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# Transportation and Harvesting

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# Monitoring for subsistence fish farmers

- A fish farm is a business; therefore all activities on the farm should be recorded. Proper record
- keeping is a valuable management tool. It is the means to measure the cash input and cash
- output, in order to evaluate and improve the farm performance and plan for future operations.
- The records will assist in showing the farmer how much money can be made from the business
- (income), and how much money can be saved and spent on the running of business for the next
- pond cycle.

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# *What should be recorded?*

At the very least, record the number of fish and the total weight of fish harvested from the pond.

- This can be compared to the record of
  - how many fish were stocked into the pond at the beginning of the pond cycle and used to estimate the percentage survival of fish.
- Enter any daily observations such as
  - dead fish, water temperature,
  - water colour, water requirements, pond stocking dates, fish numbers stocked and their weight,
  - daily feed rations, sampling dates, sampling data, harvesting dates, fish numbers harvested and
  - their weight, total food requirements, and other relevant notes or data.
-

# *What should be recorded?*

Keeping pond record sheets and a logbook will help answer questions such as the following:

- If a harvest is less compared to previous harvests, what change was made to make it worse?

- If one harvest is more compared to others, what improvements were made?

- Did a cold season affect the growth of the fish?

- How many fish and what size of fish can be available to sell at different times of the year?

- Could low percentage survival have been due to bad water quality, someone stealing the Fish, or fish escaping?

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# *What should be recorded?*

- Notes recorded in a logbook for a pond over a complete cycle can include:
- **FISH**
- Source of fingerlings
- Number of fingerlings stocked
- Date stocked
- Total weight of fish stocked
- Average weight of fish
- Sample weight (every 2–3 weeks)
- Gain in weight at each sample
- Harvest weight
- Value of harvest
- % survival

# *What should be recorded?*

- **WATER**
- Temperature
- Dissolved oxygen and pH
- Water colour and Secchi value
- Volume of water exchanged
- **FOOD**
- Type of feed and Cost per kg of feed
- Feeding rate used at each sampling
- Daily feed ration (DFR) at each sampling
- Total amount fed (kg)
- Food conversion ratio (FCR)
- **SALES**
- Sales from farm and  at market
- Price per kg

# Monitoring for subsistence fish farmers

- ***Daily tasks***
- 1. **At least once a day**, the farmer should visit the ponds and check that:
- **the water supply** entering the ponds is adequate;
- **the pond dikes** are in good condition; and
- **the water quality** is good, as shown by the behaviour of the fish
- ***Tasks at weekly or longer intervals***

**once a week** and periodically

- to **canals and pond dikes,** for major maintenance or repair;
- to **compost piles,** to refill them as necessary.

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# Monitor Fish

- There are several reasons why you should monitor your fish regularly:
- to check closely on the **general condition and health** of the fish;
- to determine the quality of the **growth** of your fish and to improve it as soon as possible, whenever necessary;
- to determine the **efficiency of feeding** and to improve it immediately, if necessary;
- to adjust the **daily feeding ration** and to save on feed costs;
- to check if the **stocking rate** is adequate; if too high, the largest fish may be cropped out and transferred or marketed immediately;
- to check if stock is reaching **target weights**, and to help plan or revise your production or harvesting schedule.

| *Type of record* | *Utilization of Record-keeping Form* | | | *Recor Fo* |
|---|---|---|---|---|
| | Area | Frequency | Period | |
| FISH FARM MANAGEMENT | | | | |
| Fish stock monitoring | | | | |
| Feed distribution/fertilization | Pond | Periodically | Production | |
| Water quality monitoring | | | cycle | |
| FINANCIAL ASPECTS | | | | |
| Daily accounts | | Daily | One month | |
| Annual balance sheet | Farm | Monthly | One year | |
| Loan repayment | | Periodically | One year | |
| LABOUR/STORES | | | | |
| Labour register | | Periodically | One month | |
| Use of feed ingredients | | Daily | One week | |
| Feed stock | Farm | Daily | One week | |
| INTEGRATED ANIMAL HUSBANDRY | | | | |
| Production of meat birds | | | | |
| Production of egg-laying chickens | Pond | Daily | Production | |
| Production of pigs | | | cycle | |

