# Development of Value Added Products and Preliminary Marketing Trials for Jack Mackerel (<u>Trachurus declivis</u>)

Dr F. Kow and Mr R Iversen





PACIFIC FISHERIES CONSULTANTS AUSTRALASIA







**Project No. 97/410** 

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SEAFOOD SERVICES AUSTRALIA



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## 1.0 NON-TECHNICAL SUMMARY

The jack mackerel (*Trachurus declivis*) fishery is the largest single species fishery in Australia in terms of landed catch weight. Schools of jack mackerel are targeted during the summer months using purse seines and catches of up to 50 t are not uncommon.

Currently annual catch is 9 000 t with less than 1% of the catch used for human consumption.

Using the marketing name Tasikana, four products utilising the species have been developed. They are:

Product A:	"Original recipe cold-smoked fillets"
Product B:	"Hot and spicy satay fillets"
Product C:	"Satay cold-smoked fillets"
Product D:	"Ocean Jerky".

The market potential of the products, targeting ethnic communities, was investigated in Sydney and Melbourne. A total of 1 105 people were surveyed and it was found that all the developed products were liked by the great majority of the respondents.

Of the four products, product A, the Original Recipe cold-smoked fillets was the most popular, with 78% of people surveyed in Melbourne and 84% of people surveyed in Sydney rating it highly. The large number of existing commercial smoking facilities within Tasmania make it an ideal location to produce new cold smoked products for the Australian domestic market.

Shelf-life experiments have shown that the four products are shelf stable when vacuum packaged for a minimum of 21 days at  $4^{\circ}$ C and 9 months at  $-25^{\circ}$ C.

Based on price information gathered during the market surveys, the anticipated market value of the four products is \$3-\$4 for a 200 g packet which equates to around \$15/kg. The cost of production has been found to depend heavily on the price of the raw material, however at current market prices a substantial profit can be achieved.

Benefits derived from this project include the potential to increase the value of catch from \$95/t for fish intended for fishmeal to \$1,000/t for fish intended for value-adding.

However to achieve commercial success, processors will require a source of high quality jack mackerel. Present catching and handling techniques produce a highly variable end product. Thus a change to smaller vessels utilising new technology such as mid water trawls, seems practicable. With shorter trip times, smaller catch volumes and better handling practices a greatly improved end product could be achieved.

The possibility exists to exploit the 5 000 tonne inshore jack mackerel fishery which is presently not being fished. Boats based in Hobart could target inshore schools of fish in and around the D' Entrecasteaux channel, limiting trip duration to one or two days. Fish could be headed and gutted or simply slurried and then iced down for the duration without substantial loss of quality. George Town Seafoods has recently

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constructed a seafood processing facility on the wharf in Hobart with a conveyor belt system for swift transfer of fish.

It is strongly recommended that market development research to be carried out to exploit the full potential of the fishery; to investigate further issues such as market potential, consumer profile and competition from other similar products. In view of the fact that the developed products are accepted by the ethnic communities, Federal Government initiatives such as Supermarket to Asia (STA) and, or Food and Fibre Chains could be approached for the purpose.

#### 2.0 BACKGROUND

The Jack Mackerel (*Trachurus declivis*) fishery is the largest single species fishery in Australia in terms of landed catch. Tasmanian catches account for over 90% of the total Australian catch which has fluctuated from 42 000t in 1986/87 to 9,000t in 1995/96. The fishery is based primarily at Triabunna on the East coast of Tasmania where large schools of Jack Mackerel are targeted by vessels using purse-seines. (Kailola, 1993<sup>1</sup>)

Unfortunately, less than 1% of the Jack Mackerel catch is used for human consumption. Most of the catch is processed into fishmeal for aquaculture and livestock feeds while the remainder is used as pet food and bait for the rock lobster and long-line fisheries. Ex-vessel prices for fish intended for reduction to fishmeal in recent seasons have been A\$80-100/t. (Kailola, 1993<sup>1</sup>)

Because of the low prices paid per tonne of fish, the Jack Mackerel is a species which has significant potential for value-adding. It is a member of the family *Carangidae* (Jacks or Trevallies) and is related to a number of small fish species that are used for human consumption, especially by people of Asian descent. A related Australian species, the Yellowtail, (*Trachurus novaezelandiae*), is currently being used for human consumption within Australia, however the fishery is small with landings of just 185 t in 1989/90.

In previous years the Australian Maritime College has conducted several preliminary studies into value-added products utilising jack mackerel. Products such as pate, marinated satay fillets and hot smoked whole fish and butterfly fillets have been trialed by post graduate students. Limited marketing trials of these products have shown promising results and have illustrated the commercial potential of jack mackerel as a future food source.

#### **3.0 NEED**

To develop consumer acceptable value-added products, thereby increasing the value of the jack mackerel fishery.

#### 4.0 OBECTIVES

The objectives of the project were to:

- (1) Examine the potential of jack mackerel products for human consumption.
- (2) Develop a selected range of jack mackerel products for further development, with preliminary acceptability tests using focus groups, leading ultimately to the development of new Asian markets.
- (3) Market test the new jack mackerel products, targeting ethnic communities.

<sup>&</sup>lt;sup>1</sup> Kailola, P.J. (1993) "Australian Fisheries Resources" Bureau of Resource Sciences and the Fisheries Development Corporation, Canberra, ACT.

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- (4) Document all processing procedures including a HACCP plan which complies with both U.S FDA Seafood HACCP regulations and ANZ Food Standards Code.
- (5) Seek business interests for the commercialisation of the new products.

## 4.1 Assessment of Objectives

Objectives 1 to 4 have been met fully.

Two of the four products developed have been entered for '99 Innovations for Seafood - Innovative Seafood Product Competition, hosted by the Department of Primary Industries Centre for Food Technology. There were 37 entries for the competition. The Australian Maritime College was one of the five 'companies' to receive commendation.

For the last objective several processors have been approached. One of them will take on processing if there are firm orders and another will make a firm commitment with further investigation.



Plate 1. '99 Innovative Seafood Product Competition- Gold Coast.

### 5.0 METHODS

#### 5.1 Raw Material

The jack mackerel used for this project was bought from a Tasmanian based company in Hobart, which targets jack mackerel using a purse seine. The fish caught are graded and separated into long-line bait, crayfish bait and food-grade fish and are block frozen on board the vessel in 15 kg boxes. The boat fishes from September to April and thus all of the jack mackerel used in the project were caught within this time frame.

The quality of the fish purchased from the above fishing company varied markedly. At times the fish were extremely well preserved. However on other occasions, some of the boxes purchased were almost unusable due to the poor condition of the fish. The diet of the jack mackerel targeted by purse seine is mainly krill which deteriorates rapidly within the gut contents causing spoilage within hours if the fish is exposed to high (20-30°C) temperatures. The catching technique used by the fishing boat is designed to catch large numbers of bait fish rather than to supply fish for domestic consumption and therefore some modification in handling methods seems to be necessary if they are to begin to supply a greater amount of fish for human consumption.. Simply slurrying the first fish out of the net and packaging them by hand would provide a much more consistent product, however gilling and gutting the fish would be a better option. Rising labour costs then, become an issue, as a small increase in landed price may cause the value adding venture to become no longer viable.

Seasonal variation in fat content was observed in the jack mackerel used in this project, however careful processing was found to negate any effect of this variation on the taste or appearance of the four products.

# **5.2 Product Development**

#### 5.2.1 Original Recipe Cold-Smoked Fillets (Product A)

Initially, the traditional cold-smoked fillets were designed to appeal to English or European tastes. During the development stages the jack mackerel fillets were soaked for various time periods in a basic brine solution. They were then smoked for between six and twelve hours and taste tested. Taste tests showed that brining for around 1 hour produced the most acceptable taste and ten hours smoking time was found to give the product the required texture. The skin was left on the fillets, however schutes were trimmed from the tail. Appendix 1. shows the detailed recipes (with photographs) for the four developed products.

# 5.2.2 Hot and Spicy Fillets (Product B)

The recipe and method employed by Kissy  $(1994^2)$  was used as a starting point in the development of the marinated and grilled satay fillets. Over several weeks a variety of different Asian spices and sauces were added to the base marinade. During this time a number of local tasters including some of Asian descendants were consulted for ideas on improving the overall taste of the products, and the fillets were taste tested until the

<sup>&</sup>lt;sup>2</sup> Kissy, F.E, (1994) "Development of Ready Served Product Using Tasmanian Jack Mackerel (Trachurus declivis) with Special Reference to Modified Atmosphere Packaging." Graduate Diploma Thesis, Australian Maritime College Beauty Point, Tasmania.

flavour was judged to be excellent. A variety of different fresh and powdered chilli was also trialed to achieve the correct level of spiciness. After the marinade was perfected, the grilling temperature was experimented with. Grilling slowly at around 85-95°C was found to create a product which looked and tasted great if eaten immediately, however reheating made the fillets dry and unpalatable. A faster grill time using a temperature of around 150-160°C was found to produce a much juicier product which reheated extremely well, while retaining the characteristic golden colour of a satay sauce.

### 5.2.3 Satay Cold-Smoked Fillets (Product C)

The satay cold smoked fillets were designed to appeal to people of Asian descent. An identical marinade to that developed for the Hot and Spicy fillets was used however the level of chilli was kept to a minimum. The skin was left on the fillets however the schutes were trimmed from the tail in the same style as the Original-Recipe fillets. While the satay fillets were prepared in a similar manner to the traditional fillets, the smoking time was found to be much longer. It seemed that the satay sauce formed a crust on the surface of the fillets, thus slowing the curing process by reducing the penetration of smoke. This was remedied by rinsing the fillets quickly under cold water before smoking to remove the majority of the sauce.

