The Belgian Mollusk Fisheries*

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ABSTRACT

Bivalves and gastropods landed in Belgium are taken as a by-catch of fisheries targeting finfish or crustaceans, and the nation has never had specialized molluscan fisheries. Species landed consist mainly of whelk, *Buccinum undatum*; and scallops, *Pecten maximus* and *Chlamys* spp. Long-term trends in the landings of mollusks are closely related to long-term changes in fleet and vessel size, gear types used, fishing grounds and target species, and demand on the local market. In the 1950's, the annual landings of whelk fluctuated between 80 and 200 t, while those of scallop were insubstantial. Since then, the landings gradually rose to record figures of 678 t for whelk and 762 t for scallop in the mid-1970's. Most recently, there has, however, been a substantial drop in the landings of both species. Provisional figures for 1991 and 1992 revealed an almost 50% decrease in landings for whelk, and 80% decrease for scallop. Documented history on mollusk trade and consumption in the area nowadays called Belgium goes back to the early days of the Roman occupation. A regional seafood specialty in Belgium is "moules frites" (blue mussels, steam boiled with a mixture of vegetables, and served with French fries). In 1990, over 30,000 t of mussels were consumed, all of which were imported, mostly from the Netherlands. Whelk is eaten locally, but other mollusk species, such as scallops, venerids, and cardiids, were not eaten to any extent until recent decades. Mollusks, as a whole, contribute about one-fifth to the nation's per capita consumption of finfish and shellfish.

Introduction

When, around 55 B.C., the Roman emperor Gaius Julius Caesar conquered the lands west of the lower Rhine River, he met such a fierce resistance that in his written comments he called the Belgians the bravest of all Gauls: "Horum omnium fortissimi sunt Belgae, ..." Since then, the Roman empire has faded away, and so has the Belgians' fame. Nowadays Belgians have the reputation, not so much of being the bravest, but certainly of being the most burgundian of all Germanic peoples—a race that does not despise a delicate meal and a hearty drink. In gastronomic terms this is translated into a broad choice of local dishes and beverages.

When it comes to mollusks, however, the inventory of regional specialties is limited to just one: "Moules frites" (blue mussels, *Mytilus edulis*, steam-boiled with a mixture of vegetables and served with French fries). Its popularity can easily be measured from the quantities of mussels consumed: In 1990 these amounted to over 30,000 metric tons (t) (1.1 million bushels), by a total population of just under 10 million people. Most unfortunately for the local fisheries, however, all mussels are imported.

This roughly sets the tone for the Belgian mollusk fisheries; Belgium never had any specialized molluscan fisheries, and for various reasons probably none will ever develop. Bivalves and gastropods landed in Belgium are taken as a by-catch of fisheries targeting finfish or crustaceans, and the number of species marketed is small—mostly whelk, *Buccinum undatum*, and "scallop," the common denominator for a mixture of mainly great scallop, *Pecten maximus*, with much smaller quantities of queen scallop, *Chlamys* spp.

For many years research priorities in the Belgian fisheries have been on much more economically important species or species groups: Herring (in the years immediately before and after World War II), gadoids, flatfishes, shrimp, and Norway lobster, *Nephrops norvegicus*. As a matter of fact, this is the first attempt ever made to comprehensively review the Belgian mollusk "fisheries." For practical reasons, the review is limited to the period between 1950 and 1990. All fishing areas mentioned in the text are shown in Figure 1.

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Development of the Mollusk Fisheries

The 1950's

In the early 1950's the Belgian trawler fleet comprised about 460 vessels, with an overall fishing capacity of roughly 60,000 HP (Fig. 2, 3). The vast majority (about 290 vessels or almost two-thirds of the fleet) were small cutters and shrimp trawlers of <50 GRT, with engines of <120 HP. The fleet also counted about 150 mid-class motor trawlers (50–150 GRT and 120–350 HP) and a small number of large motor and steam trawlers (>150

