EUROPEAN AQUACULTURE 1991

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INTRODUCTION

Aquaculture, the farming of aquatic animals and plants in marine and freshwater, has become a major industry in the Member States of the European Community. It is estimated that total production in 1989 amounted to over 847,000 tonnes and was worth over 7,900 million ECUs. We forecast that in 1991 production will be over 900,000 tonnes representing 8,500 million ECUs. This represents around 12% of total EC fish supplies. There are no accurate figures of employment available but we have identified a minimum of 53,000 people directly employed in aquaculture. Actual numbers are likely to be substantially higher than this. In addition, large numbers are employed in the provision of supplies for the industry and in downstream production and marketing.

This paper describes the main characteristics of European aquaculture. The data was obtained from a study of European aquaculture realized with financial aid from the Commission of the European Communities, Directorate XIV Fisheries and carried out by the European Association of Fisheries Economists.

THE STATUS OF EUROPEAN AQUACULTURE

All Member States of the Community have aquaculture interests and many species are grown (Figure 1 and Table 1). The major cultured finfish are rainbow trout, Salmo gairdneri, with production of 144,000 tonnes in 1989. Trout farming has a long and successful history and trout are produced in all Member States. Next in importance, 35,000 tonnes of salmon were produced in the UK, Ireland, France and Spain in 1989. This is a newer industry with a recent history of rapid growth. Carp, Cyprinus carpio, catfish, Ictaluridae and eels, Anguillidae are also produced in substantial quantities. The production of the newer species, bass, Serranidae and bream, Sparidae is now becoming increasingly important and production of turbot, Psetta maxima, is growing. Mullet, Mugil Cephalus are grown as are small quantitites of yellowtail, Seriola sp.

Shellfish production is dominated by the production of mussels, Mytilidae. Oysters of two types Ostrea Edulis and Crassostrea gigas are also produced in large quantities. Clam culture is a relatively new industry and is based primarily on the Manila clam, Ruditapes

philippinarum or Tapes semidecussata. Some production of prawns, Penaeus japonicus is now taking place.

These are the major species in commercial production but the variety of European aquaculture is not fully reflected in these figures. There is interest in the culture of many other species (Table 2) which are either produced in small quantities (eg tilapia) or are still at the experimental stage (eg sturgeon Acipenser oxyrhynchus and transmontanus, halibut, Hippoglossus hippoglossus).

Turning to a Member State perspective, (Figure 2 and Table 1), the UK is currently the largest producer of finfish with large salmon and trout farming industries. The second largest producer of finfish is Italy with major production of trout, eel, bass and bream, catfish and mullet and minor production of a number of other fish. France has major trout farming interests and production of bass, bream, carp, eel, salmon and turbot. Spain is a large trout producer and a producer of a variety of other species including bass, bream, eel, mullet and salmon. Denmark is one of the largest European trout producing countries and has some eel cultivation. Germany produces trout and the other freshwater fish, carp, catfish and eels. Ireland produces trout and salmon. Greece has trout, bass and bream, carp and eel farming. Portugal's emerging aquaculture industry produces trout, bass and bream and eels. Belgium produces small quantities of trout, catfish, carp, eels and tilapia.

Spain, the Netherlands, Italy and France are major shellfish producing countries (Figure 3 and Table 1). Spain has a large mussel farming industry and produces clams. France is a major producer of oysters, has substantial mussel production and some production of prawns and clams. Italy produces mussels and clams, Germany produces mussels and Ireland produces mussels and oysters. The UK has relatively small production of mussels and oysters and Denmark produces small quantities of mussels. Portugal produces clams and some oysters. Shellfish farming in Belgium is negligible.

PRODUCTION SYSTEMS IN EUROPEAN AQUACULTURE

OVERVIEW

There is no single system of production in aquaculture. Variations are found between species and the same species can often be cultured in different ways. The key parameter is the degree of control over the aquaculture environment and over the growing process. Systems range from extensive systems where there is little interference with the species such as the trapping of fish behind barriers on retreating tides. The fish are grown to

maturity within these enclosed waters, feeding on natural nutrients and with no interference until harvesting. At the other extreme are intensive systems with total control of water flow, temperature, feed input and the breeding cycle. In general, the larger the degree of control selected, the more intensive is the capital input and often the higher the stocking density of fish in a given body of water. Choices between systems depend on a number of factors. The first is the technical and biological suitability of different systems for a particular fish species. The second is the relative cost of different inputs in relation to the quantity and/or quality of output. Systems with higher capital costs may achieve greater degrees of control but may cost more to operate or be economic only at larger scales of operation. Local environments are also subject to variation, giving scope for the operation of different systems which are particularly suited to certain locations. Finally, technology is still evolving and improving leading to the development of new ways of doing things, so that efficiency must be seen as a dynamic rather than a static concept.

MARINE FINFISH: BASS, BREAM AND SALMON

The most popular method for farming marine finfish is the use of net cages suspended in seawater in which the fish are reared until maturity. The fish are fed but systems are dependent on the natural movement of water for oxygen and cleansing. Most salmon are reared in this way and this system is also used for the rearing of bass and bream. There are variations in the size and complexity of the systems used and their supporting infrastructure. In the most exposed locations in the waters of the Atlantic increasingly robust systems are being used for salmon farming. Increasing interest is being shown in the development of off-shore farming technologies which offer better growth conditions, although it is not yet clear whether these will offset higher handling costs. There are developments in salmon farming in France which use barges moored offshore to rear fish in pumped seawater. There are some land based sites using pumped seawater for salmon, bass and bream farming. These systems offer good control over the growing cycle but often have higher capital costs. The size of unit varies. In salmon farming there has been a tendency for average production per site to rise to over 100 tonnes with some sites producing over 500 tonnes. Average production per site in bass and bream farming is very small but in many cases this reflects the newness of the industry and the fact that many businesses are still building up to capacity levels of operation.

CARP AND CATFISH

Carp are farmed extensively and intensively but the average size of unit is low at around 2-3 tonnes production per annum. Both European and African catfish are grown in intensive recirculating water systems in Belgium and African catfish are grown in the same way in the Netherlands. European catfish are also grown in

extensive systems in France and Germany, often in conjunction with other fish such as carp.

