ADDED VALUE EEL/RICE PRODUCTS FOR THE JAPANESE MARKET

Stage 1: Feasibility Study

by: J K McDonald, Food Technologist, Product Development Group; and
B Warfield, Marketing Officer

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Crawdad Crayfish Farms Pty Ltd
Ricegrowers Coop Ltd

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- Mr B Goodrick, Senior Seafood Technologist, IFIQ
- Mr R Berry, R&D Manager, Ricegrowers Coop Ltd
- Mr T T Chow, Crawdad Crayfish Farms Pty Ltd
- Mrs Bronwen Prazak, Manager, Japan Tourist Bureau, Brisbane
- Australian Food Processing Laboratories, Preston, Victoria

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EXECUTIVE SUMMARY

This report sets out the results of a study undertaken by IFIQ to determine the feasibility of producing a shelf-stable eel/rice convenience meal for the Japanese market.

The study was divided into three parts:

- a survey of current technical and marketing information on eel and eel products;
- a preliminary production trial to evaluate the effects on pre-processing methods and retort processing on eel and rice in suitable packaging; and
- evaluation of the concept of a heat and eat eel/rice meal by Japanese consumers in focus groups.

The information survey included on-line searches of available databases (both Technical and Marketing) and personal communications with a number of Government agencies involved either directly or indirectly with the Japanese market. The responses indicated that there was no market research information available at the time in terms of consumer preferences for a specific product such as the proposed eel/rice meal or for the ready to eat preprocessed retail market in general. There was information available about eel in terms of biology and farming but processing information was limited to Kabayaki eel exported from Taiwan to Japan and to eel products produced and consumed in Europe. The initial information relating to Japanese consumption of eel was limited and contradictory.

The production trial set out to evaluate the effect of the retort process on minimally preprocessed eel pieces, with and without an eel sauce and to evaluate the suitability of a rice variety which had been developed specifically for the Japanese market. The two ingredients were packed separately (in 250 g plastic trays with foil webbing) but processed under identical conditions. It was hoped that samples from these runs could be used in focus groups to obtain feedback from Japanese consumers residing in Brisbane.

The retort cycle used in the trial was too severe to produce a quality rice or eel product, but indicated the process had potential.

The trial highlighted the fact that more work was required in the preprocessing stage to increase the quality of presentation and eating quality for both the eel and rice.

At this point various Japanese recipes were looked at for their suitability in terms of the combination of the eel and rice for a retorted product. The choice was limited to Kabayaki style eel - where the rice would necessarily be treated and packaged separately, and 'Nimono', a casserole-style recipe that would allow the eel and rice to be processed together in the one pack. The limiting factor from a product development point of view was how to develop an acceptable flavour profile. The Kabayaki eel product from Taiwan includes a separate sachet of eel sauce plus another sachet of dried herbs.

It was therefore decided to run a series of focus groups using Japanese consumers (men and women of various ages) to find out the response to our concept, and whether the flavour of the Kabayaki eel was the preferred option.

The results of the focus groups are presented in the last report. They indicate that the product concept needs modifying because eel is viewed as an expensive (upmarket) item reserved for eating on special occasions, while processed food items are viewed as cheaper alternatives. They emphasised the importance of the 'eel' sauce and the appearance of the eel.

The response of the focus group participants to the concept of ready prepared rice was not clear cut. Rice is generally regarded as easy to prepare and better if freshly cooked but there are a number of processed rice packs available in Japanese supermarkets. These were regarded by the focus groups as 'emergency' items purchased perhaps by young single working Japanese and not equal in quality to freshly prepared rice.

The initial results of the feasibility study indicate that the initial concept has potential but more market research information is required before further product and process development work proceeds.

INTRODUCTION

IFIQ's Product Development Group was approached to develop added-value eel products for the Japanese market by Mr Steve Peterson of Crawdad Crayfish Farms Pty Ltd. The group was also approached independently by Mr Greg Osbourne, Technical Manager, Ricegrowers Coop Ltd to discuss the development of added-value rice/seafood convenience meals for the Japanese market.

Discussions with both companies indicated that they were interested in a joint project to look at the feasibility of developing a eel/rice product for export. Consequently a proposal was submitted to the National Seafood Centre for funding support.

This proposal was accepted 1 July 1993 with the three parties contributing equally to the project costs for Stage 1.

This report outlines the results of the work carried out in the Feasibility Study. The report is divided into the following three sections:

- literature survey report;
- production trial report; and
- market research report.

Technical and Marketing Information Report

CONTENTS

OBJECTIVES

The purpose of this secondary market research was to source both technical and marketing information relating to eel products in particular, and the convenience meal market in Japan in general. It was hoped that this information base would allow us to focus on relevant product and process development of an eel/rice convenience meal for the retail market.

METHODOLOGY

Literature survey using IFIQ's Information Services

This was achieved using on-line searches of available databases. These included:

- Food Science and Technology abstracts (FSTA) (Appendix 1);
- Foods Intellegence abstracts (Appendix 2).

Government agencies

A number of contacts within State and Federal Government agencies both in Australia and Japan were contacted to broaden the non-technical information base.

These contacts included:

- Mr John McVeigh, Business Manager, NSC, IFIQ
- Mr Bruce Goodrick, Seafood Group, IFIQ
  - on the processing of eel in Taiwan;
- Mr Chris Ovenden, Agribusiness Marketing Services, QDPI
  - on the seafood market and on consumption patterns of the takeaway market (Bentos or lunchbox market);
- Mr Harry Onji, Tokyo office, Japan Secretariat Trade and Investment Branch, Department of the Premier, Trade and Development
  - on eel consumption in Japan;
- Mr Tim Goode, Austrade, Adelaide, South Australia;
  - on accessing relevant market information through Jetro;
- Dr John Prescott, CSIRO Japan Project
  - on primary market research to be conducted in-country; and
- Mrs Bronwen Prazak, Manager, JTB
  - on retail products, eel consumption in Japan, and the lunchbox market.

RESULTS

In the main the abstracts included studies on pesticide residues in eel; feeding studies on cultured eel; assessment of eel spoilage; chemical, bacteriological and sensory changes in eel during smoking and storage; chemical investigations on canned, roasted eel; summary of live and processed eel from Taiwan; eel surimi; shelf-life studies on gas package smoked eel; aquaculture of eels; and flavour volatile of roasted fish meat. The most relevant abstracts are to be found in Appendix 1. There was limited information pertaining to the retailing of eel products.

The response from Mr Onji indicated that eel species was an important issue, with *Anguilla japonica* being the preferred species. However, the feedback from the focus groups indicated that there was an interest in tasting Australian eel although its correct preparation was paramount.

Mr Chris Ovenden and Mrs Bronwen Prazak were able to supply information about the takeaway (lunchbox) market and on eel products purchased in Japan. Mrs Prazak also gave feedback on the acceptability of the eel and rice production trial samples.

Dr Prescott, of CSIRO and Mr Goode, of Austrade indicated that their services would be available for in-country survey of prototypes (the latter via Jetro) but that general marketing information on a specific product such as the eel/rice product concept in particular was not available.

CONCLUSIONS

The results of this desk-top survey indicated that marketing information relating to this project was very limited and there was conflicting information about how and when eel was consumed.

The next step in evaluating the project concept was to manufacture some prototype product and organise in-house focus groups using Japanese consumers resident in Brisbane to provide feedback and some direction for future development work in terms of packaging, presentation and quality of the eel and rice ingredients.

Consequently a production trial was organised and the outcomes are presented in the next section of this report.

APPENDIX 1

Food Science and Technology abstracts (FSTA)

No. Records Request
1: 276 EEL

1 of 41
Marked in Search: #1

AN: 92-10-R0025
TI: Detection of IQ-type mutagens in canned roasted eel.
AU: Lee-H; Tsai-SJ
AD: Dep. of Biochem., Chung Shan Med. & Dental Coll., Nat. Chung Hsing Univ., Taichung, Taiwan
PY: 1991
SO: Food-and-Chemical-Toxicology; 29 (8) 517-522, 24 ref.
NU: ISSN: 0278-6915
LA: En (English)
SC: R Fish-and-marine-products
AB: Basic extracts of canned roasted eel exhibited the highest mutagenicity of 7 types of canned products [steamed pink salmon, steamed mill fish, steamed mackerel in tomato ketchup, fried squid, roast pork, roast beef and roast eel] assayed with Salmonella typhimurium TA98 in the presence of S-9 mix. The major mutagenic compounds of canned roasted eel extracts were purified and analysed by HPLC. The mutagenic fractions corresponding to the peaks of standard 2-amino-3,8-dimethylimidazo[4,5-f]quinoxaline (MeIQx) and 2-amino-3,7,8-trimethylimidazo[4,5-f]quinoxaline (7,8-DiMeIQx) were further confirmed by the comparison of UV spectra, tester strain specificity and nitrite treatment. The estimated contents of MeIQx and 7,8-DiMeIQx were 1.1 ng and 5.3 ng/g of canned roasted eel, resp. Cooking temp. and time seemed to be the major factors affecting mutagen formation in fried eel. The type and amount of mutagenic compounds detected in canned roasted eel are likely to be correlated with the relative levels of specific free amino acids in raw eel.
DE: CARCINOGENS-; eels, mutagens in canned roasted; fish, mutagens in canned steamed; meat, mutagens in canned roasted; FOOD-SAFETY; FISH-SPECIFIC; ROASTED-FOODS; CANNED-FOODS; FISH-; mutagens in canned steamed fish; MEAT-; mutagens in canned roasted meat
ID: Sea-foods; Prepared-foods
UD: 9210

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Marked in Search: #1

AN: 91-01-D0001
TI: The almanac of food industries in Taiwan, ROC. 1990.
CA: Taiwan, Food Industry Research & Development Institute
PB: Taipei-10516,-Taiwan;-China-Economic-News-Service.
PY: 1990
SO: 137pp.
DT: Book
LA: En (English)
SC: D Economics
AB: This almanac of food industries in Taiwan is divided into 5 sections: Features; Industry reports (from the canned foods, frozen foods, beverages, tea, savoury flavourings, edible oils, fast foods, food packaging, baked foods and confectionery, live and processed eel, and whole plant export sectors of the food industry); Statistics (import and export figures for individual sectors of the food industry); Company profiles; and Departments (major suppliers of food and agricultural products).
DE: INDUSTRIES-; foods industry, Taiwan, Book, Asia; ASIA-; foods industry, Taiwan, Book; BOOKS-; foods industry, Taiwan, Asia
UD: 9101

AN: 90-08-R0056
TI: Effect of frozen storage and other processing factors on the quality of surimi.
AU: Hsu-SY
AD: Graduate Inst. of Food Sci. & Tech., Nat. Taiwan Univ., Taipei, Taiwan
PY: 1990
SO: Journal-of-Food-Science; 55 (3) 661-664, 20 ref.
NU: ISSN: 0022-1147
LA: En (English)
SC: R Fish-and-marine-products
AB: A split plot design was applied to study the effect of frozen storage on the quality attributes of surimi [prepared from frozen pike eels]. Gel strength of surimi products was shown to be significantly (P less than 0.01) affected by storage and its 3-way or lower order interactions with leaching, grinding, setting and heating processes. Whiteness of the fish sausages was significantly (P less than 0.01) affected by storage and its interactions with leaching, grinding and heating processes. Significant interactions of storage with other process variables imply that the conventional single-variable-at-a-time strategy is inadequate to optimize the surimi processing system. Storage conditions should be included in optimization.
DE: STORAGE-COLD; eel surimi, quality of stored frozen; FROZEN-FOODS; FISH-SPECIFIC; FISH-PRODUCTS; GELS-; eel surimi, gels strength of stored frozen; STRENGTH-; OPTICAL-PROPERTIES; fish sausages, whiteness of stored frozen; SAUSAGES-
UD: 9008

AN: 90-08-R0049
TI: [Shelf-life of gas packaged smoked fish products.]
AU: Bruenner-KK; Spreekens-KJA-van
AD: Inst. voor Visserijprodukten TNO, Ijmuiden, Netherlands
PY: 1990
SO: Voedingsmiddelentechnologie-; 23 (4) 24-26
NU: ISSN: 0042-7934
LA: Nl (Dutch); Non-English
LS: en (English)
SC: R Fish-and-marine-products
AB: Samples of (i) sliced cold-smoked salmon, (ii) hot-smoked mackerel fillets and (iii) hot-smoked eel fillets were vacuum packaged or packaged under an 80% CO2/20% N2 atm, and stored at 7 degree C. Some samples were held under 100% CO2 for 24 h at 0 degree C before packaging and storage. At intervals during storage, the sensory and microbiological quality was determined. Tables and graphs of results are given. For all products and treatments, shelf-life was limited by bacteriological quality. Bacteriological shelf-life was considerably increased by gas packaging for all 3 fish types. Pre-treatment in pure CO2 gave a further increase in the shelf-life of (ii) and (iii) (to approx. double that of vacuum-packaged samples), but not (i). For (i), pure CO2 treatment followed by vacuum packaging gave a shelf-life equivalent to that achieved by gas packaging. Sensory shelf-life was improved by gas packaging only for (ii).
DE: PACKAGING-; fish products, packaging gas & shelf-life of smoked; SHELF-LIFE-; FISH-PRODUCTS; SMOKED-FOODS; FISH-SPECIFIC; eel, packaging gas & shelf-life of hot-smoked; SALMON-; packaging gas & shelf-life of cold-smoked salmon; MACKERELS-; packaging gas & shelf-life of hot-smoked mackerels

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Marked in Search: #1

AN: 89-12-R0028
TI: [Fatty nutrients of cultured eel.]
AU: Sugii-K; Watanabe-T; Kinumaki-T
AD: All Japan Kamaboko Makers' Ass., 3-37 Kandasakumacho, Chiyoda-ku, Tokyo 101, Japan
PY: 1988
SO: Bulletin-of-the-Tokai-Regional-Fisheries-Research-Laboratory-[Tokai-ku-Suisan-Kenkyusho-Kenkyu-Hokoku]; No. 126, 37-48, 18 ref.
NU: ISSN: 0040-8859
LA: Ja (Japanese); Non-English
LS: en (English)
SC: R Fish-and-marine-products
AB: Analyses of fatty nutrients, e.g. vitamins A and E, and fatty acids were carried out on eel groups cultured in different environments with different feedstuffs from early spring to late autumn. Results obtained were as follows: no marked fluctuations were observed in moisture, protein, fat and ash in different groups during 3 seasons; fluctuations due to environment, feedstuff or season were recognized by comparing polyenoic % in fatty acid composition; vitamin A contents of fillets were generally less than 4700 IU/100 g [level stated in Standard Tables of Food Composition in Japan (1982)] except in some groups in autumn; and vitamin E contents of fillets were in the range of 1-9 mg/100 g and roughly correlated with vitamin A contents.
DE: FISH-SPECIFIC; eels, season & nutrients in; SEASON-; NUTRITION-; VITAMINS-; eels, vitamins in; FATTY-ACIDS; eels, fatty acids composition of
UD: 8912

