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Some Notes on the Smoking of Fish

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F O R E W O R D.

This circular has been written to embody answers to queries which are frequently put to the Fisheries Division. It appears to be impossible to publish full directions for the smoke curing of fish, as this is not a procedure which readily allows of chemical or physical control. Smoking can be cheaply and effectively carried out with simple equipment by men with the requisite knowledge and experience, and it has yet to be shown that scientific control would be economical, though this is possible in tropical climates if justified by the demand for smoked fish. The use of dehumidifiers is practical in at least one commercial plant in U.S.A., and some kilns of special design are operating in Canada and Norway, but otherwise the time-honoured methods prevail.

Scientific studies have considerably helped the fish smoking industry, but rather by demonstrating economies and improvements of the product than by revolutionizing the mode of procedure. This Division has begun, therefore, by carrying out strictly practical tests, some of the results of which are embodied in this circular.

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July, 1940.

Some Notes on the Smoking of Fish

The Division of Fisheries is continually being asked questions concerning the smoking of fish, and it is the purpose of this short paper to answer some of those questions

1. *What Australian fish can be smoked to give a marketable product?*

The answer to this question is that any fish with a high or moderate oil content can reasonably be expected to smoke well. Non-oily fish tend to have a less rich flavour, and at the same time usually bring too high a price in the fresh fish market to be economical for the purpose. Other fish which give a delicious product occur only in small quantities and could only be smoked for a very local market. Such a fish is the trevally. We are left with the more abundant fish, barracouta, salmon, mullet, Spanish mackerel, and yellowtail (kingfish of New South Wales). Barracouta gives a very good smoked product, as is recognized in Victoria. Salmon gives a cheap grade of smoked fish which is quite palatable but of poor appearance. The last factor is one that cannot be overcome owing to the large flakes and rather tough structure of the flesh. Salmon also varies considerably in gloss even for fish handled under identical conditions. Mullet gives a very good smoked fish, either kippered or as fillets. It somewhat resembles English kippers in flavour. Spanish mackerel is the best fish that it has been our fortune to handle, and smoked fillets are the equal of the best imported fillets as they arrive in Australia. The drawback to the smoking of this fish is its high price in the fresh state. The Queensland Government might with advantage give attention to the development of the mackerel industry with a view to smoking, in order to replace high quality imported fish during war time. The yellowtail (New South Wales kingfish, *Seriola grandis*) gives a good

smoked fillet, not as high in quality as Spanish mackerel. Mention must also be made of the tommy ruff of South Australia and Western Australia, which is not exploited, though it is the best substitute for English kippered herrings.

2. *What fish can be purchased at a price to allow of economic smoking?*

Barracouta, mullet, salmon and possibly tommy ruff, yellowtail and possibly Spanish mackerel.

3. *What is the loss in smoking, and how does this bear on price and sale value?*

The smoker should allow for a recovery of 35 to 40 per cent. of the raw weight. In the case of Spanish mackerel which is sold after gutting, the loss is about 50 per cent., and of barracouta sold gutted and headed, about 40 per cent. During smoking a further 12 per cent of the dressed weight is lost. Apart from the handling involved, the cost of the smoked fillet must be reckoned as more than twice that of the raw fish. The cost of anatto dye, brine, sawdust, etc. is not very high, and the capital cost of commercial kilns is also low. Labour costs depend on the skill of those employed and on local conditions.