EEL

Eels are grown in both extensive and intensive systems. The extensive systems in ponds are primarily to be found in Spain and in Italy but the volumes produced by this route are small and are not growing. There is currently more interest in the development of intensive eel farming technologies. In Northern Europe this involves the use of intensive recirculating systems with heated water, often a by-product of other manufacturing processes. In Greece attempts are being made to use bore water and oxygenation. Bottlenecks remain in the rearing of young eels and there have been difficulties in developing suitable cost-effective technologies. However, many problems are now thought to be overcome and increases in production are expected in the future.

TROUT

Trout farming is an industry with technologies that are well known and developed, if subject to continuing modification. There are a variety of trout farming systems in operation throughout Europe from earth ponds to tank based recirculating systems and to the growth of trout in cages in fresh and sea water. A wide variety of sizes of operation coexist within the industry. In Italy there are large trout farms producing over 1000 tonnes per annum but equally in most countries there are smaller units producing 10 tonnes or less.

OTHER FINFISH

Mullet are produced in Italy and Spain mainly from extensive culture. Tilapia are only produced in Belgium and at one site where 200 tonnes are produced using an intensive circulating system in conjunction with other species. Turbot juveniles are produced in Northern Europe in Germany and in Scotland while on-growing is concentrated in Spain. At present the average production of turbot per site is low (around 20 tonnes) but this is expected to rise rapidly as new facilities begin to operate at capacity levels of operation. Yellowtail production is limited to Spain. The fish are grown in sea cages but development is limited by a lack of hatchery technology and the consequent reliance on the capture of wild juveniles.

MOLLUSCS AND CRUSTACEA

Mollusc culture relies primarily on the availability of naturally occurring feed. Clam culture is a relatively new activity which is developing particularly in France, Spain and Ireland. Large extensive systems are used with large numbers of producers, some of them part-time and often combining clam culture with that of oysters and other molluscs. There is a mixture of integrated and non-integrated activities from seed production through to on-growing. In some cases, because of the heavy costs of site development and harvesting, the use of harvesting

and other equipment is pooled between groups of producers.

Mussel culture is one of the oldest established aquaculture industries. A number of different technologies are used but mussel culture can broadly be classified into two types. Bottom cultivation is extensive and relies on the management of native fisheries through restocking programmes using natural seed beds as a source of seed or spat. This is the oldest type of production and this is found in Ireland, the United Kingdom, the Netherlands, Germany and France. Expensive capital equipment is required for harvesting and as a result such operations operate at large scale or involve co-operation in the use of equipment between harvesters. Cultivation using ropes suspended from rafts or from buoyed longlines in sheltered waters is practised in the United Kingdom, Ireland, Spain, France and Italy. The largest installations of this type are raft based systems in Spain.

A number of systems are also used for the culture of oysters. There are managed beds which are dredged and more managed intertidal cultivation using tressels or trays. Like clam culture it is an industry of small producers, although in some cases such as production in France, considerable co-operation between producers takes place at the marketing stage. Production of other crustacea is very small, although there is some cultivation of crayfish.

Prawn farming technologies are still at an embryonic stage. Production is either extensive (less than three animals per square metre) or semi-intensive (4 to 20 per metre). In France there are a large number of small farms involved, combining the activity with oyster culture. In Spain culture has concentrated on the use of salt ponds which has not been entirely successful due to problems of high salinity. Large scale operations have hit problems of a lack of appropriate equipment, skills and technology.

AQUACULTURE ECONOMICS AND ORGANISATION

It is not possible to generalise about optimal sizes and forms of organisation for aquaculture because of differences between species and locations. As has been seen above a number of different systems co-exist even within the same sector. However a number of general issues can be raised.

The first is that in production terms, small businesses ie those employing less than ten people are very important in European aquaculture. There are a number of reasons for this. The first is that in some cases in newer sectors eg bass and bream farming, industries are

still scaling up to full capacity and are currently operating with limited output. In other sectors businesses are operating at small scales in steady state conditions because little expensive equipment is needed and thus major economies of scale do not exist. In industries using cage farming techniques beyond a certain minima a variety of sizes of site co-exist and although the average size of site is rising, it is considered that most production economies are achieved by 200 tonnes annual output. Beyond that point at many sites deteriorating environmental conditions reduce any further benefits of size. In other industries such as the trout industry which use land based circulating systems, substantial economies of scale do exist, but higher cost smaller producers coexist with lower cost larger producers because they are supplying direct to local markets and obtain higher margins to compensate for the higher costs. There is evidence that provided that they are supplied with appropriate inputs and have access to technical knowledge, small scale owner managed operations can be extremely effective because of the high standards of husbandry which they achieve. In some cases a small scale base may be appropriate initially where there are large numbers of unknown factors and levels of risk are high.

At the same time a distinction must be made between the viability of small and medium sized production units and the way in which products are marketed. Correct organisation of marketing is important to the development of European aquaculture. While some small producers will find sufficient profitable outlets close to their farms, the volumes of product involved are such that this cannot be a marketing solution for all producers, particularly the larger ones. However, accessing larger markets makes different demands on producers and there are important economies of scale in marketing. These are associated with the ability to supply outlets demanding large volumes from a single source, improved bargaining power, a supply of resources to develop export markets and the ability to build product ranges including in some cases integration into processing.

There are a number of ways in which size in marketing terms can be achieved in addition to a large single production unit. Small farmers can grow on contract for larger producers or for wholesalers, benefiting from the technical advice of larger partners and from their marketing expertise. There are examples of co-operatives of smaller (and larger) producers eg in trout farming in France, the UK and Denmark and examples of the establishment of joint marketing companies (salmon). These are able to pool resources for marketing and employ specialist personnel. They are able to achieve consistency of output through the application of quality control schemes and co-ordinated planning. Sometimes wholesalers have played an enabling role by building relationships with groups of producers on a partnership

basis, on whose behalf they carry out marketing (salmon, trout). Often smaller producers have been actively encouraged in these developments by government agencies, although problems still exist in some sectors (salmon, trout, shellfish, carp etc). Without proper marketing organisation producers are likely to be weak, particularly in a world where the standards of marketing of other food producers are rising and where marketing is often in the hands of very sophisticated companies with whom fish farmers directly and indirectly have to compete.

