



trends in FISH UTILIZATION

J J Connell
R Hardy

A Buckland Foundation book

Trends in fish utilization

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Foreword

A perusal of Frank Buckland's biography written by our former colleague Dr Geoffrey Burgess failed to reveal if that august Victorian had ever expressed an opinion on the prospects for making food out of all parts of the fish that swim in the waters off British shores. It is true that his adventurous spirit compelled him to explore the effects of eating what many people would consider to be repulsive life forms but this is not quite what we have in mind for this book! He was, however, deeply involved in many of the problems which beset the fish industry of his time and we like to think that he would have been interested in the subject we were asked to write about by the Trustees of the Buckland Foundation.

The original request was confined to an examination of how far underutilized species could be used for food but this seemed to us to be only part of the wider efforts that the industry and researchers are and could be making towards the best use of our fish resources. With the agreement of the Trustees, therefore, we have taken into our discussion fish and shellfish raw materials from whatever source that in our opinion might be exploited more effectively. The scope of these raw materials and the range of things we might do with them are outlined in the Introduction.

The kinds of raw materials that we are considering are fairly numerous and vary considerably in their nature, quantity and value. In order to understand, therefore, the problems of how they might be brought into use, we have felt it necessary in Chapter 2 to examine them systematically and at appropriate length. At a number of places, the list draws on published estimates but in order to avoid replicating detailed and lengthy analyses and statistics we have presented only a selection of the main facts. Inevitably, our estimates of the quantities of fish and

shellfish flesh that could be processed and marketed are subject to considerable uncertainty and in some cases are pure guesswork. But it has been necessary for us to set down some figures in order to sustain our argument that there is a major untapped potential for food in the seas round our shores.

Ways in which the U K might go about manipulating and modifying these unused or underused resources are discussed in Chapters 3 and 4. Chapter 3 deals with methods that on technical grounds we could apply without too much difficulty, while Chapter 4 ranges over new technology from that which is just emerging to the frankly speculative. The emphasis throughout, however, has been to try to be as practical and realistic as possible. We appreciate that the fish industry usually moves steadily and is not prone to take undue risks; a book full of highly imaginative technology would not be well received.

Research ideas alone cannot make a profit for or feed anyone. There are a number of difficult non-technical factors that need to be examined and hurdles overcome before commercial success can be reasonably assured. Chapter 5 attempts to show that we are alert to these factors and consider them as important as technological ones. No doubt others are more competent to examine these factors in depth: we did not consider it our job to more than touch on them.

The whole book embodies one of the main lines on which our laboratory, Torry Research Station, has been engaged for some years. In common with scientists in other centres throughout the world, we have been trying, in response to demands for new types and increased quantities of foods, to determine ways of making use of raw materials which nobody considered useful before. If there is anything entirely new in the book we claim it as our own but most of the ideas we describe stem from colleagues at Torry and elsewhere. To all those who have been or are engaged in this kind of research we owe a debt of gratitude. It should be made clear that any views expressed in the book are personal to the authors and do not necessarily represent official policy of the Ministry of Agriculture, Fisheries and Food.

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October 1980

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Introduction

From the beginning of recorded history man has used fish as food. Archaeological studies and observations made on primitive peoples indicate that any fish that could be caught was eaten unless by experience it was found to be detrimental to health. In times of plenty preservation processes were developed to tide over more harsh times. The fish first used were mainly composed of freshwater, littoral or anadromous species, the latter with their large migration runs often being used for preservation. In order to catch and preserve fish, technologies were developed that must be some of the oldest in man's history. Examples are the introduction of cords, nets, hooks and boats and the development of drying, salting, smoking and possibly in colder climates, chilling and freezing methods.

Most probably the place of fish in the diet declined in the transition from nomadic to agrarian societies where the catch was insufficient to feed the burgeoning population. Nevertheless it appears that fish was still prized as a means of adding variety to the diet which consisted primarily of cereals. This was especially true in the colder climates where animal husbandry was such that in the winter time meat was scarce. These factors encouraged the development of fish preservation methods either by salting or drying and also of a rudimentary form of fish farming.

If we shift our attention to western Europe further use of fish was not possible until three technological developments occurred, namely the improvement of the seaworthiness of boats, the availability of suitable fishing gear and methods of delivering the fish in a satisfactory condition to the consumer. All these did not occur together but the gradual outcome around the time of the Middle Ages onwards was the development of sea

fisheries and the decline of some of the freshwater fisheries. By comparison with freshwater fisheries, marine fish could be caught in much greater quantities and thus became a relatively cheap commodity. As so often happens in such circumstances people became more choosy and wasteful, rejecting some fish species and only eating parts of others. This move against the fullest use of fish was further exacerbated by the fact that methods of fish preservation left much to be desired, whereas animal husbandry was continually being improved, thus making meat products more readily available and competitive. The outcome of this was that the expansion of fish usage that followed the early developments came to a halt and a decline in the relative importance of fish in the diet occurred. This is the situation that pertains today in the U K. Thus, although the supply of fish has remained virtually static since the last war, the available statistics (Price Commission, 1976) show that direct consumption has declined. There are reasons to believe this may change. First, there is an increasing demand for food in the world and the U K may find itself unable to compete for desirable commodities. Secondly, the world's oceans and seas are no longer underexploited. Thirdly, the restrictions on the areas open to our fishermen develop pressures for their fuller exploitation.