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Marked in Search: #1

AN: 89-02-D0005
TI: The almanac of food industries in Taiwan, ROC. 1988.
CA: Taiwan, Food Industry Research & Development Institute
AD: PO Box 246, Hsinchu 300, Taiwan
PY: 1987
SO: 172pp.
DT: Book
LA: En (English)
SC: D Economics
AB: [Continued from preceding abstr.] Section (iii) includes: Raw products, crop statistics (pp. 97-103). Statistics 1: ROC export and imports of seasonings (pp. 104-105). Statistics 2: ROC export and imports of frozen foods (pp. 105-109). Statistics 3: ROC export and import of dehydrated foods (pp. 110-113). Statistics 4: ROC export and import of foods in temporary preservative (pp. 114-117). Statistics 5: ROC export and import of processed foods of meat (p. 118). Statistics 6: ROC export and import of processed seafoods (pp. 119-120). Statistics 7: ROC export and import of dairy products (pp. 121-122). Statistics 8: ROC export and import of canned foods (pp. 123-127). Statistics 9: ROC export and import of tea and surrogates (pp. 128-129). Statistics 10: ROC export and import of soft drinks and carbonated waters (pp. 129-132). Statistics 11: ROC export and imports of food processing machinery (pp. 132-134). Section (iv) includes: Sze Chuan Food Products Co., Taiwan Snack Foods Corp., Gen Hong Foods Ind. Co. Ltd., Taitung Enterprise Corp., Wu Chuang Eatables Factory Co. Ltd., C'ttee Eel Processing, Ping, Roun Products Co., Ho Roun Products Co. Ltd., Tai Fang Foods Industry Co. Ltd., Song Chen Enterprise Co., Ban Chang Frozen Industry Co., Ve Wang Group, King Fong Industrial Co., Wan Jia Shian

Food Factory Co. Ltd., Great China Metal Industry Co., Great Wall Enterprise Co., Welfare Products Corp., Union Chinese Corp., A.G.V. Products Corp., and Hai Jyi Foods Co. (v) include: Index of advertisers (pp. 12-13). Major ROC suppliers of raw and processed agricultural products (pp. 135-156). Mini-profiles of ROC agricultural product manufacturers (pp. 157-162). Reader inquiry service (p. 163).
DE: INDUSTRIES-; foods industry, guide to Taiwan, Book, Asia; ASIA-; foods industry, guide to Taiwan, Book; BOOKS-; foods industry, guide to Taiwan, Asia
ID: Economics-
UD: 8902

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Marked in Search: #1

AN: 87-11-A0014
TI: Annual report 1986.
CA: Taiwan, Food Industry Research & Development Institute
AD: PO Box 246, Hsinchu 300, Taiwan
PY: 1987
SO: Annual-Report,-Food-Industry-Research-and-Development-Institute; NO-M-76-47, 74pp.
LA: En (English)
SC: A Food-sciences
AB: Activities of the Institute for 1986 are summarized in some detail, together with tables of data, under the following headings: Summary of achievements in 1986; Edible oil (single solvent refining of rice bran oil, development of rice bran oil used for deep frying, colour reversion of soybean oil); Food processing and preservation (application of high vacuum canning technology, manufacture of croquettes, quality change of frozen prepared food during distribution and retailing, storage stability of Chinese sausages as influenced by pH and aw, preserves); Food packaging (detn. of residual solvents in packaging materials, improvement of seam qualities of mushroom and asparagus cans, rusting control of 5-gal square tank, improvement of side seam coating, packaging test of welded cans made from different kinds of plates, performance of DRD 2-piece can as food container); Food machinery (application of automatic shrimp peeling system, improvement of sweet corn huskers, improvement of eel skewering machine, rice crust (guo-ba) cutter); Food quality (volatile constituents of stir-fried bell pepper, aroma and pungency of ginger, detection of adulteration of milk powder in fresh milk, storage quality of domestically produced sorghum); Food safety (good manufacturing practice of infant formula plant, bacteriological safety evaluation of canned cucumber pickle, systematic surveillance of microbial contaminants in dairy foods, health food development); Biotechnology (establishing a culture collection of microorganisms, a host-vector system for gene cloning in the coryneform bacteria, characterization and expression of the isoamylase gene from Pseudomonas amyloderamosa); Services and training; Research projects completed in 1986; Publications; seminars, personnel, etc. [See FSTA (1986) 18 10G51 for 1985 report.]
DE: FOOD-SCIENCE; research-development in Taiwan food science, Report, Asia; ASIA-; food science, research-development in Taiwan, Report
UD: 8711

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AN: 87-02-R0024
TI: Taiwanese eel farms getting organised.
AU: O'Sullivan-D
AD: 55 Bethell Avenue, Parkdale, Victoria 3194, Australia

SO: Australian-Fisheries; 45 (4) 30-32
LA: En (English)
SC: R Fish-and-marine-products
AB: Aspects of eel farming and processing in Taiwan are described. After 10 months eels weigh about 4-6 pieces/kg. Eels for live export are placed in iced water to slow their body functions then put in plastics bags filled with O2; survival time is up to 3 days. For processing, chilled eels are beheaded, gutted and backbone removed before cooling or smoking. Roasted eel pieces on bamboo sticks may be frozen with liquid N2 at -40 degree C and stored at -20 degree C for export.
DE: FISH-SPECIFIC; eels, processing of
UD: 8702

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Marked in Search: #1

AN: 85-12-R0080
TI: The lipid content and fatty acid composition of wild Australian eels, Anguilla australis australis Richardson.
AU: Sumner-JL; Beumer-JP; Chambers-A; Mobley-MC
AD: Food Tech. Unit, Royal Melbourne Inst. of Tech., GPO Box 2476V, Melbourne, Victoria 3001, Australia
PY: 1984
SO: Food-Technology-in-Australia; 36 (6) 287-289, 13 ref.
LA: En (English)
SC: R Fish-and-marine-products
AB: A comparison has been made of the fat content and fatty acid composition of short-finned eels, (i) Anguilla australis australis Richardson, harvested from drainage systems in Victoria, Australia, and (ii) Anguilla australis schmidtii Phillipps, a short-finned species harvested in New Zealand. Australian feeding eels had a fat content of 12.6% and migrators, 19.0%, compared with 8.7% and 15.0% for New Zealand feeders and migrators, resp.; the tail portion (behind the anus) had generally 3-4 times more lipid than the trunk (pectoral fin to anus). (i) had lower proportions of 22:5 and 22:6 and commensurately higher proportions of 16:0 and 18:0 fatty acids compared with (ii), resulting in lower degrees of unsaturation in the lipids of the Australian eels.
DE: LIPIDS-; eels, lipids in Australian wild; eel lipids, fatty acids composition of Australian wild; FATTY-ACIDS; FISH-SPECIFIC
UD: 8512

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Marked in Search: #1

AN: 85-09-R0024
TI: [Comparison of cultured and wild eel lipids.]
AU: Kim-KS; Oh-KS; Lee-EH
AD: Dep. of Food & Nutr., Pusan Womans Junior Coll., Pusan, S. Korea
PY: 1984
SO: Bulletin-of-the-Korean-Fisheries-Society; 17 (6) 506-510, 9 ref.
LA: Ko (Korean); Non-English
LS: en (English)
SC: R Fish-and-marine-products
AB: Muscle lipids of cultured and wild eel, Anguilla japonica, were analysed by gas chromatography for fatty acid compositions of total lipid (TL), neutral lipid (NL), phospholipid (PL) and glycolipid (GL). HPLC patterns of NL were also analysed. Lipid contents of dorsal muscle of cultured fish were slightly less than in wild fish. Contents of TL, NL and PL of wild and cultured fish were similar, while GL content of wild fish was higher. In the fatty acid compositions of TL, NL and PL, % C16:0, C18:1 and C22:6 in cultured fish were greater than in wild fish, while % C16:1

slightly different.
DE: FATTY-ACIDS; eel lipids, fatty acids composition comparisons of cultured vs. wild; FISH-SPECIFIC; LIPIDS-
UD: 8509

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Marked in Search: #1

AN: 85-07-R0072
TI: [Taste compounds of wild eel meat.]
AU: Yang-ST; Lee-EH
AD: Dep. of Food Sci. & Tech., Nat. Fisheries Univ. of Pusan, Pusan, S. Korea
PY: 1984
SO: Bulletin-of-the-Korean-Fisheries-Society; 17 (1) 33-39, 19 ref.
LA: Ko (Korean); Non-English
LS: en (English)
SC: R Fish-and-marine-products
AB: To elucidate the taste compounds of wild eel, Anquilla japonica, free acids, nucleotides and their related compounds, organic bases, sugars, organic acids and minerals were analysed. Taste panel assessments of synthetic extracts prepared with each extractive component omitted were carried out by a triangle difference test, and changes in profile were assessed. In free amino acid composition, lysine was dominant (20% of total), other abundant amino acids being glycine, arginine, alanine and histidine. Inosine monophosphate (IMP) was the dominant nucleotide (70% of total) while adenosine triphosphate, adenosine diphosphate, adenosine monophosphate, inosine and hypoxanthine contents were low. Among organic bases, total creatinine was abundant. Betaine content was 24 mg/100 g. The main organic acids were butyric, valeric and succinic acid. As for the sugars, contents of glucose and inositol were 1-2 mg/100 g. K-+, Na-+, PO4-3-- and Cl-- were the major ions. From the results of omission test the major components contributing to taste were glycine, serine, glutamic acid, IMP, Na-+, K-+, Cl--, PO4-3--, lysine, alanine, isoleucine, aspartic acid and creatinine.
DE: FISH-SPECIFIC; eels, taste compounds detn. in wild; FLAVOUR-COMPOUNDS; ORGANOLEPTIC-EVALUATION; eels, taste compounds organoleptic evaluation in wild
UD: 8507

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Marked in Search: #1

AN: 85-07-R0057
TI: Isolation of lysosomes from eel muscle (Anguilla spec.).
AU: Rehbein-H
AD: Fed. Res. Cent. of Fisheries, Inst. of Biochem. & Tech., Palmaille 9, D-2000 Hamburg 50, Federal Republic of Germany
PY: 1984
SO: Journal-of-Food-Biochemistry; 8 (2) 79-89, 26 ref.
LA: En (English)
SC: R Fish-and-marine-products
AB: Activities of 2 acid glycosidases were determined in the white muscle of eel (round fish). The distribution pattern of these enzymes in the fractions obtained by differential centrifugating of homogenized muscle demonstrated that at least part of their activity originated from the lysosomes. Triton X-100, hypotonic solution and freezing/thawing were effective in releasing alpha-glucosidase from the lysosomes. Freezing and thawing of eel muscle (round fish) also resulted in the release of alpha-glucosidase activity.
DE: FISH-SPECIFIC; eel muscles, glucosidases activity in frozen-thawed;

UD: 8507

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Marked in Search: #1

AN: 85-11-R0077
TI: [Volatile components of fish roasted with seasoning.]
AU: Kasahara-K; Nishibori-K
AD: Notre Dame Seishin Univ., Okayama 700, Japan
PY: 1984
SO: Bulletin-of-the-Japanese-Society-of-Scientific-Fisheries-[Nihon-Suisan-Gakkai-shi]; 50 (7) 1241-1244, 2 ref.
LA: Ja (Japanese); Non-English
LS: en (English)
SC: R Fish-and-marine-products
AB: Headspace volatiles and dichloromethane extracts of volatiles prepared from sardine and eel roasted with and without seasoning and roasted seasoning were analysed by gas chromatography and MS. Numbers and amounts of hydrocarbons derived from meat were greater in volatiles from sardine than in those from eel. Organoleptic results showed that the volatile hydrocarbons were to some extent responsible for the peculiar odour of roasted sardine. Furfural, phenylacetaldehyde, ethyl alcohol, furfuryl alcohol and phenethyl alcohol were found in volatiles of sardines and eels roasted with seasoning, and of roasted seasoning itself; it is concluded that these aromatic substances are responsible for masking the specific odour of roasted fish. [From En summ.]
DE: VOLATILE-COMPOUNDS; fish, volatile aroma compounds of roasted; AROMA-COMPOUNDS; ROASTED-FOODS; CONDIMENTS-; fish, seasonings & volatile aroma compounds of roasted; FISH-SPECIFIC; sardines, seasonings & volatile aroma compounds of roasted; eels, seasonings & volatile aroma compounds of roasted; FISH-; volatile aroma compounds of roasted fish
UD: 8511

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Marked in Search: #1

AN: 84-02-R0068
TI: [Studies on histological changes in sea foods during processing and storage. II. Changes in muscular tissue of the eel, Anguilla japonica, in frozen storage.]
AU: Song-DJ; Lee-EH
AD: Dep. of Food Sci. Tech., Jeju Nat. Univ., Jeju, S. Korea
PY: 1982
SO: Bulletin-of-the-Korean-Fisheries-Society; 15 (3) 199-206, 16 ref.
LA: Ko (Korean); Non-English
LS: en (English)
SC: R Fish-and-marine-products
AB: Histological changes during frozen storage and subsequent thawing of eel, and changes in muscle fibres caused by heating and drying, were observed under the microscope. Muscle tissue developed mainly intracellular ice crystals at -40 degree C, but extracellular ice crystals at -20 degree C. No changes were observed in the subcutaneous fat after thawing regardless of storage temp., while insufficient recovery of muscle cells resulted. Muscle homogenate lacked transparency due to freezing, disfiguration and contraction by drying.
DE: HISTOLOGY-; eel muscles, histological changes in frozen stored; FROZEN-FOODS; eel muscles, thawing & fats changes in frozen stored; FISH-SPECIFIC; STORAGE-COLD; FATS-ANIMAL; THAWING-
UD: 8402

