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SMALL-SCALE INDUSTRIES DEVELOPMENT

DP/TTP/89/200

TRUST TERRITORY OF THE PACIFIC ISLANDS

Technical report: Salt drying of fish*

Prepared for the Government of the
Trust Territory of the Pacific Islands
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Haruyoshi Iguchi, UNIDO consultant and
Christer S. Friberg, National Fisheries Corporation

Backstopping officer: Seiichiro Hisakawa
Institutional Infrastructure Branch

United Nations Industrial Development Organization
Vienna

* This document has not been edited.

V.91 23706

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1. OBJECTIVES

a. Development Objective

Strengthening of the economy through the production and processing of marine and fish products toward import substitution, the creation of employment opportunities and enhancing income.

b. Immediate Objective

To train fishermen in Pohnpei State commercial methods of catching and processing on small scale commercial basis the Big-eyed Scad (*Trachurus crumenophthalmus*), locally referred to a "Petiti".

2. BACKGROUND AND JUSTIFICATION

The Federated States of Micronesia (FSM) is constituted of several hundred islands scattered over more than one million square miles of the Central-Western Pacific Ocean. The FSM includes four states namely: Yap, Chuuk, Pohnpei and Kosrae.

The number of manufacturing industries in the FSM are few and the Government is actively promoting the development of an industrial based economy, which includes small scale and medium scale industries.

While the commercial fishery in the FSM conducted by foreign fishing vessels is highly developed the local commercial fishery is still in an early stage of development. Among many identified commercially valuable species of fish, the Big-eyed Scad (*Trachurus crumenophthalmus*) is one.

The Big-eyed Scad, a member of the Jack Fish Family (Carangidae) and found world-wide in warmer waters, supports one of the more important commercial fisheries in Hawaii. In addition to fishing, Hawaiian fishermen have developed an appropriate technique for drying this species. However, as a result of modern means of preservation and a large fresh fish market, drying is no longer practised.

FSM has already identified a commercially important resource of Big-eyed Scad. However, due to the early stage of this fishery there is a lot of room for improvements in the areas of fishing, processing and marketing.

In commercial production, Dried Big-eyed Scad is a Value-Added Product, while in the subsistence economy drying would be the most appropriate way of preserving edible marine products, e.g. Big-eyed Scad.

3. PROJECT ACTIVITIES

UNIDO Consultant, Mr. Haruyoshi Iguchi, visited Pohnpei between May 31 and June 25, 1990. During this period he carried out the following tasks:

a. Taught local fishermen Hawaiian techniques for the construction of fishing gear for fishing for Big-eyed Scad.

b. Taught local fishermen Hawaiian techniques for fishing for Big-eyed Scad

c. Introduced the design of a Hawaiian type solar-dryer.

d. Taught local fishermen how to process big-eyed Scad for drying and how to dry the product. In addition the Consultant taught techniques how to process Skipjack and Yellowfin Tuna for drying.

4. PROJECT OUTPUT

a. Detailed Description of Processing and Sun-drying Big-eyed Scad and related Marine Products

see Appendix A
B
C
D

b. Recommended Plant Lay-out for Small-scale Commercial Processing of Big-Eyed Scad and related Marine Products.

see Appendix E

c. Proposed Business Plan for Small-scale Commercial Processing of Big-Eyed Scad

1. Facilities and Equipment

A proposed small-scale industry at Teketik for drying of Big-eyed Scad should begin with six small solar-dryers, each 3 by 6 feet in size. The size (equals weight) of dryer allows easy transportation by one or two men, as the dryer should be kept in a sheltered area during night hours. It should possibly be considered to compare the economics between solar and electric drying, considering the high rainfall and humidity at Teketik.

In commercial processing a proper processing area is recommended (re. CODEX: Recommended International Code of Practice for Fresh Fish). This area should include refrigerated storage and portable water. The planned EDA Fish Processing Plant should meet these requirements. Until the processing plant is in operation the Teketik Coldstorage can be used, providing fish processing can be done within an enclosed area free from flies. A suitable area is possibly within the chill room.

For processing, tables, knives, cutting boards and plastic containers are required.

2. Operation

Personnel and facilities used in processing should comply with the International Code of Practice for Fresh Fish.

The recommended number of persons for an operation of six solar-dryers are two, one manager and one assistant.

Trainees could be invited in order to transfer the technology to other parts of the FSM.

Production of dried Big-eyed Scad is generally made in three days cycles and with six dryers the products from two dryers or 160 fish could be marketed on a daily basis.

Processing Cycles - Operation of six Solar-dryers, as per Recommendations

	Dryer 1-2	Dryer 3-4	Dryer 5-6
Initial Processing	June 1	June 2	June 3
Drying, day 1	2	3	4
Drying, day 2	3	4	5
Ready Product	4	5	6
Initial Processing	June 4	June 5	June 6
Drying, day 1	5	6	7
Drying, day 2	6	7	8
Ready Product	7	8	9

etc.