PRODUCTS

Most European aquaculture output is sold fresh or live. Processing is important for only a few species: salmon (mainly for smoking), mussels, eel (mainly for smoking), trout (filleting and some smoking). For many species the explanation is simple: higher prices are available for fresh products, particularly where products from aquaculture are perceived to have quality advantages over wild products. In other cases it reflects the early stage of development of the industry and the limited volumes available (shellfish production in Scotland). In some cases fish are not suited to heavy processing (bass). This pattern is broadly expected to continue to 1995 although it should be noted that there are reasons to expect some increases in the proportions of processed products. The trend in consumer demand is towards more convenient products including more value added products such as prepared recipe dishes but also including more simple processing such as filleting. The rapid development and improved prices in the European trout industry in the later 1980s were greatly helped by the introduction of trout fillets which found rapid consumer acceptance in most Member States. Processing also gives the opportunity to develop new market outlets and attract new consumers which helps to build a more stable demand base for the industry.

The extent of vertical integration into processing by farmers varies. More salmon is smoked by independent processors than by integrated salmon grower-processors. Most trout processed in France and in the UK is processed through co-operatives or processing plants owned by growers. In Denmark major processors have some interests in trout farming but also buy trout from non-integrated producers. In Ireland mussels are processed by an integrated venture but one which buys product from other growers. It is unlikely that a single strategy will ever prevail. Businesses who can combine the very different skills of fish processing alongside a farming business have the opportunity for extra profit for the business as a whole. At the same time many of the non-integrated processors are efficient and competitive and deal in a range of fish products. Large scale multi-product food

processors benefit from economies of scale in both production and marketing. Such companies may make more attractive customers than competitors.

MARKETS

Some aquaculture production finds local markets close to the production sites. It is estimated that this represents around 15% of total supplies and for all species at least some percentage of production is sold in this way. Examples are of trout and carp farming in Germany where most producers are small scale and output is sold at the farm itself or to local retail and catering outlets.

A further 55% of production is sold in national markets and at least some of the output of all species is marketed in this way.

The remaining 30% of output is exported and export markets are important for eels, bass and bream, clams, mussels, oysters, salmon and trout, although the volume of exports varies widely between countries. Most exports are to other members of the European Community. Within Europe the main markets taking farmed fish imports from other Member States are Italy, Germany and France. Greece and Spain both export bass and bream and shellfish to Italy. The UK and Ireland export salmon to Italy. The large French and German markets buy trout from Italy and Denmark, salmon from Scotland and Ireland and shellfish from the Netherlands. Italy with its large scale trout farms is one of Europe's most efficient producers and exports trout to Germany and to France. Most of Danish trout production is exported, mainly to Germany. France exports shellfish to Italy and to Spain.

In terms of value the major exports are of salmon and the UK and Ireland export salmon to most Member States. In addition fresh and processed salmon is the only product to exported outside the Community on any scale. There are major exports of salmon from the United Kingdom and Ireland to the United States and to many other countries around the world.

The choice of markets depends on their availability, size and value as well as the size of producers and the stage of industry development. Thus in Spain and in Greece production of a number of species is consumed locally to the farm but this reflects small volume production and as it expands broader national and international markets will be sought. German small scale trout farmers, as indicated above, supply local markets but the rest of the German market is supplied by large imports from Denmark. Very little salmon is consumed close to the point of production because of the remoteness of the industry from population centres but the high value of the product has

justified the development of distant export markets and high transport costs to reach them. The large scale and low costs of Dutch mussel production in a small country mean that larger international markets are sought for the product.

MARKETING AND MARKETING CHANNELS

Most farmed fish are sold via the traditional fish wholesale system alongside the landings from wild fisheries. As such the fish tends to be sold on a commodity basis like other fish products. Relatively few new marketing channels have been created by aquaculture products, although important exceptions do exist. Both fresh and processed salmon and trout are now sold directly to multiple food retailers, particularly in northern Europe where multiple food retailing is most highly developed and substantial quantities of product now use this route to the consumer. On the whole it is only the larger businesses or co-operatives in command of substantial volumes of production and good quality control who are involved in this new marketing route. Fish going to processing are often supplied on semi-fixed contractual terms and on a continuous basis.

Aquaculture faces a number of challenges in the development of marketing. Consumers are becoming more demanding in terms of product quality, consistency and reliability of supplies, as are trade customers such as retailers, wholesalers and caterers. This is in fact a major advantage to fish farmers because fish reared under farmed conditions are able to achieve more consistency in terms of size, delivery and often quality than is available from the wild catch. The industry as a consequence is now paying more attention to these issues at both an individual and collective level. Trade associations have played a major role in this in the salmonid industry and in some shellfish sectors through the development of quality control schemes. Some trade customers have also imposed increasingly stringent demands on their suppliers, raising both the standards of product and of management in the industry.

Increasingly affluent European consumers have access to a wide variety of attractive food products including other fish. A major requirement for producers is to promote their products effectively against competing alternatives. This is necessary for new products, to widen the base of consumption and to maintain existing consumption levels. Because there is little branding in the industry, this task has on the whole been left to the collective promotional activities of trade associations. The extent to which such activities have been carried out varies. Most activity has taken place in salmonids and for some of the more established shellfish such as mussels and oysters. However, this is an expensive

activity and trade associations, all of which in Europe operate on a voluntary basis, often have difficulty in raising sufficient funds for this from their members.

Like any other primary commodity sector, good marketing also means an effective balance of supply and demand. In fish farming, because entry costs are relatively low, there is a recurring tendency for producers to overestimate the amount of product which a market can absorb and to overestimate the rates at which markets can grow. The results are periods of declining prices and profitability, even in sectors where there remains considerable potential for profitable long term growth. The aquaculture sector has not been subject to intervention mechanisms to deal with thse problems, but a consequence is that producers and grant giving bodies will have to continue to monitor demand trends carefully.