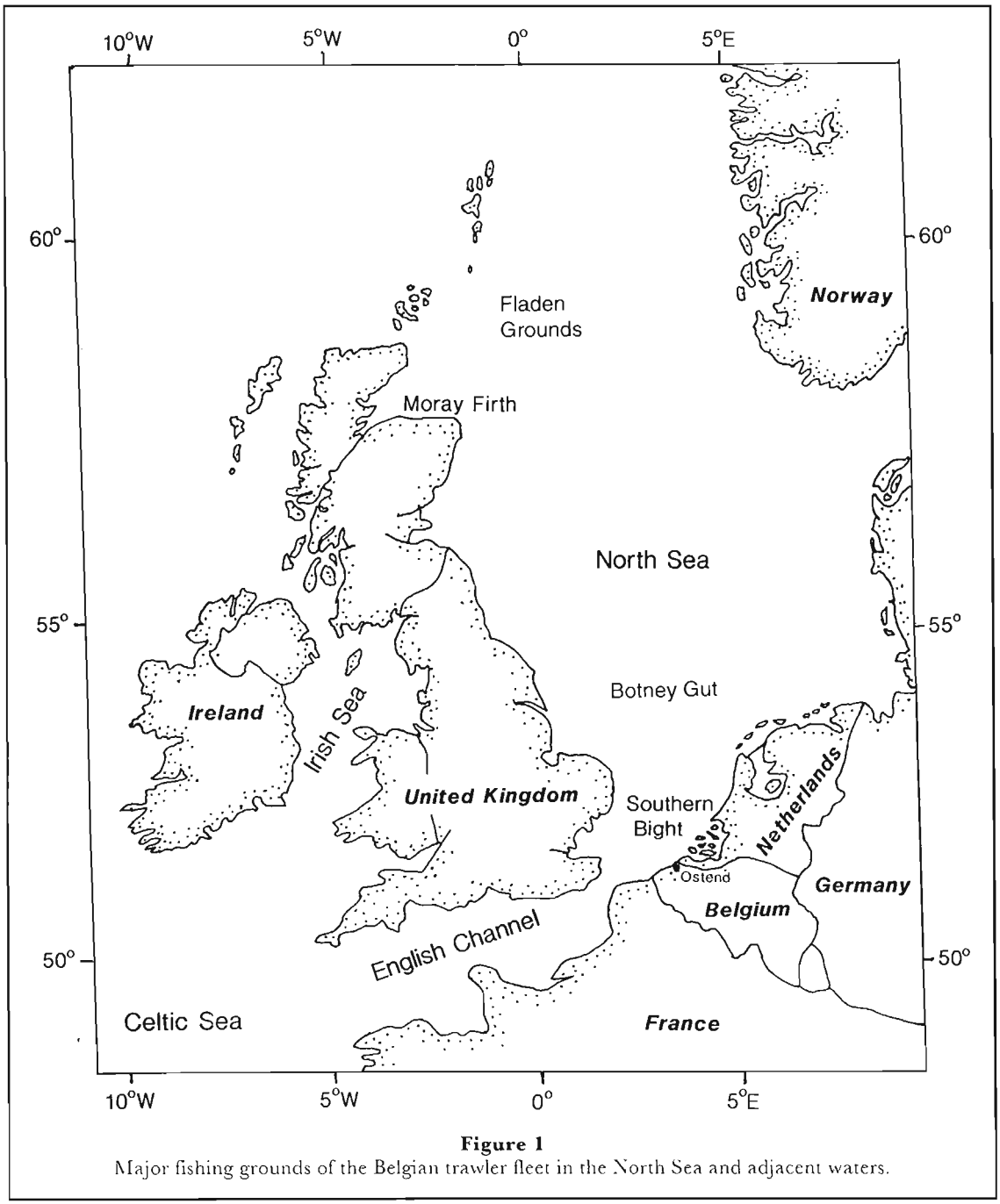

Figure 1
Major fishing grounds of the Belgian trawler fleet in the North Sea and adjacent waters.

GRT and >350 HP). The latter included some older vessels, built in British shipyards in the mid–1920's.

Shrimp trawlers, cutters, and the smaller motor trawlers were concentrated mainly in the coastal waters, the Southern Bight, and the easternmost part of the English Channel, where they fished for brown shrimp, *Crangon crangon*; gadoids (cod, *Gadus morhua;* and whiting, *Merlangius merlangus*); flatfish (especially plaice, *Pleuronectes platessa*; and sole, *Solea solea*), various species of rays, *Raja* spp.; herring, *Clupea harengus*; and sprat, *Sprattus sprattus* (Fig. 4, 5).

Most mid-class and some of the larger trawlers fished in the northern North Sea (particularly in the Moray Firth and on the Fladen Grounds) and the central and the southern North Sea. Their landings consisted mainly of gadoids (haddock, *Melanogrammus aeglefinus*; cod; and whiting), flatfish (plaice and sole) and, locally and seasonally, herring (Fig. 4, 5).

The largest vessels successfully fished for gadoids (haddock; cod; saithe, *Pollachius virens*; and whiting), ling, *Molva* spp.; and redfish, *Sebastes* spp.; on the southern and western coast of Iceland. In 1950, their landings accounted for about one-fifth of the Belgian finfish and shellfish production; 5 years later they scored the highest ever landings of 20,850 t, just under one-third of all finfish and shellfish landed in Belgium (Fig. 4).

In the early 1950's, the fisheries on the so-called western grounds (English Channel, Celtic Sea, and Irish Sea) were not particularly important. Together they yielded between 3,000 and 5,500 t of finfish and shellfish annually, or <10% of the Belgian landings (Fig. 4).

In the immediate post-war period, otter trawling was the most popular fishing method: Demersal for roundfish, flatfish, and shrimp; pelagic or semipelagic for herring and sprat. Beam trawling, which proved to be much more efficient to catch shrimp and flatfish, was introduced in the shrimp fishery in the early 1950's (Desnerck and Desnerck, 1976), but it took almost 10 years before this technique was largely adopted by the flatfish-directed trawlers.

Otter trawling is not the most efficient way to catch strictly benthic organisms, such as whelk or scallop. Thus, the whelk and scallop landings remained small to insubstantial throughout the 1950's. Annual landings of whelk fluctuated between 80 and 200 t, with the highest figures being recorded in the early 1950's (Fig. 6). Great scallop and queen scallop were only considered as a

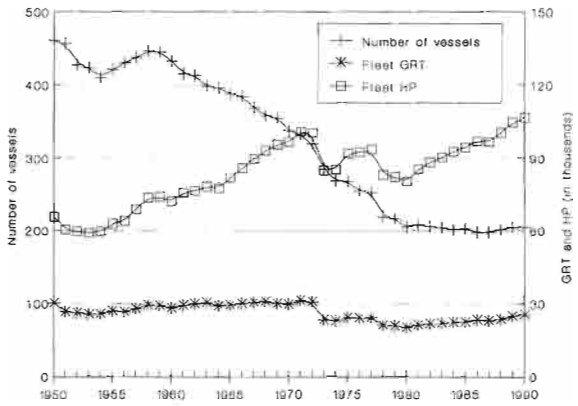

Figure 3
Number of vessels, overall gross tonnage (GRT in thousands), and nominal fishing power (1,000 HP) of the Belgian trawler fleet, 1950–90.

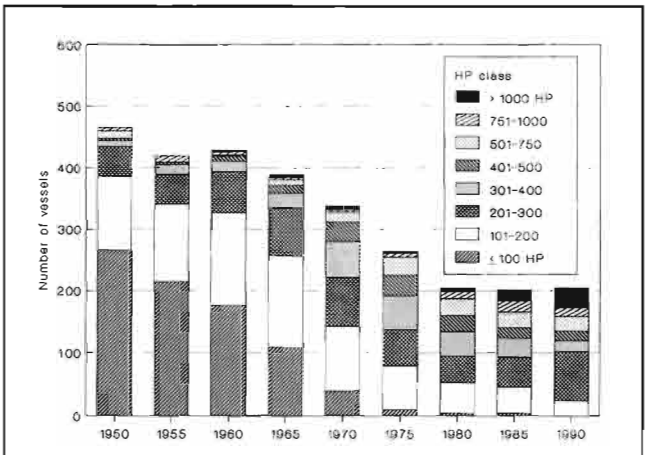

Figure 2
Numbers of vessels in the Belgian trawler fleet by horsepower class, 1950–90.

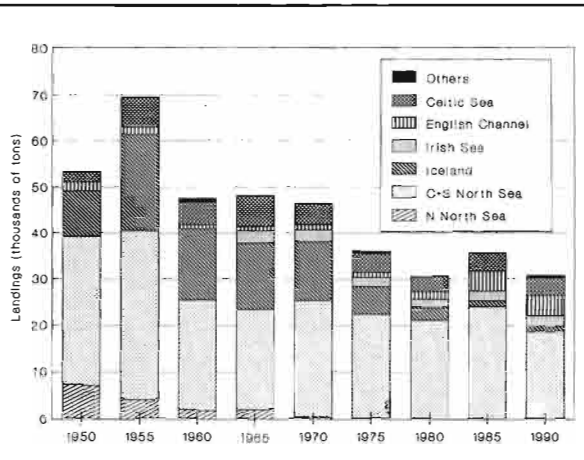

Figure 4
Quantities of finfish and shellfish landed by the Belgian trawler fleet (thousands of metric tons) by ICES Subarea, 1950–90.