# Fish marketing for commercial farmers

- **To sell more table fish at better prices**, check on the following possibilities:
- (a) **Where can you sell your table fish:**
- on the farm itself: easier, but usually at a lower price;
- at the local market: easy but limited demand;
- at more distant markets: more difficult and costly, but offers increased possibilities for sales.

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# Fish marketing for commercial farmers cont.

- (b) **Which kind of fish do the consumers prefer:**
- which species: with scales or without, fatty or lean, etc.;
- which size: any size from very small to larger or minimum size is essential, are large fish acceptable;
- which quality: fresh or processed, gutted or not, with head on or off, alive or dead.

# Fish marketing for commercial farmers cont.

(c) **To whom to sell your fish:**

- to the consumers directly: higher price but time consuming;
- to traders or wholesalers: lower price but can be simpler;
- to hospitals, canteens, other institutions: good price but delivery should usually be regular;
- to a marketing cooperative, as a member: better price perhaps, but needs active cooperation and good management.

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# Fish marketing for commercial farmers cont.

- (d) **How to sell your fish:**
- in a shop, on your farm or in town: additional costs involved;
- at an auction sale at the farm: very risky;
- through a contract at an agreed price: easy if well organized.

# Fish marketing for commercial farmers cont.

- (e) **When to sell your fish:**
- regularly, every day or week; at longer intervals;
- irregularly, concentrating on a particular season or period when prices are best.

# Fish marketing for commercial farmers cont.

- (f) **At which price to sell your fish:**
- free or fixed price;
- insufficient supply may justify higher price;
- poor quality may reduce price;
- larger quantities sell at lower price;
- what is your minimum price allowing for total production and marketing costs (remember that transport can be expensive);
- surplus fish might be sold cheaply and still mak a profit, if variable costs can be covered.

# *Diversifyingfish production*

- Raising more than one type -of fish may help contribute to the economic viability of your fish farm. **other types of fish** as :
- **juvenile fish** to be sold to other fish farmers;
- **selected broodstock**, with improved genetic characteristics: prices are usually high so are the risks taken over a production cycle which can be rather long;
- **sport fish**: sell fish for stocking in sport fisheries;
- **ornamental fish** such as goldfish, koi carp;

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# *Marketing fresh fish of good quality*

- **Local sale of fresh farmed table fish** is the simplest and cheapest way of marketing. But **to ensure good quality and a good price**, your fish should be handled properly.
- (a) **Before harvest:** remember to stop feeding them at least one day beforehand.. Plan your harvest properly.

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# *Marketing fresh fish of good quality*

- (b) **During harvest** (see : handle the live fish carefully. If necessary transfer them quickly to a storage facility, for example, to remove any unwanted muddy flavour or to simplify or make more attractive selling arrangements.

# *Marketing fresh fish of good quality*

- (c) **After harvest:** if muddy, rinse them well in clean water. It is best to kill the fish quickly with minimum stress, for example by chilling them in very cold water (about 40ºC) or crushed ice. Prepare your fish, if needed, according to customers' preferences, which may include operations such as sorting/grading (see Chapter 12), gutting, decapitating, splitting, scaling and filleting

# *Preventing rapid deterioration of fish quality*

- ***Preventing rapid deterioration of fish quality***
- As soon as a fish dies, it starts to decompose. This process is mainly caused by the **increased activity of bacteria** (see Section 15.3), which rapidly multiply within the fish under favourable conditions of food, temperature and humidity. Bacteria are especially numerous in pond. water as well as on the gills and in the digestive tract of live fish. It is from there that decomposition will quickly spread to the whole body as soon as a fish dies, unless good handling prevents it

