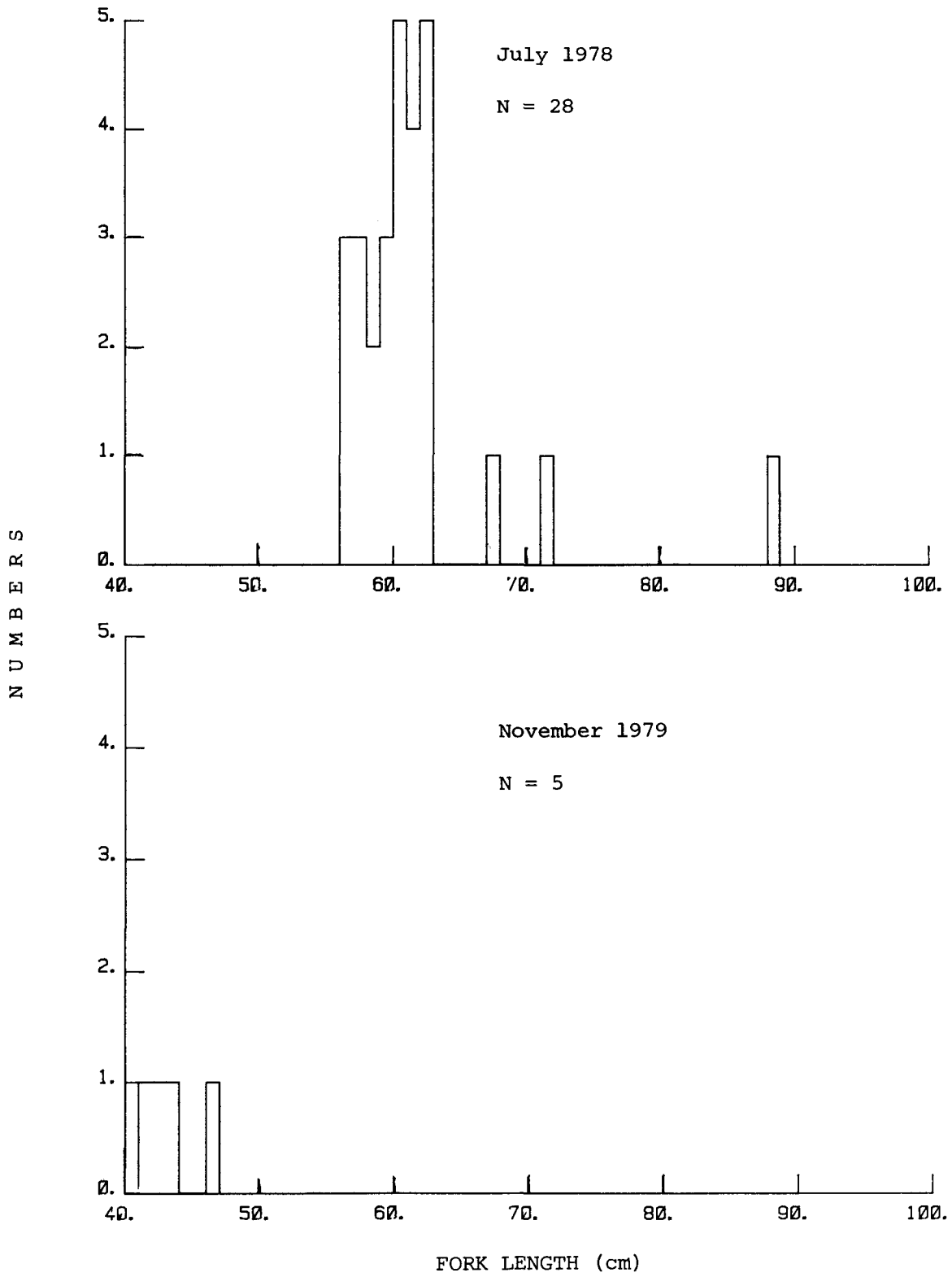
FEMALE SKIPJACK GONAD MATURITY STAGE

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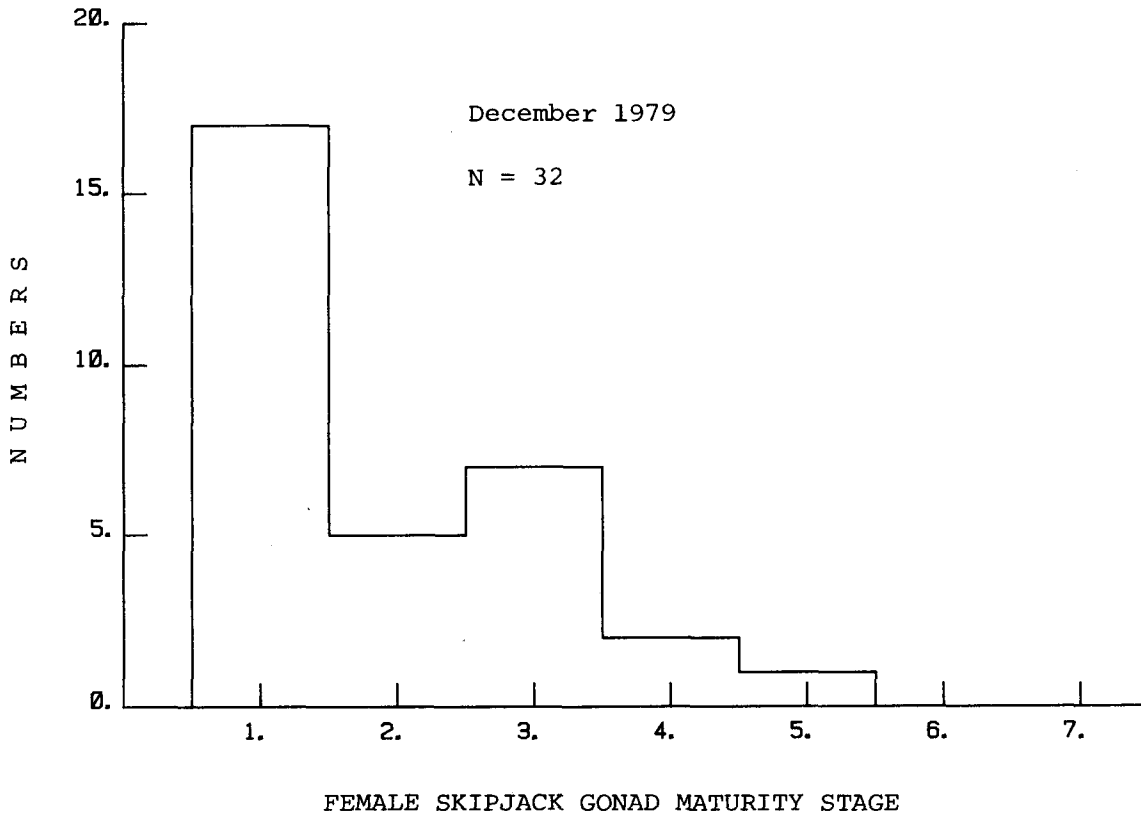
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YELLOWFIN

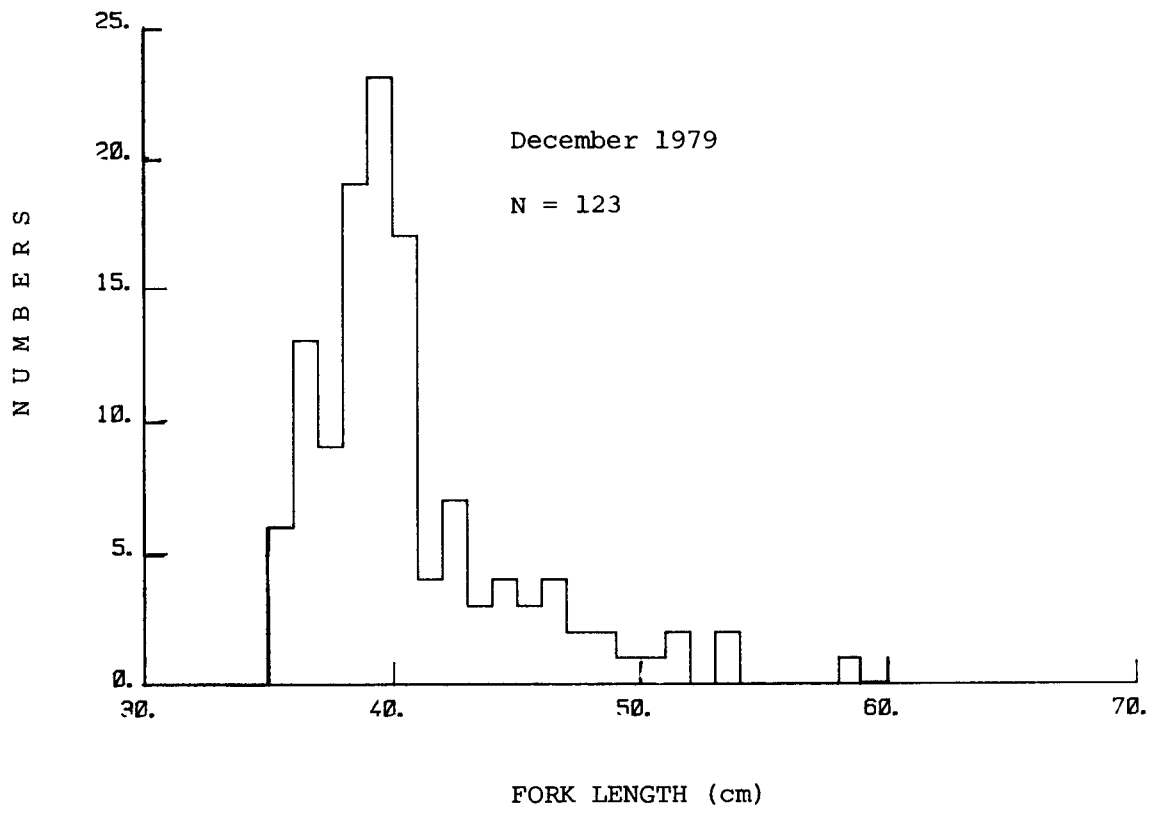


PHOENIX ISLANDS

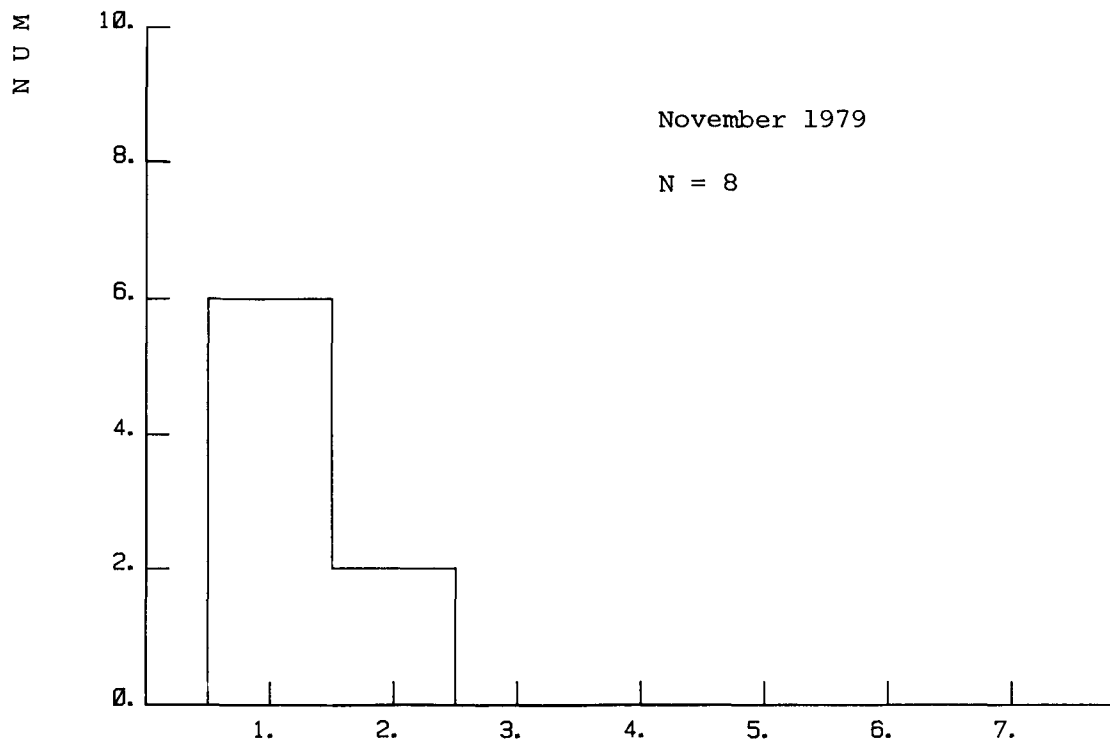
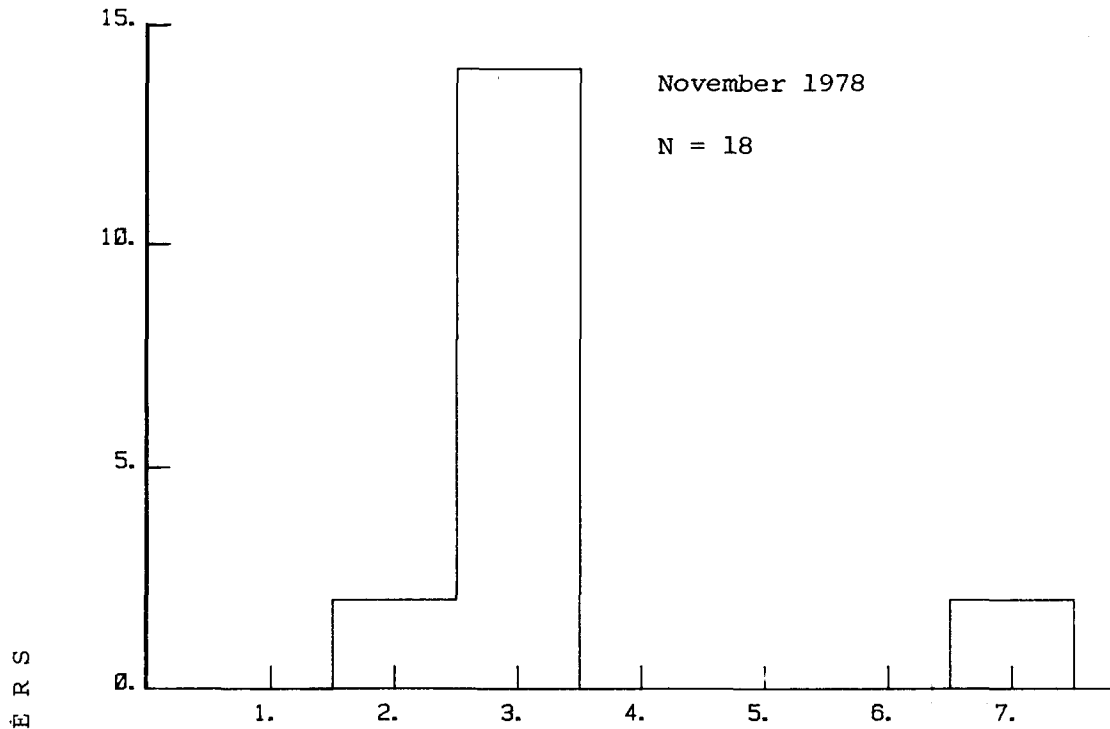


PHOENIX ISLANDS

SKIPJACK



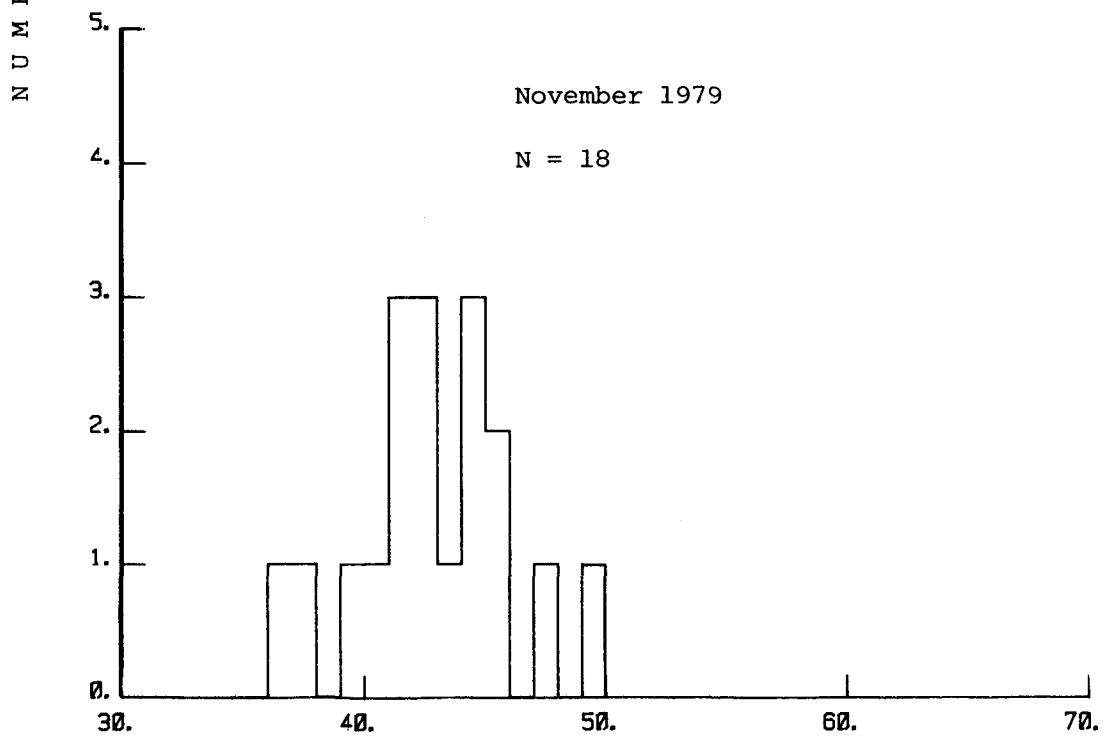
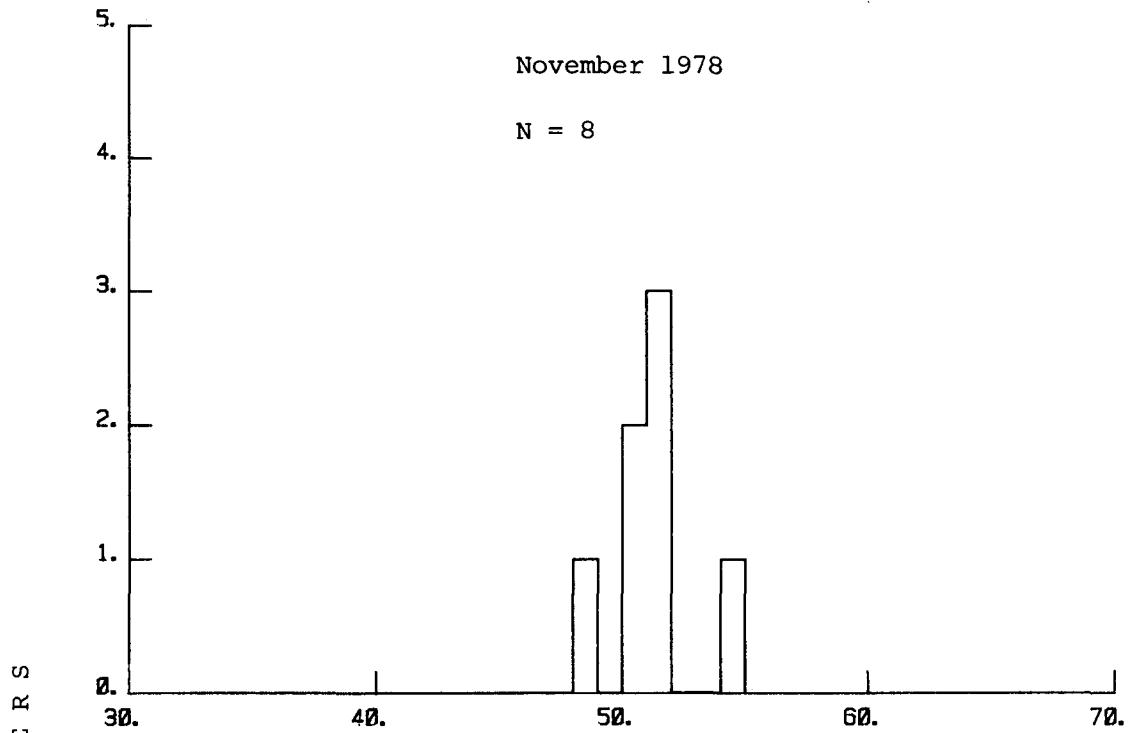
MARSHALL ISLANDS



FEMALE SKIPJACK GONAD MATURITY STAGE

MARSHALL ISLANDS

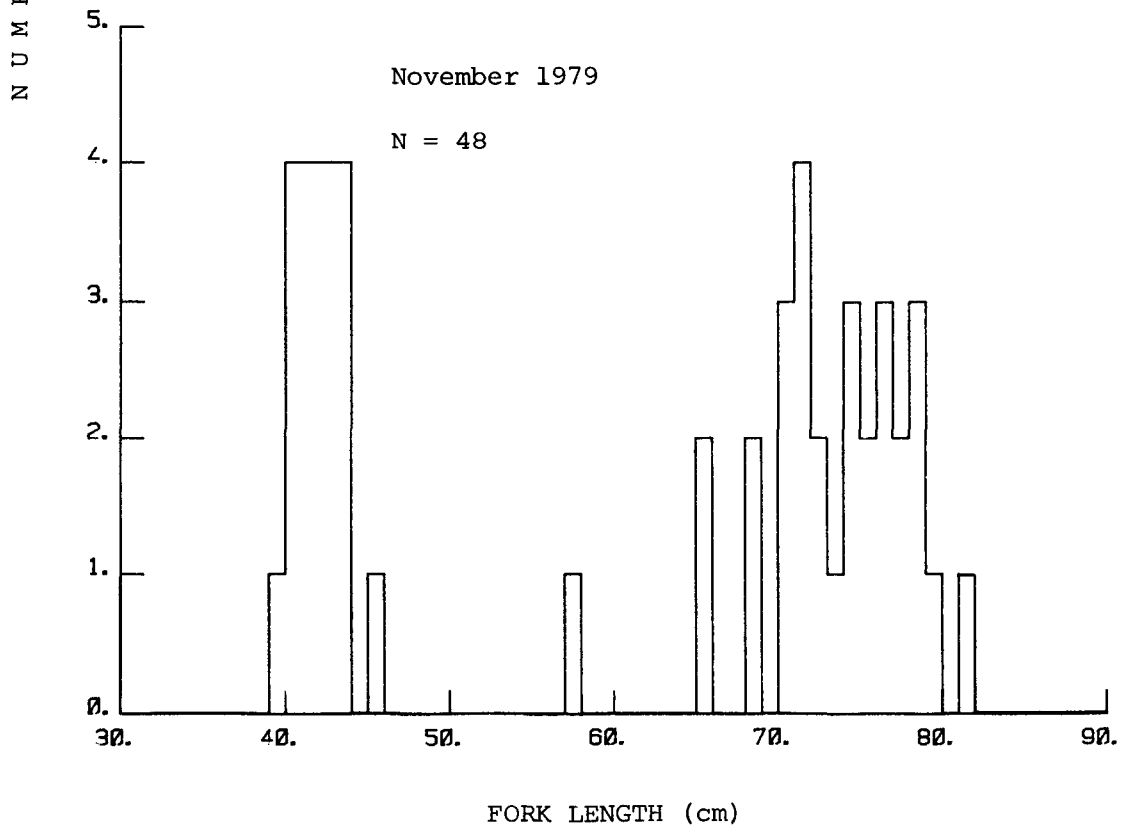
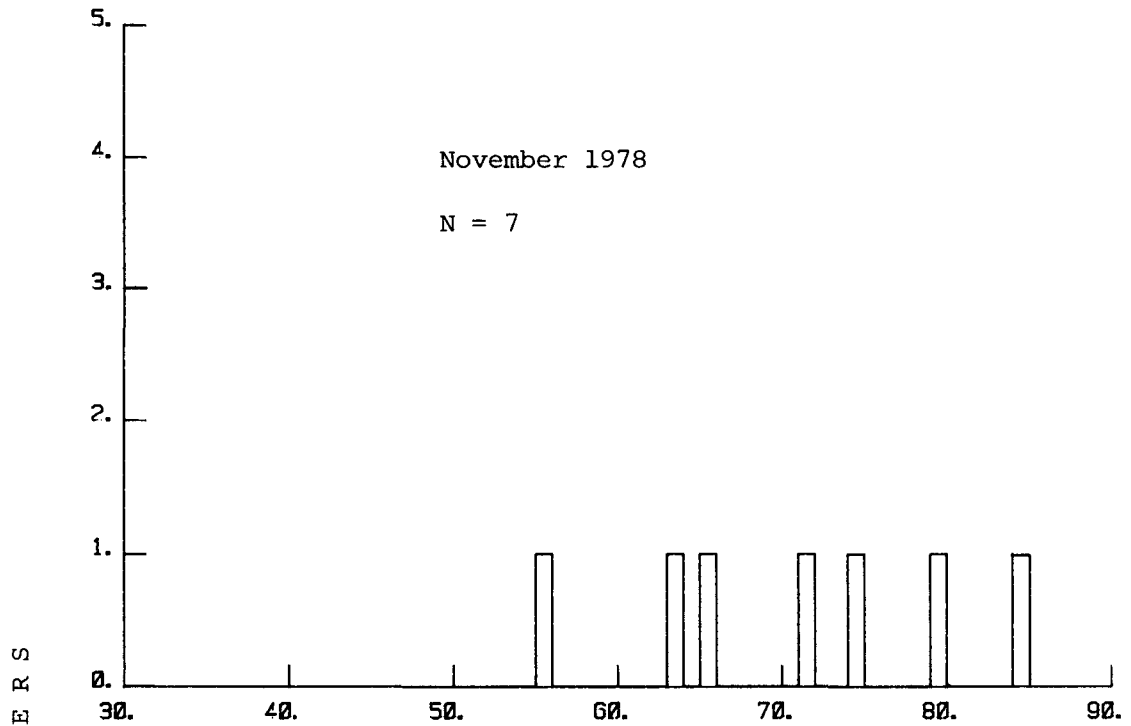
SKIPJACK



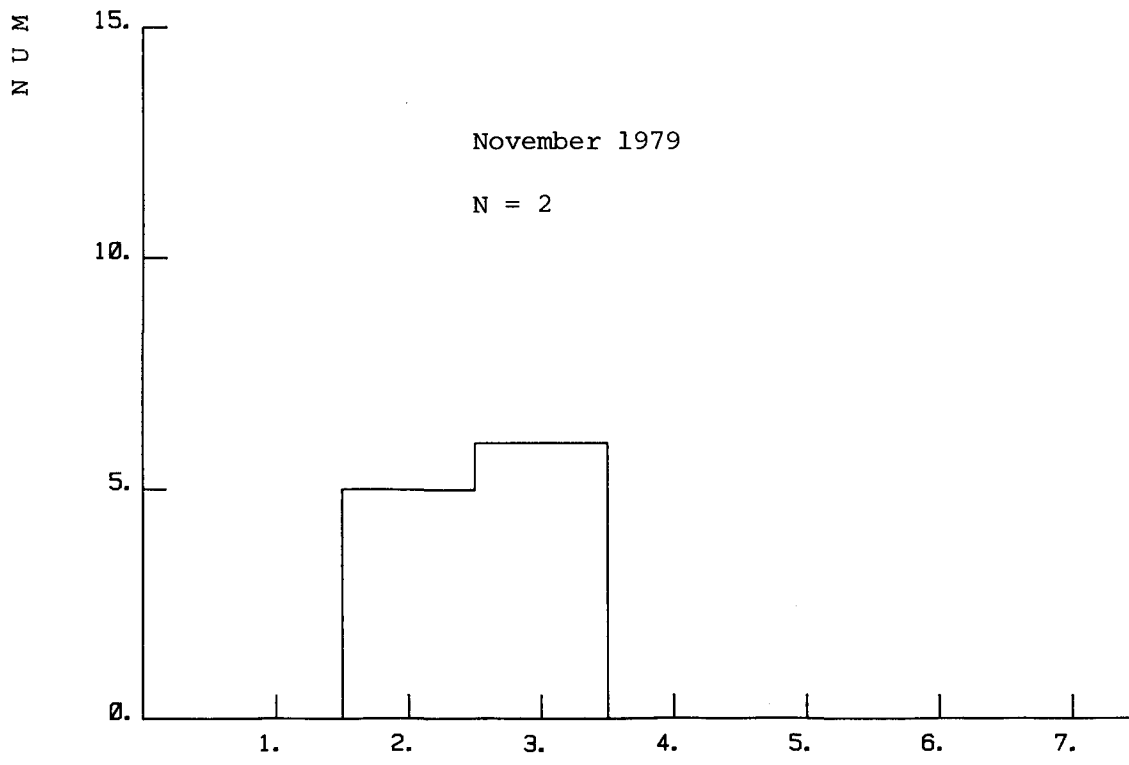
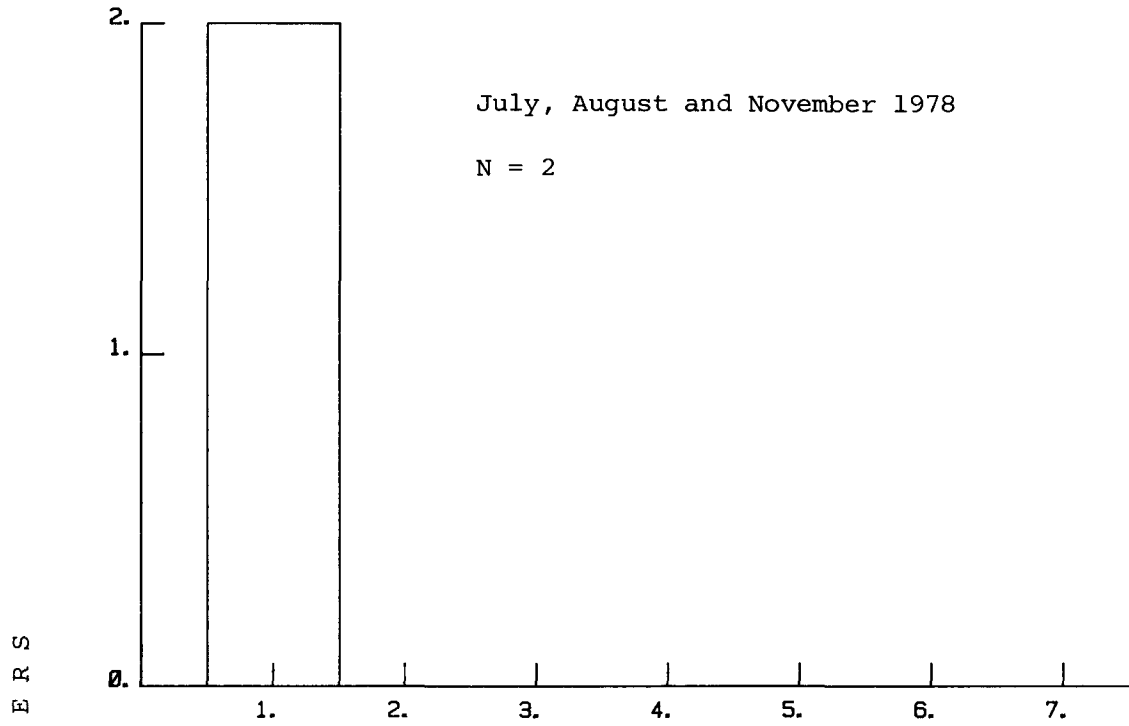
FORK LENGTH (cm)

