UNIVERSITY OF GREENWICH

Natural Resources Institute

Post Harvest Fish Loss Model

Manual

Contents

Introduction

The generic Predictive Model focuses on the two most important post-harvest fish losses: physical and quality losses.

Physical loss: fish or product that is discarded and not sold for whatever reason, be it due to spoilage, damage or insect infestation.

Quality loss: quality deterioration can lead to a loss in value. Fish is downgraded and sold for a lower price than it could have been sold for if the quality was better. The value of the loss is the difference between the price attained and the price the fish would have sold for had its quality been good.

The Model categorises what happens to fish from the time of capture into a succession of stages and assumes that there is a transport event between each stage. It enables the user to present and link data on loss at different stages in a distribution chain. It is designed for people who wish to mimic a fish distribution chain and explore the effect of loss reduction interventions at different stages of the chain. It enables the user to identify key losses and shows the impact of hypothetical interventions to reduce loss at the distribution stage level and on the total loss for the whole distribution chain.

The Model shows the role that income from the sale of by-products has on the overall chain loss. The loss may be balanced out by by-product income.

In order to use the Model certain essential data are required for each stage of the distribution chain. These are: percentage of fish physically lost, percentage of fish sold for a reduced price, price of good quality fish, price of poor quality fish and weight of fish. Data are also required on the local currency to US$ exchange rate, type and value of any by-products, by-product as a proportion of whole fish and weight loss due to processing.

The data may represent some particular sample of fish or may be averaged over several samples to represent the mean loss at each stage of the chain.

The data can be generated using the Field Based Loss Assessment Methods developed by the DFID Post Harvest Fisheries Research Programme.

The accuracy of the Model predictions will be related to the accuracy of the data used. This will be related to the type of method used for data collection and the way in which it has been applied. The Model should not be used as a stand-alone decision-making tool. It should be used as a guide to identify interventions for which a cost: benefit analysis and technical appraisal should be conducted. The Model does not take into account the fact that fish of differing qualities may be entering a stage. It has been developed to model data for single species of fish rather than mixed catches where prices and loss may vary according to species. Furthermore, the model is designed to run from data on a single product type and chain. If fish from a batch are divided after landing into some which are processed and some which are sold fresh, then the two sets of data will need to be modelled separately.

Research and development of the generic Predictive Model were conducted using MATHCAD software. Any continuing development of the Model would be done using MATHCAD as this facilitates the evaluation of alterations.

This Excel version of the Model utilises the NAMES facility of Excel to create an impression of simplicity. This has enabled a user-friendly representation of the complex mathematical formulae. The actual complexity of the Model can be appreciated by browsing the calculation worksheets: Fishing, Transp2Land, Landing, Transp2proc, Processing, Transport2Whol, Wholesale, Transp2Ret, Retail, Transport2Export, and Export.

Using the Model

When opening the EXCEL file you can use it as read-only (recommended option) or as not read-only, which will allow changing formulae etc.

Also, make sure that you respond to the security warning that "Macros have been disabled" by clicking on "Enable Content"

The Input-Output (IO) worksheet is the user interface. It consists of a data Input Table, into which the user enters data and an Output Table, which presents the results of the model calculations. Also shown on the IO sheet are fields for entering data on currency and by-products and fields that summarise overall losses. Please note that the model does not require the user to enter data for every stage of the Input Table in order for it to work. Stages can be omitted if they are not relevant.

Definitions

The following is a list of the Input ***Table*** fields:

Input Table Horizontal Axis

reduced price ratio – the price of low-quality fish expressed as a proportion of the price of good quality fish. For example, if good quality price is 100 and low-quality price is 70, then the reduced price ratio would be 70/100 = 0.7.

% sold red price – the proportion of fish sold for a reduced or low price, because of spoilage or damage (quality loss), expressed as a percentage of the weight of fish entering that stage.

% physical lost – the proportion of fish that is lost (physical loss) at this stage of the chain expressed as a proportion of the total weight of fish entering the stage. Fish can be physically lost from the chain resulting from factors such as insect infestation, spoilage, damage or theft.

best price kg – the price of good quality fish per kilogram, expressed in local currency. The price refers to the good quality fish as it is sold on to the next stage in the chain. In order to calculate the price, data may be required on the kg weight of traditional units by which fish are sold.