In order to maximize profit and considering the small type of operation the finished product should be marketed directly to consumers or to a retail outlet.

d. Pre-feasibility for Processing and Sun-drying of Big-Eyed Scad.

see Appendix F

e. Proposed Action Plan (Time Schedule)

A commercial production could start immediately, considering:

1. A consistent supply of Big-eyed Scad appears available throughout the year around the island of Pohnpei.

2. The number of sunny days is relatively constant throughout the year.

3. The necessary facilities for a commercial drying operation are available assuming that the Teketik Coldstorage facility is used.

4. The basic equipment for processing material are available locally.

5. Four trained personnel are available.

By starting production using six small solar-dryers, marketing should be no major problem. However, before production expands further more research on marketing should be conducted as actual cost of production and the local market are yet only estimates. Neighboring markets in Guam and Hawaii would most likely absorb a considerable volume of dried products but in such a case we have to consider, import regulations, whole sale prices and freight costs.

Appendix A

Case 1: Recommended procedures for drying Big-eyed Scad at the Teketik Coldstorage are as follows:

Area where any processing of fish occurs must be highly sanitary and comply with the International Code of Practise for Fresh Fish (re. CODEX)

a. Initial Processing

1. The initial product must be fresh, preferably no more than 2-3 days on ice. Basically the meat must be firm.
2. For the size of dryer we use for this project (3 x 6 feet screen area) we can dry 80 fish, average size 1/4 lb each.
3. The fish will initially be split along the center from the top down, gills and intestines removed and abdominal area cleaned well with portable water.
4. After proper rinsing, rock salt will be rubbed into each fish. The fish will after this be placed in a cool area (preferably refrigerated) over-night.

b. Solar-Drying

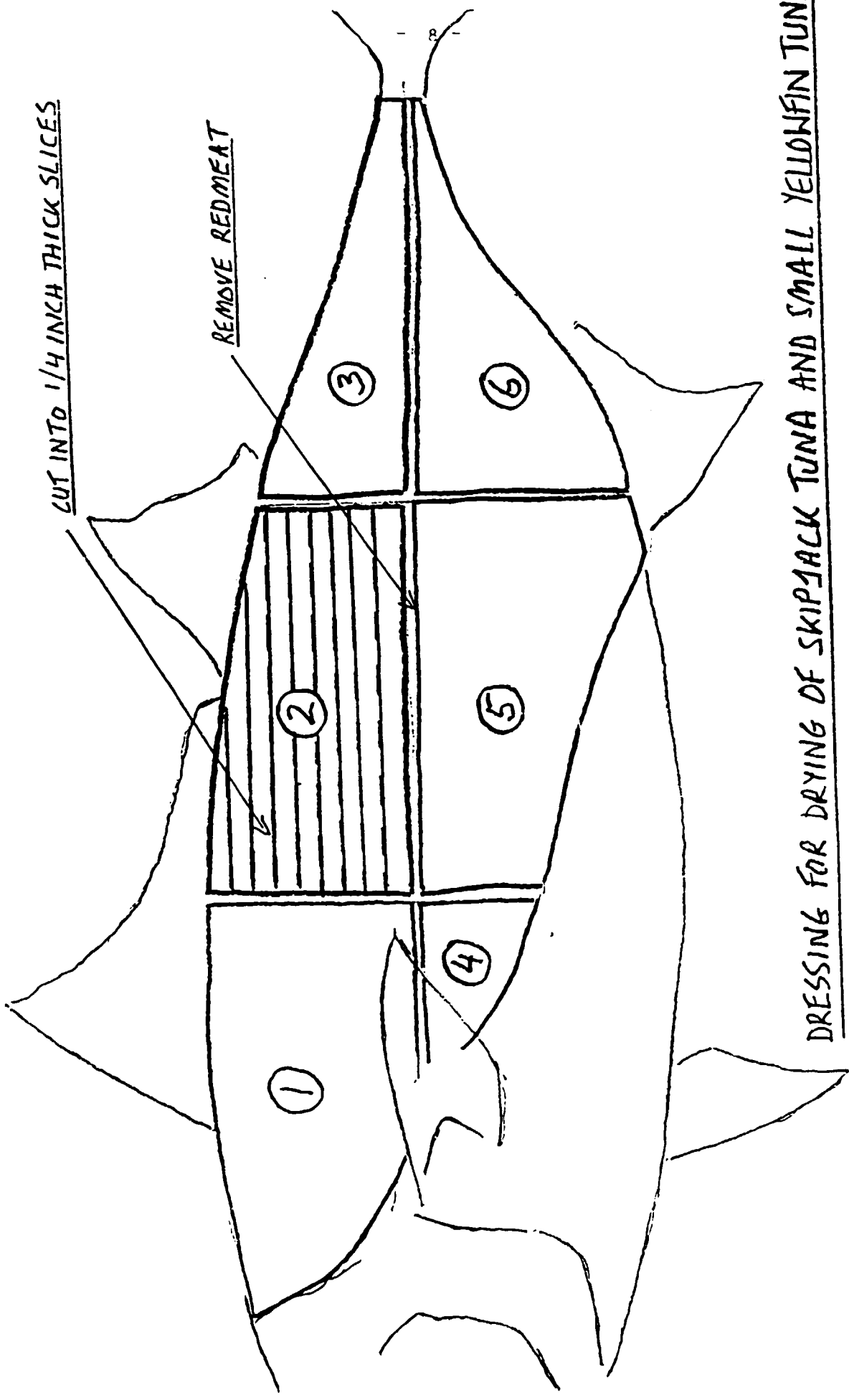
1. The fish will be well-rinsed in potable water to remove any excess salt. The fish should be soaked in clean water for about 2 hours.
2. For the first 5 hours the fish will be placed on the dryer with the skin down (towards the screen). For the remaining period of drying (about 3 days) the fish will be dried with the skin up.
3. During night-hours or during excessive cloudiness and rain the fish should be kept in a cool (preferably refrigerated) area until processing is completed.

