

Fish Canning Handbook

Edited by

Les Bratt

Consultant in Food Technology
Cleeve Prior, Worcester, UK

 **WILEY-BLACKWELL**

A John Wiley & Sons, Ltd., Publication

Fish Canning Handbook

Fish Canning Handbook

Edited by

Les Bratt

Consultant in Food Technology
Cleeve Prior, Worcester, UK

 **WILEY-BLACKWELL**

A John Wiley & Sons, Ltd., Publication

This edition first published 2010
© 2010 Blackwell Publishing Ltd

Blackwell Publishing was acquired by John Wiley & Sons in February 2007. Blackwell's publishing programme has been merged with Wiley's global Scientific, Technical, and Medical business to form Wiley-Blackwell.

Registered office

John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, United Kingdom

Editorial offices

9600 Garsington Road, Oxford, OX4 2DQ, United Kingdom
2121 State Avenue, Ames, Iowa 50014-8300, USA

For details of our global editorial offices, for customer services and for information about how to apply for permission to reuse the copyright material in this book, please see our website at www.wiley.com/wiley-blackwell.

The right of the author to be identified as the author of this work has been asserted in accordance with the UK Copyright, Designs and Patents Act 1988.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, except as permitted by the UK Copyright, Designs and Patents Act 1988, without the prior permission of the publisher.

Wiley also publishes its books in a variety of electronic formats. Some content that appears in print may not be available in electronic books.

Designations used by companies to distinguish their products are often claimed as trademarks. All brand names and product names used in this book are trade names, service marks, trademarks or registered trademarks of their respective owners. The publisher is not associated with any product or vendor mentioned in this book. This publication is designed to provide accurate and authoritative information in regard to the subject matter covered. It is sold on the understanding that the publisher is not engaged in rendering professional services. If professional advice or other expert assistance is required, the services of a competent professional should be sought.

Library of Congress Cataloging-in-Publication Data

Fish canning handbook / edited by Les Bratt.

p. cm.

Includes bibliographical references and index.

ISBN 978-1-4051-8099-3 (hardback : alk. paper) 1. Canned foods--Sterilization. 2. Fishes--Preservation.

3. Canning and preserving. 4. Fishery products--Microbiology. 5. Canned fish products--Safety regulations--Europe.

6. Canned fish products--Safety regulations--North America. I. Bratt, L. (Les)

TP371.35.F57 2010

664'.942--dc22

2010003296

A catalogue record for this book is available from the British Library.

Set in 10/12 pt Times by Aptara® Inc., New Delhi, India
Printed in Singapore

Contents

<i>List of contributors</i>	xi
<i>Preface: review of the market for, and sources of, canned fish</i>	xiii
1 Legal requirements for producers selling canned fish into Europe	1
John Hammond	
1.1 Introduction	1
1.2 Imports into the EU	2
1.3 General food law	2
1.4 Product-specific controls	4
1.5 Hygiene rules	6
1.6 Fishery products from outside the EU	8
1.7 Identification marking	10
1.8 Microbiological criteria	10
1.9 Labelling	11
1.10 Lot marking	20
1.11 Food contact materials	22
1.12 Additives	24
1.13 Flavourings	25
1.14 Contaminants	26
1.15 Pesticides	26
1.16 Veterinary medicinal products	27
1.17 Weights and measures	28
1.18 Warning	29
References	29
2 Legal requirements for producers selling canned fish into North America	32
Kenneth Lum	
2.1 Introduction	32
2.2 Canned fish description	32
2.3 Why are regulations necessary?	33
2.4 Legal requirements and food safety	33
2.5 Regulatory systems in Canada and the United States	34
2.6 Canadian requirements	34
2.7 United States requirements	43
3 HACCP systems for ensuring the food safety of canned fish products	51
Alan Williams	
3.1 Introduction	51
3.2 The HACCP Principles	52

3.3	Prerequisite programmes	52
3.4	How to set up and conduct an HACCP study for canned fish products	54
3.5	Implementation	74
3.6	ISO 22000	74
3.7	Conclusions	74
	References	75
	Appendix 1: Useful websites (for HACCP Guidance and including generic HACCP plans in some cases)	77
	Appendix 2: Modular HACCP approach for the canning of tuna products, showing typical activities within each module	78
	Appendix 3: Example of a tabular documentation format for prerequisite programmes	79
	Appendix 4: Extract from a non-tabular format HACCP plan approach for can seaming (CCP 2)	80
	Appendix 5: Extract of a tabular HACCP Chart for CCP 3 sterilisation and CCP 4 in the generic fish canning flow diagram	82
4	National and international food safety certification schemes	85
	Harriet Simmons	
4.1	Introduction	85
4.2	Food safety legislation	85
4.3	Food safety management systems	85
4.4	Certification: A brief overview	86
4.5	Hazard analysis critical control points	88
4.6	The Global Food Safety Initiative	90
4.7	A comparison of major global certification programmes for food safety	100
4.8	Summary of comparison of global certification programmes	100
5	Fish quality	102
	Tony Garthwaite	
5.1	Introduction	102
5.2	Important fish species	102
5.3	Pollution aspects	104
5.4	Handling and transport	106
5.5	Spoilage factors	106
5.6	Reception and testing	111
5.7	Storage	114
5.8	Defrosting frozen fish	116
5.9	Fish preparation	121
5.10	Chemical indicators of quality	130
	References	130
6	Design and operation of frozen cold stores	132
	Stephen J. James and Christian James	
6.1	Introduction	132
6.2	Factors affecting frozen storage life	133

