

**FISH in  
NUTRITION**

# FISH IN NUTRITION

*Edited by*

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## PREFACE

**D**URING the past ten years FAO has devoted considerable time, energy and expenditure to the study of the world's fishery resources and to the problem of how best to exploit and utilize them. Its Fisheries Division has promoted a number of useful studies and published their results in a series of books.

The present volume is the outcome of an FAO Conference on "Fish in Nutrition" held in Washington in September 1961. This Conference, as the title indicates, had a broader scope than any previous one, inasmuch as its theme included the study of human nutrition as well as animal nutrition.

The Conference, which was attended by about three hundred participants from many countries, aroused keen interest throughout the world. Seventy papers were submitted by experts from twenty-four nations, and the majority of those attending took part in the discussion. I believe that the information thus collected is of such value that it should be made available to a wider public. With this end in view, the proceedings of the Conference are now being published in the form of this book.

The Conference, among other things, focused attention on the problems of human nutrition the urgency of which has been brought to the fore through the Freedom from Hunger Campaign. A large proportion of the world's population suffer from varying degrees of malnutrition. Protein deficiency is one of the major causes of malnutrition, and it is obvious that fish, a protein-rich food, could be an important factor in reducing the incidence of malnutrition. Yet, the present harvest of fish is still below 40 million metric tons, that is, less than one per cent of the total world food production. It would seem then that quantitatively fish plays a negligible part in the world's food supply, a situation that lends itself to vast improvement through a more rationalized exploitation of the resources of the sea for providing human nutrition.

It would be appropriate here to recall the message which was sent to the Conference by President Kennedy. He said: "A first responsibility of the human race is to see that its members have enough to eat. . . . Nutritional problems are not peculiar to countries where food is scarce. Protein malnutrition is, in fact, a serious disease affecting nearly two-thirds of the world's population. There is, therefore, an urgent need for the exploitation of what is probably the major untapped source of food: products from seas and inland waters. . . . Your part in the task that lies ahead, like that of other dedicated people in commerce, in laboratories, in factories, farms and fishing boats, is to recreate the miracle of the loaves and fishes—a miracle no less spiritual for being scientific."

I am glad to have this opportunity of adding my own thanks, and those of FAO, to the many tributes already paid to all those who helped to ensure the smooth running and success of the Conference. Finally, in commending this book, I must express the hope that its study may soon result in a marked increase and improvement in the use of fish and fisheries products in the fight against hunger and malnutrition.

B. R. SEN  
*Director-General,  
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## INTRODUCTION

**T**HE FAO Conference on Fish in Nutrition was unique in so far as it brought together for the first time on an international platform people working in fisheries, in production as well as research, with specialists in nutrition and animal feeding. Its object was to evaluate some of the existing knowledge of the rôle of fish in human and animal feeding, and to stimulate further study and exploration.

One such matter which emerged was the possible rôle of fish protein concentrates in human nutrition, a product which is not only needed now to relieve animal protein shortage in diets, but will become more and more necessary in nutrition as population density increases. It may be said that fish protein concentrates furnish a way of making directly available to man the riches of the multitudinous "small fishes" which abound in the ocean but are only slightly used in contrast to the larger and more expensive forms of fish which at present mark consumer taste.

The Nutrition Division and the Animal Production and Health Division of FAO, who are vitally concerned with developing a more extended use of food from the sea, collaborated extensively and, while it was left to the Fisheries Division to take the lead, the effort and the result must be regarded as the outcome of a joint undertaking.

The Conference was fortunate in having as its Chairman Mr. Donald McKernan, Director of the U.S. Bureau of Commercial Fisheries. This Bureau indeed was largely responsible for stimulating the interest and active support of the U.S. Government and of other national bodies. Thanks must also be expressed to the U.S. National Institutes of Health, whose grants made it possible to bring to Washington such an impressive number of distinguished experts.

Many people shared the work, not only of preparing the original papers, but also of getting these into suitable shape for presentation at the Conference. Amongst those who must be especially mentioned are A. G. van Veen, Nutrition Division of FAO; J. C. Shaw, Animal Production and Health Division; D. G. Snyder, Bureau of Commercial Fisheries, U.S.A., who acted as associated editors, assisted by A. D. Ingram-Schirato, and M. R. Khan, Fisheries Division, who prepared the index. Other tasks fell to members of our staff: M. Laing, P. McLaughlin, P. Andrews, D. D. Tapiador, M. C. de Freitas. The translations were done by P. M. Frances and A. M. Rosfelder.