c. Marketing and Storage

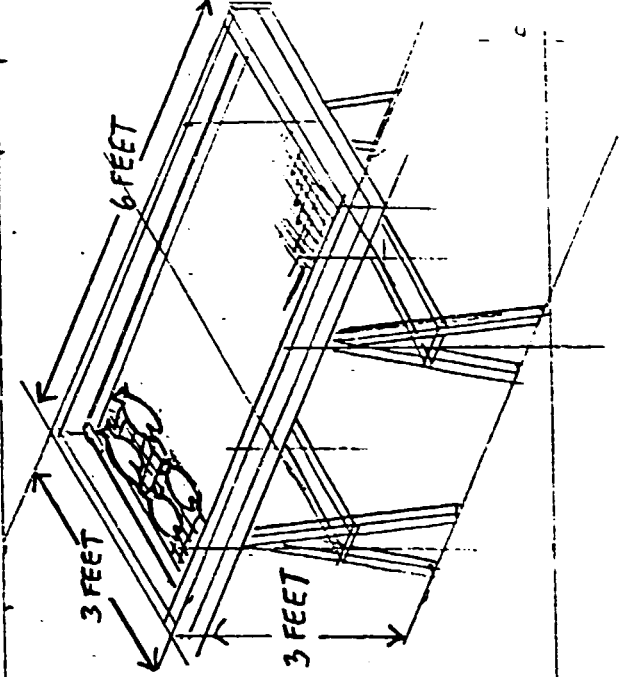
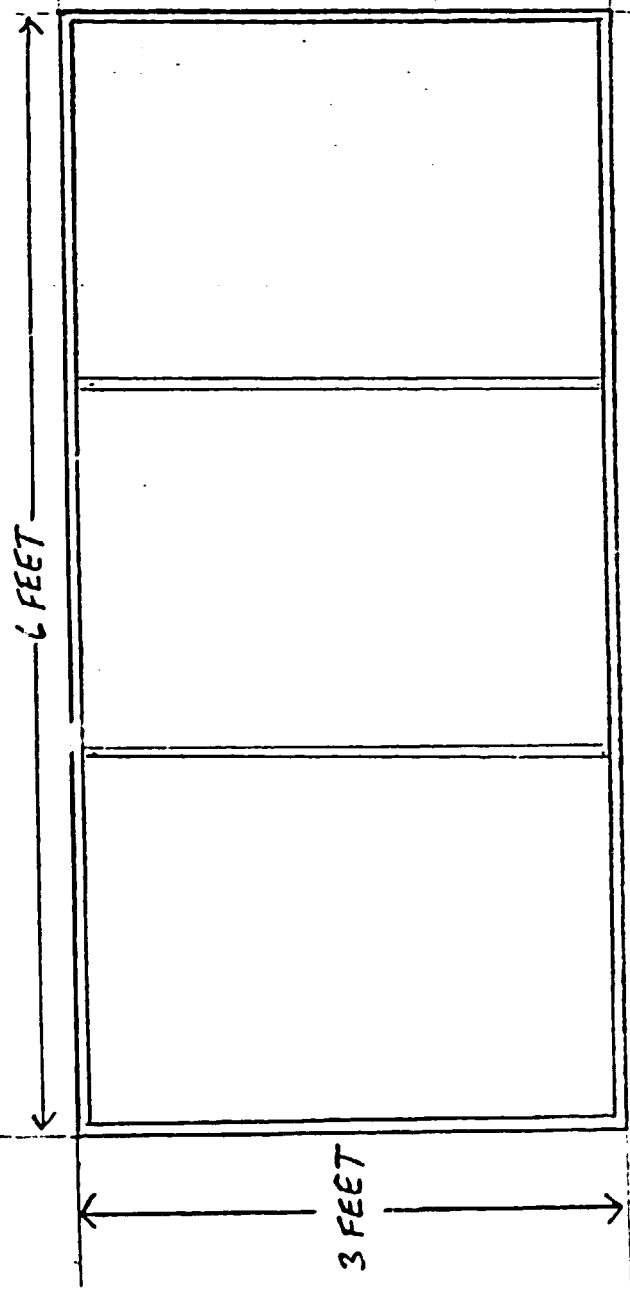
1. Product ready for marketing as a Value-Added Product.
2. The finished product should preferably be individually packed in a labelled plastic bag. For marketing purposes packaging is important and if e.g. vacuum packing is available it should be used.
3. It is always important to keep the finished product in a dry place.