# processing

- As soon as the fish are harvested you can **reduce bacterial activity** and thus prevent deterioration of fish quality:
- keep **the fish clean**, avoiding bacterial contamination;
- if acceptable to consumers, **gut the fish**, removing all internal organs and blood, and/or **cut off the gills** (or the head);
- **reduce the temperature** of the fish, either by simply keeping it cool (away from direct sun rays) or better, by chilling it with ice;
- expose the fish to **very high temperatures** such as boiling in water or cooking over a fire;
- **reduce the water content** of the fish by drying, salting or smoking (see paragraph 15).

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# Processing

- Thus, to ensure that your harvested fish will remain fresh and in good condition until they are sold, make sure of the following.
- (a) **Sell them** as soon as possible. Harvest only the quantity of fish that you expect to sell on the same day.
- (b) **Keep them cool**, in the shade and under a wet cover of sisal bags, banana leaves, grass, etc. If at all possible, use ice
- (c) **Keep them clean**. Wash them with clear water. Keep them off the ground and protect them well, for example in wooden boxes or plastic/sisal bags, from mud, dust, insects, etc.
- (d) **Never keep dead fish in water**. They will spoil rapidly.
- (e) **To transport them** avoid the warmest hours of the day, travel early in the morning or even at night. If at all possible, use crushed ice and an insulated container (

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# *Using ice to preserve fish quality*

Fish can be simply preserved with ice, whenever it is readily available in sufficient quantities and at a reasonable cost. Iced fish should also be acceptable to the consumer at a price covering the extra costs involved. The use of ice will also allow you to reach more distant markets with good quality fish.

- For best results, apply these simple rules.

- (a) **Use clean ice**, made from good water, and not contaminated by handling, crushing, etc.
- (b) **Ice clean fish while it is fresh**, as soon as possible after harvest and preferably within one hour of death.
- (c) Use **an insulated container**. A simple one can be made from a beer crate lined on the outside with sheets of styrofoam, at least 3 cm thick. Cover this with plywood and add an insulated lid

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# *Using ice to preserve fish quality*

- d) **Wash these containers well** between use, for example with a chlorine bleach solution or another non-toxic kitchen disinfectant. Rinse thoroughly with clean water.
- (e) **Use plenty of ice**: in hot weather at least as much ice by weight as fish. In cooler weather a ratio of one part ice to two to three parts fish may be feasible. This depends also on the length of icing desirable and on the insulation quality of the boxes.
- (f ) **Use the ice properly** so that it is in close contact with all fish:
- first place a layer of ice on the bottom of the container;
- add a layer of fish, separating them with ice;
- add ice along the sides of the container;

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# *Using ice to preserve fish quality*

- (f ) **Use the ice properly** so that it is in close contact with all fish:
- first place a layer of ice on the bottom of the container;
- add a layer of fish, separating them with ice;
- add ice along the sides of the container;
- make other layers in a similar way;
- top the container when nearly full with a last layer of ice;
- close the container tightly and keep it in a cool place.
- (g) For best results gut the fish, remove their gills and wash them well before icing.
- 11. In the tropics, well-iced fish **can last for many days**. If your fish is to be kept for such long periods, you should add extra ice to each containerfrom time to time, depending on the conditions of transport and storage.