MARSHALL ISLANDS

YELLOWFIN

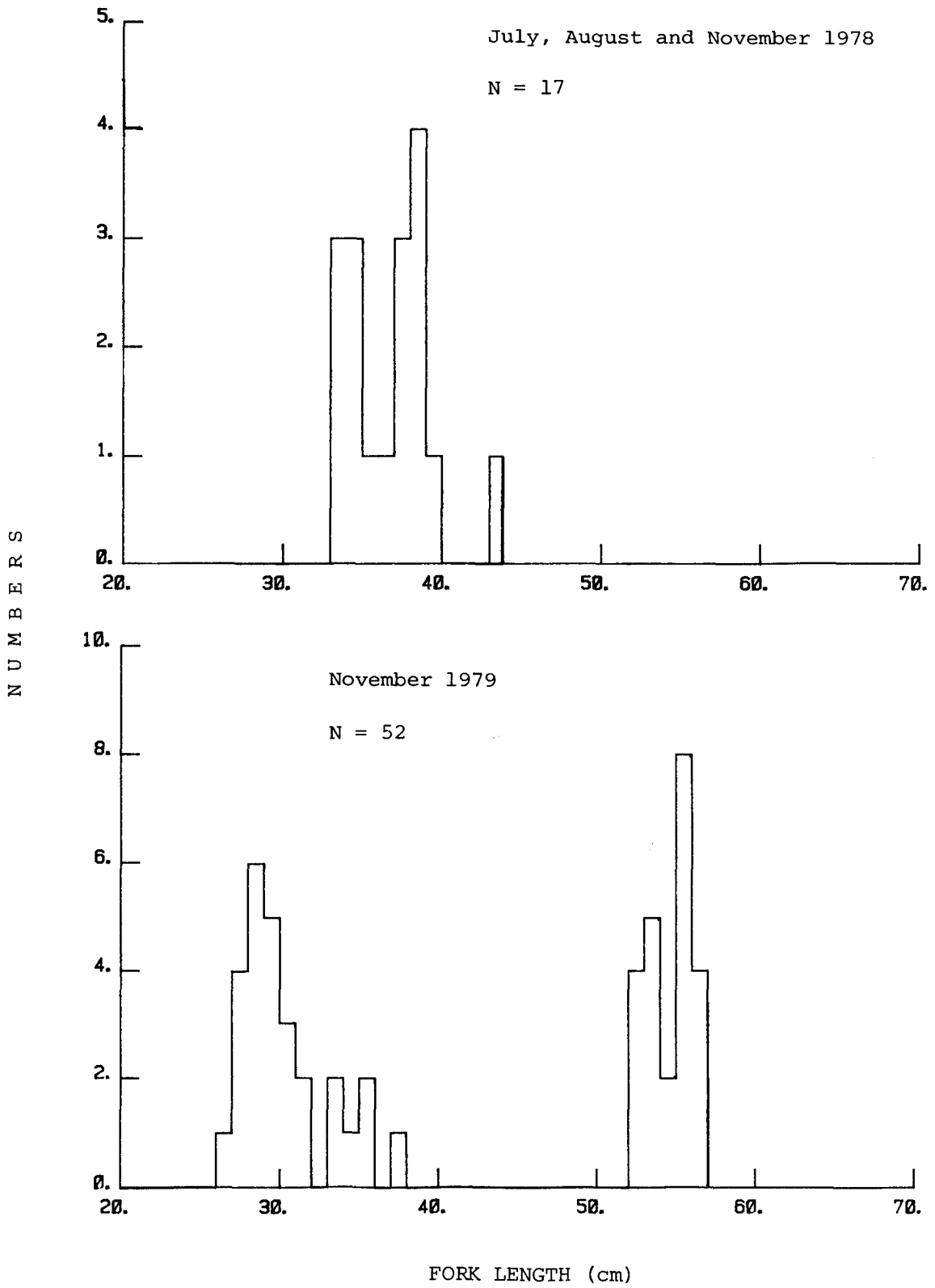


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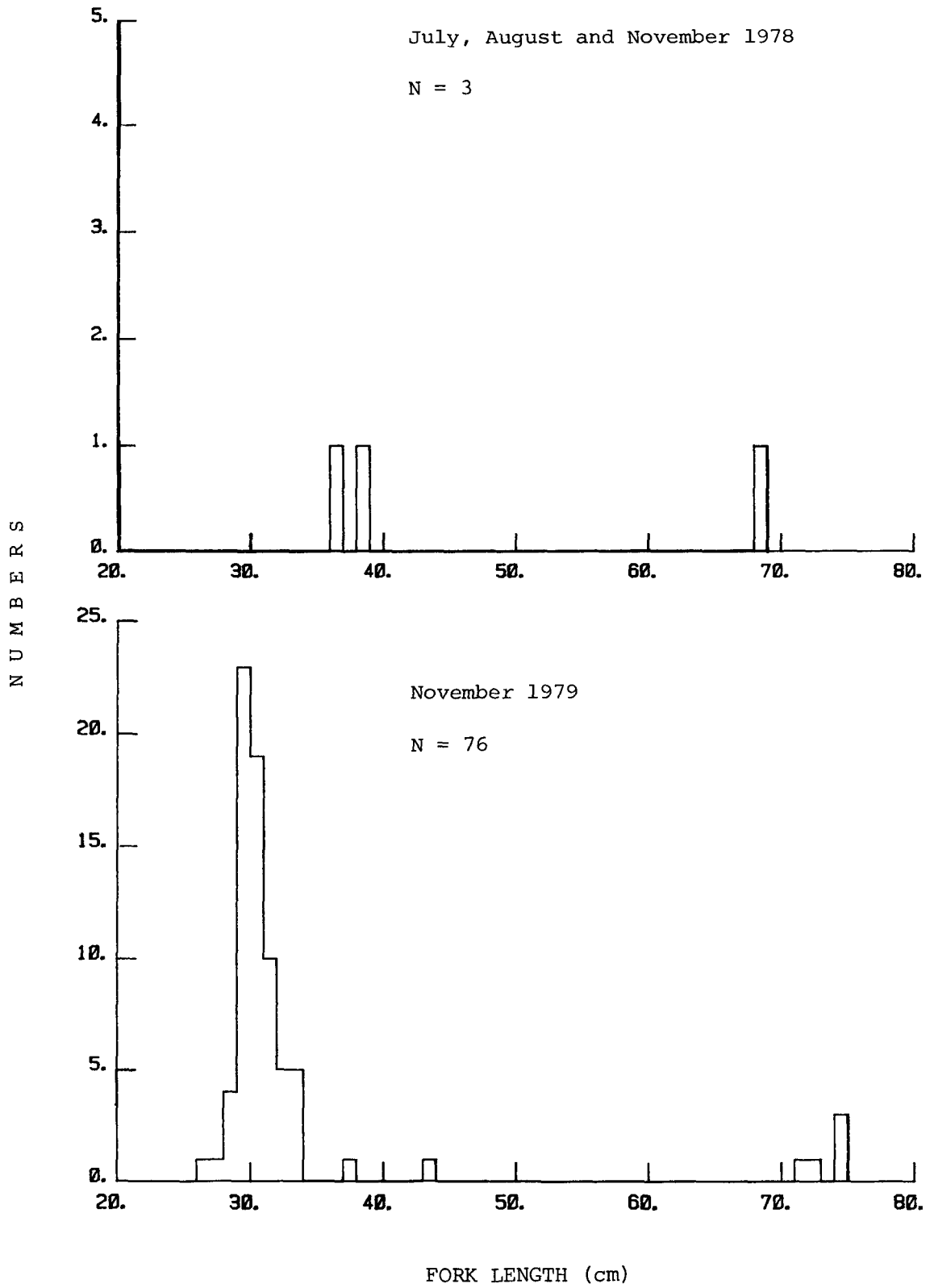


FEMALE SKIPJACK GONAD MATURITY STAGE

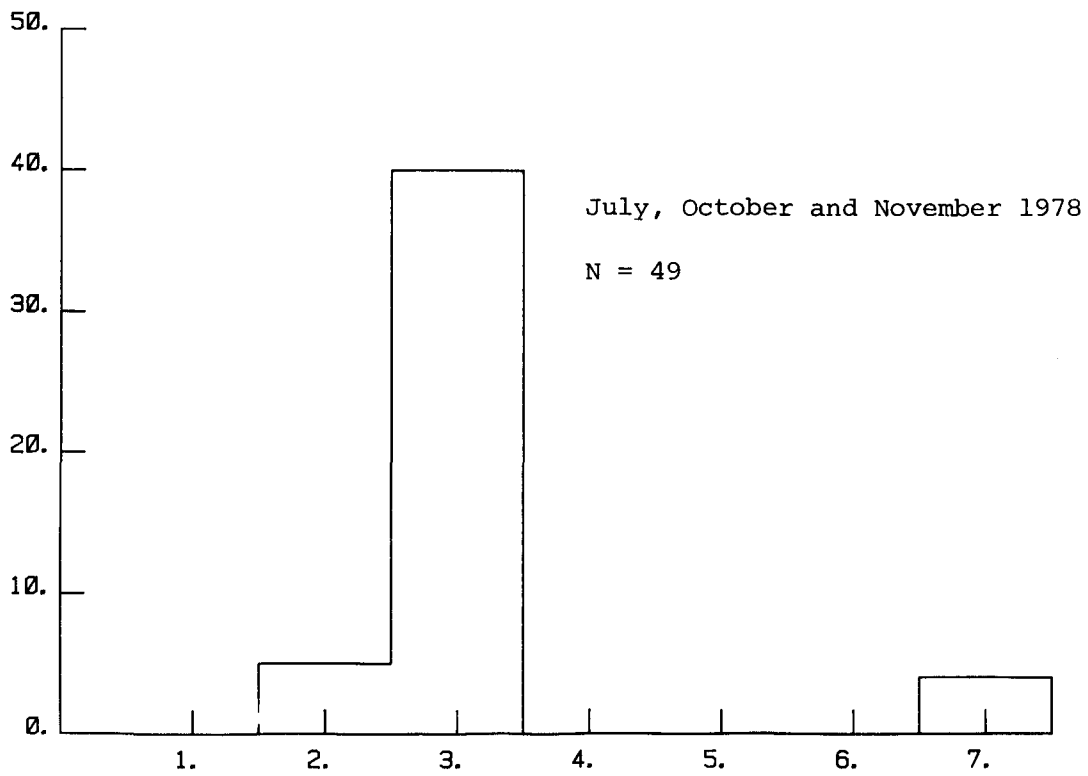
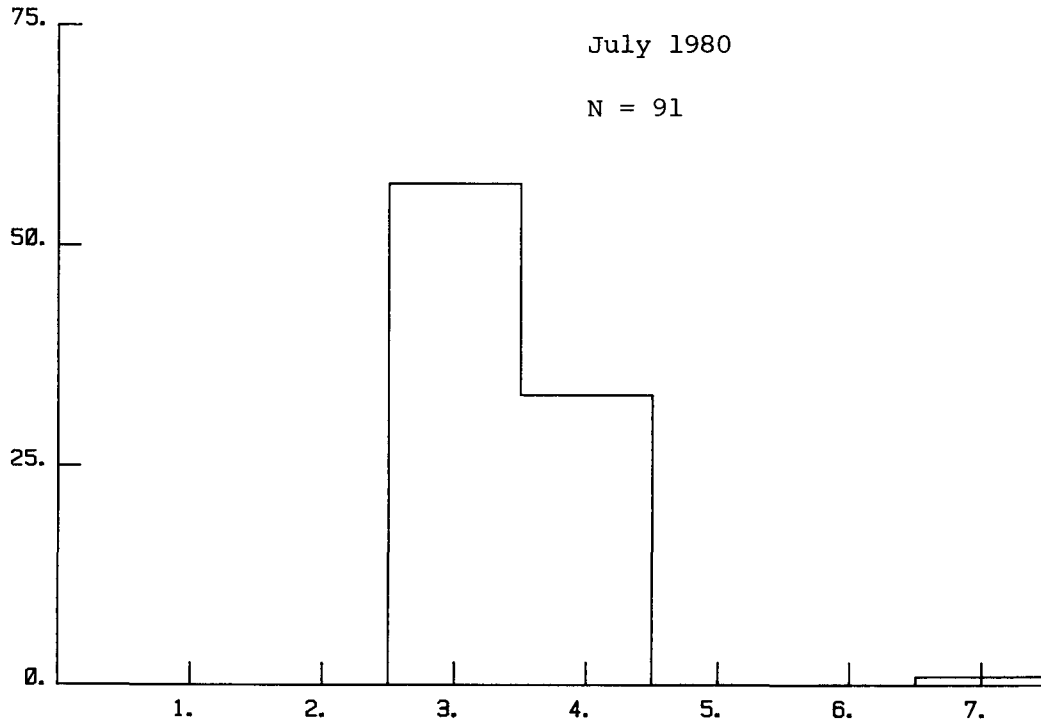
KOSRAE
SKIPJACK



KOSRAE
YELLOWFIN

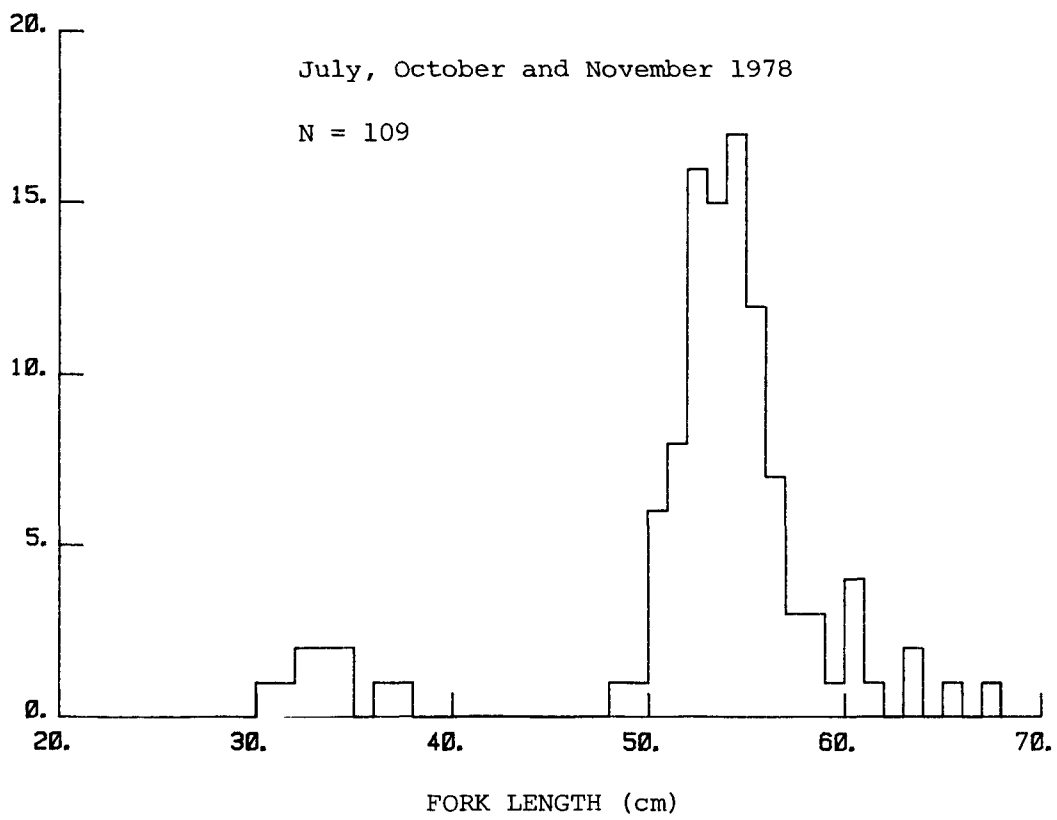
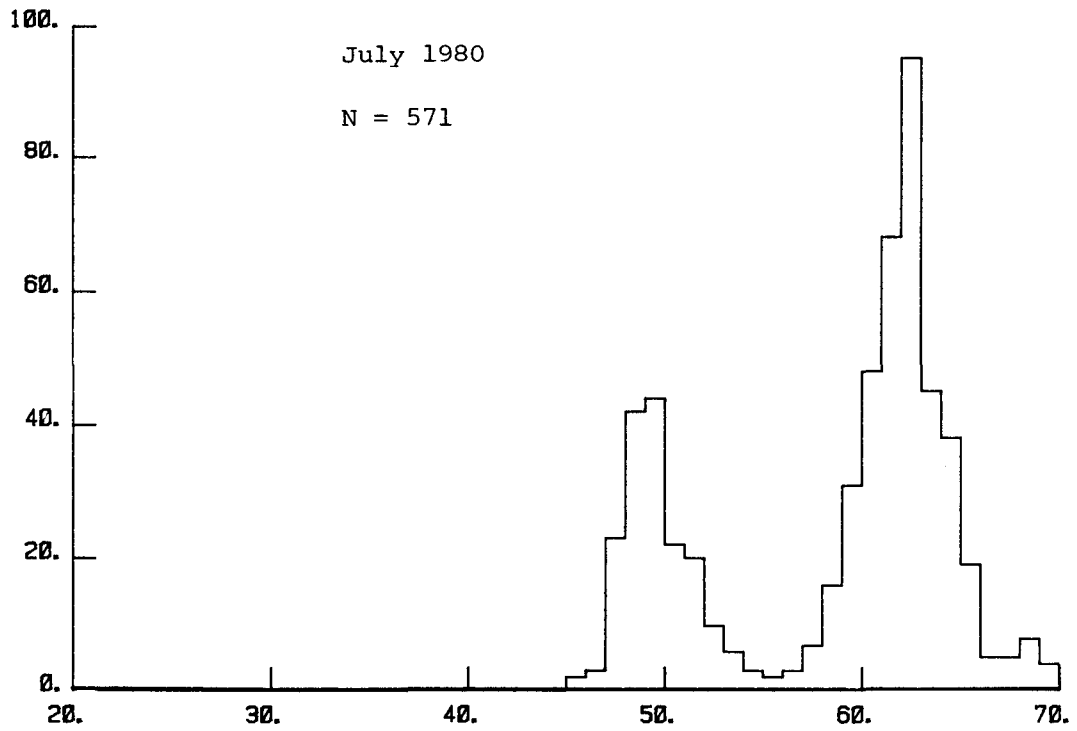


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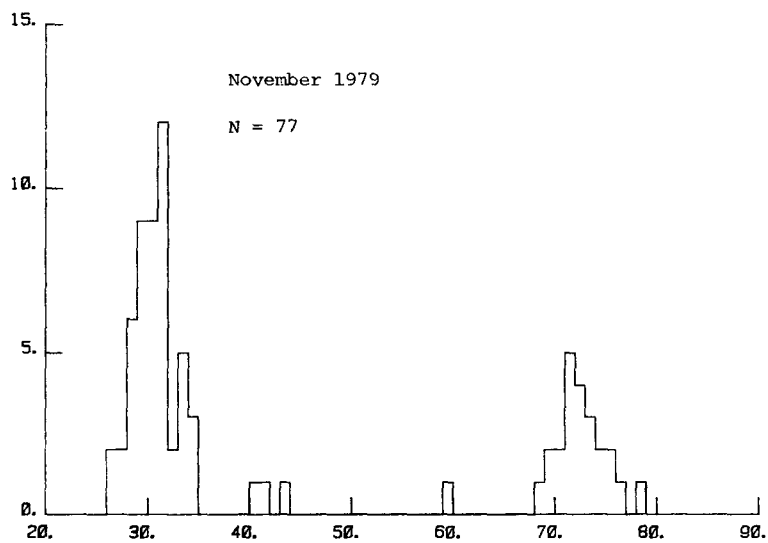
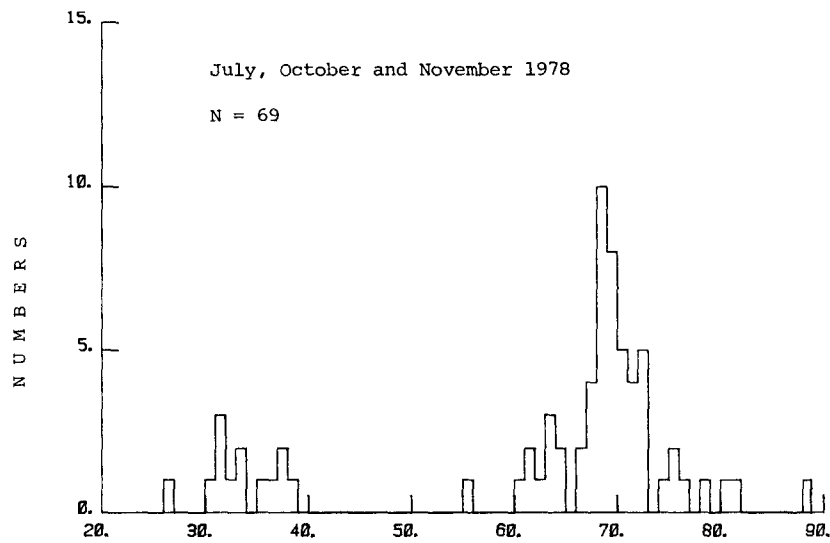
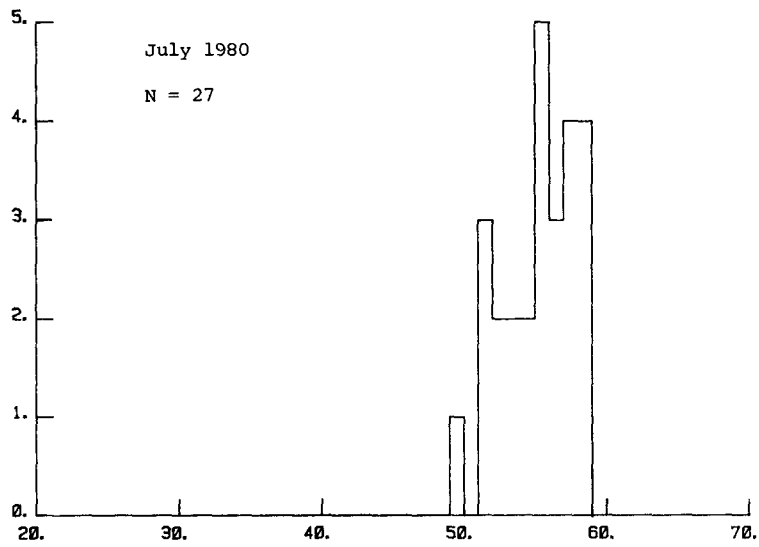


FEMALE SKIPJACK GONAD MATURITY STAGE

PONAPE
SKIPJACK

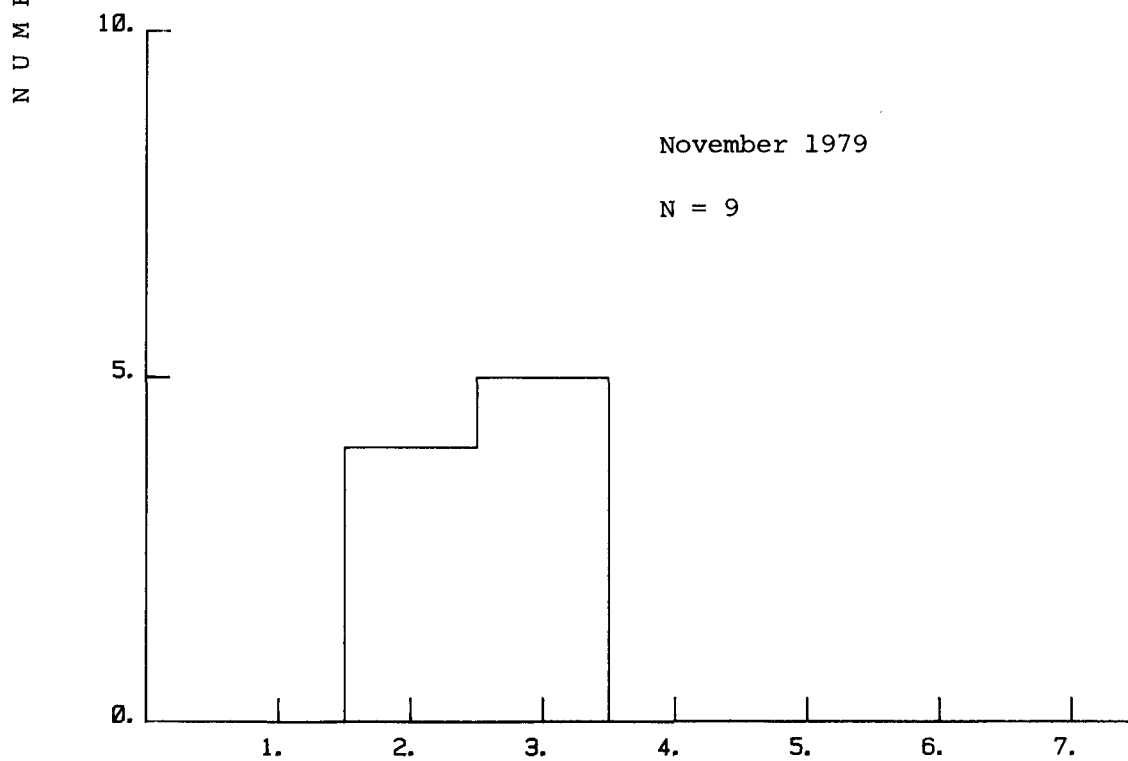
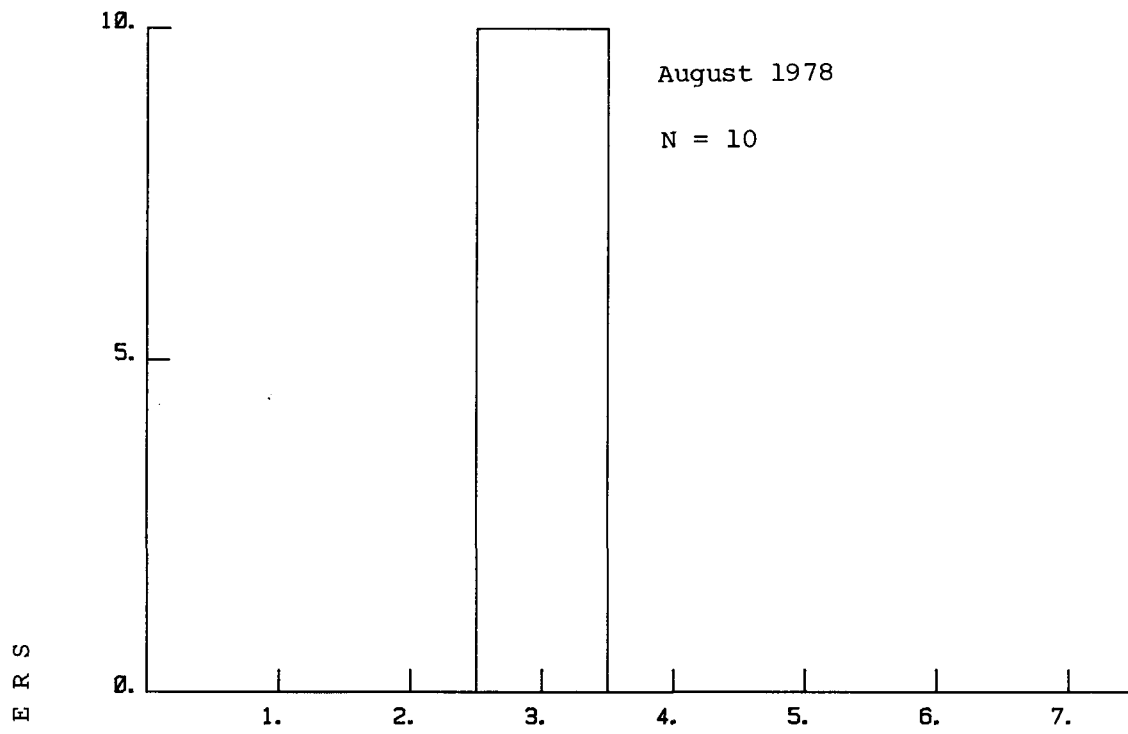