# 5.2.4 Ocean Jerky (Product D)

The development of Jack Mackerel Jerky began with the original marinade described in Kissy (1994) and a recipe for Yugan Pian (Spicy Fish Slices). A drying temperature of 60°C was chosen and drying times ranging from 12 to 24 hours were trialed. It was found that the thickness of the fillets was the major factor influencing drying time, while fillet size remained of secondary importance. Most samples were found to reach a suitable texture after 18 hours, however thicker fillets took up to 24 hours. Taste testing of the jerky led to a number of modifications to the marinade with the major alteration being the omission of vegetable oil. The fillets were found to be oily enough without the addition of extra oil and the higher oil content hindered the drying process. For preservation purpose, the water activity of a number of jerky samples was tested to verify the required drying time. Please refer to Section 5.2.1 for detailed method of Aw (water activity) determination. The corresponding values with different lengths of drying time are presented in Appendix 2. The drying period of 17 to 18 hours was found to be optimum length of drying where the Aw was low enough to limit the growth of almost all pathogenic micro-organisms (see Section 5.2.1 below for further explanation), while the texture of the jerky was not adversely affected.

# 5.3 Physical and Chemical Methods

# 5.3.1 Water Activity Measurements

Water activity (Aw) is the indication of the amount of water available for the growth and the rate of growth of micro-organisms. The Aw of pure water is 1.00. Most bacteria grow well in media with Aw levels of 0.990 to 0.998. Many bacteria fail to grow with Aw levels below 0.95 while the levels below 0.86 limit the growth of pathogenic bacteria. Moulds will generally tolerate lower Aw levels than bacteria; many types will grow down to 0.75 or 0.70. The water activity of the samples was measured using a Novasina "Aw centre" water activity meter, which was connected to a computer. Water activity data was recorded on the computer using Blast software. All measurements were taken at  $25.0 \text{ }^{\circ}\text{C}$  +/-  $0.3 \text{ }^{\circ}\text{C}$ .

Calibration and sample analysis was carried out using the method detailed in the Novasina water activity meter instruction manual.

The machine was calibrated by using 3 saturated salt solutions of known water activity :  $Mg(NO_3)_2$  (Aw 0.53), NaCl (Aw 0.75), and BaCl<sub>2</sub> (Aw 0.902).

The various salt solutions were placed in 25 mm diameter plastic containers which were inserted into the sample ports of the water activity meter and left to equilibrate. Equilibration was judged to be complete when one full computer screen of the same water activity value was achieved.

Sample preparation involved cutting the samples into approximately 1 mm pieces using a knife. The samples were then placed into the 25 mm diameter plastic sample containers until the containers were filled level with the top. A lid was placed on the container to stop moisture absorption or loss until the samples were analysed.

The samples were analysed in a manner identical to that of the saturated solutions. The lid was removed from the 25 mm container and the sample was then placed into the sample port of the water activity meter and left to equilibrate. Time taken to reach equilibration was approximately 30 minutes. Equilibration was judged to be complete when one full computer screen of the same water activity value was achieved. The results were printed on a dot matrix printer connected to the computer.

#### 5.3.2 Formaldehyde Determination

The undesirable chemical constituent formaldehyde, derived from smoke, adsorbs itself onto the surface of the products. Its concentration varies with processing conditions such as temperature, velocity of smoke or humidity.

Not more than 40 mg/kg formaldehyde contents in smoked products are permitted by the Australian Food Standard Code. A detailed method for the determination of formaldehyde contents in cold-smoked products is presented in Appendix 3.

#### 5.4 Sensory Tests

For preliminary investigation of market potential of the developed products sensory evaluations have been carried out (Plate 2). An Hedonic smiley scale was used to i22ndicate overall impressions of the four Jack Mackerel products. A score of 1 or 2 indicates "like", a score of 3 indicates "unsure" and a score of 4 or 5 indicates "dislike" (see Appendix 4).

The survey method used to assess the market demand and acceptability of the four new jack mackerel products consisted of a questionnaire combined with a taste test. A sample copy of the questionnaire can be found in Appendix 4. The questionnaire contained information regarding the sensory qualities of the four products as well as marketing information such as ethnicity, sex, and age of the respondent and the price





Plate 2. Display for sensory evaluation.

people were willing to pay for a packet containing two fillets. It can be noticed from the survey form that the name Tasikana has been chosen for the four products developed so that consumers could identify the same products in future. The labels used are shown in Appendix 5. Surveys were carried out in Melbourne (Plate 3) and Sydney (Plate 4) at the venues listed below. Please refer to Appendix 6 for contact details.

#### 5.4.1 Melbourne Consumer Survey venues:

Daimaru.
The Melbourne Fine Food Fair.
The Melbourne Fine Food Fair.
"Fishy Business", Glenferrie Rd, Hawthorn.
"Oceanworld", Chadstone Shopping Centre.
"Claringbold's", Prahran Market.
"Clamms Seafood", Acland St, St. Kilda.

#### 5.4.2 Sydney Consumer Survey venues:

"Nicholas Seafood Traders" Sydney Fish Markets.
"Peter Michaels Seafood" Westfield Chatswood.
"Roselands Quality Seafoods" Roselands Shopping
Centre.
"Burwood Plaza Seafood" Burwood Plaza.
"M&H Michael's Seafood" Westfield Parramatta.

#### 5. 5 Shelf-life Trials

Frozen and chilled shelf-life trials were carried out on the four products. During the experiments, the frozen products were kept at -25°C and sampled at intervals over a 10 month period, while the chilled products were kept at 4°C and sampled at intervals over a period of 28 days. Before the experiments began all products were placed in separate vacuum-sealed bags.

The quality of the samples at each stage of the shelf-life trial was assessed using microbiological techniques and a sensory evaluation.

The sensory evaluation of the four products was conducted using a taste test and was carried out by a number of staff and students at the Australian Maritime College. The taste test used an identical Hedonic smiley scale to that used in the market survey, however respondents were asked to assess the flavour, texture and overall acceptability of each of the four products.



Plate 3. Market survey in Daimaru, Melbourne.

Photo courtesy of R. Iversen

The microbiological assessment consisted of three separate agar plate counts: a Total plate count, a Pseudomonas plate count and a Coliform plate count. Ten gram samples of each product were aseptically transferred to a stomacher bag, 90 mL of sterile dilution blank was added and the contents were stomached for 1 minute in a Colworth Stomacher. A dilution series was prepared and 1 mL samples of each dilution were plated in the three separate agars before incubation. Incubation times were as follows:

Coliform count	: 24 hours at 37°C
Total plate count	: 72 hours at 25°C
Pseudomonas count	: 72 hours at 20°C

After incubation the number of colonies on each plate was counted and the results were recorded as number of colony forming units per gram of sample.

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Plate 4. Market survey at Prahran Market, Melbourne.

## 6.0 RESULTS

#### 6.1 Physical and Chemical Test

#### 6.1.1 Water Activity

As mentioned in Section 5.3.1 above Aw levels of dried Ocean Jerky vary with the drying period (Appendix 2). The optimum period of drying is 17 to 18 hours where the Aw was found to stabilise around 0.85, a level that will limit the growth of pathogenic bacteria. Further drying was found to adversely affect the texture of the jerky.

#### **6.1.2 Formaldehyde contents**

Formaldehyde contents of the cold-smoked products have been determined to be between the range of 4.2 to 4.9 mg/kg which are well below the limit of 40 mg/kg.

For confirmation two samples of the cold-smoked products have been sent to a commercial analytical laboratory in Melbourne (Dunn, Son and Stone Rodadale Nominees Pty Ltd.). Formaldehyde values for the two samples were found to be 4.7 and 4.8 mg/kg respectively using the method of AOAC 931.08.

#### 6.2 Market Survey

#### 6.2.1 General Profile of the Consumers Sampled.

#### 6.2.1.1 Melbourne

A total of 699 people were surveyed at seven sites around Melbourne. Of the people surveyed, 57% were aged between 18 and 40 years old, 39% were older than 40 years old, and just 4% were aged less than 18 years old (Table 1). The number of males and females surveyed was very similar. The sex ratio was 48.1% male and 51.9% female. Seventy eight percent of the people surveyed were found to speak English as a first language with the other twenty two percent speaking a European or Asian language (Table 2). Ninety nine percent of people surveyed said they liked eating fish.

Table 1. Age bleakdown of respondents from the Merbourne surveys. (1-039)				
	Under 18 years of age	18-40 years of age	Over 40 years of age	
Male	2.3%	25.9%	19.9%	
Female	2.1%	31.2%	18.6%	
Total	4.4%	57.1%	39.5%	

Table 1. Age breakdown of respondents from the Melbourne surveys. (n=699)

Table 2. Ethnicity of respondents from the Melbourne surveys. (n=699)

	English	European	Asian	Other
Male	39.6%	5.3%	3.5%	0%
Female	38.5%	5.9%	7.0%	0.2%
Total	78.1%	11.2%	10.5%	0.2%

#### 6.2.1.2 Sydney

A total of 406 people were surveyed at five sites around Sydney. Of the people surveyed, 58% were aged between 18 and 40 years old, 36% were more than 40 years old, and 5% were aged less than 18 years old giving the similar age distribution as that

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of Melbourne (Table 3). But unlike Melbourne the sex ratio of males to females was found to be 63% female and just 37% male. Forty four percent of people surveyed spoke English as a first language, while twenty four percent spoke a European language and twenty seven percent spoke an Asian language as a first language (Table 4). This gives the proportion of both European and Asian speaking respondents to be twice of that of Melbourne. Finally similar to that of Melbourne 100% of people surveyed said they liked fish.

Table 5. Age breakdown of respondents from the bydie's surveys. (If 400)					
	Under 18 years of age	18-40 years of age	Over 40 years of age		
Male	1.9%	18.9%	15.3%		
Female	3.2%	38.7%	20.9%		
Total	5.1%	57.6%	36.2%		

Table 3. Age breakdown of respondents from the Sydney surveys. (n=406)

Table 4.	Ethnicity	of respondents	from the	Sydney	surveys.	(n=406)	)
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	English	European	Asian	Other
Male	17.6%	11%	6.1%	1.8%
Female	26.9%	13.6%	21%	2%
Total	44.5%	24.6%	27.1%	3.8%

#### 6.2.2 The preferences for the new products

#### 6.2.2.1 General acceptability

The acceptability of the products have been investigated. The mean score for each product with standard deviation, for Melbourne, is given in Table 5.