For many years the U K has drawn on the same list of fish and shellfish species and the same type of products for its food. The length of the list comprising some 60 species surprises some when it is brought to their attention, but it is in fact shorter than that enjoyed by some of our neighbouring countries and certainly does not compare to that of the Japanese. We feel it is necessary for the U K to reappraise those of its marine animal resources which in the past have been rejected as quite unsuitable for food. The aim of this book is to examine how the U K can make the most of the unused or little used marine animal resources available to it. Before embarking on this task we need to make clear what we mean by 'make the most of', 'unused or little used' and 'available'.

By 'making the most of' we simply mean for direct human consumption and not for animal feeding. If the economic and social conditions are right it is almost always possible to convert unused resources to fish meal and oil or special animal feed-stuffs. Certain technical problems do exist in achieving this con-

version but it is not our intention to dwell on them. Given a free choice and the technical capability, however, it is more efficient, though not necessarily very much more so, to use such resources directly for human food and this route must be the first to try. Thus, although in some cases conditions dictate that we should make fish meal we will be considering here primarily cases where so-called upgrading is possible, that is, use for higher quality and value commodities.

'Unused or little used' refers again to human consumption. The resources we will be considering can be conveniently divided into conventional and unconventional. The former includes species like sprats and mackerel which have been fished extensively for years, often but not exclusively for fish meal and oil, much more of which could be used directly as human food particularly in the U K; the description underutilized is sometimes used here. In most cases this category includes species which are fully exploited in biological terms; that is, more could not be fished without depleting the stock. Unconventional resources are predominantly stocks which up to the present time have been rarely if at all used directly for human consumption; these include blue whiting, scad or horse mackerel, silver smelts, sandeels, some deepwater species and the mixed lots which are termed the bycatch, that is animals accumulated in the gear incidental to the prosecution of a directed fishery and normally discarded at sea.

A quantitatively less important unconventional resource is edible flesh which remains on the skeleton after the usual methods of industrial preparation but which can be partly recovered in a minced form by the use of special machines called deboners. This means of recovery can be applied to the remnants of many species and insofar as it is already fairly widely practised one might question whether the operation should be called unconventional. Our reason for placing it in this category is that there is still scope for the expansion of the technique and its potentialities still remain largely unexploited. In recent years the U K processing and retailing industries have been turning to a wider variety of imported species in order to fill gaps in supplies, particularly of large, white-fleshed fish following the loss of access to some important distant water fishing grounds. Three which are prominent in this category are South American

hakes, Alaska pollack and so-called Pacific cod. Experience with these is quite new in this country and they can therefore legitimately be embraced by the term 'little used'. In some instances there are problems with their utilization but we do not propose to devote much attention to them. Finally, there are those unlikely parts like heads and organs which are now either dumped at sea or relegated to the offal bin and thence to fish meal but from which it might be possible by suitable technical manipulations to garner edible material.

The meaning of 'available' is more difficult to define in the circumstances in which the U K finds itself. We all know of the dramatic and serious changes in the stocks traditionally available to the U K fleet. Also a considerable degree of uncertainty overshadows the future and makes forward planning by the industry difficult. Sea areas round Iceland, the Faroe Islands, off the Norway coast and in the Barents and near the White Sea which have for decades provided a substantial fraction of our supplies are now either closed to or are severely restricted to us through a system of licences. Even unconventional species like capelin which we might have wished to catch in these areas are now denied us. The present position with regard to fishing opportunities is complex (*Fifth Report, Expenditure Committee*, 1978), and a full description of it is beyond our scope. Briefly, the U K has, subject to certain minor historic rights of a few foreign countries, exclusive right to fish within a 6 nautical mile limit completely round our coast and similar rights within 12 miles in certain coastal areas. We also share exclusive rights up to 200 miles (or the median line) with our E E C partners.

Government and industry are advised on how stocks should be managed by Departmental scientists and act accordingly. All the highly prized fish species are either fully- or over-exploited and until stocks of them are allowed to recover and proper management introduced over several years, there is no prospect of increasing the sustained yield of any of them. Some shellfish species are not in this position. As a result of a shift from cod and herring to mackerel fishing the U K has managed to sustain a home-based total catch of about 900,000 tonnes. Increased imports have made up some of the shortfall in supplies particularly of cod and herring.

The exact share of E E C stocks which the U K will be able

to take and the amount of fish we will be able to import in the future are, therefore, uncertain but judged from the latest negotiations and state of world supplies, the expectation is that at least in the short term we should be able to obtain a fairly high proportion of current supplies. It should be noted here that even if aquaculture could be termed unused or little used, it cannot in the foreseeable future make a substantial contribution to U K supplies (*Fisheries Research and Development Board*, 1978) and we do not propose to discuss it or the products from it in any detail. The reduction in and remaining uncertainty about future supplies is very unsatisfactory from a national or industrial point of view particularly since we are likely to be more dependent than before upon factors beyond our control.