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AN: 84-02-R0067
TI: [Studies on histological changes in sea foods during processing and storage. I. Changes in muscular tissue and fat migration of eel, Anguilla japonica, during drying.]
AU: Song-DJ; Ha-JH; Lee-EH
AD: Dep. of Food Sci. Tech., Jeju Nat. Univ., Jeju, S. Korea
PY: 1982
SO: Bulletin-of-the-Korean-Fisheries-Society; 15 (2) 137-146, 20 ref.
LA: Ko (Korean); Non-English
LS: en (English)
SC: R Fish-and-marine-products
AB: Histological changes of eel muscular tissue during drying were studied under the microscope. Contraction of connective tissue occurred first during dehydration and was followed by the contraction of muscle fibre. Movement of fat during drying depended on the division and contraction of myocommata. When muscle tissue was heated, the connective tissue broke down, while muscle fibre dehydrated and solidified.
DE: DRYING-; eel muscles, drying & histological changes in; HISTOLOGY-; FISH-SPECIFIC; FATS-ANIMAL; eel muscles, drying & fats migration in
UD: 8402

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Marked in Search: #1

AN: 83-09-U1014
TI: Frozen roasted eel.
CA: Taiwan, National Bureau of Standards
PY: 1980
SO: Chinese-National-Standard; CNS N5121, 1 & 1p.
LA: En (English); Ch (Chinese)
SC: U Standards-laws-and-regulations
DE: FISH-SPECIFIC; eels, requirements for Taiwan frozen roasted, Standards, Title, Asia; FROZEN-FOODS; ROASTED-FOODS; ASIA-; eels, requirements for Taiwan frozen roasted, Standards, Title; STANDARDS-; eels, requirements for Taiwan frozen roasted, Title, Asia
UD: 8309

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Marked in Search: #1

AN: 82-07-R0432
TI: [Study of freezing of marinated or precooked dishes based on mullet or eel.]
AU: Crivelli-G; Senesi-E; Maestrelli-A; Bertolo-G
AD: IVTPA, 20133 Milan, Italy
PY: 1979
SO: Annali-dell'Istituto-Sperimentale-per-la-Valorizzazione-Tecnologica-dei-Prodotti-Agricoli; 10, 37-42, 5 ref.
LA: It (Italian); Non-English
LS: en (English)
SC: R Fish-and-marine-products
AB: (i) mullets stored at -30 degree C for 5-7 months were defrosted in running water at 15 degree C and fillets were roasted in an IR oven; (ii) eels similarly stored for 10 months and defrosted were skinned and ashed whole, and then filleted or sliced. Each of the 2 fish preparations placed in PVC bags was divided into 2 batches, 1 batch of each being covered in the bags with 5% brine with 2% acetic acid and aroma infusion of marjoram, sage and black pepper, while the 2nd batch was covered like the 1st, the aroma infusion being replaced by a Rebaund-Metroz synthetic preparation; finely comminuted garlic and parsley were then added to all bags, which were allowed to ripen at 4 degree C for 7 days for (i) and 4 days for (ii),

months. For the precooking treatment, (i) and skinned (ii) were sliced and made into fish broth or fish stew in juices of different formulation, and (i) fillets were roasted in an IR oven, placed in baggs and covered with juice. Bags with fish broth, stew or fillets were frozen at -18 degree C and stored at -30 degree C for 6 months. Appearance, taste and consistency of all variants were assessed by a panel after storage for 3 and 6 months. Total scores on 5-point scales are tabulated. It is concluded that all variants retained their high quality for less than6 months frozen storage.
DE: FREEZING-; mullet dishes, freezing of marinated; eel dishes, freezing of marinated; eel dishes, freezing of precooked; mullet dishes, freezing of precooked; ORGANOLEPTIC-PROPERTIES; mullet dishes, organoleptic properties of stored frozen; FROZEN-FOODS; eel dishes, organoleptic properties of stored frozen; FISH-SPECIFIC
UD: 8207

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Marked in Search: #1

AN: 82-05-R0324
TI: [Study of new smoked eel products.]
AU: Senesi-E; Torreggiani-D; Bertolo-G; Caserio-G
AD: Istituto Sperimentale per la Valorizzazione Tecnologica dei Prodotti Agric., Milan, Italy
PY: 1981
SO: Industrie-Alimentari; 20 (2) 107-111, 10 ref.
LA: It (Italian); Non-English
LS: en (English)
SC: R Fish-and-marine-products
AB: A study of techniques applicable to eels for (i) processing or (ii) canning was undertaken. Cleaned and gutted fish were immersed in 20% NaCl solution for 1 h, drained, spitted, ''broken'' in boiling water, then hung for smoking either (i) for 4 h at 85-95 degree C, the inner temp. of the fish reaching 70 degree C, then skinned and sliced, encased in fish gelatin and packaged in plastics packs, and stored at 0-4 degree C, or (ii) for 3 h at up to 65 degree C and 1 h at up to 85 degree C, then canned (in lacquered Al containers) in fish gelatin, sterilized at 102 degree C for 30 min, and stored at ambient temp. or at 4 degree C. Both (i) and (ii) were examined bacteriologically and sensorily at intervals. For (i) storage time was 30 days, after which total bacterial load exceeded that permissible, although the product was still sensorily acceptable. For (ii), sensory quality was maintained for 5 months even at ambient temp. and for up to 12 months at 4 degree C. Sterilization temp. of 102 degree C was not sufficiently high to guarantee biological sterility, but the product may be considered as semi-preserved. After the quoted storage times had elapsed, consistency deteriorated and the gelatin liquefied. Use of fish gelatin is, however, advocated as it compares favourably with oil as regards cost.
DE: KEEPING-QUALITY; eels, keeping quality of plastics films packaged; eels, keeping quality of canned; FISH-SPECIFIC; PLASTICS-FILMS; PACKAGING-; CANNED-FOODS
UD: 8205

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Marked in Search: #1

AN: 82-03-U0202
TI: [Frozen roasted eel.]
CA: Taiwan, National Bureau of Standards
PY: 1980
SO: Chinese-National-Standard; CNS N5121, 1p.
LA: Ch (Chinese); Non-English
SC: U Standards-laws-and-regulations

Title, Asia; ROASTED-FOODS; FROZEN-FOODS; ASIA-; eels, requirements for Taiwan frozen roasted, Standards, Title; STANDARDS-; eels, requirements for Taiwan frozen roasted, Title, Asia
UD: 8203

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Marked in Search: #1

AN: 81-09-R0608
TI: [A new method for preservation of semi-dried fish and baked eel, ''Shirayaki''.]
AU: Uchiyama-H; Ehira-S; Kakuda-K; Uchiyama-T; Nakamura-H; Uchida-Y
PY: 1980
SO: Bulletin-of-the-Tokai-Regional-Fisheries-Research-Laboratory-[Tokai-ku-Suisan-Kenkyusho-Kenkyu-Hokoku]; No. 102, 31-49, 14 ref.
LA: Ja (Japanese); Non-English
LS: en (English)
SC: R Fish-and-marine-products
AB: A procedure for preservation of semi-dried fish and baked eel by packaging in low-O2-permeability plastics film bags with an O2 absorber (based on activated Fe powder) and storage at -3 degree to +3 degree C is described. Trials were conducted on experimentally prepared semi-dried flying fish (Cypselurus pinnatibarbatus japonicus), commercial samples of semi-dried fish of various spp., and commercially-prepared baked eel (Anguilla japonica). Quality characteristics considered include bacterial count, total volatile basic N, trimethylamine N, ATP and related compounds, actomyosin denaturation ratio, peroxide value, TBA value and organoleptic properties. Tables of results are given, and discussed in detail. Results for flying fish showed that the viable bacterial count decreased by a factor of 100 during storage at -3 degree C for 40 days, reaching a final level of 10-2/g. No increase in concn. of total volatile basic N or trimethylamine N was observed. K value (calculated on the basis of concn. of nucleotides and their degradation products) and actomyosin denaturation ratio increased gradually during storage. Samples stored for 1-2 months at -3 degree C under the deoxygenized atm showed no significant deterioration. Similarly, the commercially semi-dried fish products showed excellent quality retention during storage for 1 month at -3 degree C; and the baked eel showed no sign of spoilage or rancidity during storage for 6 months at -3 degree C. [From En summ.]
DE: FISH-SPECIFIC; flying fish, keeping quality of cold stored plastics bagged semi-dried; eels, keeping quality of cold stored plastics bagged baked; KEEPING-QUALITY; STORAGE-COLD; PLASTICS-FILMS; BAGS-
UD: 8109

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Marked in Search: #1

AN: 81-03-R0146
TI: Frozen roasted eel processing industry in Taiwan. (In 'Fishery products of Taiwan'.)
AU: Chen-HC
AD: Dep. of Fishery Tech., Taiwan Provincial Kaohsiung Junior Coll. of Marine Tech., Kaohsiung, Taiwan
PY: 1977
SO: pp. 21-26, 4 ref.
DT: Book
LA: En (English)
SC: R Fish-and-marine-products
AB: After briefly mentioning ways of cooking eels in Taiwan, the conventional method of processing and roasting eels for export is described and illustrated. 2 modifications to the conventional method are described:

(for 5, 10 or 15 s), and (ii) soaking for 3 s in 10% NaCl solution (pH 3.5 or 9.5) before roasting. With (i), combined heating for 2 min over flame following 15 s in microwaves inactivates coliform bacteria and effects about a 4 log cycle reduction in viability of total microorganisms, with a product wt. loss of 24.35%. This treatment has almost the same effect on wt. loss and microbial counts as heating for 5 min by flame alone; however the former creates a desirable appearance. With (ii), soaking in 10% NaCl (pH 3.5) for 3 s reduces wt. loss of products by at least 0.35% compared with the conventional method, and the decrease in microbial counts is significant after freezing; this modification is applicable in industry. Selection of disinfectants and sanitation practice in a frozen roasted eel processing factory is also discussed. [See preceding abstr.].
DE: COOKING-; eels, cooking of; ROASTING-; eels, roasting of export; HYGIENE-; eel factories, hygiene in frozen roasted; FROZEN-FOODS; FISH-SPECIFIC
UD: 8103

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Marked in Search: #1

AN: 81-03-R0145
TI: Fishery products of Taiwan.
AU: Chuang-JL; Pan-BS; Chen-GC [Editors]
AIA: Chang-WT; Chen-HC; Jeng-SS; Chen-CS; Chen-WH; Huang-DF
PB: Taipei,-Taiwan;-Joint-Commission-on-Rural-Reconstruction.
PY: 1977
SO: 91pp., many ref.
DT: Book
LA: En (English)
SC: R Fish-and-marine-products
AB: This paperback book, JCRR Fisheries Series 25B, contains 9 chapters under the following 5 section headings: Introduction (pp. 1-9); Well-established products (pp. 11-35); Traditional products (pp. 37-54); Algae utilization (pp. 55-74); and Research and extension (pp. 76-91). Individual chapters are: Fisheries development in Taiwan, by W. T. Chang & J. L. Chuang (pp. 2-9, 6 ref.). Frozen fishery product industry in Taiwan, by J. L. Chuang (pp. 13-19, 3 ref.). Frozen roasted eel processing industry in Taiwan, by H. C. Chen (pp. 21-26, 4 ref.). Canned seafood industry in Taiwan, by J. L. Chuang (pp. 27-35, 7 ref.). Minced fish products, by S. S. Jeng (pp. 39-42). Low-moisture fishery products, by B. S. Pan (pp. 43-54, 20 ref.). Agar-agar manufacturing, by G. C. Chen (pp. 56-67). Chlorella industry in Taiwan, by C. S. Chen (pp. 68-74, 2 ref.). Fishery technology research and extension work in Taiwan, by J. L. Chuang (pp. 76-86, 31 ref.). Appendix I deals with Fish and fishery products inspection in Taiwan, by W. H. Chen (pp. 87-88). Appendix II deals with Complete utilization of shark in Taiwan, by D. F. Huang & J. L. Chuang (pp. 89-91), which lists 25 species of sharks widely utilized, and gives uses. 5 of the chapters are abstracted separately [see following 5 abstr.].
DE: FISH-PRODUCTS; fish products industry, aspects of Taiwan, Book; INDUSTRIES-; BOOKS-; fish products industry, aspects of Taiwan
UD: 8103

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Marked in Search: #1

AN: 80-12-R0661
TI: Theory and practice of eel culture.
AU: Matsui-I
PB: Rotterdam,-Netherlands;-A.-A.-Balkema-Price-F30.00;-ae15.00;-£7.00.
PY: 1980
SO: Ed. 2, vi + 132pp. ISBN 90-6191-036-6, 5 ref.

DT: Book
LA: En (English)
SC: R Fish-and-marine-products
AB: This revised edition of the book, originally published in 1964, is No. 4 in the Aquaculture Series. It includes recent information from different regions and the latest progress in eel culture. It discusses the history of eel culture, distribution of eels in general, morphology of the Japanese eel, capture of elvers, entry into estuaries and rivers, methods of their capture and maintenance in rearing pounds. It includes information on the technical aspects as well as on improving the production of eels. The book also includes information on packing and transportation of elvers and marketable eels.
DE: FISH-SPECIFIC; eels, culture of, Book; BOOKS-; eels, culture of
UD: 8012

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Marked in Search: #1

AN: 79-12-R0734
TI: [Data on the fat content of eel.]
AU: Amin-EM
PY: 1979
SO: Rybnoe-Khozyaistvo; No. 1, 59-60
LA: Ru (Russian); Non-English
SC: R Fish-and-marine-products
AB: The rate of fat accumulation by the eel (originating from the Nile delta) was studied in relation to changes in eel fatness according to age and season of the yr. Intense fat accumulation occurred in eel 4-6 yr old, with average fat content increasing x 1.3/yr. In following yr the fat increase was slower. The highest fat content was attained by eel 9-11 yr old, in some individuals reaching 40%. The highest fat content in eel tissue was found during the period (Feb. to Oct.) of migration to the sea.
DE: FATS-ANIMAL; eels, fats accumulation in; FISH-SPECIFIC
UD: 7912

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Marked in Search: #1

AN: 79-11-R0695
TI: [Eels in human nutrition.]
AU: Gianninoto-SI; Perillo-G
AD: ITIS G. Galilei, Latina, Italy
PY: 1979
SO: Industrie-Alimentari; 18 (1) 39-42, 10 ref.
LA: It (Italian); Non-English
SC: R Fish-and-marine-products
AB: Aspects discussed include: life cycle of eels; eel farming; nutritional value; and preservation (by freezing, smoking or marinating). A table is given showing data for yield and composition of edible parts of marine eels (Anguilla vulgaris), freshwater eels (A. fluviatilis) and 'Capitone' var. eels. Values are, resp.: edible yield, 70.7, 69.7 and 65.0%; protein 15.90, 13.01 and 13.00%; lipid 19.32, 23.72 and 21.50%; carbohydrate 0.67, 0.60 and 0.50%; moisture 62.16, 59.20 and 62.00%; and ash 1.24%, 1.03% and not given.
DE: FISH-SPECIFIC; eels, aspects of
UD: 7911

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Marked in Search: #1

AN: 79-01-R0052
TI: Eels and their utilization.