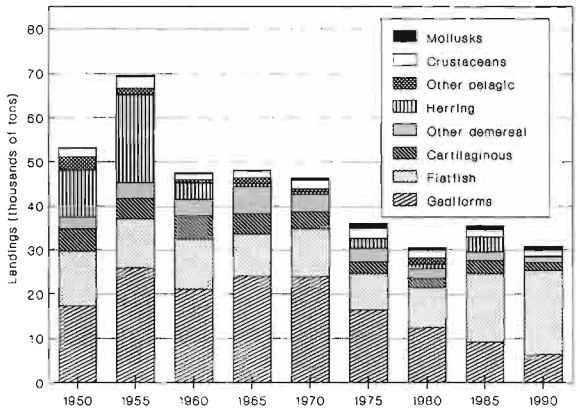

Figure 5
Quantities of finfish and shellfish landed by the Belgian trawler fleet (thousands of metric tons) by species or species group, 1950–90.

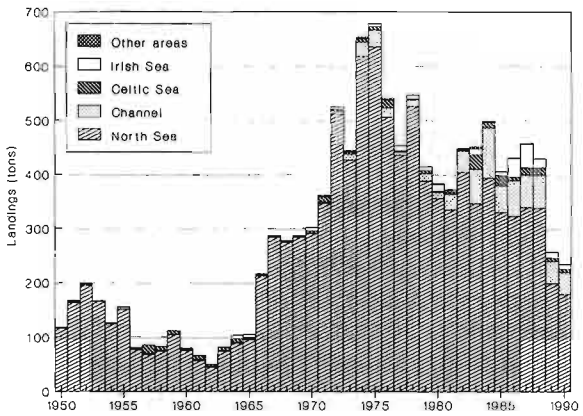

Figure 6
Belgian landings of whelk, *Buccinum undatum*, all fishing gears combined, by ICES Subarea, 1950–90.

separate item in the official landings statistics from 1972 onward. Until then they were included under the heading "Other shellfish," i.e., all shellfish except brown shrimp; Norway lobster; lobster, *Homarus gammarus*; brown crab; *Cancer pagurus*; cephalopods; and whelk. Judging from the quantities of "Other shellfish" landed in the 1950's (<25 t and most often even <5 t/year), the landings of great scallop and queen scallop must have been extremely low at that time.

During the 1950's only minor changes occurred in terms of fleet composition and fishing capacity; fleet size slightly decreased to 432 vessels in 1960; average gross tonnage remained fairly constant; and average engine power rose slightly from 142 HP in 1950 to 167 HP in 1960. Despite the decrease in fleet size, the overall fishing capacity increased by 20% from about 60,000 HP in the early 1950's to just over 72,000 HP in 1960 (Fig. 3).

The changes in terms of catch composition, on the other hand, were much more pronounced. The distant fishery in the Icelandic waters peaked in 1955, then slowly declined to about 16,000 t in the early 1960's (Fig. 4). Overfishing of the herring stocks in the North Sea resulted in a sharp drop in landings, from 19,800 t in 1955 to merely 3,700 t in 1960. As a consequence, gadiforms became by far the most important species group, representing >40% of the Belgian finfish and shellfish landings (Fig. 5).

Early 1960's to the Mid–1970's

In the early 1960's, several trends began to develop within the Belgian fishing industry which would have a major impact on whelk and scallop landings. Throughout the 1960's, many small cutters and shrimp trawlers were decommissioned (Fig. 2). Simultaneously, new and much larger vessels entered the fleet (albeit in smaller numbers), while the engines in many existing vessels were replaced by more powerful ones. Up to the early 1970's, the nominal decrease in fleet size was largely matched by the net increase in average engine power. As a result, total fishing capacity gradually rose from about 72,000 HP in 1960 to just over 100,000 HP in the early 1970's, after which it slightly decreased again to about 92,000 HP in 1975 (Fig. 3).

In the 1960's the Belgian finfish-directed trawler fleet also started to switch from otter trawling to beam trawling. The beam trawl had already been introduced in the shrimp fishery in the early 1950's (see previous section) and, since then, it had become increasingly popular. Beam trawling for flatfish started in the mid–1960's, and because of its obvious merits of yielding much higher catch rates, it quickly superseded otter trawling. Many vessels were adapted or even reconstructed to allow beam trawling. Most of the newly built units were from the very beginning conceived as beam trawlers, or as multifunctional trawlers which could use either a beam or an otter trawl.

Beam trawls owe their effectiveness to the much heavier groundrope and the fact that they can be easily rigged with so-called tickler chains. Tickler chains sweep the seabed in front of the groundrope and raise flatfish from the seabed into the trawl's mouth. Heavy groundropes and tickler chains also contribute to increase catches of epibenthic animals, such as large gastropods, scallops, and starfish.

Figure 7
Nephrops-directed otter trawler (27 m length over all, 98 GRT, 375 HP) fishing in the Botney Gut-Silver Pit area, central North Sea. Photograph by E. Coucke.

Later on, the development of chain mats and groundropes with wooden or rubber "bobbins," enabled the beam trawlers to fish for flatfish even on rough grounds with scattered boulders and stones, which were not accessible to otter trawlers.

The overall increase in nominal fishing power throughout the 1960's, combined with the introduction of the much more efficient beam trawl in the mid–1960's, resulted in a considerable increase in effective fishing capacity of the Belgian trawler fleet, especially with respect to bentho-demersal finfish and shellfish. This had an immediate effect on the whelk landings, which quickly rose from about 100 t in 1965 to a record of 678 t in 1975. Over 90% of these were caught in the North Sea (Fig. 6). This is not surprising because at that time most of the flatfish-directed effort was confined to the North Sea. Precise data on the areal distribution of the fishing effort are not available for this particular period but, judging from the proportions of plaice and sole taken (the prime target species of the beam trawlers), it can be assumed that some 65–90% of the beam trawl effort must have been concentrated in the North Sea.

Another feature which undoubtedly contributed to the increase in the whelk landings was the expansion of the *Nephrops* (Norway lobster) fishery in the central North Sea (particularly in the Botney Gut-Silver Pit area) from the late 1960's onward (Fig. 7).

Throughout the 1950's and most of the 1960's, the larger part (60–90%) of the *Nephrops* landed by Belgian trawlers was taken in Icelandic waters. In the late 1960's and early 1970's, however, the landings of Icelandic *Nephrops* fell sharply, and in 1974 they came to a definite end. The latter was an immediate consequence of the September 1972 agreement between Iceland and Belgium which laid down the conditions under which Belgian trawlers were allowed to fish in the Icelandic EEZ. This agreement included, amongst others, an explicit ban on *Nephrops* trawling.