CUT INTO 1/4 INCH THICK SLICES

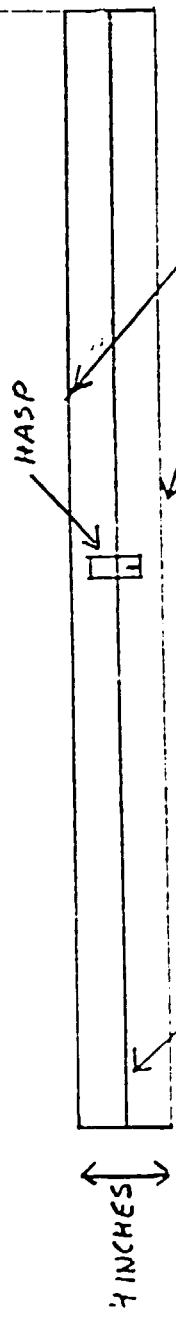
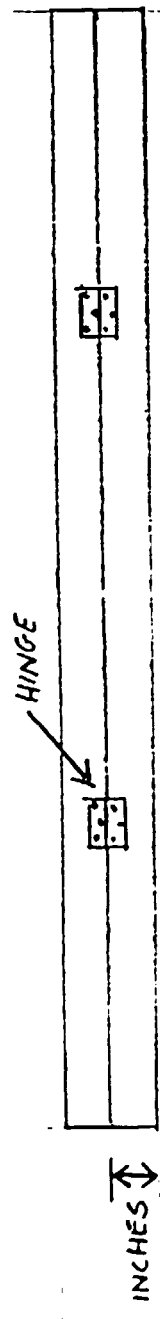
REMOVE REDMEAT