6.3	Cold store design	140
6.4	Specification and optimisation of cold stores	143
6.5	Thawing	145
6.6	Conclusions	149
	References	150
7	Packaging formats for heat-sterilised canned fish products	151
	Bev Page	
7.1	Overview of the basic materials used for heat-sterilised fish packaging	151
7.2	Metal cans for heat sterilised-fish products	151
7.3	Plastic containers for heat-sterilised fish products	177
7.4	Glass containers for heat-sterilised fish products	177
	Further reading	178
8	Retorting machinery for the manufacture of heat-sterilised fish products	179
	Claude Vincent	
8.1	Introduction	179
8.2	Retorting equipment available	180
8.3	Technical features of horizontal batch retorts	195
8.4	General arrangement of a sterilising plant	200
8.5	Utilities required for batch retorts	203
8.6	The different usages of a retort	207
8.7	Legal steps to be taken when installing a new retort	208
9	Management of thermal process	210
	Nick May	
9.1	Role of the thermal process manager	210
9.2	Documentation of thermal process requirements	211
9.3	Maintaining and calibration of key instrumentation	213
9.4	Training of key staff	214
9.5	Review of production records	215
9.6	Managing non-conformance (process deviations)	215
9.7	Conclusion	217
	References	217
10	Principal causes of spoilage in canned fish products	218
	Joy Gaze	
10.1	The quality of raw materials	218
10.2	Hygiene and good manufacturing practice	219
10.3	Potential spoilage issues associated with canned fish products	219
10.4	Typical causes of spoilage in canned fish products	220
10.5	Types of spoilage	221
10.6	Microbiological examination of suspect spoilt cans	223
10.7	Microbiological investigations – decision criteria	223
10.8	Conclusion	223
	References	224

11 Commercial sterility and the validation of thermal processes	225
Geoff Shaw	
11.1 Introduction	225
11.2 Temperature measurement systems	226
11.3 Processing vessels	228
11.4 Temperature distribution	228
11.5 Retort survey	229
11.6 Test loading	229
11.7 Data analysis	230
11.8 Heat penetration measurement	231
11.9 Commercial sterility and lethality	231
11.10 General method	233
11.11 Heat penetration experimental methods	234
11.12 Flexible packaging	235
11.13 Future developments and information	236
References	236
Other sources of information	237
12 The quality department in a fish cannery	238
Leila Radi	
12.1 Avant-propos	238
12.2 The organisation and the scope of operations of the quality department	238
12.3 Quality assurance for the management of pre-requisite measures	239
12.4 Quality control	244
12.5 Establishment of a quality plan	246
12.6 Standard quality procedures	246
12.7 Training of quality staff against procedures	247
12.8 Handling of non-conforming materials	247
12.9 Establishment and monitoring of corrective actions	248
12.10 Legislative compliance	248
12.11 Research and development	249
12.12 Security	249
12.13 Conclusion	250
Acknowledgement	250
References	250
13 The laboratory in a fish canning factory	251
Linda Nicolaidis and Les Bratt	
13.1 Laboratory facilities	251
13.2 Chemical analyses	254
13.3 Microbiological testing	255
13.4 Analysis required for cannery water and retort cooling water	256
13.5 Swab testing	256
13.6 Incubation tests	257
13.7 Sterility tests	257
13.8 Laboratory accreditation	260
Further reading	260

14	Cleaning and disinfection in the fish canning industry	262
	Peter Littleton	
14.1	Introduction	262
14.2	The cleaning process	262
14.3	Principles of cleaning	264
14.4	Open plant cleaning	265
14.5	Floor cleaning	270
14.6	Tray and rack washing machines	271
14.7	Principles of disinfection	272
14.8	Factors affecting disinfectant effectiveness	273
14.9	Choosing the right disinfectant	274
14.10	Where to disinfect	274
14.11	Types of disinfectants	275
14.12	Oxidising disinfectants	275
14.13	Non-oxidising disinfectants	277
14.14	Effects of time and concentration	278
14.15	Specific issues relating to fish canning operations	279
14.16	Cleaning management	279
14.17	Cleaning programme	280
	References	282
15	The canning factory	283
	Les Bratt	
15.1	The fish canning factory: Introduction	283
15.2	Site selection	283
15.3	Factory design and construction	284
15.4	The principal areas of the factory	289
15.5	Services	296
	References and suggestions for further reading	298
	<i>Index</i>	299

List of contributors

Les Bratt

Les Bratt (Food Technology) Ltd, Cleeve Prior,
Worcestershire, UK

Tony Garthwaite

Consultant Food Technologist, TG Associates,
Grimsby, UK

Joy Gaze

Microbiology Department, Campden BRI,
Chipping Campden, Gloucestershire, UK

John Hammond

Campden BRI, Chipping Campden,
Gloucestershire, UK

Christian James

Food Refrigeration and Process Engineering
Research Centre (FRPERC), The Grimsby
Institute (GIFHE), Grimsby, Lincolnshire, UK

Stephen J. James

Food Refrigeration and Process Engineering
Research Centre (FRPERC), The Grimsby
Institute (GIFHE), Grimsby, Lincolnshire, UK

Peter Littleton

Technical Services Manager, Holchem
Laboratories Ltd, Haslingden, Rossendale,
Lancashire, UK

Kenneth Lum

GMA/Food Products Association, Center for
Northwest Seafood, Seattle, WA, USA

Nick May

Campden BRI, Chipping Campden,
Gloucestershire, UK

Linda Nicolaides

Food Safety Specialist, Natural Resources
Institute, Greenwich, UK

Bev Page

Packaging Consultant, Ravenshead,
Nottingham, UK

Leila Radi

International Quality Control Corporation,
Rabat, Morocco

Geoff Shaw

Ellab UK Limited, Bawburgh, Norfolk, UK

Harriet Simmons

Technical Director for the Food Inspection
Services, National Britannia Ltd, Caerphilly
Business Park, Caerphilly, UK

Claude Vincent

STERIFLOW S.A.S., Paris, France

Alan Williams

Department of Food Manufacturing
Technologies, Campden BRI, Chipping
Campden, Gloucestershire, UK

Preface: review of the market for, and sources of, canned fish

Canning is a well-established and traditional means of providing food which is stable at ambient temperatures, has long shelf life and in consequence is eminently suitable for world-wide distribution. Canned fish is therefore exported from countries all over the world into the consumer markets of Europe and North America. The manufacturing of canned fish has provided, and continues to provide much-needed employment, individual incomes and the means for foreign currency exchange for developing countries, particularly in Southeast Asia, South America and the Indian Ocean.

Within the past 20 years or so there have been noticeable changes within the canned fish industry. The increased emphasis on food safety has given rise to better understanding of the process of heat sterilisation, together with ever-sophisticated equipment providing the means to measure that sterilisation; the introduction of the ISO 9000 Standard has led to the better organisation of Quality Management Systems in which responsibilities are better defined and understood; modern processing equipment with microprocessor control has provided the better regulation of temperatures and pressures during thermal processing; and the widespread adoption of HACCP systems has allowed companies to identify and concentrate their efforts on those matters contributing to product safety.