The gap in the market, created by the "loss" of the Icelandic *Nephrops* grounds, was quickly filled by the expansion of the *Nephrops*-directed otter trawl fishery in the central North Sea. *Nephrops* landings from this area almost doubled from the late 1960's to the late 1970's, from 295 t in 1968 to 575 t in 1978.

In the 1980's (the only period for which accurate landings data by statistical rectangle, gear type, and vessel class are available) the *Nephrops*-directed otter trawlers landed between 35 and 65 t of whelk annually, i.e., 10–20% of all whelk caught in the North Sea by Belgian trawlers. Similar vessel class or gear statistics are not available for the 1960's or the 1970's, but it seems likely that the increase in the *Nephrops*-directed effort in the late 1960's and in the 1970's contributed to the increase in landings of whelk from the North Sea as well.

Scallop was not dragged along by the same stream of events which pushed up the whelk landings from the mid–1960's onwards. For several reasons it took almost another decade before the scallop landings started to rise (Fig. 8).

First of all, the offshore fishing grounds in the North Sea never have been extremely rich in scallops. According to ICES statistics, the North Sea as a whole never yielded >10% of the European scallop landings, most of which were taken in inshore waters on the British east coast. This explains, at least in part, why the Belgian scallop landings remained at a low level throughout the 1960's and the early 1970's. At that time, most of the Belgian beam trawl effort was concentrated on the more or less offshore fishing grounds in the North Sea, which are even poorer in scallop than the coastal waters.

However, judging from the quantities of scallop landed from the North Sea in the 1980's, it is almost certain that the quantities caught in the 1960's and early 1970's must have been large, as compared with the few tons actually landed. Discarding must have been substantial, and this was closely related to the small sales potential for scallop at that time. Unlike whelk, scallop had little or no "culinary tradition" in Belgium. Cooked or steam-boiled whelk was a well-known dish, especially to the coastal population, but for some reason scallop was not widely appreciated. This started to change in the early 1970's. The revival of tourism and gastronomy, both induced by the economic boom of the "Golden Sixties," helped to familiarize the Belgian consumer with more "exotic" seafoods, such as scallop, squid, and cuttlefish. A market was established, and from the mid–1970's onwards, the national demand for scallop quickly rose.

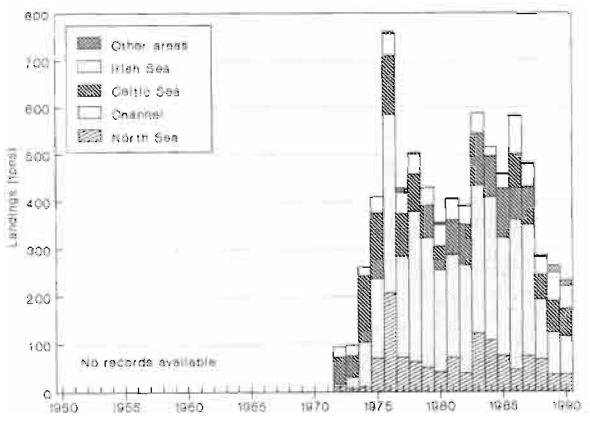

Figure 8
Belgian landings of scallops, *Pecten maximus* and *Chlamys* spp., all fishing gears combined, by ICES Subarea, 1950–90.

Mid-1970's to the Mid-1980's

In the late 1970's and throughout the 1980's, modernization of the Belgian trawler fleet continued (Fig. 2, 3). Fleet size decreased further, from 268 vessels in 1975 to 205 in 1980, then roughly stabilized. Between 1975 and 1985 the average gross tonnage rose from 90 to 110 GRT, and the average engine power from 343 to 468 HP. These trends continued during the late 1980's, raising the average gross tonnage to 124 GRT in 1990, and the average engine power to 520 HP. Over the same period the overall fishing capacity of the fleet first decreased from about 92,000 HP in 1975 to just below 80,500 HP in 1980, then steadily increased again to its present level of about 107,000 HP (Fig. 3).

Changes in landings composition were most striking with regard to both areas fished and species landed. By the end of the 1960's, the herring fisheries had completely collapsed and, except for a short upsurge in the mid-1970's and another one in the mid-1980's, annual landings hardly exceeded 1,000 t or even 500 t. Because of the "facing out" agreement with Iceland, the landings from that area (mainly gadoids and redfish) fell off rapidly from about 12,500 t in the early 1970's to <1,500 t in the mid-1980's. On top of that, several important gadoid stocks, especially in the North Sea, started to suffer from overexploitation, causing an extra drop in the gadoid landings (Fig. 4, 5).

Consequently, the Belgian trawler fleet was increasingly geared to flatfish (Fig. 9, 10). In 1982, flatfish became the most important species group in the landings. By 1990, their part in the Belgian finfish and shellfish production had reached record levels of 61.5% and almost 70%, respectively, of quantities landed and gross return to the fishermen (Fig. 5 and 11).

The search for plaice and sole led to a further overall increase in beam trawl effort and to a further diversion of effort to the western fishing grounds (English Channel, Celtic Sea, Irish Sea, and Bay of Biscay). Sole-directed beam trawl effort (which may be considered as a fairly reliable index of the overall fishing effort toward flatfish) rose sharply from the mid-1970's to the

Figure 9
Flatfish-directed beam trawler (30 m length over all, 182 GRT, 900 HP) of the type currently fishing in the North Sea and on the western grounds. Photograph by R. Fonteyne.

Figure 10
Beam trawl with chain mats, used to fish for flatfish on rough grounds. Photograph by R. Fonteyne.

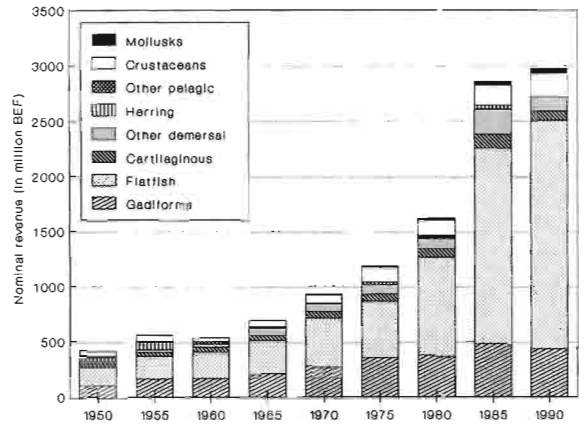

Figure 11
Gross return of the Belgian finfish and shellfish landings by species or species group, 1950–90.

early-1980's in all western areas. Trends varied from one area to another, from a roughly 50% increase in the Celtic Sea and the Irish Sea, to a steep fivefold increase in the English Channel.