Input Table Vertical Axis (these also correspond to the output table)

Fishing – the time from capture (fish entering the net) to the point of sale of the catch into the next stage of the chain. Physical loss at this stage may include fish thrown overboard because of spoilage. Any fish of lower quality in a catch may be downgraded and sold for a low price.

Transp2L - this typically refers to the transport of fish by collector boats or by other means from fishing canoes or boats or to remote landings, to a first point of sale. This stage may not apply to all distribution chains.

Landing – the time from when the fish are landed to when they are sold on into the next stage that could be for processing and/or could be for fresh fish mongering. Spoilage at this stage due to poor preservation techniques may mean fish are downgraded and sold for a low price. Theft and damage due to poor handling are causes of physical loss.

Transp2p – if fish are processed or are to be distributed fresh then they may be transported from the point at which they are sold and brought to a processing, packaging, icing or onward transport area. Delays at this stage may lead to unnecessary spoilage, especially if no ice is used. If an agent is operating at this stage, then a transaction to the next stage may take place.

Processing – fish are often processed to extend their shelf life and a number of different methods may be employed. Insect infestation, damage during the process and poor handling and packing can cause both physical and quality loss during processing. The stage ends once fish leave the processing site. This may involve a transaction from a processor to a trader who has come to the site to buy. Otherwise, the fish may remain with the processor up to the wholesale stage. The value of the fish and losses should be calculated according to the price received by the processor from a trader or wholesaler.

The weight of a batch of fish may change as a result of a processing operation. For example smoking can reduce the weight of fish by 40 to 50%. This weight loss is dealt with using the percentage after drying and the percentage after gutting fields (see below).

Transp2W – fish may be transported to a wholesale market by a variety of different means. Both physical and quality loss can occur during transport due to damage and spoilage. Loss may be incurred by the processor who still owns the fish or by a trader who has purchased the fish from the processor.

Wholesale – fish normally pass through a wholesale marketing stage where they are sold in bulk and then sold on, in smaller lots, to retailers. Storage of cured fish at this stage can be for several months and this can leave the product susceptible to insect infestation and attack by other pests.

Transp2R – this refers to loss that can occur during transport of the fish between the wholesale market and a retail stage.

Retail – the point in the chain at which fish are mainly sold to the final consumer. Retail stage loss occurs because of spoilage or insect infestation.

Transp2Exp – rather than selling fish to the final consumer in-country, it may be exported. This stage deals with the loss that can occur during transport to an exporter or during export. The transport may be typically from the fishing, landing or processing stages. Whether there is a transaction at this stage or not will depend on whether an exporter is using agents or is buying from a distributor. Loss can result from spoilage due to poor icing and delays or damage during transport – the fragmentation of smoked fish.

Export – fish may be processed in a factory before export or simply bought by a trader and taken directly out of the country. This stage refers to the export of fish directly and not export via a processing factory. This reflects the artisanal focus of the model.

Output Table Horizontal Axis

The following is a list of the ***Output*** table fields ***(horizontal axis):***

Weight (kg) – the weight of fish at the beginning of, or entry to, a stage. At the Processing stage any weight loss due to processing is taken off as data on losses should refer to fish after processing.

Weight lost (kg) – the weight of fish physically lost at that stage.

Wt at low price – the weight of fish sold for a reduced price (quality loss).

Reduced $price kg – the price that low quality fish are sold for.

% of fish at model start - this is a financial percentage loss, not a weight percentage loss. It is the value of the financial loss in each stage, expressed as a percentage of the initial value of the catch, at the model start.

% of fish at stage start - this is also a financial percentage loss. It is the value of the financial loss in each stage, expressed as a percentage of the value of the catch on entry to that stage.

total $ losses – value of the combined physical and quality loss in US$.

Other Input Fields

The following is a list of other input fields:

Local currency – enter the name of the local currency used.

To US$ exchange – relevant exchange rate of local currency to 1 US$.

Start weight (kg) – the weight of the quantity of fish that enters the chain or is caught.

Dataset identity – enables the user to enter a brief description of the data, e.g. country of origin.

By-product name – the name of any by-products that are sold.