Product	Mean Score	Standard Deviation
Product A	2.1	1.7
Product B	2.2	1.5
Product C	3.0	2.5
Product D	2.9	2.0

Table 5. Mean Hedonic scores for the four jack mackerel products in Melbourne.

The Table above shows that the mean score for Product A was 2.1, while the mean score for Product B was 2.2 which indicates that both products were well liked. Product C had a mean score of 3.0 and Product D had a mean score of 2.9 which suggests that these products were not as popular as products A and B.

Table 6 below shows the acceptability of the four products in Sydney. The mean score of 2.2 is the same for Products A, B and C indicating that these three products are placed in the "like" category. Similar to the response from Melbourne Product D had a mean score of 3.1 ("unsure").

Product	Mean Score	Standard Deviation
Product A	2.2	2.0
Product B	2.2	1.7
Product C	2.2	1.6
Product D	3.1	2.2

 Table 6. Mean Hedonic scores for the four jack mackerel products in Sydney.

Consumer preference is further analysed to the proportion of consumers that are likely to purchase the products.

#### Melbourne

The results for Melbourne are presented in Figure 1. It can be seen that a clear majority of people surveyed in Melbourne like Product A and Product B (78% and 72% respectively), and that more than half the people surveyed like Product C and Product D (68% and 54% respectively). While first three products are disliked by less than 10% of the respondents, the last product is disliked by quarter (25%) of the people surveyed.

#### Sydney

The results from Sydney are presented in Figure 2. Just like Melbourne, majority of the respondent likes all the products developed.

In fact the first three products A, B and C are liked by the great majority (84%, 81% and 79% respectively), while more than half the people surveyed liked Product D(58%). Compared to Melbourne even less people (< 5%) dislike the first three products and similar to Melbourne about quarter of the respondents (23%) dislike Product D.

# 6.2.2.2 Consumer preference breakdown by age, gender and ethnicity Melbourne

The break down of consumer preference by age, gender and ethnicity in Melbourne is analysed and the proportion of 'like' responses from each age group, ethnic group, and gender group has been calculated for the four products to determine the most preferred product (Table 7). Frequency analysis from this Table shows that for products A to D the values are 55.6%, 30%, 7.4% and 7.4% respectively revealing product A being most popular followed by product B. Asian spoken groups prefer product B as expected and product C is popular with the European spoken middle aged group. Product D is selected only by elderly Asian spoken males.



Figure 1. Proportional breakdown of consumer preferences for the four products in Melbourne.





	Age Group	Under 18 years of age		18-40 years of age		over 40 years of age	
Ethnicity		Male	Female	Male	Female	Male	Female
English		Α	Α	В	A	A	A
European		N/A	N/A	A,C	C	A	A
Asian		A,B	A,B	В	В	B,D	A
Other		N/A	A,B,D	A	A	A	В

**Table 7.** Product preferences of different ethnic groups divided by age and gender for the Melbourne surveys.

#### Sydney

The results for Sydney are presented in Table 8. Frequency analysis from this table gives the values of 46.8%, 25.0%, 18.8% and 9.4% respectively for Products A to D. Again Product A is most popular followed by B and C. Unlike Melbourne, the English spoken groups in Sydney prefer product B while the European and Asian spoken groups find A more appealing.

Table 8. Product preferer	ices of different ethnic	groups divided by	age and gender fo	r the Sydney
surveys.				

Age Group	Under 18 years of age		18-40 years of age		over 40 years of age	
Ethnicity	Male	Female	Male	Female	Male	Female
English	A	B,C	В	C	A,C,D	В
European	B,C,D	Α	Α	A	Α	Α
Asian	A,C	A,D	Α	В	Α	Α
Other	N/A	N/A	В	A	A,B	A,B,C

# 6.2.2.3. Comparison of preferences across locations within Melbourne and Sydney.

Since samples were taken from several locations in Melbourne and Sydney there is a need to establish whether the preferences are homogenous across these locations.

#### Melbourne

The mean scores from different locations of Melbourne for the four products are shown in Figure 3. An analysis of variance comparing scores and sampling locations was also carried out. It has been found that significant differences between the scores of all four products between the seven sampling sites (Levels of significance difference for Products A to D are 0.0005, 0.003, 0.0 and 0.0 respectively). The differences in consumer preferences could be attributed to varying ethnic tastes in the sampled groups due to the large variations in the ethnicity of populations in each area or even varying affluence which would influence the types of foods eaten in the home. This is an interesting development which could allow us to target different products to specific areas.



Figure 3. Variations in mean hedonic scores for the four products across sampling locations in Melbourne.



Figure 4. Variations in mean hedonic scores for the four products across sampling locations in Sydney.

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## Sydney

Similar analysis has been carried out for the Sydney area (Figure 4). An ANOVA comparing mean scores and sampling sites was also carried out revealing that a significant difference between the scores of Products A (0.01)and C (0.05) between the five sampling sites, however no significant difference was found between the scores of Products B (0.15) and D (0.44).

# 6.2. 3. The average price consumers are willing to pay for the products in Melbourne and Sydney.

#### Melbourne

Respondents were asked how much they would be willing to pay for a packet containing two fillets of the cold smoked or grilled products. A total of 66% of people said three dollars, while 11% said two dollars and another 14% said four dollars. The highest price anyone was willing to pay for a packet was found to be seven dollars. The average price both male and female respondents were willing to pay was calculated from the survey data. The results of this analysis including price range, variance, and standard deviations are displayed in Table 9.

#### Sydney

When the Sydney respondents were asked how much they were happy to pay for a packet containing two fillets of the cold smoked or grilled products, 36% of people said three dollars, 33% said four dollars, 19% said five dollars and only 5% said two dollars. The highest price anyone was willing to pay for a packet of two fillets was found to be ten dollars (Table 9).

product mey i	moot mea,		-	-		
Survey	Gender	Sample	Average	Price	Price	Standard
Location		Size	Price (\$)	Range (\$)	Variance	Deviation
Melbourne	Male	84	3.214	2-6	0.797	0.893
	Female	102	3.176	1-7	0.602	0.776
Sydney	Male	95	3.989	2-10	1.862	1.364
	Female	202	3.851	2-8	1.082	1.040
Overall	Male	179	3.676	2-10	1.505	1.227
	Female	304	3.625	1-8	1.021	1.010

 Table 9. Average prices consumers were willing to pay for a 150g packet of the four products including range, variance and standard deviation. Note: Respondents were asked for a price on the product they most liked.

It can be seen from the results in Table 9 that people in Sydney would be prepared to spend more money on a packet of fillets than those in Melbourne. This is also reflected in the highest price anyone was willing to pay for the packet of fillets which was found to be ten dollars in Sydney compared to seven dollars in Melbourne. The results in Table 9 also show that in both Sydney and Melbourne males were prepared to spend more than females on the four products.

An approximate cost of production was estimated for the four products. Survey results show that people are willing to pay \$3-\$4 for a pack containing 200g of product. At a retail margin of 30% on the \$3 sell price the products need to wholesale at around \$2.30 per pack. Assuming the food grade fish can be purchased from fishermen for \$1/kg, a yield of 45% will result in a price of \$2.30/kg, or approximately 55c per pack.

Labour costs for filleting, preparation and packing should cost approximately 30c per pack. If overheads and smoking costs are approximately \$2/kg (50c per pack), further yield losses and ingredient costs are 20c per pack and packaging costs are 15c per pack, a finished product cost of \$1.70 per pack can be derived.

Allowing for freezing and distribution costs a profit margin of 10-20% can still be obtained. The price of the fish is critical since at a price of \$1.50/kg all profit is eliminated.

### Wholesale price: \$2.30

**Costs:** 

Fish : \$1/kg (less 45% yield losses) = 55c per pack Labour: 30c per pack Overheads/smoking: \$2/kg = 50c per pack Ingredients/extra yield loss: 20c per pack Packaging: 15c per pack.

Finished product cost: \$1.70.

# 6.3 SHELF-LIFE TRIALS

#### 6. 3.1 Chilled Shelf-Life Trials

#### 6. 3.1.1 Microbial Assessment

The results of the microbiological analysis for the four products during the chilled shelf-life trial are displayed in Figure 5. Before the shelf-life trial began, a bacterial load of  $10^5$  CFU per gram was chosen as the spoilage cut off level and any samples above this level were assumed to be hazardous to human health. This is in agreement with the recommendations from Leatherhead Food RA (Lawley & Gibbs 1998). It can be seen from Figure 5 that all four products remained at acceptable bacterial levels throughout the 28 day trial. In the majority of samples analysed, the Total Plate Count and Pseudomonas counts were similar, indicating that most of the bacteria present on the samples were Pseudomonas species. Importantly, there was an absence of E.Coli growth in all four products during the trial.

The cold smoked products had the lowest number of bacterial colonies per gram of product throughout the trial. The final bacterial count for the Satay Cold Smoked Fillets was just 300 CFU per gram which highlights the excellent preservation properties of smoke and spices. The Ocean Jerky also had a remarkably low bacterial count throughout the trial. After 21 days the dried Jerky had a count of just 60 CFU



Figure 5. Graphs of bacterial counts per gram of product over time for the four products during the chilled shelf-life trial (4°C).

per gram, due mostly to the reduced water activity and high load of chilli. The grilled Hot and Spicy Satay Fillets showed the highest bacterial levels of the four products. The grilled fillets were the only product to record levels of bacteria in the order of 10<sup>4</sup> CFU per gram, and the product reached levels of 10<sup>3</sup> CFU per gram in just 14 days. After reviewing this information, it would appear that the Hot and Spicy Satay Fillets should preferably be marketed as a frozen product only.