AD: Gloucester Lab., Northeast Fisheries Cent., NOAA, Emerson Avenue, Gloucester, Massachusetts 01930, USA
PY: 1978
SO: Marine-Fisheries-Review,-National-Oceanic-and-Atmospheric-Administration; 40 (4) 1-20, 47 ref.
DT: Review
LA: En (English)
SC: R Fish-and-marine-products
AB: Characteristics of the genus Anguilla, the common eel, are reviewed, including its description, life cycle, fisheries, methods of catching, storage and transport of elvers, yellow and silver eels, processing (frozen live eels, killing and cleaning), preparation (fresh or frozen eels, smoked eels, jellied eels, proximate composition), markets, and eel culture throughout the world.
DE: FISH-SPECIFIC; eels, use of, Review; REVIEWS-; eels, use of
UD: 7901

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Marked in Search: #1

AN: 79-01-R0034
TI: Effect of pH and sodium chloride on heat resistance of microorganisms in eel bouillon and eel fillet.
AU: Chen-HC; Lin-HH; Wu-CY; Chung-CY
AD: Dep. Fishery Tech., Kaohsiung Junior Coll. of Marine Tech., Chi Chin, Kaohsiung, Taiwan
PY: 1977
SO: Bulletin-of-the-Japanese-Society-of-Scientific-Fisheries-[Nihon-Suisan-Gakkai-shi]; 43 (4) 443-447, 7 ref.
LA: En (English)
SC: R Fish-and-marine-products
AB: The thermal resistance of Escherichia coli Type I in eel bouillon with varied pH (3.5-9.5) and NaCl concn. (0-20%) was studied first, and the effect of NaCl concn., baking and freezing on the wt. loss and survival of microorganisms in eel fillets was later studied in a frozen baked eel (sirayaki) processing factory. Thermal resistance of E. coli decreased at extremes of pH and with increasing NaCl concn., though gradually at concn. greater than 10%. The combined effect of extreme pH and 10% NaCl lowered D values by greater than0.96 log cycles for temp. between 55 degree and 65 degree C, relative to a pH 7 salt-free control. Frozen baked eel pretreated in 10% saline solution for 3 s showed a reduced wt. loss but no significant reduction in microbial count. However, after freezing there was a significant (P less than 0.01) decrease in microbial numbers in saline-soaked fillets.
DE: MICROORGANISMS-; eel bouillon, microorganisms thermal resistance in; HEATING-; FISH-SPECIFIC; SOUPS-; eel fillets, microorganisms thermal resistance in; ESCHERICHIA-; eel bouillon, Escherichia coli thermal resistance in; FROZEN-FOODS; eel, microbial counts of frozen baked
UD: 7901

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Marked in Search: #1

AN: 78-10-R0534
TI: Taste of the Orient.
AU: Anon
PY: 1978
SO: Fishing-News-International; 17 (6) 62-63
LA: En (English)
SC: R Fish-and-marine-products
AB: Some exotic fish recipes from the East, particularly Taiwan, are

surrounding a stuffing of minced pork, dried mushroom and other seasoning. Roasted eel are prepared from 4 in long fillets, flattened by stretching on bamboo sticks, roasted in an open flame oven then in a second oven; they are frozen for export. The production of minced fish to be made into fish balls, fish bits, etc. is described.
DE: FISH-PRODUCTS; fish products, recipes for exotic; fish dumplings, recipes for; FISH-SPECIFIC; eels, recipes for roasted; ROASTED-FOODS; BAKERY-PRODUCTS
UD: 7810

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Marked in Search: #1

AN: 77-09-R0465
TI: Eel capture, culture, processing and marketing.
AU: Forrest-DM
PB: Farnham,-Surrey,-UK;-Fishing-News(Books)-Ltd.-Price-£7.25.
PY: 1976
SO: 205pp. ISBN 0-85238-070-4, many ref.
NU: ISBN: 0-85238-070-4
DT: Book
LA: En (English)
SC: R Fish-and-marine-products
AB: This book includes a chapter on eel processing (pp. 153-171) covering killing, cleaning, gutting, freezing, glazing, cold storage, brining, smoking, jellying, canning, and manufacture of kabayaki (eel slices dipped in soya sauce and a chapter on eel marketing in various countries (pp. 173-191).
DE: FISH-(SPECIFIC); eels, processing of, Book; BOOKS-; eels, processing of
UD: 7709

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Marked in Search: #1

AN: 77-07-R0340
TI: Tasmanian fish products undergo taste tests.
AU: Anon
PY: 1976
SO: Australian-Fisheries; 35 (12) 23
LA: En (English)
SC: R Fish-and-marine-products
AB: Results of taste tests conducted by CSIRO's Tasmanian Food Research Unit on the acceptability of locally-produced smoked eel, fish sausages and fish fingers are briefly reported. Fish fingers made from morwong (Nemadactylus macropterus) or redfish (Centroberyx affinis) were liked 'very much' by 23% and 30% respectively and liked at least 'slightly' by the majority of tasters. Smoked eel was rated 'very acceptable' by 44% and 'acceptable' by 53%. Spiced highly-smoked fish sausages prepared from ocean perch (Helicolenus papillosus) were reported to be delicious in small pieces as a cocktail snack, but comparison with meat sausage is unrealistic and categorized responses were variable.
DE: FISH-(SPECIFIC); eels, taste tests for smoked; FISH-PRODUCTS; fish fingers, taste tests for; fish sausages, taste tests for; ORGANOLEPTIC-EVALUATION; fish products, taste tests for; SAUSAGES-; TASTE-
UD: 7707

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Marked in Search: #1

AN: 77-05-R0262
TI: [Storage of frozen mullet and eel in plastics bags. II. Tests with inert and vacuum packaging.]

AD: Istituto Sperimentale per la Valorizzazione Tecnologica dei Prodotti Agric., Milan, Italy
PY: 1975
SO: Annali-dell'Istituto-Sperimentale-per-la-Valorizzazione-Tecnologica-dei-Prodotti-Agricoli; 6, 29-38, 16 ref.
LA: It (Italian); Non-English
LS: en (English)
SC: R Fish-and-marine-products
AB: See FSTA (1976) 8 2R102.
DE: STORAGE-(COLD); mullet, storage quality of frozen vacuum packaged; FISH-(SPECIFIC); PACKAGING-; VACUUM-; FROZEN-FOODS
UD: 7705

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Marked in Search: #1

AN: 77-01-R0043
TI: Effect of microwave and open flame heating on the microbial counts and weight loss of eel.
AU: Chen-HC; Wu-CY; Lin-HH; Chung-CY
AD: Dep. of Fishery Tech., Kaohsiung Junior Coll. of Marine Tech., Chi Chin, Kaohsiung, Taiwan
PY: 1976
SO: Bulletin-of-the-Japanese-Society-of-Scientific-Fisheries-[Nihon-Suisan-Gakkai-shi]; 42 (4) 405-410, 5 ref.
LA: En (English)
SC: R Fish-and-marine-products
AB: The decimal reduction time and the thermal death time of E. coli Type I in eel bouillion were studied, and the effects of microwave and open flame heating on microbial inactivation and wt. loss of eel fillet were compared. The thermal death time regression curve of E. coli in eel bouillion was found to have a Z value = 5.1 degree C. The values read from this curve were accurate with greater than90% confidence. The lethal effect on microorganisms in eel fillets treated by open flame was higher than that of microwaves at 2450 MHz if the results were evaluated on an equal wt. loss basis. The wt. loss of flame-heated fillet was 0.43% for every degree (degree C) increase in temp. within the range from 50 degree C to 80 degree C, and for microwave-heated fillet was 0.44% between 42 degree C and 87 degree C. The combination of heating for 2 min over flame followed by 15 s in microwaves had almost the same effect in wt. loss and microbial counts as that heated for 5 min by flame alone.
DE: HEATING-; eels, wt. loss from heated; MICROWAVES-; eels, wt. loss from microwaves heated; FISH-(SPECIFIC); eels, microbial counts of heated; eels, microbial counts of microwaves heated; WEIGHT-; MICROORGANISMS-
UD: 7701

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Marked in Search: #1

AN: 77-01-R0006
TI: [Food poisoning caused by smoked eel.] Lebensmittelvergiftung durch Raeucheraale.
AU: Harms-F; Kruse-KP
AD: Staatliches Veterinaeruntersuchungsamt, Hanover, Federal Republic of Germany
PY: 1976
SO: Archiv-fuer-Lebensmittelhygiene; 27 (3) 88-91, 18 ref.
LA: De (German); Non-English
SC: R Fish-and-marine-products
AB: An outbreak of food poisoning occurred in Hanover (Federal Republic of Germany) and vicinity at the beginning of Sept. 1974. It involved 81 people

Hamburg. Cases of food poisoning were reported at the same time from other Federal German localities served by the same factory. Examination of the patients, suspected eels, and the factory revealed Salmonella typhimurium lysotype 1 as the causative agent. The unusually high total bacterial count, with great numbers of enterococci and Enterobacteriaceae, in the suspected eels is discussed and forensically evaluated.
DE: POISONING-; eels, poisoning from smoked; FISH-(SPECIFIC); SALMONELLA-; eels, Salmonella typhimurium in smoked
UD: 7701

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Marked in Search: #1

AN: 76-02-R0102
TI: [Storage of frozen mullet and eel in plastics bags. II. Tests with inert gas and vacuum packaging.]
AU: Polesello-A; Pizzocaro-F
AD: Instituto Sperimentale per la Valorizzazione Tech. dei Prodotti Agric., Milan, Italy
PY: 1975
SO: Freddo-; 29 (3) 3-6, 40, 16 ref.
LA: It (Italian); Non-English
LS: en (English)
SC: R Fish-and-marine-products
AB: Freshly-caught mullet (Mugil cephalus) were frozen in forced air at -35 degree C, packaged in transparent (nylon/polyethylene) or opaque (nylon/Al/polyethylene) bags, sealed under (i) vacuum, (ii) N2 or (iii) N2O, and stored for 10 months at -30 degree C. Samples were analysed after 0, 3, 6 and 10 months. Although storage in (iii) resulted in discoloration and flaccid flesh, all samples stored for less than6 months were acceptable after cooking. Volatile acidity increased during storage in all 3 atm. studied. The freshness index (hypoxanthine number), benzidine number and free fatty acid concn. increased especially markedly in samples packaged in (iii); peroxide value increased most markedly in samples packaged in (i) and (ii). None of the chemical indices studied exceeded the limits of acceptability. Storage for less than6 months at -30 degree C in evacuated transparent bags is recommended. [See FSTA (1975) 7 3R157 for part I.]
DE: BAGS-; mullet, keeping quality of plastics bags packaged frozen; KEEPING-QUALITY; PLASTICS-(FILMS); FISH-(SPECIFIC); FROZEN-FOODS; PACKAGING-
UD: 7602

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Marked in Search: #1

AN: 76-02-R0094
TI: [Flavour volatiles of roasted fish meat.]
AU: Kasahara-K; Nishibori-K
AD: Notre Dame Seishin Univ., Okayama, Japan
PY: 1975
SO: Bulletin-of-the-Japanese-Society-of-Scientific-Fisheries-[Nihon-Suisan-Gakkai-shi]; 41 (1) 43-49, 1 ref.
LA: Ja (Japanese); Non-English
LS: en (English)
SC: R Fish-and-marine-products
AB: The meat of 4 kinds of fish, (eel, conger eel, yellowtail and horse mackerel) was roasted with seasoning composed of soy sauce and sugar, and the flavour volatiles formed were analysed by gas chromatography. The head space vapour (HSV) gas chromatograms obtained were similar to each other. Of the 5 peaks found in the HSV of eel meat roasted with seasoning the largest one was identified as ethanol and 3 small peaks as carbonyls. Only

These results indicate that soy sauce and sugar are essential in formation of the aroma of roasted fish meat.
DE: ROASTED-FOODS; fish meat, volatile flavour compounds detn. in roasted; eel meat, volatile flavour compounds detn. in roasted; VOLATILE-COMPOUNDS; FISH-(SPECIFIC); FISH-(COMPOSITION); volatile flavour compounds detn. in roasted fish meat; FLAVOUR-COMPOUNDS
UD: 7602

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Marked in Search: #1

AN: 75-03-R0157
TI: [Preservation of frozen mullet and eel in plastics packs. I. Preliminary studies with inert gas and under vacuum.]
AU: Polesello-A; Nani-R
AD: Istituto Sperimentale per la Valorizzazione Technologica dei Prodotti Agricoli, Milan, Italy
PY: 1973, publ. 1974
SO: Industrie-Agrarie; 11 (6/7/8) 256-262, 36 ref.
LA: It (Italian); Non-English
LS: en (English)
SC: R Fish-and-marine-products
AB: 2 spp. of mullet (Mugil cephalus and Mugil chelo) and 1 of eel (Anguilla anguilla) were packaged in 2 types of nylon/Saran/polyethylene bags under vacuum, in an N2 atm., in an N2O atm. or in air (control). The packs were frozen at -35 degree C, and held for 6 months at -20 degree or -30 degree C. The fish were analysed for contents of volatile acids and bases, peroxide and benzidine values, free fatty acids (as oleic) and organoleptically. On the basis of the results, given in tabular form, it was shown that the lower temp. (-30 degree C) was essential to maintain a satisfactory quality, and that N2O was effective only where a very tight seal was achieved on the bags. There was a surprising variance between organoleptic and analytical findings.
DE: FISH-(SPECIFIC); eels, plastics packs preservation of frozen; mullet, plastics packs preservation of frozen; FROZEN-FOODS; fish, plastics packs preservation of frozen; PACKAGING-; fish, vacuum packaging of frozen; PACKS-; PLASTICS-; VACUUM-; GASES-; fish, inert gases packaging of frozen; PRESERVATION-
UD: 7503