DRESSING FOR DRYING OF SKIPJACK TUNA AND SMALL YELLOWFIN TUNA



HAWAIIAN STYLE
SOLAR DRYER

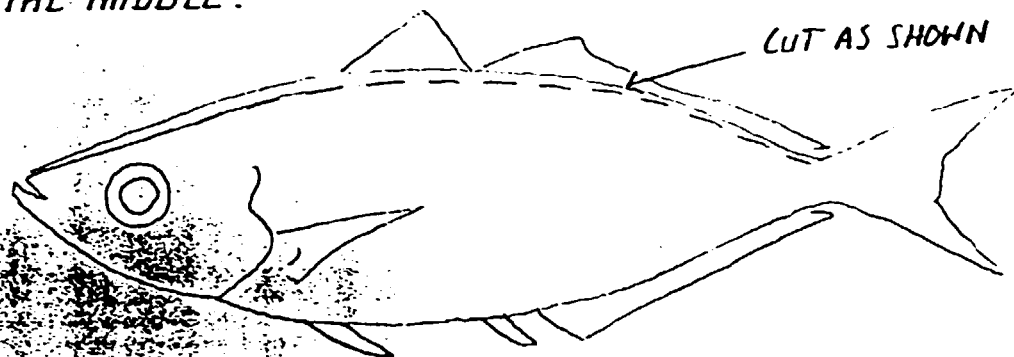


TOP AND BOTTOM COVERED BY FLY SCREEN

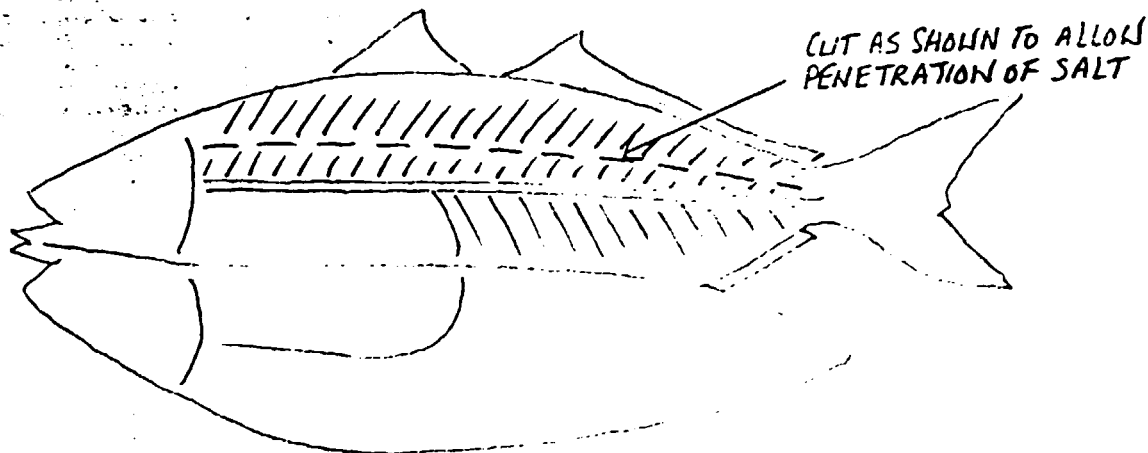
CENTER FRAME IS COVERED BY
CHICKEN WIRE OR SIMILAR
(ONE INCH MESH)

INITIAL PROCESSING OF BIG-EYED SARD FOR DRYING

1. CUT FROM THE TAIL FORWARD AND THROUGH THE HEAD IN THE MIDDLE.



- 1a. BREAK THE HEAD AND SPLIT THE FISH OPEN.
- b. REMOVE GILLS AND BUTTS AND ANY EXPOSED BLOOD
- c. WASH THE FISH IN CLEAN WATER

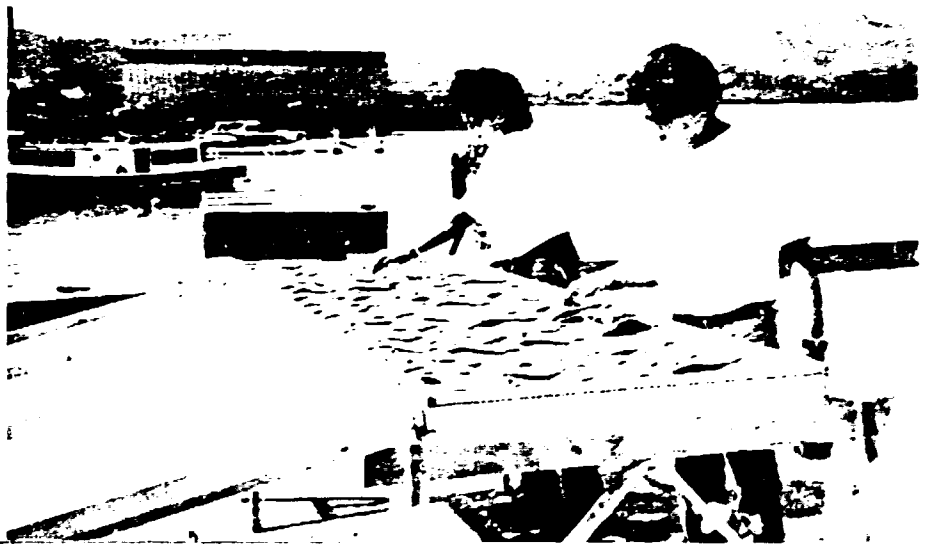


3. FOR SALTING LAY THE FISH WITH SKIN DOWN IN A CONTAINER AND SPRINKLE SALT BETWEEN EACH LAYER.
4. SALT THE FISH OVER-NIGHT (12-15 HOURS)
5. AFTER SALTING RINSE FISH WELL (1-2 HOURS) BEFORE DRYING