The overall increase in flatfish-directed fishing effort in areas with high scallop densities (such as the English Channel and, to a lesser extent, the Celtic Sea and the Irish Sea), together with the increasing demand for scallop on the national market, brought about a real boom in the scallop landings, from <50 t in the late 1960's and early 1970's to a record 762 t in 1976. The next year, the landings dropped by nearly 45% to about 430 t. From then onward until about 1987, they fluctuated between 350 and 600 t. More than half of the scallop landings were taken in the English Channel. The Celtic Sea yielded 15–25% of the landings, the North Sea 10–20%, and the Irish Sea 5–15% (Fig. 8).

Over the same period, whelk landings were at a similar level, fluctuating between 350 and 500 t. Until 1982, >90% of these were landed from the North Sea. Together with scallop, however, the landings of whelk from the western grounds (especially from the English Channel) rose sharply during the middle and late 1970's, and by 1983 their part in the Belgian whelk landings had reached 20–25% (Fig. 6).

The Late 1980's

Most recently the landings of both whelk and scallop dropped substantially, from 430 t in 1988 to just over 230 t in 1990 for whelk (Fig. 6), and from 480 t in 1987 to also about 230 t in 1990 for scallop (Fig. 8). Provisional figures for 1991 and 1992 suggest that the whelk landings are stabilizing at between 230 and 265 t, while scallop landings continued to decline to a mere 90 t in both 1991 and 1992 (a decrease of about 80% from the mid-1980's).

For scallop, sufficient evidence exists to conclude that the alarming decrease in landings is due to a depletion of the stocks, especially on the western grounds (see the section on seasonal fluctuations in the landings). Contrary to scallop, the state of exploitation of the whelk stocks has never been studied in detail, at least not in the North Sea. Therefore, it is difficult to identify the precise reason for the decline in the landings. The recent drop in whelk landings per unit effort (discussed later), and the dwindling auction prices, which fell roughly 25% despite an almost 50% decrease in landings (see next section), suggest that both biological and economic factors may have contributed to the decline in whelk landings.

Trends in Gross Returns and Auction Prices

Ever since the early 1950's, the Belgian mollusk "fisheries" have been of minor importance in terms of both quantities landed and financial returns to the fishermen. In the 1950's and early 1960's, whelk and scallop represented <0.4% of the overall yield of the Belgian sea fisheries (all finfish and shellfish landed by Belgian trawlers in Belgian ports) (Fig. 5), and <0.3% of the sales figures in the auctions (Fig. 11).

This situation changed, at first in the late 1960's with the rise of the whelk landings, and again in the mid-1970's with the rise of the scallop landings. Since then, the contribution of whelk and scallop to the total sea fisheries yield has fluctuated between 2.0 and 3.5%, and their share in the sales figures has fluctuated between 1.0 and 1.5%.

The gross returns of whelk increased from BEF0.3–1.0 million (BEF1 = US$0.03) in the 1950's and the early 1960's to BEF7.0–10.0 million in the late 1970's and the 1980's. Record sales figures were reached in 1983 and 1984, with almost BEF13.0 million (0.6% of the total sales figure for all finfish and shellfish landed in Belgium).

Nominal auction prices of whelk (not adjusted for annual inflation) varied considerably throughout the 1950's and the 1960's from BEF3.5 to 9.5/kg. From the early 1970's to the early 1980's they almost tripled, to over BEF28.0/kg, then fell again to between BEF17.0 and 22.5/kg (Fig. 12).

Deflated auction prices (adjusted to 1950 prices, using a compound pluri-annual inflation index), show little or no long-term trends. Even the sharp rise in whelk landings from the mid–1960's to the mid–1970's had no major impact on prices. Rather surprisingly, the recent drop in landings was not accompanied by an increase in the auction prices. Since 1984, deflated

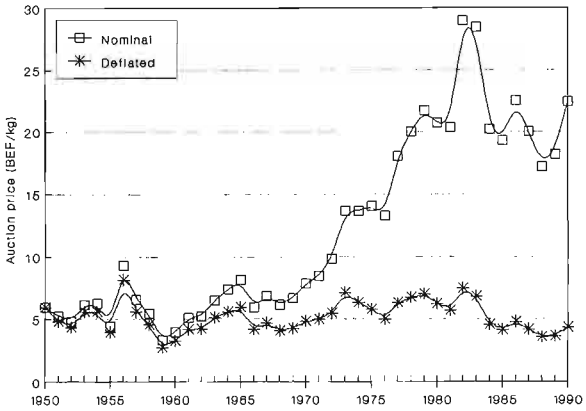

Figure 12
Nominal and deflated auction prices (BEF/kg) of whelk, *Buccinum undatum*, 1950–90.

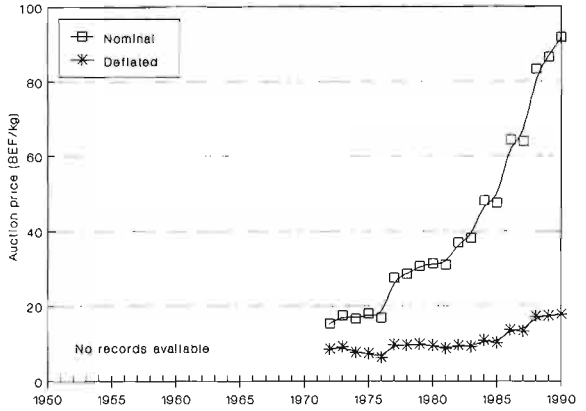

Figure 13
Nominal and deflated auction prices (BEF/kg) of scallops, *Pecten maximus* and *Chlamys* spp., 1950–90.

prices have been far below the average for the preceding 15 years, and in 1988 they almost reached a historical minimum (Fig. 12). Whether this is due to market saturation is unclear, but it almost certainly enhanced discarding by the fishermen which, in turn, may have put some pressure on the landings.

Whelk always has been among the cheapest of fisheries products, outvalued by almost all other finfish and shellfish, except for some ill-reputed species such as horse mackerel, *Trachurus trachurus*, and flounder, *Platichthys flesus*.

Data on gross returns and prices per kilogram of scallop are available from the early 1970's onwards. At that time the demand for scallop on the local market was poor and the auction price low, at about BEF15.0–18.0/kg. Since then, nominal auction prices increased almost continuously, to a peak value of BEF91.5/kg in 1990. Deflated auction prices also showed an upward trend, from BEF6.5–10.0/kg in the 1970's and early 1980's to over BEF17.0/kg in the late 1980's, a doubling of their market value in <10 years (Fig. 13).