FUTURE PROSPECTS FOR AQUACULTURE IN THE EUROPEAN COMMUNITY

OVERVIEW

Production in the Community is forecast to rise by 119,000 tonnes to 966,000 tonnes in 1995 ie an increase of around 15% from 1989 levels (Figure 4). Aquaculture output will become a larger part of total fish supplies, particularly at the high quality end of the fish product range. Increased production represents also, particularly for higher value species, opportunities to increase substitution for imports from outside the Community (salmon, prawns).

The rates of increase will differ between species. Market conditions and the market appeal of each species are major factors in the potential for future development, although general demand trends are favourable. Consumer incomes are rising and there are moves towards lighter and more nutritious meals. At the same time world supplies of fish from capture fisheries are static. On the supply side, the supply of fish feed is not considered to be a problem because of adequate supplies of fish meal and fish oil. By contrast, for some species, particularly those grown in freshwater, site availability and the need to meet increasingly stringent environmental standards constrain expansion in some Member States. Disease has been a problem for some species in some locations. This is a problem which is being addressed both by the industry through improved husbandry standards and by vaccine suppliers through improved products. More stringent European regulations should also help to reduce disease incidence.

PROSPECTS BY SPECIES

Of the finfish the fastest rates of growth are expected in the production of bass and bream with the largest increases forecast for Greece and Spain (Figure 5). These

are new industries in the introductory stage of development. Now that many of the early technical problems have been overcome and because demand conditions are favourable, rapid expansion is expected. Turbot production is currently smaller but is at a similar stage of development. Large increases are now forecast for turbot production in France and Spain, amounting to a fivefold increase between 1990 and 1995.

There are sites available for the expansion of salmon production, but expansion will be a function of market conditions. The industry has faced a difficult market situation in the last few years as a result of rapid expansion of global production (particularly in Norway) but supplies are now stabilising. Consequent improvements in trading conditions may enable limited further expansion in the later 1990s.

Trout production will remain a major contributor to the EC aquaculture total but overall this will not be one of the faster growing species. There is potential for increasing production in some countries (Italy, France, UK (Scotland), Greece. In these countries it is market conditions that will dictate the pattern of expansion. Favourable demand conditions will encourage growth and vice versa. In some countries the main constraint is the absence of sites for expansion (Denmark, Germany, some parts of the UK).

Catfish production will increase but its limited market appeal will mean that it remains a low volume and somewhat speciality product. Carp is a product with a limited market and prices which do not appear to justify expansion. Mullet and tilapia are in a similar position within the European Community, although tilapia may have better prospects in French overseas territories. Eel production has been beset by problems of insufficiently understood technologies within intensive farming systems and consequent high production costs in relation to demand, although there is hope that some of these problems have now been overcome. Given favourable market conditions some expansion can therefore be expected. Some growth is forecast in Spanish yellowtail production but this will remain a minor product.

Market conditions are generally believed to favour some expansion in shellfish production (Figure 6). Of the shellfish the best prospects lie with mussel culture with production increases forecast in Belgium, Greece, Ireland, Italy and France. Lack of sites precludes further expansion in the large Spanish industry and exploitation of Dutch mussel beds is at a maximum. Production may also increase in the United Kingdom although there are problems of production and marketing organisation to be overcome before this is achieved. Like the Irish industry, longline mussels grown in colder waters and at greater expense have to convince the market of their superior quality compared with cheaper dredged

mussels and mussels from Southern Europe. Oyster production is expected to remain static with the exception of the newer industries in Ireland and UK (Scotland) where some growth from existing small levels is expected. Clam production is expected to grow in France if disease problems can be overcome.

PROSPECTS BY COUNTRY

From a country perspective (Table 3), the largest percentage increases are expected from the countries with the newer industries and in Southern Europe. Greece, Italy, Portugal and France are all expecting large increases in production, in many cases associated with the development of bass and bream production. The largest percentage increases are expected from Greece and Portugal, while the largest absolute increase in volumes will come from Spain and France. Ireland is forecasting substantial increases in production but actual levels will be very dependent on conditions in the world salmon market and the same is true in the UK. Resource constraints preclude much expansion in Belgium and Germany although some small increases are expected. For Denmark a fall in production is forecast as a result of the imposition of more stringent standards by the Danish authorities on the trout industry. This is a case which will be watched with a great deal of interest by the aquaculture industry elsewhere in Europe. While undoubtedly costs will initially be raised and output will be constrained it is also possible that with improvements in technology and husbandry the industry over the longer term will be able to restore production to earlier levels.

The 1990s will be an exciting decade for European Aquaculture. With static world wild fish landings and generally favourable consumer demand trends, there are market opportunities for many species. If product quality can be maintained and improved and costs contained, it should also be a profitable period for the sector.

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Table 1

Aquaculture Production by Country and Major Species in the Community

1989 - Tonnes

Species	Belgium	France	Denmark	Germany	Greece	Ireland	Italy	N'lands	Portugal	Spain	UK	TOTAL
Bass		)239			)500		) 1950		5	50		)3163
Bream		)			)		)		19	400		)
Carp	500	2700		5500	300		100				20	9120
Catfish	66			110			1500	600				2276
Clam		460					7000		7000	100		14560
Eel	50	35	480	210	30		4500	13	100	150		5568
Mussel		47000	100	31000	1500	12300	90000	107000		203440	4913	497253
Mullet							2500		315	300		3115
Oyster		130000		125		500		900	100	300	137	132062
Prawn		380								100		480
Salmon		100				6261				220	28500	35081
Tilapia	200											200
Trout	800	28500	29500	15500	2000	1500	32000	200	973	16800	16500	144273
Turbot		10		50jv						270		280+jv
Yellow Tail										50		50
TOTAL	1616	209424	30080	52445	4330	20561	139550	108713	8512	222180	50070	847481

jv Juveniles, excluded from totals.

Source : Official statistics and estimates made by research where no official statistics available. See Appendix 7 for further details.