### 6. 3.1.2 Hedonic Taste Test Trial

In conjunction with the microbiological analysis, a sensory evaluation was carried out on the four products to assess the extent of flavour, texture and overall deterioration during the chilled shelf-life trial. The results of the taste test are displayed in Figure 6. It can be seen from the graphs in Figure 6 that although the mean hedonic scores had a substantial degree of fluctuation, no deterioration in quality could be detected by the people involved in the taste tests during the first 21 days of the trial. In fact, the mean hedonic scores for all four products improved as the shelf-life trial continued.

### 6.3.2 Frozen Shelf-Life Trials

#### 6. 3.2.1 Microbial Assessment

The results of the microbiological analysis for the four products during the frozen shelf-life trial are shown in Figure 7. A similar spoilage cut-off level of  $10^5$  counts per gram of product was used for the frozen trial and it can be seen from the graphs in Figure 7 that all four products remained well below this cut-off level throughout the 10 month trial. The bacterial flora of the frozen products showed many similarities to the chilled products, with the majority of bacteria present from the species Pseudomonas and an absence of the E.Coli species.

The four products appear to have an excellent frozen storage life, as all samples showed bacterial levels below 10<sup>3</sup> CFU per gram throughout the 10 month trial. The Satay Cold Smoked Fillets again showed the lowest levels of bacterial growth during the trial, and had a final count of just 30 colonies per gram. The Hot and Spicy Satay Fillets had the second lowest bacterial count and had a final count of just 100 CFU per gram after the 10 month trial. This provides more evidence that the Hot and Spicy Satay Fillets should be marketed only as a frozen product. The Original Recipe Cold-Smoked Fillets and the Ocean Jerky had marginally higher bacterial counts of 130 and 250 CFU per gram respectively at the conclusion of the trial, however both of these results are still well within the tolerances of the experiment.

# 6.3.2.2 Hedonic Taste Test Trial

During the frozen shelf-life trial a sensory evaluation was also carried out on the four products to assess the extent of flavour, texture and overall deterioration. The results of the taste test are displayed in Figure 8. It can be seen from the graphs in Figure 8 that the frozen products exhibited similar sensory profiles to the chilled products during the shelf-life trial. Although the degree of fluctuation in the mean hedonic



Figure 6. Changes in mean hedonic scores over time for the four products during the chilled shelf-life trial (4°C).



Figure 7. Graphs of bacterial counts per gram of product over time for the four products during the frozen shelf-life trial ( $-25^{\circ}$ C).



Figure 8. Changes in mean hedonic scores over time for the four products during the frozen shelf-life trial (-25°C).

scores was reduced in the frozen trial, no deterioration in quality could be detected by the people involved in the taste tests.

### 6.4 HACCP

The Food Safety Plan which complies with US FDA Seafood HACCP regulations and ANZ Food Standards Code is drafted for the four products and is presented in Appendix 7.

### 7.0 BENEFITS

**Fisheries:** Increase in value of catch from \$95/t for fish intended for fishmeal to \$1,000/t for fish intended for value-adding.

**Processors**: Both small and large scale industries, processing raw products and employing more workers. Possibility of developing export market.

**Distributors and Retailers**: Possible higher profit margin on value-added goods.

**Processing associated industry**: e.g. increased packaging required to market value-added goods.

Increased incomes to fishers and other operators in the food distribution chain cannot be precisely qualified at this time. Transforming low value jack mackerel into a higher priced product via value-adding should result in economic benefits to all parts in the chain, including harvesters, processors, wholesalers and retailers.

#### 8.0 INTELLECTUAL PROPERTY

The FRDC's proportion of ownership of the project intellectual property is 55.12 per cent.

# 9.0 FURTHER DEVELOPMENT

Full-scale commercialisation of products should be promoted. For this purpose a processors will be identified .

However to achieve commercial success, processors will require a source of high quality jack mackerel. Present catching and handling techniques produce a highly variable end product. Thus a change to smaller vessels utilising new technology such as mid water trawls, seems practicable. With shorter trip times, smaller catch volumes and better handling practices a greatly improved end product could be achieved.

The possibility exists to exploit the 5 000 tonne inshore jack mackerel fishery which is presently not being fished. Boats based in Hobart, utilising new technology such as mid water trawls, could target inshore schools of fish in and around the D' Entrecasteaux channel, limiting trip duration to one or two days. Fish could be headed and gutted or simply slurried and then iced down for the duration without substantial loss of quality. George Town Seafoods has recently constructed a seafood processing facility on the wharf in Hobart with a conveyor belt system for swift transfer of fish.

97/410 Value Added Products from Jack Mackerel

It is strongly recommended that market development research to be carried out to exploit the full potential of the fishery; to investigate further issues such as market potential, consumer profile and competition from other similar products. In view of the fact that the developed products are accepted by the ethnic communities, Federal Government initiatives such as Supermarket to Asia (STA) and, or Food and Fibre Chains could be approached for the purpose.

#### **10.0 STAFF**

Felicia Kow	Principal Investigator
Robert Iversen	Co-investigator
Mike Williams	Technical Assistant
Lindsay Foster	Lab Technician

#### **11.0 DISTRIBUTION**

#### FRDC

Australian Seafood Industry Council Australian Seafood Industry Education Network CSIRO Division of Fisheries Seafood Services Australia Australian Food Industry Science Centre Austrade Tasmania Austrade Victoria Austrade NSW Marine Industries Section ACT Bureau of Resource Sciences ACT AFMA, ACT Marine Resources Division TAS Fisheries Victoria Marine and Fresh Water Resources Institute VIC **NSW** Fisheries Fisheries Division SA **Fisheries Division NT** Fisheries Group Qld Fisheries Department of WA Library, CSIRO Div of Marine Research National Library State Library Tas

# **APPENDIX 1.**

# FINAL RECIPES AND METHODS FOR THE FOUR NEW JACK MACKEREL PRODUCTS

#### 1. Hot and Spicy Fillets

Handling Requirements: Fish should be filleted and the belly cavity and skin removed. Pin bones should be removed if possible however they are usually very brittle and hard to remove.

**Fish Quality:** Fish should be as fresh as possible. Eyes should be clear and free from blood. Gut contents should smell fresh, not rancid. Flesh should be firm and translucent, not soft and opaque. Fish should be size graded with the largest chosen for this product.

#### **Specifications:**

#### Satay Marinade for the Hot and Spicy Fillets

15 g fresh Ginger
2 cloves Garlic
2 medium onions
1 tbsp salt
2 tbsp sugar
8 g hot chilli powder
2 tbsp pepper shell
120 mL lemon juice
80 mL vegetable oil
80 mL sweet soy sauce

Method: Fillet the mackerel and remove the skin from the fillets. Soak 2 tbsp pepper shell in 200 mL of boiling water for 30 minutes. Add cooled pepper shell liquor and other ingredients to a blender and blend on high for 2-3 minutes or until the mixture is smooth. Pour marinade over fillets and allow to marinate overnight in the refrigerator (4°C). Grill on high heat (150-160°C) for 8 minutes until fillets are browning then turn and grill the bottom for a further 2 minutes.



Hot and Spicy Satay Fillets
#### **APPENDIX 1. (Cont.)**

#### 2. Satay Cold-Smoked Fillets

**Handling Requirements:** Fish should be filleted and the belly cavity removed. The last 5cm of the tail containing the majority of the schutes should be trimmed. Pin bones should be removed if possible however they are usually very brittle and hard to remove.

**Fish Quality:** Fish should be as fresh as possible. Eyes should be clear and free from blood. Gut contents should smell fresh, not rancid. Flesh should be firm and translucent, not soft and opaque. Fish should be size graded and the medium sized fish chosen for this product.

#### **Specifications:**

#### Satay Marinade for the Satay Cold-Smoked Fillets

15 g fresh Ginger
2 cloves Garlic
2 medium onions
1 tbsp salt
2 tbsp sugar
4 g hot chilli powder
2 tbsp pepper shell
120 mL lemon juice
80 mL vegetable oil
80 mL sweet soy sauce

Method: Fillet the mackerel, leaving the skin on and remove the last 5cm from the tail end of the fillets. Soak 2 tbsp pepper shells in 200 mL of boiling water for 30 minutes. Add cooled pepper shell liquor and other ingredients to a blender and blend on high for 2-3 minutes or until the mixture is smooth. Pour marinade over fillets and allow to marinate overnight in the refrigerator (4°C). Quickly rinse the majority of the marinade from the fillets and place them on a smoking rack to drain for 10 minutes. Cold smoke the fillets for 10 to 12 hours until the texture of the fillets is rubbery and they have a good glossy sheen.



Satay Cold-Smoked Fillets

#### **APPENDIX 1. (Cont.)**

#### 3. Ocean Jerky

**Handling Requirements:** Fish should be filleted and the belly cavity and skin removed. Pin bones should be removed if possible however they are usually very brittle and hard to remove.

**Fish Quality:** Fish should be as fresh as possible. Eyes should be clear and free from blood. Gut contents should smell fresh, not rancid. Flesh should be firm and translucent, not soft and opaque. Fish should be size graded with the smallest chosen for this product.

#### **Specifications:**

#### Satay Marinade for the Ocean Jerky

15 g fresh Ginger
2 cloves Garlic
2 medium onions
1 tbsp salt
2 tbsp sugar
10 g hot chilli powder
2 tbsp pepper shell.
120 mL lemon juice
20 mL Worcestershire sauce
1/3 cup Honey
100 mL sweet soy sauce

Method: Fillet the mackerel and remove the skin from the fillets. Soak 2 tbsp pepper shells in 200 mL of boiling water for 30 minutes. Add cooled pepper shell liquor and other ingredients to a blender and blend on high for 2-3 minutes or until the mixture is smooth. Pour marinade over fillets and allow to marinate overnight in the refrigerator (4°C). Place the fillets on a rack and allow them to drain for 10 minutes. Dry the fillets at 60°C for 18-20 hours until the fillets are sufficiently dried and the texture is firm but not crisp.