Percentage left after drying – processing usually involves some form of weight loss that is not classed as a loss but is a result of a deliberate action. Sun drying and smoking are two processes which result in a significant weight loss.

Percentage left after gutting – as for percentage left after drying.

(by-product) Percent of catch – this refers to the proportion of a whole fish that is a by-product in its finished and processed form. For example, 100 kg of fresh whole Nile perch can produce 1 kg of dried swim-bladder or maw. Thus 1% would be the percent of catch.

**(by-product) Price in US$** - selling price of by-products converted into US$.

Loss Summary Fields

The following is a list of **loss summary** fields:

Net total losses (local currency) – the sum of the value of physical and quality loss for the whole chain expressed in the local currency used.

**Net total losses in US$** - the sum of the value of physical and quality loss for the whole chain expressed in US$.

Total losses considered as a % of initial value of catch – the total loss in value terms expressed as a percentage of the value of the fish that enters the chain before any loss using the value of the fish at that stage.

Total losses considered as a % of maximum value of fish – the total loss in value terms expressed as a percentage of the value of the fish assuming no loss and using the best price attained.

Profit in US$ - not a loss summary field and not strictly profit, this refers to the income generated from the sale of by-products.

Gross total losses in (local currency) – the loss in local currency once any revenue from by-products has been deducted.

**Gross total losses in US$** - the loss in US$ once any revenue from by-products has been deducted.

Other Fields

Quit excel – click on this to end the session, save and exit.

Inputting data

The IO sheet is used for data entry. Data are entered into the **Input Table** and the **Other Input fields**.

For each stage of the distribution chain, data must be entered into all of the **Input Table horizontal fields**.

The chain may consist of all of the stages in the Model or only a few of the stages. If a stage is not relevant to the chain being modelled, then leave the **Input Table Horizontal fields** blank or enter a zero for that stage. For example, if the chain is for distribution of whole fresh fish then the processing stage may not apply and is therefore left blank.

Data should be entered into all or some of the **Other Input fields** depending on the chain type**.** If there is no processing stage, and therefore no weight loss due to processing, then the weight after drying should be left as 100%. If there are no by-products from the chain, then these fields should be left blank.

Interpreting the Results

Once data have been entered the model will show the results in the **Output Table** and in the **Loss Summary fields.**

Total $ Losses in the right-hand column of the **Output Table** is a key indicator of where loss is significant in a chain. **Net total loss** gives an indication of the accumulated loss for the whole chain for that quantity of fish.

Modelling Interventions

Once a data set has been entered it is then possible to see the effect of “what if” scenarios on the loss at the stage level and for the chain as a whole. Examples of typical “what if” scenarios are:

- Physical loss during processing is reduced by x% by altering the processing equipment?
- Transport loss is reduced by better packaging?
- Ice is used and the quality loss is reduced by x%?

You may have ideas on the sort of interventions that are appropriate for the chain in question. You may have data on how much these interventions can reduce loss and this information can be used in the model.

If loss data are statistically valid, and representative of a target population, then it will be possible to estimate loss levels on a larger scale rather than for just the micro level. The total loss level for a chain using landing data for a season or year may be of interest to planners and policy makers. If the total financial loss appears to be substantial and interventions can reduce this then estimating the potential benefits of loss reduction may attract interest and lead to more detailed cost: benefit and technical appraisals.

Saving Data

In the “File” drop-down menu, use the “Save As” option with a new name. Keep the original read-only file as a template for your next model.

Tips

What do you do if the IO sheet does not fit onto your computer screen?
Use the cursor to select (*highlight*) the working area of the sheet. In the “View” menu, click “Zoom” and “Fit selection” or click “Selection” on the Zoom tool of the “Standard” tool bar. The working area should now fit the screen.

Further Information

For further information and advice on how to use the Model please contact the FAO Post Harvest Fisheries Research Programme Manager or two of the developers of the Model who are: Prof Robert A. Cheke of the Natural Resources Institute of the University of Greenwich, Central Avenue, Chatham Maritime, Kent, ME4 4TB, UK (Email: r.a.cheke@gre.ac.uk / robert.cheke@btinternet.com) or Ansen Ward (Ansen.Ward@FAO.org /ansenward@hotmail.com).