Table 2

Other Cultivated Species by Country

	Species	Status
Belgium		
Bass	Dicentrarchus labrax	Research and pilot production.
Bream	Sparus auratus	Research and pilot production.
Catfish	Clarias lazera	Commercial production/input.
	Silurius glanis	Commercial production.
Carp:		
Herbivorous	Ctenopharyngodon idella	Secondary sp in association with others.
Koi	Cyprinus Carpio (ornamental)	Research into intensive culture.
Silver	Hypophthalmichtys molitrix	Secondary sp in multi sp operation.
Mussel	Mytilus edulis	Commercial production.
Oyster	Ostrea edulis	Commercial production.
Perch	Perca fluvialis	Needing more research.
Cerch	Stizostedion lucioperca	Needing more research.
Pike	Esox lucius	Needing more research.
Prawn	Penaeus spp and Macrobrachium carcinus	Researching for intensive culture.
Roach	Rutilus rutilus	Commercial production.
Sole	Solea solea	Research
Tench	Tinca tinca	Commercial production.
Denmark		
Mussel	Mytilus edulis	Only one farm remaining.
France		
Catfish	Ictaluridae	Research
Eel	Anguilla sp	Research
Turbot	Psetta Maxima	Developing
Sturgeon	Acipenser	Research
Germany		
Carp:		
Herbivorous	Ctenopharyngodon idella	Secondary species and for pool clearance.
Catfish	Silurus glanis	
Oyster, Pacific	Crassostrea gigas	Research/developing.
Pike	Esox lucius	Secondary species.
Sturgeon	Acipenser sturio	
Tench	Tinca tinca	Complementary sp in association with carp.
Trout, Brook	Salvelinus fortinalis.	

Greece		
Crawfish	Palinurus sp	Experimental
Lobster	Homarus sp (gammarus)	Experimental
Oyster		In association with mussels.
Prawn		Infant
Salmon	Oncorynchus kisutch	Experimental
Shrimp	Penaus kerathurus	
Sponge	Demospongia sp	Experimental.
Ireland		
Abalone (Ormer)	Haliotis tuberculata	Experimental - on-going research.
Clam, Manila	Tapes semidecussatus	New, infant.
Lobster	Homarus gammarus	Experimental
Scallop	Pecten maximus	Experimental
	Placopecten yessoensis	Experimental
Italy		
Bream, White	Diplodus sargus	Under production.
Oyster		Commercial production.
Prawn	Penaeus japonicus	Limited production.
Salmon	Salmo salar	Introduction
Shrimp Freshwater		Introduction
Sole	Solea vulgaris vulgaris	Limited production.
Sturgeon	Acipenser oxyrhynchus and transmontanus	Introduction
Yellowtail	Seriola lalandi	Under production. Experimental.
Netherlands		
Cockles	Cardium edule	Association with other mollusc production.
Eel	Anguilla anguilla	Introductory/infant stage.
Trout, Sea	Salmo trutta	Introductory stage.
Portugal		
Bream, White	Diplodus sargus	Commercial production.
Carp	Cyprinus carpio	Not produced since 1987.
Cuttle fish	Sepia officinalis	Very limited production.
Mussel	Mytilus galloprovincialis	Commercial production.
Salmon	Salmo sp	limited production.
Scallop	Pecten sp	Limited production.
Shrimp	Penaeus japonicus	Very limited production.
Sole	Solea vulgaris	Limited production.
	Solea senegalensis	Limited production.

Spain		
Artemia	Artemia salina	Experimental
Bream:		
Red Sea	Chrysophrys major	Research/Experimental
Clam:		
Japanese	Tapes semidecussatus	Introduction
Crayfish	Procambarus clarkii	Introduction
Grouper	Epinephelus guaza	Experimental
Lobster	Homarus gammarus	Experimental
Scallop	Pecten maximus	Experimental
Sole	Solea vulgaris vulgaris	Experimental
Shrimp	Leander serratus	Experimental
Trench	Tinca tinca	Introduction
Trout, Sea	Salmo trutta	Experimental
Tuna	Thunnus sp	Experimental
Turbot	Psetta maxima	Development/growth
Warty Venus	Venus verrucosa	Experimental
UK		
Bass	Dicentrarchus labrax	Experimental/limited production.
Bream	Sparus aurata	Experimental/limited production.
Carp	Cyprinus carpio	Limited production with some potential.
Clam: Hard-shelled	Mercenaria mercenaria	Managed naturalised stock-declining.
Manila	Tapes semi-decussatus	Under research/trials.
Crab	Cancer pagurus	Research Trials
Crayfish, Nobel	Astacus leptodactylus	Very limited production.
Signal	Pacifasticus leniusculus	Very Limited production.
Slender clawed	Astacus astacus	Very Limited production.
Eel	Anguilla anguilla	Not currently in production.
Halibut	Hippoglossus hippoglossus	Experimental/pilot venture.
Lobster	Homarus gammarus	Research trials.
Queens	Chlamys opercularis	Limited production/infant.
Scallops	Pecten maximus	Limited production/ infant
Turbot	Psetta maxima	Insignificant production.

Table 3.

Community Finfish Production by Member State In Tonnes 1983-1995

Country	1983	1984	1985	1986	1987	1988	1989	1990	1995
Belgium	910	960	1210	1280	1286	1476	1616	1710	1710
Denmark	34617	31804	31004	30079	33858	28278	29980	28500	28600
France	25201	25162	28123	30116	30593	33763	31584	38610	41340
Germany	20300	19800	20222	19950	20000	21300	21320	23320	26810
Greece	2304	1949	1919	2021	2317	2897	2830	4704	13900
Ireland	988	1097	1289	1778	3152	5105	7761	10100	10100
Italy	6300	28250	33050	34350	37250	39780	42550	44600	51970
N'lands	150	155	277	403	514	611	813	926	3050
Portugal		69	28	1804	2502	2293	1412	2875	4280
Spain	13726	14620	14484	15201	16835	16728	18240	21241	32300
UK	11306	12632	17141	22820	28241	32971	45020	52020	57020

Table 4.

