of supply decreased considerably. Recovery depends on recovery in the world supply of cereals, but much might be done to increase supplies of pig meat by keeping a few pigs on every farm, where they obtain their maintenance requirements from scavenging. In Poland and Germany pig production is based on surplus potatoes, but here this crop requires too much labour to make it a feasible proposition at the present time.

SUMMARY

Our needs in meat are about 146 lb./head/year, of which we now produce only about 38 lb., though pre-war we produced about 65 lb. The total amount we could produce depends on the steps taken to implement production; with the increase in the productivity of the new long-ley grassland, meat production should be greater than in pre-war days.

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## The Contribution of British Sea Fisheries to the Nation's Food Supply

By R. J. H. BEVERTON, *Fisheries Laboratory, Lowestoft*

The productivity of sea fisheries depends ultimately, as that of animal stocks on land, on primary producer organisms deriving their energy from the sun by photosynthesis. Green plants fulfil this role in terrestrial communities, but their place is taken in the sea by minute unicellular green organisms floating freely in the upper waters. All important fish, however, are carnivorous, with the consequence that fish stocks become inter-related in a complex way. Moreover, fish populations cover large areas as a single unit, and are fished by several countries simultaneously. While it does not seem practicable at the present time to increase the basic productivity of sea fisheries by increasing the quantity of primary producer organisms, it is possible to adjust the fishing effort so as to derive the greatest yield from the growth of fish stocks. In some regions, particularly the North Sea, the maximum level of yield had been reached some years ago, and by 1938 fishing had increased beyond the optimum. The result was over-fishing, with a consequent fall in productivity of the stocks and in profit to the industry. From such regions, and for the fish which suffered from over-fishing, the potential yield, though limited, is somewhat greater than the 1938 level. The difference, amounting to a rough figure of 20% for the demersal fish of the North Sea, could be achieved by suitable regulation of the fishing effort. During the war, fishing was greatly restricted, and stocks increased as a consequence, though indications are that this increase will be a temporary one only. For this reason, and because fishing fleets are still expanding, the present level of productivity from home waters has to be interpreted with caution.

The edible weight of fish landed by British vessels in Great Britain in 1938 and 1946 totalled about 550,000 t. and 500,000 t. respectively. The contribution of the important species, both as edible weight and in terms of protein, calcium and calories, is given in Table 1. These figures must be regarded as estimates only, in view of the range of variation in edible proportion and in chemical composition. If the population of the United Kingdom is taken as 48 millions in 1946, fish could have supplied 4·5 g. of protein, 13 mg. of calcium and 35·5 Cal./head/day.

### *Cod*

Cod made up nearly one-third of the total landings (edible weight) in 1938 and in 1946. The North Sea cod supply is limited, but there are reserves in Arctic waters which already supply over half the total landings of cod, and which are far from being exploited to the full. Expansion of the Arctic trawler fleet, provided it is accompanied by improvement in methods of preservation and handling of the catch at sea, particularly in the summer months, could materially increase both the quantity and quality of Arctic cod.

### *Haddock*

The haddock presents a rather similar picture, being over-fished in the North Sea, and with reserves in the Arctic. However, not only is the North Sea a relatively more important source of haddock than of cod, but the Arctic haddock population seems far less extensive. The measures suggested for cod, nevertheless, should also result in greater haddock yields from the Arctic.

### *Hake*

As far as is known, there are no reserves of hake comparable with those of cod and haddock. The hake grounds were severely over-fished before the war, and though stocks recovered as a result of the reduced wartime fishing, recent increases in Spanish and Portuguese trawling are rapidly nullifying this improvement. As a direct demonstration of the value of reduction of fishing effort on an over-fished stock, it may be noted that at one period during the war one-third to one-half the number of trawlers were landing two to three times the pre-war weight of hake (Hickling, 1946).

### *Plaice*

The North Sea grounds are the major source of plaice, but here, too, over-fishing was severe before the war. The stocks increased three to four times during the war, and though this improvement is still not quite exhausted, it cannot be long before the continued expansion of trawler fleets reduces landings to their pre-war level.

Table 1. *Estimated edible weight of landings of fish by British vessels in England, Scotland and Wales in 1938 and 1946*

(The table is compiled from data of the Ministry of Agriculture and Fisheries (1939, and unpublished) and of the Fishery Board for Scotland (1939). Conversion factors are based on data of Reay, Cutting & Shewan (1946) and Lovern (1946).)