Conferences such as this one serve to catalyse action. It is to be hoped that the rate of progress will be an increasing one and that steady advances on many fronts will be made to the end that man may harvest and put to better use a crop which is, after all, a gift of nature.

D. B. FINN  
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## NOTE FROM THE CHAIRMAN

**T**HE seas offer a wealth of nutritional resources. They already are a principal source of protein. They can provide many times the current food supply if we but learn how to garner and husband this self-renewing larder. To meet the vast needs of an expanding population, the bounty of the sea must be made more available. Within two decades, our own nation will require over a million more tons of seafood than we now harvest."

This statement, made by President Kennedy in a message to Congress in March 1961, delineates in a few words the theme and objective of the FAO International Conference on Fish in Nutrition, held in Washington, D.C., on September 19-27, 1961.

This Conference was indeed convened to discuss how the living resources of the sea—first harvested by our fishermen and then processed by our fish plants—have contributed in the past and can contribute in the future to man's health and welfare.

In fact, FAO has recently postulated that these marine resources even now produce a larger supply than that from cattle and swine on the land. The stark realities of the world population explosion and of world hunger cannot be longer ignored. Viewed against this background of hungry multitudes, the discussions and presentations covered in this book assume historic importance. Few question the estimates of demographers that world population is increasing at a rate never before experienced in the history of man. It has been estimated that in A.D. 1600 the population of the earth was 300 to 400 million people. Two centuries later this figure had doubled and from then on population growth accelerated at an ever-increasing rate. By 1900, the population had risen to about 1,500 millions and during the last 60 years that figure doubled again. An indication of what is going to happen in the future is given by many experts, who forecast that within the next 40 years we will have reached the 6 billion mark.

On the other hand, nutritionists from the Food and Agriculture Organization, the World Health Organization, and other international agencies, in assessing the present state of food production in the world, estimate that two-thirds of the present world population does not receive an adequate daily diet.

One child dies of hunger every second of the year; of the 900 million children under 15 years of age, more than 500 million live and die critically undernourished and the catalogue of associated miseries could be continued over many pages, with statistics collected from all the continents.

Hunger can mean many things to various people. The term commonly describes conditions ranging from acute, extreme starvation to the symptoms of "hidden hunger". By and large, however, the dietary nutrient most lacking in deficient diets all over the world is good quality protein.

What is understood by this term "good quality protein"?

In man's long and arduous struggle to understand the nature, composition and function of food-stuff, he at least learned that Hippocrates was wrong when he said, some thousands of years ago, that man required nothing but energy to subsist. We know today that the human body requires a large number of different components which it cannot synthesize itself. Among these are certain protein components, called essential amino acids, and it is the combined presence and proportions of these in foods that determine their value. Only animal proteins contain all the essential amino acids that man cannot synthesize himself, and only animal proteins are, without supplementation, considered to be "good quality proteins".

### *Note from the Chairman*

Good quality proteins are not universally available in sufficient quantities in the form of agricultural products. Furthermore, land resources for crops and animal grazing are not inexhaustible; only one-fifth of the total available crop land is left unutilized and this, at best, could only supply enough food (predominantly vegetable) for presently underfed peoples—and this only if the most modern agricultural methods could be applied world-wide. Even if this could be achieved—and great capital expenditures and major educational and technological efforts will have to be made in this direction—there would still be a serious deficit in the supply of animal proteins to supplement adequately the diets of today's population, let alone that of tomorrow's additional millions.

In view of this, it is not surprising that, in their quest for food, scientists and industrialists all over the world have again focused their attention upon the seas as a vast potential source of nutrients.

The high nutritive value of fish protein has been recognized since earliest times, but notable utilization of this food has always been limited to certain areas owing, in part, to the extremely perishable nature of fish.

As the first topic to be considered at this Conference, it seemed logical to review the rôle of fish in world nutrition. It seems strange with over three-quarters of our globe covered by the sea, and with living matter found not only in the surface film but to some degree at least at all intermediate levels even down to the great depths within the ocean, that such a small amount of our present total food supply is contributed by the sea. Our present-day harvest of some 40 million metric tons of fish and fisheries products provides only a small part of the food consumed in the world today. This figure is significant in view of the fact that the current annual food deficit has been estimated to be greater than the present total world fish production.

We considered at this Conference to what extent the sea could contribute to this great need for food for the future. We examined the potential productivity of the sea and the practicability of doubling or even tripling the harvest of its living resources. We went even one step further and examined briefly what means or methods, what research and engineering, are going to be necessary to bring about the full use of the living resources of the world's oceans.

