

Development of the oil and gas resources of the United Kingdom 1979



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A Report to Parliament by the Secretary of State for Energy
July 1979

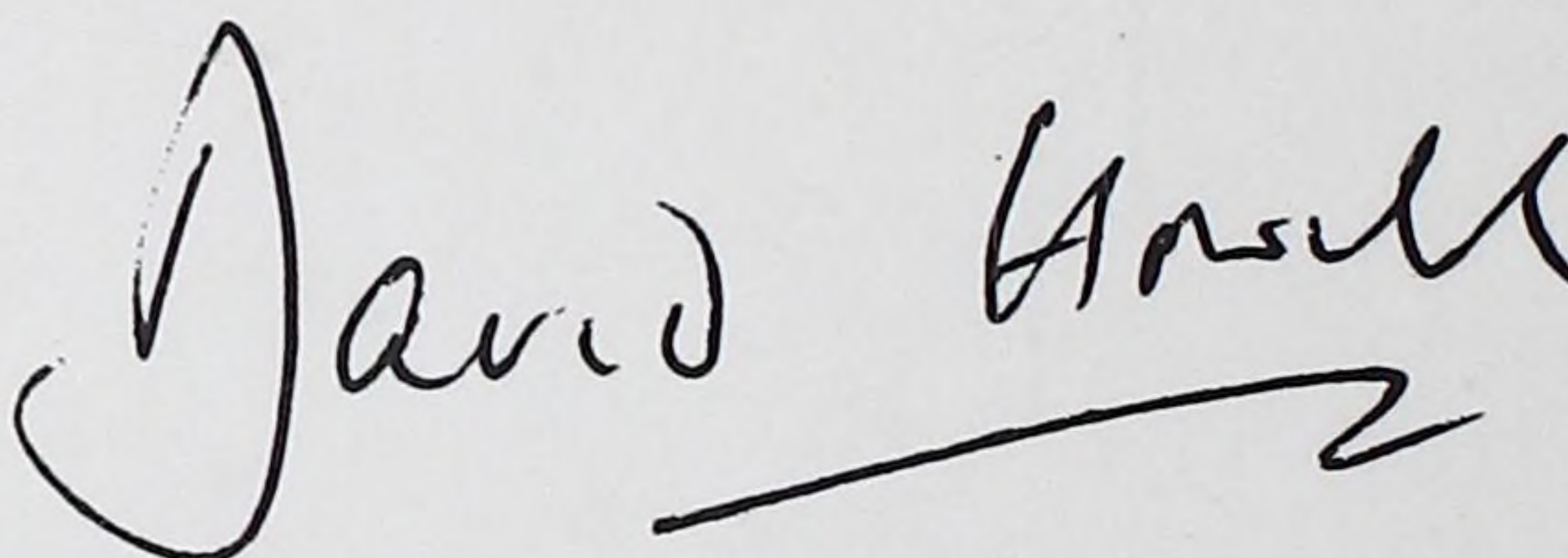
LONDON
HER MAJESTY'S STATIONERY OFFICE

FOREWORD

This report is the sixth in the series of annual reports by my Department recording progress in the development of our oil and gas resources. It was prepared under the previous Administration and it presents a detailed account of developments during 1978.

The exploration and development of the oil and gas resources of the UK Continental Shelf has been a formidable achievement and has called for enterprise, skill and determination. It is the aim of the present Government that the vitally important further exploration work should go forward with increased vigour, so as to secure timely and successful development in the years ahead when production from existing fields begins to decline.

To this end the Government is rapidly reviewing existing policies including those for licensing new territory on the UK Continental Shelf, for the assignment of licences and for the role of the British National Oil Corporation. We want to create the conditions in which all concerned can play their part in the development of our oil and gas resources for the benefit of the nation as a whole.

A handwritten signature in black ink, reading 'David Howell'. The signature is fluid and cursive, with a long horizontal stroke extending from the end of the name.

The Rt.Hon. David Howell, MP
Secretary of State for Energy
June 1979.

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Front cover design is based on a British Petroleum Co. Ltd. photograph of production platform FA (Graythorp I) in BP's Forties oil field in the North Sea.

Throughout the text, one thousand million (10^9) is referred to as one billion, and one million million (10^{12}) as one trillion.

Useful conversion factors:

1 tonne = 7.4 barrels

1 cubic metre = 35.31 cubic feet

Summary

This report describes the development of the United Kingdom's resources of oil and gas during 1978. It also brings up to date estimates of our oil and gas reserves and forecasts of production.

Oil production

Four new oil fields — Dunlin, Heather, Ninian and Thistle — began production in 1978.

Total oil production reached 54.0 million tonnes — a rise of over 40 per cent compared with 1977. This increase was mainly due to the build-up of production from the Brent, Claymore, Forties and Piper oil fields, as well as the beginning of production from the four new fields. Production is expected to reach 70-80 million tonnes in 1979.

Sullom Voe, the new oil terminal in the Shetland Islands, received its first oil by pipeline in November, and by the end of the year was handling over 200,000 barrels per day (equivalent to nearly 10 million tonnes per year).

Gas production

Gas supplied during the year from the UK Continental Shelf amounted to 38 billion cubic metres (1.35 trillion cubic feet). An increasing quantity came from the Frigg field which straddles the boundary between the Norwegian and UK sectors of the North Sea.

In December, associated gas from the Piper oil field started to flow through a spur line to the main trunk line from Frigg to St. Fergus in Scotland. Gas Gathering Pipelines (North Sea) Limited published their report in July on more extensive gas gathering schemes for the Northern Basin.

Exploration and development

Three significant finds of oil were made in the northern part of the North Sea, and appraisal of one of these, a discovery in block 30/17b by the British National Oil Corporation (BNOC), has been promising.

Development work started on the Beatrice and Fulmar fields.

In July the British Gas Corporation announced that the Morecambe gas field, discovered by a subsidiary of the Corporation, was commercially attractive and would be developed.

158 offshore exploration, appraisal and development wells were drilled during the year compared with 201 in 1977.

Licensing

A new round of offshore production licensing, the sixth, was announced in August 1978, offering an additional area of some 10,000 square kilometres for exploration. The forty-two blocks conditionally awarded in March 1979 are located in the South Western Approaches — an area where exploration drilling started as recently as December — north and west of Shetland and in the North Sea.

Awards of sole licences — 11 blocks to BNOC and one to the British Gas Corporation — were announced in April 1978.

Participation agreements

During the year the negotiation of participation agreements with the 62 companies holding pre-Fifth Round licences who have actual or prospective

commercial finds, was completed. In general, these agreements give BNOC the right to take at market value up to 51 per cent of the oil companies' share of petroleum from producing fields, together with full membership of the operating committees of commercial fields, pipelines and terminals.

Economic benefits

Sales of oil produced on the UK Continental Shelf reached £2.8 billion and the value (at oil equivalent prices) of gas production was some £2 billion.

Government income in the financial year from royalties, Petroleum Revenue Tax and Corporation Tax was some £520 million.

Investment

Total capital investment in oil and gas production is estimated to have been £2.3 billion in 1978 — about 22 per cent of total UK industrial investment.

Offshore safety

There was a reduction in the number of fatal accidents offshore even though there was a small increase in the offshore workforce from 12,100 in 1977 to 12,500 in 1978.

Part I: Production and reserves

Oil production

In the course of 1978 four new offshore oil fields came onstream:— Dunlin, Heather, Ninian and Thistle, adding to the eight already in production at the beginning of the year (Argyll, Auk, Beryl, Brent, Claymore, Forties, Montrose and Piper). Details for each of the fields are given in the field by field review (Part V) and Appendix I.

Total production during 1978 was 54.0 million tonnes compared with 38.2 million tonnes in 1977. The total includes about 400,000 tonnes of gas condensate (a mixture of pentane and higher hydrocarbons) extracted mainly from the output of the Frigg and Southern Basin gas fields, about 600,000 tonnes of petroleum gases from oil fields and about 100,000 tonnes of crude oil from the fields in the East Midlands and Dorset. Production figures for individual fields are given in Appendix I. By December the rate of crude production had increased to more than 1.3 million barrels per day (equivalent to nearly 65 million tonnes per year).

Last year's Brown Book* forecast 1978 production as 55-65 million tonnes. Actual production fell short of this figure because of delayed production start-ups of the four newest fields, lower than expected production from one or two fields and, to a lesser extent, from a reduced rate of production from some fields to minimise gas flaring prior to the commissioning of gas-handling equipment.

Two offshore fields, Buchan and South Cormorant are expected to start

production later in 1979. Production started in March 1979 from the Wytch Farm field in Dorset.

The pattern of oil production so far has served to underline the difficulties of making accurate forecasts for production in the years ahead. The forecasts for 1979 to 1983 given in Table 1 below assume that no Government cutbacks are necessary to control the rate of depletion in 1982 or later. The forecasts up to 1981 are lower than previous estimates and take more account of possible delays to offshore developments, particularly during the early years when oil production is being built up rapidly. These delays have the effect of deferring some production to later in the 1980s so that the forecasts beyond 1981 are unchanged or even increased.

Table 1 Forecast of United Kingdom Continental Shelf oil production for 1979-1983

Year	1979	1980	1981	1982	1983
Forecast production (million tonnes)	70-80	85-105	95-115	115-140	115-140

Oil reserves

The quantity of recoverable oil reserves originally in place on the UK Continental Shelf is estimated to lie between 2,400 and 4,400 million tonnes (18 — 33 billion barrels). Up to the end of 1978, 106 million tonnes of this total have been produced since the first oil field, Argyll, began production in June 1975. Remaining reserves at the end of 1978 were therefore in the range 2,300 — 4,300 million tonnes (17 — 32 billion barrels).

Table 2a shows the make-up of remaining reserves in the discoveries which have already been made. Following the

* Development of the oil and gas resources of the United Kingdom 1978. HMSO price £2.25.

approval of their development plans. Beatrice, Fulmar, Magnus and Maureen were classified, at the end of 1978, as 'fields under development' rather than as 'other significant discoveries'. The promising discovery made by BNOC in June 1978 in block 30/17b is now included in the category 'other significant discoveries' which are listed in full in Appendix 2. Despite the new finds, the total quantities of reserves in present discoveries are little changed, after allowing for cumulative production up to the end of 1978, from the figures given in the 1978 Brown Book. This is because of a reduction in the estimates for a few fields which followed further appraisal drilling during the year.

Table 2b gives estimates of the quantities of reserves which may be discovered in the future. The range is chosen to be broadly comparable with the range of 1,397 to 2,511 million tonnes for present discoveries. It is obtained by statistical techniques which are used to estimate the expected number, and probable oil content, of oil-bearing structures for the areas where seismic data and the results of drilling are available. The range in this type of estimate is mainly associated with the confidence felt in the number of structures which may be oil-bearing. In remaining areas where less information is available, reserves have been estimated from a comparison with geologically similar areas.

Table 2

Estimated oil reserves on UK Continental Shelf as at 31 December 1978

(a) Remaining recoverable reserves in present discoveries				(million tonnes)
	Proven*	Probable*	Possible*	Possible Total
(1) Fields in production or under development	1121	124	173	1418
(2) Other significant discoveries not yet fully appraised	276	385	432	1093
(3) Total for present discoveries	1397	509	605	2511
(b) Recoverable reserves in future discoveries				(million tonnes)
(1) Reserves in future discoveries under present licences, including the Sixth Round				350-800
(2) Reserves on the remainder of the UK Continental Shelf				550-1000
(3) Total for future discoveries				900-1800
(c) Total of recoverable reserves originally in place on the UK Continental Shelf				(million tonnes)
(1) Cumulative production to the end of 1978				106
(2) Remaining reserves in present discoveries (from Table 2a)				1397-2511
(3) Total of reserves originally in place in present discoveries				1503-2617
(4) Reserves in future discoveries (from Table 2b)				900-1800
(5) Total of reserves originally in place on the UK Continental Shelf (rounded)				2400-4400

* The terms 'proven', 'probable' and 'possible' are given the internationally accepted meanings in this context:-

- (i) Proven — those reserves which on the available evidence are virtually certain to be technically and economically producible.
- (ii) Probable — those reserves which are estimated to have better than a 50% chance of being technically and economically producible.
- (iii) Possible — those reserves which at present are estimated to have a significant but less than 50% chance of being technically and economically producible.

The upper end of the range 350 — 800 million tonnes of reserves which may be discovered under present licences has been increased beyond the possible total for this category given in 1978 because of the inclusion of estimates for blocks in the latest Round of licensing — the Sixth. A reduction following the disappointing results of exploration wells drilled in the Celtic Sea has been partially offset by a reappraisal of the prospectivity of parts of the North Sea.

The estimate of 550 — 1,000 million tonnes of reserves on the remainder of the UK Continental Shelf, including reserves in deep water which are not currently technically producible, brings the total of reserves which may be discovered in the future to 900 — 1,800 million tonnes.

Table 2c shows the total of reserves originally in place — 2,400 to 4,400 million tonnes. The lower end of this range is not comparable with the lower end of the range 3,000 — 4,500 million tonnes given in the 1978 Brown Book because the statistical presentation has been changed; the figure of 2,400 now evaluates all finds, beyond those already proven, very conservatively so that it matches the low probability attached to the upper end of the range.

Gas production

(a) Gas supplied to the British Gas Corporation

In total, 38 billion cubic metres (1.35 trillion cubic feet) of natural gas were produced from the UK Continental Shelf in 1978. Production figures for individual fields are given in Appendix 3.

Most of the gas purchased by the British Gas Corporation (BGC) continues to come from the Southern Basin of the North Sea but the Northern Basin's contribution increased markedly during the year.

In August 1978 gas began to flow to the St Fergus terminal from production facilities on the Norwegian side of the

Frigg field, supplementing supplies from the UK side which began in 1977. By the end of the year the Frigg field was supplying 42 million cubic metres (1.5 billion cubic feet) a day or about 22 per cent of BGC's requirements. Under the agreement reached between the British and Norwegian Governments in December 1977, 39.18 per cent of the total production from the field is deemed to derive from the UK Continental Shelf.

In order to accommodate the rapid build-up of supplies from the Frigg field while limiting the expansion of gas sales for non-premium uses, the take of gas from the Southern Basin fields was reduced. In consequence total natural gas production from the UK Continental Shelf was about 5 per cent lower in 1978 than in 1977.

The total reserves from all fields now under contract to BGC could support an average production rate of 160 million cubic metres (5.6 billion cubic feet) a day by the early 1980s. However, during 1978 BGC completed negotiations with the licensees of the Leman and Indefatigable fields on the restructuring of their supply contracts and, as a result, BGC will have greater flexibility in matching production to the demand for gas; the Corporation has the option of taking a smaller amount of gas in the early 1980s, deferring the balance for later use.

(b) Associated gas

The gas from a 'dry' gas field — one containing insignificant quantities of oil — is predominantly methane (the main constituent of natural gas as supplied to consumers by BGC) with some ethane and other hydrocarbons. Gas is also found in association with oil and this gas is likely to contain, in addition to methane, substantial quantities of petroleum gases (ethane, propane and butane) as well as condensate.

Associated gas from Brent, the major source of such gas currently under development, will be landed by a trunk gas pipeline starting in 1980; the gas will be piped to St Fergus in Scotland

through the Shell/Esso Far North Liquid and Associated Gas (FLAG) system. Most associated gas deposits are too small, however, to allow individual gas pipelines to shore to be economic.

There have been two studies of the possibilities of constructing a gas gathering pipeline system in the Northern Basin of the North Sea to collect gas from a number of deposits. The preliminary study by Williams-Merz (consulting engineers) suggested that an economically attractive system was possible and it was therefore decided that more extensive studies were worthwhile. The study company, Gas Gathering Pipelines (North Sea) Limited (GGP), which was consequently set up, made its report to the Secretary of State for Energy early in 1978. An abbreviated version of GGP's report was published in July 1978 as Energy Paper No. 30. GGP suggested a number of schemes for gathering associated gas from fields in the northern North Sea and transmitting it to shore in the existing gas trunk lines running from the Frigg and Brent fields to St Fergus. One such scheme came into operation in December 1978, when gas from the Piper field began to flow into the Frigg pipeline system. The Government and the licensees concerned are examining two more schemes which would deliver gas from fields in the East of Shetland area to the FLAG line. These might also involve deliveries from fields which have an excess of gas to others which do not produce enough to meet their platform fuel requirements.

Although the GGP report concluded that there was no immediate need for a new trunk pipeline to the shore, the Government is keeping a close watch on the situation as it develops, so that any need for a pipeline is identified in good time.

Where a field is connected to an oil pipeline, some of the associated gas can be injected into the oil stream and separated out at the shore terminal (leading to the recovery of much of the butane and propane but only a fraction of

the methane and ethane): where there is no gas pipeline, this method of recovering the gas has been encouraged and at Forties, extra equipment has been installed on the platform for the purpose. Developments at the Sullom Voe oil terminal, which will receive a large part of the oil piped ashore from the UK Continental Shelf, are aimed at ensuring maximum recovery of the gases dissolved in the oil, and about three million tonnes a year are expected to be landed when the terminal is fully operational.

Where the oil is loaded into tankers offshore, less gas can be recovered because safety reasons limit the amount which can be dissolved in the oil.

During 1978 production of petroleum gases, which came mainly from Forties and Piper amounted to 600,000 tonnes. The quantities landed are expected to increase as more fields pipe their oil ashore, as the FLAG system comes into operation and as more gas gathering schemes are implemented.

Table 3 below gives rough estimates for 1980 and 1985 of the quantities of ethane, propane and butane which are expected to become available from oil and gas terminals. The estimate for 1980 is lower than that given in last year's Brown Book because of delays in the completion of gas-handling facilities at Sullom Voe and St. Fergus.

Table 3 Quantities of UK Continental Shelf petroleum gases expected to be available from oil and gas terminals

	thousand tonnes		
	Ethane	Propane	Butane
1980	300	1200	600
1985	900	2400	1700

The figures are derived by subtracting from total landings the quantities which are likely to be used as fuel at the terminals or supplied to BGC in specification gas, and residual dissolved gases present in crude shipped from terminals.

In addition to the petroleum gases, gas streams also contain quantities of condensate and nearly half a million tonnes a year are landed at gas terminals, mainly from the Southern Basin.

If there is some prospect of an oil field being connected to a pipeline at a future date, it may be possible to re-inject the associated gas into the field for later recovery. Not all the re-injected gas may be recovered, however. Re-injection is in any case sometimes practised as a means of assisting the recovery of oil from a field.

(c) Flaring

If none of the above methods proves economic to dispose of all the associated gas, then to ensure continued oil production it becomes necessary to allow the flaring of gas; consents for this purpose are issued under petroleum production licences.