PONAPE
YELLOWFIN



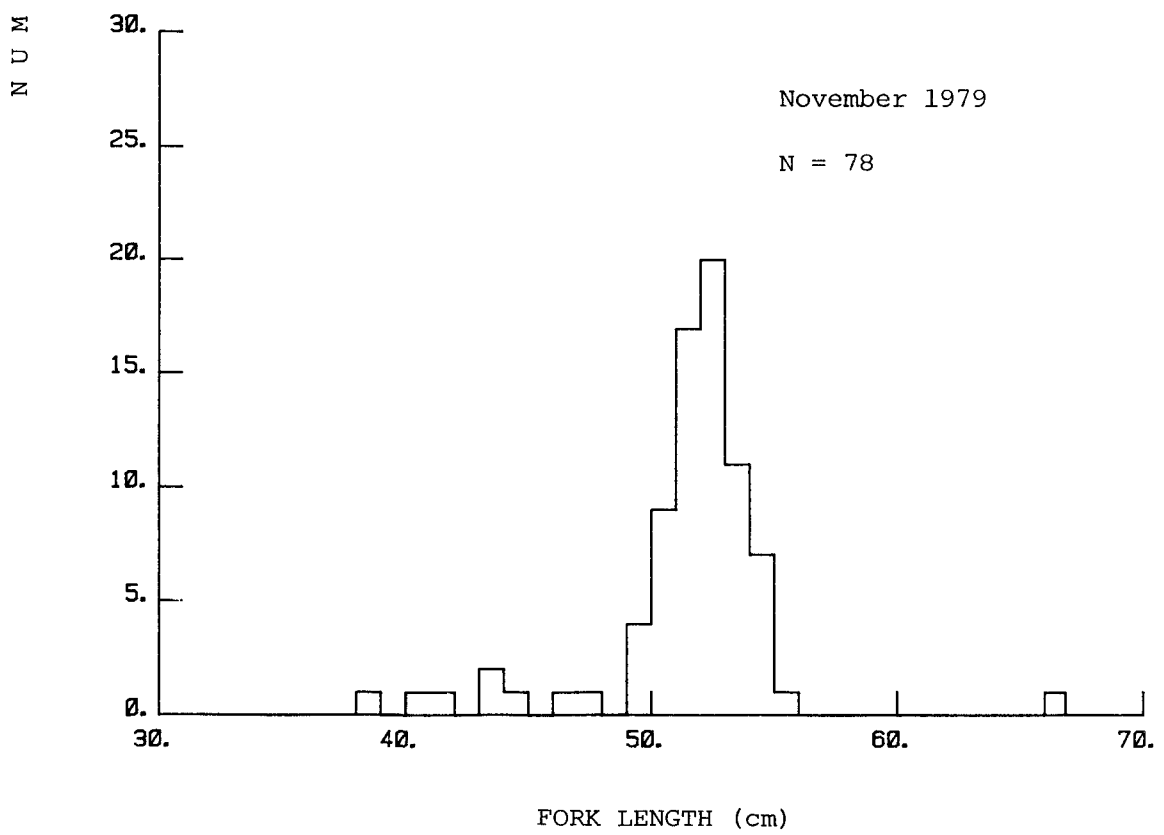
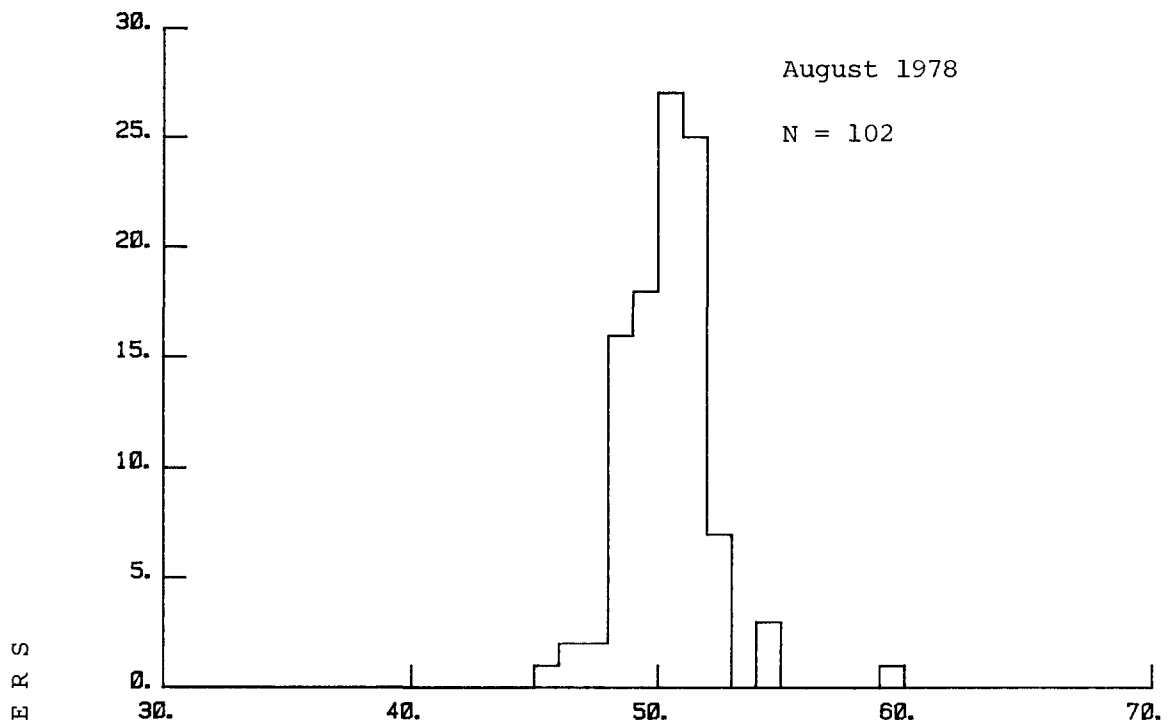
FORK LENGTH (cm)

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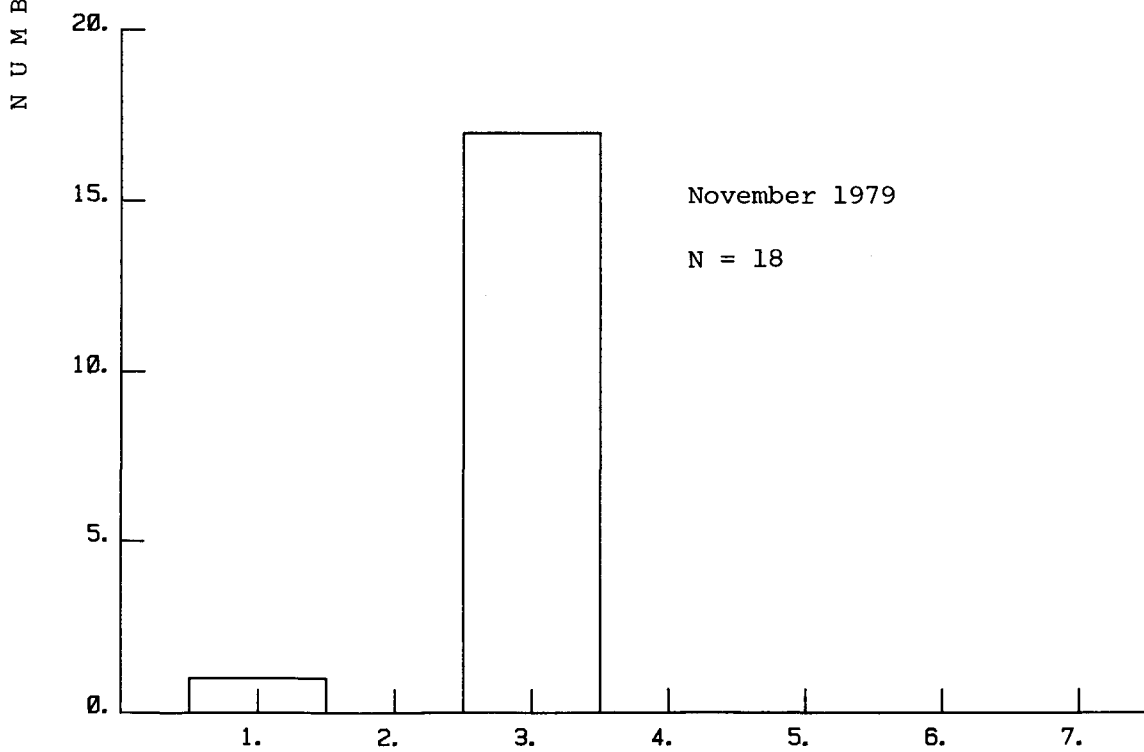
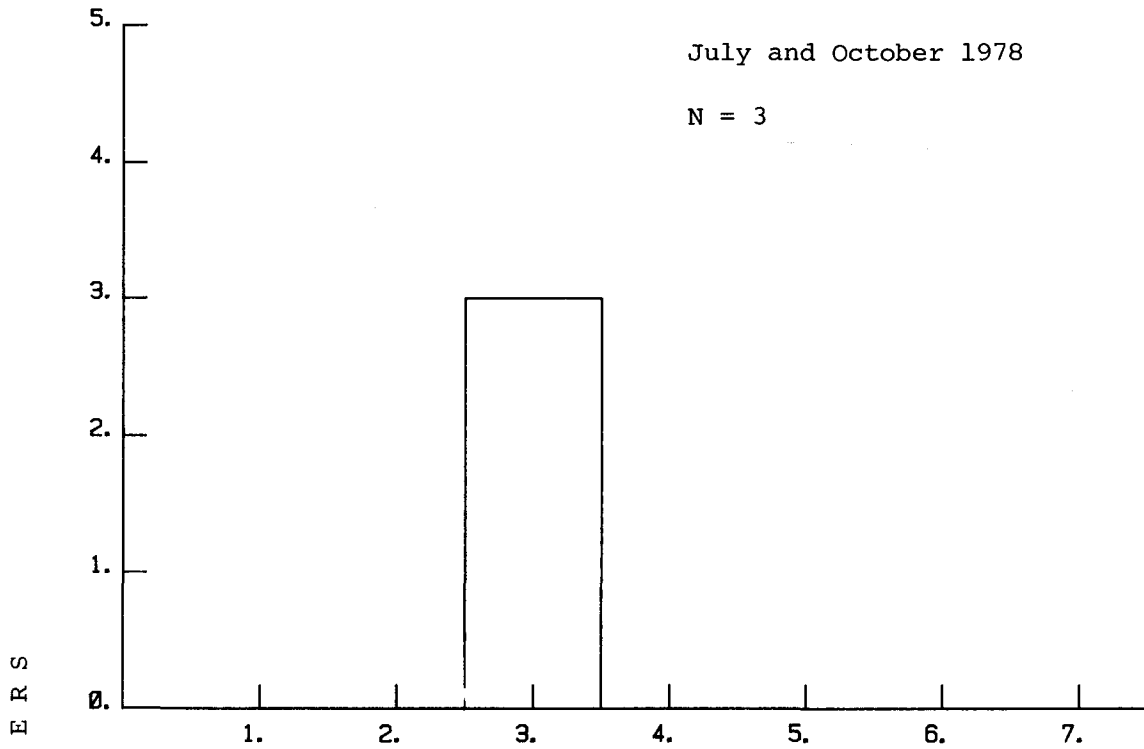


FEMALE SKIPJACK GONAD MATURITY STAGE

TRUK
SKIPJACK



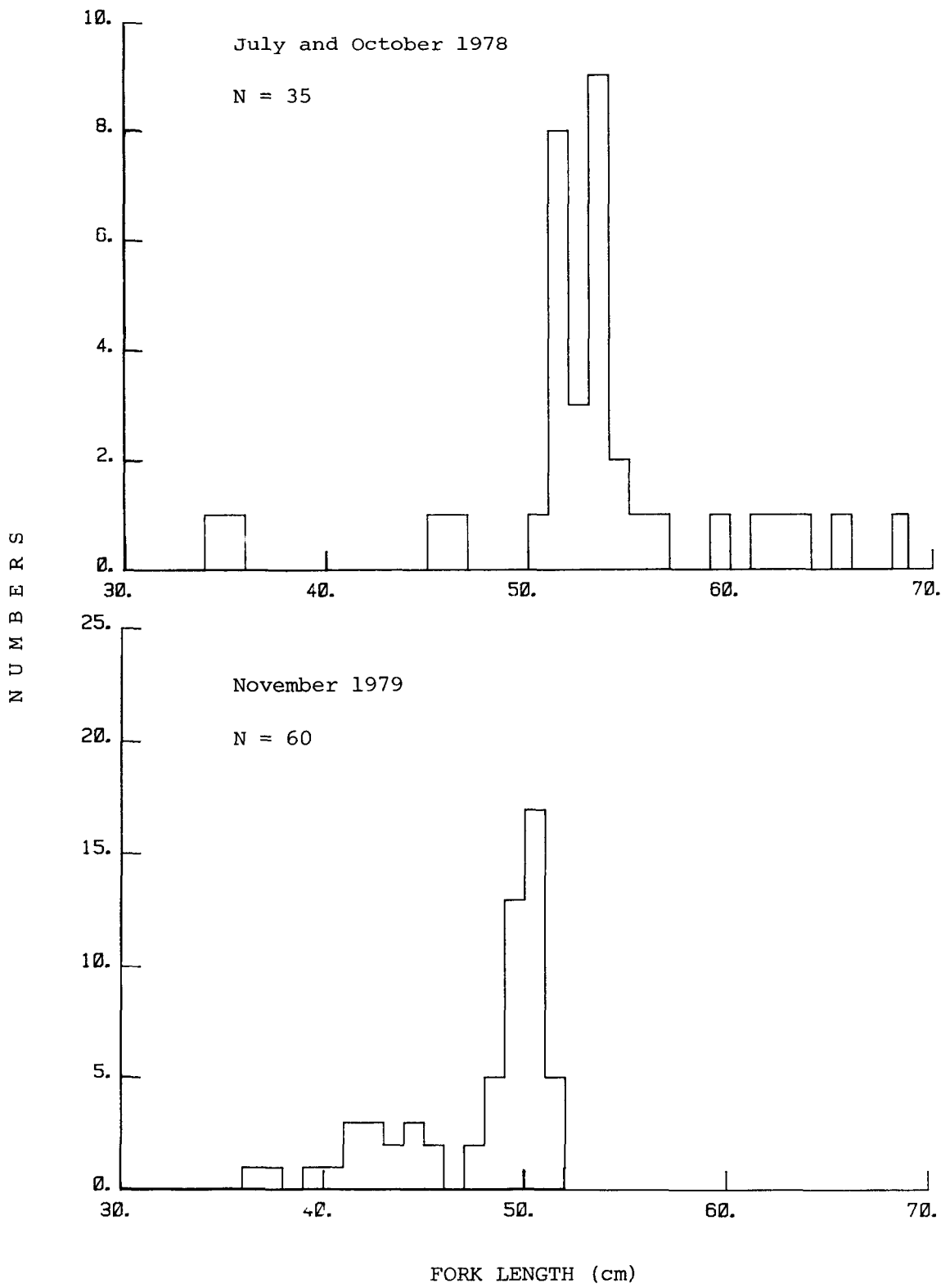
MARIANA ISLANDS



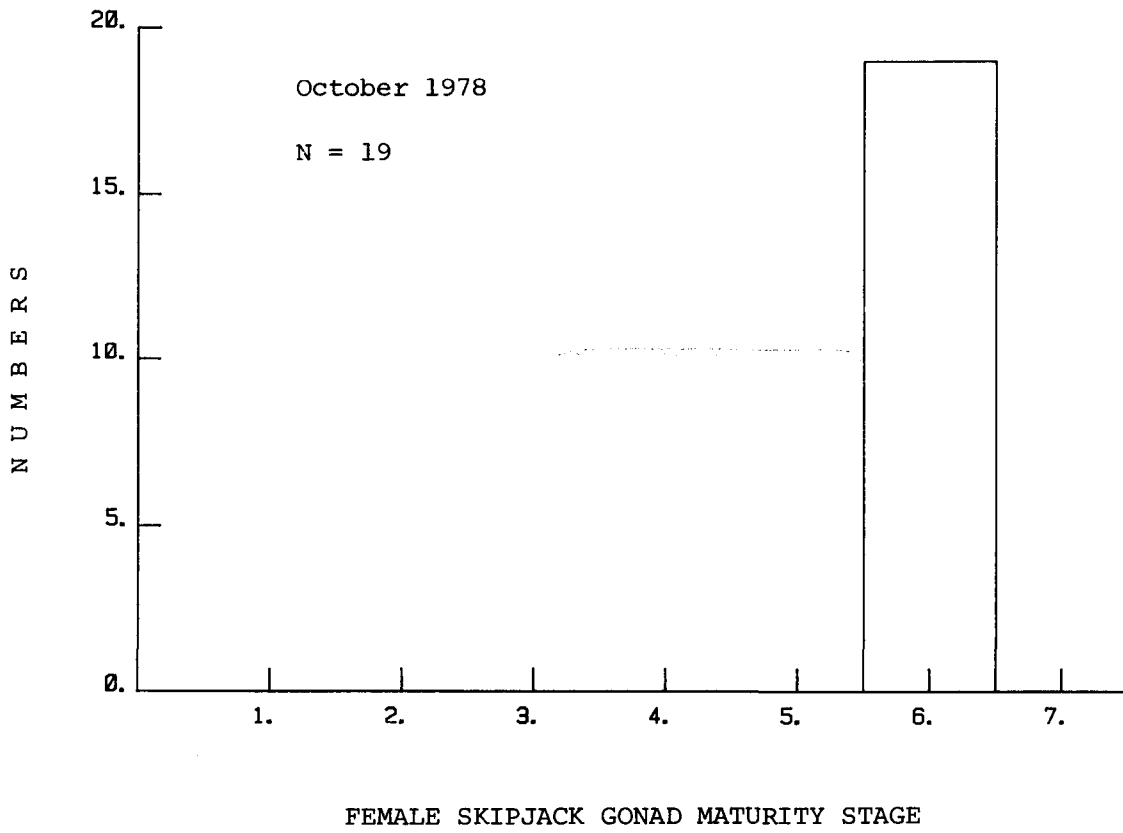
FEMALE SKIPJACK GONAD MATURITY STAGE

MARIANA ISLANDS

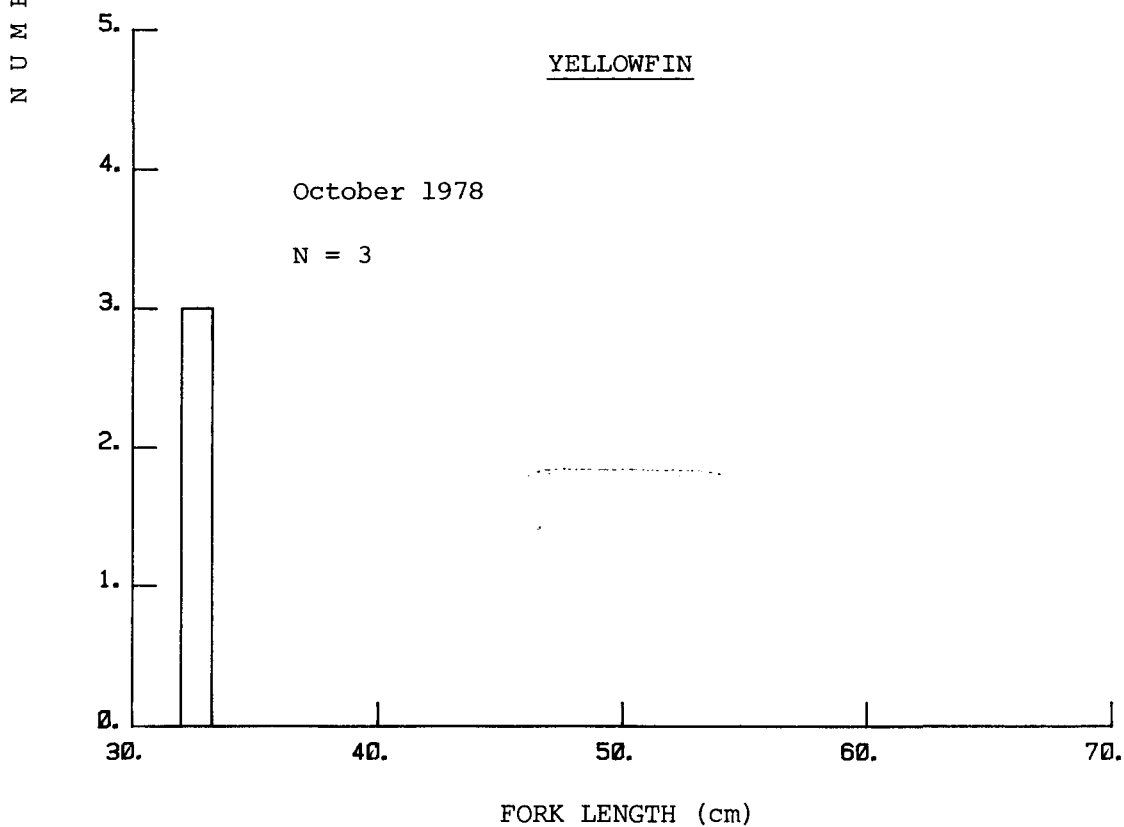
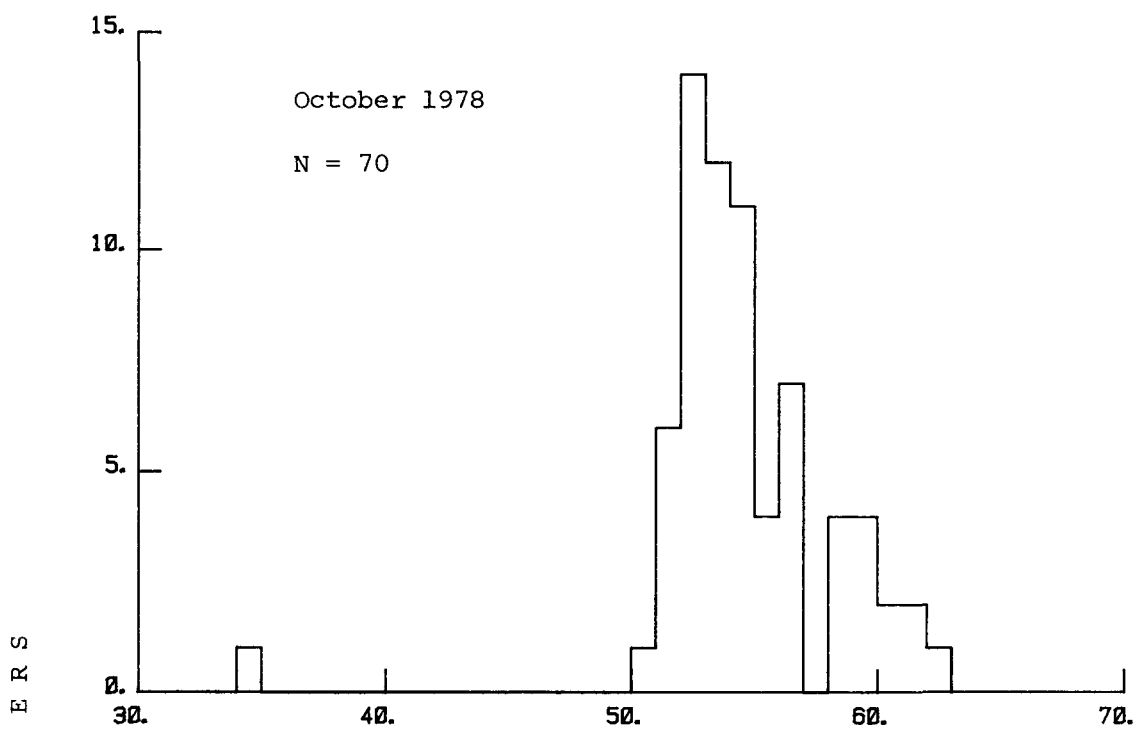
SKIPJACK



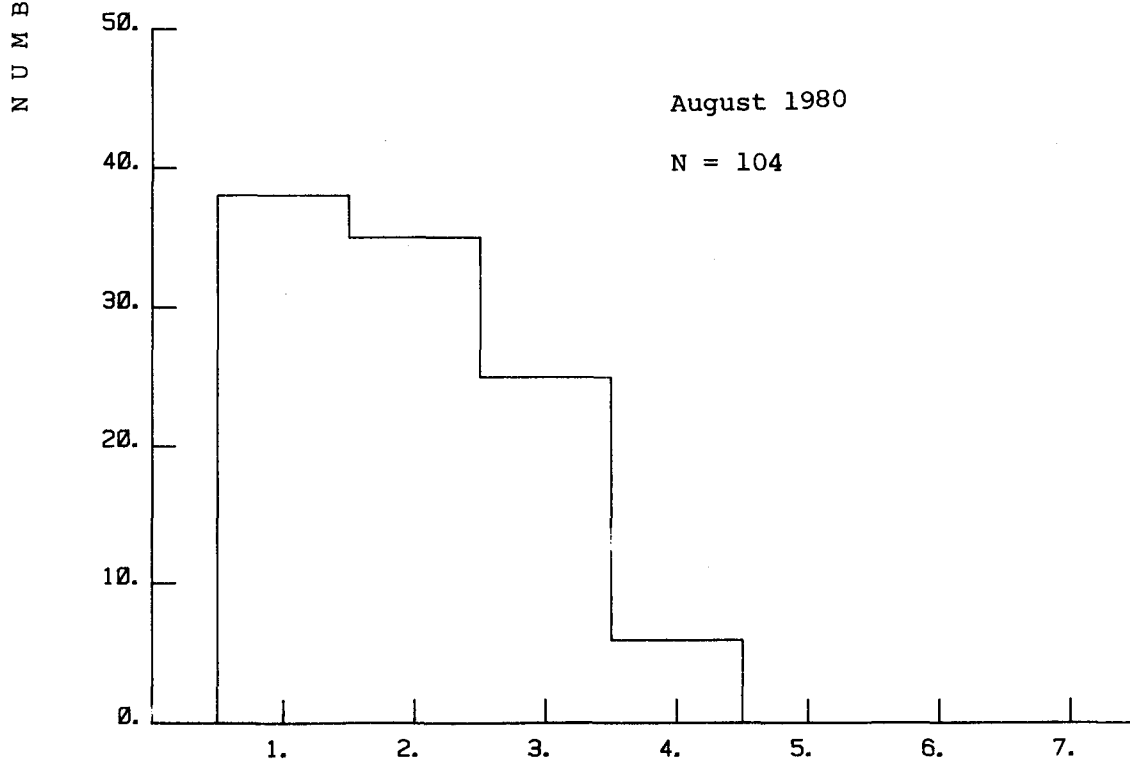
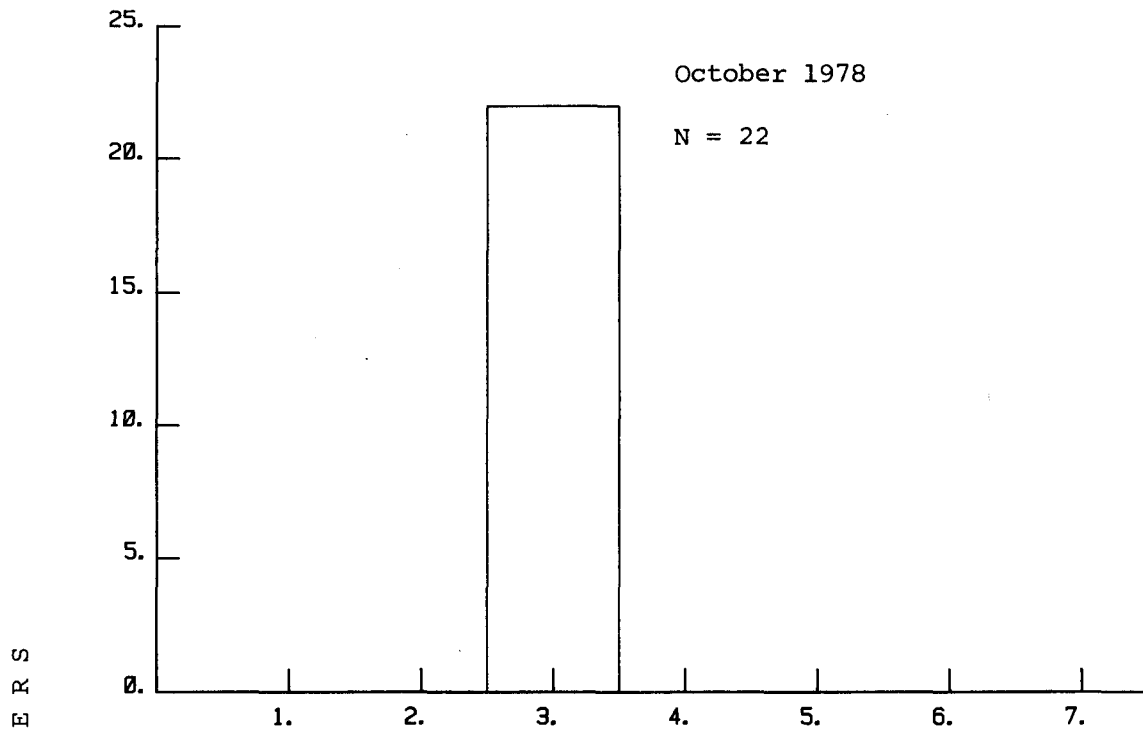
YAP