Nowadays, scallop ranks in the top ten of the most expensive fisheries products, behind turbot, *Psetta maxima*; anglerfish, *Lophius piscatorius*; halibut, *Hippoglossus hippoglossus*; sole; brill, *Scophthalmus rhombus*; brown shrimp; lobster; Norway lobster; and lemon sole, *Microstomus kitt*; but ahead of some "renowned" fisheries products such as haddock, cod, plaice, and ray.

Increasing landings combined with increasing prices made the gross returns of scallop rise quickly, from <BEF5.0 million in the mid-1970's to >BEF20.0 million in the 1980's. Scallop had an outstanding year in 1986, with a sales figure of BEF37.5 million (1.2% of all finfish and shellfish auctioned).

Over short periods and under relatively stable market conditions, there appears to be a close inverse relationship between landings and auction prices, for both whelk and scallop. In the long term, however, this relationship is overshadowed by the major changes in the market situation, which occurred over the past decades. The increase in demand for scallop in the mid–1970's, for example, created a much larger sales potential for this species and, as a result, the market was able to absorb much larger quantities, without any drop in the auction prices (Fig. 13).

Present Status of the Fisheries

Seasonal Fluctuations in Landings and LPUE's

Seasonal fluctuations in landings and landings per unit of fishing effort (LPUE[1]) are well documented for whelk and scallop for the years 1981–90. The available database includes total and species-directed effort (in numbers of voyages, hours fished, and HP corrected fishing hours) as well as quantities landed by area, month, gear type, and vessel class. Discussing or even summarizing all the data would be beyond the scope of this publication. The focus, therefore, will be on two representative examples, beam trawl landings of whelk from the North Sea and scallop from the English Channel, with some side comments on the other fisheries.

North Sea whelk landings by flatfish-directed beam trawlers show a clear seasonal pattern, with peak values

[1] The LPUE's in this paper were calculated from effort data for vessels actually landing whelk or scallop, and not from effort data for the fleet as a whole. Unless stated otherwise, LPUE's are given in kg/hour trawling.

in autumn and early winter, usually between September-October and January-February (Fig. 14). In most years there is a second, much lower and much narrower peak in the landings around June. Roughly similar fluctuations appear from the data series for the *Nephrops*-directed otter trawlers operating in the central North Sea and for the flatfish-directed beam trawlers in the English Channel.

The whelk LPUE's of North Sea beam trawlers display a seasonal pattern similar to that in the landings. In the early and mid-1980's (i.e., before the decline of the whelk landings), the average LPUE's during the peak season varied from 0.6 to 2.8 kg/hour trawling for the 51–100 GRT vessels, from 1.7 to 3.6 kg for the 101–150 GRT vessels, from 3.5 to 6.5 kg for the 151–200 GRT vessels, and from 4.5 to 7.9 kg for the largest vessels. The data available for vessels ≤50 GRT were too erratic to be included in this comparison. Data for individual seasons show a clear, almost linear relationship between GRT and LPUE (Fig. 15). In recent years, however, the peak LPUE's dropped by about 50% as compared with the figures for the early 1980's. This may be due to a decline of the stocks or to an increase in discarding by the fishermen in response to the relatively low auction prices of whelk (see previous section on trends in gross returns).

Scallop landings by beam trawlers fishing in the English Channel show marked seasonal fluctuations, with sharp peaks between December–January and April–May (when, from a gastronomical point of view, the scallops are at their best, because of the fully developed gonads or "coral"), and marked lows during summer (Fig. 16). Similar patterns are recorded for the Celtic Sea and the Irish Sea, albeit slightly shifted in time. Peak landings usually occur between January–February and April–May in the Celtic Sea, and between March–April and May–June in the Irish Sea. Beam trawling in the Irish Sea is a strictly seasonal activity, with 55–85% of the fishing effort concentrated in the period March–June. The seasonal pattern of the North Sea scallop landings is irregular, with respect to both rhythm and range of the fluctuations.

Before the decline of the scallop landings in 1988, peak season LPUE's in the English Channel ranged

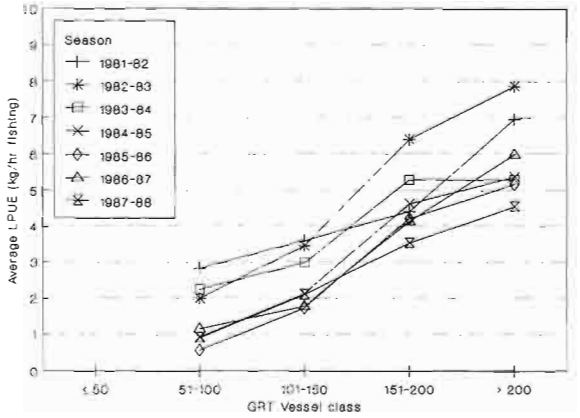

Figure 15
Relationships between beam trawler GRT and peak season LPUE's of whelk, *Buccinum undatum*, landed from the North Sea.

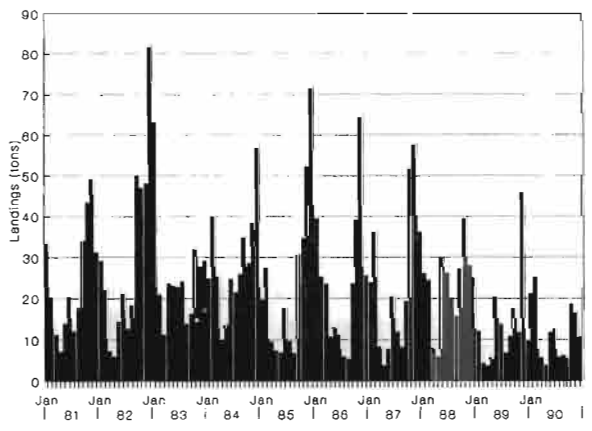

Figure 14
Monthly landings of whelk, *Buccinum undatum*, from the North Sea by flatfish-directed beam trawlers, all vessel classes combined, 1950–90.