2



Ocean Jerky

#### **APPENDIX 1. (Cont.)**

#### 4. Original Recipe Cold-Smoked Fillets

**Handling Requirements:** Fish should be filleted and the belly cavity removed. The last 5cm of the tail containing the majority of the schutes should be trimmed. Pin bones should be removed if possible however they are usually very brittle and hard to remove.

**Fish Quality:** Fish should be as fresh as possible. Eyes should be clear and free from blood. Gut contents should smell fresh, not rancid. Flesh should be firm and translucent, not soft and opaque. Fish should be size graded and the medium sized fish chosen for this product.

#### Specifications:

#### Brine for the Original Recipe Cold-Smoked Fillets

15 L cold water
120 mL lemon juice
1.5 kg salt
750 g sugar
2 onions sliced
2 cloves Garlic
2 tbsp mixed herbs
2 tbsp ground black pepper
1/3 cup honey

Method: Make up the brine and allow it to cool to approximately 4°C by placing it in the refrigerator overnight. Fillet the mackerel, leaving the skin on and remove the last 5 cm from the tail end of the fillets. Soak the fillets in the chilled brine for 1 hour then place them on a rack to drain for 10 minutes. Cold smoke the fillets for 10 to 12 hours until the texture of the fillets is rubbery and they have a good glossy sheen.

3



Original Recipe Cold-Smoked Fillets

#### **APPENDIX 2.**

## VARIATION OF WATER ACTIVITY (Aw) VALUES WITH DRYING TIME OF OCEAN JERKY

Time (Hour)	Aw
10	0.01
12	0.91
13	0.90
15	0.88
16	0.89
17	0.84
18	0.86
19	0.84

According to the method of Nash (1953) 5.0 mL of reagent B (approximately 150 g ammonium acetate and 3 mL 0.05M acetic acid and 2 mL 0.02M acetylacetone made up to 1 L with water) was mixed with 5.0 mL of extract and the standard solutions. The standard solutions were made up of 1.0, 2.0, 3.0, 4.0 and 5.0 mL standard FA solution (8 µgFAmL<sup>-1</sup>) and made up to 5.0 mL with water. The solutions were heated in a water bath for 5 min at 58°C (the time for 99% completion of reaction depends on temperature according to the Arrhenius reaction: 37°C, 40 min; 58°C, 5 min) and the absorbance measured at 415 nm on a Baush and Lomb spectronic 2000 spectrophotometer system.

Sample calculation: Molecular weight FA (HCHO) = 30 Dilution factor (KOH) = 50/5 = 10Dilution factor = 80/10 = 8Weight adjustment to Kg = 1000/weight = 1000/20.87 = 47.92 g Equation of straight line from standard curve = (Absorbance + 0.00029)/0.0136Absorbance reading 410 nm (FA) = 0.28µg HCHO = (0.28 + 0.00029)/0.0136 = 20.61 µg = 0.02061 mg mmolHCHOKg<sup>-1</sup> = (( $0.0261 \times 10 \times 8 \times 47.92$ )/30) = 3.34 mmolKg<sup>-1</sup>

#### APPENDIX 4. SAMPLE MARKET SURVEY FORM

## TASIKANA PRODUCT SURVEY.

OUESTIONS:	(1)	(2)	(3)		(1) (2)	
1. Your Age Group:	<18,	18-40,	40+	2. Your Sex:	M/F	

- 3. No. of Family Members:
- 4. Do you like eating fish? (1) (2) Y / N.

5. Which face best describes how you feel about this fish sample?

				(°°°)	
	1	2	3	4	5
Sample					
A					
Sample					
B					
Sample					
C					
Sample					
D					

6.How much would you be happy to pay for a packet of 2 fillets? (Wt approximately 200g)

(1) (2)
7. What is the main language spoken at home? English, European,
(3) (4)
Asian, Other.

8. Any comments about your favourite sample?

#### **APPENDIX 5.**

#### LABELS FOR TASIKANA PRODUCTS.



#### **APPENDIX 6**

#### MELBOURNE AND SYDNEY SEAFOOD RETAILERS

#### Melbourne

Mr. Brian Beirne Managing Director, Daimaru Australia Ltd. 211 Latrobe Street, MELBOURNE, VIC, 3000.

The Melbourne Fine Food Fair Melbourne Exhibition and Convention Centre Box 286, WTC Post Office, MELBOURNE, VIC, 3005

Mr. Roy Palmer Fishy Business 724 Glenferrie Road, HAWTHORN, VIC, 3122

Ms. Agnes "Susie" Wong Ocean World Seafood Shop 239, Chadstone Shopping Centre 1341 Dandedong Road, CHADSTONE, VIC, 3148

Claringbold' s Seafoods Shop 510, Prahran Market 163-181 Commercial Road, SOUTH YARRA, VIC, 3141

Mr. Con Andronis Clamms Fast Fish 141 Acland Street, ST. KILDA, VIC, 3182

#### Sydney

Kim Georgiou Roselands Quality Seafoods. Shop 142 Market level, Roselands Shopping Centre, ROSELANDS, NSW, 2196. PH: 02 9750 4033.

Nick Georgious Nicholas Seafood Traders. Sydney Fish Markets, Box 247, PYRMONT, NSW, 2009. PH: 02 9968 1542.

Michael Georgiou M&H Michael's Seafood. Shop 3034, Level 5, Westfield Shopping Centre, PARRAMATTA, NSW, 2150. PH: 02 9633 2819.

Sandy Talarmis Burwood Plaza Seafood. Shop 9, Burwood Plaza, 42 Railway Parade, BURWOOD, NSW, 2134. PH: 02 9745 3948.

Chris Papageorge Peter Michaels Seafood. Shop 210, Westfield Shopping Centre, CHATSWOOD, NSW, 2067. PH: 02 9411 8110.

#### **APPENDIX 7.**

#### FOOD SAFETY PLAN

Name of the company

## **F.P.A DOCUMENT**

**Establishment No:** 

**Postal Address:** 

Telephone No: Facsimile No:

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## DECLARATION

 I\_\_\_\_\_\_\_\_\_, General Manager of \_\_\_\_\_\_\_\_

 \_\_\_\_\_\_\_\_ do declare that I will comply the F.P.A.

 Preparation Control Documentation and the F.P.A. System of Inspection

Signed: \_\_\_\_\_

Printed Name: \_\_\_\_\_

Date: \_\_\_\_\_

.

## SCHEDULE OF PRODUCTS

#### Processed Jack Mackerel Products Export:

The company is involved in the export of following processed jack mackerel products

- 1. Original recipe cold smoked fillet.
- 2. Satay cold smoked fillet.
- 3. Hot and spicy fillet.
- 4. Ocean Jerky

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## **AUTHORISED SIGNATORIES**

FULL NAME	POSITION	SPECIMEN SIGNATURE
	Manager	
	Administrator	
	Leading hand	

Notification has to be given to AQIS within three working days of a signatory's termination of employment

## **EXPORT CERTIFICATION AND CONTROL**

## Ex 222 EXPORT CLEARANCE NOTICE (AFTER COMPLETION OF SHIPMENT)

Original	is sent to AQIS office (within three working
	days of the date of issue).
Duplicate	Company copy.
Triplicate	Exporter/agents copy.
Quadruplicate	is sent to AQIS office (within three working
·	days of the date of issue).

#### E 51 TRANSFER CERTIFICATE

Original	is sent immediately to the AQIS office in the state where the product is going
Duplicate	goes with the load and is kept on record by the receiving establishment.
Triplicate Quadruplicate	is sent immediately to the regional AQIS office. Company copy.

## Ex 46 HEALTH CERTIFICATE (CERTIFICATE AS TO CONDITION)

Original	goes to the importing country.
Duplicate	Exporter/agents copy.
Triplicate	Company copy.
Quadruplicate	is sent to AQIS with copy of Ex 222.

AQIS is consulted for any new market

#### STORAGE OF CERTIFICATES

Documents are held under locked security and a record book is maintained for incoming documents and their serial number. The documents are only handled by signatories listed above.

#### CANCELLED DOCUMENTS

Company keeps its copy of each particular document and the remainder is sent immediately to AQIS Office.

## **HYGIENE TRAINING PROGRAM**

#### 1. Communicable Diseases:

No person, while known or suspected to be suffering from, or to be carrier of a disease likely to be transmitted through processed food or while afflicted with infected wounds, skin infection, sores or with diarrhea, is permitted to work in any food handling area in any capacity in which there is any likelihood of such a person directly or indirectly contaminating the food with pathogenic micro-organism.

#### 2. Injuries:

Any person who has a cut or wound must not continue to handle processed food or food contact surface until the injury is completely protected by a waterproof covering which is firmly secured, and which is conspicuous in color.

#### 3. Personal Cleanliness:

- a) A person in a food handling area must maintain a high degree of personal cleanliness.
- b) A person must not wear any jewelry when engaged in preparing processed food except slipper earrings and plain wedding rings.
- c) A person must not wear fingernail varnish if handling food with bare hands.
- d) A person must not engage in any behavior which could result in any behavior which could result in contamination of processed food, such as eating, smoking, chewing anything such as gum, sticks, tobacco or betel nuts, or any other unhygienic behavior in food handling areas
- e) A person who will be engaged in handling of food must wash his or her hands:
  - I. on entering the food handling area; and
  - II. immediately after using the toilet; and
  - III. after touching the nose or mouth; and
  - IV. after handling contaminated material; and
  - V. Whenever necessary to avoid contaminating the food in the area.
- f) A person who will be engaged in handling food must wash and disinfect his or her hands immediately after handling any material, which might be capable of transmitting disease.

The Manager of the company performs the Hygiene Training program and a training record is maintained

## WATER / ICE QUALITY STATEMENT

All water / ice referred to any where in this document, in connection with its use in ingredients, processing or cleaning, should be

- Of potable standard which conforms to *Export Control* (*Processed Food*) Orders Schedule 2, 24.1.
- Sampled not less then monthly during periods of operation, or more frequently when required.
- Sampled by Authorized personnel.
- Analyzed by NATA accredited laboratory

Records of water / ice testing results should be maintained at Registered Establishment No \_\_\_\_\_ and should be available for audit / review by AQIS Officer.