YAP
SKIPJACK

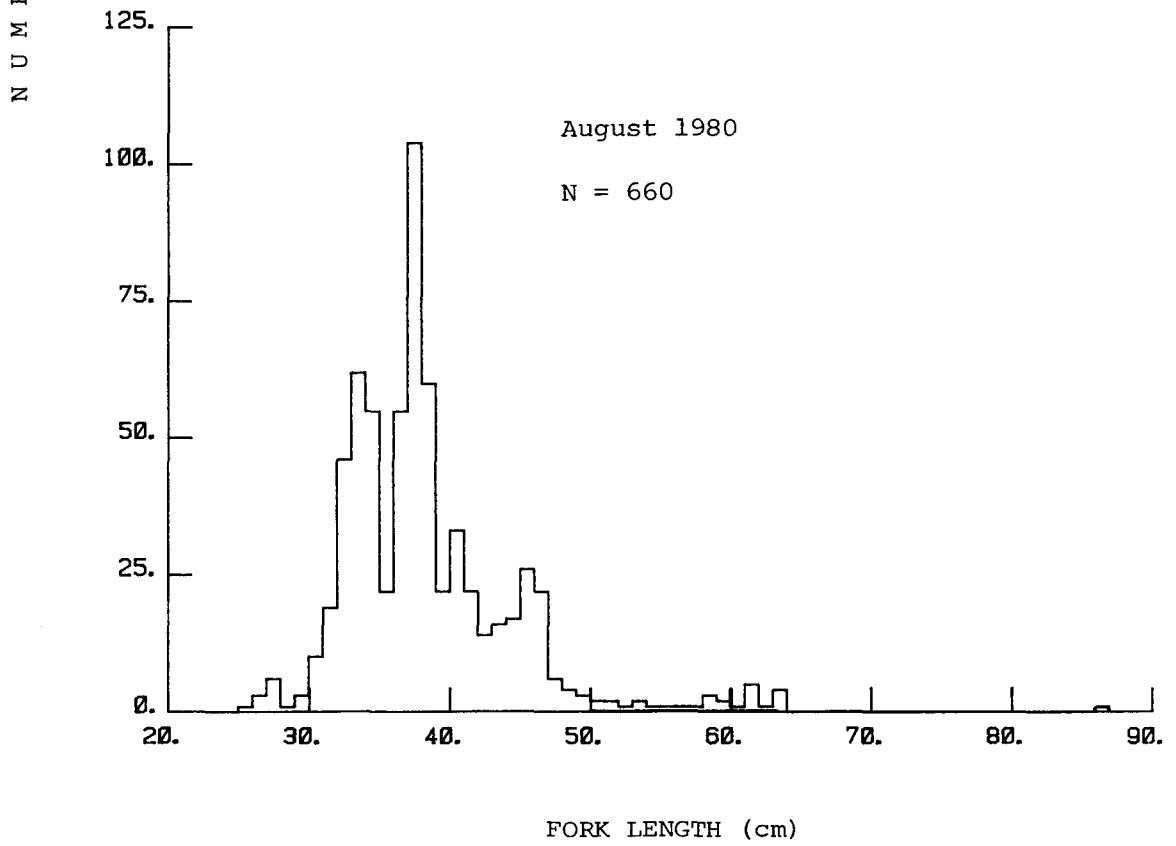
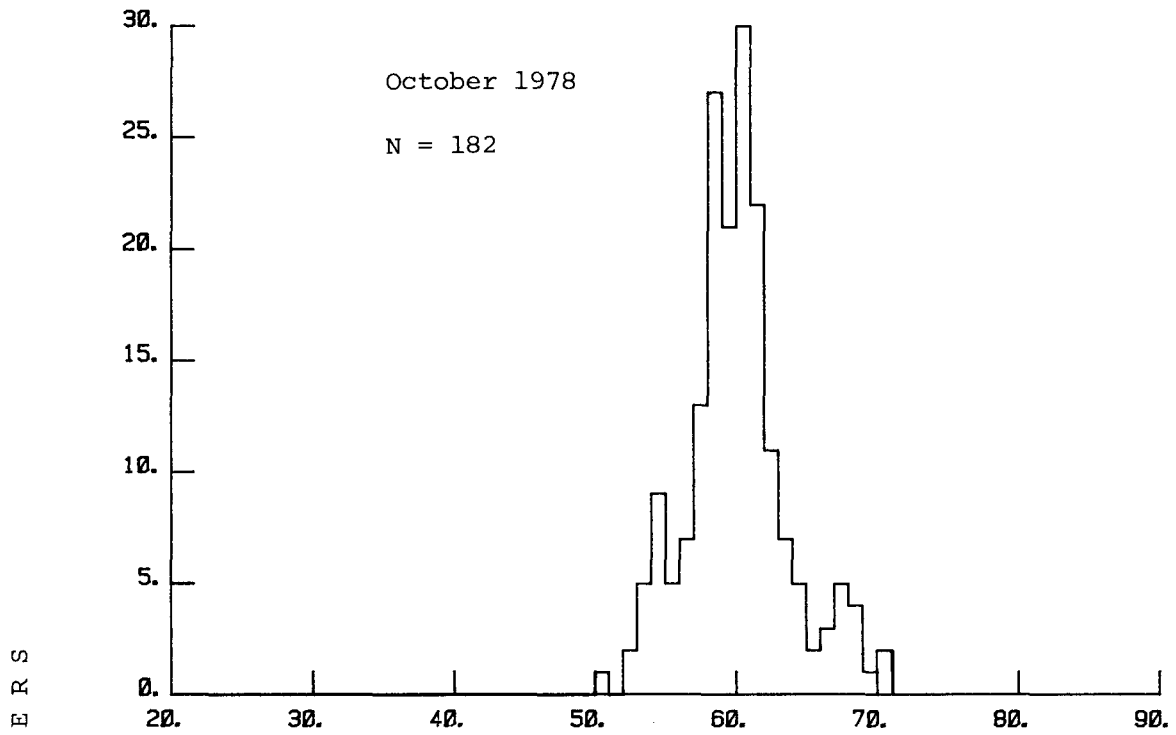


PALAU

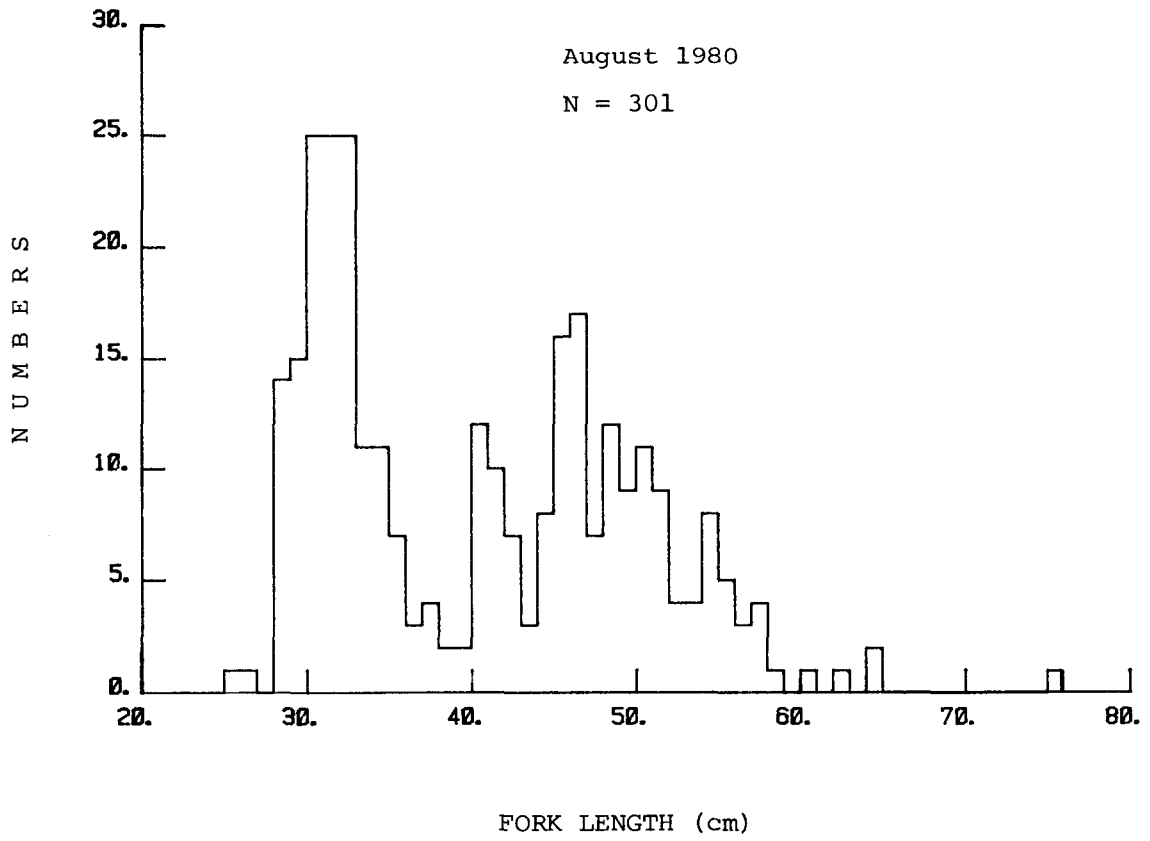


FEMALE SKIPJACK GONAD MATURITY STAGE

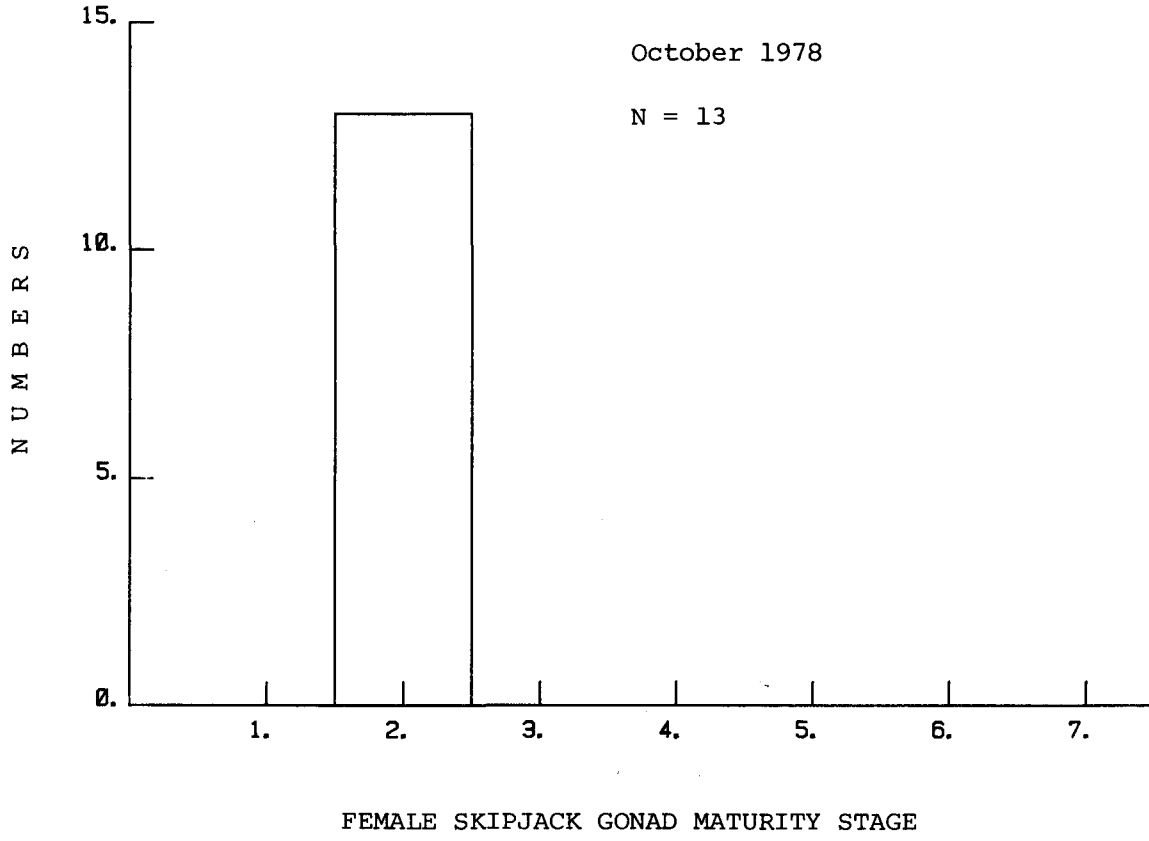
PALAU
SKIPJACK



PALAU
YELLOWFIN

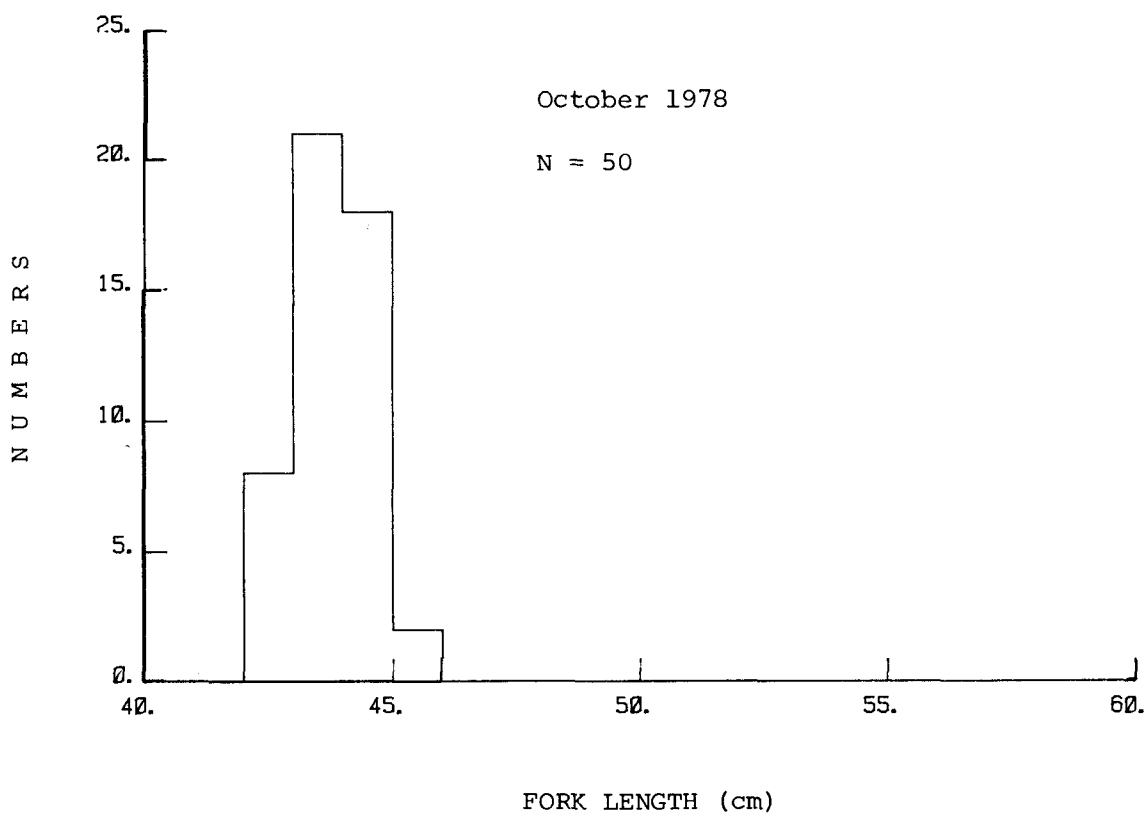


BONIN ISLAND

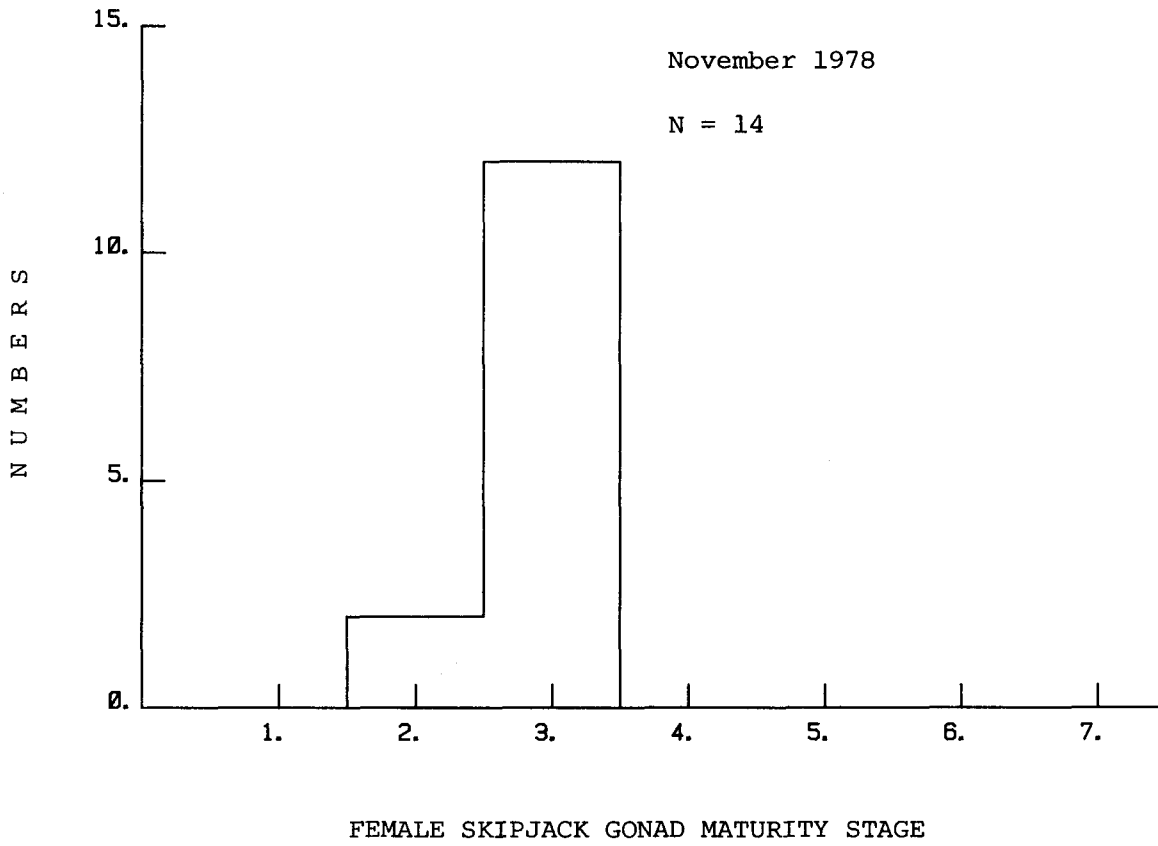


BONIN ISLAND

SKIPJACK

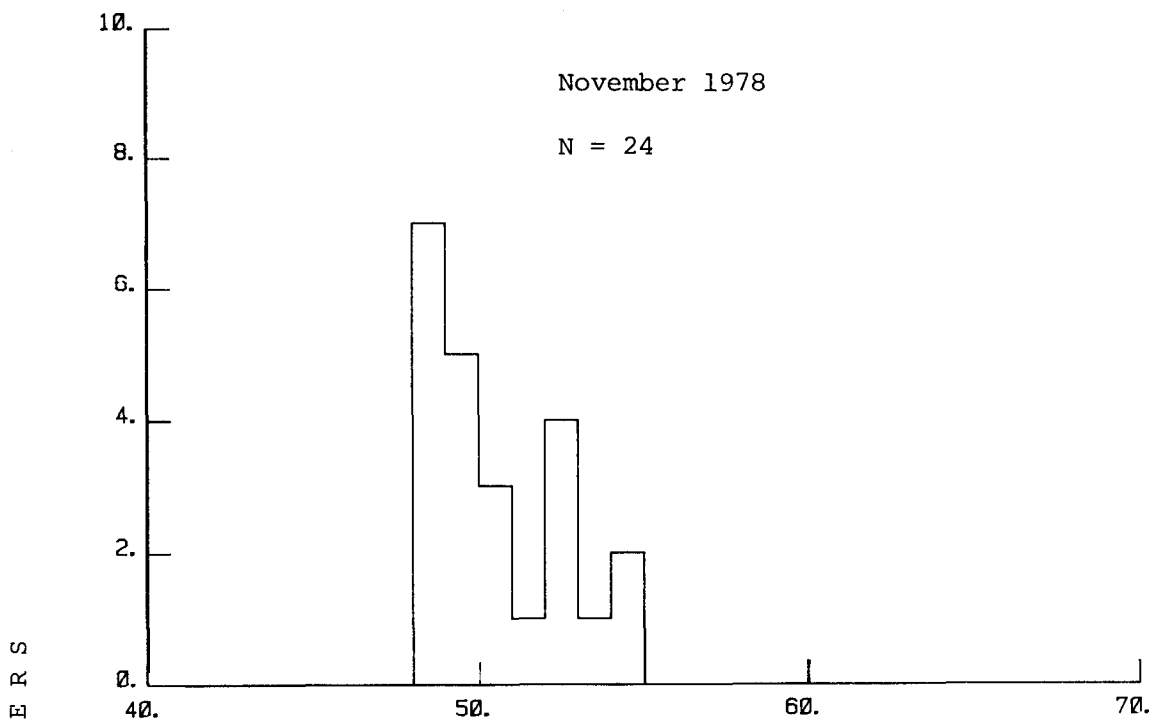


TOKELAU



TOKELAU

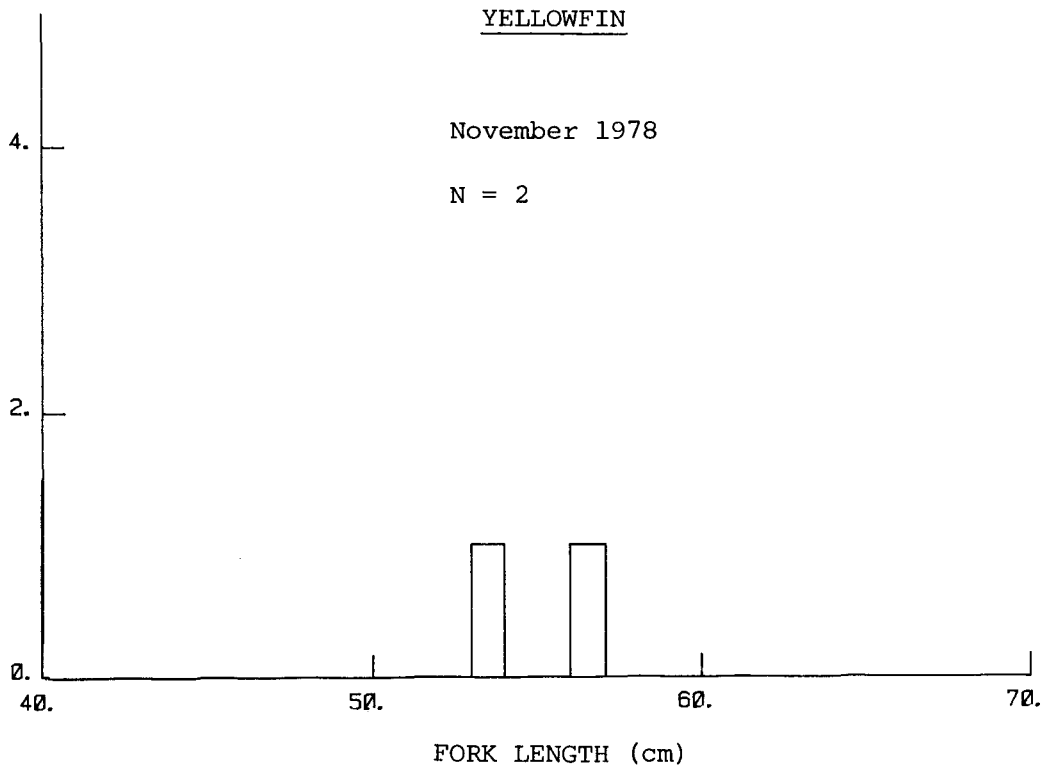
SKIPJACK



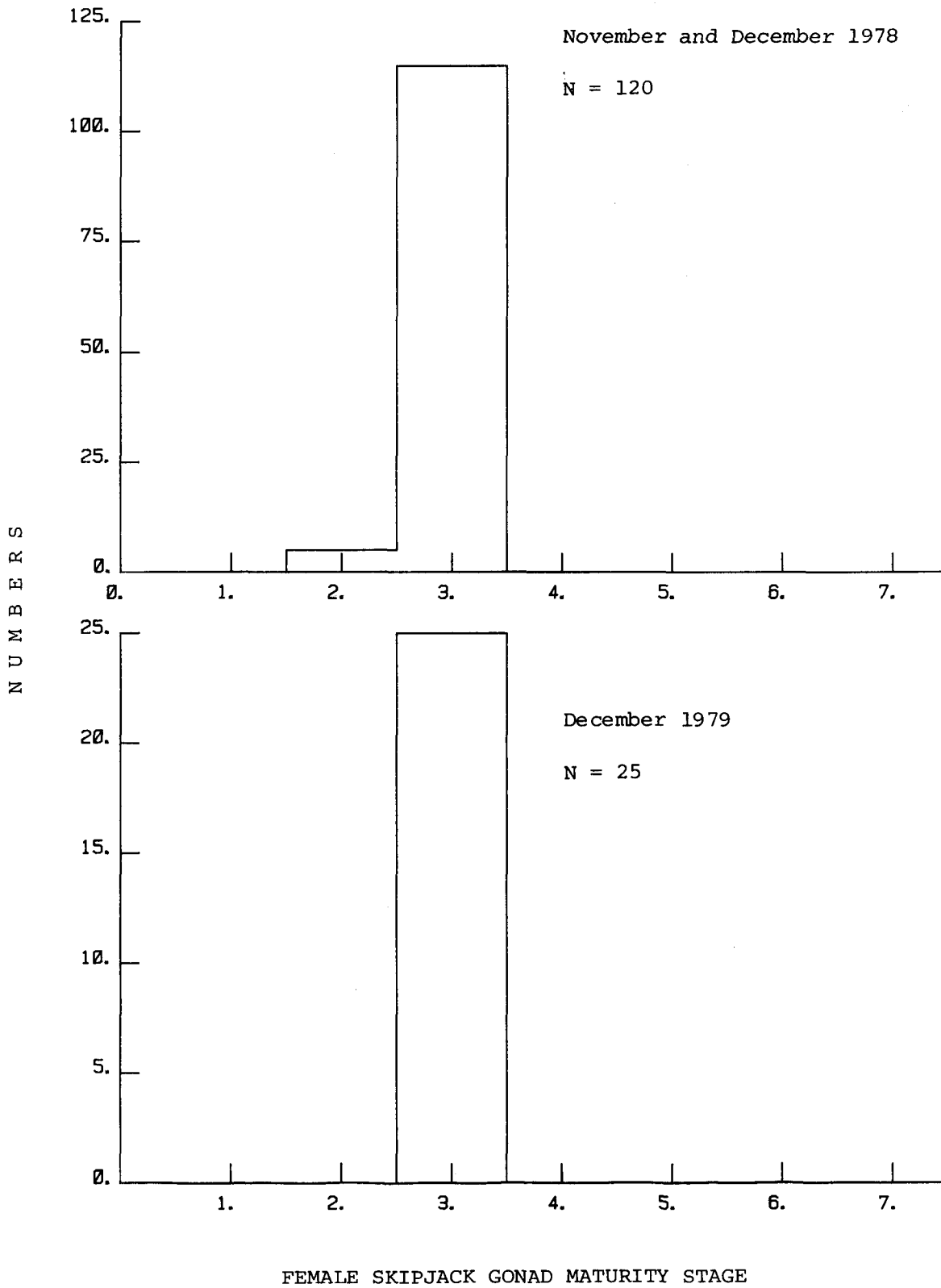
YELLOWFIN

November 1978

N = 2

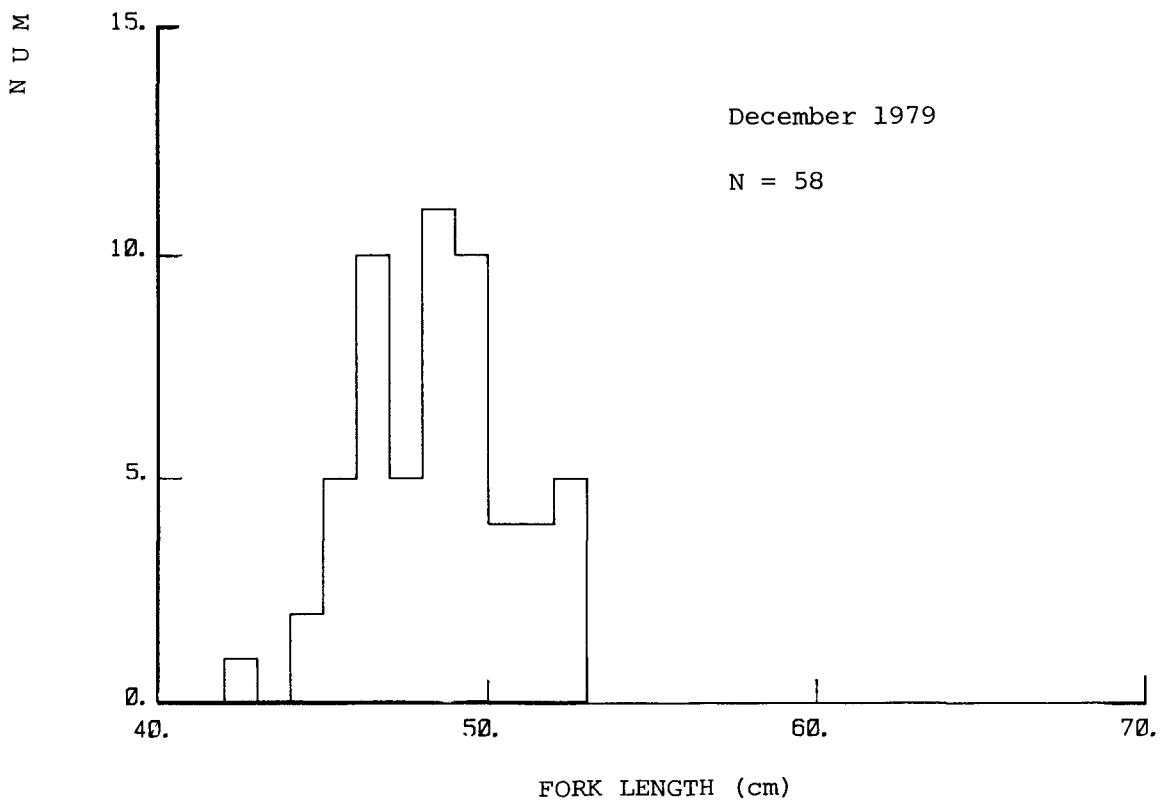
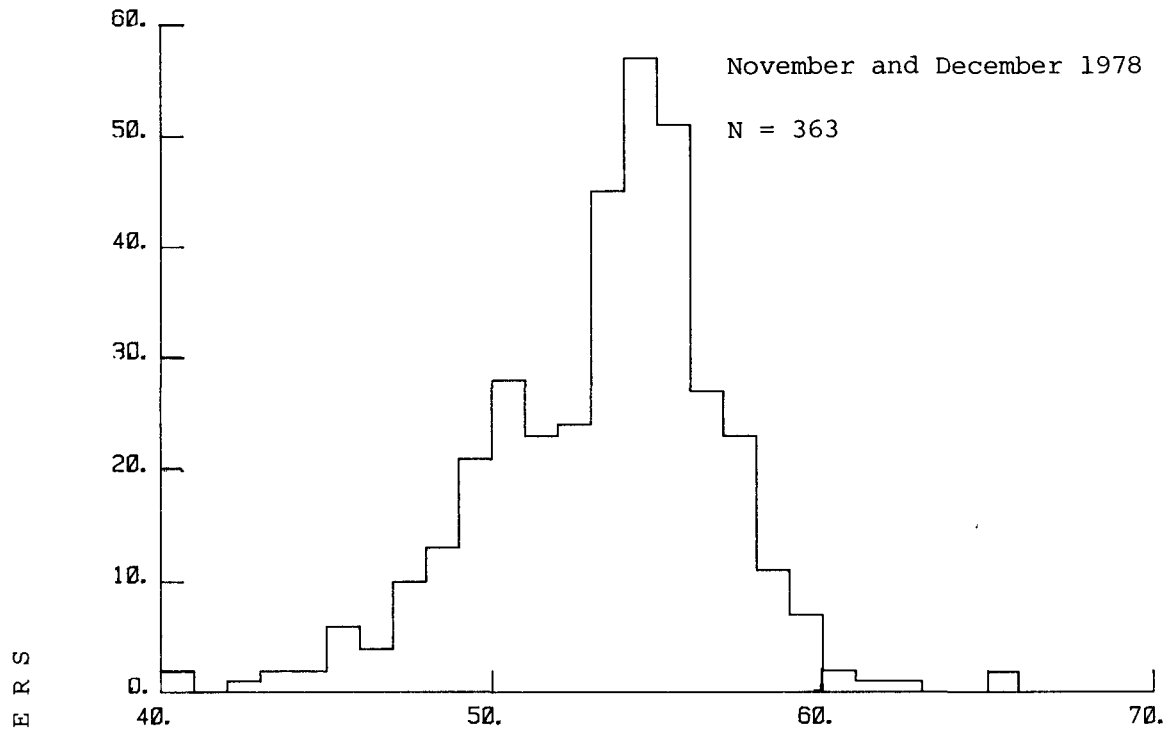