| Species | Fillets or edible weight 1938 (t. × 10³) | Fillets or edible weight 1946 (t. × 10³) | Protein 1946 (t.) | Calcium 1946 (t.) | Calories 1946 (Cal. × 10⁶) |
|---|---|---|---|---|---|
| Demersal: | | | | | |
| Cod | 153·9 | 137·4 | 21,984 | 20·60 | 96,180 |
| Haddock | 67·0 | 73·7 | 11,790 | 29·50 | 51,590 |
| Hake | 21·8 | 41·6 | 6,056 | 8·30 | 38,438 |
| Plaice | 14·6 | 32·7 | 5,232 | 6·54 | 27,206 |
| Whiting | 13·0 | 14·5 | 2,320 | 5·80 | 10,150 |
| Saithe | 13·8 | 7·6 | 1,216 | 1·90 | 5,320 |
| Skate | 9·6 | 6·6 | 1,056 | 1·65 | 4,891 |
| Ling | 6·1 | 5·3 | 848 | 1·06 | 3,710 |
| Turbot | 1·7 | 2·7 | 432 | 0·67 | 2,246 |
| Sole | 1·7 | 2·6 | 416 | 0·65 | 2,163 |
| Dogfish | 3·7 | 2·5 | 325 | 0·38 | 2,463 |
| Halibut | 2·8 | 2·1 | 336 | 0·53 | 2,323 |
| Lemon sole | 4·2 | 1·4 | 224 | 0·30 | 1,165 |
| Dab | 2·0 | 1·2 | 192 | 0·30 | 998 |
| Conger eel | 1·3 | 1·1 | 176 | 0·28 | 1,217 |
| Catfish | 3·8 | 1·0 | 160 | 0·25 | 923 |
| Megrim | 2·6 | 1·0 | 160 | 0·25 | 832 |
| Redfish | 1·9 | 1·0 | 160 | 0·25 | 1,106 |
| Gurnard | 1·0 | 0·7 | 112 | 0·18 | 646 |
| Tusk | 1·5 | 0·6 | 96 | 0·15 | 420 |
| Witch sole | 1·4 | 0·3 | 48 | 0·08 | 250 |
| Remaining demersal | 10·0 | 10·0 | 1,600 | 2·50 | 8,060 |
| Total | 339·4 | 347·6 | 54,939 | 82·12 | 262,297 |
| Pelagic: | | | | | |
| Herring | 161·6 | 120·0 | 19,200 | 120·00 | 242,400 |
| Sprat and whitebait | 6·5 | 2·4 | 384 | 2·40 | 3,655 |
| Remaining pelagic | 7·2 | 3·5 | 560 | 3·50 | 5,330 |
| Total | 175·3 | 125·9 | 20,144 | 125·90 | 251,385 |
| Freshwater: | | | | | |
| Salmon | 1·0 | 0·7 | 119 | 0·18 | 1,378 |
| By-products: | | | | | |
| Liver oil | 16·0 | 10·5 | — | ? | 98,016 |
| Roes | 2·0 | 1·0 | 180 | ? | 941 |
| Total | 18·0 | 11·5 | 180 | — | 98,957 |
| Shellfish: | | | | | |
| Crabs | 1·9 | 2·6 | 520 | 0·75 | 3,060 |
| Cockles | 2·2 | 2·0 | 220 | 2·50 | 1,482 |
| Mussels | 2·0 | 1·9 | 228 | 2·66 | 1,427 |
| Lobsters | 0·5 | 0·8 | 160 | 0·49 | 1,007 |
| Shrimps | 1·1 | 0·7 | 147 | 2·24 | 753 |
| Whelks | 0·7 | 0·7 | 126 | 0·39 | 697 |
| Oysters | 0·2 | 0·1 | 10 | 0·02 | 83 |
| Winkles | 0·2 | 0·1 | 15 | 0·15 | 90 |
| Remaining shellfish | 0·5 | 0·8 | 128 | 0·80 | 831 |
| Total | 9·3 | 9·7 | 1,554 | 10·00 | 9,430 |
| Grand total | 543·0 | 495·4 | 76,936 | 218·20 | 623,447 |

*Redfish* (*Sebastes*)

Redfish is a source of good quality fish food which has only been in demand in recent years. Recent evidence suggests that vast unexploited reserves of this fish may exist but that these will be technically difficult to exploit.

*Herring*

Herring formed about one-quarter of the total landings (edible weight) in 1946 and nearly one-third in 1938, and has the highest food value. Alone among the North Sea fish of major economic importance, the herring shows no sign of over-fishing, and it is unlikely that present landings represent even half its potential productivity. There are two main difficulties in increasing the landings: the peak of the East Anglian herring season may only last a few days; the fish itself will not keep longer than 36–48 hr. Improvements in methods of marketing and preservation are therefore needed before landings can be increased.

SUMMARY

Fish at present can supply about one-ninth to one-eighth of the required animal protein, of a high grade and in a very easily digestible form. Given developments along the lines suggested, a conservative estimate would be that the reserves of Arctic cod and North Sea herring alone could be utilized to increase the total weight of fish landed by 40% during the next few years.

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## Home Production of Eggs

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It can be calculated from Table 3 of the accompanying paper by Bransby, Magee, Bowley & Stanton (1947) that 10,000 million eggs are required every year to supply the population's needs; this is approx. 208 eggs/head. In the calculations set out in this paper I have used the *Monthly Digest of Statistics*, no. 19, July 1947, as my authority for the basic data on population, food consumption and imports of eggs and egg products. On the assumption that 5 oz. of dried egg are equivalent to twelve shell eggs, the total egg consumption in the United Kingdom for 1946 was 8659 millions or approx. 180 eggs/head. The actual egg consumption during 1946 was, therefore, not widely different from the amounts recommended, the difference being in the nature of 28 eggs/head. Though lower than the recommended amounts, this consumption is