The rate of flaring in 1978 was around 12.5 million cubic metres (440 million cubic feet) a day, equivalent in energy terms to about 7 per cent of total oil production. Further information is given in Appendix 4. The rate is expected to drop from 1980 as gas injection and collection schemes come into operation. The commissioning of some of these schemes has been delayed because of technical difficulties and adverse operating conditions offshore. The amount of gas flared has been kept under close control and to this end consents have normally been given for limited periods of time — three months or less — so that the operators' progress towards making gas conservation schemes fully effective can be monitored closely. This is the case at all the producing fields listed in Table 10 except for Argyll and Auk, where it was accepted that the quantities of gas available were too small for economical use to be made of them and long-term flaring consents have been issued.

Gas reserves

The quantity of recoverable gas reserves originally in place on the UK Continental Shelf is estimated to lie between 1000 and 2300 billion cubic metres (35-80 trillion cubic feet). Details of the make up of this range are shown in Tables 4a and 4b. After deducting cumulative

production up to the end of 1978 remaining reserves are put at 700-2000 bcm (25-70 tcf).

These estimates are now prepared on a basis broadly comparable to the oil reserve figures, but for a number of reasons the upper end of the range is less certain. The factors involved include the need to estimate gas/oil ratios in future oil discoveries, the difficulties of knowing to what extent it will be possible to collect associated gas economically, and the smaller scale of exploration for gas as compared with oil.

The reduction in proven reserves in existing discoveries in Table 4a is entirely due to production in 1978. The lack of any increase in the probable reserves reflects the disappointing results of appraisal drilling on oil and gas finds. The total figures of 706 and 1480 bcm (25 and 52 tcf) respectively for proven and possible total reserves provide reasonable lower and upper limits to remaining reserves in known discoveries.

It is not appropriate, given the degree of accuracy involved, to split the expected reserves in future discoveries between licensed and unlicensed areas as was done for oil in Table 2b. The range of 0-550 bcm (0-20 tcf) shown in Table 4b is built up from more detailed estimates in different areas but the roundness of the overall figures reflects the considerable uncertainties.

For purposes of longer term planning of gas use it is necessary to have a picture of possible ultimate availabilities of natural gas to the UK, which include both recoverable reserves on the UK Continental Shelf and likely imports from abroad. For such planning purposes a central estimate of 2000 bcm (70 tcf) (including gas already produced) is currently used.

**Table 4 Estimated gas reserves on United Kingdom Continental Shelf
as at 31 December 1978**

Totals in billion cubic metres (figures for trillion cubic feet in brackets)

(a) Remaining recoverable reserves in present discoveries

	Proven*	Probable*	Possible*	Possible Total
<i>Southern Basin</i>				
Fields under contract to British Gas	387 (13.7)	14 (0.5)	25 (0.9)	426 (15.1)
Other discoveries believed to be commercial but not yet under contract	51 (1.8)	65 (2.3)	—	116 (4.1)
Other discoveries	—	31 (1.1)	40 (1.4)	71 (2.5)
Total Southern Basin	438 (15.5)	110 (3.9)	65 (2.3)	613 (21.7)
<i>Other areas (including Northern Basin)</i>				
Fields under contract to British Gas (Brent and Frigg†)	173 (6.1)	—	—	173 (6.1)
Morecambe and other significant gas and condensate fields	40 (1.4)	166 (5.9)	314 (11.1)	520 (18.4)
Other gas associated with oil:				
(1) Fields in production or under development (including Piper)	55 (1.9)	50 (1.8)	10 (0.3)	115 (4.0)
(2) Other possible developments	—	—	59 (2.0)	59 (2.0)
Total other areas	268 (9.4)	216 (7.7)	383 (13.4)	867 (30.5)
Total for present discoveries	706 (24.9)	326 (11.6)	448 (15.7)	1480 (52.2)

(b) Ultimately recoverable reserves

	bcm (tcf)
(1) Cumulative production to end 1978.	280 (10)
(2) Reserves remaining in present discoveries	706 (25) — 1480 (52)
(3) Total of ultimately recoverable reserves in present discoveries.	986 (35) — 1760 (62)
(4) Reserves in future discoveries.	0 — 550 (20)
(5) Ultimately recoverable reserves on the UK Continental Shelf (rounded).	1000 (35) — 2300 (80)

* The terms proven, probable and possible are given the internationally accepted meanings (see Table 2).

† UK Share.

Part II: Summary of activity

Drilling activity

158 exploration, appraisal and development wells were drilled offshore in 1978, bringing the total since exploration began in 1964 to 1,296.

Details of rig activity and the number of wells drilled in different areas are given in Appendix 6.

Development

There was an increasing emphasis on development work in 1978. Sixty per cent of the wells drilled during the year were development wells, over half of them in the area east of Shetland where activity, measured in terms of rig years for fixed platforms, increased from 8.2 years in 1977 to 11.2 in 1978. The total number of offshore development wells drilled in the year was 96, the same number as in 1977.

Exploration and appraisal

Thirty-seven exploration wells and 25 appraisal wells were drilled in 1978. This compares with 67 exploration wells and 38 appraisal wells drilled in 1977. Most of the wells were drilled in the northern part of the North Sea — an established oil province where three significant finds were made during the year in blocks 2/10a, 14/18 and 30/17b. In December 1978 exploration drilling began in the South Western Approaches and Channel area. The first well was started by BNOC about 150 miles south west of the Scilly Isles, and the second by BGC about 25 miles south of the Isle of Wight.

Development and production programme approvals

Under the terms of Petroleum Production Licences, licensees cannot develop a

field or produce petroleum without the consent of the Secretary of State for Energy or his approval of a development and production programme.

In 1978 the Secretary of State approved development and production programmes for Fulmar, Beatrice and Magnus. He also issued a long-term consent for Buchan. The approvals of the Maureen, North Cormorant and Tartan fields were given early in 1979.

Development and production at the other oil fields listed in Tables 10 and 11, and at producing gas fields, is proceeding under the terms of temporary consents issued on a six-monthly or annual basis whilst details of the programmes are finalised.

Pipelines and terminals

At the end of 1978 oil from five fields (Argyll, Auk, Beryl, Brent and Montrose) was loaded directly into tankers offshore. For most of the year production from Thistle was also loaded into tankers offshore but in December the pipeline link to Sullom Voe came into use. Oil from other fields amounting to over 80 per cent of production in 1978 and all gas brought ashore, is transported by pipeline. The main oil and gas pipelines already completed or under construction are listed in Appendix 8, and are marked on the fold-out map at Appendix 15.

Oil pipelines

Five submarine trunk oil pipelines are in operation:—

- Ekofisk (in Norwegian waters) to Teesside.
- Forties to Cruden Bay (connected

by a land line to Grangemouth) in Scotland.

- Piper/Claymore to Flotta in Orkney.
- Ninian to Sullom Voe in Shetland.
- South Cormorant to Sullom Voe.

The two pipelines to Sullom Voe started operating in 1978. Feeder lines link Thistle via Dunlin to South Cormorant and Heather to Ninian. Brent is also linked to South Cormorant by a feeder line which is expected to start operation later in 1979. At the end of 1978 just over 700 miles of submarine oil pipeline were in use.

Gas pipelines

The two pipelines running 220 miles from the Frigg field to St Fergus in Scotland came into operation in 1977 and 1978 respectively bringing the gas from the northern North Sea into the mainland distribution network. An inter-field pipeline conveying gas between the Piper and Claymore oil fields and a link from Piper to the Frigg trunk line Manifold Compression Platform (MCP-01) are also in operation. A pipeline from Tartan to Piper is ready for connection to the Tartan platform which is due to be installed in 1979. The 281 mile long pipeline from Brent to St Fergus is awaiting connection to the Brent platforms and it is expected to be commissioned in 1979 ready for the first gas deliveries in 1980. By the end of 1978 just over 850 miles of submarine gas pipeline were in operation.

Sullom Voe

Construction work continued during 1978 at the Sullom Voe oil terminal in the Shetlands which is now more than half completed. Its current design capacity is 1.4 million barrels per day (nearly 70 million tonnes per year), and when this is achieved the terminal will be handling more than half of the UK North Sea oil production. When the gas processing facilities are completed, the terminal will

be able to recover petroleum gases for sale or use as fuel, but at present much has to be flared offshore. The cost of the terminal is estimated at just over £1000 million, and the construction workforce employed at the site is over 5,000.

Following the commissioning of storage tanks and loading equipment the first oil was pumped ashore through the Brent pipeline from Dunlin in November, and the terminal was officially opened on 20 January 1979.

Oil reached the terminal from Heather through the Ninian pipeline at the beginning of December, and by the end of 1978 the terminal was also receiving crude oil from Thistle and Ninian. Throughput at the end of the year was over 200,000 barrels per day.

Other terminals

Other terminals in operation are:—

- Flotta in the Orkneys which handles production from Piper and Claymore. During 1978 construction work was carried out on additional gas treatment plants at the terminal, and the first of these additional plants began operation in February 1979.
- Teesside which handles oil from the Norwegian Ekofisk field.
- The Forties landward installations and
- four gas terminals; St Fergus, Bacton, Easington and Theddlethorpe.

Developments on land

Total production from UK landward oil fields in 1978 remained at about 100,000 tonnes.

Development drilling on the upper reservoir of the Wytch Farm field in Dorset was substantially completed during 1978. Nine development wells and one exploration well were drilled. Production began in March 1979.

A stratigraphic test well was drilled at Swinden, Lancashire in May 1978. In December a well, funded by the Department of Energy and drilled by the Natural Environment Research Council, was commenced near Shrewton, Wiltshire, to determine the geological succession in the area.

Part III: Operational aspects

Offshore employment

The workforce employed on offshore installations, such as rigs and platforms, covered by the Mineral Workings (Offshore Installations) Act 1971 is estimated to have numbered 12,500 in July 1978, a small rise from the figure of 12,100 in 1977.

The total was obtained from a survey by the Department of Energy (see Appendix 9). The workforce employed on vessels such as pipe laying barges or support ships, was not included in the survey — the number, probably several thousand, varies greatly during the year, and no detailed figures are available.

About 40 per cent of the offshore workforce was employed on construction work and was mainly located on Brent, Forties, Heather, Ninian and Thistle fields. Production and maintenance occupied 7 per cent and 13 per cent respectively of the workforce and a further 18 per cent was engaged in drilling or ancillary drilling activities. The number of divers employed on installations was just over 200, but this does not include the many divers employed on the UK Continental Shelf in support vessels or barges. The remainder about 19 per cent, were employed in domestic work which includes cleaning, catering, wireless operations and general 'ship's crew'.

The usual place of residence for nearly half of the workforce (47 per cent) was in Scotland, many of them in Aberdeen (15 per cent of the total workforce). A further 46 per cent were normally resident in England. The survey showed that just over 85 per cent of the workforce were British.

Training

The Petroleum Industry Training Board (PITB) estimates that in 1978 over £3 million was spent on training by offshore companies (excluding capital expenditure on company training centres).

Facilities at the Drilling and Production Technology Training Centre at Montrose were expanded in response to the demand from companies, and the number of courses increased by over 60 per cent. 1033 trainees attended the centre in 1978 compared with 689 in 1977, and there was a significant increase in the number attending the Well Pressure Control programme. The Manpower Services Commission (MSC) continued to provide financial support for the basic rig crew course under the Training Opportunities Scheme and in encouraging employers to use the other drilling courses. Production training expanded during 1978, when nearly 400 trainees attended the programmes. In 1978 the MSC agreed to convert the original setting-up loan to a grant. The PITB expects that in future years, the costs of the Centre will be met by course fees.

The Offshore Fire Training Centre, operated by the PITB but wholly financed by industry, has provided courses at a number of levels since it opened in January 1978. These levels include basic, fire leader, fire control and team training. By the end of the year over 1,400 personnel had attended these programmes. The centre cost over £1 million and possesses extensive fire training facilities, including a three-storey structure simulating offshore production platforms of several types.

The Petroleum Training Association (North Sea) at Yarmouth and the Scottish Offshore Training Association in Aberdeen aim to help member companies identify common needs and provide appropriate training programmes, and have proved to be very effective in satisfying local requirements. Over 4,500 personnel undertook short courses during 1978. The important series of seminars run by the associations for Offshore Installations Managers, and others covering current regulations and safety matters generally, continue to be heavily supported. The seminars are a useful forum for identifying training needs. The safety aspects of electrical equipment offshore have received particular attention and a range of courses was successfully developed to cover this important area.

The Petroleum Training Association (North Sea) also provides survival training using two self-propelled survival craft and inflatable life rafts. An increase of 80 per cent in man days in training was recorded in 1978, involving a number of programmes including helicopter escape (in conjunction with Ministry of Defence HMS Vernon in Portsmouth) and in-sea training at Lowestoft. Capital investment and running costs are financed by industry.

The Offshore Survival Centre of the Robert Gordon Institute of Technology in Aberdeen has constructed a 34-foot platform on the River Dee with three enclosed Life Saving Systems from which are operated seven motor-propelled survival craft. The cost of the platform, £250,000, was met by the Scottish Education Department and industry. In addition, construction of a tank housing a helicopter under-water escape trainer was begun. Its completion is planned for the summer of 1979 and it will also provide facilities for all in-water drills and research work associated with offshore survival. The total number of personnel trained at the Institute on a variety of programmes in 1978 was in excess of 2,000 with some 6,000 men receiving survival training since courses started in 1972.

In 1978, four schools approved by the Manpower Services Commission were training divers to the Commission's standards. They were the Underwater Training Centre at Fort William which qualifies divers in both air and mixed gas diving, Fort Bovisand at Plymouth, Prodiver at Falmouth and the Royal Engineers Diving Establishment at Marchwood, all of which carry out air diving training only. A fifth school, the Ministry of Defence Marine Services School at Rosyth received approval in January 1979 and will also carry out training in air diving. In 1978 156 divers passed courses in air diving (70 at Fort William, 33 at Prodiver, 35 at Fort Bovisand and 18 at the Royal Engineers Establishment) and a further 34 qualified in mixed diving at Fort William. Consultations are now proceeding on proposals by the Health and Safety Commission for new regulations to control diving operations which, when in force, will make it mandatory for all new divers entering the industry to be qualified to approved standards.

Offshore safety

The code of regulations planned under the Mineral Workings (Offshore Installations) Act 1971 was completed in 1978 with the making of the Offshore Installations (Fire-fighting Equipment) Regulations. These Regulations, which apply to both fixed and mobile installations, require the provision of automatic fire and gas detection and alarm systems, manual fire alarms, water mains, pumps, hydrants and hoses, fixed extinguishing systems and firemen's equipment. Fire-fighting equipment plans must also be kept and displayed on installations. The Regulations came into force on 1 April 1979 and the Secretary of State for Energy has authorised Surveyors of the Department of Trade Marine Division to conduct statutory examinations of fire-fighting equipment on his behalf.

In September 1978 the Secretary of State for Energy set up an independent committee, chaired by Dr J.H. Burgoyne, to review the offshore safety regulations

and procedures for which he is responsible. The Committee will present its report, conclusions and recommendations as soon as possible. Its terms of reference require it to consider:

- 1 the nature, coverage, effectiveness and administration and enforcement of the Department of Energy's regulations, in so far as they are concerned with safety, governing offshore exploration, development and production of oil and gas.
- 2 the role of the Certifying Authorities, which issue Certificates of Fitness for each installation.

The Department of Energy's responsibilities for enforcing offshore the provisions of the Health and Safety at Work Act 1974 were formally recorded in an Agency Agreement made between the Department and the Health and Safety Commission. The Agreement came into force on 1 November 1978 and, amongst other things, provides for the appointment of inspectors from the Department's Petroleum Engineering Division under the provisions of the 1974 Act. These powers will be in addition to the powers the inspectors already have under the Offshore Installations (Inspectors and Casualties) Regulations 1973.

In July 1978 the Health and Safety Commission set up an Oil Industry Advisory Committee. It will advise the Commission on:

- 1 the protection of people at work from hazards to health and safety arising from their occupation within the oil industry and protection of the public from related hazards arising from such activities;

- 2 associated matters referred to them by the Commission or the Health and Safety Executive.

The Committee's members were nominated by the CBI and the TUC, and they will concentrate initially on offshore matters. There is cross-membership between the Advisory Committee and the independent committee chaired by Dr Burgoyne.

Offshore accidents and dangerous occurrences

In 1978 there was a general improvement in safety standards offshore, and an important contributory factor was the continued cooperation of the companies and the installation managers in the application of the offshore safety regulations.

Table 5 below shows the number of deaths occurring offshore in 1978. Four of the total of seven men known to have died during the year were killed in accidents at work, two of them in a single diving accident. The other three died of natural causes. The significant reduction in the number of fatalities over previous years (17 in 1976 and 11 in 1977) is welcome. This is particularly true for offshore installations where, for the first time, there were no fatal accidents at all.

There were 40 serious accidents and 89 dangerous occurrences in 1978 (see Appendix 10). The number of serious accidents remained the same as in 1977 but the number of dangerous occurrences showed a sharp rise over the previous year's figure of 68. This increase may, in some part, be due to better reporting standards, but the high number of dangerous occurrences, particularly those involving the use of

Table 5 Deaths while working offshore on the development of oil and gas

Accidents at work	
— workers on offshore installations	0
— seamen working alongside installations	2
— divers working around offshore installations	2
Deaths from natural causes	3
Total	7

cranes, is a cause of concern. However, for the first time in six years, there were no fatal accidents resulting from the use of cranes. There have been improvements in some areas, particularly in the number of serious drilling accidents, which has decreased by 50 per cent from the previous year's figure.

Since seamen were not included in the Department of Energy's survey of the offshore workforce, accident rates can only be calculated for those actually employed on offshore installations. In 1978 these rates were nil for fatal accidents and 2.6 per thousand for serious injuries. In comparison, the rates for 1977 were 0.8 per thousand and 2.9 per thousand respectively (see Appendix 10).

The number of divers working in the UK sector of the North Sea varied considerably during the year but remained within the range of 1,000-1,500. Taking a nominal figure of 1,250 the diving fatality rate in 1978 was 1.6 per thousand, (1976: 7.0 per thousand, 1977: 2.5 per thousand).

Offshore emergency planning

Further revisions of the Department's "Offshore Emergencies Handbook" were issued in 1978. The handbook describes the main lines of communication to be followed and action to be taken by Government, industry and other affected organisations in the event of an emergency involving an offshore installation, such as fire, collision, structural failure, helicopter crash, oil spill or pipeline failure. The handbook also incorporates a directory of the names and telephone numbers of key personnel in Government, industry and agencies such as HM Coastguard, the Police and Health Authorities.

The primary responsibility for dealing with an offshore emergency rests with the operator of the oil or gas field, and every operator must make emergency provisions for his installations. In addition the industry has arranged for operators to provide mutual assistance in an

emergency. In 1978 the UK and Norwegian Governments jointly took note of the formal agreement between the UK Offshore Operators Association and the North Sea Operators Committee (Norway) under which fields are grouped into five sectors and each operator as a member of a "sector club" would be helped by fellow club members in an emergency. Assistance would be available regardless of the median line and could take the form of a loan of special equipment, emergency fire fighting vessels or extra supplies of chemicals.