DRYING OF
BIG-EYED SCAD

1. Trainees
processing fish
for drying.



2. Hawaiian style
solar dryer with
Big-eyed Scad ready
for drying..



3. Dried Big-eyed
Scad ready for
marketing.



STEPS IN DRYING
BIG-EYED SCAD

1. Cutting of
fish, from tail
to head.

2. Removal of gills
and gutts.



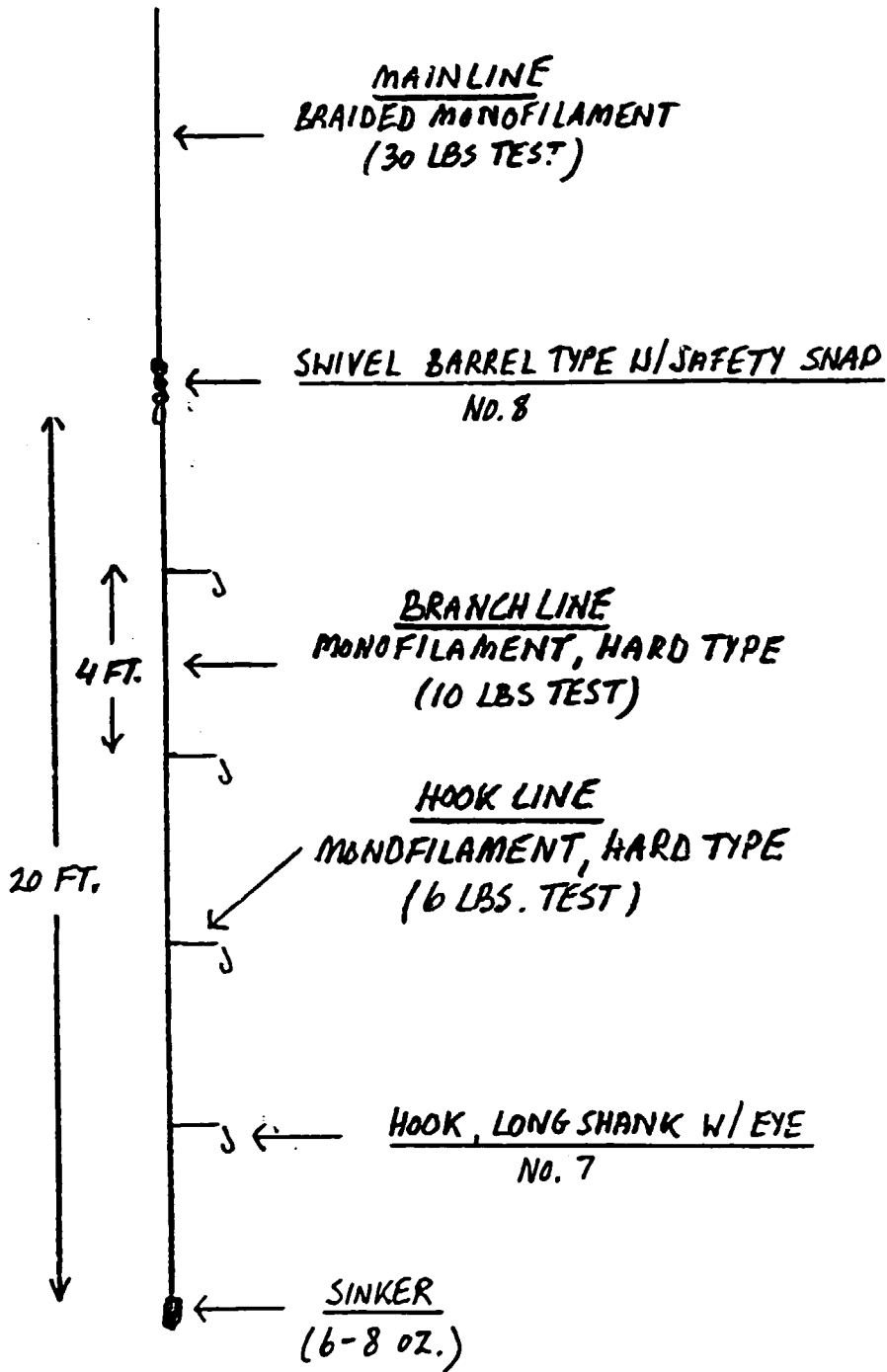
3. Cleaning of
fish, before
salting (note
tooth brush)



Training in
rigging of
fishing gear
for Big-eyed
Scad fishing.



Preparation of
Skipjack Tuna for
drying.



RECOMMENDED RIG FOR BIG-EYED SCAD HANDLINE FISHING

Joint FAO/WHO Food Standards Programme
CODEX ALIMENTARIUS COMMISSION

CAC/RCP 9-1976

This Publication, highly recommended
as a reference to the handling of fresh
fish is available through FAO

**RECOMMENDED INTERNATIONAL CODE
OF PRACTICE
FOR FRESH FISH**



**FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
WORLD HEALTH ORGANIZATION**

SPC No. 1-6633



Appendix B

Case 2: Recommended procedures for drying Big-eyed Scad in areas where refrigeration and portable water are not available are as follows:

a. Initial Processing

1. The initial product must be fresh and processed immediately after catching if not preserved on ice.
2. For the size of dryer we use for this project (3 x 6 feet screen area) we can dry 60 fish, average size 1/4 lb each.
3. The fish will initially be split along the center from the top down, gills and intestines removed and abdominal area cleaned well with portable water. If portable water is not available, clean seawater can be used.
4. After proper rinsing, rock salt will be rubbed into each fish. The fish will after this be placed in a cool and sanitary area over-night.

b. Solar-Drying

1. The fish will be well-rinsed in potable water to remove any excess salt. If potable water is not available, clean seawater can be used. The fish should be soaked in clean water for about 2 hours.
2. For the first 5 hours the fish will be placed on the dryer with the skin down (towards the screen). For the remaining period of drying (about 3 days) the fish will be dried with the skin up.
3. During night-hours or during excessive cloudiness and rain the fish should be kept in a cool and sanitary area until processing is completed.

c. Marketing and Storage

1. After drying is completed it is ready for long-term storage (2-3 months).
2. It is always important to keep the dried product in a dry and well-ventilated place.