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# *Using ice to preserve fish quality*

- Before processing, **the fish is usually prepared** as follows.
- (a) **Gutting:** cut the belly open from anal vent to throat with a sharp knife. Remove the internal organs. Cut the head off or cut the throat open to remove gills and blood vessels.
- (b) **Cleaning:** carefully remove in clean water all traces of blood and mucus. In tilapia, brush off the black membrane from the inside of fish.
- (c) **Splitting:** open fish with a deeper cut along the backbone, being careful not to cut through the outside skin

# *Using ice to preserve fish quality*

- (d) **Scoring fish** longer than 25 cm or thicker than about 2 cm by making cuts along the length of the fish at intervals of 2 to 4 cm.
- (e) **Salt the fish** directly, or to prepare for further processing, especially if fish are large and/or fatty, soak them for 60 minutes in a salt solution, called **brine**, made by diluting 1 to 2 kg salt per 10 l water. Drain/dry the fish in a cool place for about one hour before further processing (see paragraph 15).
- **Note:** to avoid breeding of flies and bacterial contamination of your fresh fish, keep **the fish offal**, together with spoiled fish and trash fish, in a **well-covered container** to be processed later (see paragraph 20).

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# *Using ice to preserve fish quality*

- . There are **three main processing methods**:
- **drying:** the removal of most of the water both from the surface and the deeper flesh of the prepared fish;
- **salting:** the replacement and removal of most of the water present in the flesh by salt;
- **smoking:** the removal of most of the water from the flesh and the depositing of preserving chemicals on it.

# *TRANSPORTING FISH*

**Seed transportation**

Good quality seeds are particularly packaged and send to farmers who will then grow and trade. There are ample factors to be considered in this process; equipment, chemicals, environmental conditions. Thus the operation management is essential.

The methods of packaging and transportation are divided into two: open system and closed system.

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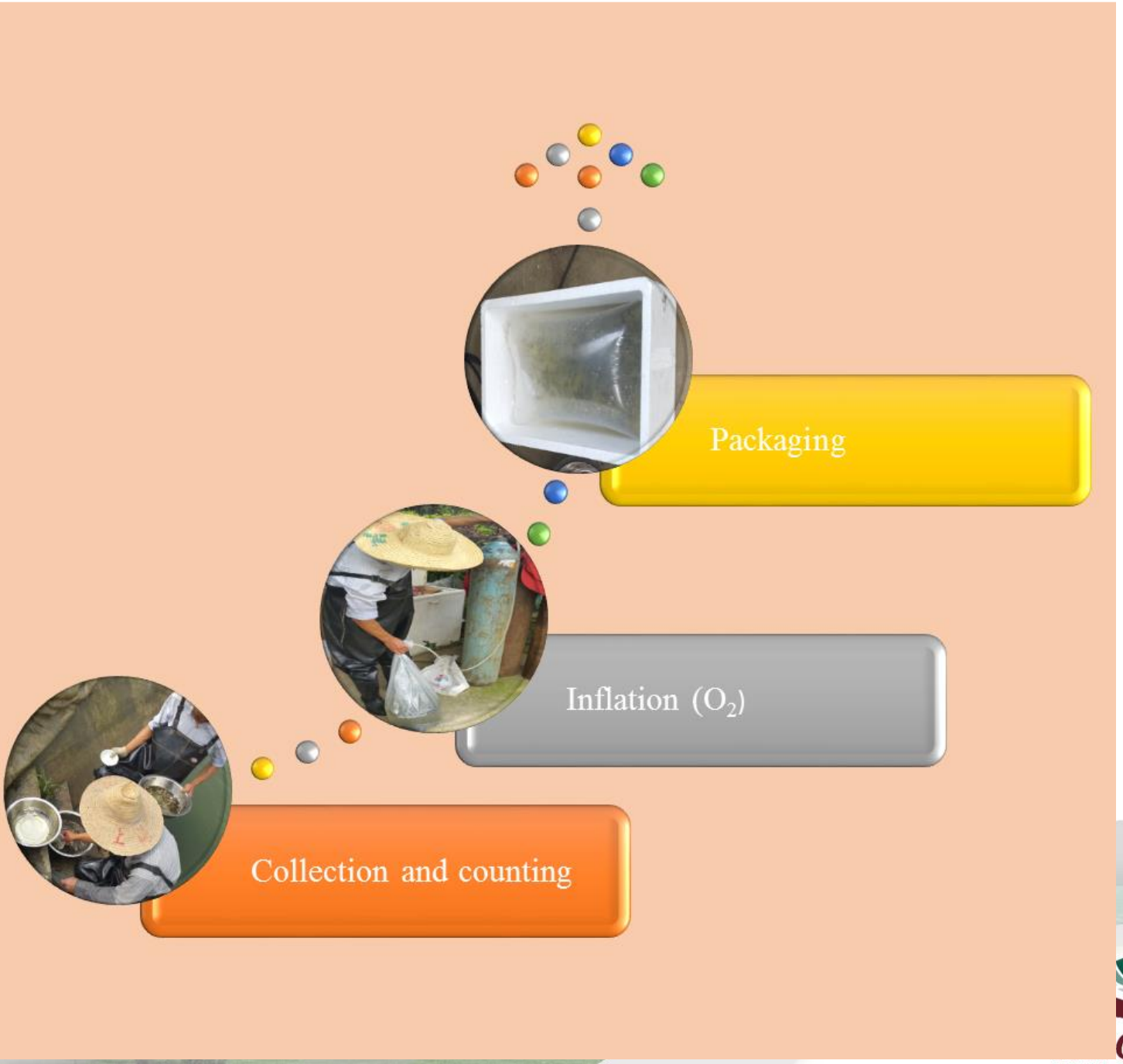
Packaging
Inflation ($O_2$)
Collection and counting