The Government's special plans for action in the event of a blow-out were tested during an exercise — NOROX 78 — held in October and as a consequence are being further refined. The plans provide for a Blow-Out Emergency Team (BET) to be established in Aberdeen if a blow-out occurs on a UK oil field. The Team would liaise between central Government and the local emergency action centres to monitor the situation and co-ordinate the necessary action. It would also handle enquiries from the news media.

Environmental aspects

(a) Oil spill contingency arrangements
Where an oil spill is not causing or likely to cause damage, it is preferable, in the absence of reliable recovery equipment, for it to be allowed to evaporate and degrade naturally rather than for it to be dispersed chemically. Guidelines to this effect have been prepared on behalf of the Standing Committee on Pollution Clearance at Sea (SCOPCAS) and were issued to every active operator in April 1978. The individual operators would be responsible for dealing with a pollution incident at an offshore installation or shore terminal and each one is required to have plans for such eventualities. The plans are based to a large degree on the use of jointly-owned stocks of dispersant and spray equipment currently held by the United Kingdom Offshore Operators Association at Aberdeen, Lerwick, Lowestoft, Pembroke Dock and Plymouth. The Government role in such

incidents is likely to be limited to monitoring the operator's activities and offering advice and assistance. If, however, the operator's response was inadequate the Government might give positive directions to the operator or, in an extreme situation, take over control of the clean-up operation. This role would be exercised in small incidents by the Principal Officer of the appropriate Marine Survey Office of the Department of Trade and in large ones by that Department's newly-formed Marine Pollution Control Unit.

This Unit, headed by Rear Admiral M L Stacey, will have a small permanent staff which will include a senior coastguard inspector, a senior marine surveyor, a scientist and a part-time adviser from the oil industry. In a major pollution emergency, the Unit would be augmented by drawing on other Department of Trade staff for advice and assistance.

Twenty-seven spills from offshore installations were reported to the Department in 1978. The total amount of oil involved was approximately 250 tonnes. There was additionally a spillage of some 1,100 tonnes of fuel oil at the Sullom Voe terminal in late December. This was caused by the tanker 'Esso Bernicia' sustaining damage by coming into contact with the loading jetty after a fire in one of the three tugs manoeuvring the ship.

(b) Chemicals used offshore

A wide range of chemicals are used offshore as drilling mud additives, corrosion inhibitors, biocides, process additives etc, and many of these are ultimately discharged to the sea. Most are thought to be fairly harmless to marine life or are used only in small amounts. However, to ensure a higher degree of environmental protection, a non-statutory notification scheme for such chemicals has been agreed with industry and was introduced on 1 February 1979. This requires certain essential information on each chemical to be available to operators and Government, and consultations with

fishery experts on the more potentially critical cases. It should enable operators to take more account of environmental factors when selecting chemicals for particular applications, as well as helping Government specialists to advise on the options for disposal, where necessary.

(c) Controls on discharges from platforms and shore terminals

The Secretary of State for Energy has the power to exempt oil operators from certain parts of the Prevention of Oil Pollution Act 1971, as amended by the Petroleum and Submarine Pipelines Act 1975, allowing them to discharge water into the sea which contains small amounts of oil obtained during oil production and processing, up to a limit specified in the exemption. Operators are normally required to maintain the oil content of any discharge below an average of 40-50 parts per million and they are required to take samples at least twice a day, analyse them by an approved method, and submit their findings to the Government each month. In addition, samples are taken by Government inspectors from time to time and analysed separately.

Limited exemptions on these lines have been issued for the following offshore installations; Argyll, Auk, Beryl, Brent A, B, C, D and SPAR, Dunlin, Heather, Montrose and Thistle. A total of some 100 tonnes of oil was permitted to be discharged in this way from these platforms during 1978.

Similar controls but with more restrictive limits are imposed by the Secretaries of State for Scotland and the Environment on discharges from the shore terminals in Scotland and England respectively.

Protection of installations

Government arrangements for supplementing the offshore industry's provisions for the protection of installations were kept under review in 1978.

The introduction of the five Island Class vessels for joint protection of oil and gas

and fisheries resources was completed and the Nimrod Long Range Maritime Patrol fleet continued to be deployed on protection tasks at a level equivalent to four aircraft. In addition, other defence resources were available for deployment as necessary.

Contingency plans for the protection of installations against terrorist attacks were again tested in a variety of exercises during the year.

During 1978, 500 metre safety zones, which no unauthorised vessels are allowed to enter, were established around four new oil installations — Ninian Central, Ninian North, Brent C and Cormorant A. The safety zone around the West Sole 48/6E gas platform was cancelled on removal of the platform, leaving the total number of safety zones protecting oil and gas installations on the UK Continental Shelf at 70.

Table 8. Government revenues attributable to North Sea oil and gas

Financial Year	Revenue	Corporation Tax	Total (rounded)
1976/77	1070.7	10.0	1080.7
1977/78	1877.7	25.0	1902.7
1978/79	1978.7	25.0	2003.7

Revenue is shown in millions of pounds sterling. Corporation tax is shown in millions of pounds sterling. Total is shown in millions of pounds sterling.

Part IV: Government and the economic and industrial impact of North Sea oil and gas

The economic benefits of North Sea oil and gas

The direct economic benefit of North Sea oil and gas arises from the large difference between its value (reckoned broadly in terms of the cost of importing substitute fuels from abroad) and the resources needed in its production. In 1978 sales of oil produced on the UK Continental Shelf reached £2.8 billion and the value of UK indigenous natural gas production estimated at the cost of equivalent imported oil was around £2 billion. The resources needed in the production of oil and gas are substantial; these costs are described in the next section. Nevertheless this leaves a very significant excess of revenues over costs, a large part of which accrues to the nation as receipts of royalties and taxes on profit. The figures for 1976 to 1978 are shown below.

The figures for revenue attributable to the North Sea may be put into perspective by comparison with the 1978-79 estimated VAT yield, £4.8 billion and income tax yield, £19.3 billion.

Costs and investment

Estimates of exploration, development and operating costs incurred by operators and other production licensees engaged in the exploitation of the UK's oil and gas resources for 1976, 1977 and 1978 are given in Appendix 11.

Total expenditure on exploration in 1978 amounted to £257 million which represents a decrease of £118 million from the 1977 level. This reflects the decrease in drilling activity.

Table 6 Government revenues attributable to North Sea oil and gas

				£ million
Financial Year	Royalties	Petroleum Revenue Tax	Corporation* Tax	Total (rounded)
1976/77	71	—	10	80
1977/78	228	—	10	240
1978/79	288	183	50	520

* Estimated proportion of corporation tax receipts attributable to North Sea oil and gas.

As Table 6 shows, royalties have accounted for the bulk of Government revenues so far. The first Petroleum Revenue Tax payment was made in 1978. The small contribution to date from Petroleum Revenue Tax and Corporation Tax is accounted for by the structures of the taxes; tax is not paid until after capital and other allowances have been used, and therefore payments do not start until a few years after a field has begun production.

The expenditure on the construction and installation of platforms and associated equipment and on pipelines and onshore terminals amounted in 1978 to £1,732 million for the development of oil fields and £283 million for the development of gas fields compared with £1,556 million and £334 million for oil and gas respectively in 1977. With the development of associated gas it is increasingly difficult to maintain a distinction between oil and gas field

expenditure since costs tend to be increasingly of a joint nature.

Operating costs of oil and gas fields in 1978 amounted to £255 million and £88 million respectively. The increase in oil field expenditure — from £159 million in 1977 — is attributable, for the most part, to the fields that came on-stream in 1978, to higher transportation costs because of increased production, and to the manning of additional facilities.

Whilst the level of operating expenditure in the gas fields was about £48 million in both 1976 and 1977 this reflected a slight reduction for the Southern Basin fields that was offset by the costs of the Frigg field and terminal which came on-stream in September 1977. The increase in operating costs of the gas fields in 1978 to £88 million, reflects moderate increases in the level of Southern Basin costs and the continuing build-up of production of the Frigg field.

The costs of producing oil from the offshore fields vary widely from one field to another. Previous estimates quoted for existing commercial fields put the costs in the range \$3-9 per barrel at 1976 prices. Simply allowing for general price increases and changes in exchange rates since 1976 would convert these figures into a range of approximately \$4-12 at 1978 prices. However a closer re-examination of the revised estimates on costs and production indicate that fields starting production before the end of 1978 have costs in the range of about \$4-13 per barrel at 1978 prices.

The extremes of the range depend critically on the assumptions for individual fields, such as the quantity of reserves, which may be subject to change; an average cost is less affected by individual field estimates. The average cost of fields starting production before the end of 1978 is estimated at \$6 per barrel at 1978 prices. For fields expected to start production in 1979 and 1980 the average cost is estimated at \$7.5 per barrel at 1978 prices.

The figures of cost per barrel quoted above include exploration, development and operating costs over the expected life of the field, but exclude payments to the Government through royalties, Petroleum Revenue Tax and Corporation Tax. The importance of capital funds employed in offshore developments and of the time lag between capital expenditure and production is taken into account by assuming a real rate of return on the resources tied up which represents their value in alternative uses.

Taking a wider view of investment in oil and gas production, the capital investment in the industry as a whole, including contractors providing services unique to the industry such as drilling, is estimated at about 22 per cent of total in 1977 and £2.3 billion in 1978. In the period 1965-1978 inclusive, total investment is estimated to have been in the order of £8.8 billion. A further £4.8 billion (in estimated prices prevailing at the time the money is to be spent) may be invested in the period up to the end of 1980.

In 1978 offshore related investment is estimated at about 22 per cent of total UK industrial investment and about 8 per cent of Gross Domestic Fixed Capital Formation.

There was no evidence in 1978 of any curtailment of the development of the UK Continental Shelf due to shortage of investment funds.

The two main sources of finance continued to be the companies' own resources and loans by UK-based banks, with total identifiable lending by the latter providing around one-third of the total requirement. North Sea financing has now become a normal part of the lending of all the major banks.

There was no recourse by private companies during the year to UK Government finance or guarantees. Existing Government guarantees were reduced from £60 million to £21 million.

Comparison of oil and gas production with consumption in the UK

Table 7 and Figure 1 show the relationship between indigenous oil and gas production and United Kingdom total primary fuel consumption and illustrate the progress towards net self-sufficiency in oil. Not all the oil from the UK sector of the North Sea is, however, used to meet UK requirements; imports and exports of different qualities of crude oil, and some products, are necessary to balance supply with refinery and end-use demand.

In 1978 indigenous oil production corresponded to about 57 per cent of total requirements and 25 per cent of total primary fuel consumption. In 1979 these figures could reach 78 per cent and 35 per cent respectively. In 1978, indigenous natural gas production provided about 88 per cent of primary gas demand, equivalent to 16 per cent of total primary fuel consumption. With the build-up of production from the cross-

median Frigg gas field the proportion of imported gas has increased. It is expected that in 1979 indigenous natural gas production will correspond to around 80 per cent of primary gas demand (equivalent to about 15 per cent of total primary fuel consumption for the year).

Table 7 United Kingdom indigenous oil and gas production compared to United Kingdom total primary fuel consumption.

(million metric tonnes of oil or oil equivalent)

	Total primary fuel consumption (1)						Gross indigenous oil production (3)	Gross indigenous natural gas production (4)
	Total	Coal	Petroleum	Natural gas	Nuclear electricity	Hydro-electricity		
1974	215.3	69.3	106.4	31.2	7.1	1.3	0.4	30.6
1975	204.1	70.6	93.3	32.6	6.4	1.2	1.6	31.8
1976	207.6	71.8	92.5	34.6	7.6	1.1	12.1	33.7
1977	211.6	72.2	92.9	36.9	8.4	1.2	38.2	35.3
1978	212.2	70.5	94.3	38.3	7.9	1.2	54.0	33.7
1979 (forecast)	216.0	70.0	96.0	40.0	9.0	1.0	75 (2)	32.0

(1) Includes oil and gas for non-energy uses and marine bunkers.

(2) The nominal figure of 75 million tonnes for 1979 is the mid-point of the 70-80 million tonnes forecast range.

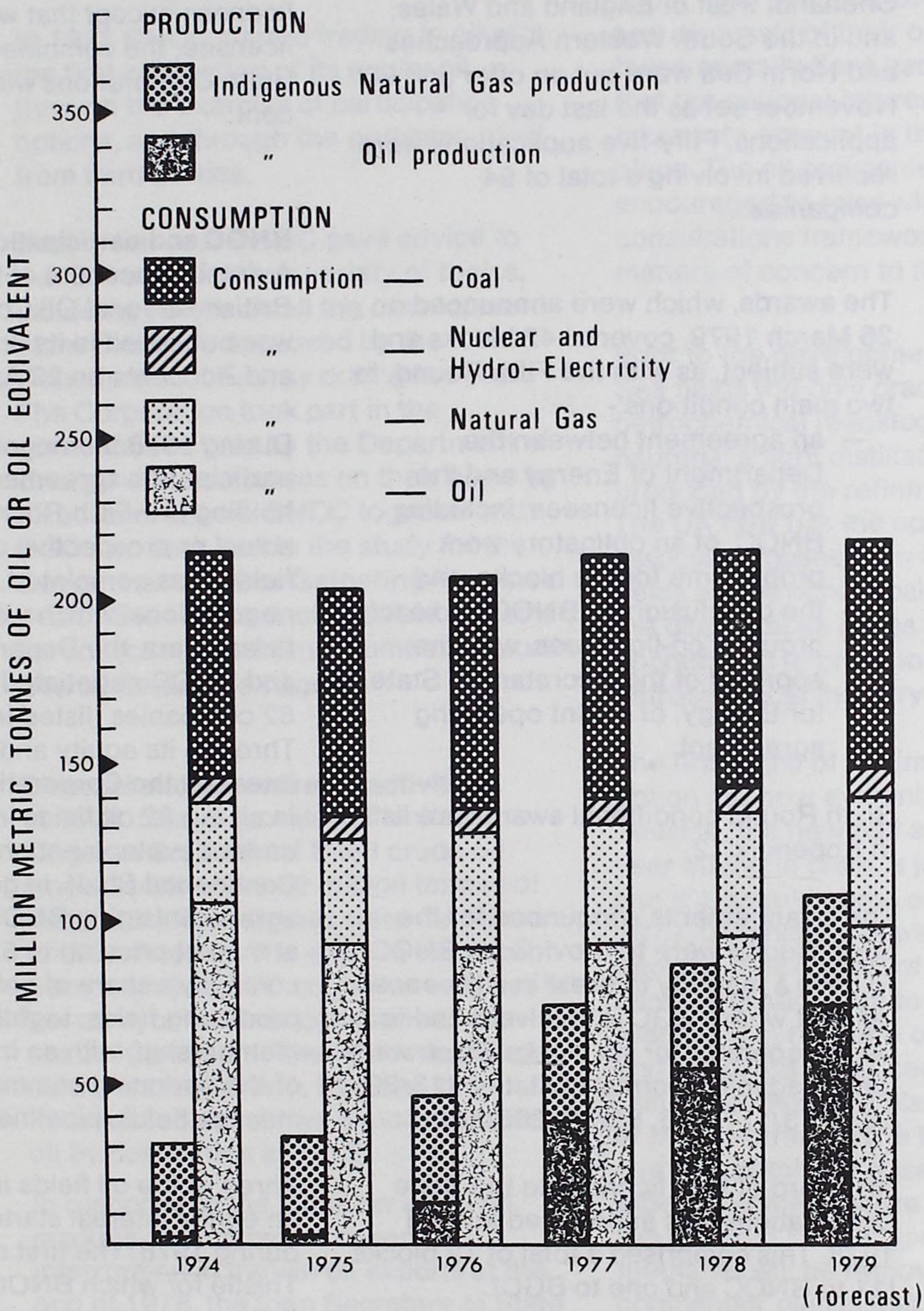
(3) Crude petroleum together with condensate and petroleum gases extracted at terminal separation plants.

(4) Includes land and colliery methane and associated gas (notionally methane) produced and used on Northern Basin oil production platforms.

(5) The forecasts do not include the effect of oil saving measures currently being implemented as the UK's contribution to the IEA's objective of reducing oil demand in member states by 5% in 1979.

Figure 1

United Kingdom indigenous oil and gas production compared to United Kingdom total primary fuel consumption



Licensing

(a) Offshore

Applications for the Sixth Round of offshore licensing were invited in August 1978. The invitation was preceded by the publication in May 1978 of a Consultative Document setting out the proposed arrangements for the Round.

Forty-six blocks north and west of Shetland, west of England and Wales, and in the South Western Approaches and North Sea were put on offer and 20 November set as the last day for applications. Fifty-five applications were received involving a total of 94 companies.

The awards, which were announced on 26 March 1979, covered 42 blocks and were subject, as with the Fifth Round, to two main conditions:-

- an agreement between the Department of Energy and the prospective licensees, including BNOC, of an obligatory work programme for the blocks, and
- the conclusion by BNOC and each group of co-licensees, with the approval of the Secretary of State for Energy, of a joint operating agreement.

Sixth Round conditional awards are listed in Appendix 12.

The arrangements announced for the Sixth Round were to provide for BNOC to have a majority interest in all licences (except where BGC is involved) and to be the operator for six blocks which were identified in the formal invitation (13/30, 20/2, 73/1, 73/16, 85/28, 208/26).

An award of sole licences to the State Corporations was announced in April 1978. This comprised a total of 12 blocks (11 to BNOC and one to BGC).

Also in April 1978 the then Secretary of State for Energy announced that any licensee proposing to dispose of part or all of his licence interest would be asked to give BNOC or BGC as appropriate, the first opportunity to negotiate for the

acquisition of some or all of the licence share on offer.

(b) Onshore

New terms and conditions for onshore production licences were announced on 2 June 1978. These gave the Secretary of State for Energy discretion, for the first time onshore, to require 51 per cent participation by BNOC in new production licences except that where BGC is also a licensee, the combined share of the two State Corporations will not exceed 51 per cent.

BNOC and participation

A detailed account of the activities of the British National Oil Corporation in 1978 was published in its 3rd Annual Report and Accounts on 23 April 1979.

During 1978 the negotiation of participation agreements with companies holding pre-Fifth Round licences, with actual or prospective commercial oil fields, was completed. In the negotiations, which were spread over three years, the Department of Energy and BNOC negotiated agreements with 62 companies (listed in Appendix 13). Through its equity and participation interests the Corporation is now involved in all the 22 oil fields in production or under development on the UK Continental Shelf. In general, the agreements give BNOC the right to take at market price up to 51 per cent of each company's share of petroleum from the producing fields, together with full membership, with an independent vote, of the operating committees which manage fields, pipelines and terminals.

Three of the oil fields in which BNOC has an equity interest started production during 1978. The first of these was Thistle for which BNOC is the operator. It started production early in 1978. Later in the year production started from Ninian and Dunlin. The Corporation also has equity interests in one producing gas field (Viking) and three oil fields currently under development (the UK parts of Statfjord and Murchison and an interest

in the Beatrice field which it acquired early in 1979).

