ORIGINAL : ENGLISH

DEVELOPMENT OF A NOVEL TUNA PRODUCT IN KIRIBATI

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1. The Outer Island Fisheries Project (OIFP), which has centres on three outer islands in Kiribati, started operating in 1987 as an extension of the national fishing company's (Te Mautari Ltd) tuna pole-and-line fishing operations, supplying frozen tuna in bulk for canning. Two reviews of the project in 1990 expressed concern at the economic viability of this type of operation, geared to blast-freezing tuna landed from an artisanal fleet, particularly given increased fuel prices and a decline in the world market price for tuna destined for canneries.

2. These factors, together with a change in management, prompted a rethink of the objectives of the project, the subsequent diversification of its operations to include the processing and marketing locally of reef-fish, and a look at alternatives for marketing tuna. As part of the diversifying process, the project refurbished a previously disused fish market on Betio, South Tarawa, in late 1991. It is here that the tuna jerky processing and marketing trials began in March 1992, following technical advice from SPC's Post-Harvest Fisheries Advisor.

3. The idea of producing tuna jerky is to utilise and add value to bulk frozen or fresh tuna landed at the project's three outer island centres, which is then shipped to our fish-market in Betio for processing. Generally only yellowfin tuna (*Thunnus albacares*) above 15 kg are used in order to maximise return on yield. The result is a value-added product which is both easy to produce, utilises a plentiful resource, is convenient to store and has wide market appeal.

4. The technology used in the production of tuna jerky is not only simple, but is also an improvement on existing methods of fish preservation used in Kirbati (on the outer islands particularly) which traditionally involves the salting and sun-drying of fish surplus to daily requirements. The key steps in the process are shown below.

5. Development of this product has been confined to using yellowfin tuna, as opposed to skipjack tuna, because the latter has a higher oil content (leading to rancid odours in the dried product), is more prone to worm infestation in the meat, and has a darker red meat which produces a poorer textured product on drying.

6. Yield rates are also considerably higher using a large yellowfin tuna. The average yield of the meat to be marinated is 46 per cent, dependent on both how well the fish has been bled following capture and how well it is loined and sliced. Yield of the finished dried product from the raw material averaged 11 per cent during the initial trials but more recently has been improved to 15 per cent.

7. The solar dryer used in the process was designed to suit local conditions, incorporating ideas from literature research and previous experience, and was built for a total cost of A$170, excluding labour (total 40 man hours).

8. The concept of solar drying uses the sun to heat the air inside the dryer and create an airflow by convection, as opposed to simple sun drying, which relies on radiant heat. It allows the product to be dried quicker and avoids the problem of insect infestation. The solar dryer is able to dry approximately 2.5 kg of finished product at a time, equivalent to an input of 17 kg of raw material.

9. On days with clear skies and a light 10 knot wind i.e. ideal drying conditions, the temperature inside the solar dryer is consistently 10–15°C above the ambient temperature of between 32–34°C. The marinating of the tuna is timed such that drying can begin by 0800hr, and provided there is no rain (when the relative humidity would be 100 per cent so no natural drying would occur) continues through to 1700hr; a total of 9 hours per day.

10. Experience has shown that it takes at least 12 hours i.e. 1.5 days, given ideal drying weather, to produce a stable product with water activity (Aw) below 0.7 (in order to inhibit bacterial spoilage). The texture of the product is also enhanced during drying as a result of the high drying temperatures, given the fact that tuna meat starts 'cooking' above 40°C. In order to minimise any possibility of spoilage, partially dried jerky is stored overnight in sealed containers packed in ice.

11. In order to speed up the drying process to within one day, the OIFP has considered the option of installing a simple heat collector, made of perspex and timber and fitted to the air inlet, which would then pre-heat the air (reportedly by up to 5°C) before it enters the dryer.

12. Another improvement, which would also have the added advantage of enhancing the drying time on overcast days, would be to install at the air inlet a heating element and electric fan, with a thermostat to regulate the temperature. At a cost of approximately A$ 500 for the equipment plus running cost, any such addition can only be justified if it could be accommodated in the product's selling price.

13. The economics of developing this product require that the raw material, in this case yellowfin tuna, is relatively low in price. In the case of Kiribati the local market price is A$ 0.75/lb (A$ 1.65/kg). All of the raw materials for the product can be obtained locally, although for our export-quality jerky we use one particular brand of quality soya sauce, imported in bulk from New Zealand.

14. The cost of producing our brand of tuna jerky, based on the local marketing cost, has been calculated per kg of finished product (dried weight) as shown in the box below. This is equivalent to a manufacturing cost of A$ 1.11 per 50 gram pack; with an 8 per cent mark-up the local selling price is pitched at A$ 1.20/packet.

15. For the export market, extra packaging costs would be incurred, including the use of 'Ageless' oxygen absorber sachets and sophisticated labelling. This should be more than compensated for by increased financial returns, bearing in mind that similar jerky products (made from beef) retail in Australia for approximately A$ 100/kg.