COOK ISLANDS



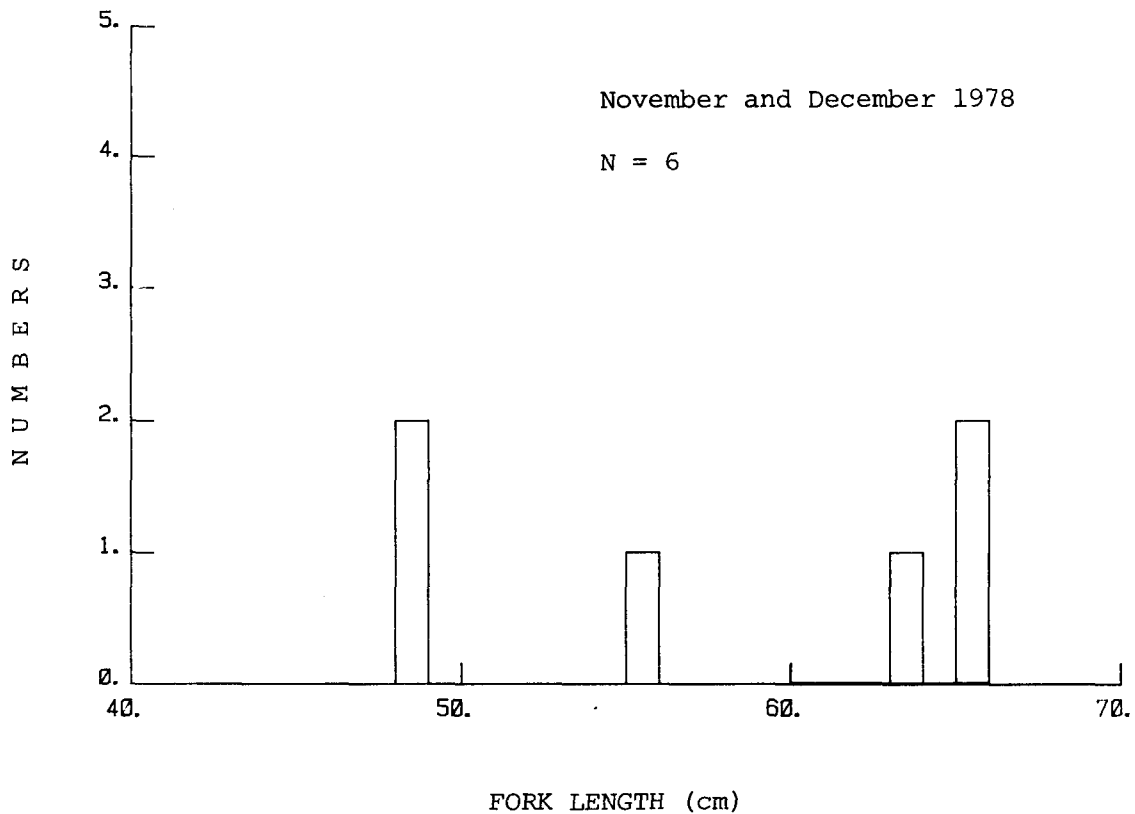
COOK ISLANDS

SKIPJACK

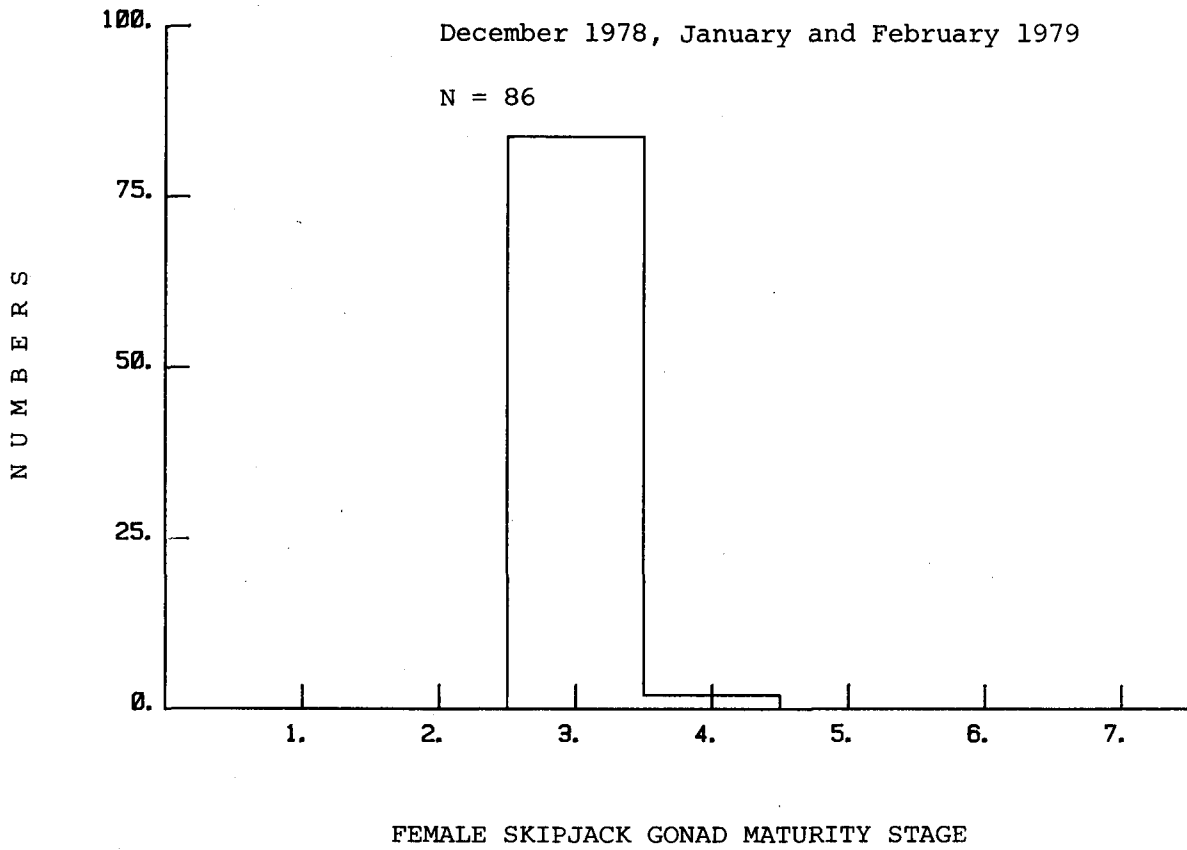


COOK ISLANDS

YELLOWFIN

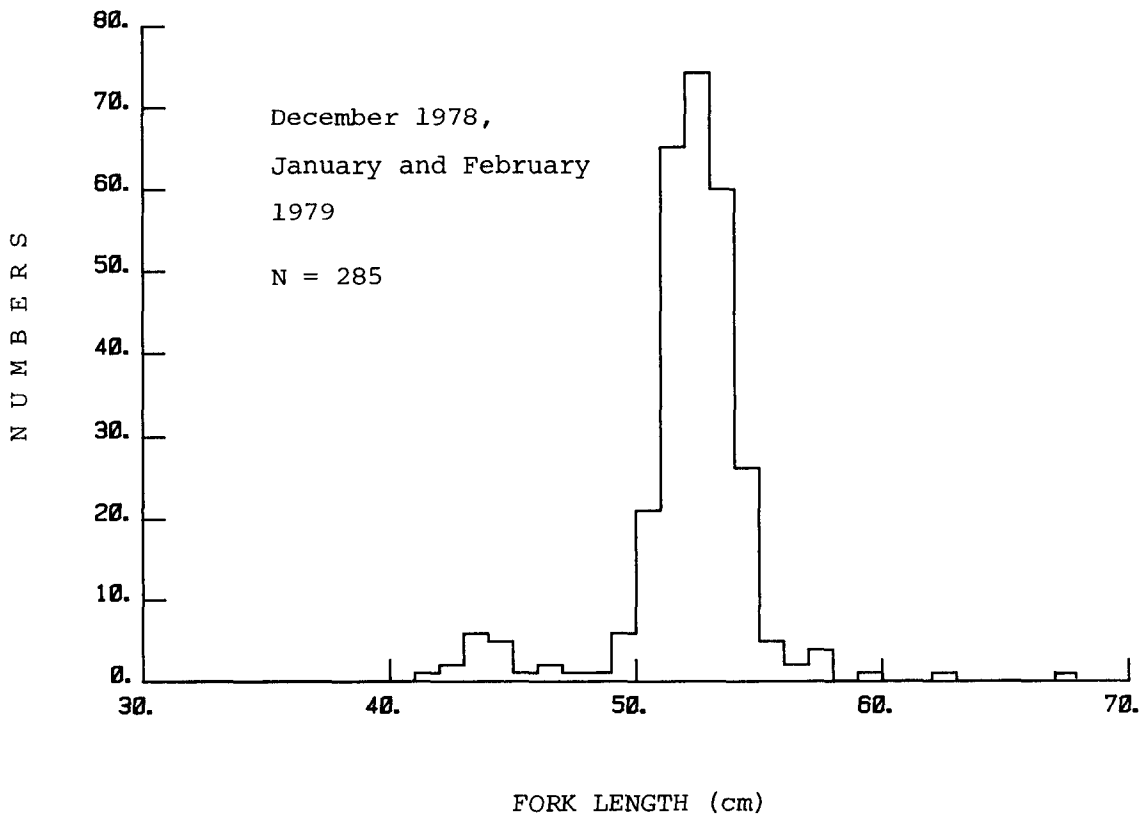


SOCIETY ISLANDS



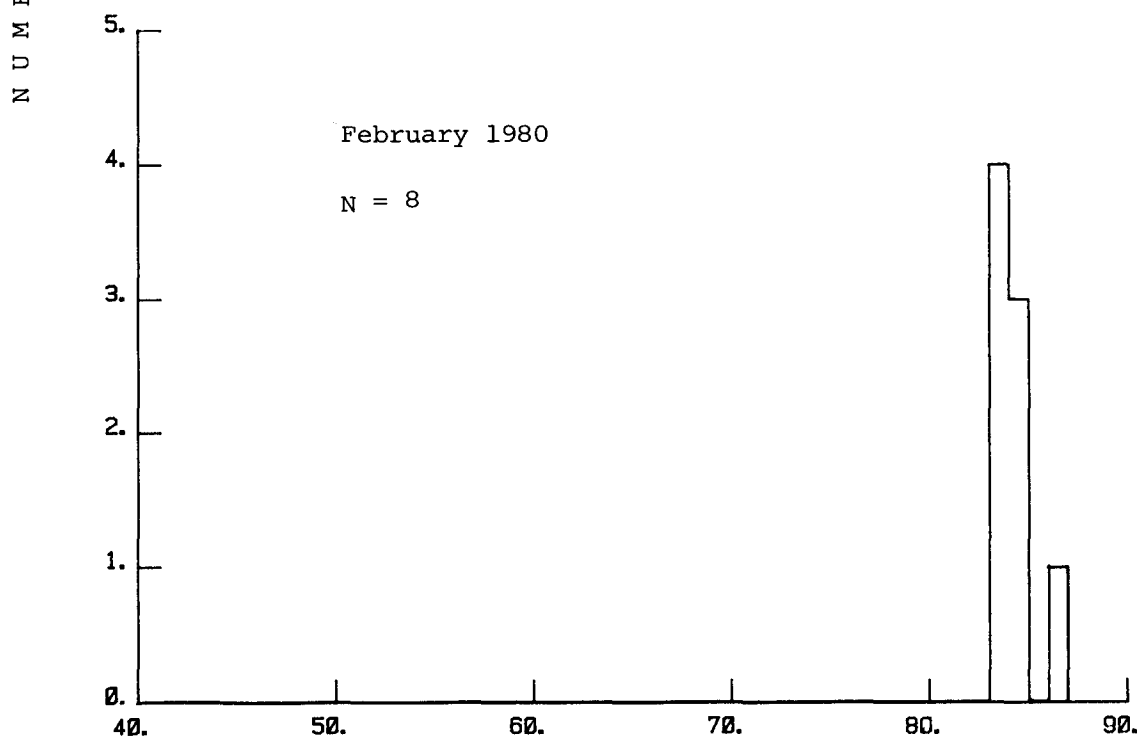
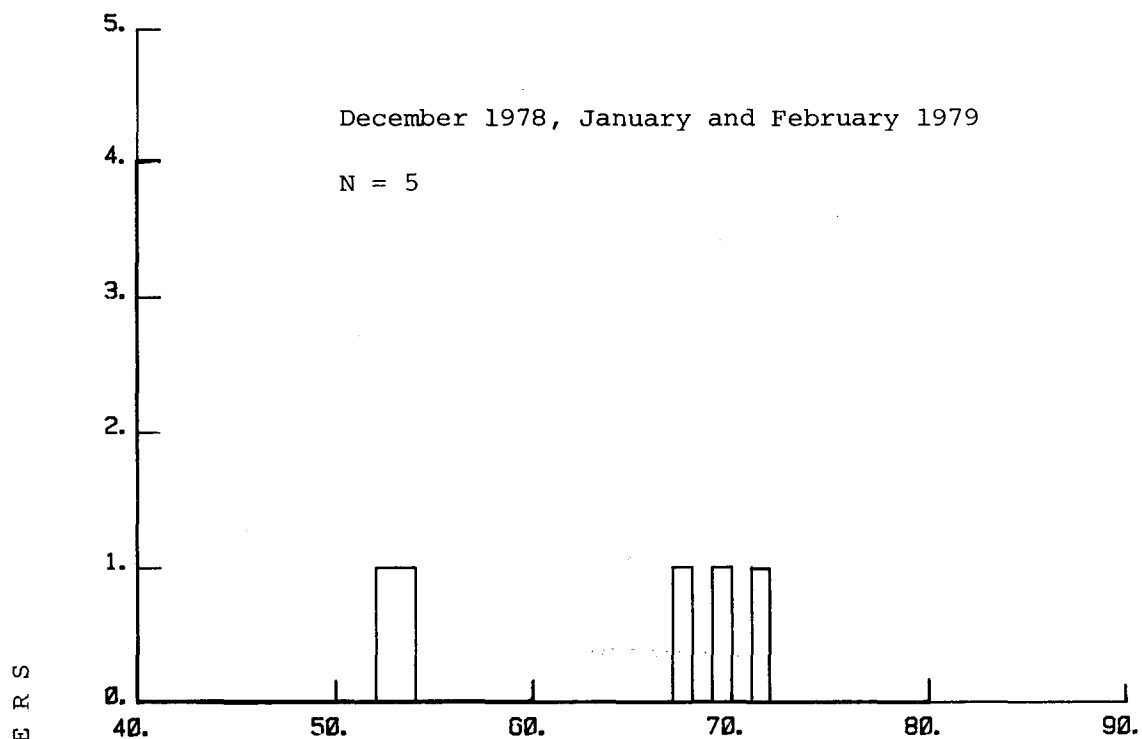
SOCIETY ISLANDS

SKIPJACK



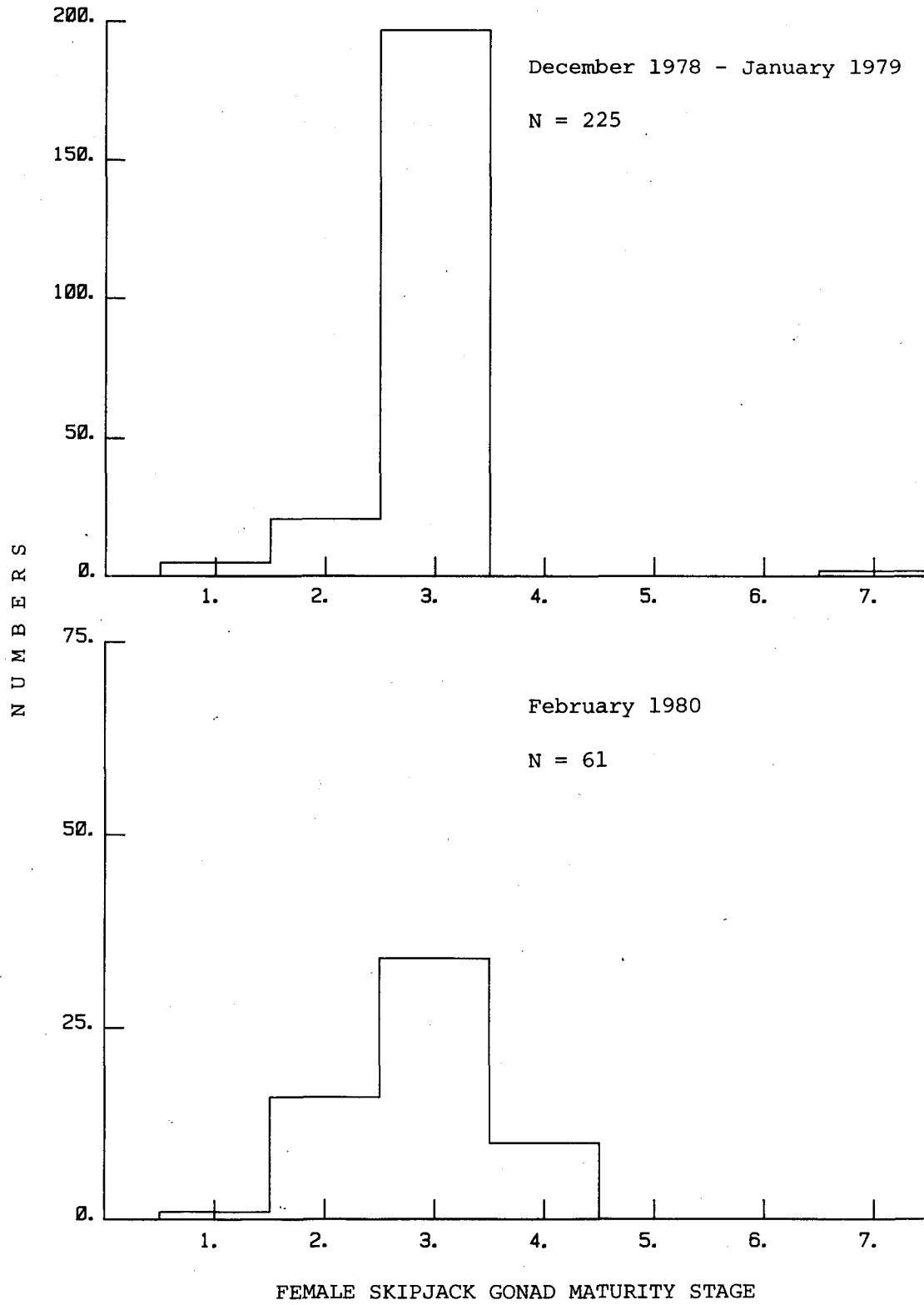
SOCIETY ISLANDS

YELLOWFIN



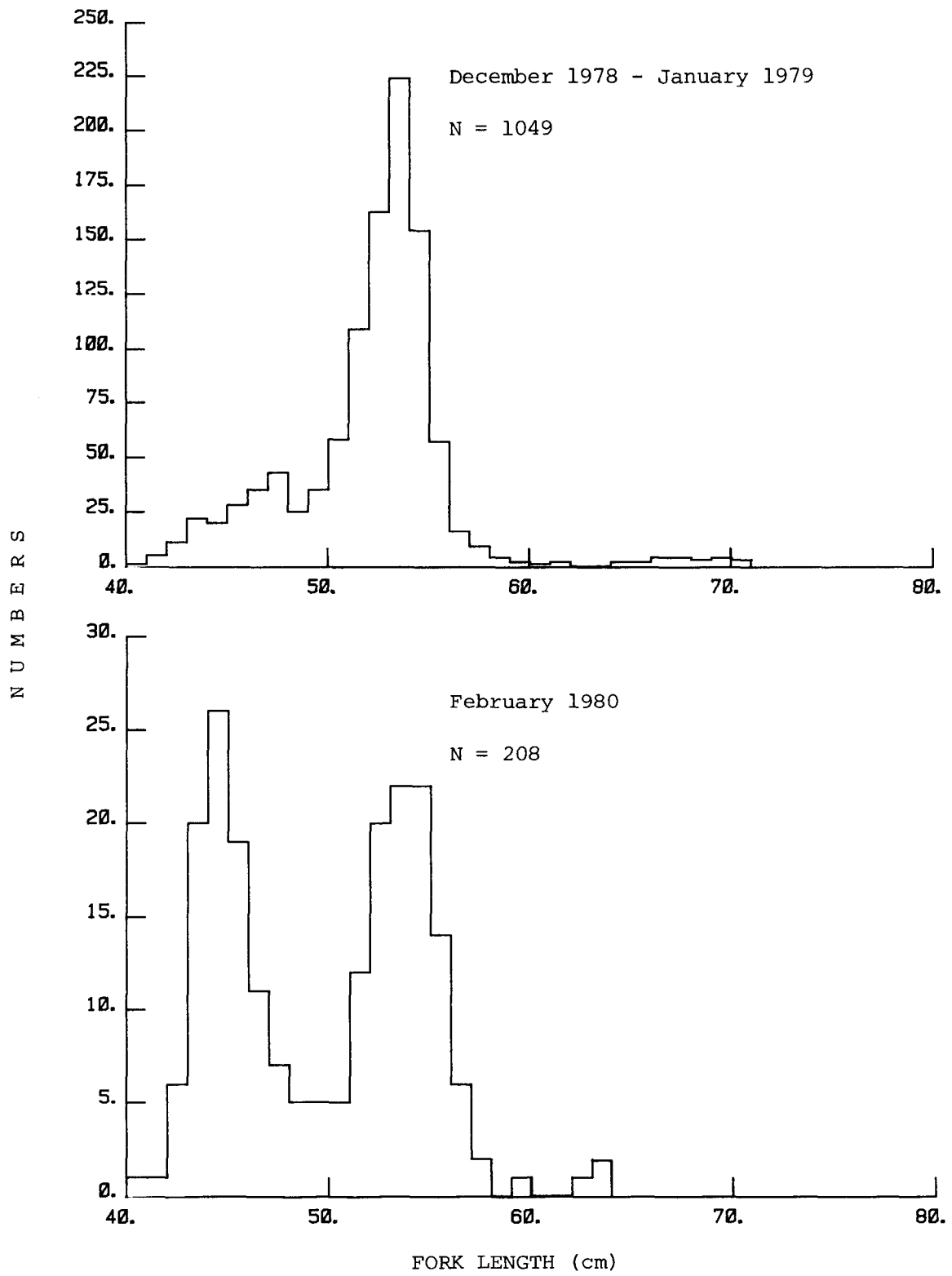
FORK LENGTH (cm)

TUAMOTU ARCHIPELAGO



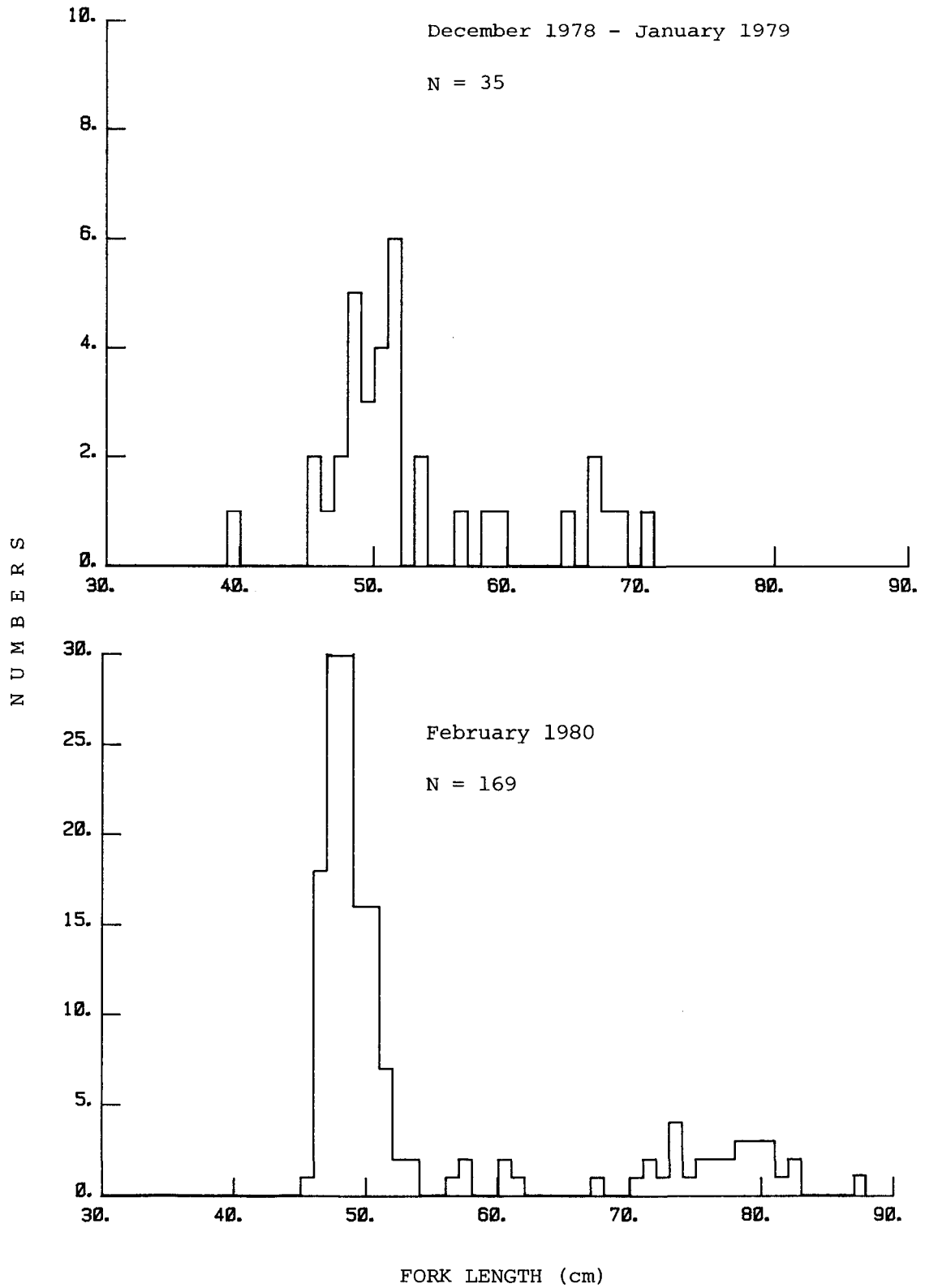
TUAMOTU ARCHIPELAGO

SKIPJACK

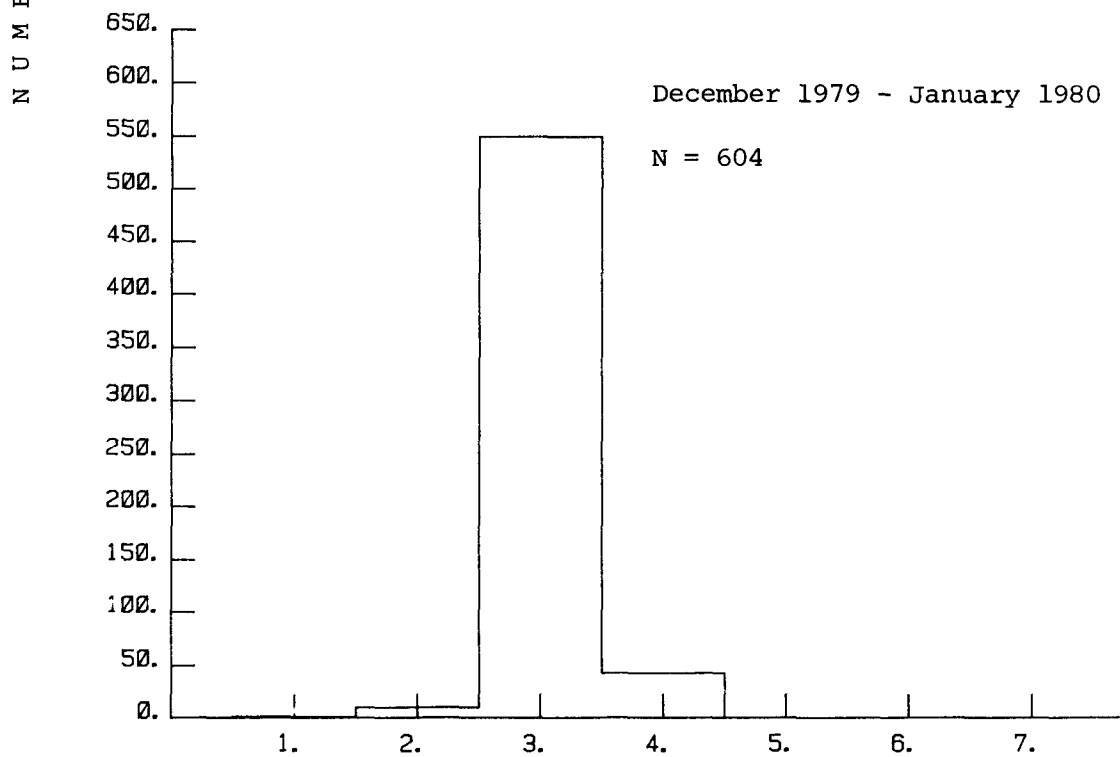
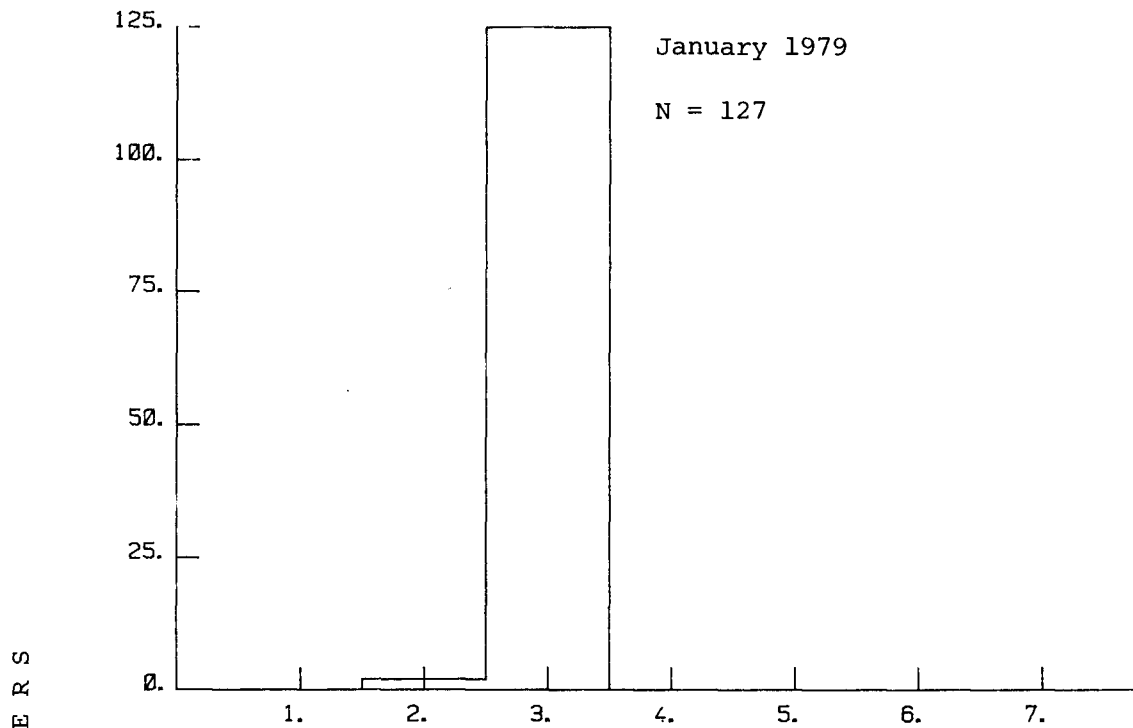