Our second topic at the Conference was to examine the chemical composition of fish and fisheries products in order to ascertain their wholesomeness and the desirability of using fish protein to an increasing extent in the human diet. We wanted to know to what extent is knowledge available which will allow us to assess the nutritional attributes of fish protein, and are there unique qualities in fish which can be helpful in overcoming the protein deficiencies in the human diet?

Experts present at this Conference discussed the present state of knowledge concerning how fish should be prepared to provide maximum nutritional benefits. We know there are nutrient losses in the preparation and processing of fisheries products. Can we develop specific information on how these losses occur and in what directions must we go to maximize, by special processing, the benefits from the fish resources harvested? How can we use existing information, and develop new information, to provide a maximum amount of the kinds of nutrients which are needed in various national diets?

The third general topic concerned the contribution of fish and fisheries products in the various national diets. It is obvious that we need to assess the present contribution, to determine what limitations exist, and what can be done to overcome these limitations to the greater use of fish in nutrition.

This Conference, as represented by the present book, has attempted, for the first time, to bring before the world the various means for increasing not only the harvest of fish but also the number, variety, and nutritive value of the products manufactured therefrom, and thus permit fish to assume, on a world-wide basis, its rightful rôle in human nutrition.

The realization of these objectives has taxed the energies of all participants, but I believe that the set goals have, to a large extent, been reached. This Conference and the concerted, international

*Note from the Chairman*

efforts that it represents can, of necessity, be only a modest beginning. Much remains to be done, for the overall task of providing additional food for our world's peoples is urgent and the obligations compelling. It is our hope that this book will inspire continued efforts to make the benefits of nutritious foods available to all of mankind.

Great credit is due the FAO for its foresight in having perceived the need for this Conference and for the organizational work associated with it as well as to the respective FAO-member nations for their enlightened support of its objectives. Congratulations are due also to the many people who have contributed so freely and wholeheartedly of their time and effort in order that this valuable reference text could be made quickly available to those in need of information on the nutritive value of fish and shellfish.

*Donald L. McKernan.*

*Chairman,  
FAO Conference on Fish in Nutrition*



## CONTENTS

	<i>Page No.</i>		<i>Page No.</i>
LIST OF ILLUSTRATIONS . . . . .	ix	The Amino Acid Composition of Fish Muscle Proteins . . . . . <i>G. Hamoir</i>	73
LIST OF CONTRIBUTORS . . . . .	xi	Effects of Biological Factors (Sex, Seasonal Races, Spawning Migrations) on Fat, Protein and Water; their Distribution in Sea-Trout ( <i>Salmo trutta</i> L.) . . . . . <i>J. T. Kukucz</i>	76
PREFACE . . . . . <i>B. R. Sen</i>	xvii	Sur la présence naturelle de formaldéhyde dans les produits alimentaires marins . . . . . <i>F. Soudan</i>	78
INTRODUCTION . . . . . <i>D. B. Finn</i>	xix	Enzymes of Marine Fish Muscle and their Rôle in Fish Spoilage . . . . . <i>Günther Siebert</i>	80
CHAIRMAN'S NOTE . . . . . <i>Donald L. McKernan</i>	xxi	Endogenous Proteolytic Enzymes and their Action on Water-Soluble Fish Tissue Proteins <i>A. M. Dollar and C. M. Blackwood</i>	83
		Discussion . . . . .	84
<b>PART I—THE RÔLE OF FISH IN WORLD NUTRITION</b>			
The World Biomass of Marine Fishes <i>Herbert W. Graham and Robert L. Edwards</i>	3	<b>LIPIDS AND VITAMINS</b>	
World Aquatic Biomass—Its Future Abundance <i>G. L. Kesteven</i>	9	The Lipids of Fish and Changes occurring in them during Processing and Storage <i>J. A. Lovern</i>	86
Discussion . . . . .	21	Oxidation of Fish Lipids . . . . . <i>H. S. Olcott</i>	112
Importance of Fisheries Production and Utilization in the Food Economy <i>G. Meseck</i>	23	Some Modern Methods of Separation and Analysis applicable to Fish Oils <i>Ralph T. Holman</i>	117
Discussion . . . . .	37	Relationship between Processing Techniques and the Amount of Vitamins and Minerals in Processed Fish . . . . . <i>Hideo Higashi</i>	125
The Rôle of Fish in Human Nutrition <i>B. C. Guha</i>	39	B-Vitamins in Fish and Shellfish <i>Olaf R. Braekkan</i>	132
The Rôle of Fish in Animal Feeding <i>G. F. Combs</i>	43	B-Vitamins in Some Fish Products <i>Olaf R. Braekkan</i>	141
Discussion . . . . .	50	Muscle Lipids of Tuna <i>H. S. Olcott, J. Froines and C. Y. Shuster</i>	146
		The Effect of Linoleic and Linolenic Acids on the Solubility of Cod Actomyosin <i>Frederick King, Margaret Anderson and Maynard Steinberg</i>	148
<b>PART II—CHEMICAL COMPONENTS OF FISH AND THEIR CHANGES UNDER TREATMENT</b>			
<b>PROTEINS AND GENERAL COMPOSITION</b>			
Proximate Composition of Fish <i>Maurice E. Stansby</i>	55	Polyunsaturated Fatty Acids in Fish Mito- chondria . . . . . <i>T. Richardson, A. L. Tappel and E. H. Gruger</i>	150
Amino Acid Composition of Fresh Fish and Influence of Storage and Processing <i>Fritz A. L. Bramstedt</i>	61	Discussion . . . . .	151
Proteins in Fish Muscle . . . . . <i>Jens W. Jebsen</i>	68		