# TRANSPORTING FISH

- Open systems are designed for commercial trade and long distance transportation. In the case of seed and brood stocks, closed system is the most suitable. In a closed system Figure ; fry are harvested, counted and placed into a plastic bag. Oxygen gas in inflated into the bag, tightly sealed and placed into a steroform box for transportation. In all cases, the following must be considered
- Water depth of 30-35 cm.
- Low dosage of antibiotics.
- Low salt concentration.
- Oxygen (10 mg per 20 g for 2.5 hours).
- Average transportation of less than 24 hours.
- Tilapias are easier to transport because of their tolerance to high temperatures and have high resistance to disease

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# *TRANSPORTING FISH*

- Fish in oxygenated bags
- Water is poured into the bags (double bag) and fish are transferred into bags. The bags are pressed above the water to remove atmospheric air, oxygen is added, and the bags are tied with a rubber band.

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# *TRANSPORTING FISH*

- The plastic bag is placed inside another sack or in a wooden box or container for ease of carrying.
- With oxygenated bags, the fish density can be twice as much as when buckets are used.

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# *TRANSPORTING FISH*

## Long distance

- **Harvest fingerlings** from ponds or nurseries and put them into hapas set up in clean tanks, or directly into tanks
- 2.Leave the fingerlings for two to three days to **recover from handling stress**


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# *TRANSPORTING FISH*

## Long distance

- 3.Ensure **sufficient aeration** or a continuous **flow of water** to provide oxygen
- 4.The sides of tanks should be smooth, so fish do not get damaged when scooping them out

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# ACCUSTOMIZE AND RELEASE

Check pond/tank temperature, and bag temperature, with a thermometer.

- Release when difference is no greater than 4oC.

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# ACCUSTOMIZE

Splash in water to make a 50:50 mixture of pond and bag water, then wait another 5-10min

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# RELEASE

- Hold the bag on its side, so that fish can swim out by themselves.