TUAMOTU ARCHIPELAGO

YELLOWFIN



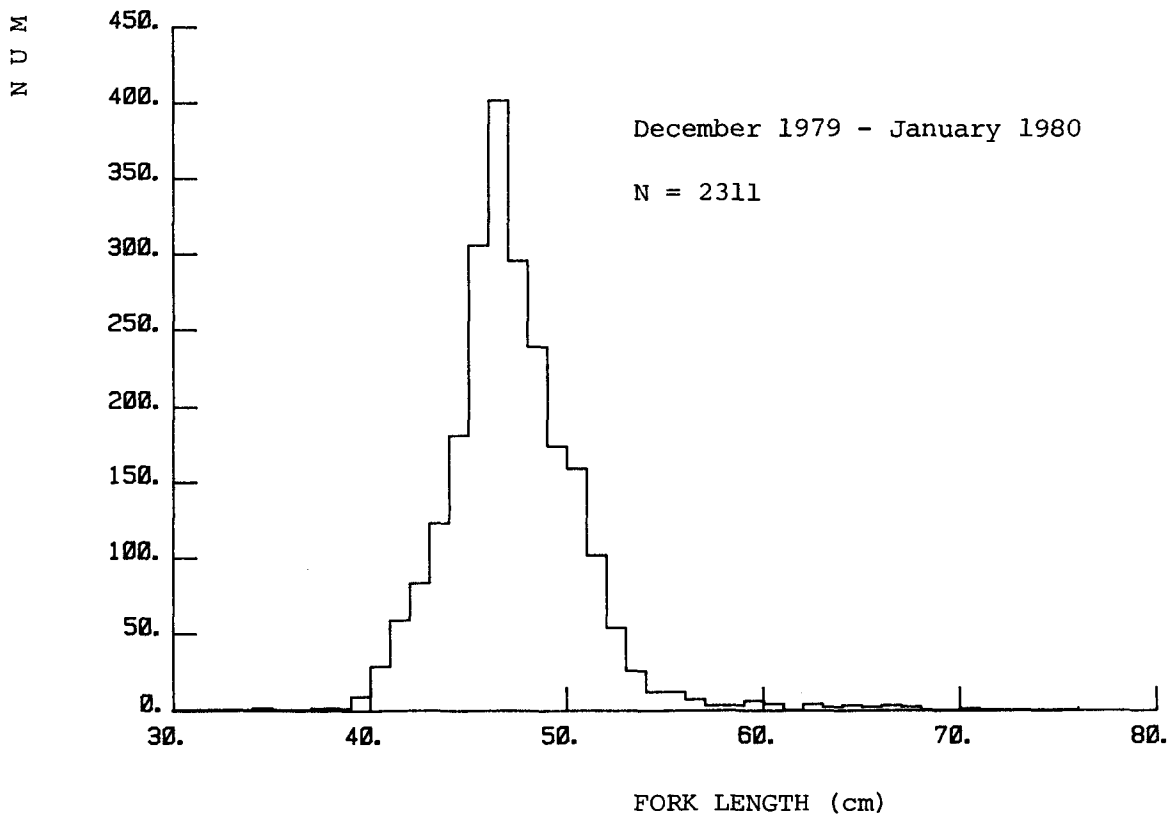
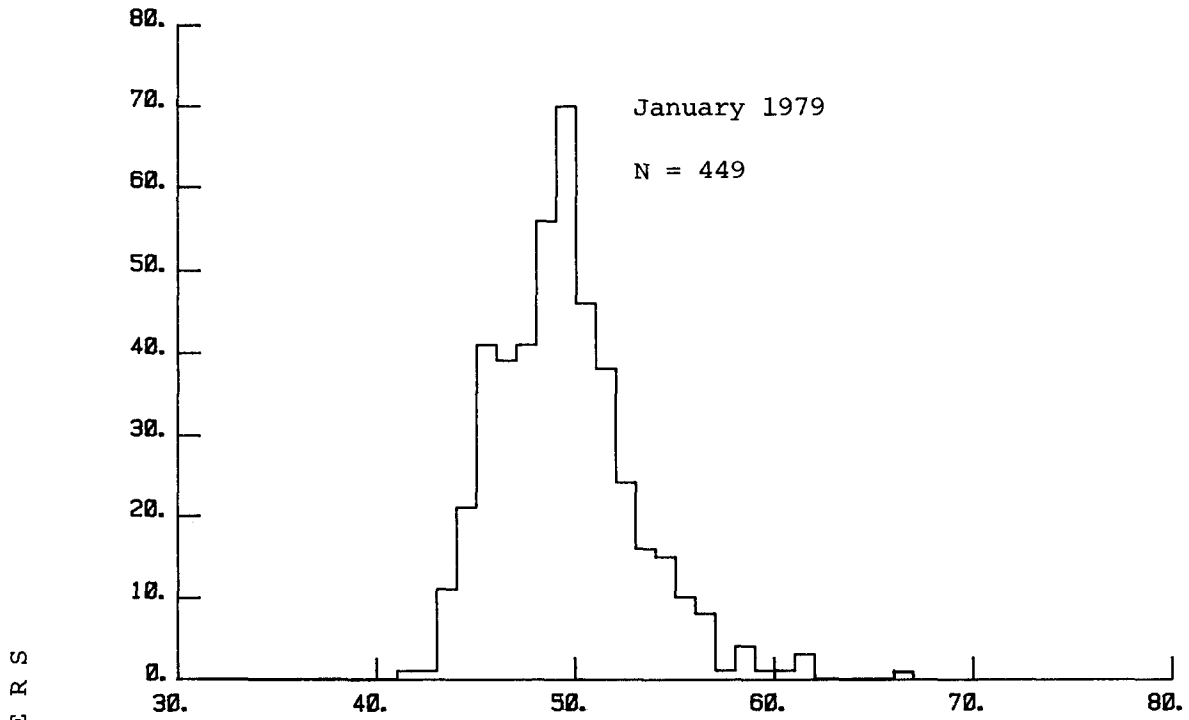
MARQUESAS ISLANDS



FEMALE SKIPJACK GONAD MATURITY STAGE

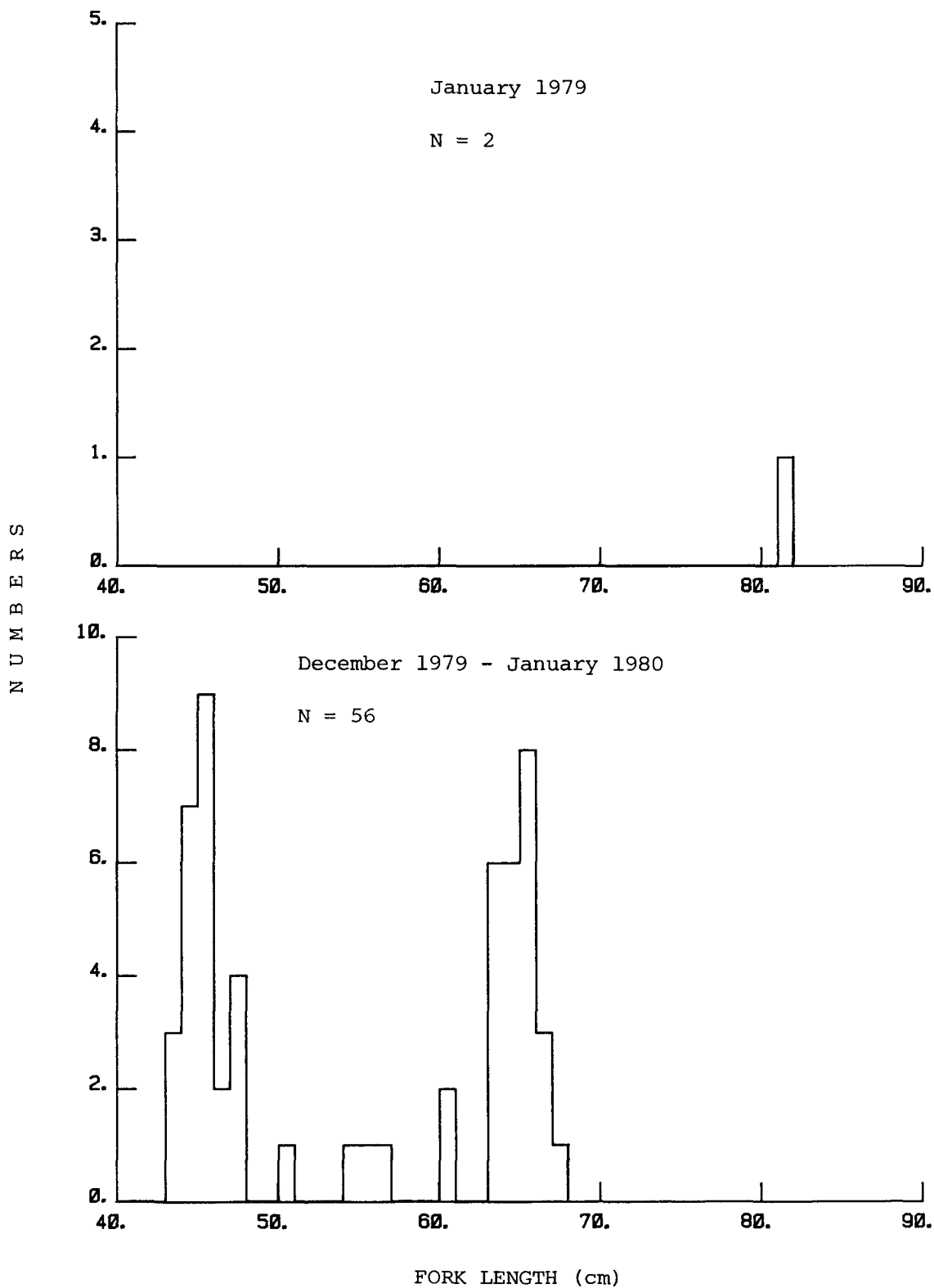
MARQUESAS ISLANDS

SKIPJACK

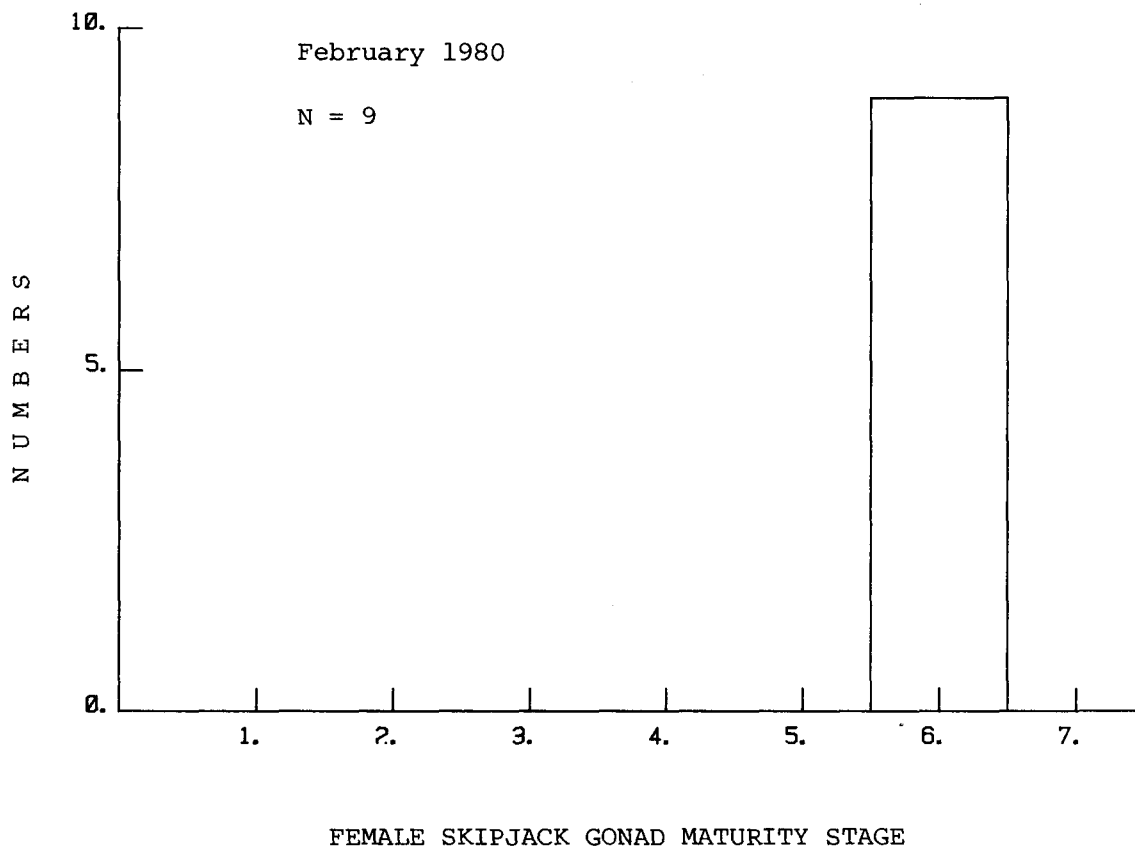


MARQUESAS ISLANDS

YELLOWFIN

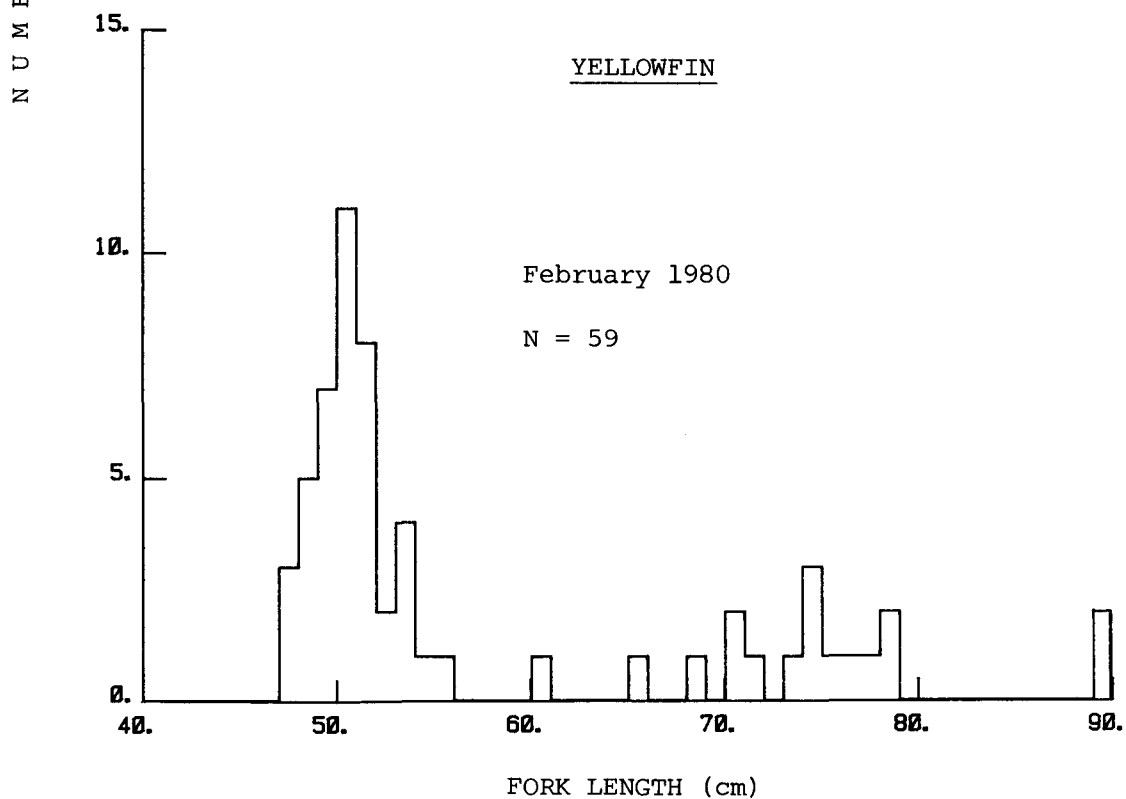
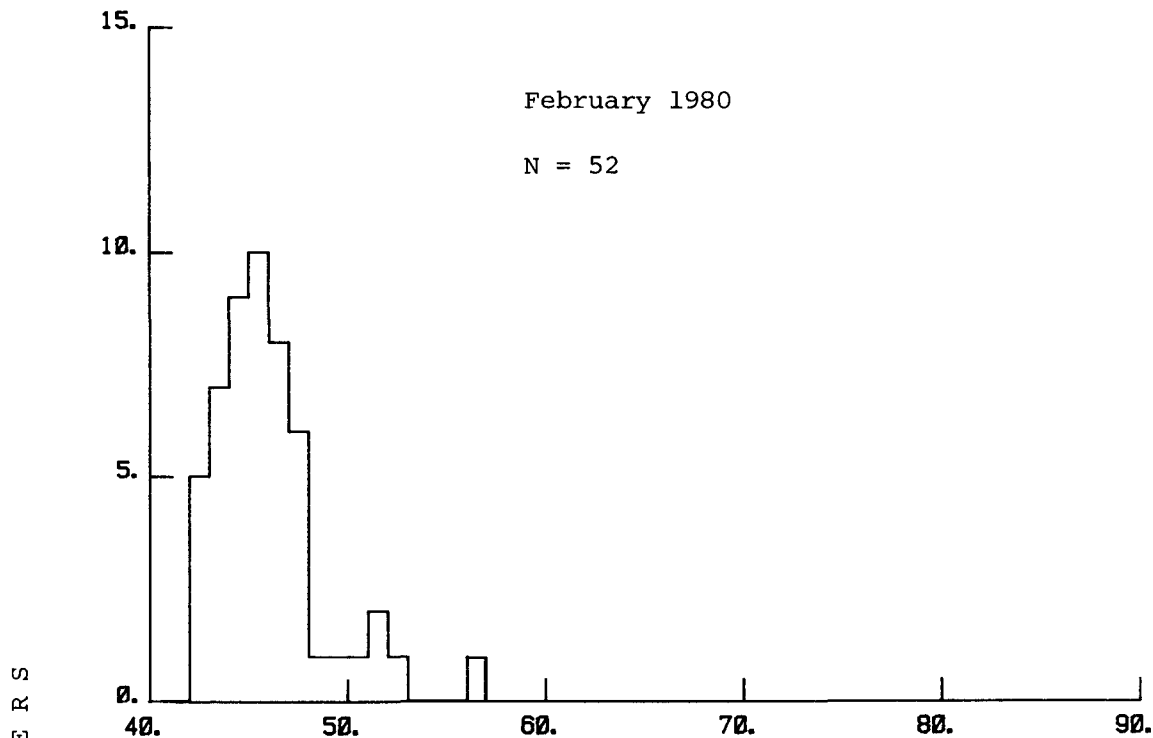


GAMBIER ISLANDS

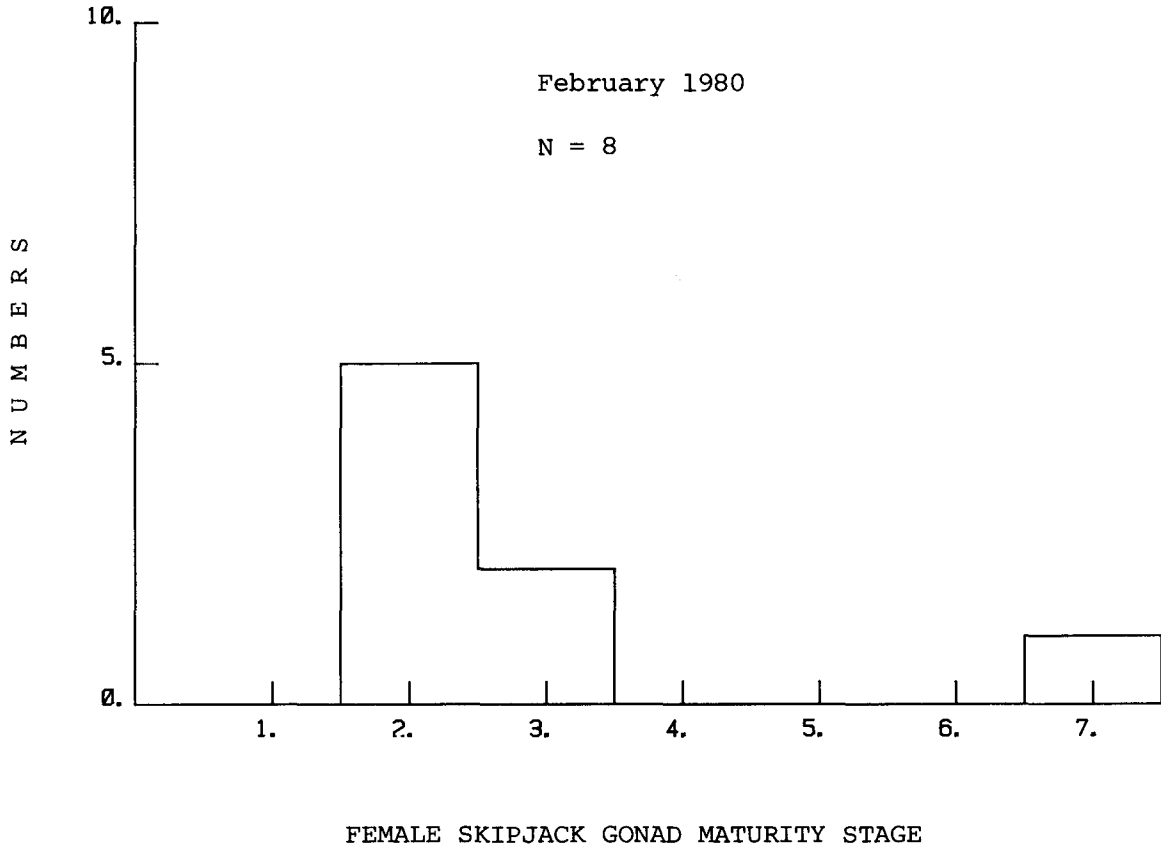


GAMBIER ISLANDS

SKIPJACK

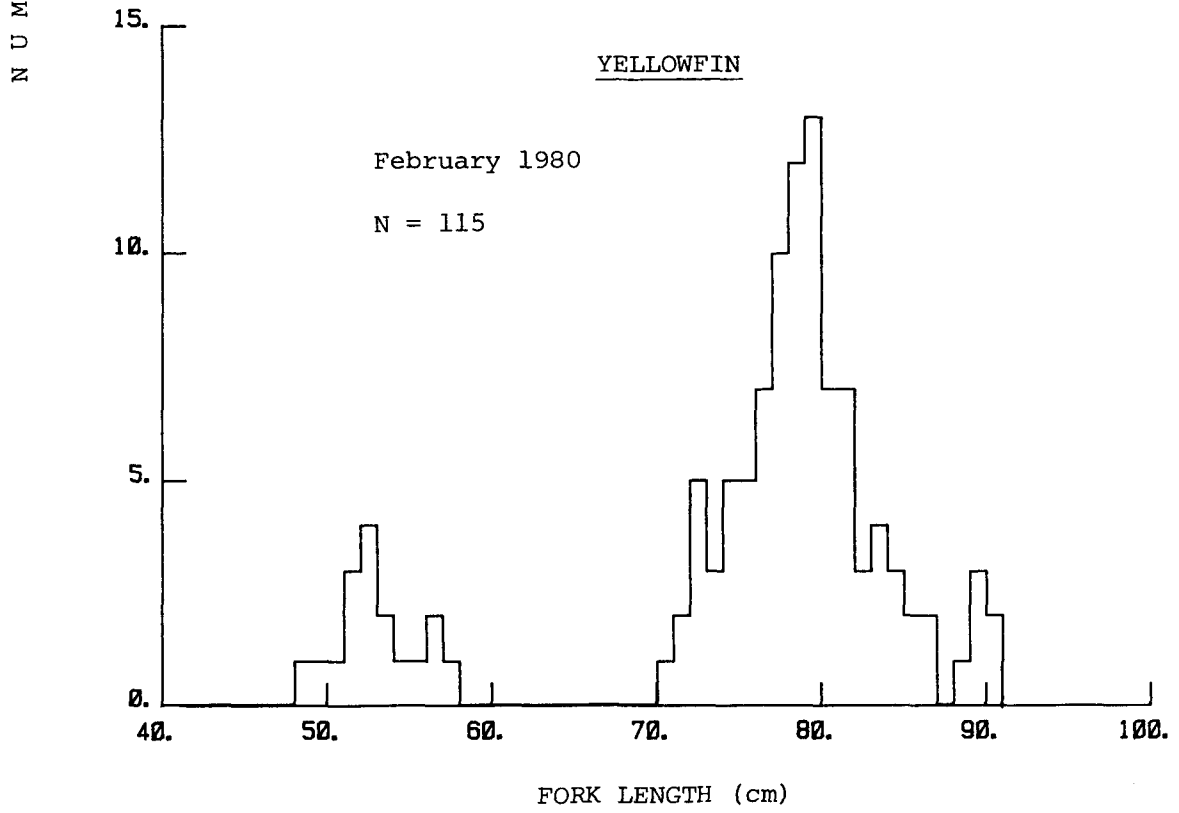
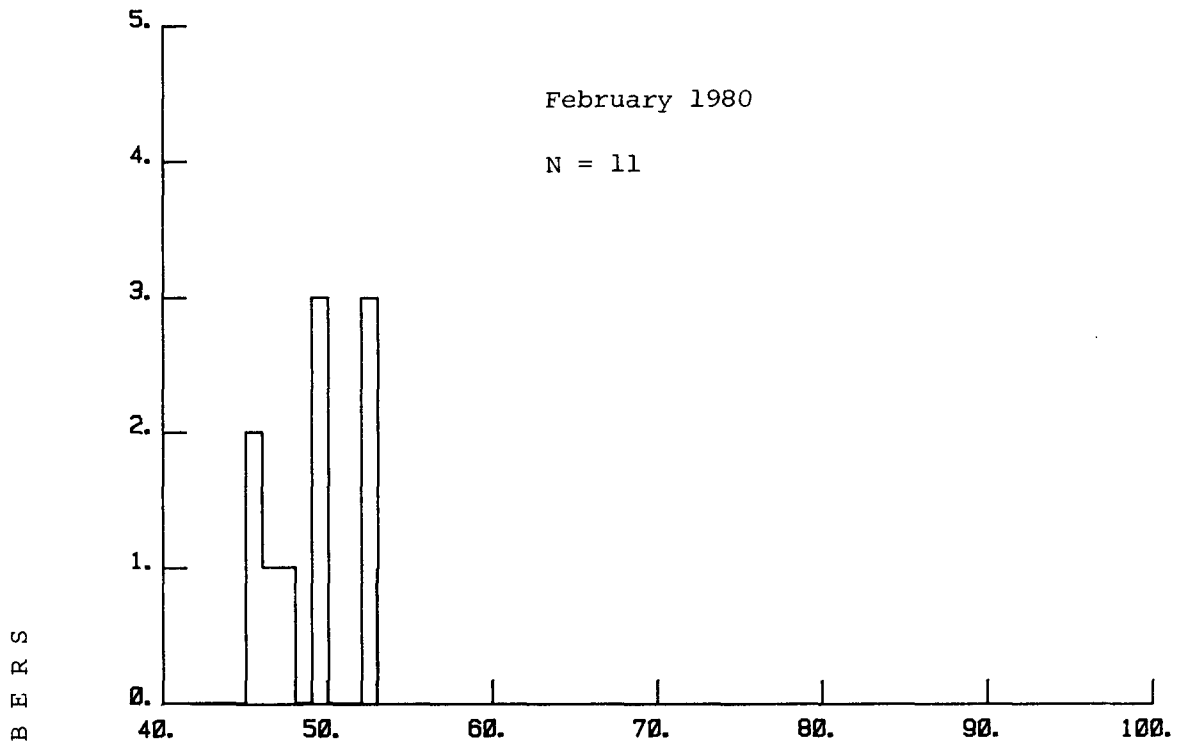