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Marked in Search: #1

AN: 75-06-R0287
TI: [Preservation of frozen mullet and eel in plastics packs. I. Preliminary studies with inert gas and under vacuum.]
AU: Polesello-A; Nani-R
PY: 1973
SO: Annali-dell'Istituto-Sperimentale-per-la-Valorizzazione-Tecnologica-dei-Prodotti-Agricoli-; 4, 41-53, 36 ref.
LA: It (Italian); Non-English
LS: en (English)
SC: R Fish-and-marine-products
AB: See FSTA (1975) 7 3R157.
DE: FISH-; quality of stored frozen plastics packaged fish; FISH-(SPECIFIC); eels, quality of stored frozen plastics packaged; mullet, quality of stored frozen plastics packaged; FROZEN-FOODS; fish, quality of stored frozen plastics packaged; PACKAGING-; PLASTICS-; STORAGE-(COLD)
UD: 7506

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AN: 74-04-R0236
TI: Studies on smoking of eel fillets.
AU: Solanki-KK; Kandoran-MK; Venkataraman-R
AD: Central Inst. of Fisheries Tech., Sub-station, Veraval, Gujarat State, India
PY: 1970
SO: Fishery-Technology; 7 (2) 169-176, 12 ref.
LA: En (English)
SC: R Fish-and-marine-products
AB: Studies were made of a method for preparing smoked eel fillets. Medium-size fresh eels (2.5-5 kg each and 120-150 cm long) were cleaned with water, bladder and guts were removed and fillets (skin-on) of various sizes (16 x 2, 16 x 2.5, 16 x 3, 18 x 4, 20 x 5 cm) were obtained. Effects of the following factors on product quality were then studied: fillet size; dry salting; brine concn. (5, 10, 15 and 20% for 30 min); brining time (15, 30 and 45 min and 1, 1, 2 and 3 h in 20% brine); pre-drying period (sun-drying for 15, 30 and 45 min and 1 and 2 h); source of smoke (teak, 'sajad', acacia and mango wood saw dusts, teak wood chips, coconut husk and coconut husk · teak saw dust); smoking period (up to 20 h); final drying period (up to about 7 H); moisture (21.3 to 57.8%) and salt (8.23 to 14.52%) contents of final product. Results are presented in graphs and tables and discussed in detail. From the results the following conditions are suggested for producing a top quality product: fillet size 16 x 3 and 16 x 2.5 cm and 2.5 cm thick, salting by dipping in 20% brine for 30 min; pre-drying in the sun for 30-45 min; equal proportions of coconut husk and teak saw dust (wt. basis) as smoke source; smoking for 15 h; final drying period of 5 h; final moisture content 30-35%; final salt content about 13%. A product manufactured according to these recommendations had a shelf-life of about 8 months at room temp. when packaged in polyethylene bags. The smoked fillets had an attractive reddish colour, pleasant odour and a palatable flavour. Compositional data are presented.
DE: FISH-(SPECIFIC); eel fillets, preparation of smoked; PRESERVATION-; eel fillets, /salting/ of; DRYING-; eel fillets, /drying/ of; SMOKING-; eel fillets, /smoking/ of; MOISTURE-CONTENT; eel fillets, smoked; KEEPING-QUALITY; COLOUR-; SMELL-; FLAVOUR-; PACKAGING-; eel fillets, packaging in polyethylene bags; POLYETHYLENE-; BAGS-
UD: 7404

39 of 41
Marked in Search: #1

AN: 72-08-R0347
TI: [Eel slaughtering machine: simple and purposeful construction.] Die Aal-Schlachtmaschine: Einfach und zweckdienlich konstruiert.
AU: Anon
PY: 1972
SO: Allgemeine-Fischwirtschaftszeitung; 24 (8) 10
LA: De (German); Non-English
SC: R Fish-and-marine-products
DE: FISH-(PROCESSING); Eel slaughtering machine; SLAUGHTER-
UD: 7208

40 of 41
Marked in Search: #1

AN: 70-09-R0314
TI: Freshwater eel fishermen develop export trade.
AU: Pownall-PC [Editor]
AD: Fisheries Branch, Dept. Primary Ind., Canberra, A.C.T. 2600, Australia
PY: 1970
SO: Australian-Fisheries-Newsletter; 29 (3) 20-24

SC: R Fish-and-marine-products
AB: Eel catch in Victoria was 288 000 lb in 1968-69, and 35 000 lb in Tasmania. Life history of the eel is briefly reviewed. Killing of eels by placing in salt for 2 h or by putting them in a tank of fresh water and passing an electric current through it is followed by slime removal in cold water or a 1% ammonia solution. After gutting and washing, the eels may be frozen and stored at -20 degree F, soaked in brine for 10 min and smoked for 1 h at 95 degree F, h at 120 degree F and 1 h at 170 degree F, jellied by boiling small pieces and adding gelatine solution to the liquid, or smoked or jellied before canning. The short-finned eel is more popular for European markets than the long-finned eel.
DE: EXPORTS-; Exports of eels by Australia; EELS-; AUSTRALIA-; CLEANING-; /Cleaning/ of eels; FREEZING-; /freezing/ of eels; STORAGE-; /storage/ of eels; SMOKING-; /smoking/ of eels; JELLY-; /jellying/ of eels; CANNING-; /canning/ of eels
UD: 7009

41 of 41
Marked in Search: #1

AN: 69-05-R0133
TI: Australian factory thrives on freshwater eels.
AU: Anon
PY: 1969
SO: Fishing-News-International; 8 (2) 49
LA: En (English)
SC: R Fish-and-marine-products
AB: The processing of eels netted from the lakes and rivers of western Victoria is described. 80% of the export eels are frozen live after being kept in tanks for a wk to clear food from their stomachs and remove the mud taste. The remainder are de-slimed in salt solution, gutted, pickled and smoked using oakwood. Processing of jellied eels is also being considered.
DE: EELS-; Eel processing in Australia; AUSTRALIA-
UD: 6905

No. Records Request
1: 169 EELS

1 of 5
Marked in Search: #1

AN: 90-03-V0108
TI: Process for preparing sterilized packaged fish and product thereof.
AU: Sugisawa-K; Matsumura-Y; Okamoto-H; Abe-K
PY: 1989
SO: United-States-Patent
PN: US 4 840 805 (US4840805)
PC: US
PA: House Food Industrial Co. Ltd.
PPR: JP 86-87697 (860416) [House Food Ind., Higashiosaka, Japan]
PPD: 860416
PPA: House Food Ind., Higashiosaka, Japan
DT: Patent
LA: En (English)
SC: V Patent-literature
AB: Fish, e.g. sardine, mackerel, eels etc., are dried to 35-82 wt.% moisture content, broiled, packaged (preferably vacuum packaged in PVDC-coated polyethylene terephthalate/crystalline polypropylene), and then heat sterilized.
DE: VACUUM-; fish, manufacture of sterilized vacuum packaged, Patent; PACKAGING-; FISH-; manufacture of sterilized vacuum packaged fish, Patent
UD: 9003

2 of 5
Marked in Search: #1

AN: 85-04-F0033
TI: Flexible packaging systems for processed fish.
AU: Rao-CVN
AD: Processing & Packaging Div., Cent. Inst. of Fisheries Tech., Cochin-682 029, India
PY: 1984
SO: Seafood-Export-Journal; 16 (3) 27-30
LA: En (English)
SC: F Packaging
AB: Retort pouches have been found suitable for packaging fish-based entrees, such as broiled eels, sardines, scallops, mackerel with beans, tuna in oil, fried prawns, boiled salmon, prawns, and crab. Flexible packages made from laminates may prove to be good alternatives to glass bottles for the packaging of fish pickles.
DE: PACKS-; fish entrees, retort pouches for; MEALS-; FISH-PRODUCTS; fish pickles, retort pouches for; PICKLES-
UD: 8504

3 of 5
Marked in Search: #1

AN: 84-04-G0299
TI: [Some observations on major frozen foods exported from Taiwan to Japan.]
AU: Kato-S
AD: IIR Executive Committee, Japanese Association of Refrigeration, Tokyo, Japan
PY: 1983
SO: Refrigeration-[Reito]; 58 (664) 143-158, 6 ref.
LA: Ja (Japanese); Non-English

AB: Processing methods for frozen eels are described, and Taiwan export standards for eels are surveyed. Reference is also made to manufacturing aspects of frozen agricultural products and meats.
DE: FROZEN-FOODS; eels, processing of frozen; FISH-SPECIFIC; TRADE-; eels, export requirements for Taiwan; frozen foods, production of
UD: 8404

4 of 5
Marked in Search: #1

AN: 85-01-R0003
TI: Smoked fish.
AU: Anon
PY: 1984
SO: Frozen-&-Chilled-Foods; 37 (8) 14, 16, 18, 20-21
LA: En (English)
SC: R Fish-and-marine-products
AB: Developments by various manufacturers are looked at in this feature on smoked fish. Items mentioned include various kinds of smoked fish (mackerel, salmon, rainbow trout, eels, haddock fillets, kippers, etc.), mousses, marinades, smoked salmon pate, gravlax (a Scandinavian delicacy - salmon slices marinated in a mixture including salt and dill, and served with a mustard sauce which is included with the film packed product), peppered mackerel, smoked prawns, etc.
DE: PRODUCT-TECHNOLOGY; fish, developments for smoked; SMOKED-FOODS; FISH-; developments for smoked fish
UD: 8501

5 of 5
Marked in Search: #1

AN: 80-08-R0457
TI: [Quality and storage characteristics of hot-smoked fishery products. II. Storage dependent organoleptic changes in halibut, 'Buckling' herrings and eels.] Qualitaet und Lagerverhalten heiss geraeucherter Fischereiprodukte. II. Lagerungsabhaengige sensorische Qualitaetsveraenderungen von Heilbutt, Bueckling und Aal.
AU: Karnop-G
AD: Inst. fuer Biochem. & Tech., Bundesforschungsanstalt fuer Fischerei, Hamburg, Federal Republic of Germany
PY: 1980
SO: Deutsche-Lebensmittel-Rundschau; 76 (3) 75-81, 5 ref.
LA: De (German); Non-English
LS: en (English); fr (French)
SC: R Fish-and-marine-products
AB: Studies on changes in the organoleptic properties of freshly-smoked (i) Greenland halibut (29 samples), (ii) Buckling herrings (24 samples) and (iii) eels (12 samples) during storage in open or closed wooden boxes are described. Samples were stored at constant temp. of 6 degree , 12 degree or 20 degree C, or temp. fluctuating over this range, until spoilage occurred. Data are given for the shelf life of the fish, changes in overall organoleptic scores of the fish during storage, and the relation between sensory score and commercial acceptability. Storage life decreased with increasing storage temp. for all 3 spp. The shelf life of (iii) was considerably greater than that of (i) or (ii); that of (ii) tended to be greater than that of (i). Shelf-life tended to be slightly less in open than in closed boxes. Deterioration of (i) was most rapid at the site of the hole made by the spit on which the fish were smoked. Spoilage rate increased by a ratio of 1:2 over the temp. range 6-12 degree C for (i) and (ii), vs. a ratio of 2:3 for (iii). Implications of these results for storage, distribution and retailing of smoked fish are discussed. [See

DE: KEEPING-QUALITY; fish, keeping quality of boxes stored smoked; BOXES-; STORAGE-; SMOKED-FOODS; ORGANOLEPTIC-PROPERTIES; fish, organoleptic changes in boxes stored smoked; FISH-SPECIFIC; halibut, organoleptic changes in boxes stored smoked Greenland; eels, organoleptic changes in boxes stored smoked; HERRINGS-; organoleptic changes in boxes stored smoked Bueckling herrings
UD: 8008

APPENDIX 2

Foods Intelligence Abstracts

1993 Database

No. Records Request
1: 7 EELS

1 of 2
Marked in Search: #1

TI: A comparison of highly unsaturated fatty acid levels in wild and farmed eels (Anguilla anguilla).
AU: ABRAMI-G; NATIELLO-F; BRONZI-P; MCKENZIE-D; BOLIS-L; AGRADI-E
CS: Ist. Sci. Farmacol., via Balzaretti 9, Milano 20133, Italy
SO: COMPARATIVE BIOCHEMISTRY AND PHYSIOLOGY B COMPARATIVE BIOCHEMISTRY 101(1-2): 79-81
PY: 1992
LA: English
AB: Absolute and relative amounts of eicosapentaenoic acid (EPA) and docohexaenoic acid (DHA) in muscle of eels from four different fish farms were compared with samples from wild eels from two different areas of northern Italy. Farmed eels were richer in DHA and EPA than wild animals. The addition of cod liver oil to the diet of farmed eels led to a significant accumulation of EPA and DHA, but no change in total lipid content. The calculation of two indices related to highly unsaturated fatty acid (HUFA) content (FLQ = fish lipid quality; AI = atherogenic index), indicated the higher nutritional value of farmed vs wild fish. We conclude that farmed eels are an adequate source of fish products for human nutrition and propose use of the above-mentioned indices as an effective means for assessing fish nutritional quality for populations at high risk of chronic degenerative disease.
DE: EICOSAPENTAENOIC ACID; DOCOSAOHEXAENOIC ACID; MUSCLE; HUMAN NUTRITIONAL VALUE; LIPIDS, OILS & FATS (DC60300); NUTRITION (DC70100); MUSCLE (DC81000)
DT: Article
AN: 199202003760
UD: 9202

2 of 2
Marked in Search: #1

TI: Bacteria control in the process of frozen roasted eels.
AU: LIN-S-T
CS: Dep. Sea Product Processing, China Junior College Marine Technol., Taipei, Taiwan
SO: JOURNAL OF THE FISHERIES SOCIETY OF TAIWAN 18(3): 233-240
PY: 1991
LA: English
AB: To investigate the development of aerobic plate count and coliform during processing of roasted eel, sampling was aseptically performed at each process stage. All aquatic eels were found to be contaminated by coliform. This contaminated coliform was very difficult to kill using various bactericides and was considered to the the main cause of recontamination during processing. Data obtained in this study suggesting that both the aerobic plate count and coliform on the surface of roasted eels met the requirement for frozen prepared foods, when the central temperature of eel fillets was higher than 68.1 degree C during roasting process using a gas IR machine.
DE: ANGUILLA JAPONICA; AEROBIC PLATE COUNT; AVAILABLE CHLORINE; RECONTAMINATION; COLIFORM; FROZEN FOOD; FOOD PROCESSING; FISH; FISH & SHELLFISH PRODUCTS (DC10600); FOOD PREPARATION, PROCESSING & STORAGE (DC11500); FOOD MICROBIOLOGY (DC50100); DISINFECTANTS & DISINFECTION (DC50300); INFECTIOUS DISEASE (DC51100); BACTERIOLOGY (DC51200)
DT: Article
AN: 199201003855