Microbiological testing should be carried out on Tank Water every 6 months and sent to NATA accredited laboratory for analysis. The results should be held on file.

AQIS regional office should be notified in writing (FAX), within two working days of receipt of results of examination of any sample of water / ice not complying with the standards i.e.:

- Any E. coli per 100 mL.
- More then 10 coliform organism per 100 mL.
- Any two consecutive samples containing 1 to 10 coliforms per 100 mL.
- Any three samples containing 1 to 10 coliforms per 100 mL. In any consecutive 12 months.

## LISTERIA PROGRAM

Required for high risk ready-to-eat product as according to *"Manual For Control Of Listeria In Registered Establishments Processing Fish For Export "* by AQIS (1994).

## **CALIBRATION STATEMENT**

#### Calibration of Scales:

All scales should be calibrated daily by the Production Supervisor with certified weight and recorded in daily scale check report

Date:	Time:	Checked By:
Certified Weight	Scale Type/Reading	Comment
10 Kg		
5 Kg		
2Kg		
1Kg		

#### **Chlorination of Process water:**

All process water should be chlorinated and reading taken by the QC Personal and recorded in the daily hygiene report. The chlorine level in the water should be maintained within 2 ppm.

#### **Digital Thermometers:**

All digital thermometers should be calibrated on the first working day of each month and recorded in the comments of the daily hygiene report of that day.

#### **Refrigeration Gauges:**

All refrigeration gauges should be calibrated once in six months and recorded in the comments of that days daily hygiene report

## HYGIENE CLEANING PROGRAM

The Administrator takes charge of all cleaning programs. All New personnel are trained on correct cleaning procedure and the existing staff is supervised. New and existing personnel are also trained on general hygiene

Hygiene cleaning program is followed regularly for

#### 1. Tables, Floor and Aprons:

Tables, floor and aprons are scrubbed daily with a DPI approved \_\_\_\_\_\_ and rinsed thoroughly

#### 2. Ceiling and Walls:

Ceilings and walls are washed when required with high pressure hose and scrubbed monthly with a detergent. the walls and ceilings are disinfected and rinsed thoroughly

#### 3. Toilets and Amenities:

Toilets and amenities are cleaned daily during production with Sodium Hypochlorate. All toilets, walls and benches are scrubbed.

#### 4. Soap Dispensers & Paper Towel Dispensers:

Soap dispensers and paper towel dispensers are checked daily. \_\_\_\_\_ Soap is used.

#### 5. Drains:

Drains are cleaned daily with Sodium Hypochlorate and rinsed.

#### 6. Exterior:

Concrete wash down area hosed when required with high-pressure hose. Exterior walls are washed with Sodium Hypochlorate and the exterior grounds are maintained monthly.

#### 7. Chiller Tanks:

Chiller tanks are cleaned twice a week with high-pressure water. They are scrubbed fortnightly with sodium Hypochlorate

#### 8. Hopper Bins:

Cleaned immediately after employing with high-pressure water. When soiled scrubbed with \_\_\_\_\_\_ detergent.

#### 9. Bulk Transport Bins:

Cleaned daily with high-pressure water.

#### 10. Smoke House:

Smoke house is thoroughly cleaned with heavy duty detergent after every use and the disinfected using \_\_\_\_\_.

#### 11. Grilling and Drying Equipment' s:

Scrubbed thoroughly with heavy duty detergent after every use and disinfected.

#### 12. Chemicals Used for Cleaning:

The following chemicals are used for cleaning and disinfection.

1.

2.

3.

Administrator is responsible for all cleaning programs. The administrator trains new personals on correct cleaning procedures before commencing work and supervises existing staffs. All chemicals are suitably labeled with warning of toxicity and direction for use on the premises. Chemicals and pesticides are stored In separate store room and only handled under strict supervision. The administrator trains new and existing personals on general hygiene.

## VERMIN CONTROL

The underlying basis of pest control is good house keeping and efforts should be made to keep all surrounds, which could provide harboring to pests clear.

Rodent baits are distributed within the following area

Number of bait station location

1.

2.

3.

The following rodenticides are used:

1.

2.

3.

Insects and termites are sprayed with the following chemicals:

1. 2.





## DAILY HYGIENE AND PREMISES REPORT

Inspection date:

ltem	Condition	Report/Action Taken
Cleanliness & Condition . of areas		•
Equipment		
Ventilation & lighting		
Storage of Packing		
Waste disposal		
Vermin control		
Toilets clean		
Lunch room clean		
Change room clean		
Exterior clean/ waste removed		
Shock room		
Holding Room		
Chlorine	PI	om
Checked by: Hygiene Officer (Block	Letters)	Date:Signature
Administrator (Block Lette	ers)Sig	nature

## **PRODUCT ASSESSMENT REPORT**

Product		
Brand		
Production Date		
Declared Net contents		
Serial No 's:	Batch Size:	Sample Size:

#### Sample Unit Assessment

Declared Net Weight							
Actual Net Weight							
Declared Grade							
Damage							
Parasite							
Disease							
Abnormal Color							
Moribund Fish							
Packaging							
Decision	Passe	d	De	etained		Reje	cted
Checked by:	Checked by: Date:						
Operator (Block Letters) Signature							
Administrator (Block Letter	s)			Signatu	re		

#### Table of Defects

Style	Defect	Tolerance
ÂII	Moribund Fish	NIL
All	Abnormal Color	Practically Free
All	Parasites	NIL
All	Damage	Practically Free
All	Disease	NIL
All	Incorrect Labeling	NIL

## SAMPLING PLAN

The company follows the sampling plan 1 of the *Export Control (Processed Food) Orders – Schedule 6, 5.1.* in normal sampling circumstances. In the case of resubmitted batches the sampling plan 3 of *Export Control (Processed Food) Orders – Schedule 6, 10.1.* is followed.

Sampling Plan 1 (Normal Sampling):

Sample less than 1kg

Batch Size	No. Of Sample Units	Acceptance Number
_	2	0
_	2	0
5 – 2,400*	3	0
2,401 – 12,000	6	1
12,001 – 24,000	13	2
24,001 – 48,000	21	3
48,001 – 84,000	29	4
84,001 – 144,000	48	6
144,001 – 240,000	84	9
0ver 240,000	126	13

\* In this sampling plan when batch size is less than 15, only non-destructive inspection is performed unless, in the opinion of an authorized officer, destructive sampling is warranted

Sampling Plan 3 (For Sampling of Resubmitted Batches):

Net contents of immediate sample less than 1kg

Batch Size	No. Of Sample Units	Acceptance Number
_	3	0
	5	1
5 – 2,400*	6	1
2,401 – 12,000	13	2
12,001 – 24,000	21	3
24,001 – 48,000	29	4
48,001 – 84,000	48	6
84,001 – 144,000	84	9
144,001 – 240,000	126	13
0ver 240,000	200	19

\*In this sampling plan when batch size is less than 15, destructive inspection is performed on atleast half the samples, non-destructive inspection is carried out on the remaining samples.

	Re	ceival o	of Fish an	nd Filleting				
No	Process	Symbol	Frequency	Check	Responsibility			
1.	Receipt of whole fresh fish in chilled water	$\bigcirc$	Every lot	Random sampling for Histamine, Organoleptic check	Q A Personal			
2	Head on gutting & gilling (HOGG)	$\bigcirc$	Every fish	Proper removal of gut & gills. Removal of all blood traces	Operator			
3.	Desliming	$\bigcirc$	Every fish	Proper removal of slime	Operator			
4.	Transport to filleting area		Every bin	Minimum delay of fish	Operator			
5.	Filleting (side only)	$\bigcirc$	Every fish	Filleting technique	Operator			
6.	Fillet weighing	$\bigcirc$	Every lot	Weighing machine	Operator			
7.	Fillet storage (pre-processing)	$\bigtriangledown$	Every lot	Temp check of chiller room	Operator			

# **Process Flow Chart**

.

### Hazard Analysis (HACCP) Table(S) Receival of Fish and Filleting

	Critical Steps	Potential Hazard	Critical Control Point	Preventive, Control & Monitoring Measures		
				Monitoring Procedure	Target Level & Tolerance	Corrective Action
1	Receival of whole fresh fish Chilled water	Microbial deterioration	1-5	Check for proper Organoleptic properties of fish and Histamine level of the fish.	Up to 2 hrs. Temp to 2° C Histamine level less than 100 mg/kg (ANZFA)	Reject the lot if Histamine level is higher than specified
2	Fillet Weighing	Incorrect weight Scale calibration incorrect	Weighing procedure Calibration of scales	Operator accurately weighs fillets. The supervisor checks randomly Daily scales are calibrated & recorded	Exact weigh as specified. Scales properly tarred Nil tolerance	Supervisor check for exact weight specifications On detection the supervisor ceases the scales and sends for repair

\* Control Point: 1 = cleansing in-process product & additive 2 = temperature 3 = cleaning contact surface 4 = atmospheric conditions

5 = separation of functions 6 = operator hygiene (Based on technical paper by C..D. Garland, 1995)

## **RISK ASSESSMENT** Original Recipe Cold-Smoked Fillets

(John Sumner, 1995)

#### **Risk Assessment for Biological Hazards**

- A. Special class restricted for at risk populations, like aged, immunocompromised, infects (Listeria)
- C. Process has no step, which destroy sensitive organisms. (No heat process)
- D. Product is subjected to reconstitution between processing and packaging.
- E. Product for abuse by distributor or consumers which could render the product hazardous.
- F. Product is consumed without further process to kill microorganisms.

Out of 6 risk characteristics (A-F) 5 characteristics have been identified as potential Biological Hazards. Thus, this product falls in the risk category V as high-risk product.