PITCAIRN ISLANDS



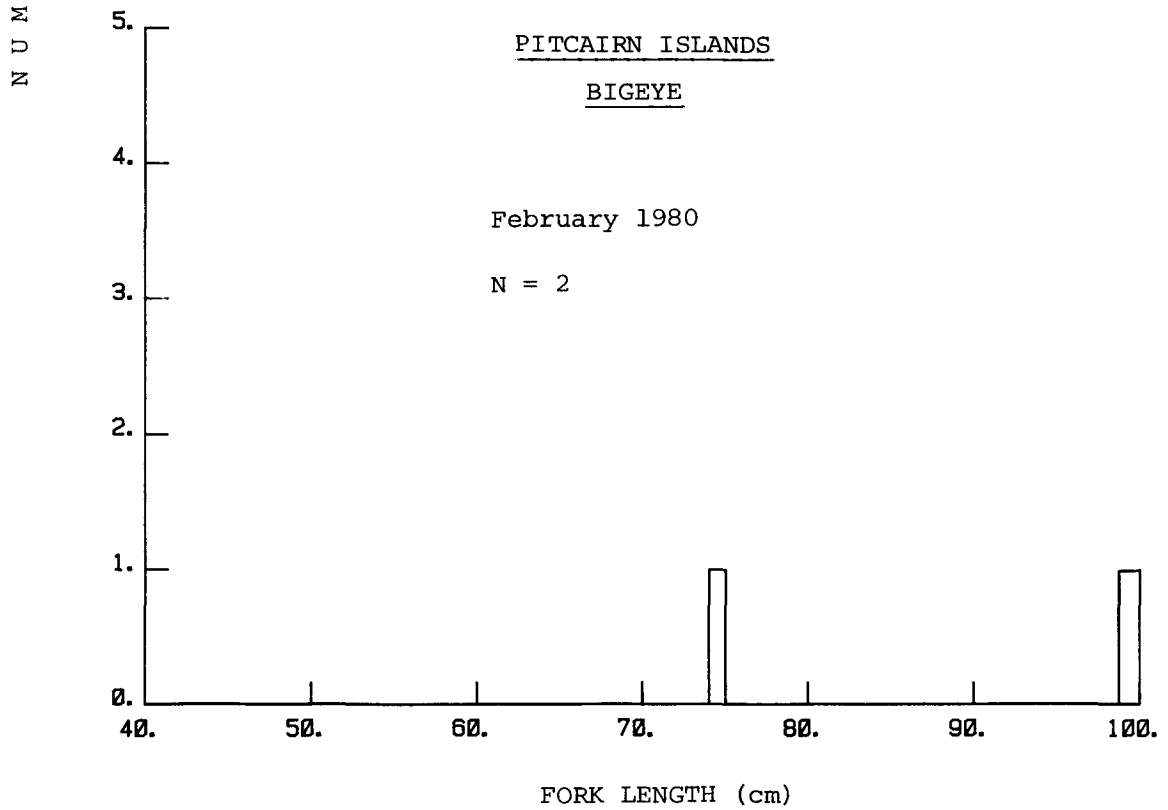
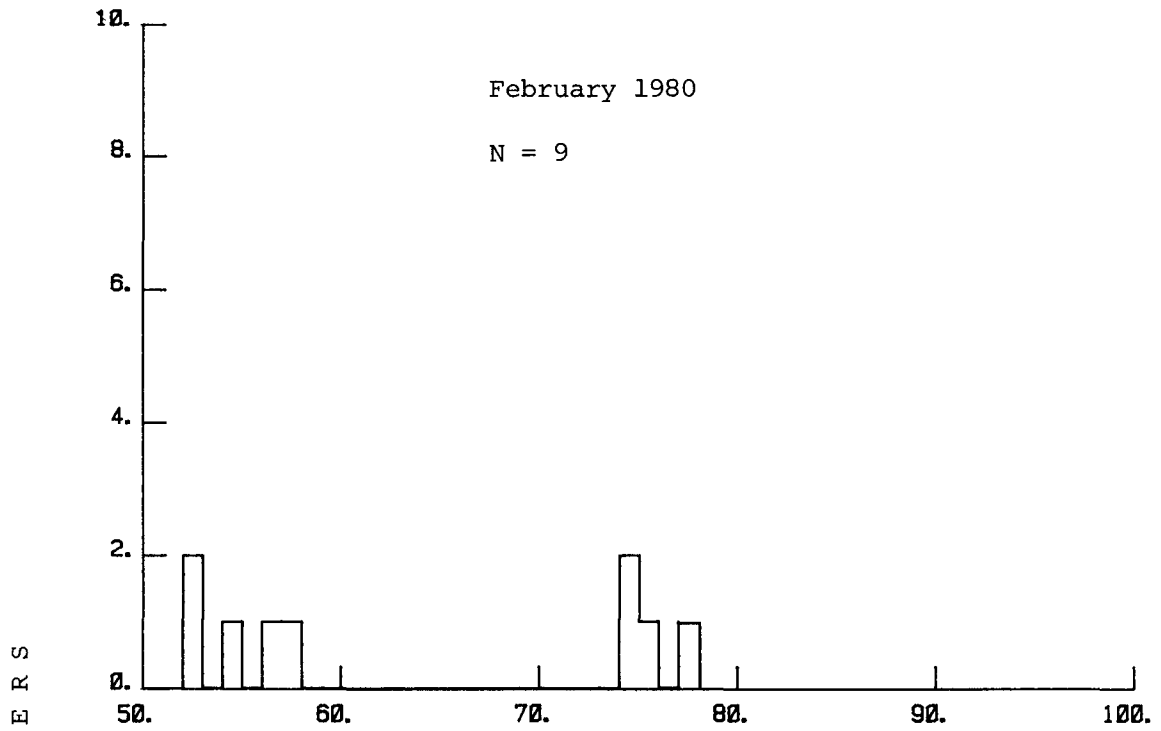
PITCAIRN ISLANDS

SKIPJACK

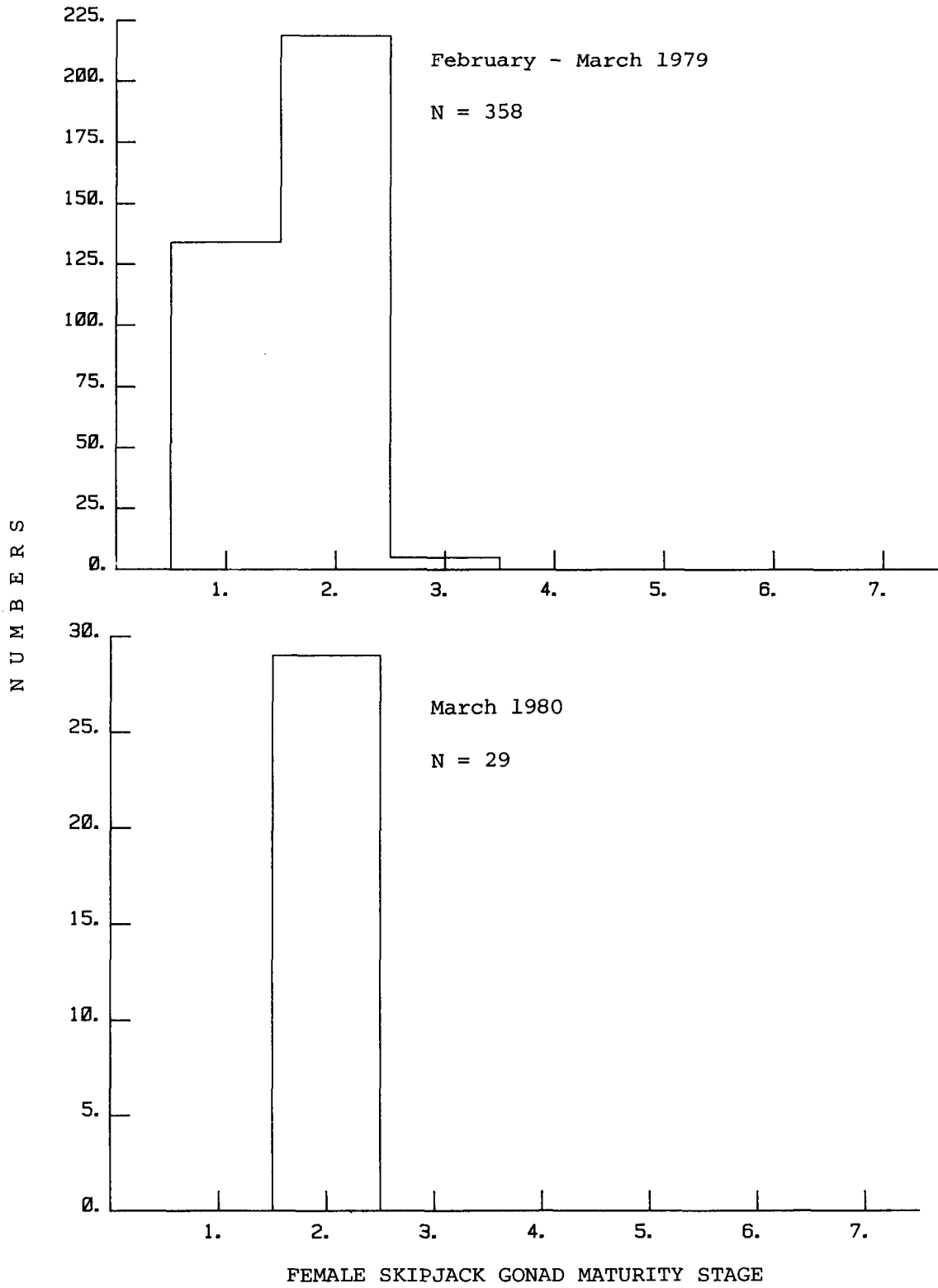


GAMBIER ISLANDS

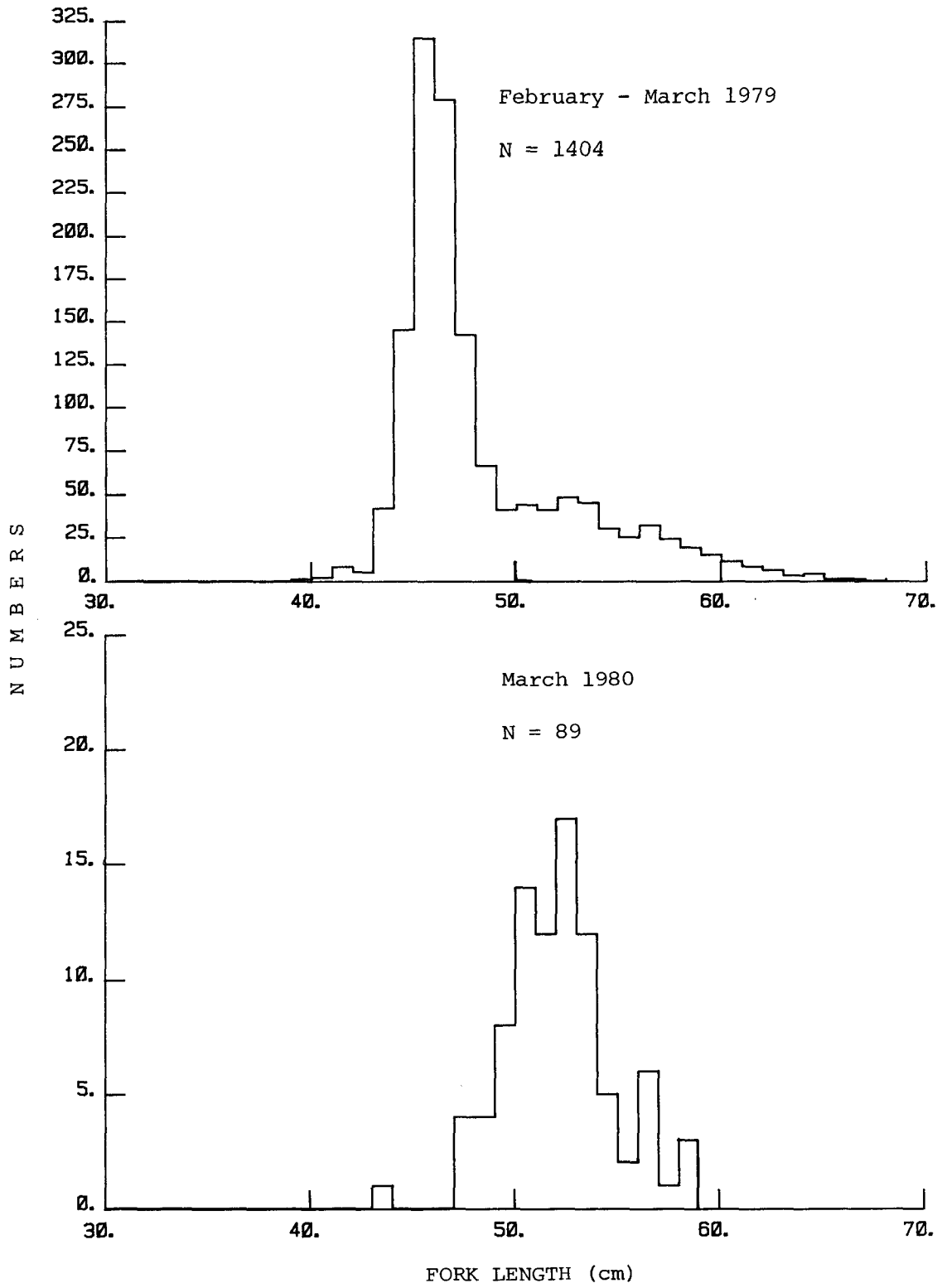
BIGEYE



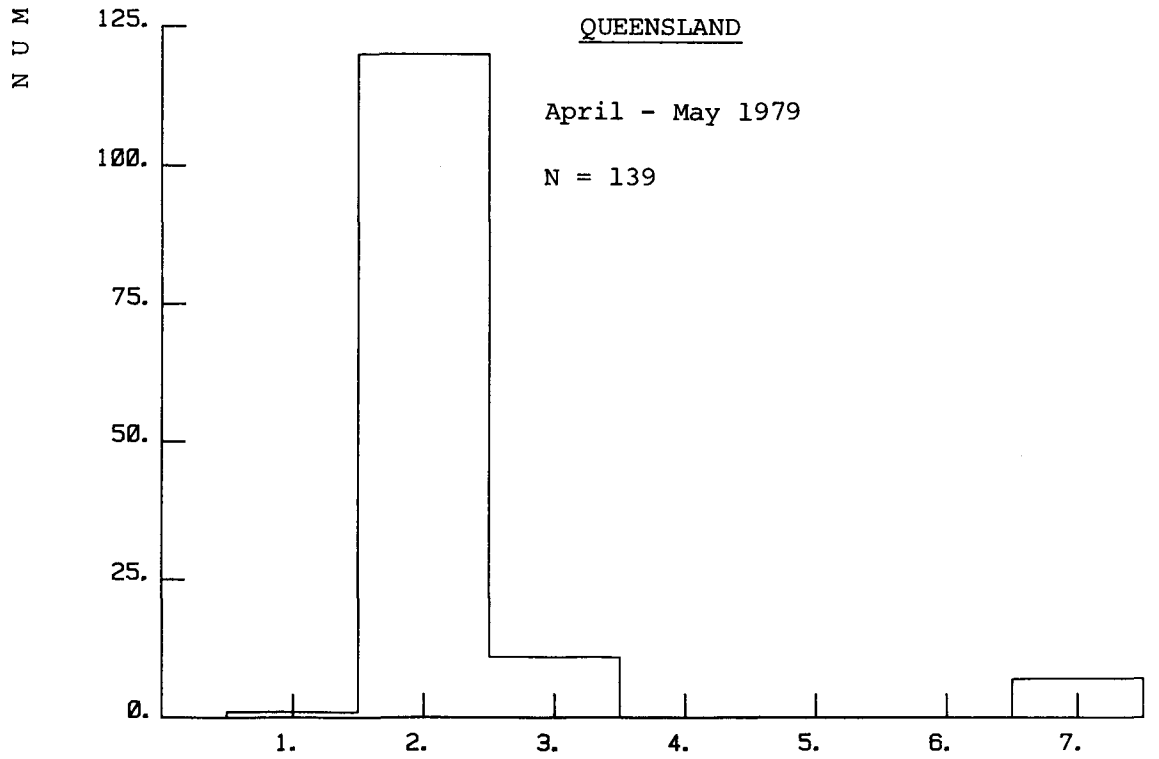
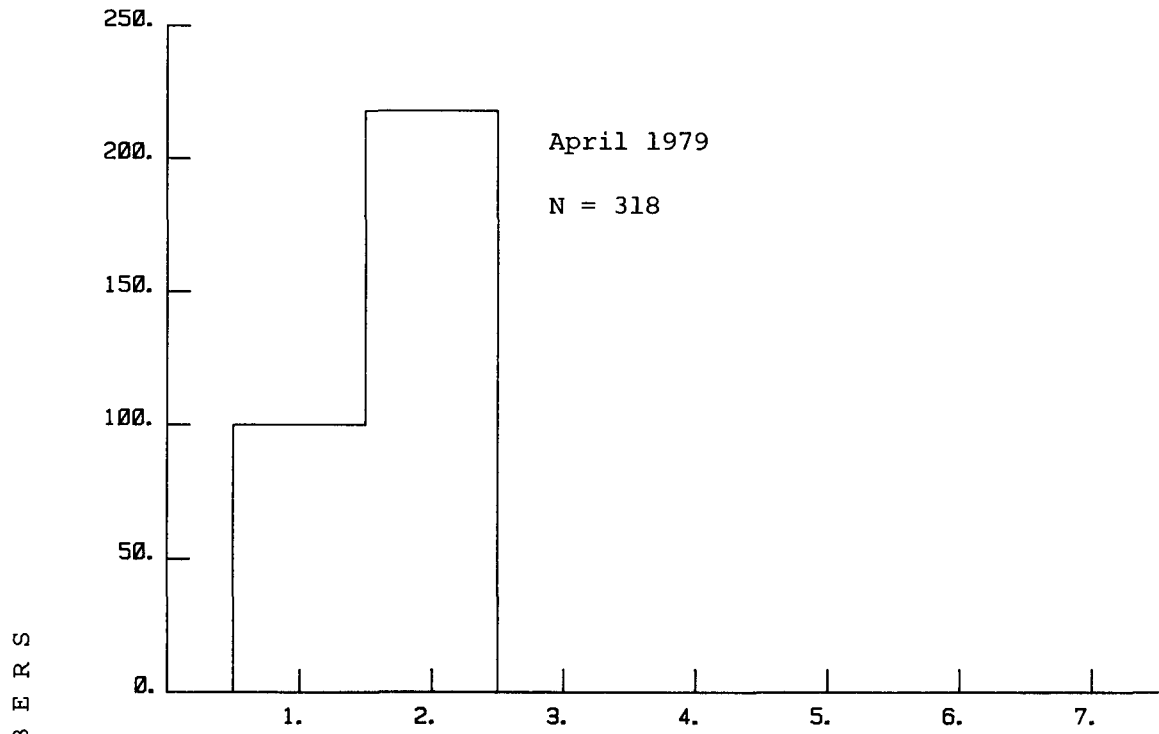
NEW ZEALAND



NEW ZEALAND
SKIPJACK

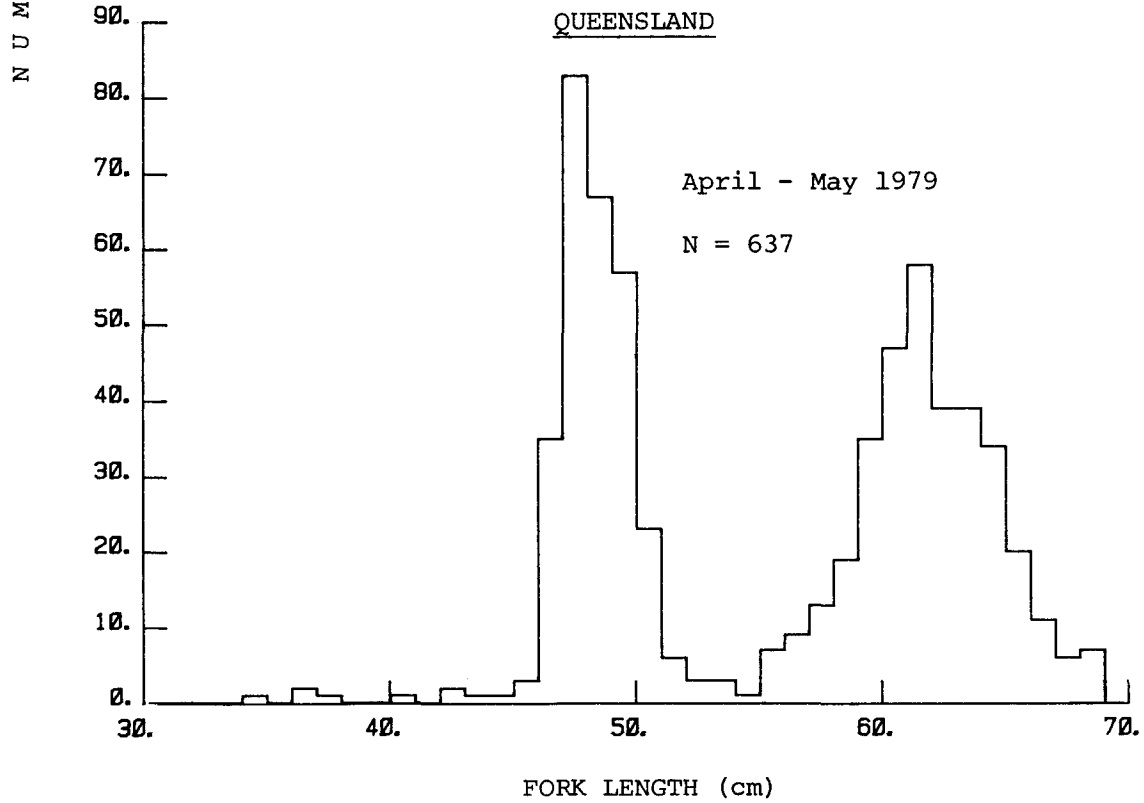
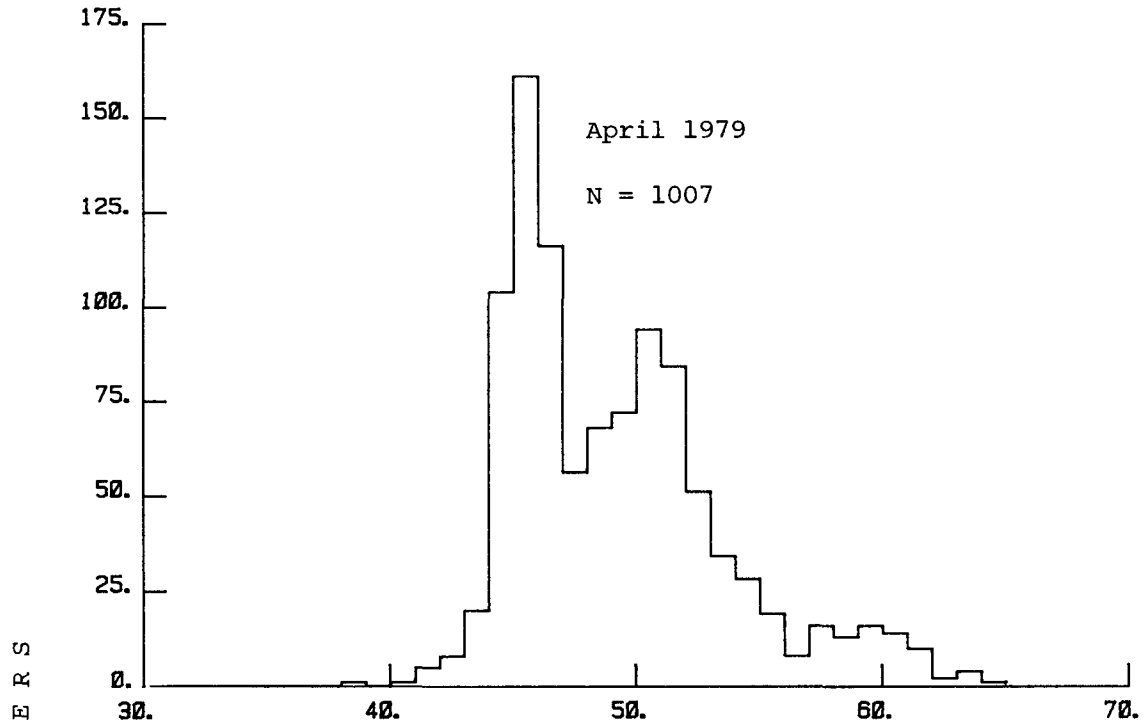