16. The recipe used for the marinade has been a key variable in developing this product, and is now based on the following ingredients: soya sauce (500 ml for each 3 kg of tuna – wet weight), brown sugar (20 per cent by weight of the marinade) and lemon juice (which being acidic helps to break down the proteins in the meat and thereby help the marinating process). In addition various herbs and spices are used to flavour the final product. Proximal analysis of earlier samples of our product by the International Food Institute in Queensland gave the following results:

Moisture content	18.0%
Ash	10.0%
Fat	1.0%
Salt	10.0%
Protein	61.0%
Total	100.0%

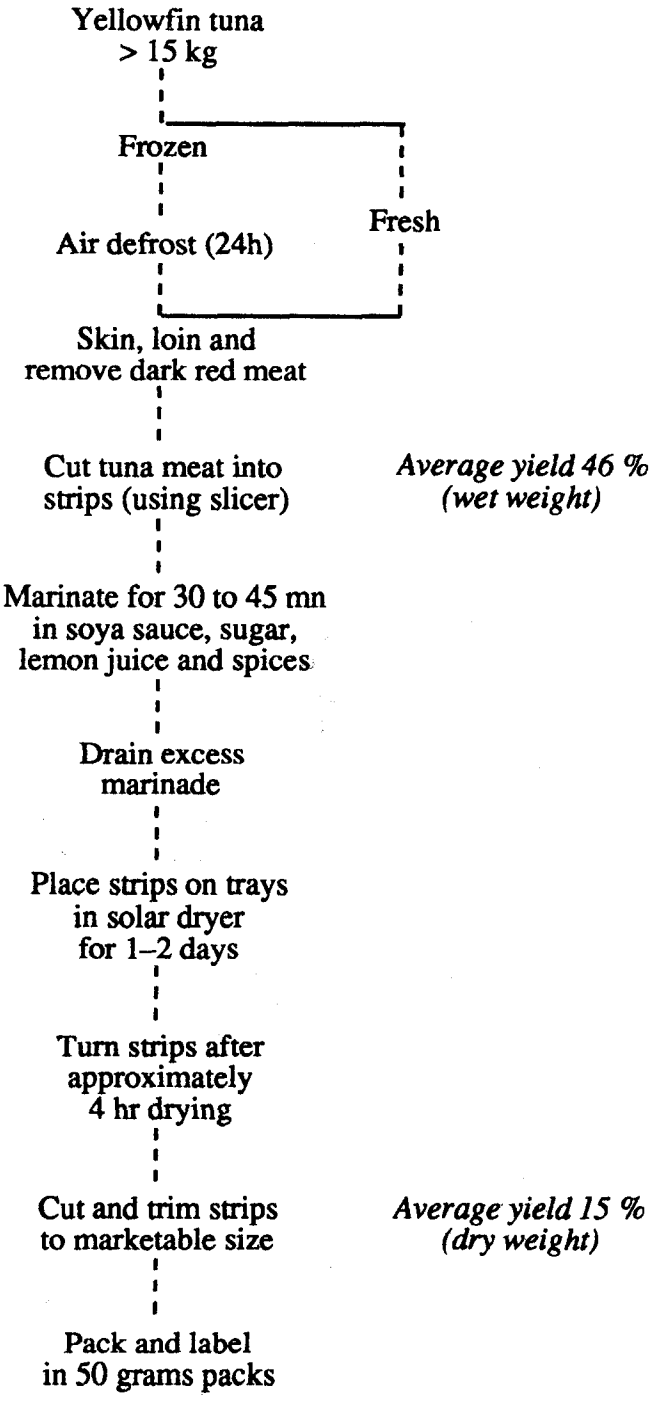
17. Since these results were obtained the OIFP has sought to reduce the salt content to below 5 per cent by reducing the marinade time from overnight (12 hours) to 45 minutes, in order to avoid the problem of 'salting out', a phenomena observed during trials where salt crystals collect on the surface of the product during storage. Not only does this detract from the appearance of the product, but it could also be mistaken for mould by a consumer.

18. Additional analysis of our samples of product indicate a mercury content of 0.36 mg/kg (on a dry weight basis), which is below the limit set for seafood products in Australia of 0.5 mg/kg.

19. Bacterial counts for faecal coliform, yeasts/moulds, staphylococcus and *Escherischia coli/E. Coli* also indicate no major problem with respect to Australian food health regulations. Close attention to good personal hygiene and recommended fish handling practices at all stages of the production process is of vital importance to ensure that these standards are maintained and to help prevent spoilage. As a final check, all of our product is subject to quality control inspection prior to packaging and sale.

20. Encouraged by our efforts to develop a dried tuna product, the OIFP was invited to participate in a series of meetings earlier this year in Australia organised and funded by ACIAR (the Australian Centre for International Agricultural Research) and SPC. Attended by representatives from four Pacific Island countries (Kiribati, Tuvalu, Tokelau and Marshall Islands), the meetings provided an opportunity to review the fundings of a number of projects aimed at developing novel tuna products for small Pacific Island countries.

21. Armed with the results of two product development research projects and a marketing desk study, all funded by ACIAR, the OIFP has, during the past few months, refined our original product type for export. Sophisticated packaging and labelling has been designed with the assistance of a marketing consultant, who will also be conducting marketing trials planned for later this year, aimed initially in Australia at airport duty free stores and at the hotel market.



Labour (5 hours @ A$ 1.20/hour)	A$ 6.00
Fish cost (at a dry weight retrieval rate of 15%)	A$ 11.00
Marinade (using a wet weight retrieval rate of 46% and marinade absorption rate of 9.5%	A$ 2.69
Equipment depreciation/misc. expenses	A$ 1.00
Packaging and labelling (20 x 50 gram packs)	A$ 1.50
Total cost 1 kg dried product	A$ 22.19