It is natural in these circumstances that increased attention should be paid to potentially useful resources round our shores and elsewhere which for various reasons have not yet been exploited at all, or if so, not to their fullest extent. As the following chapter will show the picture of unexploited or under-exploited species is brighter than that for species such as cod, herring, haddock and plaice. In fact, the total catch within the E E C's economic zone of fish and shellfish whose flesh is likely to be basically acceptable to U K consumers plus the quantity of recoverable marine animal protein adds up to at least twice that which we use at the moment.

Of the species in question the most promising are blue whiting, scad, sprats and pilchards. Secondly there are species like Norway pout and sandeels which are already caught for industrial use. Finally, we have those which are not caught commercially such as the deepwater species off the west coast of the British Isles, silver smelts and silvery pout.

All of these, together with what is currently wasted through discarding and inefficient handling and processing, offer reasonable starting points on which to build new food technologies because one can see some hope of being able to use them within the next decade or so. Consideration has been given in the past to more difficult starting materials such as lantern fish and zooplankton. In our view the problems of harvesting, handling and utilizing these very small and poorly-fleshed creatures for direct human food are likely to be formidable. Little if any of the experimental investigations required to assess their potential has

been done and we do not propose to discuss them further.

Properly managed our readily available fish and shellfish stocks offer an indefinitely renewable, strategic source of food entirely within our and our partners' control: reason enough to strive to make the most of them. The U K imports nearly half its food and there is every incentive to produce more ourselves. To quote a recent official policy paper (*Food from our own resources*, 1975): 'a continued expansion of food production in Britain will be in the national interest'.

Up till now we have been considering resources near at hand but a good deal of interest has been shown recently in the possibility of using underexploited species in the very distant waters of the southern Atlantic. The existence there of large stocks of crustacea and fish in areas over which there are as yet no fishing restrictions has drawn the attention of several nations. A growing list of these have mounted exploratory fishing expeditions in this area, some of which have approached full industrial scale. The success attending these ventures has been variable and often not sustained (Everson, 1977). A particularly intriguing prospect is, of course, the small crustacea familiarly known as krill. Influenced by our history of exploration and scientific endeavour in the Antarctic, our knowledge of conditions there including those related to whaling, and the apparently glittering prizes, it has seemed to a small band of U K enthusiasts that we too should be taking steps to join in the hunt. Amongst others, for example, the Trade and Industry Sub-Committee of the House of Commons' Expenditure Committee has exhorted (*Fifth Report, Expenditure Committee*, 1978) the U K Government and fishing industry to 'pursue more energetically than hitherto the possibilities of new species and unfamiliar waters . . . in the South Atlantic'. Another official enquiry (Shackleton, 1976) drew attention to the prospects for fishing developments based on the Falkland Islands but because of the great political and other uncertainties clouding this area, we have chosen not to discuss it further. The attitude of the Government and the majority of the fishing industry and technical experts to southern Atlantic ventures is understandably rather more cautious because they would have the responsibility of tackling the considerable logistic, political and social problems and the investment risk involved. Thus, in the *Fisheries Research and*

Development Board 1978 we read: 'Despite the potential value of krill as a large source of protein, the high costs and difficulties of operations in the Antarctic would in our view militate against any involvement by British-based industry at present. The fish resources there would need to be both plentiful and of high economic value on the U K market to make a British based fishing venture worthwhile'. In that these views do not entirely rule out U K interest in Antarctica and since the resources there are undoubtedly available to us if we wish to take them, the authors feel justified in examining their availability.

From time to time the idea of British fishing ventures in other distant parts of the world is raised: off the South American, South African and Australian coasts and in the Indian Ocean are sometimes mentioned. These ideas, although once real possibilities, were made before the extensions of national jurisdiction and the growth of fishing activity which have occurred in these areas. This, however, may provide opportunities for U K investment in ventures overseas making use of British skills in the fish industries in order to supply fish for U K markets. We do not propose to amplify these considerations further.

So much for what is or could be available. Whether it will be possible eventually to increase significantly home utilization or exports, depends upon successful combinations of technical, economic and social factors some of which will be examined in later chapters. Up to 1974 the trend of fish purchases for home consumption was downward, from 6.62 oz/week in 1950 to 4.46 oz/week in 1975, although it appears to have stabilized in the last few years. It has been suggested that this trend could be explained by the increase in price of fish relative to that of other competing flesh foods; others point to the decreased supply of some favourite species and alleged conservative attitudes to fish on the part of the U K consumer. In either case there is hope over time of reversing the process by the exercise of skilful technology and marketing. There have been substantial changes in the pattern of fish eating in the past and there is no reason to suppose why, within limits, presently unfamiliar kinds and forms of fish could not be successfully marketed. Examples can be found in the fairly recent greater use of scampi, saithe and mackerel in the U K. The fish trades in the U K are skilled in a variety of both traditional and modern techniques and have