In exploration and appraisal, BNOC participated in 20 of the 62 wells drilled in 1978. It was responsible as operator for five of those wells, the same number as in 1977. BNOC is the operator for the first promising oil discovery to be made in Fifth Round acreage, in block 30/17b.

In 1978 BNOC started trading in oil with the first production of its equity oil, through the exercise of participation options, and through the purchase of oil from third parties.

During the year BNOC gave advice to the Government on a variety of topics, including advice on all the development plans that were approved by the Department of Energy during the year. The Corporation took part in the consultations held by the Department of Energy with companies on their plans for disposal of UK oil. BNOC together with BGC also took part in the study for the Government by Gas Gathering Pipelines (North Sea) Limited, of possible systems for collecting gas from a number of North Sea oil fields (see page 6).

Disposal and downstream activities

In 1978, total disposals† of United Kingdom Continental Shelf crude oil amounted to some 52 million tonnes of which 28 million tonnes were delivered to UK refineries. The exports of UK oil went mainly to EEC countries — about 50 per cent, or to American markets — about 30 per cent. The remaining 20 per cent went to Norway, Sweden and Finland. Table 8 shows exports of crude oil by destination in 1978.

In response to the strain on world oil markets caused by the severe interruption in Iranian oil exports at the end of 1978, the then Secretary of State for Energy announced on 31 January 1979 (Hansard col. 461) that the Government would expect oil companies exporting North Sea crude to do so in the markets of members of the International Energy Agency and of the European

Community but without conflicting with the maintenance, so far as possible, of existing patterns of trade in other markets.

Arrangements have been made for oil companies with UK Continental Shelf oil production to consult the Department of Energy regularly, either under the terms of participation agreements or otherwise, about their plans for UK refining activities and disposals of their oil. The objective in these consultations has been to ensure that the national interest is properly taken into account in the companies' plans. The oil companies have been encouraged to raise within the consultations framework any relevant matters of concern to them.

Prior to the development of the North Sea fields the only practical petrochemical feedstock for the UK was naphtha, a light distillate fraction produced by the refining of crude oil. The UK now has the option of also using associated gases from North Sea oil fields as petrochemical feedstocks and the use of these gases has been encouraged in order to strengthen our petrochemical industry.

The first signs of the impact of this new option are now evident. At Wilton, on Teeside, the new half a million tonnes a year ethylene plant, a joint project of BP and ICI, should come on-stream in mid-1979. Originally this was conceived as a naphtha cracking plant but it will now be capable of taking up to 50 per cent of its feedstock in the form of butane. Shell and Esso, the joint licensees of the gas-rich Brent field, are planning a complex at Mossmorran on the Firth of Forth to use the petroleum gases. The gas pipeline comes ashore at St Fergus and the gas sold to BGC (predominantly methane) will be removed there. The companies' plan is that the remaining mixture, the natural gas liquids, should be piped to Mossmorran and separated

† Disposals in a given period are equal to total production during that period less changes in stock held by the production industry.

Table 8 Exports of UK Continental Shelf crude oil 1978

Destination	Quantity millions of tonnes
Bahamas*	1.5
Belgium	0.4
Denmark	2.2
Federal Republic of Germany	5.2
Finland	0.5
France	1.7
Netherlands*	2.3
Netherlands West Indies*	1.7
Norway	1.4
Sweden	3.0
USA	4.0
Total exports	23.9

* Most of the exports to the Netherlands West Indies and the Bahamas will have been for re-export as crude or products to the United States, whilst some of the exports to Rotterdam may have been for transshipment elsewhere.

into its components — ethane, propane, butane and condensate. The propane and butane would be liquefied and, together with the condensate, shipped out by tanker. The ethane would be used as feedstock in an adjacent ethylene plant with a projected output of some half a million tonnes a year. Planning applications for these plants are before the Secretary of State for Scotland.

The shortage of light distillates worldwide has led to widespread investment by refiners in cracking facilities to upgrade heavier fuels into gasolines. Crackers produce olefins as by-products. These can be reacted with butane in alkylation units to make more gasoline. The increased demand for butane for this purpose in the UK alone could be over a million tonnes annually by the early 1980s, and the advent of associated gas from the North Sea will help to meet this demand.

UK offshore orders

During 1978 offshore exploration, development and maintenance continued to provide significant opportunities for suppliers of goods and services. In 1978 a total of £1574 million of orders for goods and services for the UK Continental Shelf was reported to the Offshore Supplies Office by the oil operating companies. Of this total the UK

offshore supplies industry share was £1037 million or 66 per cent. An analysis of the returns by industrial sector is shown in Table 9. The notes to the Table indicate a number of reasons why the value of orders should not be compared directly with expenditures reported by companies.

Significant orders placed in 1978 were production facilities for BP's Buchan Field, the Fulmar and Indefatigable jackets, the Beatrice drilling deck and over 20,000 tonnes of modules for Ninian North, Murchison and Tartan.

The Offshore Supplies Office of the Department of Energy continuously monitors procurement to ensure that UK industry is given a full and fair opportunity to compete for contracts. It assists wherever possible in further improving the UK's ability to compete effectively both at home and overseas.

Offshore technology research and development

The Department of Energy's research and development programme in the field of offshore oil and gas technology, which is determined in the light of advice from the Offshore Energy Technology Board (OETB), can be summarised under three main headings:

Table 9 An analysis of orders placed for UK goods and services for developments offshore

Sector	Value of orders placed		
	Total	UK Share	UK % *
Exploration			
A. Surveying	11	8	73 (67)
B. Exploration and appraisal drilling	72	14	19 (26)
Sub-total	83	22	27 (33)
Development			
C. Production platforms	401	296	74 (63)
D. Installation operations	147	60	41 (66)
E. Plant & equipment	132	98	74 (72)
F. Submarine pipelines	42	16	38 (16)
G. Development drilling	30	21	70 (35)
H. Terminals	232	198	85 (96)
Sub-total	984	689	70 (69)
Production			
I. Maintenance	73	53	73 (33)
Sub-total	73	53	73 (33)
General services (excluded wherever possible from A-I above)			
J. Transport	206	173	84 (50)
K. Diving and underwater services	30	23	77 (49)
L. Drilling tools and equipment	71	37	52 (57)
M. Support of personnel offshore	67	20	30 (44)
N. Miscellaneous	60	20	33 (81)
Sub-total	434	273	63 (56)
Grand Total	1,574	1,037	66 (62)

* 1977 percentages in brackets

1. The above analysis by sector of the orders placed for the UK Continental Shelf in 1978 is based on data collected from the individual returns supplied by each operator under a voluntary arrangement agreed with the UK Offshore Operators Association (UKOOA).
2. The UK share represents the value of the contracts and main sub-contracts placed with companies which through employment, manufacturing or sub-contracting make a substantial contribution to the UK economy. The main purpose of the returns is to monitor the flow of orders in respect of UK Continental Shelf activity and the share of orders gained within the UK. They are designed to fit in, so far as possible, with the normal recording processes of the offshore operating companies and cannot deal in detail with what is imported and what is home produced.
3. The value of orders and expenditure data are not directly comparable for a number of reasons;
 - i the expenditure that results from an order is often spread over a number of years.
 - ii the allocation of orders between categories especially where services are concerned presents a problem because of sub-contracts that flow from the main order.
 - iii offshore operators' expenditure on their own personnel and administrative costs, which are rising rapidly, are included in expenditure but not in the value of orders.
 - iv orders are subject to inflation and variations after the date that they are reported and it is sometimes difficult for companies to advise upon all such variations as they occur, due to the complexity of operations. A significant number are recorded including, in 1978, cancellations of orders placed in previous years amounting to £51 million.

- (i) The acquisition and analysis of geophysical, geological and reservoir engineering data to enable an appreciation to be made of our likely hydrocarbon reserves.
- (ii) The determination of the necessary standards to be laid down by the Department in pursuance of its statutory responsibilities for the safety of offshore operations.
- (iii) Assistance in the development of the offshore supplies industry in the United Kingdom.

The funds made available in 1976-77 and 1977-78 amounted to £9.6 million and £14.4 million respectively. Expenditure in 1978-79 is expected to continue at a similar level to that in 1977-78.

The programme of work associated with the collection of geophysical, geological and reservoir engineering data is continuing with magnetic, gravity and seismic studies of selected areas of the North Sea and Continental Margin. The programme included in 1978 the preliminary work on the siting of a deep stratigraphic well in the north western part of the Hampshire Basin at Shrewton (see page 11). Drilling began in December, and the well will also be used to provide data for the Department's geothermal energy programme. Preliminary discussions were also held with a number of companies with the intention of forming a consortium to undertake a stratigraphic drilling programme in deep waters around the UK with the intention of drilling the first well in 1980 to the west of Scotland.

Research and development studies directed to the Department's responsibilities in the field of offshore safety are progressing and work on the integrity of materials used offshore and seabed foundations has figured prominently. Seminars have been initiated on the results of work associated with the United Kingdom Offshore Steels Research Project and the Seabed Stability Programme and an initiative

concerning research and development into Enhanced Oil Recovery was announced. Although the recovery ratios in the North Sea are high by world standards — approaching 40 per cent — and the oil industry has been active for many years in this area, the research has been directed at fields onshore. The OETB is therefore supporting further research and development on enhanced recovery suitable for conditions on the UK Continental Shelf.

Shared cost research and development programmes with industry have been encouraged with a view to developing a stronger UK capability in the offshore market. This has involved an extension of work on improved methods of non-destructive testing, the development of manned and unmanned submersibles and projects aimed at eliminating or reducing the problems associated with engineering underwater. Further funds have been committed for work on novel platform design.

During the year a considerable number of interim and final reports were issued on projects set up in earlier years. Whenever possible, a short summary is included in the bi-monthly Departmental publication, "Offshore Research Focus". In many instances a copy of the complete report is available from the Technical Reports Centre at Orpington.

International matters

The Governments of Norway and the United Kingdom agreed in 1978 to extend the median line boundary north of the previously agreed limit. Under Article 4 of the UK/Norway Continental Shelf Delimitation Agreement of 1965, the two countries are required to reach agreement on the most effective method of exploiting any cross-median line fields and on apportioning the reserves from such fields.

An agreement for the Frigg field — the first cross-median line field to be discovered — was signed in 1976 and entered into force in 1977. In May 1978,

King Olav of Norway officially inaugurated the Frigg field and Her Majesty the Queen inaugurated the Frigg pipeline terminal at St Fergus in Scotland.

Discussions continued throughout 1978 on suitable agreements for the development of the Statfjord and Murchison fields; the former lies predominantly on the Norwegian Continental Shelf and the latter predominantly on the UK side of the median line. The licensees for both fields are the same and it is expected that both sets of agreements, between the licensees and between the two Governments, will be signed in 1979. In the case of Statfjord, the two Governments are also discussing policies for the economic development of the field.

The UK/Norwegian Coordinating Committee, established in 1976 to provide collaboration in offshore matters of mutual interest, met for the third time in June 1978. The two delegations, headed by the Secretary of State for Energy and the Norwegian Minister of Petroleum and Energy, discussed among other topics, safety, median line fields, gas gathering pipelines and opportunities for the offshore supplies industries of both countries.

The Special Working Group on Safety and Related Issues, which was set up by the Co-ordinating Committee for the exchange of information with particular emphasis on contingency planning, met in February 1978. The discussions covered a wide range of topics including emergency communications, occupational safety such as the evacuation of divers and the safety aspects of pipelines.

In March 1978, following a further series of oral hearings, the international Court of Arbitration, which was entrusted with the delimitation of the Continental Shelf between the United Kingdom and France, delivered a further decision on the United Kingdom's request for interpretation of its principal Award; this

request was based on apparent discrepancies between the boundary lines laid down by the Court in the South Western Approaches and to the north and west of the Channel Islands and the principles laid down in the Award itself. The Court decided that the United Kingdom's request was admissible and rectified the enclave boundary north and west of the Channel Islands as the United Kingdom had requested; the Court found, however, that it had no power to correct the course of the boundary in the South Western Approaches. The Court's decision of March 1978 was published in March 1979 in a White Paper (Cmnd 7438).

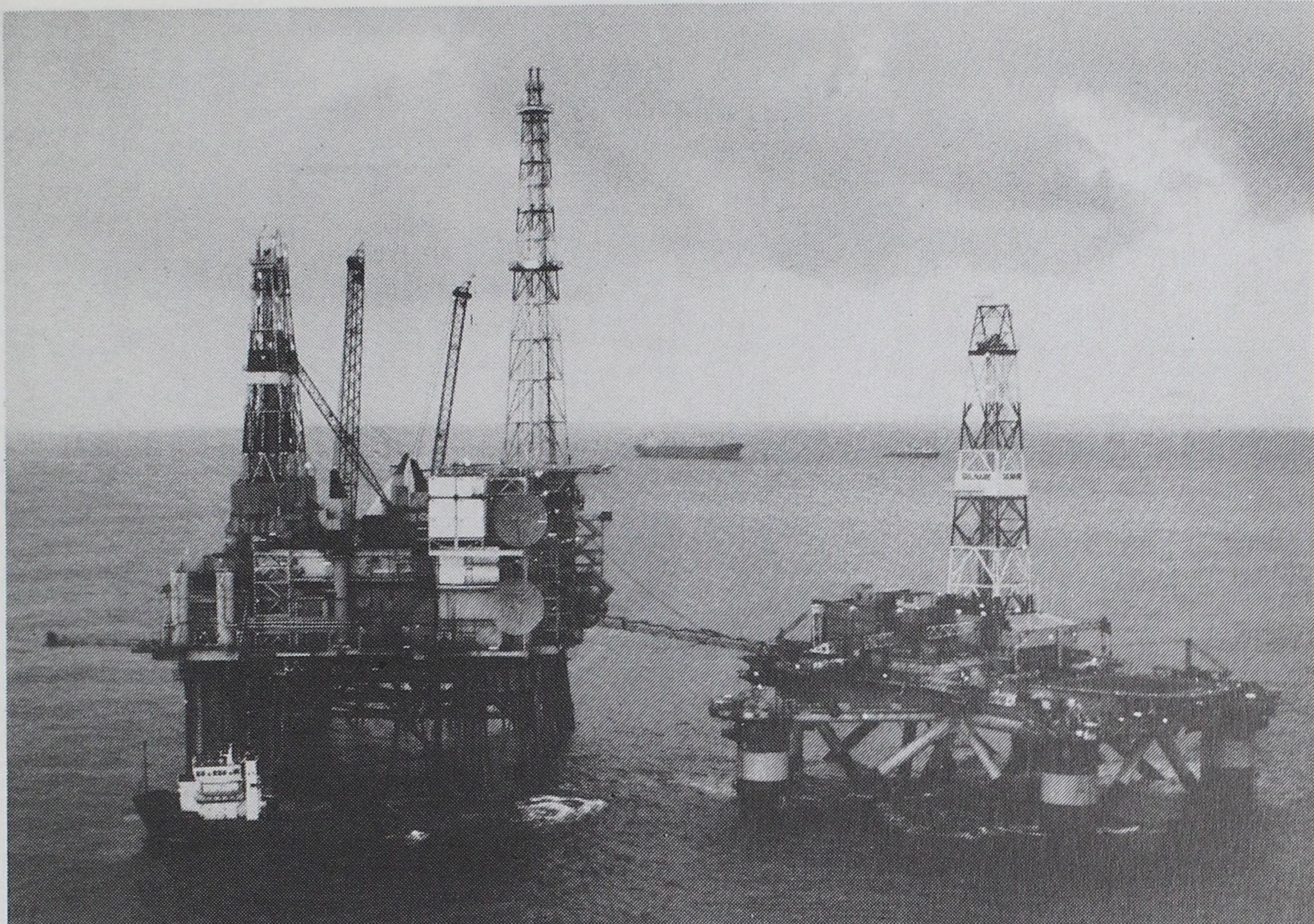
Part V: Field by field review

Offshore oil fields in production

Table 10 below provides basic information on the twelve fields in production. It is followed by individual notes on the developments on each field.