⓾●Count dead ones remaining

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# *HANDLING FISH*

- “**Fish handling**” is taking your fish out of water and carrying them about, for example when transferring them from one tank or pond to another.
- It is important to be gentle with your fish and keep the amount of handling to a minimum, to avoid injury and stress that can lead to disease or death

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**Wear gloves, and cover the eyes**

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# processing, products and markets

- . The processing challenge:
- Specific species requirements
- Phytosanitary requirements
- The cold chain
- The market chain – knowing it beforehand
- Creating and retaining quality
- Legal requirements
- Animal welfare
- Product / client requirements

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# processing, products and markets

- . PRODUCTS:
- Very diverse
- Depends on the species
- Depends on the market
- Depends on the “capacity”
- Getting the “rights product fit”


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# processing, products and markets

- The marketing challenge:
- Production species
- Cultural and market perceptions
- Cost and cost perception vs. production costs
- The offer of “VALUE”
- Presentation form (packaging)
- Dynamics of global markets and volume of supply
- Dynamics of local markets – and rural markets
- Consistency in supply
- Consistency in quality
- Uptake agreements !!
- Market security.

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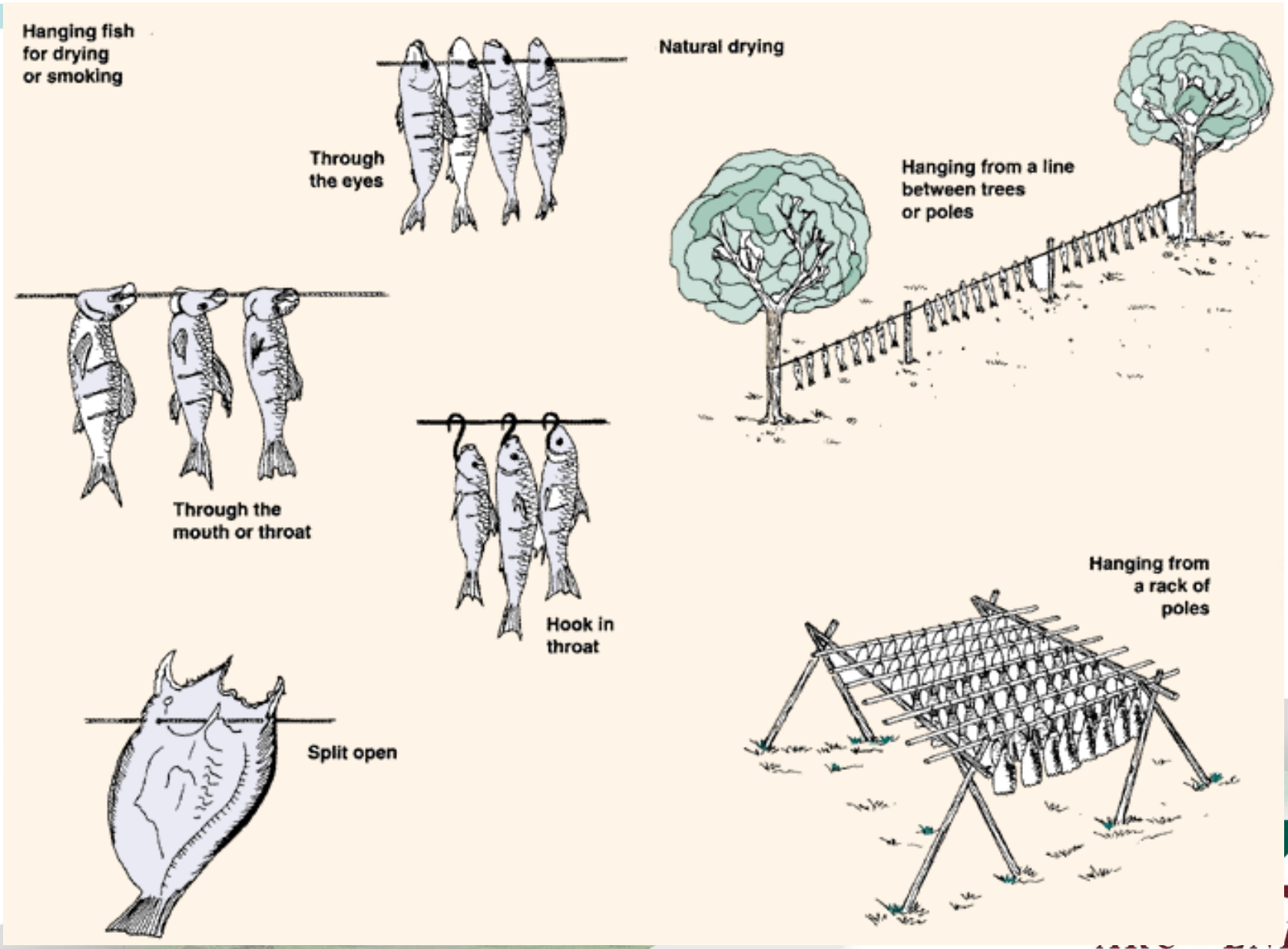
| | DRYING | | SALTING | | | |
|---|---|---|---|---|---|---|
| METHOD | **Natural drying** | **Solar drying** | **Kench salting** | **Pickle curing** | **Brine salting** | |
| Procedure | Expose fish to hot air and/or dry wind<br>Protect from rain<br>Overnight, store in a weighted pile<br>Do not dry too fast at beginning | Place fish in hot air dryer<br>Best in less favourable weather | Arrange fish in pile, well mixed with salt<br>Make centre of pile 10 cm higher than edges<br>Drain brine produced<br>Invert pile layers after one day and every three days after | Arrange fish in pile, well mixed with salt<br>Keep brine in container<br>Keep fish below surface of brine with board and weight<br>Invert layers every two weeks | Prepare salt solution:<br>• fatty fish 25-35%<br>• lean fish 15-25%<br>Keep fish in brine with board/weight<br>Add salt to maintain brine concentration | Place<br>Vary<br>• for<br>• for<br>• the<br>Towa<br>smok<br>wet g |
| Equipment | Drying rack | Solar dryer | Container with holes in bottom | Watertight container | Watertight container | Colun<br>Chori<br>Ivory<br>Alton |
| Supplies | — | — | 30-35 kg salt/100 kg fish | 20-35 kg salt/100 kg fish | Fatty fish 25-35 kg salt<br>Lean fish 15-25 kg salt<br>... per 100 kg fish | Wood<br>palm |
| Duration | Until no further weight loss | Until no further weight loss | At least 24 to 48 h, until no more brine drains out | At least 24 to 48 h | At least 24 to 48 h | 48 to<br>22-33 |
| Further uses | — | Disinfection of dried fish infected with fly larvae and insects | — | — | Washing of moulded dried or smoked fish: 20-25% brine and sun drying | Resm<br>40°C-<br>• hu<br>• dr |