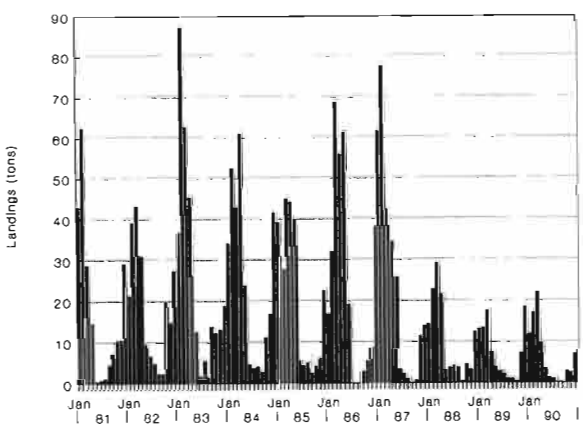

Figure 16
Monthly landings of scallops, *Pecten maximus* and *Chlamys* spp., from the English Channel by flatfish-directed beam trawlers, all vessel classes combined, 1950–90.

from 3.9 to 6.3 kg/hour trawling for the ≤50 GRT vessels, from 3.2 to 8.3 kg for the 51–100 GRT vessels, from 2.6 to 6.7 kg for the 101–150 GRT vessels, and from 3.5 to 17.8 kg for the 151–200 GRT vessels. Data for the vessels >200 GRT were too few to allow any comparison. The data series for individual seasons show a broad and hardly conclusive array of relationships between GRT and LPUE.

Since 1988, the peak season LPUE's of scallop in the English Channel fell by >70% as compared with the early 1980's. Similar drops occurred in the North Sea and the Celtic Sea but not in the Irish Sea. The severe drop in the LPUE's in scallop-rich areas such as the English Channel and the Celtic Sea gives reason for concern since it may be symptomatic of an alarming depletion of the scallop stocks.

Management Regulations

Except for the regulations set by the Commission of the European Union (which are legally binding to all EU member countries), national or local management regulations that specifically apply to the Belgian mollusk fisheries do not exist. For great scallop there is a minimum landing size of 110 mm (ICES Sub-area VIId - English Channel East) or 100 mm (all other areas), measured across the largest width of the shell (EU Regulation 3094/86, Section 5). No minimum landing size regulations exist for queen scallop or whelk.

For the time being, there are no catch or effort restrictions for any of these species (at least not in the areas accessible to the Belgian trawler fleet). This may change, even in the near future, especially if the depletion of the scallop stocks continues along the trend set during the most recent years.

Management regulations not directly aimed at mollusks, such as the temporary closing of fishing areas for plaice or sole to avoid overshooting the TAC's, may, however, have an immediate impact on the landings of other species as well, including whelk and scallop.

Mollusk Trade and Consumption

The First Traces of Mollusk Consumption

The documented history on mollusk consumption in the area nowadays called Belgium, goes back to the early days of the Roman occupation (1st century A.D.). Excavations on inland Gallo-Roman sites revealed fragments and complete shells of several marine mollusk species (Gautier, 1972, 1983; Cordy, 1981; Peuchot, 1981; Van Neer, 1988, 1990), amongst which oysters were by far the most abundant. Oysters were highly prized by the Romans, and the presence of a variety of oyster that is typical for the English Channel and the British Isles, suggests they were sometimes traded over long distances.

Strong evidence on the methods used to transport the oysters is lacking, but they most probably were firmly tied up to avoid loss of liquid, and then covered with seaweed to keep them cool and moist (Peuchot, 1986). Even under these conditions, the shelflife of oysters is relatively short, which led to the hypothesis that they were brought quickly to destinations, possibly by mounted couriers (Peuchot, 1981).

Mussels and cockles, *Cerastoderma edule*, were first found in remains from the 1st to 3rd centuries (Gautier, 1972, 1983; Peuchot, 1981), and whelks in funeral tombs and rubbish dumps from the 2nd to 4th centuries (Gautier, 1972). Mollusks probably were consumed even earlier by prehistoric populations living along the coast, but, as yet, no faunal remains from such sites are available.

Archeozoological investigations on medieval and early post-medieval sites, covering a time span of >1,000 years between the 6th and the 17th century, yielded numerous fish and shellfish remains, including oysters, mussels, cockles, whelks, and periwinkles, *Littorina littorea* (Gautier, 1983; Gautier and Van der Plaetsen, 1986; Van der Plaetsen, 1985a). The finds confirm that, throughout the ages, there has been an active trade in fisheries products, including mollusks, between the coastal areas and the inner parts of the country; Van der Plaetsen (1985b) provides a comprehensive review.

Rise and Fall of the Oyster Growing Industry

The local history of oyster growing dates back to the end of the 18th century, when the first oyster growing farm was established near Ostend (Halewyck and Hostyn, 1978). Young oysters were imported from the United Kingdom and grown to a commercial size in man-made ponds. The industry flourished during the "Belle Epoque" period, from about 1865 to 1914, with annual exports of up to 30 million of the internationally renowned "Ostendaises" or "Royal d'Ostende" to France, Russia, the Balkans, Germany, and Austria. On the eve of World War I, the oyster industry counted 26 growing farms and employed >270 people (Halewyck and Hostyn, 1978).

After World War I, the oyster growing industry started to subside. Many oyster parks had been severely damaged during the war, and the supply of young oysters was badly affected by a disease outbreak in the English rearing farms (Halewyck and Hostyn, 1978). First attempts to revive the industry and to actually rear oysters in the Ostend Sluice-dock (an inland seawater basin, originally designed to "blow out" the harbor) were fairly successful, but they were thwarted by World War II.

New trials, especially in the 1960's, largely failed because of increasing problems with water quality and with competitors (barnacles and *Crepidula*) of the seedling oysters (Halewyck and Hostyn, 1978). The last oyster growing company ceased its activities in the early 1980's.

Trends in Mollusk Consumption Since the 1950's

In 1990 (the most recent year for which exhaustive trade and consumption statistics were available), Belgium imported about 34,200 t of live, fresh, frozen, or dried marine bivalves and gastropods (product weight, not converted to live weight), and 2,600 t of canned or likewise preserved mollusks (including cephalopods). The total live weight of the bivalve and gastropod imports (all commodity groups combined) was estimated at about 37,500 t, a figure that exceeded the grand total of the Belgian finfish and shellfish landings by roughly 6,500 t. The overall value of the imports (all commodity groups, cephalopods excluded) amounted to BEF2.6 billion, i.e., 11.5% of the grand total for all finfish and shellfish imports for human consumption in 1990.

The 1990 imports of bivalves and gastropods (excluding canned products) comprised, amongst others, 30,630 t product weight of live or fresh blue mussels; 1,590 t of oysters (European flat oyster, *Ostrea edulis*; and various species of cupped oysters, *Crassostrea* spp.); and 900 t of fresh or frozen pectinids, mainly from the Netherlands (92.0%) and France (4.5%). Imports from non-EU countries represented <0.5% of the total.