Contents

	Page No.		Page No.		
<b>INFLUENCE OF PROCESSING</b>		<b>The Nutritive Value of Buffalo Fish and Other Arkansas Pond-Reared Fish</b> <i>M. C. Kik</i>	257		
<b>The Influence of Refrigeration and Canning on the Nutritive Value of Fish</b> . <i>F. Bramsnaes</i>	153	<b>Valor Biológico de pescados de Consumo en España. Influencia sobre el mismo de algunas Técnicas de Conservación</b> <i>G. Varela, A. Pujol, Y. O. Moreiras</i>	259		
<b>The Influence of Drying, Salting and Smoking on the Nutritive Value of Fish</b> <i>C. L. Cutting</i>	161	<b>Tryptophan Content of Fish Meat with Special Reference to the Protein Score</b> <i>S. Konosu and F. Matsuura</i>	261		
<b>The Influence of Fermentation on the Nutritive Value of Fish with Special Reference to Fermented Fish Products in South-East Asia</b> <i>K. Amano</i>	180	<b>Studies on the Nutritional Value of Fish Flesh Proteins</b> <i>A. B. Morrison, E. J. Middleton, H. Fougère and J. A. Campbell</i>	263		
<b>The Influence of Solvent Extraction on the Nutritive Value of Fish Protein</b> <i>A. B. Morrison</i>	201	<b>The Nutritive Value of Fish Flour and its Use as a Protein Supplement</b> <i>B. C. Johnson, V. C. Metta and H. E. Schendel</i>	264		
<b>The Influence of Irradiation Preservation on the Nutritive Value of Fish and Fishery Products</b> <i>J. M. Shewan</i>	207	<b>Enrichment of Lime-Treated Corn Flour with Deodorized Fish Flour</b> <i>Ricardo Bressani</i>	266		
<b>The Effect of Storage in Refrigerated Seawater on the Amino Acids and other Components of Fish</b> . <i>Edward Cohen and John Peters</i>	220	<b>Evaluation of Fish Flour in the Treatment of Infantile Malnutrition</b> <i>G. G. Graham, J. M. Baertl and A. Cordano</i>	271		
<b>Pasteurization—A Method of Extending Storage Life of Shellfish Meats</b> <i>C. F. Dunker and G. W. Wharton</i>	222	<b>Discussion</b> . . . . .	274		
<b>On Toughness of Boiled Fish Meat</b> <i>Toyo-o Takahashi</i>	224				
<b>Fish Sausage in Japan</b> . . . <i>Minoru Okada</i>	226	<b>LIPIDS</b>			
<b>Effect of Several Processing Variables on the Protein Content and Quality of Fish Flour</b> <i>C. H. Kurtzman, D. G. Snyder, L. E. Ousterhout, F. T. Piskur and P. F. Braucher</i>	228	<b>Fish Oils in Relation to Blood Cholesterol and Cardiovascular Diseases</b> <i>Henrik Dam and Erling Lund</i>	277		
<b>Nutritional and Chemical Changes in the Lipid Fraction of Stored Anti-Oxidant-Treated and Untreated Herring Meals</b> . <i>B. E. March, J. Biely, F. Claggett and H. L. A. Tarr</i>	230	<b>Comparative Effects of Marine Oils, Marine Oil Fractions and Whole Fish Meals on Hyper- cholesteremic Rats</b> . . . <i>James J. Peifer</i>	282		
<b>Discussion</b> . . . . .	231	<b>The Relation of Fish and Fish Products to Plasma Lipids and Possibly to Atherogenesis</b> <i>L. W. Kinsell</i>	284		
<b>PART III—CONTRIBUTION OF FISH AND FISH PRODUCTS TO NATIONAL DIETS</b>		<b>Polyunsaturated Fatty Acids in Fish Fat, in the Diet and in the Blood</b> <i>Olav Notevarp and Bjorg N. Cyvin</i>	286		
		<b>Use of Fish in the Control of Hypercholesteremia and Obesity</b> <i>C. M. Harlow and A. R. Morton</i>	292		
		<b>Nutritive Values of Marine Animal Oils</b> <i>Takashi Kaneda</i>	294		
		<b>The Nutritive Value of Sardines</b> <i>S. A. Miller, H. A. Dymysza and S. A. Goldblith</i>	295		
		<b>Discussion</b> . . . . .	296		
		<b>GENERAL</b>		<b>TRACE ELEMENTS</b>	
		<b>Food Intake, Nutrition Requirements and Incidence of Malnutrition</b> <i>K. K. P. N. Rao</i>	237	<b>Importance of Minor Elements in Food, especially in Fish</b> . . . . <i>Joachim Kühnau</i>	298
		<b>Discussion</b> . . . . .	246	<b>Discussion</b> . . . . .	299
		<b>PROTEINS</b>			
		<b>Fish Proteins in Nutrition and their Importance in the Prevention of Protein Malnutrition</b> <i>Jean Mayer</i>	248		