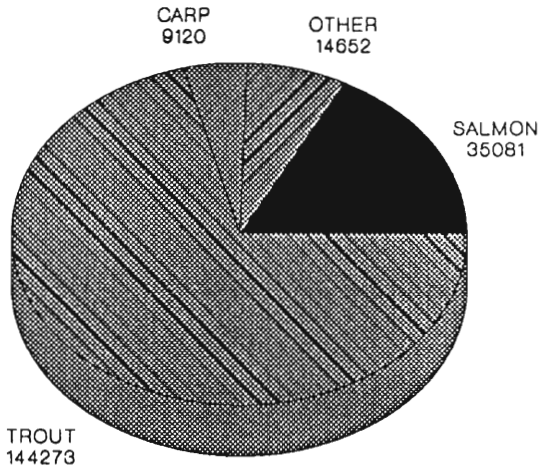
Community Crustacea & Mollusc Production by Member State In Tonnes

Country	1983	1984	1985	1986	1987	1988	1989	1990	1995
Denmark	50	50	50	50	100	100	100	100	400
France	169220	166270	166003	181502	177980	176733	177840	181050	186800
Germany	31633	59311	20818	29342	25966	29805	31125	30155	30250
Greece	155	190	210	230	480	1100	1500	3000	6000
Ireland	6791	14225	10290	11952	17238	13383	12800	18300	18300
Italy	77000	87000	97000	107000	107000	112000	97000	110000	135000
N'lands	109816	66825	106887	66054	692	64970	107900	100750	100750
Portugal	6000	6000	6000	7000	7322	7000	7100	7600	8250
Spain	212611	235052	251097	235214	174271	171048	203940	200500	200500
UK	4100	4100	4100	4100	4100	4100	5050	5200	8500

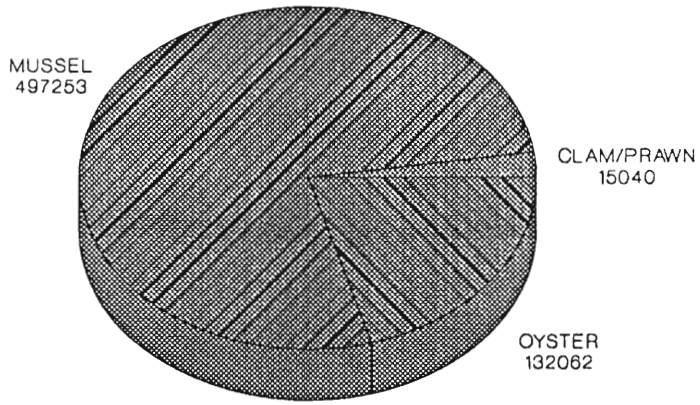
Note: No data is shown for Belgium as production of Crustacea and Molluscs is negligable.

Figure 1.

COMMUNITY AQUACULTURE PRODUCTION 1989
MAJOR SPECIES IN TONNES



FINFISH



CRUSATACEA & MOLLUSC

Figure 2.

PRODUCTION BY MEMBER STATE 1989 : FINFISH

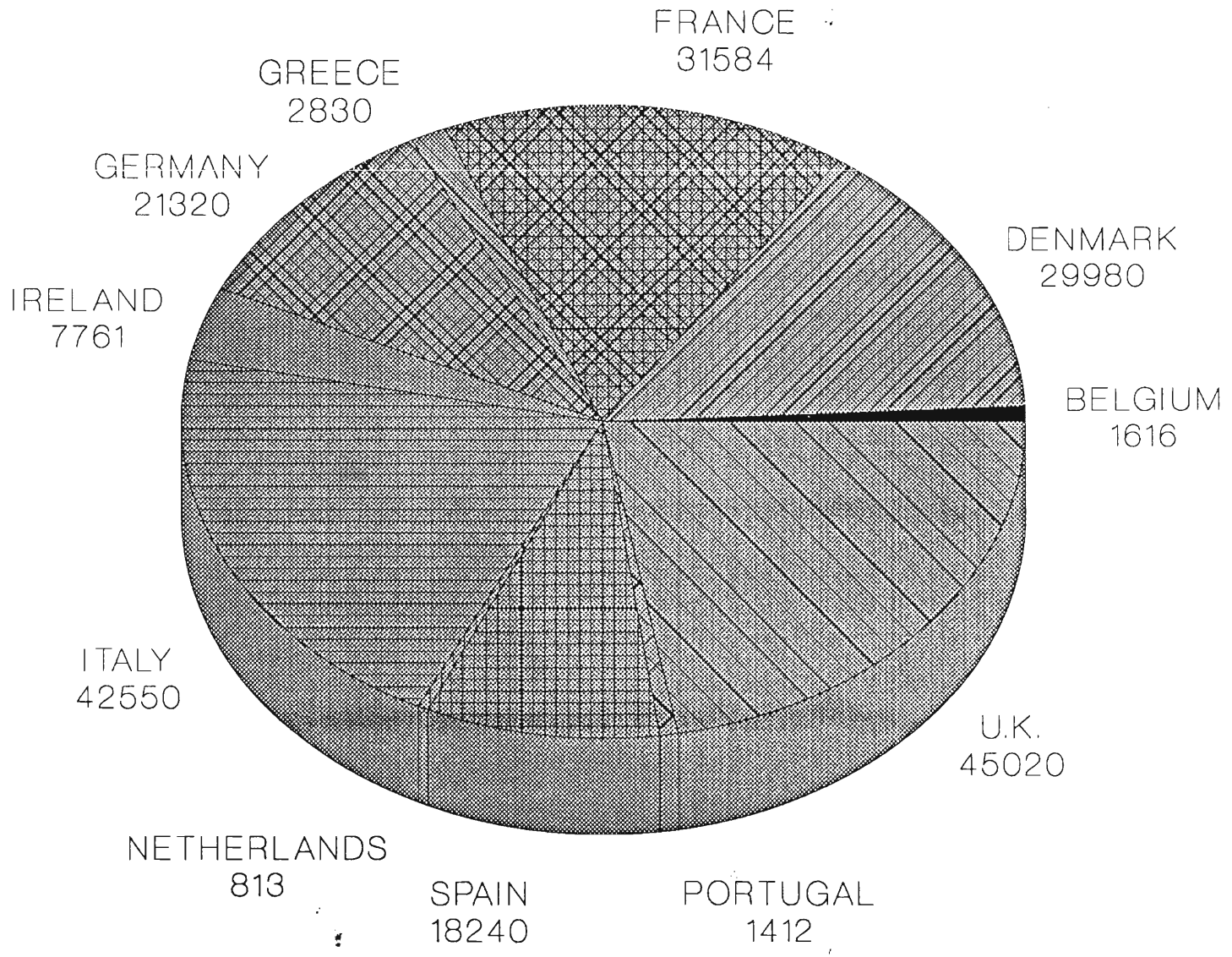


Figure 3.