#### Risk assessment for Physical and Chemical Hazard.

- C. Process has no step, which removes toxic chemicals or physical hazards (Histamine)
- E. Potential for abuse by distributor or consumer which would render the product hazardous. (Product tampering)
- F. Consumer cannot detect a Chemical or Physical Hazard (Histamine in jack mackerel).

Out of 6 risk characteristics (A-F) 3 have been identified as potential chemical and physical hazards. Thus, this product falls in the risk category III as medium risk product.

Based on the above risk assessment the product is defined as high-risk product.

	Process	Flow	Chart	
<b>Processing of</b>	Original	recipe	<b>Cold-smoked</b>	Fillets

No	Process	Symbol	Frequency	Check	Responsibility
1.	Fillets in transit for brining	$\bigcirc$	Every batch	Check for fillet condition & temp	Operator
2	Immersion in Brine Solution	$\bigcirc$	EveryCheck for brinebatchconcentration &temp		Operator
3.	Storage of brined fillets in chiller	$\bigtriangledown$	Every batch	Check for chiller temperature	Chiller Operator
No	Process	Symbol	Frequency	Check	Responsibility
4.	Transport to smokehouse		Every batch	Check for no delay	Smokehouse Operator
5.	Cold smoking in smokehouse	$\bigcirc$	Every batch	Check smoke house parameter. Heat smoke house to up to 60° prior to smoking	Smoke house operator
6.	Transport to dry area processing		Every batch	Check for no delay	Operator
7.	Trimming & skinning	$\bigcirc$	Every batch	Check for specification	Operator
8.	Transport to chiller then blast freezer	$\square \rangle$	Every batch	Check for no delay	Operator
9.	Transport to slicing area part- thawing	$ \rightarrow $	Every batch	Check for no delay	Operator
10.	Slicing	$\bigcirc$	Every batch	Check for proper slicing specifications	Slicing operator

## Hazard Analysis (Haccp) Table(S) Processing of Original recipe Cold-smoked Fillets

Critical Steps		Potential Hazard	Critical Control	Preventive, Control & Monitoring Measures		
			Folut	Monitoring Procedure	Target Level & Tolerance	Corrective Action
1	Immersion in brine solution	Product contamination in correct brining	1-5*	The supervisor check for the brine additives for potential contamination Supervisor checks for the correct brining procedure	Nil contamination in the brine additive. Brine concentration and time 1 hr.	If contamination detected the additives should be replaced and the additives should be stored in dry & sterile area. The brine should be prepared with correct procedure
2.	Cold smoking in smokehouse	Product incorrectly smoked	2-6*	Supervisor checks for correct smoking procedure	Temp 25° C – 30° C Time - 10 to 12 hrs	Smokehouse should be heated to 60° C prior to processing to eliminate any possible contamination. Supervisor should check for correct smoking procedure & correct it.

Continued .....

	Critical Steps	Potential Hazard	Critical Control Point	Preventi	ive, Control & Monitori	ng Measures
				Monitoring Procedure	Target Level & Tolerance	Corrective Action
3.	Trimming & skinning	Product contamination product not trimmed and skinned properly	2-6*	Supervisor checks for proper trimming procedure & skinning specification	Nil tolerance for trimming & skinning. Nil tolerance for hygiene. Temp - up to 10° C time up to 4 hrs.	Correction of trimming & skinning procedure. If defects found send for re- trimming. A proper hygiene practice should be maintained.
4	Slicing	Product contamination. Product not sliced properly	2.6*	Supervisor checks for proper slicing procedure & specifications. Maintain a proper hygiene.	Nil tolerance for slicing & nil tolerance for hygiene. Temp 10° C Time 1 hrs.	Correction of slicing procedure and reject of defects. A proper hygiene practice should be maintained. correct it.

\* Control Point: 1 = cleansing in-process product & additive 2 = temperature 3 = cleaning contact surface 4 = atmospheric conditions 5 = separation of functions 6 = operator hygiene (Based on technical paper by C..D. Garland, 1995)

## **RISK ASSESSMENT Satay cold Smoked Fillets**

(John Sumner, 1995)

## **Risk Assessment for Biological Hazards**

- A. Special class restricted for at risk populations, like aged, immunocompromised, infects (Listeria)
- C. Process has no step, which destroy sensitive organisms. (No heat process)
- D. Product is subjected to reconstitution between processing and packaging.
- E. Product for abuse by distributor or consumers which could render the product hazardous.
- F. Product is consumed without further process to kill microorganisms.

Out of 6 risk characteristics (A-F) 5 characteristics have been identified as potential Biological Hazards. Thus, this product falls in the risk category V as high-risk product.

#### Risk assessment for Physical and Chemical Hazard.

- C. Process has no step which removes toxic chemicals or physical hazards (Histamine)
- E. Potential for abuse by distributor or consumer which would render the product hazardous. (Product tampering)
- F. Consumer cannot detect a Chemical or Physical Hazard (Histamine in jack mackerel).

Out of 6 risk characteristics (A-F) 3 have been identified as potential chemical and physical hazards. Thus, this product falls in the risk category III as medium risk product.

Based on the above risk assessment the product is defined as high-risk product.

<b>Process Flow Chart</b>	
<b>Processing of Satay Cold-smoked Fil</b>	lets

No	Process	Symbol	Frequency	Check	Responsibility
1.	Fillets in transit for marination	$\bigcirc$	Every batch	Check for fillet condition & temp	Operator
2.	Preparation of Marinate	$\bigcirc$	Every batch	Check for marinate specification & temp	Operator
3.	Immersion fillet in marinate	$\bigcirc$	Every batch	Check temp & marinate concentration	Operator
4.	Storage of marinated fillets in chiller	$\bigtriangledown$	Every batch	Check for chiller temperature	Chiller Operator
5.	Transport to smokehouse	$ \Rightarrow$	Every batch	Check for no delay	Smokehouse Operator
6.	Cold smoking in smokehouse	$\bigcirc$	Every batch	Check smoke house parameter. Heat smoke house to up to 60° prior to smoking	Smoke house operator
7.	Transport to dry area processing	$\square $	Every batch	Check for no delay	Operator
8.	Trimming & skinning	$\bigcirc$	Every batch	Check for specification	Operator
9.	Transport to chiller then blast freezer	$\square $	Every batch	Check for no delay	Operator
10.	Transport to slicing area part- thawing		Every batch	Check for no delay	Operator
11.	Slicing	$\bigcirc$	Every batch	Check for proper slicing specifications	Slicing operator

	Hazard Analysis (HACCP) Table (S)								
	Processing of Satay Cold-smoked Fillets								
	Critical Steps	Potential Hazard	Critical Control Point	Preventive, Control & Monitoring Measures					
				Monitoring Procedure	Target Level & Tolerance	Corrective Action			
1	Immersion of fillets in marinade	Product contamination. Incorrect marination	1-5*	The supervisor checks for the marinade additive for potential contamination check for correct marination process	Nil contamination in the marinade. Time overnight	If contamination detected the additive should be replaced. The additives should be stored in dry & sterile area. The marinade should be prepared again with correct procedure.			
2	Cold smoking in smokehouse	Product incorrectly smoked	2-6*	Supervisor checks for correct smoking procedure	Temp 25° C – 30° C Time - 10 to 12 hrs	Smokehouse should be heated to 60° C prior to processing to eliminate any possible contamination. Supervisor should check for correct smoking procedure & correct it.			

Continued .....

Critical Steps		Potential Hazard	Critical Control Point	Preventive, Control & Monitoring Measures			
				Monitoring Procedure	Target Level & Tolerance	Corrective Action	
3	Trimming & skinning	Product contamination product not trimmed and skinned properly	2-6*	Supervisor checks for proper trimming procedure & skinning specification	Nil tolerance for trimming & skinning. Nil tolerance for hygiene. Temp - up to $10^{\circ}$ C time up to 4 hrs.	Correction of trimming & skinning procedure. If defects found send for re- trimming. A proper hygiene practice should be maintained.	
4	Slicing	Product contamination. Product not sliced properly	2.6*	Supervisor checks for proper slicing procedure & specifications. Maintain a proper hygiene.	Nil tolerance for slicing & nil tolerance for hygiene. Temp 10° C Time 1 hrs.	Correction of slicing procedure and reject of defects. A proper hygiene practice should be maintained. correct it.	

\* Control Point: 1 = cleansing in-process product & additive 2 = temperature 3 = cleaning contact surface 4 = atmospheric conditions
5 = separation of functions 6 = operator hygiene (Based on technical paper by C..D. Garland, 1995)

## **RISK ASSESSMENT** Hot and Spicy Fillets

(John Sumner, 1995)

#### **Risk Assessment for Biological Hazards**

- D. Product is subjected to recontamination between processing & packaging
- E. Potential for abuse by distributor or consumer which packaging will render the product hazardous.
- F. Product is consumed without further processing to kill microorganisms.

Out of 6 risk characteristics (A-F) 3 have been identified as potential biological hazards. Thus, this product falls in the risk category III as medium risk product.

#### Risk assessment for Physical and Chemical Hazard.

- C. Process has no step which removes toxic chemicals or physical hazards (Histamine)
- E. Potential for abuse by distributor or consumer which would render the product hazardous. (Product tampering)
- F. Consumer cannot detect a Chemical or Physical Hazard (Histamine in jack mackerel).

Out of 6 risk characteristics (A-F) 3 have been identified as potential chemical and physical hazards. Thus, this product falls in the risk category III as medium risk product.

Based on the above risk assessment the product is defined as medium risk product.