The changes that have occurred within the industry have also been due to long-term pressure from the retail and trading companies who provide audit of, and technical help to, their suppliers in order to ensure that food provided to their customers is safe. In recent years we have seen the introduction of numerous industry-led standards such as the International Food Standard or the British Retail Consortium Standard the requirements of which manufacturing companies are required to meet if they wish to supply to the major purchasing organisations in Europe or North America.

The introduction of new legislation has also taken place particularly within Europe. The three basic food hygiene regulations are:

- 852/2004 on the hygiene of foodstuffs;
- 853/2004 laying down specific rules for food of animal origin; and
- 854/2004 laying down the specific rules for the organisation of official controls on animal products intended for human consumption.

Food business operators are effectively required to put in place, implement and maintain a permanent procedure, or procedures, based on HACCP principles.

Canned fish is seen as intrinsically healthy, convenient and tasty. The UK market for canned fish is currently worth some £474 million at retail, equivalent to 108 624 tonnes. Standard tuna products at 55% comprise the largest sector of this market, canned salmon is second with 20%, and the oily fish, sardines, mackerels and pilchards together comprise 13.8%. Added value tuna products now account for 5% of the canned fish category and have been a key driver for growth in recent years. Product innovation has been instrumental in providing new products launched to meet incremental consumer needs identified through consumer research.

This handbook is intended as a technical reference and help for all those fish canning companies wishing to meet the demands of the technically discerning retail and trading organisations and thus greatly increase their opportunities for export.

Les Bratt

Data source: AC Nielsen Scantrack 52w/e 24th January 2009.

1 Legal requirements for producers selling canned fish into Europe

John Hammond

1.1 INTRODUCTION

The European Union (EU) represents a single market of nearly 500 million consumers across 27 Member States. Whilst large, it is less than half the size of India and a little more than one third of the size of China. The need to compete effectively with such global economies has been a major factor in the expansion of the EU over the last 50 years, from an initial Economic Community of just six Member States.

The EU remains first and foremost a 'Common Market' and in pursuit of this most of the food laws that apply in the 27 individual Member States have been developed and agreed by the EU.

As with most food law in well-developed market economies, the main functions of the controls are:

- To protect the health of people, animals and plants;
- To ensure that consumers are not misled about the composition and origin of the food that they purchase;
- To support fair competition in order that well run businesses that meet their legal obligations are not put at a competitive disadvantage in comparison with companies that take a less rigorous approach to compliance; and
- To promote free trade so that goods legally manufactured or imported into one Member State can then move freely across the entire EU.

EU food law is part of a wider legislative framework that is designed to secure the free movement of people, services, capital and goods, including food and feed, throughout its Member States. The French term *Acquis Communautaire* is often used to denote the various treaties, regulations and directives passed by the European institutions, as well as judgements reached by the European Court of Justice. The elements that control the production and marketing of food and feed are described in this chapter.

But first it is necessary to understand and distinguish the different types of EU legal instruments.

Much of the earlier body of EU food law was developed in the form of Directives. As the term suggests, they directed Member State governments to give effect to the detailed requirements set out in the Directive, but crucially left Member States with the flexibility to adopt their own national legislation to achieve this. One potential disadvantage of this approach was that Member States might implement the Directive into their national legislation slightly differently, and that any divergences might then impede the free movement of goods, one of the original objectives of developing the legislation.

For this reason, therefore, in recent years most EU food laws have been made in the form of Regulations. These apply fully and equally in all Member States without the need for implementing legislation and thus without the danger of national variations. All that is normally required in national legislation is a simple legal instrument to provide for the execution and enforcement of the EU Regulation and to put in place a system of sanctions in cases of non-compliance.

1.2 IMPORTS INTO THE EU

Against this background, it is clear that the rules that apply to imports from countries outside the EU, often termed 'third countries', are vital to ensure the most complete possible protection of EU consumers and industries.

The controls placed on such imports differ according to the type of food concerned.

Commission Decision 2007/275/EC (European Union, 2007a) draws up a list of animals and animal products, including fish that are subject to controls at border inspection posts.

Commission Decision 2001/881/EC (European Union, 2001b), as amended, lists the designated Border Inspection Posts where official veterinarians undertake veterinary checks on live animals and animal products in conjunction with the competent authorities.

Each year, the infrastructure, equipment and working of each post are inspected by a Commission veterinary expert in cooperation with the competent national authorities.

Border Inspection Post checks are carried out in close cooperation with customs officials; the list of products subject to inspection is defined by reference to the combined nomenclature (CN) established by Council Regulation (EEC) No. 2658/87 (European Union, 1987) on the tariff and statistical nomenclature.

The following products are specifically listed under, amongst others, the following principal headings:

- 16 04 Prepared or preserved fish; caviar and caviar substitutes prepared from fish eggs; and
- 16 05 Crustaceans, molluscs and other aquatic invertebrates, prepared or preserved.

At Border Inspection Posts, the product's identity and documentation are checked and some physical checks are also made, for example, on the product's packaging and labelling; laboratory testing may also be undertaken.

Consignments of food found not to comply with EU legislation are either destroyed or, under certain conditions, re-despatched within 60 days.

Because products of non-animal origin are inherently less hazardous than those of animal origin, the controls on their importation into the EU are less strict.

In broad terms, such products must meet the safety requirements of the EU General Food Law Regulation; they must not be unsound or unwholesome; and they must comply with any other specific legislative controls.

1.3 GENERAL FOOD LAW

Despite the agreement of many product and subject-specific EU food controls, until 2002 there was no EU instrument that laid down broad principles governing food and feed in general and their safety in particular. To fulfil this need, and because a number of different concepts, principles

and procedures had been included in pre-existing national food laws, Council Regulation (EC) No. 178/2002 (European Union, 2002a), laying down the general principles and requirements of food law, was adopted. This instrument also established a body charged with undertaking risk assessment known as the European Food Safety Authority (EFSA).

Under Council Regulation 178/2002, food must not be placed on the market if it is unsafe. Food is deemed to be 'unsafe' if it is considered to be:

- Injurious to health; or
- Unfit for human consumption.