PRODUCTION BY MEMBER STATE 1989 : CRUSTACEA & MOLLUSC

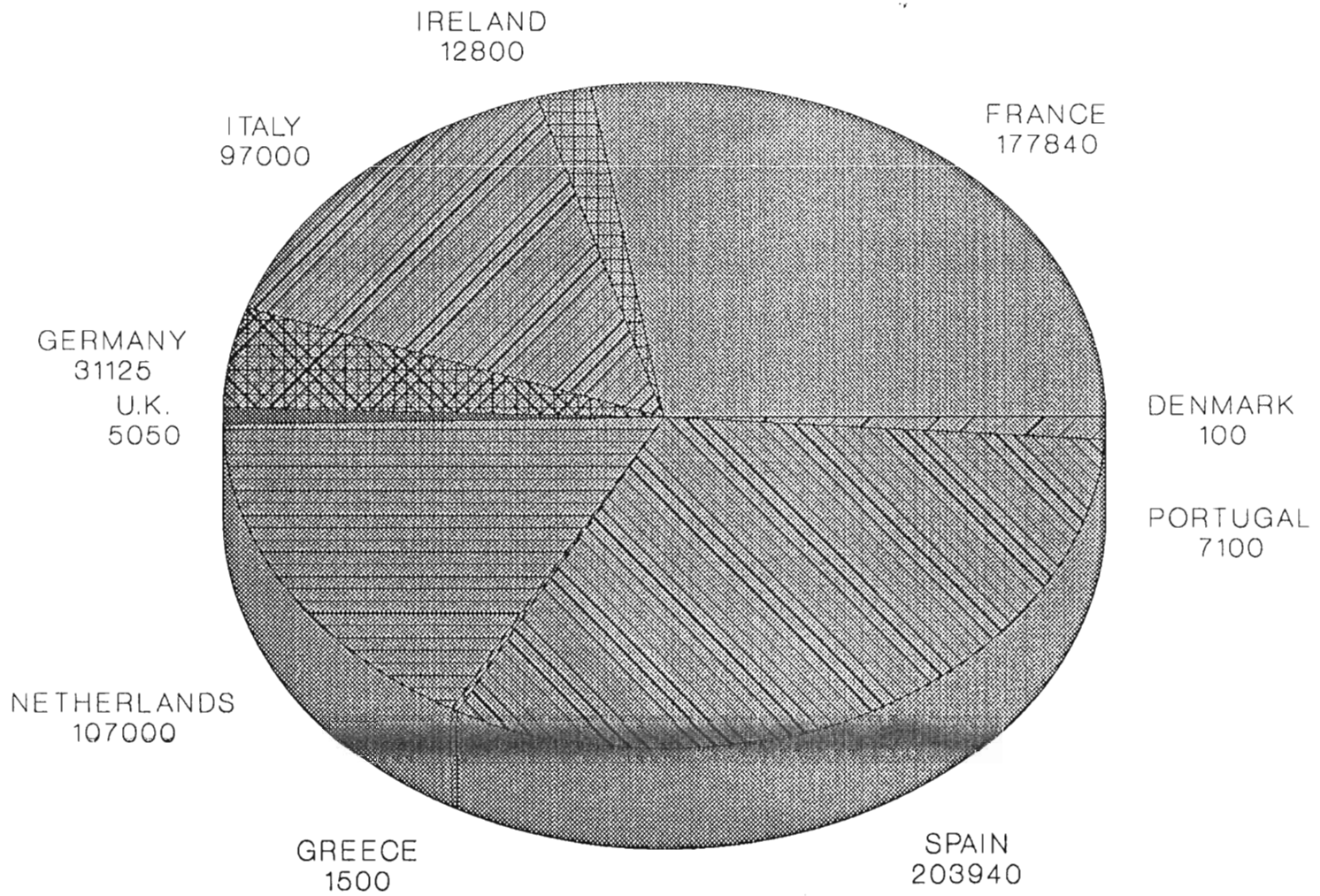


Figure 4. COMMUNITY AQUACULTURE PRODUCTION TRENDS AND FORECAST FOR MAJOR SPECIES