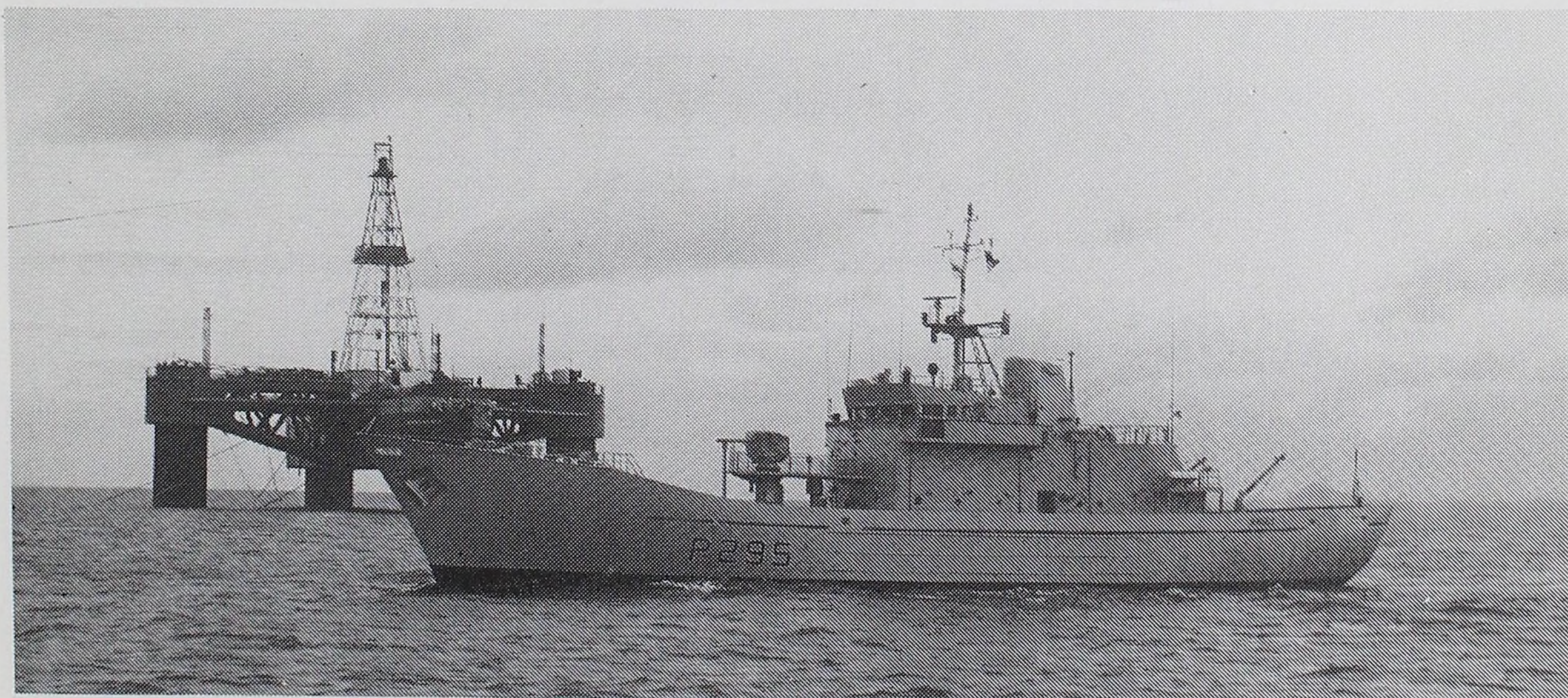
TABLE 10

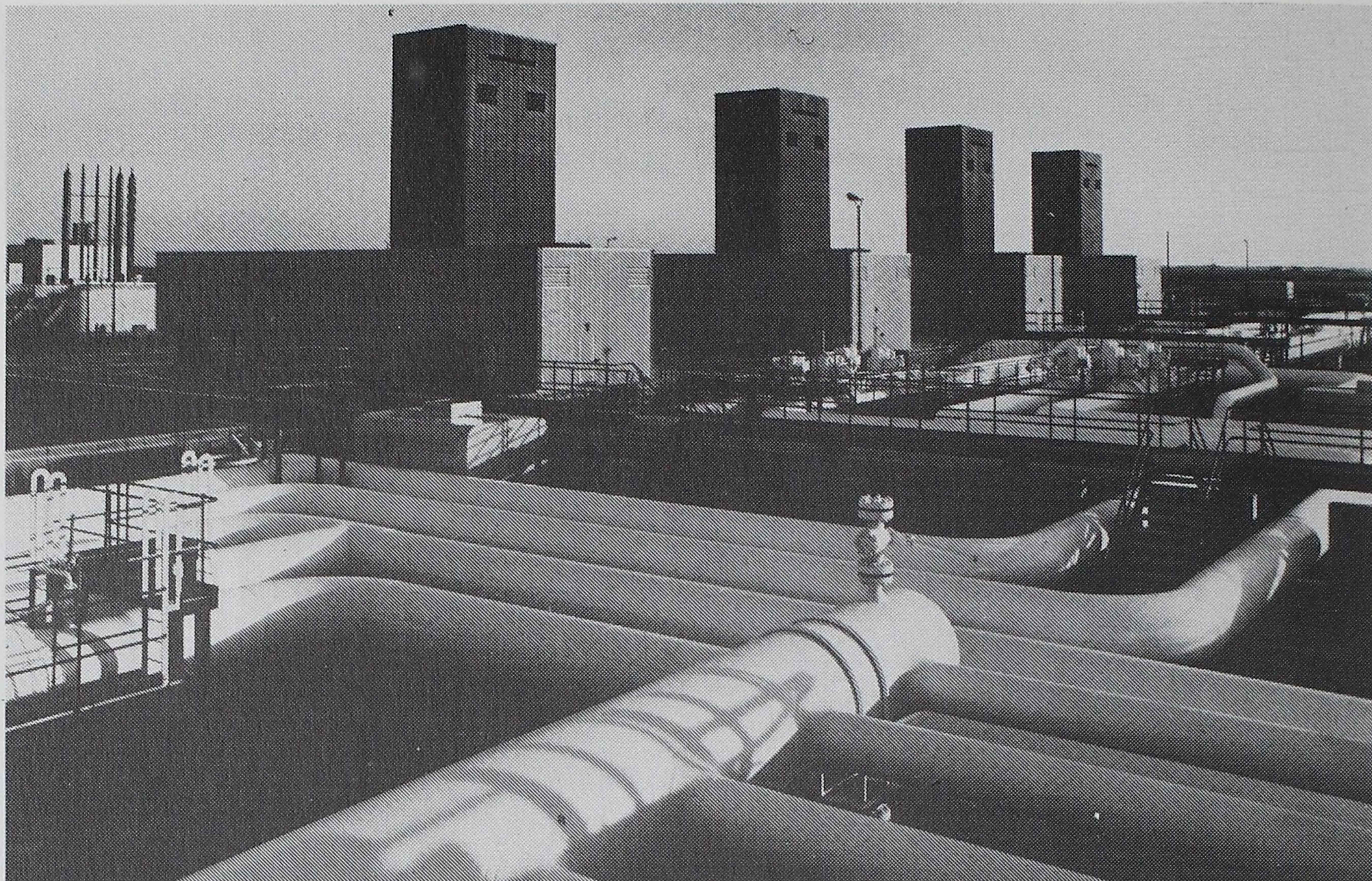
Field name (Block number)	Licensees/Company interest in block (%) at the end of 1978	Extension into other UK Blocks		Date of discovery	Date of production start-up	Operator's estimate of first year of peak production	Operator's estimated peak production (million tonnes per year)	Operator's estimate of proven recoverable reserves for the field (million tonnes) ¹
		Block number	Licensees/Company interest in block (%) at the end of 1978					
Argyll (30/24)	Hamilton Brothers Oil (Great Britain) Co Ltd/28.8 Hamilton Brothers Petroleum (UK) Ltd/7.2 RTZ Oil and Gas Ltd/25 Blackfriars Oil Co Ltd/12.5 Trans-European Co Ltd/2.5 Texaco North Sea UK Ltd (Texaco)/24 *BNOC/Nil			Oct 1971	June 1975	1977	1.1	— ²
Auk (30/16)	Shell UK Ltd (Shell)/50 Esso Petroleum Company Ltd (Esso)/50 *BNOC/Nil			Feb 1971	Feb 1976	1977	2.3	6.3 ³
Beryl (9/13)	Mobil Producing North Sea Ltd (Mobil)/50 Amerada Exploration Ltd (Amerada)/20 Texas Eastern UK Ltd (Texas Eastern)/20 BGC/10 *BNOC/Nil			Sept 1972	June 1976	1980	5	66
Brent (211/29)	Shell/50 Esso/50 *BNOC/Nil			July 1971	Nov 1976	1982	23	220 ^{3 4}
Claymore (14/19)	Occidental Petroleum (Caledonia) Ltd/36.5 Getty Oil (Britain) Ltd/23.5 Allied Chemical (Great Britain) Ltd/20 Thomson North Sea Ltd/20 *BNOC/Nil			May 1974	Nov 1977	1980	5.6	55
Dunlin (211/23)	Shell/50 Esso/50 *BNOC/Nil	211/24	Conoco Ltd (Conoco)/ 33 1/3 Gulf Oil (Great Britain) Ltd (Gulf)/16 2/3 BNOC (Exploration) Ltd/33 1/3 Gulf (UK) Offshore Investments Ltd/16 2/3	July 1973	Aug 1978	1982	7.5	— ²
Forties (21/10)	BP Oil Development Ltd/100	22/6a	Shell/50 Esso/50 *BNOC/Nil	Nov 1970	Nov 1975	1978	24	240



1 The Thistle 'A' Platform and accommodation rig Gulnare. The platform was built by Laing Offshore on Teesside and production began from the Thistle Field in February 1978. *Photograph by courtesy of the operator the British National Oil Corporation.*

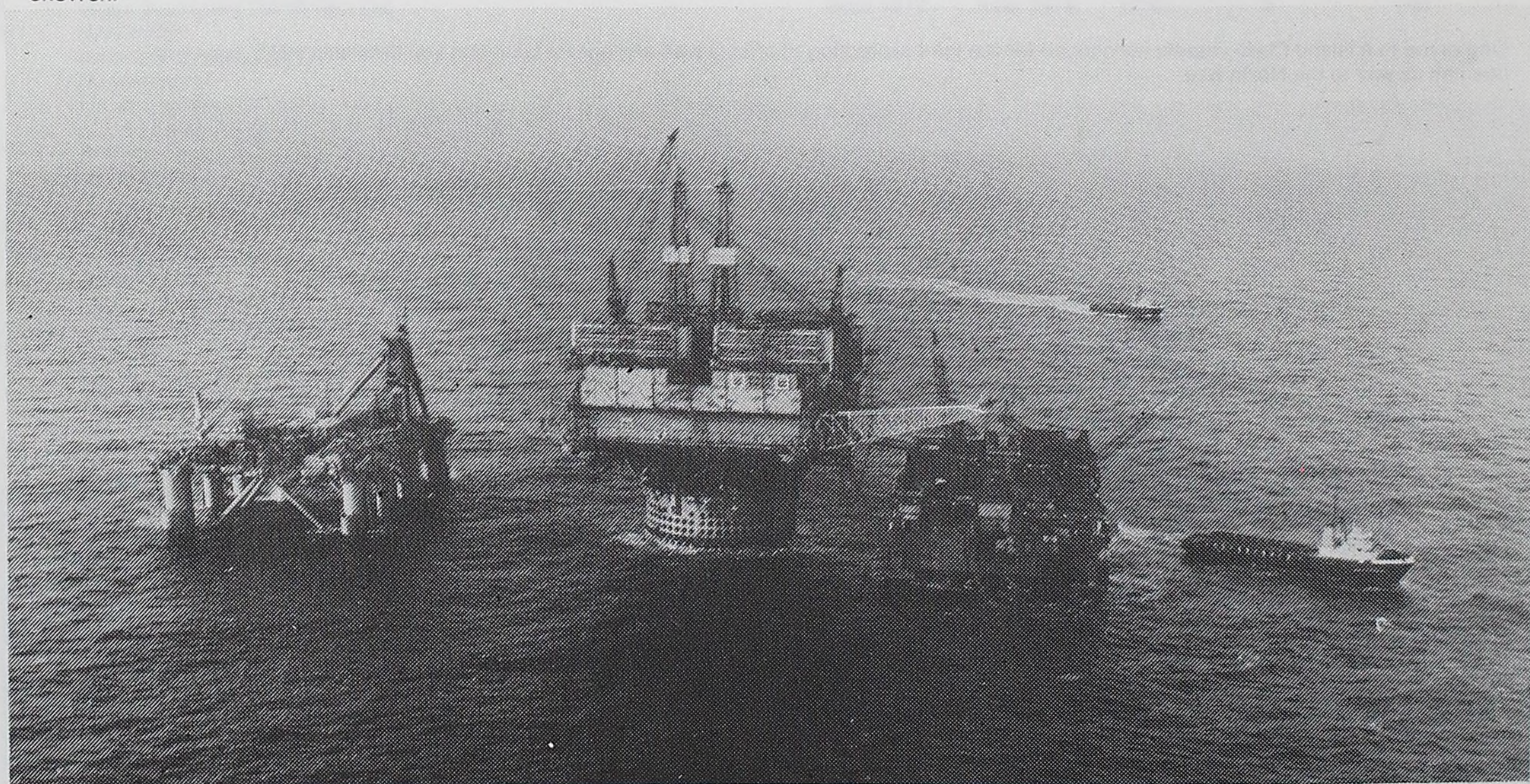
2 One of the five Island Class vessels introduced for the joint protection of offshore oil and gas installations and fisheries. HMS Jersey is seen on its way to the North Sea.





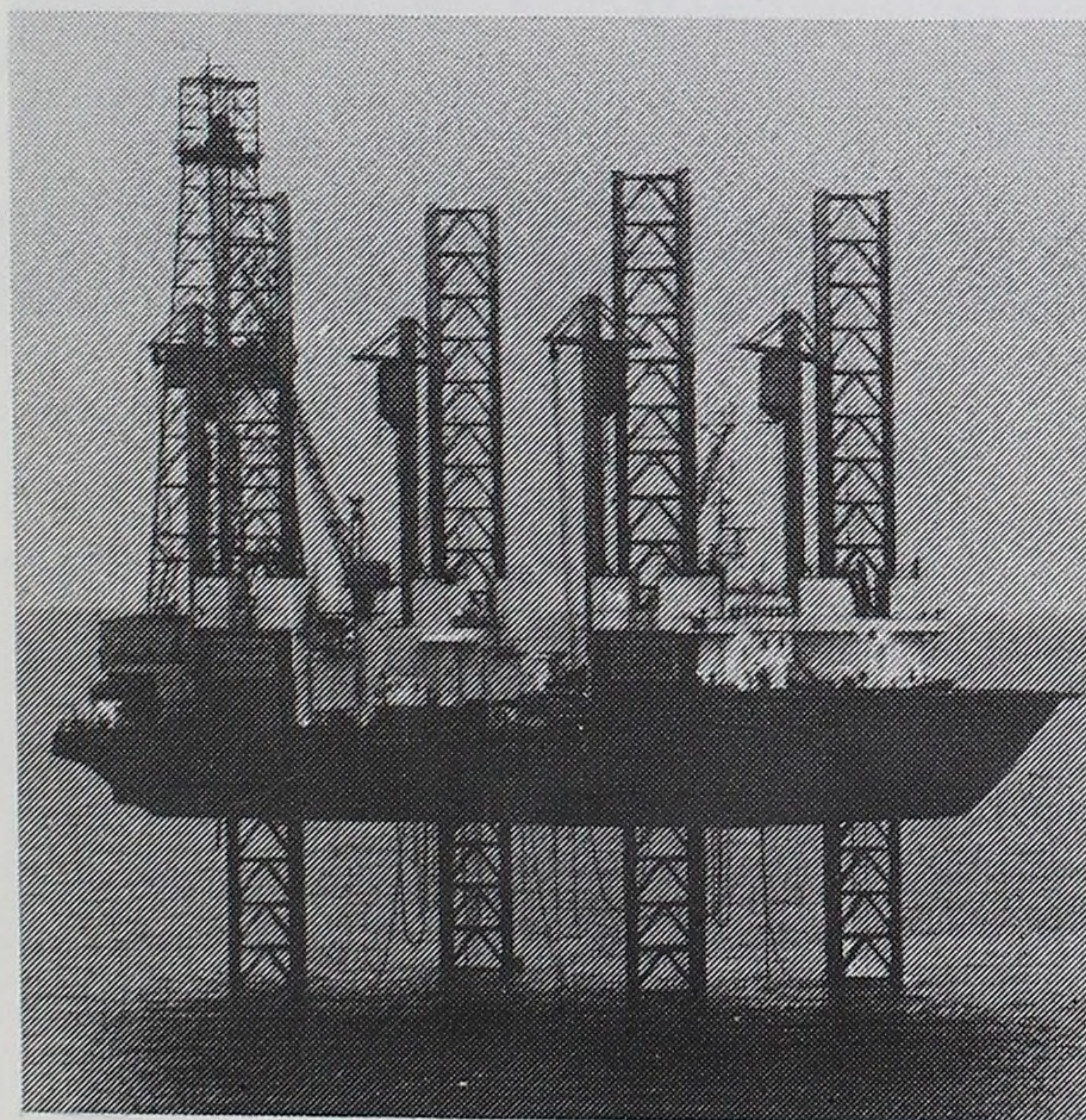
3 St. Fergus — A general view of part of the British Gas terminal showing some of the pipework and four of the compressor "cabs" where gas pressure is boosted before gas enters the landward pipelines. *Photograph by courtesy of the British Gas Corporation.*

4 Ninian Central platform installed in 1978. Concrete construction by Howard Doris at Loch Kishorn. *Photograph by courtesy of the operator Chevron.*

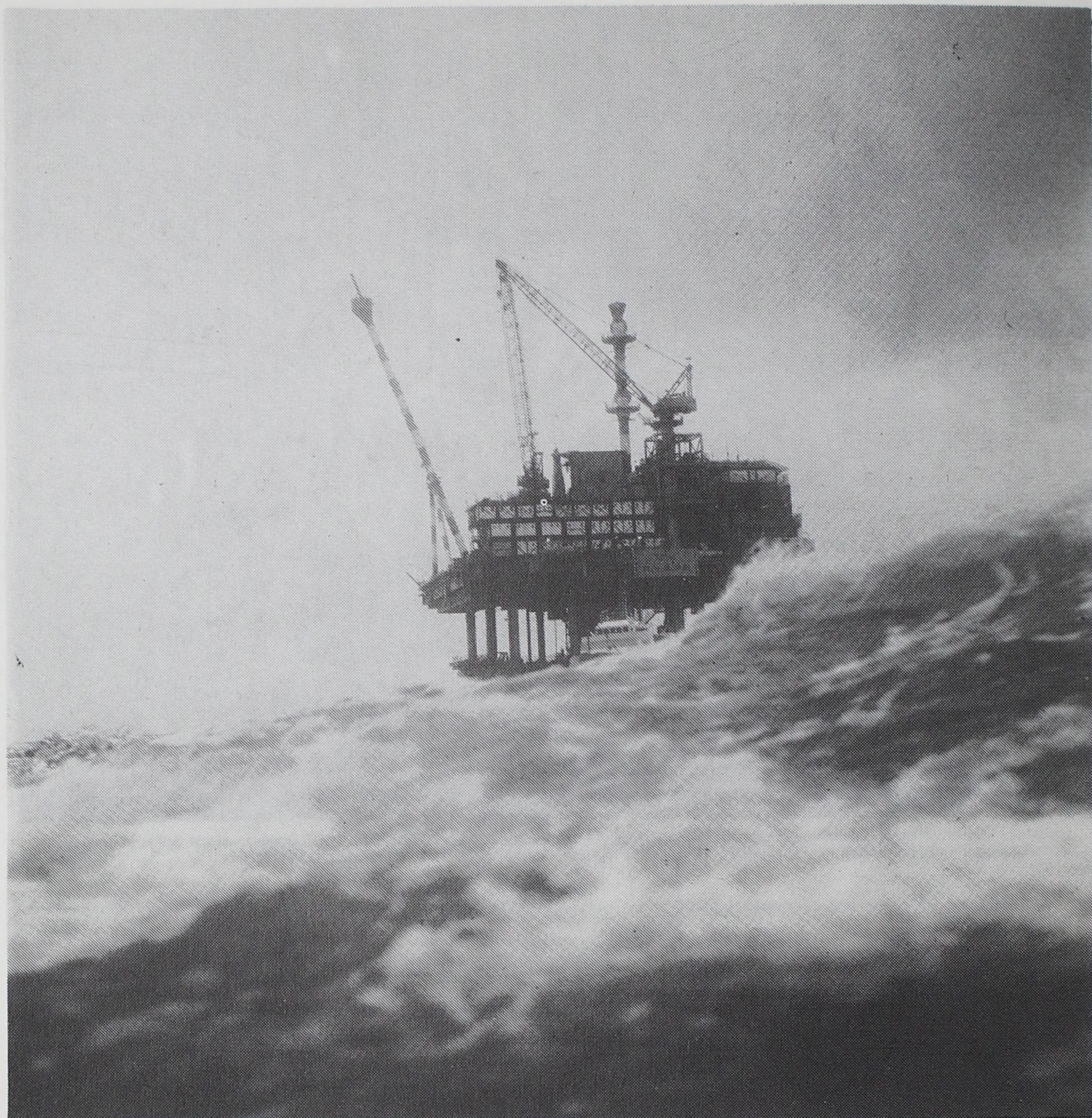




5 Shetland — Construction of Sullom Voe terminal in Calback Ness. Aerial view of 70,000 dwt Shell tanker M/T Donovanian (first tanker at Sullom Voe for harbour trials) berthed at Jetty 2, looking north-east. *Photograph, October 1978, by courtesy of British Petroleum.*



6 Three further appraisal wells were drilled during 1978 in Morecambe gas field. The drilling rig Offshore Mercury is seen on location, operating for British Gas. *Photograph by courtesy of British Gas Corporation.*



7 Situated midway between the Frigg gas field and the St Fergus terminal in rough sea, the Intermediate Manifold Compression Platform (MCP — 01).
Photograph by courtesy of Total Oil Marine.