In deciding whether or not food is 'unsafe', it is necessary to take into account:

- The normal conditions of use of the food by the consumer and at each stage of production, processing and distribution; and
- The information provided to the consumer, including information on the label or other information generally available to the consumer concerning the avoidance of specific adverse health effects from a particular food or category of foods.

In determining whether a food is 'injurious to health', the Regulation goes on to say that it is necessary to consider:

- Not only the probable immediate and/or short-term and/or long-term effects of that food on the health of the person consuming it, but also on subsequent generations;
- The probable cumulative toxic effects; and
- The particular health sensitivities of a specific category of consumers where the food is intended for that category of consumers.

Furthermore, food business operators at all stages of production, processing and distribution must ensure that foods satisfy the requirements of food law which are relevant to their activities and must verify that such requirements are met.

Whilst the general food safety requirements would, in almost all respects, have been preceded by earlier national legislation in each EU Member State, the Regulation did introduce more novel requirements for traceability and for the withdrawal and/or recall of unsafe food.

Specifically, the Regulation requires that the traceability of food and any other substance intended to be, or expected to be, incorporated into a food to be established at all stages of production, processing and distribution.

Although at first reading this may appear to be onerous, in fact it is a simple requirement for food business operators to be able to identify any person who has supplied them with a food or any substance intended to be, or expected to be incorporated into a food or feed. Similarly, food business operators must be able to identify businesses (but not, crucially, the ultimate consumer) to which they have supplied their products. In each case, this information must be made available to the competent authorities on demand.

The requirement thus falls far short of requiring full internal traceability, whereby it would be necessary to identify which consignments and deliveries of raw materials and ingredients had been incorporated into what batches of finished food.

The second new responsibility placed on food business operators by Council Regulation 178/2002 was for those who consider or have reason to believe that a food which they have imported, produced, processed, manufactured or distributed is not in compliance with the food safety requirements. In

such cases, where the food has left the immediate control of that food business operator, the food business operator must immediately initiate procedures to withdraw the food from the market and inform the competent authorities. Where the product may have reached the consumer, the operator must effectively and accurately inform the consumers of the reason for its withdrawal and, if other measures are not sufficient to protect public health, recall from consumers products already supplied to them.

One such case in 2007 involved the withdrawal of canned fish liver containing very high levels of dioxins and in particular dioxin-like polychlorinated biphenyls (PCBs). Although no maximum level had then been established for these substances in fish liver and processed products thereof, the concerned competent authorities prohibited the marketing of the products because they were deemed to be unsafe.

1.4 PRODUCT-SPECIFIC CONTROLS

In its earliest years, the then European Economic Community comprised a much smaller and arguably more coherent group of six nations. At that time, a key objective of food law was to reach Community-wide agreement on the composition and labelling of a wide range of internationally traded foodstuffs.

As the Community enlarged, however, the food-processing industries and the culinary traditions of the various Member States became ever more varied. As a consequence, it became much harder to reach agreement on compositional and related controls governing the production and marketing of particular types of food.

In the face of such difficulties and in the wake of an important judgement of the European Court of Justice in the *Cassis de Dijon* (European Court of Justice, 1979) case, a new approach became necessary.

In 1982, therefore, the European Commission (in effect the civil service of the EU) abandoned further plans to harmonise food standards in this way. Instead it suggested that, as a general principle, products legally manufactured and marketed in one Member State should, provided they were properly and informatively labelled, be capable of being traded freely across the EU.

Initially, the new approach was largely forward looking. Although, since then, there have been initiatives designed to modernise and simplify earlier controls, notably as part of the Simplification of the Internal Market (SLIM) (SLIM, 1996) Programme, a number of compositional standards remain in place, including those controlling preserved sardines and sardine-type products and separately canned tuna and bonito.

Both were developed under Regulation (EEC) No. 3796/81 (European Union, 1981) on the common organisation of the market in fishery products, which allows for Community-wide marketing standards for fishery products to be developed, particularly to ensure that products of unsatisfactory quality are marketed as well as to facilitate trade based on fair competition.

Council Regulation (EEC) No. 2136/89 (European Union, 1989c) as amended by Commission Regulation (EC) No. 1181/2003 (European Union, 2003b) defines the standards governing the marketing of preserved sardines and the trade descriptions for preserved sardines and preserved sardine-type products marketed in the EU.

Only products covered by CN codes 1604 13 11, 1604 13 19 and ex 1604 20 50, prepared exclusively from fish of the species *Sardina pilchardus* Walbaum, pre-packaged with any appropriate covering medium in a hermetically sealed container and sterilised may be marketed as preserved sardines.

The Regulations prescribe and define the presentations in which preserved sardines may be marketed ('sardines', 'sardines without bones', 'sardines without skin or bones', 'sardine fillets', 'sardine trunks' or any other form clearly distinct from these), names for certain covering media, quality criteria and labelling requirements.

The 2003 amendment was designed to ensure that the labelling of preserved products marketed and presented in the same way as preserved sardines made a clear distinction between the two, so that consumers would not be misled.

The definition of sardine-type products was those marketed and presented in the same way as preserved sardines and prepared from fish of the following species:

- (a) *Sardinops melanosticus*, *S. neopilchardus*, *S. ocellatus*, *S. sagax* and *S. caeryleus*;
- (b) *Sardinella aurita*, *S. brasiliensis*, *S. maderensis*, *S. longiceps* and *S. gibbosa*;
- (c) *Clupea harengus*;
- (d) *Sprattus sprattus*;
- (e) *Hyperlophus vittatus*;
- (f) *Nematalosa vlaminghi*;
- (g) *Etrumeus teres*;
- (h) *Ethmidium maculatum*;
- (i) *Engraulis anchoita*, *E. mordax* and *E. ringens*; and
- (j) *Opisthonema oglinum*.

The name 'sardines' can be used only in the marketing of preserved sardine-type products if it is in combination with one of the above scientific names of the species. Common names not including the word 'sardines' may continue to be used for the marketing of sardine-type products in compliance with the food-labelling directive.

A second such Regulation, Council Regulation (EEC) No. 1536/92 (European Union, 1992), defines the standard governing the marketing of preserved tuna and bonito in the EU.