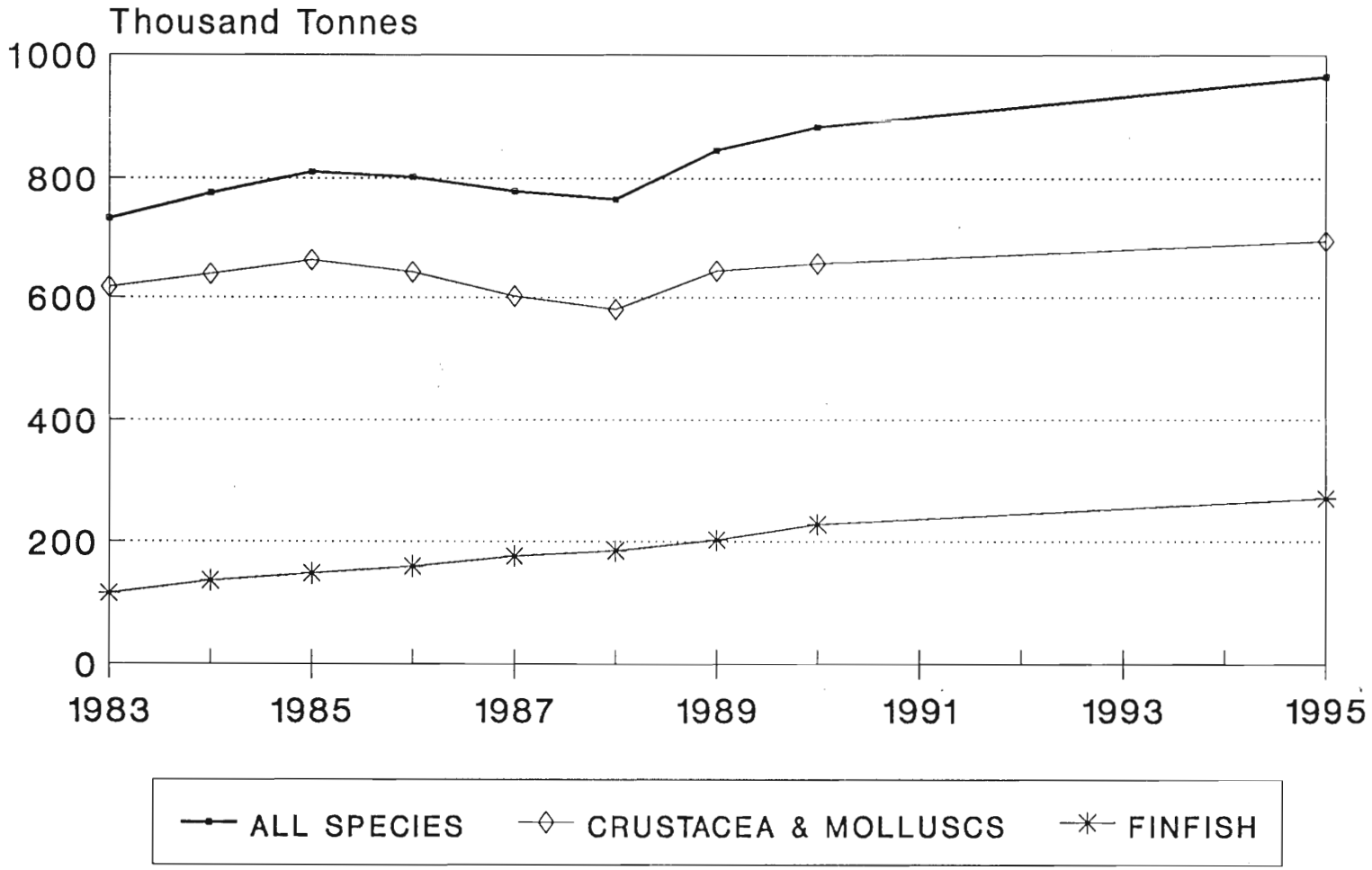


Figure 5.

COMMUNITY FINFISH PRODUCTION TRENDS & FORECASTS FOR MAJOR SPECIES

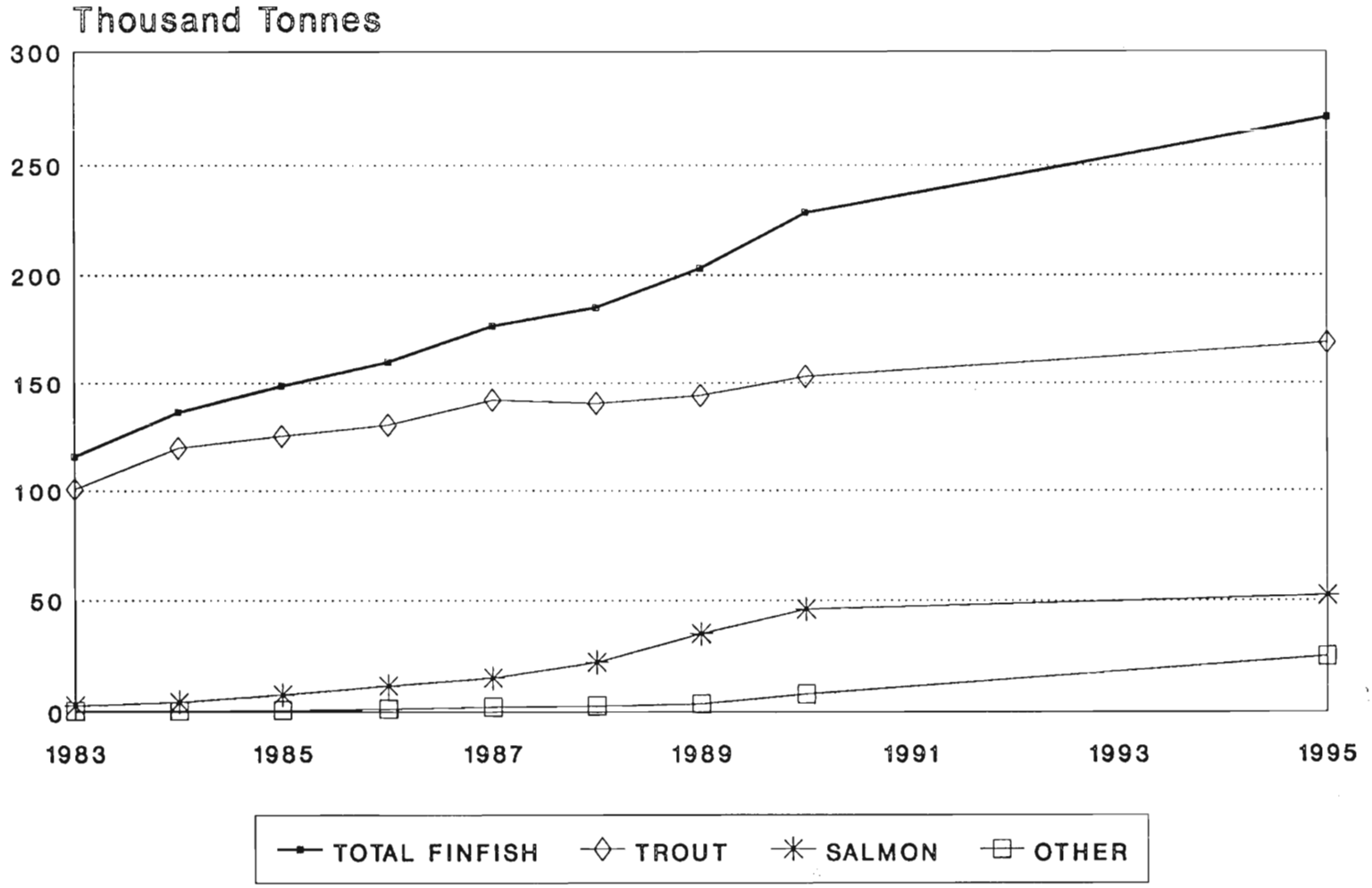


Figure 6.

COMMUNITY CRUSTACEA & MOLLUSC PRODUCTION