Appendix C

Case 1: Recommended procedures for drying Skipjack Tuna and small Yellowfin Tuna at the Tcketik Coldstorage are as follows:

Area where any processing of fish occurs must be highly sanitary and comply with the International Code of Practise for Fresh Fish (re. CODEX)

1. Initial Preparation

1. Skipjack Tuna must be day fresh (no more than 2-3 days on ice) before processing, due to the quick deterioration of the meat. Yellowfin Tuna can be kept longer if packed on ice before processing, but no more than 7 days. Neither should be gilled and gutted before processing.

2. For the size of dryer we use for this project (3 x 6 feet screen area) we can dry about 25 lbs. of meat which is equal to about 40 lbs. of whole fish.

3. The fish will initially be cut into twelve pieces and each piece will be cut lengthwise into 1/4 (or 1/2) inch thick slices.

4. After proper rinsing, rock salt will be rubbed into each slice. The salted meat will after this be placed in a cool area (preferably refrigerated) over-night.

2. Solar-drying

1. The meat will be well-rinsed in potable water to remove any excess salt and should be soaked in clean water for about 2 hours.

2. The fish will be turned over half an hour after drying has begun to avoid the meat from sticking to the screen. Drying will continue for 2-3 days or until the product is dry.

3. During night-hours or during excessive cloudiness and rain the fish should be kept in a cool (preferably refrigerated) area until processing is completed.

3. Marketing and Preservation

1. After drying is completed it is ready for marketing. If the product is sold for retail it should be packed in consumer attractive labelled plastic bags e.g. zip-lock type. Naturally, for marketing purposes nice packaging is advisable and if vacuum packing is available it should be used.

2. It is always important to keep the finished product in a dry place and free from moist.

Appendix D

Case 2: Recommended procedures for drying Skipjack Tuna and small Yellowfin Tuna in areas where refrigeration and portable water are not available are as follows:

a. Initial Processing

1. The initial product must be fresh and processed immediately after catching if not preserved on ice.
2. For the size of dryer we use for this project (3 x 6 feet screen area) we can dry about 25 lbs. of meat which is equal to about 40 lbs. of whole fish.
3. The fish will initially be cut into twelve pieces and each piece will be cut lengthwise into 1/4 (or 1/2) inch thick slices.
4. After proper rinsing in clean sea-water, rock salt will be rubbed into each piece. The salted meat will after this be covered and placed in a cool area over-night.

b. Solar-Drying

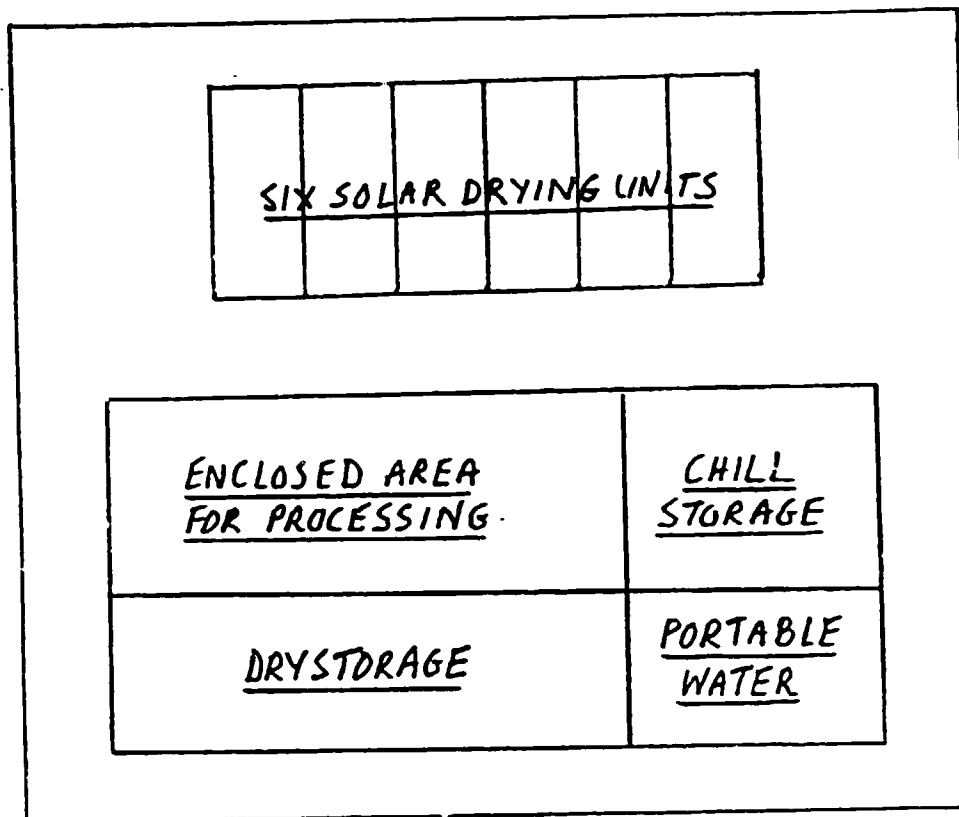
1. The meat will be well-rinsed in potable water or clean sea-water to remove any excess salt and should be soaked in clean water for about 2 hours.
2. The fish will be turned over half an hour after drying has begun to avoid the meat from sticking to the screen. Drying will continue for 2-3 days or until the product is dry.
3. During night-hours or during excessive cloudiness and rain the fish should be kept in a cool (preferably refrigerated) area until processing is completed.