No.	Records	Request
1:	3	EELS
2:	0	EEL-PROCESSING
3:	0	EEL-PRODUCTS
4:	660	RICE
5:	>16900	PROCESS*
6:	6	RICE PROCESS*

1 of 3
Marked in Search: #6

TI: A rice for all reasons.
AU: ANON
SO: FOOD PROCESSING (TONBRIDGE) Vol.62, No.9, September, P.35-36
PY: 1993
LA: English
AB: Suppliers and manufacturers are devoting increased attention to rice processing research and development. Companies such as Stevens & Brotherton and Riviana Foods derive much of their revenue from food processors using rice in new products and new processing methods.
DE: FOOD INDUSTRY; GRAIN PRODUCTS; RICE; FOOD PROCESSING; RESEARCH AND DEVELOPMENT; NEW PRODUCTS; PROCESSING METHODS; CEREALS & CEREAL CHEMISTRY (DC10300); FOOD PREPARATION, PROCESSING & STORAGE (DC11500)
NC: RIVIANA FOODS; STEVENS & BROTHERTON
DT: Article
AN: 199304009040
UD: 9304

2 of 3
Marked in Search: #6

TI: Creative importers beat ban on rice.
AU: AOKI-S
SO: NIKKEI WEEKLY Vol.31, No.1557, February 22, P.10
PY: 1993
LA: English
AB: Japanese food makers are boosting imports of rice-related products as the final stages of the Uruguay Round of GATT negotiations draw near. Continued pressure on Japan to lift its ban on rice will increase the imports of rice flour mixed with non-rice ingredients and processed rice products.
DE: FOOD PROCESSING INDUSTRY; GATT; URUGUAY ROUND; INTERNATIONAL TRADE; FOREIGN MARKETS; LIBERALIZATION; RICE MARKETS; IMPACT ANALYSIS; IMPORT; TRENDS; JAPAN; CEREALS & CEREAL CHEMISTRY (DC10300); FOOD PREPARATION, PROCESSING & STORAGE (DC11500); LEGISLATION & REGULATION (DC93500)
DT: Article
AN: 199302005742
UD: 9302

3 of 3
Marked in Search: #6

TI: Effect of spices and salt on the storage stability of precooked dehydrated rice.
AU: SEMWAL-A-D; ARYA-S-S
CS: Defence Food Research Laboratory, Mysore-570 011, India
SO: JOURNAL OF FOOD SCIENCE AND TECHNOLOGY 29(4): 210-213
PY: 1992
LA: English
AB: Effect of nineteen spices (1%), sodium chloride (0.5-2%) and transition metal ions (Fe++, Cu++, Co++Ni++ each at 5, 50 and 500 p.p.m.) on the

sunflower oil and vanaspati was investigated. All the species except Tejpat (Cinnamomum tamala) exhibited antioxygenic activity in dehydrated rice as well as pure sunflower oil and vanaspati. Red chilli, clove, mace and nutmeg exhibited maximum anti-oxygenic activity. Tejpat, on the other hand, exhibited pro-oxygenic activity in all the systems. In dehydrated rice, sodium chloride exhibited slight pro-oxygenic activity but Cu++, Fe++ and Co++ exhibited very strong pro-oxygenic activity. Only at 500 p.p.m. level Ni++ exhibited marginal anti-oxygenic activity. Nature of the oil used during processing also significantly influenced the stability of dehydrated rice and anti-oxygenic or pro-oxygenic activity of the spices and metal ions.
DE: CINNAMOMUM TAMALA; FOOD PROCESSING; FOOD ADDITIVES; SUNFLOWER OIL; VANASPATI; ANTIOXYGENIC ACTIVITY; IRON; COPPER; COBALT; NICKEL; METALS; LIPID CONTENT; FRUITS, NUTS & VEGETABLES (DC10700); FOOD CHEMISTRY & PHYSICAL PROPERTIES (DC11400); FOOD PREPARATION, PROCESSING & STORAGE (DC11500)
DT: Article
AN: 199301003181
UD: 9301

TI: Mermaid's lunch packs.
AU: ANON
SO: NEW PRODUCT NEWS Vol.29, No.2, March 9, P.32
PY: 1993
LA: English
DE: FOOD PRODUCTS; NEW PRODUCTS; VAN CAMP SEAFOOD; BRAND NAME; VARIETIES; TUNA; SALMON; FISH; SUPERMARKETS; RETAIL PRICES; TARGET MARKETS; WORKING WOMEN; USA; FISH & SHELLFISH PRODUCTS (DC10600)
NC: VAN CAMP SEAFOOD, SAN DIEGO, CA
DT: Article
AN: 199302006885
UD: 9302

Production trial Report

CONTENTS

INTRODUCTION

On 9 November 1993, a production trial was conducted to evaluate the effects of retort processing on the rice varieties Amaroo and Bogan supplied by Ricegrowers Coop Ltd and fresh chilled whole native eel supplied by Crawdad Crayfish Pty Ltd. The trial was carried out at Australian Food Processing Laboratories, Preston, Victoria. Although previous retort trials had been done by Ricegrowers Coop Ltd on another variety of rice, the Bogan and Amaroo varieties were untested. These varieties of long grain sticky rice had been presented in Japan and had received a favourable evaluation (see Appendix) so it was decided to proceed with these two varieties over other commercially available long grain and calrose rices.

Little information is available on processed eel in Australia and samples of eel with and without skin were retorted to assess the suitability of eel for this rather severe heat treatment. The eel was prepared and retorted with and without a soy based 'eel' sauce.

Various methodologies for preparing the rice before retorting were evaluated on the day and samples of the mornings first run were evaluated on the day and a second run organised for that afternoon in an attempt to fine tune the mornings's results.

The rice samples from the second trial were better, but did not have the textural or colour qualities required to put to a taste panel at this stage.

OBJECTIVES

1. To evaluate the processing suitability of fresh chilled eel in a commercial retort situation with and without skin and with and without additional liquid seasoning (eel sauce).

2. To evaluate the processing suitability of two sticky, long grained varieties of rice (Bogan and Amaroo) using commercial retorts and different pre-processing methods.

3. To select the rice variety that produced the better texture, appearance and eating quality after processing for possible presentation to Japanese panellists in a formal taste-panel to assess consumer acceptability.

4. To determine if a combination pack of eel and rice is technically feasible using commercial retort packaging and processing techniques.

PROCEDURES

EEL TRIALS

Pre-processing treatments

Fresh, chilled, gutted and cleaned whole eel were divided into 2 batches. One batch was steamed to an internal temperature of 60°C (approximately 10 minutes) in a steam cabinet to allow the skin to be removed more easily. The eels were removed from the cabinet, allowed to cool enough to be handled and then skinned, headed, and sliced. The slices were then vacuum packed and frozen in a blast freezer and held at -20°C. The second batch of eels were processed in the same way except that the skin was not removed (i.e. they were not steamed).

Processing treatments

The eel slices were packed tightly into single compartment plastic retort trays to a weight of 17 g. Then 45 g of a liquid seasoning blend was added to give a final weight of 215 gms.

Formulation for sauce

Kikomman salt reduced soy sauce	125 mL
Water	370 mL
Colflo starch	5 g

These packs were then sealed with a foil webb and retorted. See Table 1 (page 17).

Eel trial 1

Results

All samples of eel exhibited shrinkage with a corresponding loss of approximately 20% moisture. The skinned eel was unacceptable in appearance because the flesh was drier in texture than the skin-on samples and the slices had become non-descript in appearance. Also, there was more breakdown of the product.

The skin on samples were acceptable in appearance. The skin had remained intact around the slices and provided good colour contrast to the flesh. The flesh was moist and had held together well. Although there was a 20% reduction in size of each slice the slices had held their shape well.

- The sauce was acceptable in colour, flavour and consistency.

Eel trial 2

- Increase weight of eel per pack to 185 g.
- Increase the viscosity by increasing the amount of Colflo.
- Evaluate skin-on samples in a clear retort pouch without any additional liquid.

Results

- Processing conditions were 121°C for 38 minutes which were too severe. The retort pouch product was clearly over- cooked and did not held its shape - the product had begun to disintegrate.

Conclusion

Retorting in trays is the better option.

RICE TRIALS

Two rice varieties were submitted by Ricegrowers Coop Ltd for inclusion in the first retort trial. The objective was to be able to select the better performing rice variety for future development work in a combined eel/rice convenience product.

The two varieties were Amaroo, milled 19 October 1993 (A) and Bogan, milled September 1993 (B). These rices were extra well milled to produce a much whiter and cleaner product.

The rice trials evaluated four pre-processing methods for each of the rice varieties before packing into trays and retorting. These were:

- rapid boiling water vs steeping method (absorption method);
- acidified packs vs non-acidified packs.

Rapid boil method

550 g rice was added to boiling water and cooked for 15-20 mins. The rice was then drained and weighed into trays, (108 g) water added (72 g) sealed and retorted.

Steeping method

500 g rice was steeped for 45 minutes at 14°C. The steeping process was accelerated using a microwave to bring the water temperature to 45°C. The rice was then drained and weighed into trays (108 g) with 72 mL water, sealed and retorted.

Liquid seasoning trial

Rice with a lower pH during processing results in reduced discolouration. Therefore a liquid seasoning mix was made up consisting of 100 mLs vinegar, 60 g sugar and 20 g salt. 13 mLs of this solution was added to the rices (108 g) that had been rapid boiled and steeped. 59 g of extra water was also added.

Summary of retort trial

Pre-processing variables for both rice varieties

- Rapid boil
  - with liquid seasoning*
  - without liquid seasoning
- Steeping
  - with liquid seasoning*
  - without liquid seasoning

* Liquid seasoning

salt	11%
sugar	34%
vinegar	55%
	100%

- Non-acidified

-	drained cooked rice	108 g
-	water	72 g
		180 g

- Acidified rice

-	drained cooked rice	108 g
-	water	59 g
-	liquid seasoning	13 g
		180 g

Processing

Retort cylce as per Table 1. Product was packed into retort trays supplied by Nu Wave packaging (Gadsen Rheem PP).

The tray consists of an inner Evo H barrier layer bound with adhesive to recycled polypropylene on both sides and finished on both faces with virgin polypropylene. The lid is a plastic coated foil with a sealing film (LPDE). The tray is filled with product and admitted to the sealer, where continuous like material is heat sealed under vacuum before being stamped to the tray profile. The finished tray packs are assembled in retort baskets face up or down dependent on product before retorting.

Table 1 Processing schedule for Trial 1 (eel and rice packs)

Time (mins)	Temperature (°C)	Pressure (kPa)
15	90	50 steam
20	122	160 steam
3	122	180 steam
25	122	180 steam
8	70	120 water
5	50	70 water
15	35	0 water

Results

Rapid Boil Method - non acidified retort packs

Both rice varieties demonstrated discolouration (off white to pale brown) a slight 'cooked' odour, a dry mouthfeel and rubbery texture. The flavour was acceptable. The grains were visually discreet but were sticky because of an excess of starch.

Rapid Boil Method - acidified retort packs

Discolouration was reduced but the grains were still not white. It appeared that the addition of the vinegar mix had reduced the pH to a point where there was an excess of water and this resulted in poor grain definition and a starch layer in the bottom of the tray. However, there was an improvement flavour and aroma because the liquid seasoning marked the slight straw aroma and cardboard flavour of the retorted product.

A second trial was devised to reduce the concentration of the vinegar mix. However, although this resulted in an acceptable appearance (i.e. colour and grain definition were acceptable) there was no improvement in the stickiness of softness of the retorted rice.

Steeping - acidified and non-acidified cooked rice packs

The results for both the Amaroo and Bogan varieties were that all these retorted samples were unacceptable. The rice grains were indistinct and could not be separated. The appearance of each pack was of a gelatised mass. There was an associated off aroma and off-flavour ('cardboardy') and the texture was extremely soft (particularly in the acidified samples). There was uneven colour development from a slight off white colour to a straw colour (the latter occurring in packs with exposure to more head space and hence oxygen). No further trials were attempted using the steeping method.

Conclusions

The retort cycle used in this trial was excessive for both the eel and the rice. It was not possible in the time available to optimise the retort cycle for a minimum heat treatment that would maintain the product quality of both the eel and the rice and also achieve commercial sterility of both components in a final product.

The potential of improving the colour of the retorted rice by addition of an acidifying agent was identified in this trial. However, the effect of too low a pH on hydrolysis of the rice starch is a concern.

The retort process had a detrimental effect on the flavour and colour and aroma of the rice samples which was not a concern with the eel samples. The use of an acidifying agent did help mask the off flavours and aromas in the rice samples however.

The water content of the rice products was too high to give a firm but cooked texture with grain separation.

It was concluded that there was more work to be done on optimising the conditions for successful retort processing of the rice component. It was agreed that further work was to be undertaken by Ricegrowers Coop Ltd before any more production trials could be organised at AFPL. This would also be contingent upon the fact that the retorts at AFPL be dedicated to the trial product and be programmed to duplicate the laboratory conditions in order to achieve a satisfactory outcome. At the time of the trial it was not possible to reprogramme the retorts because of production pressures.

From a technical point of view this trial demonstrated that retort processing is still an option in producing a shelf stable rice/eel combination convenience product for the Japanese market.

RECOMMENDATIONS

- To continue cooking trials on the Amaroo rice variety to optimise a retort cycle that achieves product quality and a shelf-life product. This activity is to be undertaken by Ricegrowers Coop Ltd.

- To present the retort product for focus group evaluation of pack size, colour and presentation.

- To source other convencience rice products on sale through Japanese supermarkets in Brisbane for evaluation by the focus groups.

- To source Kabayaki eel products for evaluation by the focus groups.

Market Research Report

CONTENTS

EXECUTIVE SUMMARY

This research was commissioned by Fisheries Research and Development Corporation, Ricegrowers Coop Ltd and Crawdad Crawfish Farms Pty Ltd, and conducted by the International Food Institute of Queensland. The purpose of this research was to ascertain the market acceptability of an eel/rice product designed for the Japanese market and to obtain consumers' attitudes and perceptions of eel and Australian rice. Three focus groups were conducted at the International Food Institute of Queensland on 24 and 27 January 1994, involving Japanese currently residing in Brisbane.

The research revealed that consumers perceived eel to be an upmarket product which was consumed as a treat or on special occasions. As such it was expensive to buy in Japan. Consumers usually purchased eel pre-cooked, as special skills were perceived to be needed to cook eel and its essential accompaniment, eel sauce. Australian rice was considered to be of an inferior quality to Japanese rice, with low price the only positive attribute.