TABLE 10 continued

Field name (Block number)	Licensees/Company interest in block (%) at the end of 1978	Extension into other UK Blocks		Date of discovery	Date of production start-up	Operator's estimate of first year of peak production	Operator's estimated peak production (million tonnes per year)	Operator's estimate of proven recoverable reserves for the field (million tonnes) ¹
		Block number	Licensees/Company interest in block (%) at the end of 1978					
Heather (2/5)	Unocal Exploration & Production Co (UK) Ltd/31.25 Skelly Oil Exploration (UK) Ltd/31.25 Tenneco Great Britain Ltd/31.25 DNO (Heather Oilfield) Ltd/6.25 *BNOC/Nil			Dec 1973	Oct 1978	1980	2.5	20
Montrose (22/17)	Amoco UK Petroleum Ltd (Amoco)/30.77 BGC/30.77 Amerada/23.08 Texas Eastern/15.38 *BNOC/Nil	22/18	Amoco/30.77 BGC/30.77 Amerada/23.08 Texas Eastern/15.38 *BNOC/Nil	Sept 1969	June 1976	1980	2.0	14.4
Ninian (3/3)	Chevron Petroleum Co Ltd/24 BNOC (Ninian) Ltd/30 ICI Petroleum Ltd/26 Murphy Petroleum Ltd/10 Ocean Exploration Ltd/10 *BNOC/Nil	3/8	BP Petroleum Development Ltd/50 Ranger Oil (UK) Ltd/20 Scottish Canadian Oil and Transportation Co Ltd/7 London and Scottish Marine Oil Co Ltd/23	Jan 1974	Dec 1978	1981	17.9	155
Piper (15/17)	Occidental Petroleum (UK) Ltd/36.5 Getty Oil (Britain) Ltd/23.5 Allied Chemical (Great Britain) Ltd/20 Thomson North Sea Ltd/20 *BNOC/Nil			Jan 1973	Dec 1976	1979	14.6	82
Thistle (211/18)	BNOC/16.2 Burmah Oil Exploration Ltd/8.15 Deminex UK Exploration and Production Ltd/22.5 Deminex Oil & Gas (UK) Ltd/20 Santa Fe (UK) Ltd/16.9 Tricentrol Thistle Development Ltd/9.65 Charterhouse Petroleum Development Ltd/1 Ashland Oil (GB) Ltd/5.6	211/19	Conoco/33 1/3 Gulf/16 2/3 BNOC (Exploration) Ltd/33 1/3 Gulf (UK) Offshore Investments Ltd/16 2/3	July 1973	Feb 1978	1981	10.6	73

1 The reserves quoted may not be precisely comparable with each other and with other figures in this report since differences exist in the procedures and assumptions adopted by different companies and by the Department of Energy.

2 Currently under re-assessment.

3 Total discounted reserves; that is, proven plus suitable discounted figures for probable and possible reserves.

4 Stabilised crude, excluding NGL for block 211/29

* BNOC is a co-licensee through its participation agreements.

Offshore oil fields in production

ARGYLL (Hamilton block 30/24)

Water levels continued to advance in the Zechstein Reservoir causing three wells to cease production by 'watering out'. One of these, well 6, was recompleted in the Jurassic with modest results. A new well was successfully completed in the Zechstein Reservoir.

Production was interrupted early in 1978 owing to repairs to the converted semi-submersible TRANSWORLD 58. The 1979 drilling and recompletion plans are under review and the estimated future life of the field and remaining reserves are, of necessity, uncertain.

The oil is loaded into tankers offshore. As

production of gas is too small for delivery to shore to be economic, a gas flaring consent has been issued for the lifetime of the field.

AUK (Shell block 30/16)

Water levels continued to advance in this Zechstein Reservoir also, and by the end of 1978 the water content of the production reached 60-70 per cent. Two platform development wells were attempted; one was suspended and the other was still being drilled at the end of the year. One 'upstructure' appraisal well was drilled.

The oil is loaded into tankers offshore and as gas production is small, a gas flaring consent has been issued for the lifetime of this field also.

BERYL (Mobil block 9/13)

Two development wells, two water injection wells and one gas injection well were completed in the Upper Beryl Reservoir. Development drilling continued during 1978. Water injection started in the fourth quarter and gas injection continued at increasing rates. Two additional wells were converted for standby gas storage. A further production well was completed in the Trias as a 'subsea completion'.

Production which is loaded into tankers offshore, was interrupted late in 1978 by flooding of a utility shaft, but was almost fully restored by the end of the year.

BRENT (Shell block 211/29)

The fourth platform (C) was installed. From the three other platforms (A, B and D), seven production wells and six wells for gas injection were drilled in 1978.

Production began from 'A' Platform in mid-year, and was resumed in September from 'B' Platform which had been shut down since 1977. On 'D' Platform, gas injection facilities were brought into operation in the third quarter of 1978.

Later in 1979 oil is to be transported by pipeline to Sullom Voe.

CLAYMORE (Occidental block 14/19)

Six development wells including three water injection wells, were completed in 1978. Water injection started in the middle of the year. Piper field gas was used for 'gas lift' at Claymore to assist oil extraction, until late 1978 when a new higher gas to oil ratio well began production on North Claymore and satisfied Claymore requirements.

Oil is carried by a spur line to join the main pipeline from Piper to Flotta.

DUNLIN (Shell block 211/23, extending into Conoco block 211/24)

The field started production in August 1978. Initially three wells were available for production and by the end of the year three more wells had been completed. The first water injection well is being drilled.

The oil is transported through the spur line to South Cormorant and thence to Sullom Voe. Limited amounts of gas are being flared pending the installation of gas-injection equipment.

FORTIES (BP block 21/10, extending into Shell block 22/6a)

Development drilling on primary spacing is now almost complete and one rig has been engaged in development and recompletion work. In 1978 four wells were drilled from 'C' Platform and four from 'D'. Of these, five were water injection wells and one a production well. Two were suspended. Water injection continued. Commissioning work on natural gas liquid (NGL) facilities on all platforms also continued through the year.

Oil is brought ashore by pipeline to Cruden Bay and from there by pipeline to Grangemouth. NGLs are being injected into the main oil stream and recovered onshore.

Agreement on the notional division of reserves between the two blocks was announced during the year; in this connection one of the suspended wells is expected to appraise block 22/6a.

HEATHER (Unocal block 2/5)

Development drilling began in July 1978

and by the end of the year four wells had been completed. Oil production began in October and the oil is being transported via the Ninian Central Platform to Sullom Voe. Gas in excess of requirements is being flared.

MONTROSE (Amoco block 22/17, extending into Amoco block 22/18) Drilling and production continued during 1978. Water injection was initiated as planned in February, and by the end of the year some five million barrels had been injected into three wells designed for this purpose. Oil is loaded into tankers offshore.

NINIAN (Chevron block 3/3 extending into BP block 3/8) The first oil production from the southern platform started in late December 1978. Further development wells are being drilled from the southern platform, and the first water injection facilities may be commissioned later in 1979. The central platform was installed in May 1978; development drilling began in December, and production began in May 1979. Commissioning of NGL injection facilities on both central and southern platforms is scheduled for the end of 1979 — this is a temporary measure to conserve NGLs until facilities for their reception at Sullom Voe are ready. The jacket of the final northern platform was floated out into position in June and installation is in progress. Drilling is scheduled for late 1979 and production for 1980.

Oil from Ninian is being brought ashore at Sullom Voe through the joint pipeline with Heather.

PIPER (Occidental block 15/17) Four development wells and two water injection wells were completed; water injection began early in 1978. Water advance continued and repair of one of the two wet production wells for water exclusion was successful. Repair of the other failed for mechanical reasons.

Temporary re-injection of natural gas liquids through well 4 started late in 1978, whilst facilities at Flotta are expanded.

Development drilling is nearing completion. In December 1978, gas deliveries to shore began through a pipeline link to the Frigg Manifold Compression Platform (MCP-01). Oil is piped to the Flotta terminal.

THISTLE (BNOC block 211/18, extending into Conoco block 211/19) Thistle came into production early in 1978. For most of the year production was loaded offshore, but in December the pipeline link to Sullom Voe came into use. Wells are currently being drilled for water injection. A gas injection facility is planned to be available in mid-1979. The year of peak oil production is now expected to be 1981.

Offshore oil fields under development

Table 11 below provides basic information on the ten fields under development. It is followed by individual notes on the developments on each field.

TABLE 11

Field name (Block number)	Licensees/Company interest in block (%) at the end of 1978	Extension into other UK Blocks		Date of discovery	Date of production start-up	Operator's estimate of first year of peak production	Operator's estimated peak production (million tonnes per year)	Operator's estimate of proven recoverable reserves for the field (million tonnes) ¹
		Block number	Licensees/Company interest in block (%) at the end of 1978					
Beatrice (11/30a)	Mesa UK Ltd/25 Kerr-McGee Oil (UK) Ltd/25 Creslenn (UK) Ltd/15 P & O Petroleum Ltd/15 Hunt Oil (UK) Ltd/20 *BNOC/Nil			Sept 1976	1981	1981	3.9	21
Buchan (21/1)	BP Petroleum Development Ltd/27 1/12 Transworld Petroleum (UK) Ltd/14 CCP North Sea Associates Ltd/10 7/12 Gas and Oil Acreage Ltd/5 City Petroleum Co/14 Candel Petroleum (UK) Ltd/14 St Joe Petroleum (UK) Ltd/14 Charterhall Oil Ltd/1 1/3 *BNOC/Nil	20/5	Texaco/100	Aug 1974	1979	1979	2.2	6.8
North Cormorant (211/21a)	Shell/50 Esso/50 *BNOC/Nil			July 1974	1982			
South Cormorant (211/26)	Shell/50 Esso/50 *BNOC/Nil	211/21	Shell/50 Esso/50 *BNOC/Nil	Sept 1972	1979	1981	3	15 ^{3 4}
Fulmar (30/16)	Shell/50 Esso/50	30/11b	Amoco/25.77 BGC/25.77 Amerada/18.08 Texas Eastern/10.38 Mobil/20.00	Nov 1975	1981	1984	8.5	70 ³
Magnus (211/12a)	BP Petroleum Development Ltd/100			March 1974	1983	1984	5.9	60
Maureen (16/29)	Phillips Petroleum Exploration UK Ltd/35 Fina Exploration Ltd/30 AGIP Exploration (UK) Ltd/15 Century Power and Light Ltd/9 Ultramar Exploration Ltd/6 The British Electric Traction Co Ltd/5 *BNOC/Nil			Feb 1973	1982	1982	4	21
Murchison (UK) (211/19)	Conoco Ltd/33 1/3 Gulf/16 2/3 BNOC (Exploration) Ltd/33 1/3 Gulf (UK) Offshore Investments Ltd/16 2/3			Sept 1975	1980	1982	7.2 ⁵	51 ⁵
UK Statfjord (211/24)	Conoco/33 1/3 Gulf/16 2/3 BNOC (Exploration) Ltd/33 1/3 Gulf (UK) Offshore Investments Ltd/16 2/3	211/25	Conoco/33 1/3 Gulf/16 2/3 BNOC (Exploration) Ltd/33 1/3 Gulf (UK) Offshore Investments Ltd/16 2/3	April 1974	1979	1985	27 ⁵	412 ⁵
Tartan (15/16)	Texaco/100			Dec 1974	1980	1981	4	2

The expression "Oil fields under development" covers those fields on which significant development work has occurred, indicated by the placement of major contracts for offshore equipment. It does not imply possession of a Department of Energy development consent.

1 The reserves figures quoted may not be precisely comparable with each other and with other figures quoted in this report since differences exist in the procedures and assumptions adopted by different companies and by the Department of Energy.

2 Currently under re-assessment.

3 Total discounted reserves; that is, proven plus suitable discounted figures for probable and possible reserves.

4 These figures refer to production from block 211/26.

5 Total production and reserves of field including Norwegian sector.

* BNOC is a co-licensee through its Participation Agreement.

Offshore oil fields under development

BEATRICE (Mesa block 11/30a)

Development plans for the field were approved in 1978 and involve the transportation of oil via a pipeline to Nigg Bay. The platform is due to be floated out in 1980. First production is expected in 1981.

BUCHAN (BP block 21/1 extending into Texaco block 20/5)

Six development wells were completed during 1978 — all are potential oil producers. One further well remains to be drilled. Neither water nor gas injection is planned at present. Production from the field is expected to begin later in 1979.

NORTH CORMORANT (Shell block 211/21a)

A development plan was submitted to the Department at the end of 1978, and approval was given in April 1979.

Production from a single steel platform is expected to start in 1982. Oil will be transported by pipeline into the Brent system and gas by a pipeline link to the South Cormorant — Brent gas pipeline.

SOUTH CORMORANT (Shell block 211/26, extending into Shell block 211/21)

The platform was towed out in May 1978. Drilling of development wells is currently in progress.

FULMAR (Shell block 30/16 extending into Amoco block 30/11b)

Development plans have been approved and development drilling for early production took place during 1978 from a four-well subsea template. A second well was being drilled at the end of the year to evaluate the extension of the field into block 30/11b. The wellhead jacket will be installed in Summer 1979 and the template wells will be connected to the main platform in 1980 when it is installed. Production is expected to begin in 1981.

MAGNUS (BP block 211/12a)

Development plans were approved in December 1978. A steel platform will be employed, with some outlying areas

being linked in through subsea completions. Oil will travel by pipeline to Ninian, and thence to Sullom Voe. It is expected that gas will be collected by a gas gathering system.

MAUREEN (Phillips block 16/29)

Two appraisal wells had previously been drilled on this discovery made by well 16/29-1. A further appraisal well was drilled during 1978. Development plans were submitted in December 1978 and approval was given in January 1979. A gravity steel structure will be employed and the oil will be loaded into tankers offshore. First production is expected at the beginning of 1982.

MURCHISON (Conoco Group block 211/19, extending into the Norwegian block 33/9 — Statoil/Mobil Group)

Floating out of the Murchison Platform is planned for 1979. Production is expected to begin in 1980.

STATFJORD (Conoco Group blocks 211/24 and 25, extending into Norwegian blocks 33/12 and 33/9 — Statoil/Mobil Group)

The drilling of the first development well on the field was commenced in December 1978 from the 'A' Platform; production is expected to start in December 1979. The 'B' Platform is being constructed and the 'C' Platform is still under consideration.

TARTAN (Texaco block 15/16)

No new drilling took place on the field during 1978. The platform is due to be positioned in mid-1979 and production is expected to start in early 1980. Oil will be transported to Flotta via the Claymore field and link to the Piper pipeline. Gas will be transported by pipeline to Piper and thence to Frigg MCP-01 and ashore.

Offshore oil fields under appraisal

BERYL NORTH (Mobil block 9/13)

The discovery well 9/13-7 was drilled in 1975 and was appraised by two wells in 1976 and 1977. A further well was drilled in 1978. Approval was given for one of the appraisal wells (9/13-15) to be tied

into the Beryl 'A' Platform through a subsea completion. More information about the behaviour of the reservoir is required before development plans are finalised; these are expected during 1979.

BRAE (Pan Ocean block 16/7)

The original oil discovery was made in 1975 by well 16/7-3 and eight appraisal wells were drilled in 1976/77. Two further appraisal wells were completed in 1978 making a total of 13 wells on the block. Submission of plans to develop the field is expected in 1979.

HUTTON (Conoco block 211/28

extending into Amoco block 211/27)

The original discovery well was drilled in 1973 and three further appraisal wells were subsequently drilled by Amoco and Conoco. Development plans may be submitted in 1979. No further appraisal drilling took place during 1978.

NW HUTTON (Amoco block 211/27)

The field is in a separate structure from Hutton. The discovery well 211/27-3 was drilled in 1975. During 1978 an appraisal well was drilled bringing the total number of appraisal wells to six. Development plans were submitted in April 1979.

TONI-THELMA (Phillips block 16/17)

The original discovery well was 16/17-1 and three appraisal wells were drilled in 1976/77. In 1978 two further appraisal wells were drilled (16/17-5 and 6) and another was being tested at the end of the year. Further drilling is likely in 1979.

30/17b-2 (BNOC)

During 1978 an oil discovery was made in the block and an appraisal well was also drilled. Further drilling is required before any development plans are formulated.

211/18-6 (BNOC)

In 1975 oil was discovered by well 211/18-6 to the north of the Thistle field. Plans are under consideration for the development of this accumulation possibly with production tied into the Thistle platform.

Other possible developments are listed in Table 12.

Table 12 Other possible offshore oil field developments

Field	Block	Operator	Remarks
Andrew	16/28 extending to Phillips block 16/27	BP	No further drilling was carried out in 1978
Crawford	9/28	Hamilton	No further drilling was carried out in 1978.
Tern	210/25	Shell	The field was discovered in 1975 and two appraisal wells drilled in 1977. No drilling on the field was carried out in 1978.
	3/2	Conoco	No further drilling was carried out in 1978.
	3/7-1)	Chevron	No new drilling occurred in 1978. The possibility of tying in these discoveries to Ninian is being considered.
	3/8-3)	BP	
	3/7-2)	Chevron	
	3/9	Total	No further drilling was carried out in 1978. Further appraisal is needed before development can be considered and a well may be drilled in 1979.
	3/14a, 3/15	Total	Drilling in 1978 has downgraded this structure — further evaluation will be necessary.
	3/14	Total	Further drilling of this complex structure will be necessary before development can be considered.
	9/19-1	Conoco	No further drilling was carried out in 1978 but this complex area is still under study and a well is currently being drilled.
	9/13-4	Mobil	No new drilling took place during 1978 but development tied into the Beryl A platform could be considered.
	15/23	Texaco	Two appraisal wells were drilled in 1978 but proved disappointing. More drilling is expected in 1979.