## **Process Flow Chart** Hot & Spicy Fillets

No	Process	Symbol	Frequency	Check	Responsibility
1.	Fillets in transit for marination	$\bigcirc$	Every batch	Check for fillet condition & temp	Operator
2.	Skinning	$\bigcirc$	Every batch	Check for proper skinning procedure	Operator
3.	Preparation of Marinate	$\bigcirc$	Every batch	Check for marinate specification & temp	Operator
No	Process	Symbol	Frequency	Check	Responsibility
-----	---	--------------------	----------------	--	---------------------
4.	Immersion of fillet in marinate	$\bigcirc$	Every batch	Check temp & marinate concentration	Operator
5.	Storage of marinated fillets in chiller	$\bigtriangledown$	Every batch	Check for chiller temperature	Chiller Operator
6.	Transport to Grill		Every batch	Check for no delay	Grill Operator
7.	Grilling in grill	$\bigcirc$	Every batch	Check for grill parameters	Grill operator
8.	Transport to dry area processing	$\square$	Every batch	Check for no delay	Operator
9.	Trimming	$\bigcirc$	Every batch	Check for specification	Operator
10.	Transport to chiller then blast freezer		Every batch	Check for no delay	Operator
12.	Transport to slicing area part- thawing		Every batch	Check for no delay	Operator
13.	Slicing	$\bigcirc$	Every batch	Check for proper slicing specifications	Slicing operator

	Processing of Hot and Spicy Fillets									
	Critical Steps	Potential Hazard	Critical Control Point	Preventive, Control & Monitoring Measures						
				Monitoring Procedure	Target Level & Tolerance	Corrective Action				
1.	Immersion of fillets in marinade	Product contamination. Incorrect marination	1-5*	The supervisor checks for the marinade additive for potential contamination check for correct marination process	Nil contamination in the marinade. Time overnight	If contamination detected the additive should be replaced. The additives should be stored in dry & sterile area. The marinade should be prepared again with correct procedure.				
2.	Grilling in Grill	Improper grilled product	Check for proper grilling procedure	The supervisor checks for proper grilling procedure & the desired temp. and time	Temp: 150° C – 160°C. Time 8 min one side & 2 minutes the other side	If the product is not sufficiently grilled then supervisor checks & corrects the temp of grill & the grilling procedure. Supervisor sends back the defects for re-grilling.				

### Hazard Analysis (HACCP) Table (S) Processing of Hot and Spicy Fillets

Continued ......

	Critical Steps	Potential Hazard	Critical Control Point	Prevent	ng Measures	
				Monitoring Procedure	Target Level & Tolerance	Corrective Action
3.	Trimming 8 skinning	<ul> <li>Product</li> <li>contamination</li> <li>product</li> <li>not</li> <li>trimmed</li> <li>and</li> <li>skinned properly</li> </ul>	2-6*	Supervisor checks for proper trimming procedure & skinning specification	Nil tolerance for trimming & skinning. Nil tolerance for hygiene. Temp - up to 10° C time up to 4 hrs.	Correction of trimming & skinning procedure. If defects found send for re- trimming. A proper hygiene practice should be maintained.
4	Slicing	Product contamination. Product not sliced properly	2.6*	Supervisor checks for proper slicing procedure & specifications. Maintain a proper hygiene.	Nil tolerance for slicing & nil tolerance for hygiene. Temp 10° C Time 1 hrs.	Correction of slicing procedure and reject of defects. A proper hygiene practice should be maintained. correct it.

\* Control Point: 1 = cleansing in-process product & additive 2 = temperature 3 = cleaning contact surface 4 = atmospheric conditions 5 = separation of functions 6 = operator hygiene (Based on technical paper by C..D. Garland, 1995)

### RISK ASSESSMENT Ocean Jerky

(John Sumner, 1995)

#### **Risk Assessment for Biological Hazards**

- D. Product is subjected to recontamination between processing & packaging
- E. Potential for abuse by distributor or consumer which packaging will render the product hazardous.
- F. Product is consumed without further processing to kill microorganisms.

Out of 6 risk characteristics (A-F) 3 have been identified as potential biological hazards. Thus, this product falls in the risk category III as medium risk product.

#### Risk assessment for Physical and Chemical Hazard.

- C. Process has no step which removes toxic chemicals or physical hazards (Histamine)
- E. Potential for abuse by distributor or consumer which would render the product hazardous. (Product tampering)
- F. Consumer cannot detect a Chemical or Physical Hazard (Histamine in jack mackerel).

Out of 6 risk characteristics (A-F) 3 have been identified as potential chemical and physical hazards. Thus, this product falls in the risk category III as medium risk product.

Based on the above risk assessment the product is defined as medium risk product.

### **Process Flow Chart Processing of Ocean Jerky**

No	Process	Symbol	Frequency	Check	Responsibility
1.	Fillets in transit for marination	$\bigcirc$	Every batch	Check for fillet condition & temp	Operator
2.	Skinning		Every batch	Check for proper skinning procedure	Operator

No	Process	Symbol	Frequency	Check	Responsibility
3.	Preparation of Marinate	$\bigcirc$	Every batch	Check for marinate specification & temp	Operator
4.	Immersion of filler in marinate	$\bigcirc$	Every batch	Check temp & marinate concentration	Operator
5.	Storage of marinated fillets in chiller	$\bigtriangledown$	Every batch	Check for chiller temperature	Chiller Operator
6.	Transport to Dryer	$\Rightarrow$	Every batch	Check for no delay	Dryer Operator
7.	Drying in dryer	$\bigcirc$	Every batch	Check for grill parameters	Dryer operator
8.	Transport to dry area processing	$\Rightarrow$	Every batch	Check for no delay	Operator
9.	Final high heat treatment	$\bigcirc$	Every batch	Check for the temperature and time	Operator

#### Hazard Analysis (HACCP) Table (S) Processing of Hot and Spicy Fillets

	Critical Steps	Potential Hazard	Critical Control Point	Preventive, Control & Monitoring Measures				
				Monitoring Procedure	Target Level & Tolerance	Corrective Action		
1	Immersion of fillets in marinade	Product contamination. Incorrect marination	1-5*	The supervisor checks for the marinade additive for potential contamination check for correct marination process	Nil contamination in the marinade. Time overnight	If contamination detected the additive should be replaced. The additives should be stored in dry & sterile area. The marinade should be prepared again with correct procedure.		
2	Improper drying	Improper Drying	Drying temp & time	The temp of the dryer & and the drying procedure is checked. The duration of the drying process is specified	Temp of dryer 60 <sup>0</sup> C. Duration 18- 20 hrs. No tolerance in drying procedure	If drying is not adequate the supervisor extends the time of drying and checks for dryer temp.		

Continued .....

Critical Steps			Potential Hazard	Critical Control			Pre	eventi	ve, Con	trol &	Mo	nitori	ng Measu	res		
				Point												
							Mo	nitoring		Ta	rget Le	vel	&	Correc	tive A	ction
							Pr	ocedure		-	Folerai	ıce				
3.	Burning o product	of	Burning of product	Heating time	temp	&	The checks duratior process	super the tem of	visor 1p & the	temp 10 sec	180 <sup>0</sup>	С	time	If there defects and time and Burnt p rejected	e are the e is ch maint product	any temp ecked ained. t is

\* Control Point: 1 = cleansing in-process product & additive 2 = temperature 3 = cleaning contact surface 4 = atmospheric conditions

5 = separation of functions 6 = operator hygiene (Based on technical paper by C..D. Garland, 1995)

# Process Flow Chart Final Product Packaging & Freezing

No	Process	Symbol	Frequency	Check	Responsibility
1.	Packaging	$\bigcirc$	Every batch	Correct product packed into correctly labeled packs	Packer
2	Transport to blast freezer	$\square $	Every batch	Minimum delay	Operator
3.	Freezing	$\bigcirc$	Every batch	Check for temp of blast freezer	Chiller Operator
4.	4. Storage into holding freezer before sale		Every batch	Check for temp of holding freezer	Freezer manager

#### Hazard Analysis (HACCP) Table (S) Processing of Final Product Packaging and Freezing

Critical Steps Potential Hazard		Critical Control	Preventive, Control & Monitoring Measures				
			Point				
				Monitoring	Target Level &	<b>Corrective Action</b>	
	· · · · · · · · · · · · · · · · · · ·			Procedure	Tolerance		
1	Packaging (Vacuum)	Improper packing	Packing procedure	Supervisor check for	Nil tolerance time 1 hour temp –10° C	If packaging is improper the lot is	
ŀ	(Vuouuni)			procedure and		repacked. The	
				operator should		procedure is checked for defects	
				product. Operator		& corrected. The	
				should ensure no		vacuum machine is	
				delay from slicing to		checked for defects	
				packaging.		and corrected	
		Incorrect trade	Receival &	Supervisor checks	Correct trade	Supervisor	
		description	markings & labels	packets. labels for	includeing	with incorrect trade	
			5	required trade	establishment	description and is	
				description	number country of	relabeled	
					origin, name &		
					address of		
					processor, true		
					product description		
					country requirement		
		Incorrect weight	Accurately	Supervisor checks	Additional labeling	Supervisor removes	
		serial number &	transfer additional	stamped labels for	should be correct &	all incorrect packs,	

Continued .....

	Critical Steps	Potential Hazard	Critical Control Point	Preventive, Control & Monitoring Measures			
				Monitoring Procedure	Target Level & Tolerance	Corrective Action	
1	Packaging Vacuum (Contd.)	Date	labeling weights, serial No & Dates	correct weights serial No & date & record on form	accurate	labels and checks for any fault and relabels accurately	
2	Freezing	Incorrect temperature. Incorrect freezing time	2-6*	Check for the proper temperature of the freezer and the freezing duration	Time 1 hr Temp -30° C to -40° C	If the freezer temp is not correct, the supervisor corrects and records on the form. The supervisor decides the freezing duration.	
3.	Storage in holding freezer prior to sale	Product quality loss	Freezer management	Freezer manager maintains freezer conditions, prevention of reentry of warm air and well managed stock control	Up to 3 months at -35°C to -37°C	Poor quality product diverted to local market or dumped.	

\* Control Point: 1 = cleansing in-process product & additive 2 = temperature 3 = cleaning contact surface 4 = atmospheric conditions 5 = separation of functions 6 = operator hygiene (Based on technical paper by C..D. Garland, 1995)

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