The trade descriptions tuna and bonito are reserved for products falling within the following CN codes:

- Tuna: CN codes 1604 14 10 and ex 1604 20 70; and
- Bonito: CN codes 1604 14 90, ex 1604 20 50, 1604 19 30, ex 1604 20 70, ex 1604 19 99 and ex 1604 20 90

and prepared exclusively from fish of one of the following genera:

- Tuna
 - Species of the genus *Thunnus*
 - (a) Albacore or long-finned tuna (*Thunnus alalunga*)
 - (b) Yellowfin tuna (*T. (neothunnus) albacores*)
 - (c) Bluefin tuna (*T. thynnus*)
 - (d) Bigeye tuna (*T. (parathunnus) obesus*)
 - (e) Other species of the genus *Thunnus*.
 - Skipjack or stripe-bellied tuna (*Euthynnus (Katsuwonus) pelamis*).

- Bonito
 - Species of the genus *Sarda*
 - (a) Atlantic bonito (*Sarda sarda*)
 - (b) Pacific bonito (*S. chiliensis*)
 - (c) Oriental bonito (*S. orientalis*)
 - (d) Other species of the genus *Sarda*.
 - Species of the genus *Euthynnus*, with the exception of the species *E. (Katsuwonus) pelamis*
 - (a) Atlantic little tuna (*E. alleteratus*)
 - (b) Eastern little tuna (*E. affinis*)
 - (c) Black skipjack (*E. lineatus*)
 - (d) Other species of the genus *Euthynnus*.
 - Species of the genus *Auxis*
 - (a) Frigate mackerel (*Auxis thazard*)
 - (b) *A. rochei*.

The Regulations prescribe the presentation in which tuna and bonito may be marketed and the description of the presentation to accompany ‘tuna’ or ‘bonito’ in the name of the food (i.e. solid [declaration optional], chunks, fillets, flakes, grated/shredded tuna and any other form of presentation clearly identified in the product’s name).

The conditions for the use of covering media, to be declared as part of the product’s name, are laid down. For example, the word ‘natural’ may be used only for media using the liquid exuding from the fish during cooking as the covering medium, a saline solution or water, possibly with the addition of herbs, spices or flavourings. In addition, the proportion by weight of fish in the container after sterilisation relative to the net weight must be at least 70%.

The word ‘natural’ may be used only to describe a preserved tuna or bonito product as a whole when the ‘natural’ criteria for the covering medium are met and the product is presented in ‘solid’ form, as ‘chunks’ or as ‘fillets’.

Where the covering medium is not described as ‘natural’, the proportion by weight of fish in the container after sterilisation relative to the net weight must be at least 65%, but only at least 25% in the case of forms of presentation other than as solid, chunks, fillets, flakes or grated/shredded tuna.

1.5 HYGIENE RULES

EC hygiene legislation was consolidated and simplified in 2004 through a series of regulations, the most important of which are:

- Regulation (EC) No. 852/2004 (European Union, 2004a) on the hygiene of foodstuffs;
- Regulation (EC) No. 853/2004 (European Union, 2004b) laying down specific hygiene rules for foods of animal origin;
- Regulation (EC) No. 854/2004 (European Union, 2004c) laying down specific rules for the organisation of official controls on products of animal origin intended for human consumption; and
- Regulation (EC) No. 882/2004 (European Union, 2004d) on official controls performed to ensure the verification of compliance with feed and food law, animal health and animal welfare rules.

The overall aim was to create a single, transparent hygiene policy applicable to all food and all food operators, together with effective instruments to manage food safety and potential food crises, throughout the food chain.

The revised rules are based on the following key measures:

- Implementation of a ‘farm to table’ approach;
- Introduction of a ‘hazard analysis and critical control points’ (HACCP) system in all food sectors, except the primary sector;
- Registration or approval of certain food establishments; and
- Development of guides to good practice for hygiene and the application of HACCP principles.

Under Regulation (EC) No. 852/2004, food business operators must, as appropriate, adopt the following specific hygiene measures:

- Compliance with microbiological criteria for foodstuffs: since developed as Commission Regulation (EC) No. 2073/2005 (European Union, 2005c);
- Procedures necessary to meet targets set to achieve the objectives of the Regulation;
- Compliance with temperature control requirements;
- Maintenance of the cold chain; and
- Sampling and analysis.

The food business operators must also put in place, implement and maintain a permanent procedure based on HACCP principles. This applies to food business operators carrying out any stage of production, processing and distribution of food after primary production and associated operations.

The Regulation also puts in place requirements for food premises, food preparation rooms, movable and/or temporary premises, transport, equipment, food waste, water supply, personal hygiene, foodstuffs, wrapping and packing of foodstuffs, heat treatment and training.

Specifically, the following applies in relation to heat treatment of food placed on the market in hermetically sealed containers:

- Any heat treatment is to raise every part of the product to a given temperature for a given period of time and to prevent the product from becoming contaminated during the process;
- Food business operators must check regularly the main relevant parameters (particularly temperature, pressure, sealing and microbiology), including the use of automatic devices; and
- The process used should conform to an internationally recognised standard (e.g. for pasteurisation, ultra high temperature or sterilisation).

Regulation (EC) No. 853/2004 lays down supplementary specific rules on the hygiene of food of animal origin for food business operators involved in these sectors. It is important to appreciate that these are *additional* to the rules laid down in Regulation (EC) No. 852/2004, not *replacements* for them, and that the Regulation applies to unprocessed and processed products of animal origin.

Products of animal origin mean:

- Food of animal origin, including honey and blood;
- Live bivalve molluscs, live echinoderms, live tunicates and live marine gastropods intended for human consumption; and
- Other animals destined to be prepared with a view to being supplied live to the final consumer.

Establishments handling products of animal origin, including those involved in the production of fishery products, can operate only if a competent authority has approved them. The exceptions are establishments carrying out only:

- Primary production;
- Transport operations;
- The storage of products not requiring temperature-controlled conditions; or
- Retail operations other than those to which the Regulation otherwise applies.

EC guidance (European Commission, 2006) includes a non-exhaustive list of ‘unprocessed products of animal origin’ including fresh fishery products, live bivalve molluscs, live echinoderms, live tunicates and live marine gastropods.