Compared with the imports, the 1990 exports were small: 280 t of marine bivalves and gastropods (product weight) and 700 t of canned mollusks (including cephalopods). The exports (all commodity groups, cephalopods excluded) had an overall value of about BEF120 million (just over 1.5% of the total export sales figure for fisheries products). Part of the exports consisted of canned mollusks, imported as raw products and processed by the local food industry.

The availability of import and export statistics varies widely among species in both detail and time span covered. For mussels, the data series goes back to the immediate post-war years, but the imports and exports of many other species, such as pectinids, venerids, and most cephalopods, were not recorded as separate items in the trade statistics until 1988. Long-term trends in the national consumption of individual species or species groups, therefore, can be given for only a limited number of them.

The total consumption[2] of blue mussels fluctuated between roughly 19,000 and 25,000 t/year from the early 1950's until 1980. In 1981 it increased in one stroke by 5,400 t, and since then it has balanced between roughly 25,000 and 32,000 t/year, with a peak of 31,800 t in 1982. The annual per capita consumption of mussels followed a similar trend (Fig. 17). Most blue mussels were, and still are, imported from the Netherlands. In 1990 Belgium took 30,320 t or almost one-third of the Dutch mussel production, together with much smaller quantities (usually <3% of the imports) from Denmark, France, Germany, Ireland, and occasionally the United Kingdom.

The annual consumption of flat and cupped oysters has fluctuated widely over the past decades, from 560 t to just over 2,900 t. Since 1986 it has remained fairly stable at about 1,600 t/year. In 1990 the oyster imports comprised 53 t of live flat oysters and 1,530 t of "Other oysters," mainly supplied by the Netherlands (54%) and France (43%).

The total consumption of "Other mollusks" (a wide variety of bivalves, gastropods, and cephalopods including, amongst many others, whelk and scallop) increased almost linearly from 830 t (live weight) in 1965 to 4,250 t in 1990.

The data series on canned mollusks (including cephalopods) shows considerable variations. Consumption figures fluctuated between 1,000 and 1,600 t/year (product weight) from the mid–1960's to the mid–1970's and, after a sharp increase to almost 2,100 t in 1977, between 1,400 and 2,200 t/year in the late 1970's and throughout the 1980's.

The annual per capita consumption of mollusks (including cephalopods) ranged from 2.5 to 3.1 kg live weight from the mid–1960's to the mid–1970's, then

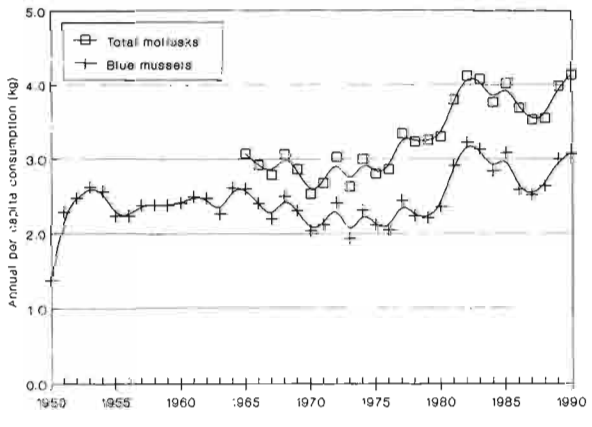

Figure 17
Annual per capita consumption (kg live weight) of mollusks (including cephalopods), and blue mussel, *Mytilus edulis*, 1950–90.

[2] Consumption figures were calculated as Imports + Landings – Exports, and unless stated otherwise, are given in metric tons live weight per annum.

quickly rose to just over 4.1 kg in 1982. Within the next 5 years it declined to about 3.5 kg, but most recently it increased again to 4.1 kg (Fig. 17). The exact share of bivalves and gastropods therein is difficult to establish, except for the years 1988–90, when they represented 91–93% of the annual mollusk consumption. A tentative breakdown by species or species group of the 1990 per capita mollusk consumption is given in Figure 18.

Mollusks, as a whole, contribute about one-fifth to the total consumption of finfish and shellfish in Belgium, a figure that has hardly changed over the past 25 years. Flat and cupped oysters are usually eaten raw from the shell, with a dash of pepper and a few drops of lemon juice; mussels and whelk are most often steam-boiled with a mixture of onions, leek, celery, and parsley. The domestic consumption of other bivalves and gastropods is low and, strictly speaking, there are no traditional, regional preparations for these species. Restaurants throughout the country, however, may offer a wide choice of dishes, most often inspired by French, Spanish, or Italian gastronomy, of which mollusks are an essential ingredient.

Mussels, scallops, queen scallops, cockles, and sometimes carpet shells, *Venerupis* spp., are also used in salads, and in sauces accompanying, for example, cooked or fried whitefish. Worth mentioning, and typically Belgian, is the so-called "sauce à l'Ostendaise," a creamy dressing with brown shrimps and mussels, which goes particularly well with sole.

The Future

Against the cheerless background of declining scallop stocks and a dwindling whelk market, the immediate future of the Belgian mollusk "fisheries" does not look promising. If the current overexploitation of the scallop stocks continues, the EU may be compelled to set precautionary TAC's to protect them. In that case, the Belgian fisheries may well be pinned down to very low or even zero TAC's in a number of fishing areas, which would put a serious constraint on the development of any specialized scallop fisheries.

Attempts to develop such a fishery were undertaken by the Fisheries Research Station (Ostend, Belgium) in the mid-1980's (Anonymous, 1986). The experiments consisted of rigging a series of scallop dredges to the beam of a beam trawl, and to fish for scallop on the offshore scallop grounds in the English Channel. Although the results were promising, with catches of up to 22.5 t of scallop in 16 days at sea (i.e., an average of 1.4 t/day), the technique was never used on a commercial scale, mainly because fishermen lacked interest in it.

The traditional, almost conservative, attitude of many fishermen and shipowners with respect to target species and fishing techniques has been a major impediment to the diversification of the Belgian sea fisheries. Beam trawling for plaice and sole currently pays well. In the long term, however, focusing on a small number of species may well prove not to have been the best way to guarantee the future of the Belgian fishing industry.

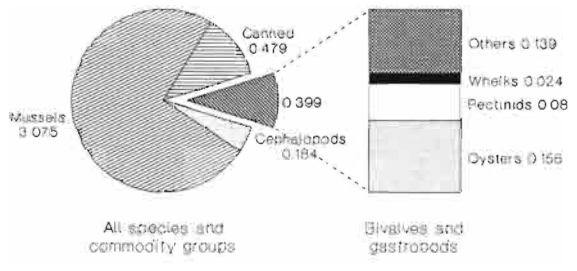

Figure 18
Tentative breakdown of the 1990 per capita consumption of mollusks (kg live weight) by species or species group.

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