AUSTRALIA
NEW SOUTH WALES



FEMALE SKIPJACK GONAD MATURITY STAGE

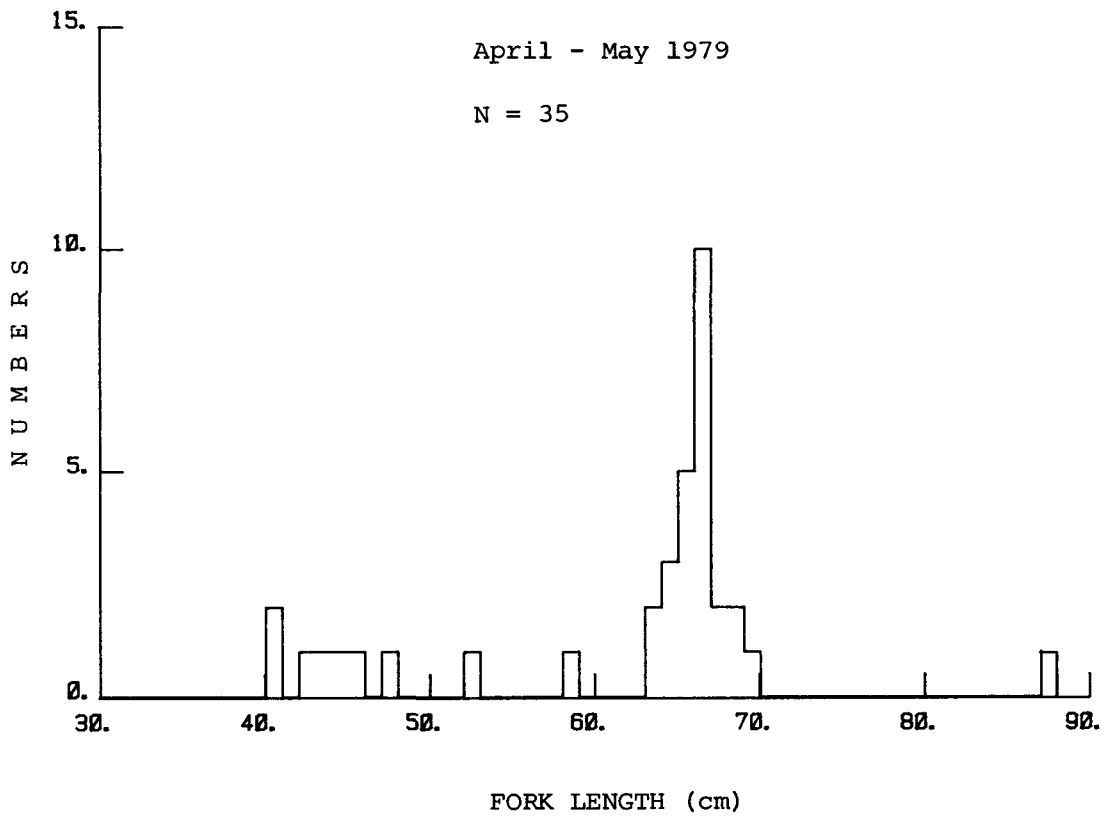
SKIPJACK
AUSTRALIA
NEW SOUTH WALES



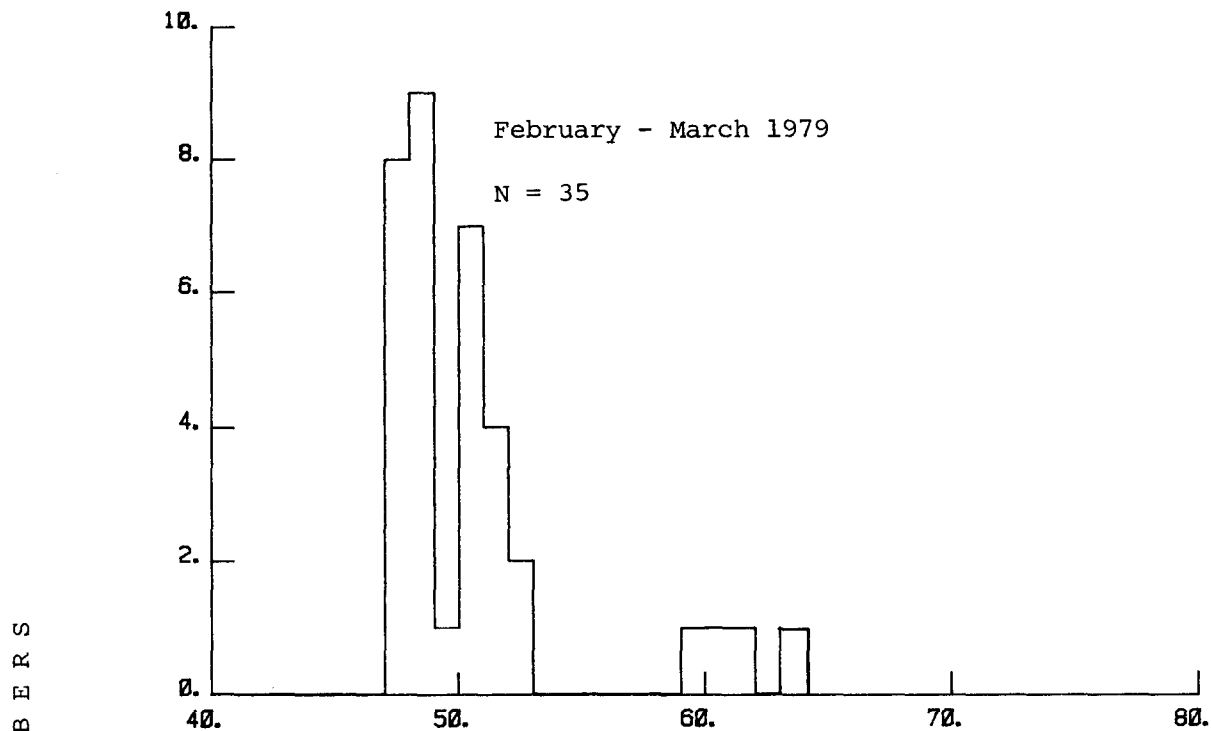
YELLOWFIN
AUSTRALIA
QUEENSLAND

April - May 1979

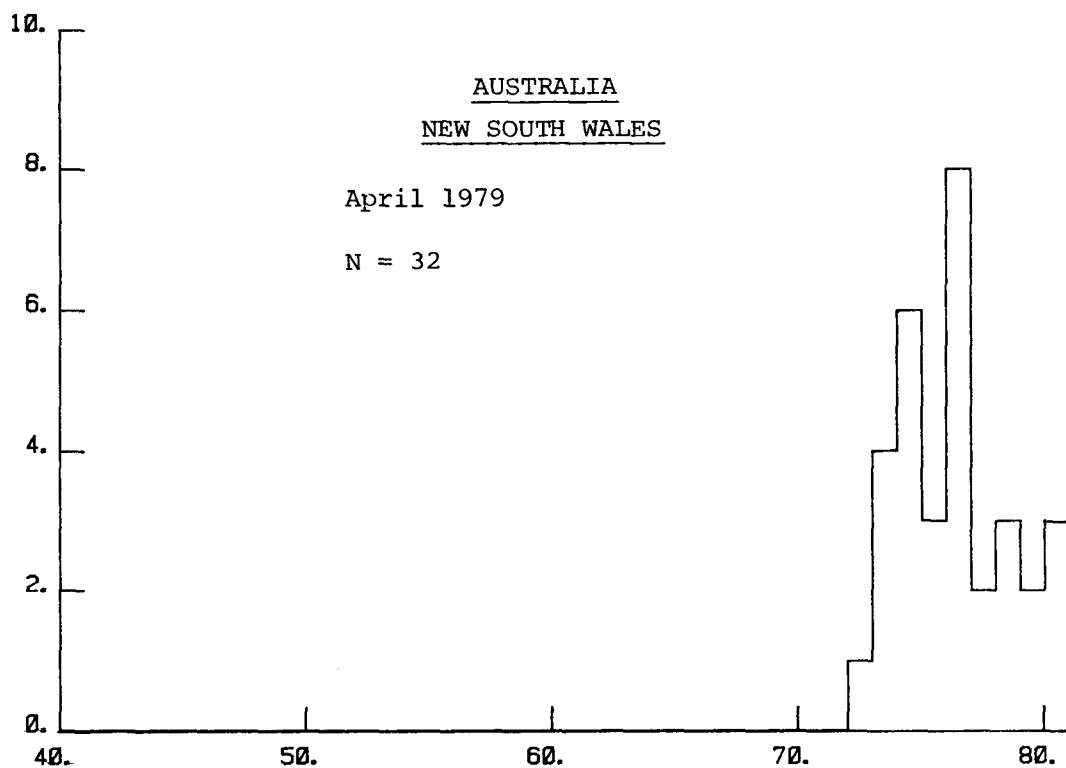
N = 35



ALBACORE
NEW ZEALAND

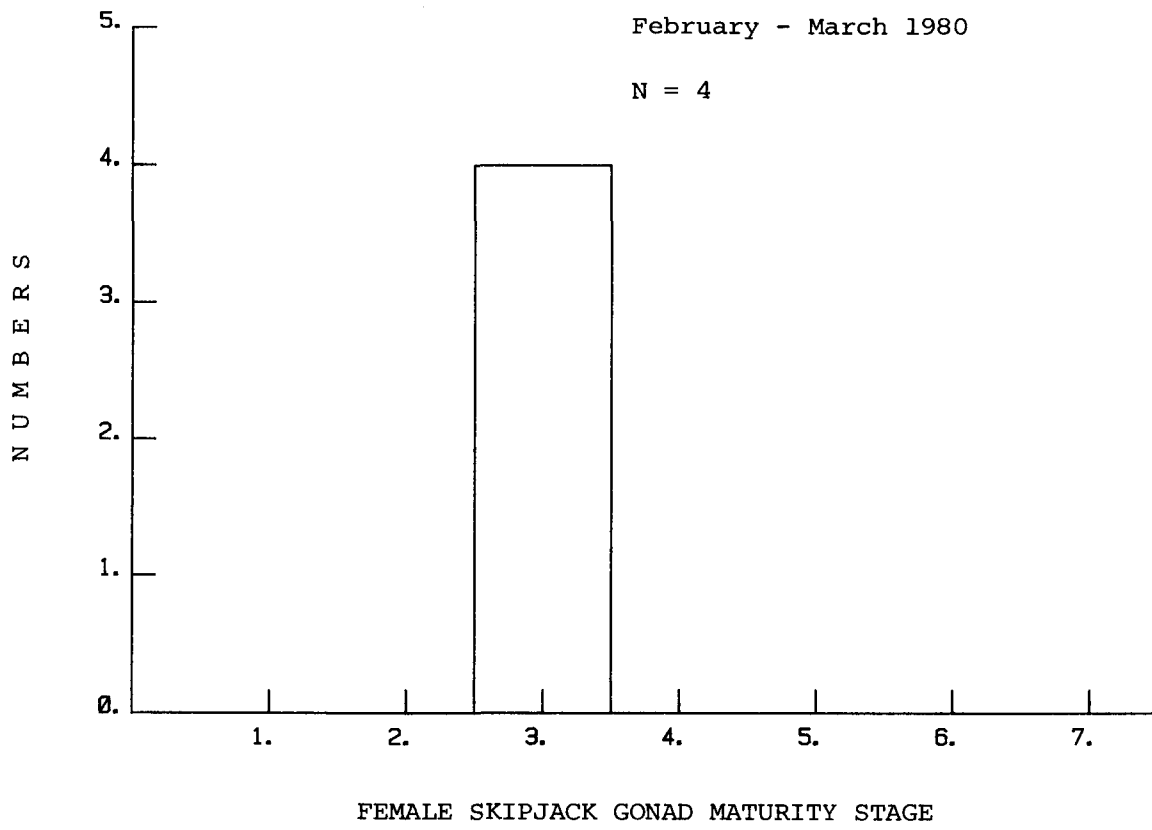


AUSTRALIA
NEW SOUTH WALES

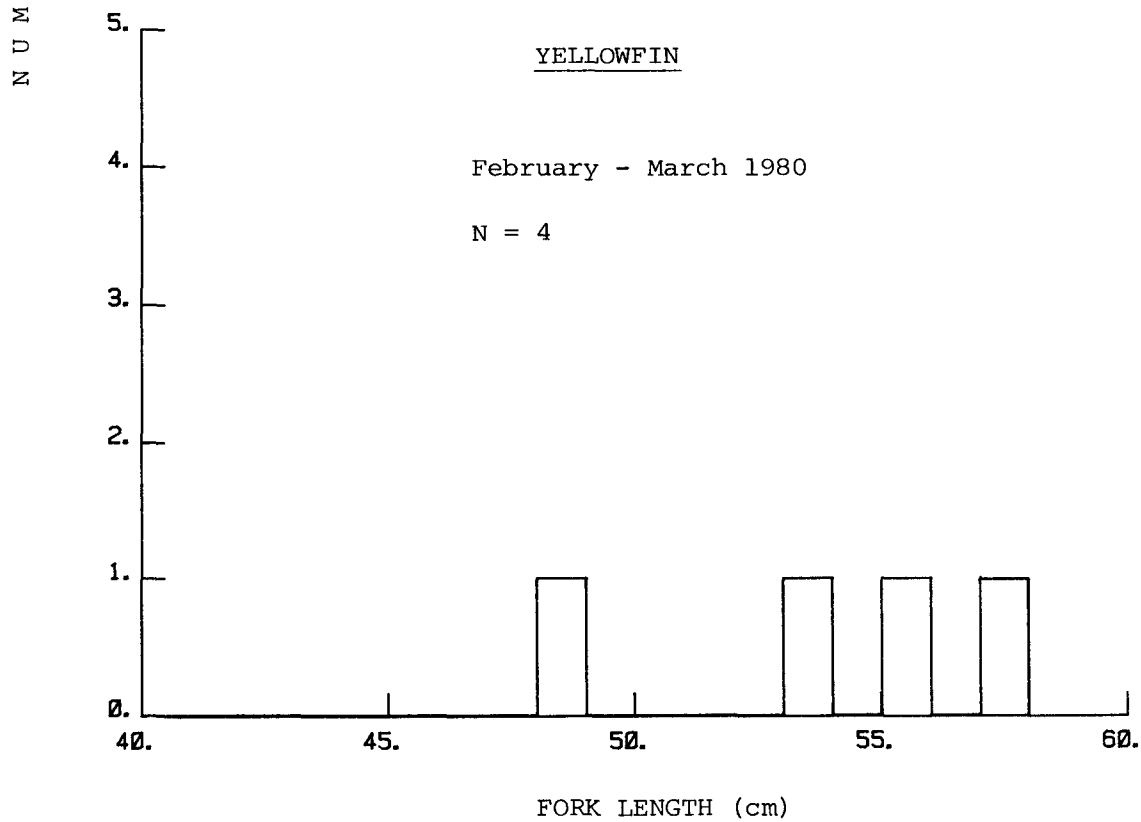
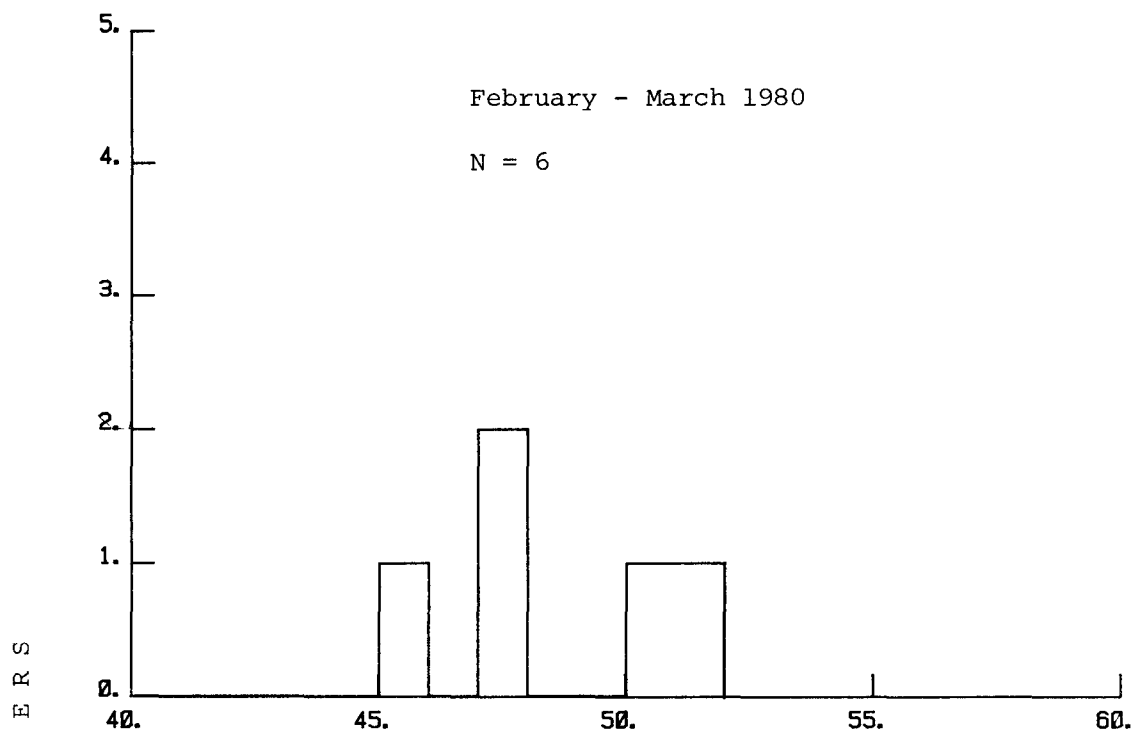


FORK LENGTH (cm)

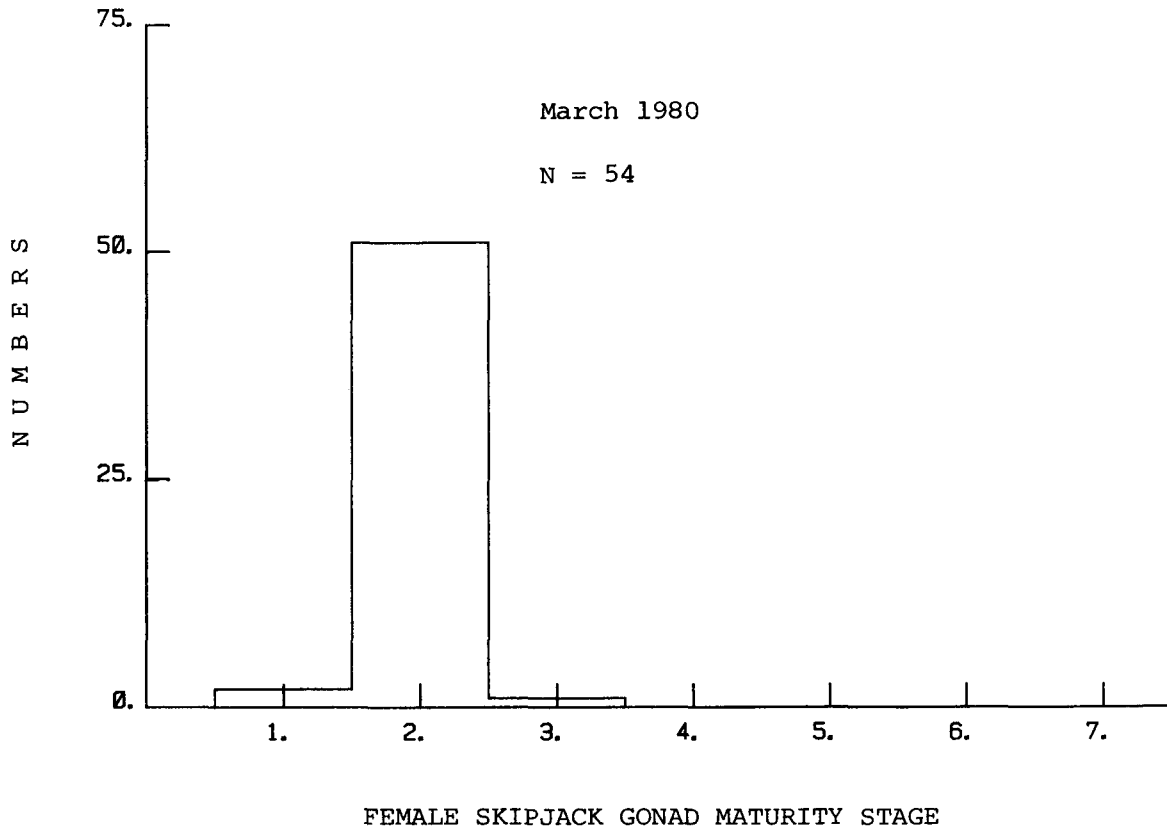
NIUE



NIUE
SKIPJACK

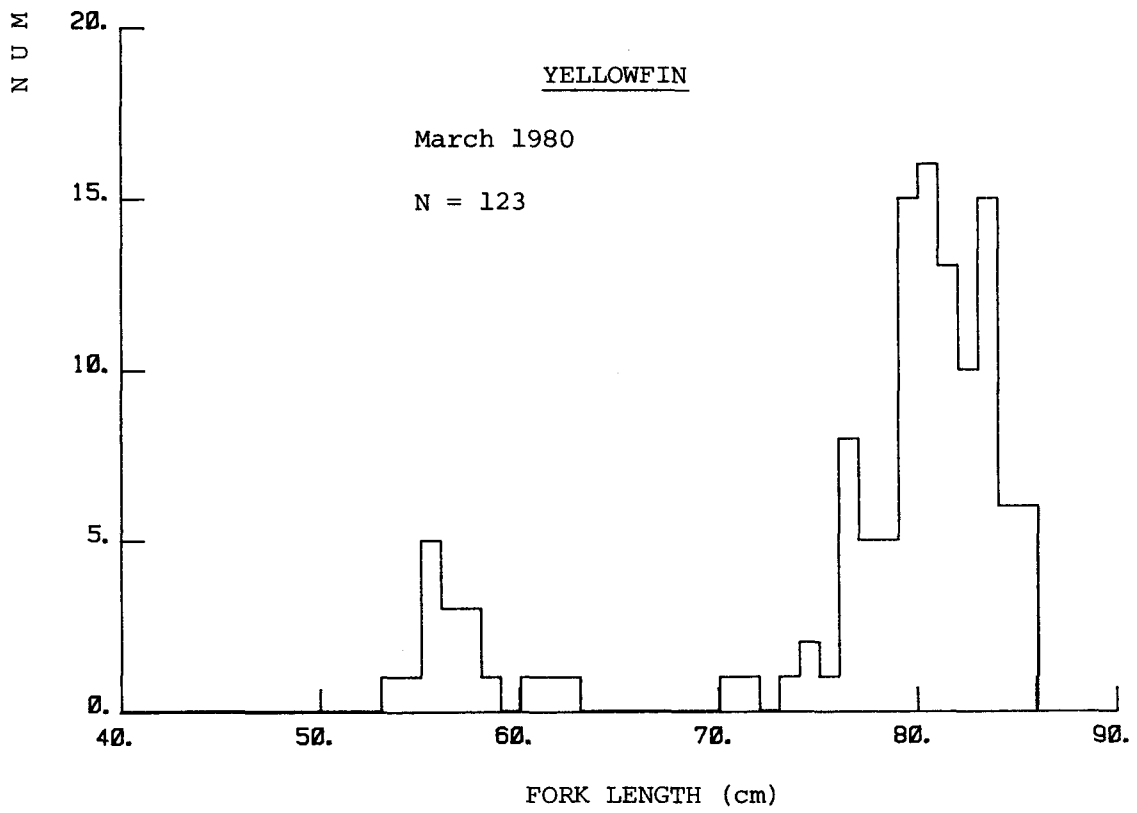
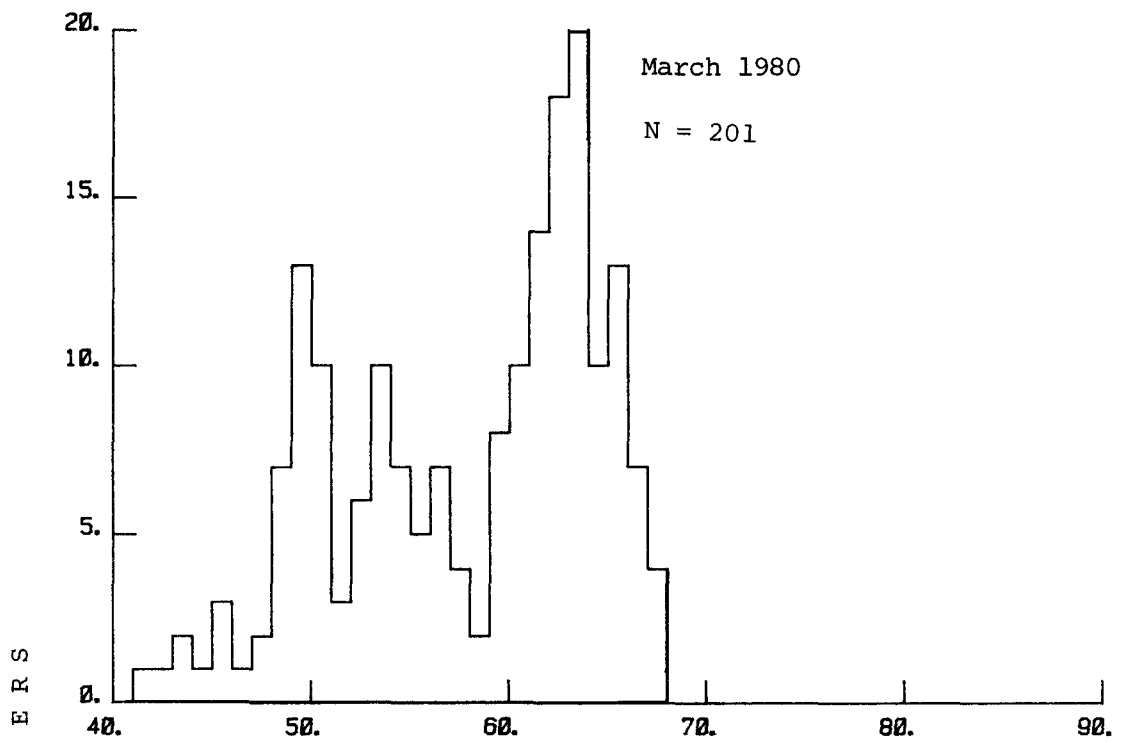


NORFOLK ISLAND

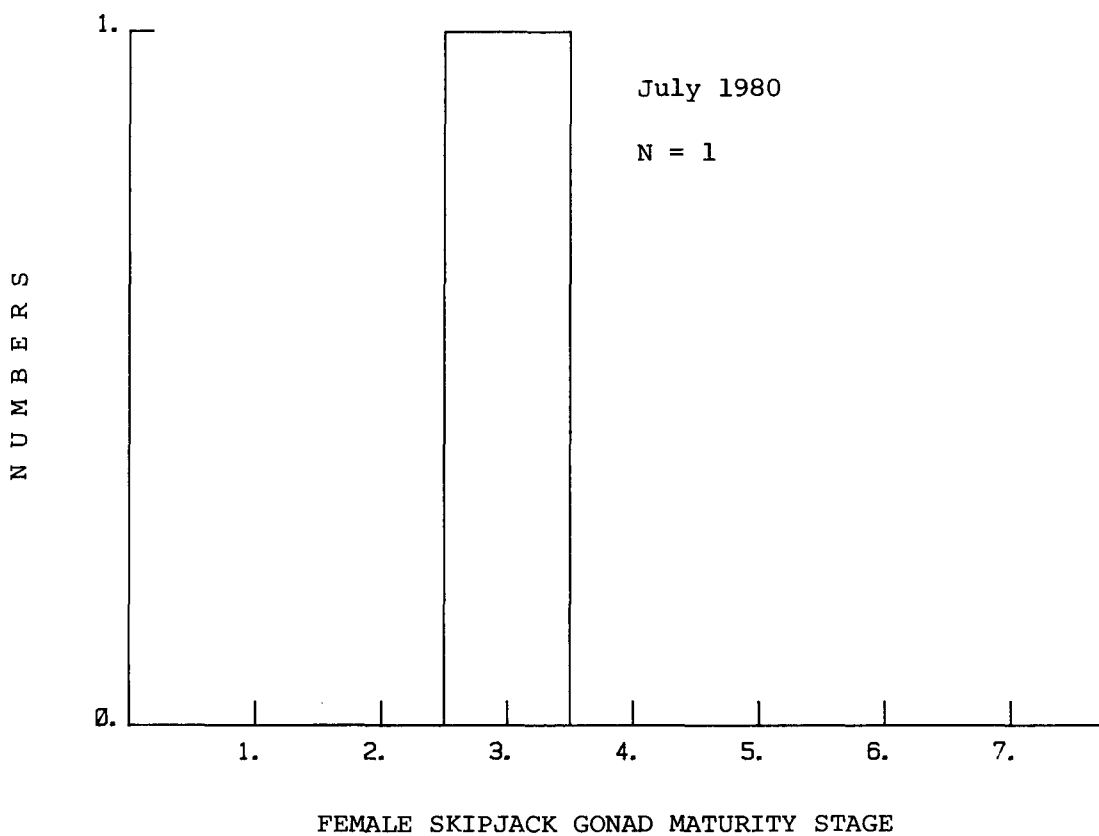


NORFOLK ISLAND

SKIPJACK



NAURU



NAURU
SKIPJACK

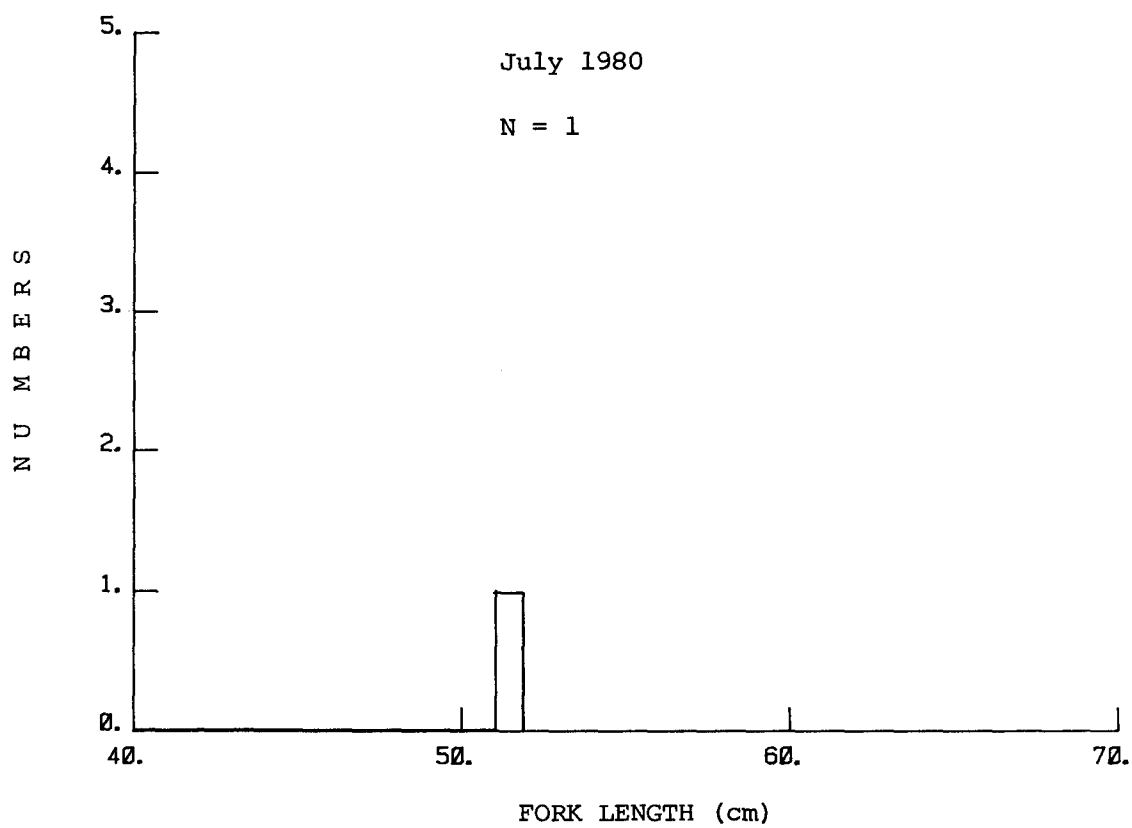


TABLE 2 - SEX COMPOSITION FOR SKIPJACK

<u>Country/Area</u>	<u>Survey Period</u>	<u>Female %</u>	<u>Male %</u>	<u>Indeterminate %</u>	<u>Sample Size</u>
Papua New Guinea	October 1977	40.8	55.9	3.4	179
Papua New Guinea	May - July 1979	50.7	48.4	0.9	765
Solomon Islands	November - December 1977	45.0	50.8	4.1	242
Solomon Islands	May - June 1980	46.8	46.0	7.2	278
Vanuatu	December 1977 - January 1978	57.5	42.5	-	153
New Caledonia	December 1977 - January 1978	49.7	49.4	1.0	715
Fiji	January - April 1978	50.0	50.0	-	498
Fiji	April 1980	47.4	50.9	1.7	660
Tonga	April - May 1978	49.1	46.1	4.8	167
Tonga	March 1980	35.8	64.2	-	95
Wallis and Futuna Islands	May 1978	38.8	44.0	17.3	730
Wallis and Futuna Islands	May 1980	50.0	49.2	0.8	122
American Samoa	May - June 1978	46.4	53.6	-	28
American Samoa	February 1980	35.5	64.5	-	31
Western Samoa	June 1978	52.3	47.7	-	44
Western Samoa	February 1980	45.2	54.8	-	31
Tuvalu	June - July 1978	49.4	46.6	4.0	348
Tuvalu	June - July 1980	54.8	45.2	-	31
Kiribati	July 1978	51.3	48.4	0.3	372
Kiribati	November 1979	51.9	22.2	25.9	27
Kiribati - Phoenix Islands	December 1979	56.1	28.1	15.8	57
Marshall Islands	November 1978	62.1	34.5	3.4	29
Marshall Islands	November 1979	53.3	33.3	13.3	15
Federated States of Micronesia - Kosrae	July, August, November 1978	11.8	-	88.2	17
Kosrae	November 1979	23.4	19.1	57.4	47
Ponape	July, October, November 1978	46.2	44.3	9.4	106
Ponape	November 1979	8.9	5.9	85.2	135
Ponape	July 1980	44.0	56.0	-	207
Truk	August 1978	47.6	52.4	-	21
Truk	November 1979	40.9	59.1	-	22
Commonwealth of the N. Mariana Islands	July, October 1978	42.9	57.1	-	7
Commonwealth of the N. Mariana Islands	November 1979	54.5	45.5	-	33
Federated States of Micronesia - Yap	October 1978	48.7	48.7	2.6	39
Republic of Palau	October 1978	55.0	45.0	-	40
Republic of Palau	August 1980	44.6	25.8	29.6	233
Japan - Bonin Island	October 1978	65.0	35.0	-	20
Tokelau	November 1978	58.3	41.7	-	24
Cook Islands	November, December 1978	58.9	41.1	-	207
Cook Islands	December 1979	58.9	41.1	-	56
French Polynesia - Society Islands	December 1978, January, February 1979	47.3	52.7	-	182
Tuamotu Archipelago	December 1978 - January 1979	42.2	57.6	0.2	535
Tuamotu Archipelago	February 1980	49.2	50.8	-	124
Marquesas Islands	January 1979	47.7	52.3	-	266
Marquesas Islands	December 1979 - January 1980	47.9	52.1	-	1,262
Gambier Islands	February 1980	45.0	55.0	-	20
Pitcairn Islands	February 1980	72.7	27.3	-	11
New Zealand	February - March 1979	54.0	35.5	10.9	667
New Zealand	March 1980	49.2	49.2	1.7	59
Australia - New South Wales	April 1979	53.2	46.2	0.7	598
Queensland	April - May 1979	51.5	47.4	1.1	270
Niue	February - March 1980	66.7	33.3	-	6
Norfolk Island	March 1980	58.1	40.9	1.1	93
Nauru	July 1980	100.0	-	-	1