Offshore gas fields in production

Table 13 below provides basic information on the seven fields in production

TABLE 13

Field name (block number)	Licensees/Company interest in block at the end of 1978 (%)	Block number	Extension into other UK Blocks		Date of discovery	Date of production start up
			Licensees/Company interest in block at the end of 1978 (%)			
West Sole (48/6)	BP Petroleum Development Ltd/100	—	—		October 1965	March 1967
Leman Bank (49/26)	Shell UK Ltd (Shell)/50 Esso Petroleum Co Ltd (Esso)/50	49/27	Amoco UK Petroleum Ltd (Amoco)/30.77 British Gas Corporation/30.77 Amerada Exploration Ltd (Amerada)/ 23.08 Texas Eastern (UK) Ltd (Texas Eastern)/ 15.38		April 1966	August 1968
		49/28	Arpet Petroleum Ltd (Arpet)/33 1/3 British Sun Oil Co Ltd/23 1/3 North Sea Exploitation and Research Co Ltd/10 Superior Oil (UK) Ltd/20 Canadian Superior Oil (UK) Ltd/3 1/3 Sinclair (UK) Oil Co Ltd/10			
		53/2	Mobil Producing North Sea Ltd/100			
Indefatigable (49/18)	Amoco/30.77 British Gas Corporation/30.77 Amerada/23.08 Texas Eastern/15.38	49/23	Amoco/30.77 British Gas Corporation/30.77 Amerada/23.08 Texas Eastern/15.38		June 1966	October 1971
		49/19	Shell/50 Esso/50			
		49/24	Shell/50 Esso/50			
Hewett (48/29)	Arpet/33 1/3 British Sun Oil Co Ltd/23 1/3 North Sea Exploitation and Research Co Ltd/10 Superior Oil (UK) Ltd/20 Canadian Superior Oil (UK) Ltd/3 1/3 Sinclair (UK) Oil Co Ltd/10	48/30	Phillips Petroleum Exploration UK Ltd (Phillips)/35 Fina Exploration Ltd (Fina)/30 AGIP (UK) Ltd/15 Century Power and Light Ltd/7.22 Plascom Ltd/4.26 Halkyn District United Mines Ltd/4.26 Oil Exploration Ltd/4.26		October 1966	July 1969
		52/5a	Phillips group as above			
		52/4a	Phillips/19 AGIP (UK) Ltd/8.1 Fina/16.3 Century Power and Light Ltd/3.9 Halkyn District United Mines Ltd/2.3 Oil Exploration Ltd/2.3 Plascom Ltd/2.3 Arpet/15.3 British Sun Oil Co Ltd/10.7 North Sea Exploitation and Research Co Ltd/4.6 Superior Oil (UK) Ltd/9.1 Canadian Superior Oil (UK) Ltd/1.5 Sinclair (UK) Oil Co Ltd/4.6			
		48/28	Arpet group as for block 48/29			
Viking (49/17)	Conoco Ltd (Conoco)/50 BNOC (Exploration) Ltd/50	49/12a	Conoco/50 BNOC (Exploration) Ltd/50		May 1968	July 1972
Rough (47/8)	Amoco/13.68 British Gas Corporation/69.23 Amerada/10.26 Texas Eastern/6.83	47/3a	Amoco/30.77 British Gas Corporation/30.77 Amerada/23.08 Texas Eastern/15.38		May 1968	October 1975
Frigg (UK) (10/1)	Total Oil Marine Ltd/33 1/3 Aquitaine Oil (UK) Ltd/22 2/9 Elf Oil Exploration and Production (UK) Ltd/44 4/9	—	—		May 1972	September 1977

Offshore gas fields in production

There are seven offshore gas fields currently in production: Leman Bank, Indefatigable, Viking Area, West Sole, Hewett, Rough and Frigg. Details are given in Table 13. In addition, associated gas is produced from the Piper oil field and in December 1978 this began flowing through a pipeline spur — 35 miles in length — to the main gas trunk line from the Frigg field to St Fergus.

On the Frigg field all 24 wells on the CDP1 platform were completed by the end of 1978. Ten wells were completed on DP2, and all remaining wells are scheduled for drilling by September 1979.

Offshore gas fields and gas condensate fields under development or appraisal

Significant gas and gas condensate discoveries are listed in Appendix 5.

In July 1978 BGC announced that the Morecambe gas field, which was discovered by its subsidiary Hydrocarbons Great Britain Limited, was commercial and would be developed. Recoverable reserves could be 60-80 billion cubic metres (2-3 trillion cubic feet). Three further appraisal wells were drilled in Morecambe Bay in 1978. Hydrocarbons Great Britain Limited are studying alternative means of developing the field and examining its possible use as buffer storage to reduce the seasonal variations in gas output from other fields.

Appendix 1

North Sea crude oil production

(million tonnes)

Field	1975	1976	1977	1978	Cumulative Total to end 1978
Argyll	0.5	1.1	0.8	0.7	3.1
Auk		1.2	2.3	1.3	4.8
Beryl		0.4	3.0	2.6	6.0
Brent		0.1	1.3	3.8	5.2
Claymore			0.3	3.0	3.4
Dunlin				0.7	0.7
Forties	0.6	8.6	20.1	24.5	53.8
Heather				0.1	0.1
Montrose		0.1	0.8	1.2	2.1
Ninian				0.04	0.04
Piper		0.1	8.6	12.2	20.9
Thistle				2.6	2.6
Total	1.1	11.6	37.3	52.8	102.8

UK total oil production for 1978 was:

Offshore Crude	52.8 million tonnes
Petroleum Gases	0.6 million tonnes
Condensate	0.4 million tonnes
Onshore Crude	0.1 million tonnes
	<hr/>
	54.0 million tonnes

- 1 Production is defined as the quantity of oil extracted from the field (liftings) minus the quantities of gas reinjected or flared offshore.
- 2 Platform and terminal use is included.
- 3 Crude oil includes condensate and residual dissolved gases present in the disposals of stabilised crude by the industry.
- 4 Petroleum gases are ethane, propane and butane produced in the treatment of liquid or gaseous hydrocarbons at pipeline terminals.
- 5 Condensate which is a mixture of pentane and higher hydrocarbons arises mainly from the treatment of gas produced from the Frigg and Southern Basin fields.
- 6 All figures given above are rounded to the nearest 100,000 tonnes (except for the Ninian field).

Appendix 2

Significant* oil discoveries

announced by the end of 1978,
excluding fields in production or under development

Field name	Block and well number	Operator of block at the end of 1978	Date discovered
—	3/15-2	Total	July 1973
Hutton	211/28-1	Conoco	September 1973
Alwyn	3/14a-1	Total	November 1973
Andrew	16/28-1	BP	June 1974
—	9/13-4	Mobil	June 1974
—	15/23-1	Texaco	October 1974
—	3/11-1	Amoco	December 1974
—	2/5-6	Unocal	December 1974
—	14/20-1	Texaco	February 1975
—	9/12-2	Unocal	February 1975
Crawford	9/28-1	Hamilton	February 1975
—	3/4-4	Texaco	March 1975
Tern	210/25-1	Shell	April 1975
—	2/10-1	Chevron	April 1975
Brae	16/7-3	Pan Ocean	April 1975
N W Hutton (part)	211/27-3	Amoco	April 1975
Beryl North	9/13-7	Mobil	May 1975
—	21/2-1	Zapex	June 1975
—	3/2-1	Conoco	June 1975
—	211/13-2	Shell	July 1975
—	16/21-1	British Sun	August 1975
—	3/4-6	Texaco	August 1975
—	16/7-2	Pan Ocean	August 1975
—	211/18-6	BNOC	September 1975
—	15/13-2	BP	October 1975
—	3/9a-2	Total	October 1975
—	15/21-3	Monsanto	October 1975
—	211/13-3	Shell	December 1975
—	23/27-3	Ranger	March 1976
—	23/26a-1	BP	March 1976
—	15/27-1	Phillips	April 1976
—	14/20-5	Texaco	April 1976
N W Hutton (part)	211/27-6	Amoco	May 1976
—	9/19-2	Conoco	May 1976
—	211/16-2	Shell	May 1976
—	14/20-6	Texaco	June 1976
—	3/7-1	Chevron	June 1976
Toni-Thelma	16/17-1	Phillips	July 1976
—	211/18-12	BNOC	July 1976
—	211/19-6	Conoco	January 1977
—	16/22-2	Total	May 1977
—	15/23-4	Texaco	July 1977
—	206/8-1A	BP	July 1977
—	210/15-2	Phillips	October 1977
—	14/18-1	Occidental	May 1978
—	2/10a-4	Chevron	May 1978
—	30/17b-2	BNOC	June 1978

* The description "significant" relates to the flow rates achieved in well tests, and this is not necessarily an indicator of the potential commerciality of the find.

Appendix 3

United Kingdom indigenous offshore natural gas production

	(10 ⁷ cubic metres)										Cumulative total to end 1978 ⁽²⁾
	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	
West Sole Field	158	118	186	228	189	183	183	201	195	153	1969
Leman Bank Field	292	797	1289	1313	1310	1561	1501	1537	1558	1472	12703
Hewett Field	56	195	338	515	571	706	764	811	785	639	5380
Indefatigable Field			16	451	456	555	625	635	678	645	4061
Viking Field				139	359	477	551	605	633	524	3288
Rough Field							1	51	106	93	251
Frigg Field ⁽¹⁾									61	265	326
Other ⁽³⁾								4	14	32	47
Total	506	1110	1829	2646	2885	3482	3625	3841	4030	3823	28025

(1) — UK share

(2) — For fields which have been in production for more than 10 years (presently only West Sole and Leman Bank) the figure given in this column will not be equivalent to the sum along the row.

(3) — Associated gas produced and used on Northern Basin oil production platforms.

Appendix 4

Gas flaring at producing oil fields

Field	Average gas flaring rate in 1978 million cubic metres per day (figures for million cubic feet per day in brackets)	Notes of measures being taken to reduce flaring
Argyll	0.11 (4)	Small, isolated field — no economic outlet for gas
Auk	0.13 (5)	Small, isolated field — no economic outlet for gas
Beryl	0.68 (24)	Commissioning of gas re-injection continued
Brent	4.38 (154)	Gas re-injection began in 1978
Claymore/Piper	2.89 (102)	Gas sales began in December
Dunlin*	0.09 (3)	Completion of Sullom Voe gas facilities will reduce flaring; gas re-injection is also planned
Forties	3.21 (113)	Commissioning of NGL recovery plants continued
Heather*	0.05 (2)	NGL injection and a gas pipeline link are expected to reduce flaring
Montrose	0.50 (18)	Small, isolated field — economic outlet for gas unlikely
Ninian*	0.01 (0.2)	NGL injection and a gas pipeline link are expected to reduce flaring
Thistle	0.41 (15)	Gas reinjection should begin in 1979

* These fields started late in 1978 and hence this average figure is lower than the typical flaring rate of the producing field.

Appendix 5

Significant* gas and gas condensate discoveries

announced by the end of 1978
excluding fields in production

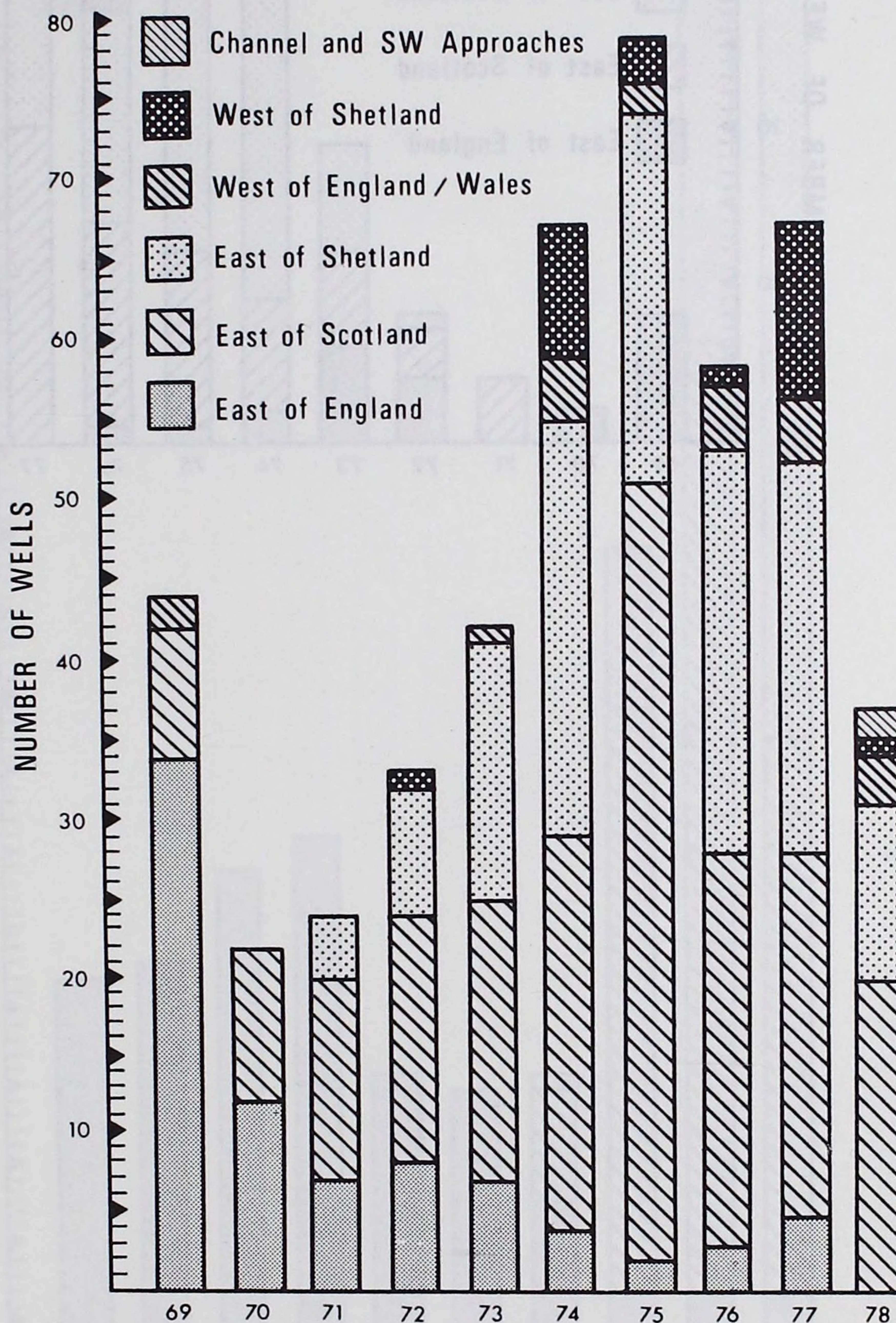
Field name	Block and well number	Operator of block at the end of 1978	Date discovered
Dotty	48/30-1	Phillips	May 1967
Scram	53/4a-1	Arco	July 1967
—	48/21a-1	Placid Oil (GB) Ltd	August 1967
Deborah	48/30-7	Phillips	August 1968
—	49/28-3	Arco	March 1969
Sean	49/25a-1	Shell	April 1969
—	49/28-3	Arco	May 1969
—	41/24a-1	Total	June 1969
—	43/20a-1	Hamilton	June 1969
—	43/8a-1	Hamilton	January 1970
—	47/13a-1	Conoco	April 1970
Broken Bank	49/21-2	Arco	July 1970
Broken Bank	49/16-2	Conoco	January 1971
—	30/2 (Condensate)-1	BNOC	June 1971
—	48/18b-1	Ranger	April 1972
Lomond	23/21 (Condensate)-1	Amoco	May 1972
—	49/22-2	Mobil	May 1972
Amethyst	47/14a-1	BNOC	October 1972
—	3/19-1	Total	July 1973
Bruce	9/8 (Condensate)-1	Hamilton	July 1974
—	211/13	Shell	July 1974
—	(Condensate)-1		
—	3/25-2	Total	July 1974
Morecambe	110/2-1	Hydrocarbons GB Ltd	September 1974
—	15/30 (Condensate)-1	Conoco	September 1975
—	21/2 (Condensate)-2	Zapex	December 1975
—	48/12-2	Kewanee	December 1975
—	49/11a-1	Phillips	March 1976
—	49/29b-2	Mobil	June 1976
—	3/14a (Condensate)-4	Total	September 1977
—	16/26 (Condensate)-2	Gulf Offshore	October 1977

* The description "significant" relates to the flow rates achieved in well tests, and this is not necessarily an indicator of the potential commerciality of the find.

Appendix 6

Drilling activity

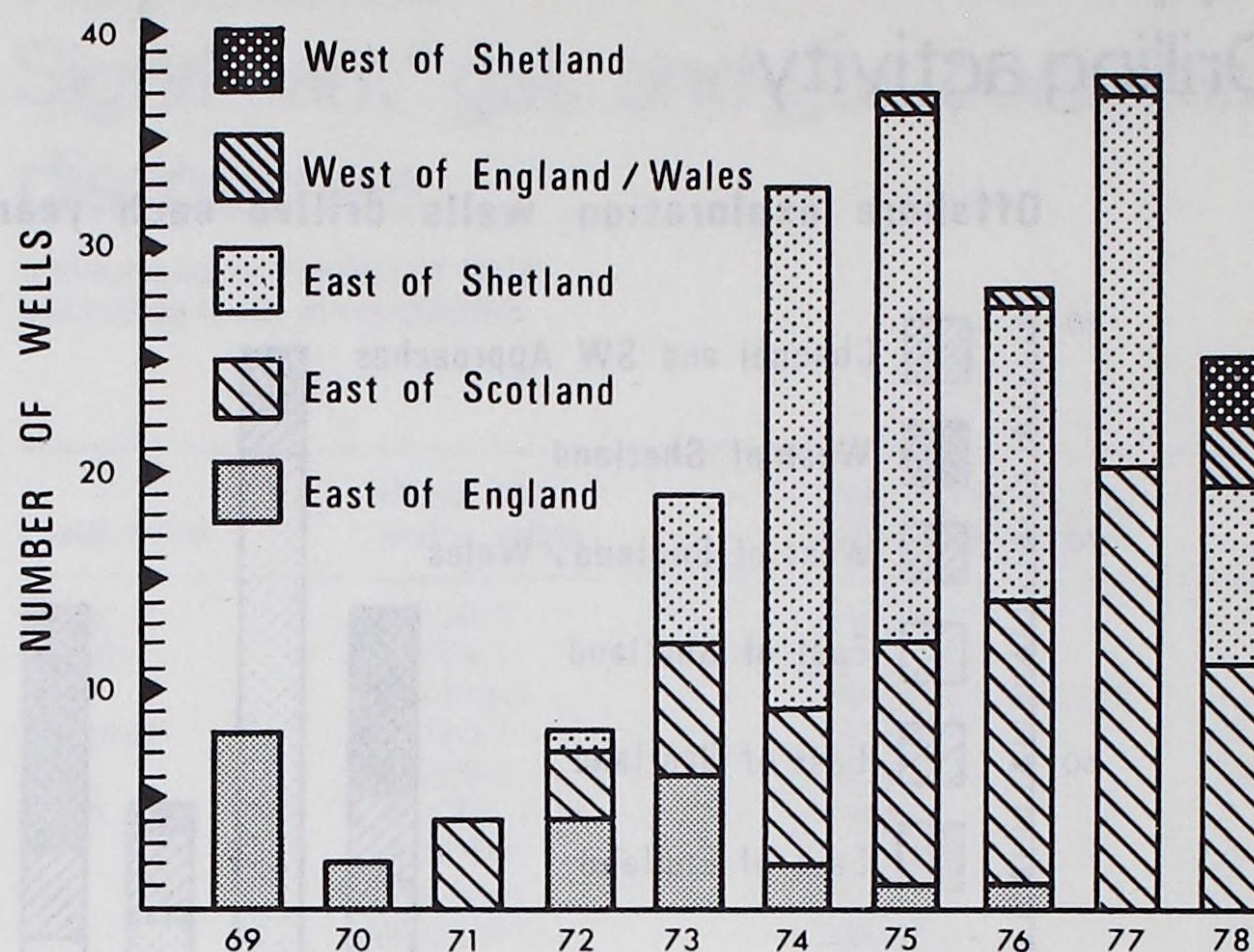
Offshore exploration wells drilled each year 1969-78