c. Storage

1. After drying is completed it is ready for long-term storage (2-3 months).
2. It is always important to keep the dried product in a dry and well-ventilated place.

Appendix E

1. Basic Design



Appendix F

PRE-FEASIBILITY STUDY FOR THE COMMERCIAL PRODUCTION OF DRIED
BIG-EYED SCAD

1. Product for Marketing

The dried product we are producing is a Value Added Product and not a product for the purpose of storing over a long period. Long-term storage would be the primary objective in a subsistence economy.

2. Weight loss in Processing

Normally in drying, weight loss is an important factor. However, in case of drying Big-eyed Scad we do not consider this as fish is not retailed by weight but by piece. We assume that the processing facility purchases fresh Big-eyed Scad for \$0.70 per lb. As there are an average of four fish per pound each fish cost in wet form \$0.175.

We expect to wholesale the dried fish \$0.50 per piece. Therefore the difference between purchase price and selling price is \$.325 per fish.

3. Production Output

Equipment:	6 solar-dryers, each 18 sq.f. screen area
Number of drying days per month:	20 days
Drying cycle:	3 days
Fish per drying cycle:	160 fish
	40 lbs.

4. Income per Month

Production per month:	3,200 fish
Wholesale value of Product per Fish::	\$0.50

Income per Month:	\$1,600.00
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5. Expenses per Month

Capital Costs:	
6 Solar-dryers	\$900.00
Assorted processing equipment (plastic pails, knives, cutting boards etc.)	\$200.00

UNIDO Consultant Work Schedule in Pohnpei
TTP/39/200

<u>Date</u>		<u>Day</u>	<u>Activity</u>
May 31		t	Expert arrived to Pohnpei
June 1		f	Project Preparation
2		s	Project Preparation
3		s	Project Preparation
4		m	Training in rigging of fishing gear
5		t	Training in rigging of fishing gear
6		w	Training in rigging of fishing gear
7		t	Training in rigging of fishing gear
8		f	Training in rigging of fishing gear
9		s	Processing and Drying
10		s	Drying
11		m	Fishing/Drying
12		t	Fishing/Processing
13		w	Drying
14		t	Drying
15		f	Processing and drying
16		s	Drying
17		s	Drying
18		m	Drying
19		t	Fishing/Processing and drying
20		w	Fishing/Processing and drying
21		t	Processing and drying
22		f	Drying/Preparation of Report
23		s	Drying/Preparation of Report
24		s	Drying/Preparation of Report
25		m	Project Ends

**List of Trainees
TTP/89/200**

Training in Rigging of Fishing gear:

Mr. Marvia Fred
Mr. Isaac Mahora
Mr. Bermino Rethnan
Mr. Sany Benjamin
Mr. Thomas Paulis
Mr. Hulusia Leonard
Mr. Dusty Henry
Mr. Casty Heinrich
Mr. Nelson, Boat No. 1
Mr. Waltis Pertinant
Mr. William Route
Mr. Stanley Poll
Mr. Toshiuki Rudolp
Mr. Nihlis Ernest
Mr. Max Malarme

Training in Fishing:

Mr. Marwia Fred
Mr. Isaac Mahora
Mr. Bermino Henry
Mr. Dusty Henry

Training in Processing and Drying:

Mr. Marwia Fred
Mr. Isaac Mahora
Mr. Bermino Henry
Mr. Dusty Henry
Mr. William Route
Mr. Stanly Poll
Mr. Toshiuki Rudolp