| | DRYING | | SALTING | | | SMOKING |
|---|---|---|---|---|---|---|
| How to improve results | **Surface drying**: increase surface area, air t° and speed; low air humidity<br>**Deeper drying**: increase t° air/flesh; reduce water content of flesh; low fat content; thin flesh | | Very pure salt (NaCl), in large quantity<br>Quick salting, in a cool place<br>Increased surface area<br>Low fat content and thin flesh (less than 5 cm) | | | Wood: thick, green logs, no resinous wood or teak (produces bad flavour)<br>**Oven**: control fire t°/smoke, efficient use of fuel, large capacity |
| Characteristics | Cheap and simple<br>Depends on local climate | | Depends on salt availability, price, quality<br>Salted fish should be acceptable to consumers | | | Depends on fuel availability and price (especially wood) |
| Preparatory treatment | Light brine salting or not | | Light brine salting or not | | | Generally light brine salting |
| Type of fish | Lean fish only | | Lean fish (air t° <30°C) | Lean fish (air t° <30°C)<br>Fatty fish (air t° <30°C) | Lean or fatty fish (all air t°) | Lean and fatty fish |


Hanging fish for drying or smoking
Through the eyes
Through the mouth or throat
Hook in throat
Split open
Natural drying
Hanging from a line between trees or poles
Hanging from a rack of poles

# Thank You

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