**PART IV—FISH AND FISHERY PRODUCTS IN ANIMAL NUTRITION**

	<i>Page No.</i>
<b>GENERAL</b>	
Effects of Processing on the Nutritive Value of Fish Products in Animal Nutrition <i>L. E. Ousterhout and D. G. Snyder</i>	303
The Binding of Lysine in Herring Press-Cake heated under Controlled Conditions <i>K. J. Carpenter and C. H. Lea</i>	310
Problèmes soulevés par l'utilisation des farines de poisson pour l'alimentation des animaux <i>A. M. Leroy</i>	312
Nutritive Constituents of Fish Meal and Fish Solubles <i>Shigeo Murayama and Masaaki Yanase</i>	320
Discussion . . . . .	322
<b>RUMINANT NUTRITION</b>	
Fish and Fishery Products in Ruminant Nutrition <i>A. Ekern, T. Homb, H. Hvidsten, O. Ulvesli and K. Breirem</i>	324
Discussion . . . . .	330
<b>PIG NUTRITION</b>	
Fish and Fishery Products in Pig Nutrition <i>R. Braude</i>	332
Preliminary Report on the Use of Fresh Anchovy ( <i>Engraulis ringens</i> ) in Pig Feeding <i>A. Bacigalupo, J. Tellez, R. Pimentel and G. Gomez</i>	353
Discussion . . . . .	354
<b>POULTRY NUTRITION</b>	
Fish and Fishery Products in Poultry Rations <i>J. Baelum</i>	356

	<i>Page No.</i>
Metabolizable Energy and Digestibility Evaluation of Fish Meal for Chickens <i>L. M. Potter, W. J. Pudalkiewicz, L. Webster and L. D. Matterson</i>	364
Quality of Fish Meal in Relation to its Value as a Supplement to Corn-Soybean Meal Chick Diets <i>H. M. Scott, W. F. Dean, A. Aguilera and R. E. Smith</i>	366
Condensed Fish Solubles in Broiler Nutrition <i>J. R. Couch, A. A. Camp and C. R. Creger</i>	368
Protein Requirements of Broilers as influenced by Fish Products <i>T. D. Runnels and D. G. Snyder</i>	370
Discussion . . . . .	372
<b>FUR-BEARING ANIMAL NUTRITION</b>	
Fish and Fishery Products in Rations for Fur-bearing Animals <i>P. J. Schaible</i>	374
The Utilization of Menhaden Products by Mink <i>R. G. Warner, C. F. Bassett and R. P. Abernathy</i>	381
Discussion . . . . .	382