‘Fresh’ with regard to fishery products means unprocessed fishery products, whether whole or prepared, including products purchased in a vacuum or in a modified atmosphere that have not undergone any treatment to ensure preservation other than chilling.

Similarly, a non-exhaustive list of ‘processed products of animal origin’ is accompanied by an explanation that these are obtained by submitting raw materials to a process, such as heating, smoking, curing, maturing, drying or marinating, which leads to a substantial alteration of the initial product.

Most importantly, however, the Regulation does not extend to foods containing both products of plant origin and processed products of animal origin, although clearly the products of animal origin used to prepare such foods must be obtained and handled in accordance with Regulation (EC) No. 853/2004.

Food business operators must not use any substance other than potable water or, when Regulation (EC) No. 852/2004 or 853/2004 permits its use, clean water to remove surface contamination from products of animal origin, unless use of that substance has been approved. At present no such substances have been authorised.

Food business operators may place products of animal origin manufactured in the Community on the market only if they have been prepared and handled exclusively in establishments:

- (a) That meet the requirements of Regulations (EC) No. 852/2004, and 853/2004, as appropriate, and other relevant requirements of food law; and
- (b) That the competent authority has registered or, where required, approved.

1.6 FISHERY PRODUCTS FROM OUTSIDE THE EU

Food business operators importing fishery products from non-EU countries must ensure that:

- (a) The exporting country appears on a list, drawn up in accordance with Regulation (EC) No. 854/2004, of third countries, from which imports of that product are permitted;
- (b) The establishment from which the product was dispatched, and in which it was obtained or prepared, has been approved;
- (c) In the case of live bivalve molluscs, echinoderms, tunicates and marine gastropods, the production area appears on a list drawn up;

- (d) The product satisfies the requirements of Regulation (EC) No. 853/2004, including the requirements on identification marking (see below), the requirements of Regulation (EC) No. 852/2004 and any import conditions laid down.

In particular, Regulation (EC) No. 853/2004 contains specific requirements on the structure of vessels, landing sites, processing establishments and operational processes, freezing and storage; and

- (e) The requirements of Regulation (EC) No. 854/2004 concerning certificates and documents are met to ensure that they are a credible guarantee of public and animal health.

When required, food business operators must ensure that certificates or other documents accompany consignments of products of animal origin.

The following third countries are approved for the import of fishery products into the EU. In each case, specific factory vessels, fishery vessels and processing plants in which these exports can be handled and prepared are approved as appropriate.

Algeria	Grenada	Oman
Albania	Guatemala	Pakistan
Antigua and Barbuda	Guinea	Panama
Argentina	Guyana	Papua New Guinea
Armenia	Honduras	Peru
Australia	Hong Kong	Philippines
Bahamas	India	Russian Federation
Bangladesh	Indonesia	Saudi Arabia
Belarus	Iran (Islamic Republic of)	Senegal
Belize	Jamaica	Seychelles
Brazil	Japan	Singapore
Canada	Kazakhstan	South Africa
Cape Verde	Kenya	Sri Lanka
Chile	Korea (Republic of)	St Pierre and Miquelon
China	Madagascar	Suriname
Columbia	Malaysia	Taiwan
Costa Rica	Maldives	Tanzania
Cote D'Ivoire	Mauritania	Thailand
Croatia	Mauritius	Tunisia
Cuba	Mayotte	Turkey
Ecuador	Mexico	Uganda
Egypt	Montenegro	Ukraine
El Salvador	Morocco	United Arab Emirates
Falkland Islands	Mozambique	United States
Faroe Islands	Namibia	Uruguay
French Polynesia	Netherlands Antilles	Venezuela
Gabon	New Caledonia	Vietnam
Gambia	New Zealand	Yemen
Ghana	Nicaragua	Zimbabwe
Greenland	Nigeria	

1.7 IDENTIFICATION MARKING

Identification marks (and a similar scheme of health marks that apply only to carcasses of fresh red meat) are applied to ensure the traceability of products of animal origin throughout the food supply chain.

The identification must:

- Indicate the name of the country in which the establishment is located. This may be written out in full or shown as a two-letter code in accordance with the relevant ISO standard (International Organization for Standardization, 2006);
- Indicate the approval number of the establishment, as allocated by the appropriate Competent Authority; and
- Be legible and indelible and the characters easily decipherable.

1.8 MICROBIOLOGICAL CRITERIA

Commission Regulation (EC) No. 2073/2005 on microbiological criteria for foodstuffs applies to all food businesses involved in food production, processing and distribution including retail. Two types of microbiological criteria are laid down:

- A food safety criterion defines the acceptability of a product or a batch of foodstuff placed on the market and
- A process hygiene criterion which indicates the acceptable functioning of the production process. This type of criterion is not applicable to products placed on the market. Rather, it sets a level of contamination which, if exceeded, requires corrective actions in order to maintain the hygiene of the processing in compliance with food law.

The food safety criteria set down in the Regulation include two criteria for fishery products set out in Table 1.1.

Results from histamine in fishery products from fish species associated with a high amount of histidine are satisfactory if:

- The mean value observed is less than or equal to m ;
- A maximum of c/n values observed are between m and M ;
- No values observed exceed the limit of M .

Results are unsatisfactory if the mean value observed exceeds m , or more than c/n values are between m and M , or one or more values observed are greater than M .

No process hygiene criteria are laid down for fishery products, other than for cooked crustaceans and molluscan shellfish, such as oysters, clams and winkles.

Table 1.1 Food safety criteria for fishery products.

Food category	Microorganisms/ their toxins, metabolites	Sampling plan ^a		Limits ^b		Analytical reference method ^c	Stage where the criterion applies
		<i>n</i>	<i>c</i>	<i>m</i>	<i>M</i>		
Fishery products from fish species associated with a high amount of histidine ^d Examples: tuna, mackerel, sardines, mahi	Histamine	9 ^e	1	100 mg/kg	200 mg/kg	High performance liquid chromatography (HPLC)	Products placed on the market during their shelf life
Fishery products which have undergone enzyme maturation treatment in brine, manufactured from fish species associated with a high amount of histidine Example: anchovies	Histamine	9	2	200 mg/kg	400 mg/kg	HPLC ^f	Products placed on the market during their shelf life

^a*n*, number of units comprising the sample; *c*, number of sample units giving values more than *m* or between *m* and *M*.