4. *What is the procedure involved in smoking?*

The fish must be split along the backbone or filleted as desired, and it is preferable to obtain uniform colour by dipping for a minute or so in a weak solution of anatto dye, though this is not essential. The fish are then brined in tubs in a 60° salinometer brine, the time of brining varying from 15 to 30 minutes according to the size of the fillets. If the fish are closely packed in the brine tubs the time must be lengthened. Care must be taken to keep the brine up to the required strength as salt is removed from the pickle. The use of 0.01 sodium nitrite in the pickle gives a slight pink colour to the surface and tends to increase the keeping qualities of the fish. After brining, the fish are hung on rods or tenters either by the lugs or by the tail, and allowed to dry on racks or in the kiln until the surface is sticky or "tacky" to the touch. The fish are then ready to smoke. They are placed in the kiln and the fires lit with the air circulation restricted. The temperature is allowed to rise during about 3 hours to about 85°F. and kept about this

temperature for somewhere near two hours. The ports in the kiln are then opened and the temperature allowed to rise to about 110° or 120°F. during the next hour. The times given are only approximate, and actual times depend on the size and thickness of the fillets or kippers, the ideas of the fish curer in charge of the operations, and most upon the external temperature and humidity. If the fish are smoked too slowly they will be dry and lose flavour, and if smoked too quickly they sweat and lose appearance, becoming rather unpalatable. They are removed from the kiln when they are just beginning to curl, though the end point is a matter for individual judgment. If the fish are smoking too rapidly they may be moved farther from the fire and the top vents opened and vice versa. It will be seen that a great deal of judgment and experience is required in fish curing, and great care is needed to secure a first class product under varying conditions.

5. *What sort of fuel is used for the fire?*

Sawdust, which must be fine and bone dry. Usually a mixture containing a large proportion of New Zealand Remu is used, but spotted gum (*Eucalyptus maculata*), sheoak (*Casuarina*), and paper bark tea-tree (*Melaleuca*) are satisfactory if they can be obtained in the right condition. The dust is spread evenly over the floor of the kiln about 2 inches in depth, and lit with a few drops of methylated spirits. For a quick fire, several parts of the dust, evenly spaced, are ignited, for a slow fire only one part is lit (centre).

6. *What are the climatic limits at which smoking can be carried out?*

It is usually considered that the external temperature should be below 75°F. and the humidity below 80 per cent. and preferably below 70 per cent. For this reason it will be found difficult to get a satisfactory gloss in hot weather. Under such conditions it is necessary to start the fire in the early morning, 4 or 5 a.m., to avoid the temperature and humidity rises after midday. This means that the brining must be done in the late afternoon preceding. A method of overcoming humidity differences is to use a regulated kiln with the humidity controlled by the use of silica gel dryers or refrigeration. No kilns of this type are used in this country.

7. *How can fish be stored prior to smoking, or is it better to store smoked fish?*

It is better to smoke fish after storage, as rancidity is less and gloss is better. Fish can safely be stored for a week at 32°F. and for a month at 10°F., though for this period or longer it is better to store at 4°F. or lower if such refrigeration is available. At these lower temperatures, fish can be smoked satisfactorily after storage periods of 3 to 6 months, though some increase in rancidity inevitably occurs. Salmon appears to deteriorate more rapidly than mullet. Smoked fish stored at these lower temperatures keeps quite well up to 3 months.

8. *Should the smokehouse be situated near the market or near the fish supply?*

The smokehouse should be, as a rule, near the market on account of the above considerations, and because it is usually desirable to smoke several kinds of fish. This applies to Australia where distances between ports and market are frequently great. Smoked fish are not improved by being packed in ice.

9. *What is a good size and design for a smokehouse?*

The size naturally depends on the amount of fish required, but it is preferable, on account of handling and control, to have two or more rather small kilns rather than one large kiln; 5 feet to 6 feet each way is a handy size. The height varies with the amount of fish to be handled, but should be so arranged that the lowest of the fish are about six feet above the hearth. The top of the kiln should be screened from the weather and should be fitted with adjustable flaps for increasing or decreasing the air flow as required. It is best to house the whole kiln in a building to ensure uniformity of external conditions.

There are many more details in actual smoking practice than can be discussed here, but it is necessary to obtain them by experience. Smoke curing to produce a uniform product under varying conditions is an art and cannot be set out on paper. Many fish curers may disagree with some of the statements made here, but they have been shown in practice at this laboratory to give satisfactory results under local conditions. In the final stages of any smoking project it will be necessary to appoint an experienced man to control the operations.