**PART V—DEMAND FOR FISH AS HUMAN FOOD AND POSSIBILITIES FOR INCREASED CONSUMPTION**

The Demand for Fish as Human Food <i>R. Hamlich and R. A. Taylor</i>	385
Fish Flour. Introductory paper <i>D. G. Snyder</i>	411
Technological Developments in Canada <i>H. Fougère</i>	413
Technological Developments in Iceland <i>Gudlaugur Hannesson</i>	416
Technological Developments in Scandinavia <i>Kaare Bakken</i>	419
Technological Developments in South Africa <i>G. M. Dreosti</i>	425
Technological Developments in the United States of America <i>E. R. Pariser</i>	432
Discussion . . . . .	435

## LIST OF ILLUSTRATIONS

*Publishers Note:* The illustrations used in this book are not strictly linked with the text of the articles with which they may be associated. They have been incorporated rather to illustrate the theme of the section of the volume in which they are placed and to take advantage of the space available in order to give the reader as much service as possible. The greater number of illustrations were chosen from the picture library of the Food and Agriculture Organization built over the years as the outcome of the field work undertaken by technical officers supplied by FAO to different countries and others of their travelling personnel. The sources of other illustrations are individually acknowledged. Thanks for permission to publish these pictures is gratefully extended to FAO and all others concerned.

	<i>Page No.</i>		<i>Page No.</i>
Norwegian Fishing Fleet . . . . .	22	South African Fisheries Laboratory . . . . .	229
African Method of Processing . . . . .	38	Herring Meal Output . . . . .	233
Fish Food Demonstration in Mexico . . . . .	42	Proof of Malnutrition—South America and India . . . . .	247
South African Fish Meal Production . . . . .	51	Fish Ponds in the East . . . . .	256
Drying Cod in Greenland . . . . .	60	Farming of Carp—Mexico . . . . .	260
Canning Tuna in Japan . . . . .	67	Fish Meat becomes Popular . . . . .	262
Malnutrition Rectified by Fish Protein . . . . .	72	Fish Flour for Burmese Children . . . . .	265
Good Catch of Fish in Ceylon . . . . .	111	Mixing Fish Flour with Cereals . . . . .	270
Improved Dryer for African Conditions . . . . .	116	Fish Meal in Pig Feeding . . . . .	309
Shrimp Processing in Cochin, India . . . . .	140	Poultry to benefit from Pakistani Fish . . . . .	311
A Research Chemist at Work . . . . .	145	Training Future Fish Technologists . . . . .	319
Tuna on Tokyo Market . . . . .	147	Canning Factory in Chile . . . . .	323
Canning Factory in California . . . . .	160	Fish Meal helps Balanced Pig Rations . . . . .	331
Drying and Salting Cod in Newfoundland . . . . .	179	Fish Meal for Chickens counters Deficiencies . . . . .	365
Fermented Fish (Canned), Sudan . . . . .	200	Fish Oil benefits Poultry . . . . .	367
Laboratory on Research Vessel . . . . .	219	Young Turkeys benefit from Fish Oil . . . . .	369
Refrigeration used on Shrimps, India . . . . .	221	Broiler Production on Big Scale . . . . .	373
Housewives in Fish Market, Brazil . . . . .	225	Fish used in Fighting Famine in the Congo . . . . .	410
Fish Sausage Production, Canada . . . . .	227		

## LIST OF CONTRIBUTORS

	<i>Page No.</i>		<i>Page No.</i>
ABERNATHY, R. P. . . . .	381	BIELY, Professor J. . . . .	230
Department of Animal Husbandry, Cornell University, Ithaca, New York, U.S.A.		Poultry Nutrition Laboratory, University of British Columbia, Vancouver 8, B.C., Canada.	
ADJETEY, J. . . . .	233	BIRD, Professor H. R. . . . .	50, 322, 323, 372, 382
Senior Fisheries Officer, Fisheries Division, Ministry of Agri- culture, Accra, Ghana.		Chairman, Department of Poultry Husbandry, University of Wisconsin, Madison, Wisconsin, U.S.A.	
AGUILERA, A. . . . .	366	BLACKWOOD, Dr. CHESLEY M. . . . .	83
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AMANO, Dr. K. . . . .	180, 231, 372	BORGSTRÖM, Professor GEORG . . . . .	21, 50, 232, 246, 296, 297, 299, 300, 323, 330, 354, 373, 382
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ANDERSON, MISS M. L. . . . .	148	BRAEKKAN, Dr. OLAF R. . . . .	50, 132, 141, 231, 232, 274, 275, 297, 354, 372
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AULISIO, GAETANO . . . . .	246	BRAMSNAES, F. . . . .	84, 153, 231, 232, 354
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	<i>Page No.</i>		<i>Page No.</i>
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