^bFor points 1.1–1.24 *m* = *M*.

^cThe most recent edition of the standard shall be used.

^dParticularly fish species of the families: Scombridae, Clupeidae, Engraulidae, Coryfenidae, Pomatomidae and scomberesoidae.

^eSingle samples may be taken at retail level. In such a case, the presumption laid down in Article 14(6) of Regulation (EC) No. 178/2002, according to which the whole batch should be deemed unsafe, shall not apply.

^fReferences: (1) Malle P., Valle M. and Bouquelet S. (1996) Assay of biogenic amines involved in fish decomposition. *Journal of AOAC International*, **79**, 43–49. (2) Duffos G., Dervin C., Malle P. and Bouquelet S. (1999) Relevance of matrix effect in determination of biogenic amines in plaice (*Pleuronectes platessa*) and whiting (*Merlangus merlangus*). *Journal of AOAC International*, **82**, 1097–1101.

1.9 LABELLING

Food labelling in the EU is principally controlled by Council Directive 2000/13/EC (European Union, 2000b) (which consolidated an earlier and much-amended Directive 79/112/EEC) on the labelling, presentation and advertising of foodstuffs.

It requires that the labelling information with which it is legally required to be labelled in a language that is readily understood by the consumer. (UK case law has determined that in practice this means the English language for products marketed in the UK.)

The ‘General Food Labelling Requirement’ set out in the Directive applies to almost all food for human consumption including canned fish, other than preserved sardines, tuna and bonito which, as explained earlier, are subject to more specific regulations.

These products are, however, subject to other controls on labelling set out in Directive 2000/13, notably those on claims; nutrition labelling, misleading descriptions; manner of marking or labelling; and intelligibility.

1.9.1 Name of food

If a name for a food is prescribed by EU law, that name must be used for the food.

Although a number of names are prescribed by law for certain fish species within Council Regulation (EC) No. 104/2000 (European Union, 2000a) and Commission Regulation (EC) No. 2065/2001 (European Union, 2001a), these naming rules extend only to the sale of:

- Live fish;
- Fish chilled and frozen fish;
- Fish fillets and other fish meat (whether minced or not);
- Dried, salted or brined fish;
- Smoked fish; and
- Crustaceans (except crustaceans which are both cooked and peeled) and (molluscs) except cooked molluscs.

Thus, canned fish are outside their scope.

Where there is no name prescribed by law, a customary name may be used. A customary name is one that over time has come to be accepted by consumers in the area where the food is sold, without the need for further explanation. An example in the UK might be Cullen Skink, a soup made from smoked haddock.

If there is no name laid down by law and no customary name, or it is not used, a descriptive name must be used. The name of the product must be sufficiently precise to inform the purchaser of the true nature of the food, to enable it to be distinguished from products with which it could be confused and, where necessary, to include a description of its use. For example, 'true nature' means a clear and accurate description of the characteristics of the food but does not require a detailed description including all of the main ingredients. A trademark, brand name or fancy name cannot legally be regarded as the name of the food, however well recognised they may be.

Although a scheme has been established within the EU to protect certain types of food names as Protected Designations of Origin, as Protected Geographical Indications or as Traditional Speciality Guaranteed, at present these extend only to certain types of agricultural products and foodstuffs. So, although it is possible to register names of qualifying fresh fish, molluscs, crustaceans and products thereof, no such facility exists for processed products.

1.9.2 Indication of treatment in the name of the food

Where a purchaser could be misled by the omission of an indication that the food is in a particular physical condition, for example flaked, or has been subjected to a treatment, such as smoking, the legal name of the food must be coupled with such an indication. This could be particularly relevant to fish products incorporating minced fish.

1.9.3 Ingredient listing

Almost all manufactured foods are also required, when pre-packed, to carry a list of ingredients. These are defined as any substance, including any additive and any constituent of a compound ingredient, which is used in the preparation of the food and which is still present in the finished product.

To simplify food labels, certain generic names listed may be used instead of more specific ingredient names, provided that any specified conditions are met.

Amongst the permitted generic names are:

Generic name	Ingredients	Conditions of use of generic name
Fish	Any species of fish	The label of the food must not refer to specific species of fish.
Herb, herbs or mixed herbs	Any herb or parts of a herb or combination of two or more herbs or parts of herbs	The proportion in the food must not exceed 2% by weight of the food.
Oil	Any refined oil other than olive oil	<i>Oil</i> must be accompanied by either the description <i>animal</i> or <i>vegetable</i> , as is appropriate, or an indication of the specific animal origin or the specific vegetable origin of the oil (as is appropriate). In the case of hydrogenated oil, the description <i>hydrogenated</i> must also be used.
Spice, spices or mixed spices	Any spice or any combination of two or more spices	The proportion in the food must not exceed 2%.

1.9.4 Allergen labelling requirements

Council Directive 2003/89/EC (European Union, 2003a) sets out requirements for the labelling of allergenic ingredients and ingredients derived from an allergenic ingredient.

The requirement is to list specified allergens and, where pre-packed foods are made using these allergens, or their derivatives, a clear reference to the source allergen must be made in the ingredients list (where appropriate). The list of allergenic ingredients that must be declared in this way includes:

- Crustaceans and products thereof;
- Fish and products thereof; and
- Molluscs and products thereof.

Although the legal requirement is for the word ‘fish’ to appear, the use of common names such as salmon, tuna and mackerel would normally be taken to indicate the presence of ‘fish’. The nature of any more exotic species should, however, be made clear.

A similar approach applies in relation to the presence of crustaceans.

Molluscs include oysters, squid, cockles, mussels, periwinkle and scallops.

All added ingredients and components of added ingredients are covered by the requirements if they are present in the finished product, even in an altered form. This includes carry-over additives, any substances used as processing aids, and solvents and media for additives or flavourings.

There are currently no statutory rules governing labelling for a possible low-level presence of allergens due to cross-contamination of foods. Advisory labelling on possible cross-contamination with allergens would normally be justified on the basis of a risk assessment applied to a responsibly managed operation. Generally, warning labels should only be used where there is a demonstrable and significant risk of allergen cross-contamination and should not be used as a substitute for good manufacturing practice.