There was a conflict in the image between eel as an up-market product and pre-packaged convenience products such as the one presented. Pre-packaged products are not seen as special or upmarket. Furthermore, consumers stated a preference for freshly cooked eel rather than eel in a pre-packaged format.

Further research is required into the pre-packaged food market in Japan to establish their penetration and acceptance. In addition, the industry collaborators need to determine if they are able to meet the quality and product specifications of consumers for eel and rice. Changes to packaging and presentation should be made prior to re-testing the product concept on Japanese consumers in order to address the perception that the pre-packaged product is not upmarket. Clear indications were provided by the focus group participants on the preferred packaging and taste and appearance of eel and rice. As the target market for the pre-packaged product was thought to be young males and females they should be used in the next stage of the consumer research.

INTRODUCTION

The International Food Institute of Queensland was commissioned by the Fisheries Research and Development Corporation, Ricegrowers Coop Ltd and Crawdad Crayfish Farms Pty Ltd to conduct focus groups, to determine the suitability of a pre-packaged eel/rice product for the Japanese market. The International Food Institute of Queensland's Product Development section will be using this research to produce a suitable product for this market. The following areas were explored: investigate the acceptance of the product concept and obtain feedback from consumers on their attitudes and perceptions of eel, Australian rice and pre-packaged foods. This report outlines the findings from the focus groups and provides recommendations for market future research and product development activities.

OBJECTIVES

The following are the research objectives of the focus groups:

- Assess the suitability of an eel/rice pre-packaged product.
- Assess the suitability, usage, perceptions of eel, rice and pre-packaged products purchased from supermarkets.
- Identify and determine the acceptability of various product and packaging presentations for an eel/rice product.
- Obtain visual and taste assessments of a commercially available smoked eel product.
- Identify how, when, where, why consumers would purchase an eel/rice product.
- Investigate consumers price perceptions of pre-packaged rice products purchased from supermarkets.

METHODOLOGY

Three focus groups were conducted at the International Food Institute of Queensland with Japanese who currently live in Brisbane. A cross section of consumers were used in the groups as no data was available to identify the potential target market for a pre-packaged eel/rice product. The groups lasted approximately 90 minutes and involved tastings of Japanese eel, discussion of packaging, and investigation of consumers perceptions of eel, rice and the pre-packaged product.

Consumers were recruited from the Japanese Tourist Bureau, by referrals and through Japanese restaurants. Letters and surveys were distributed to these establishments explaining the purpose of the research and requesting details from consumers regarding their consumption of eel and lunchbox meals (see Appendix 1). Appendix 2 describes the demographic profile of participants used in the focus groups.

SUMMARY OF FINDINGS

PERCEPTIONS

Eel is special

Eel was perceived by all groups to be something special. The terms 'special', 'treat', 'yummy' were used to describe eel. Although participants stated eel was available all year round, it was only eaten as a treat. Eel was described as a food which was purchased when guests were invited to dinner. Consumption of eel was limited to once every few months. The frequency of consumption and price of eel was compared to top grade steak.

"My father loves fish. Whenever someone comes over he goes to the fish shop and gets fresh fish, sashimi and other things. He always buys eel so maybe custom at my parents' place to have eel when someone visits."

Eel gives you energy

The nutritional qualities of eel were considered important by the groups. It was a tradition in Japan to consume eel in June/July as it was perceived to be a good source of energy. Eel was consumed then as it was thought to replenish a person's energy levels. As eel was eaten during summer one person called it a 'summer food'. It was also mentioned that eel was high in vitamins. The skin of the eel was also thought to be nutritious. Some concerns were raised in the group of young females that the skin was very fatty. Although eel was thought to be a healthy food, the young females were concerned about the fat content in the eel skin and eel sauce.

"The first thing I think of is a stamina food for summer as we eat eel and rice on the hottest day of summer on the calendar to give us stamina ... as energy. For energy sources has lots of vitamins B or D so it has been said from the ancient day that eel is very nutritious."

"There is a special day in the middle of summer, July or August most of the people will eat eel maybe they don't have appetite but they can smell the sauce, or grilled eel."

"It is a custom to eat eel ... it is like turkey, you eat turkey at Christmas time."

Eel is expensive

Eel was considered to be an expensive food to purchase in Japan. Purchases of eel was limited due to the high price; however several participants stated they would buy eel more frequently if the price was lower.

"It is quite an expensive dish in Japan like beef steak."

"Not very often. I probably would not go on my own unless somebody shouts ... I would not probably pay for it as a normal meal with a bit of eel, rice and soup would cost about thirty dollars."

"Many families cannot afford to eat eel all the time"

It was stated that a lunchbox meal containing eel would be priced between $15-$30.

Imported eel

The imported eel from Taiwan was thought to be cheaper and of a lower quality than Japanese eel. One consumer thought imported eel was fed on antibiotics. Participants stated that Japanese people generally considered all Japanese food to be of a higher quality than imported foods.

"There is a belief in Japan that foods you can get in Japan are better than imported one. Therefore if you have a choice or can afford Japanese, people would go for Japanese. However because prices are so high cannot often get Japanese eel we don't have a choice... We buy imported one eventually."

"Some of the cheap eel must be imported because if you go to an expensive restaurant it costs $40-$50 dollars, cheap restaurant eat eel for about $10. I think that is imported eel."

Despite the negative perceptions held of imported products participants stated they were unlikely to know if a food was Japanese or imported.

Australian eel

Australian eel was thought to be the wrong variety. Eel from Australia was considered to be too big, muddy, and of a low quality in comparison to Japanese eel. Only one person had eaten Australian eel. Only one person had eaten Australian eel and she described it as big, muddy and oily.

PURCHASING AND COOKING

Where is eel purchased

Eel was sold and consumed in a wide range of outlets in Japan. Consumers stated they had purchased eel from supermarkets, fish shops, eel shops, department stores and as a takeaway in the form of a bento (lunchbox meals). Eel was consumed at restaurants, eel shops and at home. Consumption of eel at home was usually limited to special occasions or as a treat. Eel bentos were only purchased infrequently due to their high price.

"Bentos are normally not expensive $2-$6 a bento. Eel bento are expensive around $20 or so."

"Would not cook myself ... would always buy from the shop already cooked with the sauce."

Supermarkets were thought to sell eel at lower prices than eel shops, restaurants and department stores. The older housewives tended to be more concerned about price than the younger females. Buying eel from department stores was considered a treat as they cooked the eel on the premises.

Cooking method and sauce

The sauce used on eel was called 'eel sauce'. Eel was cooked with the sauce either by marinating or brushing the eel with sauce as it cooked. A separate sachet of sauce was normally supplied to the consumer to add to the eel when they ate it. Sauce was important as it gave eel a good taste, smell and made the eel brown and shiny. Traditional Japanese cooking methods were linked to the preparation of eel sauce.

"I think the sauce is very important."

"Old traditional eel restaurants they never replace the sauce they keep on refilling it and goes on for hundreds of years is the secret of the taste they never tell anyone what is actually in the sauce ... the main ingredients they never tell."

The eel was usually purchased pre-cooked requiring the consumer to only reheat the eel at home. Eel which was purchased pre-cooked by consumers, was usually grilling or steaming. Consumers stated when they ate eel at home they usually reheated the eel by grilling, microwaving or boiling. It was thought that special skills were required to cook eel as the sauce was

an important part of the taste. Participants stated that different cooking methods were used for eel in different areas of Japan. Some regions in Japan liked to retain the fat, while others drained the fat from the eel.

Buying criteria for eel

When buying eel consumers stated they considered both quality and price. Participants stated they looked at the colour, price, thickness, and freshness of the eel. Some consumers liked thick skin while other liked eel skin which was thin and crispy. Attractive packaging was also considered to be very important. One person in the groups stated that Japanese people buy products based on how they look.

"When fresh looks good."

"No air bubbles in the packaging, you can tell, very clear packaging, clear writing no smudges."

PERCEPTIONS OF AUSTRALIAN RICE

Initially the groups made positive remarks about Australian rice; however as the discussion progressed it became apparent that Japanese rice was perceived to be superior due to the following reasons:

- not pure white;
- rice grains are different sizes while Japanese rice is all the same size;
- pieces of shell and black specs in the rice;
- not as sticky as Japanese rice;
- too dry;
- does not stay sticky after it has been cooked for a while. Japanese rice stays sticky even when it is cold;
- not as polished as Japanese rice;
- not shiny enough;
- Japanese rice tastes better;
- strange smell while Japanese rice has no smell;
- California rice better than Australian rice;
- harder than Japanese rice;
- more chemicals than Japanese rice; and
- has a sweet taste.

Australia rice was considered to be satisfactory when it was initially cooked; however when it cooled it lost its' taste and stickiness. The lack of stickiness was considered a problem, particularly when making rice balls, as

the rice would not hold together. Consumers thought Australian rice may be dry due to the lack of water. Australian rice was thought to be very cheap compared with Japanese rice. This was considered a positive attribute by the older housewives in group three. This group thought the low price would be the main reason why Japanese may buy Australian rice.

Although most participants believed Australian rice was a lower quality than Japanese rice a few people believed there were no differences. These people stated although they thought there were no differences other Japanese consumers strongly believed Australian rice to be inferior to Japanese rice.

PRE-PACKAGED RICE PRODUCTS

Pre-packaged rice - supermarket samples

A selection of pre-packaged rice products were purchased from a Japanese supermarket and shown to the groups. The products which were shown to the groups were pre-cooked and only required reheating. In most groups the participants had not purchased the products. Those who had bought similar products in Japan were mainly young females.

"I would not buy this I can cook it."

"We have an automatic rice cooker ... just press a button."

The older housewives did not consider the pre-packaged rice products to be value for money. Rice was considered easy to cook and therefore consumers saw no reason to buy it pre-packaged and pre-cooked. The product's main attributes were ease of use and convenience. Pre-packaged rice was thought to be suitable if you were in a rush or did not feel like cooking.

Participants thought pre-packaged rice may be suitable for people living on their own and people who did not have much time. Students, young single men and working females thought to be the main consumers of the rice samples.

The price was considered to be affordable if eaten on an infrequent basis. The quality of the rice in the product samples was thought to be satisfactory. Group one differed to the others as they thought the rice was aged or old rice. It was thought that the rice used in the pre-packaged products was a way of using up stocks of old rice.

"Must be good quality but just microwave. We can buy fresh rice balls from the same shop. I prefer fresh."

Branding was also considered important as it was thought that consumers would buy the rice products just because of the brand name. When buying a pre-packaged product the participants looked at the brand, price, and extra benefits. An extra benefit was thought to be no chemicals.

Pre-packaged rice ball mix - supermarket sample

This product was considered to be too much trouble. Participants preferred rice balls which were already made up, rather than one which required assembling. An additional barrier to purchase was a freshly made rice ball could be bought from the same shop as a pre-packaged rice ball. Freshness seemed to be an important consideration when buying any food product.

"If I bought the product it would be emergency food I would not buy it for a snack or after dinner. It is only for emergencies."

PACKAGING PREFERENCES

Colour

A range of packaging colours and sizes were presented to the groups. The preferred colours in the groups were white and red. Dark colours such as black and blue were thought to be inappropriate. A white or clear pack was thought to be clean; however in one group the white was associated with hospital food.

"Too me the white looks like hospital ... it is too hygienic".

In group one the participants thought the inside of a container should be red, white or silver. The younger group of females did not have any preferences for the colour of the packaging.

EEL/RICE PRODUCT EX PRODUCTION TRIALS AT AFPL

Product Presentation - Product Samples

The eel which was presented on top of the rice was cut longitudinally. Participants thought the eel should be cut in wider pieces and at right angles to the backbone. As the eel on one sample was cut in long pieces the participants stated they would not be able to pick the eel up with their chopsticks.

"Never slice that way ... never cut that way."

The groups thought the eel looked dry, and not shiny enough. The comment was also made the eel looked old. There was no consensus on the preferred way to present the eel. Some participants liked the eel on top of the rice while other liked the eel separated from the rice.

"Looks dry not shiny ... need more moisture."

One person was concerned the eel on top of the rice may cause discolouration. It was thought the sample where the eel was separate from the rice was a more upmarket product. According to another person in the group the proper presentation of eel was on top of the rice; however this was thought to be unsuitable for a pre-packaged product.

Package Size/Lid

The packs shown in the groups were considered too small. The size of the pack was thought to be suitable for one person; however the participants believed there should be a larger pack to allow more rice and eel.

"In Japan people buy for how it looks. Nice presentation."

The participants preferred a clear lid on the product or a picture of what it should look like when eating the product. There was confusion between a lunchbox type product and a pre-packaged product. The pre-packaged eel/rice product appeared to be an unfamiliar concept to the participants. One person in the groups suggested a more upmarket pack should be used like a bento type pack. She suggested a pack which looks like a basket weave such as used for bentos, would make the product look more upmarket.

Sauce

Some people liked the sauce in a separate sachet within the pack, while others preferred the sauce to be poured over the eel. The eel sauce which was used in the taste assessments was thought to have a good taste.

Who would buy the eel/rice product

Most people in the groups stated they would not buy the product. Participants preferred eel to be freshly cooked rather than buying it in a pre-packaged format. It was thought that young people or busy people may buy the product.

"Maybe ... if I feel like eel don't want too much trouble ... if I'm busy."

Some of the barriers to purchase were; the pack was too small, and eel shops home delivered freshly cooked eel. There was also the perception the product looked cheap which did not match their upmarket image of eel. One older housewife stated she may buy the product if it was cheaper than other eel products; however most participants stated they would not buy eel in this format.

"If no eel is available in Australia and I see that one I might buy it, but if I'm in Japan and lots of fresh nice eel available even if it is more expensive I would buy it, rather than the vacuum packed eel."

Taste perceptions

The eel used in the taste assessments was a Taiwanese product purchased from a Japanese supermarket. The groups were generally satisfied with the taste of the eel. Several people suggested the eel looked dry, lacked shininess and should have been thicker. One lady stated the eel was less fatty than the eel she had eaten in Japan. This was considered a favourable attribute, as the eel was lighter in taste and less fattening. As mentioned earlier, certain people in the group preferred eel which had a crispy skin.

"Tastes pretty good. I am wondering when it is vacuum packed how it looks like maybe it is a good idea to put a picture rather than showing the real thing. A picture of the presentation, on a nice plate."