1.9.5 Quantitative ingredient declaration

To provide consumers with useful comparative information about potentially competing products prior to their purchase and as an alternative to the development of further compositional standards and reserved descriptions, rules for Quantitative Ingredient Declaration (QUID) have been introduced in the EU.

The quantity of an ingredient or category of an ingredient used in the preparation of food must be indicated when:

- The name of the ingredient appears in the name of the food (mackerel in tomato sauce);
- The name of a category of ingredients appears in the name of the food (fish soup);
- The consumer usually associates an ingredient or category of ingredient with the name of the food (fish in Bouillabaisse); and
- The ingredient or category of ingredients concerned is emphasised on the labelling in words, pictures or graphics.

QUID is not, however, required where a product's net drained weight is indicated along with its net weight as referred to in Directive 2000/13. This requires solid foods presented in a liquid medium to declare their drained net weight in addition to the net weight. 'Liquid medium' means the following, including in mixtures and also where frozen or quick frozen, provided that the liquid is merely an adjunct to the essential elements of the preparation and thus is not a decisive factor for purchase:

- Aqueous solutions of salts, food acids, sugars or other sweetening substances;
- Water;
- Brine; and
- Vinegar.

Guidance for the Verification of Drained Weight, Drained Washed Weight and Deglazed Weight and Extent of Filling of Rigid Food Containers has been published by WELMEC (2006).

The exemption will not apply if, on mixed ingredient products, one or more ingredient was emphasised in some way, because the amount of that ingredient could not be calculated from the given weight indications.

The quantity of an ingredient or category of ingredients is generally expressed as a proportion of the total food at the 'mixing bowl' stage.

QUID declarations on products, the composition of which has been changed by cooking or other treatments involving the loss of moisture, may be based on the amount of the ingoing ingredient expressed as a percentage of the weight of the final product.

Where this calculation leads to declarations exceeding 100%, the declaration should be replaced with statements giving the amount of the ingredient used to make 100 g or mL of the final product, for example, 'Made with *x* grams of fish per 100 g'.

1.9.6 Date marking

Long-life products such as canned or jarred fish and fish products with a shelf life of more than 18 months are required to carry a durability indication in the form of 'best before' followed by the date up to and including which the food can reasonably be expected to retain its specific properties, if properly stored.

Where the food has a shelf life of more than 18 months, the date may be expressed in terms of the year only if the words ‘best before’ are replaced by the words ‘best before end’, for example, ‘best before end 2010’.

Where a food has a shelf life of less than 18 months, it may be expressed in terms of a month and a year only, for example ‘best before end December 2010’.

Such declarations need to be followed by any storage conditions that need to be observed if the unopened food is to retain its specific properties up to the date indicated. In the case of canned food, it would be unlikely that any specific storage conditions would need to be specified.

Such storage conditions relate to the food whilst it remains unopened. In addition to this, however, special storage conditions or conditions of use have to be given if the consumer needs to observe certain practices once the packaging of the food has been opened, for example ‘once open, remove from can, keep refrigerated and covered and consume within 3 days’.

It is possible to ‘signpost’ a date mark, for example, to indicate that the best before date is stamped or printed onto the base or lid of a can. In this case words such as ‘for best before see can end’ would be appropriate.

1.9.7 Name and address

It is also a requirement to indicate the name or business name and an address or registered office of either or both of:

- A manufacturer or packer; or
- A seller established within the EU.

This requirement enables consumers to contact a person responsible for the foodstuff and the details should therefore be sufficient to allow such contact to be made by post. Whilst customer care telephone numbers and website address can be supplied additionally, they cannot replace the postal address.

1.9.8 Origin marking

Particulars of the place of origin or provenance of a food are required where any indication or pictorial representation might mislead a consumer to a material degree as to the true origin or provenance of a food. Care is therefore required to ensure that the true place of origin is given if a food’s name, or its brand or trade name, includes a reference to a place in such a way which, when taken with other written illustrative information given on the label, could imply that the food comes from or has been made in a particular place or area. Where it is not possible to refer to a single country, information that is given should be as specific as possible, for example, by listed alternative supplier countries or groups of countries recognisable to consumers; even phrases like ‘origin will vary’ may be more helpful than no information at all.

1.9.9 Instructions for use

Instructions for use must be given if it would be difficult to make appropriate use of the food without them. Any instructions provided must be sufficiently detailed to enable appropriate preparation or use to be made of the food.

1.9.10 Location of information

All of the labelling requirements are required to appear on the packaging (or on a label attached to the packaging or on a label that is clearly visible through the packaging).

When the food is sold otherwise than to the ultimate consumer, for example to a caterer, then the details may be contained in the relevant commercial documents, providing it could be guaranteed that these documents can be provided when or before the food is delivered. In such cases, however, the name of the food, the indication of durability and the manufacturer, packer or seller's name and address details must always appear on the outermost packaging in which that food is sold.

1.9.11 Intelligibility

To ensure clarity of labelling information under normal conditions of purchase, all of the labelling information should be easy to understand. This would normally mean that it is provided in the official language(s) of the country(ies) to which the foods are being exported, should also be clearly legible and indelible and marked in a conspicuous place so as to be clearly visible and not hidden, obscured or interrupted by other written or pictorial matter.

1.9.12 Field of vision

Certain information must be provided in the same field of vision at least once on the label, namely:

- The legal name;
- The durability indication (or a signpost to it); and
- The quantity mark.

The same field of vision is understood to mean simultaneously readable under normal conditions of retail sale. It does not necessarily mean on the same face of the pack, but it does mean that the consumer must be able to read the information without having to keep turning the product in order to find it. So, for example, part of the side of a can and its top or bottom might well be in the same field of vision, but opposite sides of a can would not.

1.9.13 Nutrition labelling

Under Council Directive 90/496/EEC (European Union, 1990b) on nutrition labelling for foodstuffs, the provision of nutrition labelling is optional unless a nutrition or health claim is made about a food.

So, for example, whilst the indication of a fish product's content would not constitute a nutrition claim, statements such as 'low saturates' or 'reduced salt' would.

When nutrition information is provided, either the 'Group 1' format or the 'Group 2' format as set out below, must be used. However, where a nutrition claim is made for sugars, saturates, fibre or sodium, the Group 2 format is mandatory.