New product concept

The combination of eel and rice in a pre-packaged format was a new product concept to the groups. Participants were only familiar with eel in a lunchbox, in a plastic pack, in a restaurant, or freshly cooked in a department store or eel shop.

There were problems with the concept, as eel was considered upmarket while pre-packaged products were not thought to be special or upmarket. Consumers also thought rice was easy to make and therefore their was no need to buy it pre-made.

"Eat it if I wanted something easy and quick to eat."

"If I had time I think I would cook rice myself and buy just eel."

CONCLUSION

This research was designed to provide preliminary feedback from potential consumers of the eel/rice product. The preceding limitations should be considered when interpreting and using the information in this report; focus groups are a form of qualitative research, consumers in the groups were residing in Australia and therefore may not represent consumers in Japan, the females in group one deferred to the males, the males in group one had a commercial interest in eel and therefore were not representative consumers. Despite these limitations the feedback from the groups identified how Japanese position eel, their attitudes towards Australian rice and their impressions of a pre-packaged eel/rice product. Comments from the groups suggest further research should be conducted into the convenience market. There was resistance to the product concept as eel was considered an upmarket product which could be purchased freshly cooked from a wide range of outlets. It is recommended that Fisheries Research and Development Corporation and the industry collaborators consider further market research to determine the acceptability of the product concept.

RECOMMENDATIONS

The following recommendations are presented in sequence.

(a) Conduct further market research to investigate the penetration of pre-packaged convenience products in Japan.

(b) Investigate whether the differences stated between Japanese rice and Australian rice are perceptual or real. If it is a perceptual problem than industry collaborators need to address these issues through their marketing plans. If the quality differences are real and the industry collaborators want to produce a high quality product than production and processing methods may need to be reviewed.

(c) Follow up leads with the males in group one, who were seeking to produce eel to export to Japan. Any processed eel should closely match the Taiwanese product tasted in the focus groups; however it should be thicker and shinier in appearance.

(d) Produce eel sauce which matches the taste of the sauce used in the tasting session.

(e) Conduct further taste and visual tests of Australian rice, eel and sauce. These assessments should be used to determine the suitability of the product in terms of presentation and also determine any quality problems with the rice and eel.

(f) Produce an upmarket product and packaging similar to the bento style packaging. This packaging should be compartmentalised so the rice and eel are separated inside the pack. The preferred colours of white, red and silver should be used for the packaging. This product and packaging should be assessed by the potential consumers and the trade (wholesalers, retailers) in Japan.

As the consumers found the product concept new and slightly confusing, it is suggested market research precede any further product development activities.

APPENDIX 1

Questionnaire

DPI
QUEENSLAND

PARTICIPANTS WANTED FOR DISCUSSION GROUPS AND TASTING OF RICE AND EEL PRODUCTS

We require 30 Japanese consumers (males and females 18-65 years of age) to attend group discussions at our Food Research Institute at 19 Hercules Street Hamilton. Three groups will be held at the following dates and times:

Monday	24 January 1994	2.30 p.m.
Thursday	27 January 1994	2.30 p.m.
Friday	28 January 1994	2.30 p.m.

The sessions will take approximately one and a half hours and an attendance payment of $20 will be paid to participants.

If you would like to participate, please complete and post or fax the attached forms by Tuesday 11 January 1994 to

Mrs Christine Gore
Product Development
Department of Primary Industries
19 Hercules Street
HAMILTON QLD 4007

Fax 868 1853

or phone 268 8410 for further information. This is a 24 hour number. Between 5.00 p.m. and 8.00 a.m., and at weekends, we have an answering machine attached to the phone. It gives you 60 seconds to leave your name and phone number and a message.

If you have friends or relatives who may also be interested in the group, please give them a form too.

Eel and Rice Discussion Groups

Please fill in the details below so that we can put your opinions of the products into the appropriate consumer group. All information you provide is treated as confidential and your identity will not be disclosed in any report or publication of this work.

1. Sex ☐ Female ☐

2. Age
   - ☐ 18 - 24 years
   - ☐ 25 - 34 years
   - ☐ 35 - 44 years
   - ☐ 45 - 54 years
   - ☐ 55 - 64 years
   - ☐ 65 + years

3. Marital Status
   - ☐ Single
   - ☐ Married
   - ☐ Defacto
   - ☐ Divorced/Separated

4. (a) Occupation (current) . . . . . .

   (b) Hours of employment: ☐ Full time ☐ Part time

5. How long have you been in Australia?
   - ☐ 1 month or less
   - ☐ 2 - 6 months
   - ☐ 7 months - 1 year

☐ 1 - 3 years

☐ Other (Please write in) . . . . . .

6. In what country were you born? . . . . . .

7. Where in Japan did you live?

City/Town . . . . . Province . . . . . .

8. What was your occupation in Japan? . . . . . .

9. Are you the main grocery shopper? ☐ Yes ☐ No

10. On average how frequently did you eat eel in Japan?

☐ Never

☐ Several times a week

☐ Once a week

☐ Two to three times a month

☐ Once a month

☐ Several times a year

☐ Once a year

☐ Other . . . . . .

11. In what forms have you eaten eel?

☐ Dried ☐ Smoked ☐ Marinated ☐ Other . . .

12. Have you purchased a lunchbox meal (Bertos) in Japan? ☐ Yes ☐ No

13. On average how frequently did you purchase lunchbox meals (Bertos) in Japan?

☐ Never

☐ Several times a week

☐ Once a week

☐ Two to three times a month

☐ Once a month

☐ Several times a year

☐ Once a year

☐ Other . . . . . .

PLEASE PRINT

Name . . . . . .

Home Address . . . . . Postcode

Phone number (Home) . . . . . (Work) . . . . . .

Please place a tick ✓ in the boxes next to the group you would be able to attend. You will only be required to attend one, so we will telephone you before Tuesday 18 January to confirm which group you have been selected to attend.

Monday	24 January 1994 2.30 p.m. - 4.00 p.m.	☐
Thursday	27 January 1994 2.30 p.m. - 4.00 p.m.	☐
Friday	28 January 1994 2.30 p.m. - 4.00 p.m.	☐

APPENDIX 2

Demographics

SUMMARY OF DEMOGRAPHIC RESULTS

NUMBERS ARE % RESPONSE FOR EACH CATEGORY

Eel and Rice Discussion Groups

Please fill in the details below so that we can put your opinions of the products into the appropriate consumer group. All information you provide is treated as confidential and your identity will not be disclosed in any report or publication of this work.

1. Male [15] Female [85]

2. Age

[8]	18 - 24 years
[50]	25 - 24 years
[19]	35 - 44 years
[8]	45 - 54 years
[12]	55 - 64 years
[4]	65 + years

3. Marital Status

[19]	Single
[69]	Married
[8]	Defacto
[4]	Divorced/Separated

4. (a) Occupation (current) 44% housewife or unemployed, 16% liaison offices, 16% restaurants, rest - various

   (b) Hours of employment: [39] Full time [31] Part time [31] Not employed

5. How long have you been in Australia?

[4]	1 month or less		
[8]	2 - 6 months		
[8]	7 months - 1 year		
[19]	1 - 3 years		
[62]	Other (Please write in)	4-5 years	- 24%
		6-8 years	- 12%
		>10 years	- 24%

6. In what country were you born? All in Japan.

7. Where in Japan did you live?

City/Town . . . . . Province . . . . . .

8. What was your occupation in Japan? . . . . . .

9. Are you the main grocery shopper? [96] Yes [4] No

10. On average how frequently did you eat eel in Japan?

[4] Never

[8] Several times a week

[4] Once a week

[0] Two to three times a month

[12] Once a month

[65] Several times a year

[9] Once a year

[0] Other . . . . . .

11. In what forms have you eaten eel?

[0] Dried [15] Smoked [15] Marinated [62] Other

Grilled - 32%
No reply - 32%
Other - 8%

12. Have you purchased a lunchbox meal (Bertos) in Japan? [100] Yes [0] No

13. On average how frequently did you purchase lunchbox meals (Bertos) in Japan?

[0]	Never
[12]	Several times a week
[12]	Once a week
[35]	Two to three times a month
[4]	Once a month
[35]	Several times a year
[0]	Once a year
[4]	Other when travelling.

APPENDIX 3

Discussion outline

DISCUSSION OUTLINE

Objectives of Focus Groups:

1. Assess the suitability of an eel/rice pre-packaged meal.

2. Assess the suitability, usage, perceptions of pre-packaged eel, rice products purchased from Japanese supermarkets in Australia.

3. Identify / Determine the acceptability of various product and packaging presentations for an eel/rice product.

4. Obtain visual and taste assessment of a smoked eel product.

5. Identify how, when where, why consumers would or would not purchase an eel/rice product.

6. Investigate consumers price perceptions of the pre-packaged rice product purchased from the Japaneses supermarkets in Australia.

Introduction:

Purpose of discussion	-	obtain your perceptions / usage of pre-packed rice products.
	-	obtain your perceptions on a rice / eel pre-packaged product.
	-	your comments assist rice growers and seafood processors who we are doing this work for
Protocol	-	No right or wrong opinions
	-	Taping / Video tape
	-	Speak one at a time to whole group
	-	Speak English where possible
	-	Length of discussion 1hr 30 min
Introductions Group	-	Name, Occupation (Aust, Japan), Length of time in Australia

Discussion	-	What types of lunchbox (Bentos) meals have you eaten?
	-	Where eaten, why eaten, where purchased
	-	Purchased for yourself snack, meal, for family
	-	Bought / Eaten away from home , at home
	-	What difference between pre-packaged meals eaten at home and Bentos?
	-	Frequency of consumption
	-	What types of food do you like to eat with rice in pre-packaged meals?
	-	Have you eaten eel?
	-	In what ways eaten eel / what do you like/dislike about eel?

Product Samples From Japanese Supermarket

Product 1	-	Have you purchased this product in Australia / Japan
	-	When, Where, Why
	-	Preparation of product
	-	Perceptions of product / packaging (lids)
	-	Availability , consumption in Japan
	-	Price perceptions
	-	Convenience vs freshness (fridge vs dry store)
	-	Rice preferences
		- visual assessments of products
		- Appearance
		- Texture
		- Colour
		- How do you like rice to taste (use descriptors)
		- What do you think this product would taste like?
Product 2	-	As above
Product 3	-	As above
Eel / Rice Sample	-	Perceptions packaging, presentation, product
	-	Intention to purchase
	-	What changes like to see to product
	-	Price perceptions
Packaging Samples	-	Discuss colour, size, presentation
	-	Preferences, why
	-	Suitability of packaging for home, eating out
	-	Individual wrapping vs one container
	-	(Environmental issues - don't raise subject)

Smoked Eel Sample	-	Purchased
	-	When, where, why
	-	What like/dislike about eel
	-	Taste perceptions
	-	Perceptions product / packaging
Taste Smoked Eel	-	What think of taste
	-	Meet expectations
	-	How compare with other eel eaten
	-	What like / dislike about product
Recap Eel / Rice Concept	-	What do you think of a pre-packaged eel/rice product
	-	Purchasing
	-	Frequency of purchase
	-	Occasion eat product (situation)
	-	Size of container, presentation, where expect purchase product, when eat, who most likely to buy product, who wouldn't buy product WHY
Australian Vs Japanese	-	Perceptions Australian food products sold in Japan
	-	Perceptions Australian Rice vs Japanese Rice
	-	Perceptions Australian Eel vs Japanese eel
	-	Preference for Australian eel/rice product or Japanese eel/rice product WHY.

Eel/Rice Project Proposal

Stage 2

CONTENTS

INTRODUCTION

The purpose of this draft proposal is to outline the work required to produce market research samples of a retail pack for the Japanese market containing eel and rice, based on the recommendations outlined in the Feasibility Study Report (Stage 1).

STEP 1 MARKETING

The results of the focus groups indicated that obtaining market information on the pre-packaged food market in Japan is an essential first step. Such items are already manufactured in Japan and were shown to the focus group participants, but little is known about their market penetration and acceptance by Japanese consumers. The following actions are therefore recommended:

- Evaluate market information on the penetration and acceptance of pre-packaged heat and eat convenience meals in Japan, (secondary and primary research).

- Investigate whether the differences stated between Japanese rice and Australian rice are perceptual or real and how this impacts on the acceptance of the end product.

- Evaluate the acceptance of Australian eel by Japanese consumers.

- Evaluate packaging types and styles using focus groups.

At completion of Step 1 and dependent on the outcome of this market research the technical research will begin.

STEP 2 PRODUCT AND PROCESS DEVELOPMENT

The feasibility study (Stage 1) concentrated on retort processing as the most suitable means of producing a shelf-stable eel/rice meal that would be suitable for the heat and eat convenience meal market. The reasons for this choice were:

- the technology was established;
- ease of conducting production trials using an established contract manufacturing company;
- the retort process results in a shelf-stable product that is not limited by temperature in storage distribution;
- the packaging technology is available to produce a retorted product in plastic trays suitable for re-heating in a microwave oven.

The hurdles to be overcome as elucidated by production trial work are in achieving a quality rice and eel product that is a shelf-stable product.

The objectives for this part of the project work would therefore include the following:

EEL

- Investigate pre-processing methods for Australian eel for inclusion in the eel/rice meal concept:
  - preparation of whole fresh eel, eg gutted, whole vs filleted, skin on, boned out, etc;
  - sliced vs whole, etc.
- Investigate processing methods.
- Develop an 'eel' sauce for inclusion in the pack that matches the current Taiwanese product:
  - formulation;
  - in-house taste panels;
  - processing/packaging.

- Investigate the acceptance of Australian eel when processed, to Japanese consumers:

  - pilot trials;
  - production trials;
  - in-house taste panels.

RICE

- Optimise the retort process using additional technology if appropriate, and a suitable rice variety to achieve a cooked rice product with the desired visual and eating qualities expected by Japanese consumers:

  - pilot trials/production trials;
  - in-house taste panels.

PACKAGING

Review packaging options available that will withstand the retort process and maximise the presentation value of the pack in a retail situation:

- supplies of trays in preferred colours;
- production trials;
- focus groups;
- in-country evaluations.

PROCESSING

Optimise the retort process for the meal components and evaluate the available packaging in terms of presentation and suitability for re-heating:

- produce market research samples for in-house and in-country evaluation.

It is proposed that each step in the development work outlined above be closely monitored using various marketing tools to ensure the suitability of the end-product to the targeted market. It is anticipated that this would involve further in-house evaluations (taste panels and focus groups using specific Japanese Consumers groups) and at a later stage in-country promotions to supermarket chains.