(A) Exploration drilling; exploration wells started in each geographical area

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
East of England	34	12	7	8	7	4	2	3	5	—
East of Scotland	8	10	13	16	18	25	49	25	23	20
East of Shetland	—	—	4	8	16	26	23	25	24	11
West of England/Wales	2	—	—	—	1	4	2	4	4	3
West of Shetland	—	—	—	1	—	8	3	1	11	1
Channel and SW Approaches	—	—	—	—	—	—	—	—	—	2
Total all areas	44	22	24	33	42	67	79	58	67	37

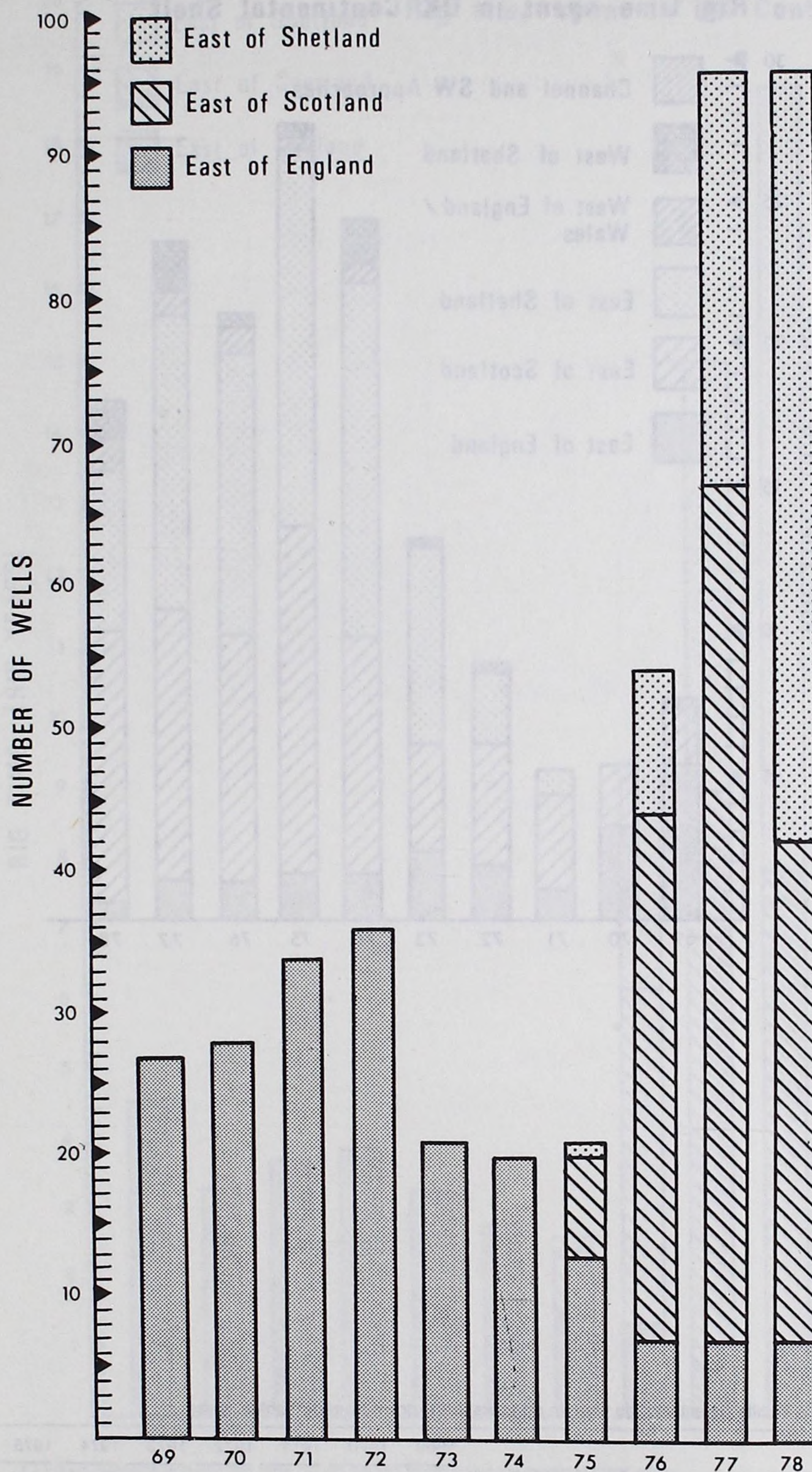
Offshore appraisal wells drilled each year 1969 - 78



(B) Appraisal drilling; appraisal wells started in each geographical area

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
East of England	8	2	—	4	6	2	1	1	—	—
East of Scotland	—	—	4	3	6	7	11	13	20	11
East of Shetland	—	—	—	1	7	24	24	13	17	8
West of England/Wales	—	—	—	—	—	—	1	1	1	3
West of Shetland	—	—	—	—	—	—	—	—	—	3
Total all areas	8	2	4	8	19	33	37	28	38	25

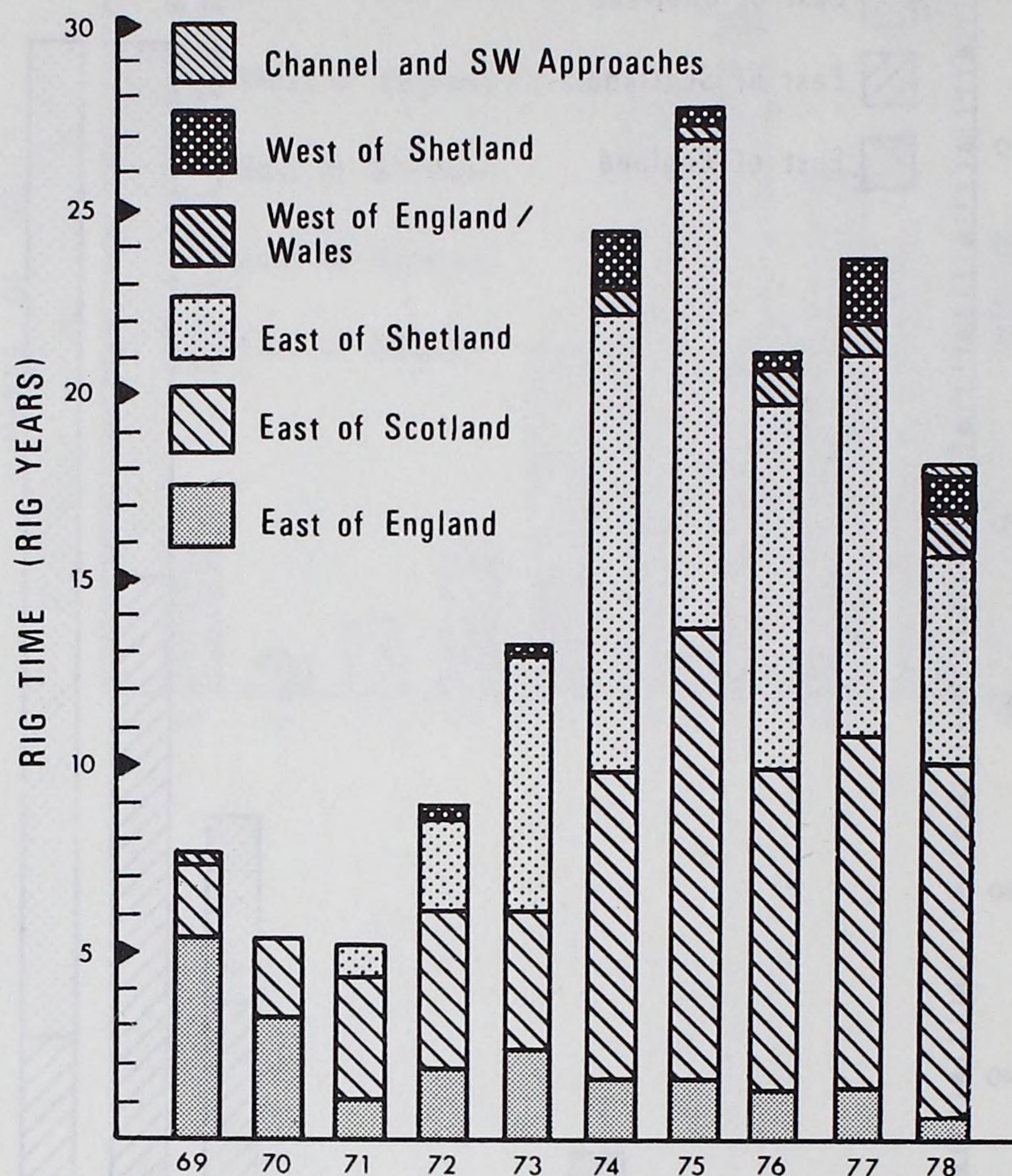
Offshore development wells drilled each year 1969 - 78



(C) Development drilling; development wells started in each geographical area

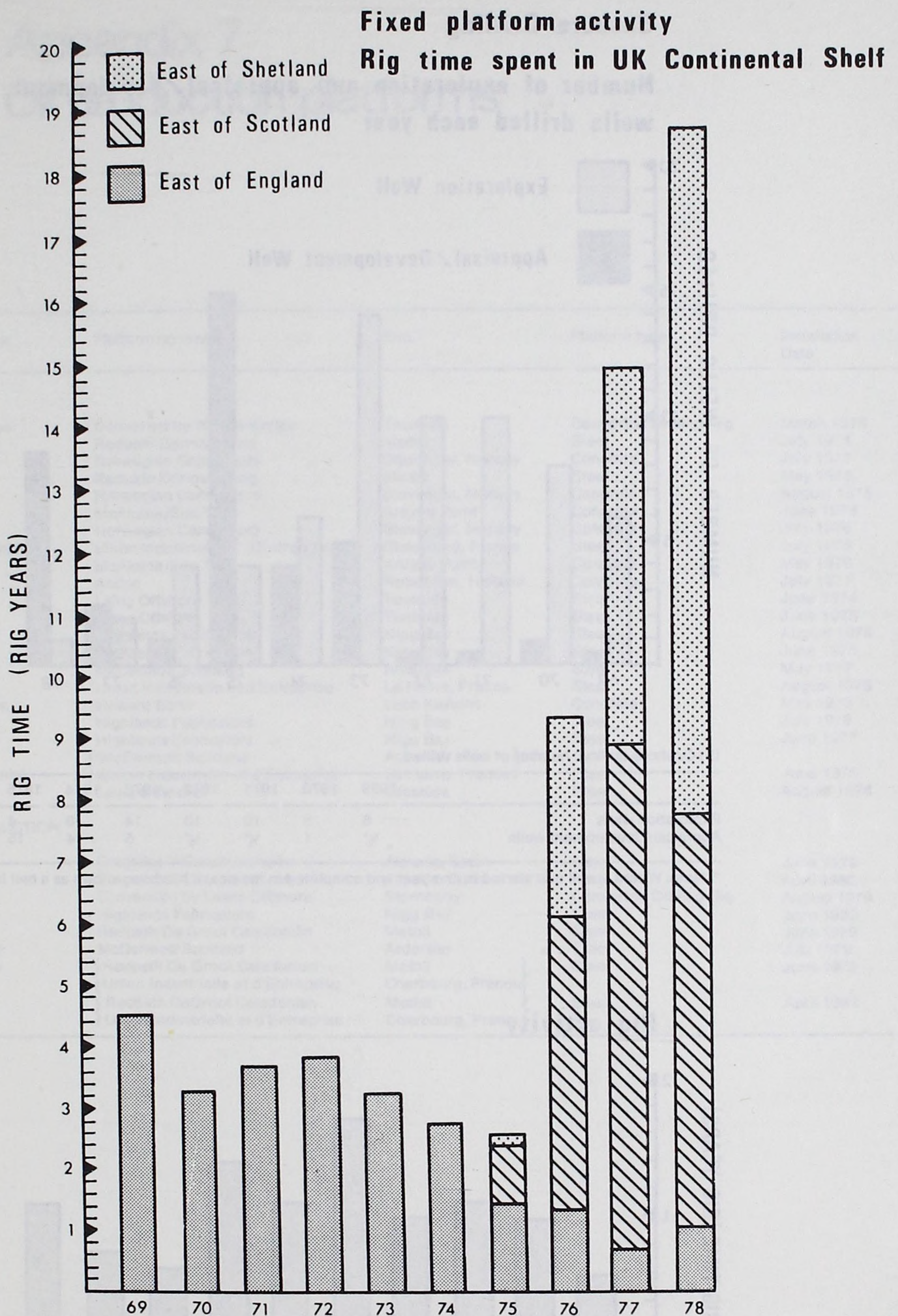
	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
East of England	27	28	34	36	21	20	13	7	7	7
East of Scotland	—	—	—	—	—	—	7	37	60	35
East of Shetland	—	—	—	—	—	—	1	10	29	54
Total all areas	27	28	34	36	21	20	21	54	96	96

Mobile rig activity **Rig time spent in UK Continental Shelf**



(D) Mobile rig activity: rig time (in rig years) breakdown by geographical areas

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
East of England	5.3	3.1	1.2	1.9	2.5	1.7	1.6	1.5	1.4	0.6
East of Scotland	2.1	2.2	3.2	4.1	3.8	8.2	12.0	8.4	9.5	9.3
East of Shetland	—	—	0.8	2.7	6.9	12.4	13.6	9.9	10.1	5.9
West of England/Wales	0.3	—	—	—	0.1	0.7	0.2	1.0	0.8	1.1
West of Shetland	—	—	—	0.1	—	1.5	0.3	0.4	1.8	1.1
Channel and SW Approaches	—	—	—	—	—	—	—	—	—	0.1
Total all areas	7.7	5.3	5.2	8.8	13.3	24.5	27.7	21.2	23.6	18.1



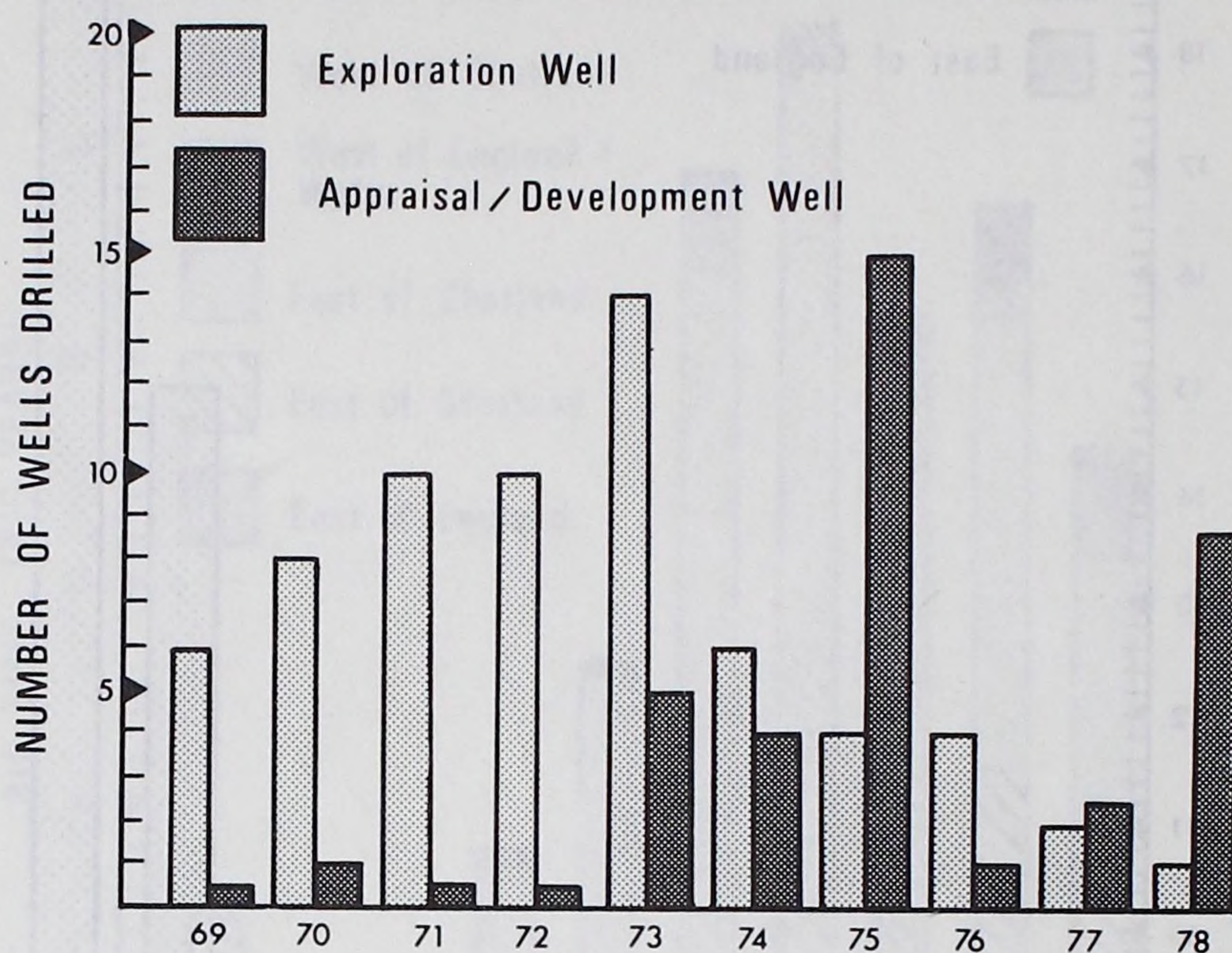
(E) Fixed platform activity: rig time (in rig years) breakdown by geographical areas

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
East of England*	4.5	3.3	3.7	3.8	3.2	2.8	1.5	1.4	0.7	1.0
East of Scotland	—	—	—	—	—	—	0.9	4.7	8.2	6.6
East of Shetland	—	—	—	—	—	—	0.2	3.2	6.0	11.0
Total all areas	4.5	3.3	3.7	3.8	3.2	2.8	2.6	9.3	14.9	18.6

* Most of this activity was associated with the development of the Southern Basin gas fields.

Onshore Drilling

Number of exploration and appraisal/development wells drilled each year

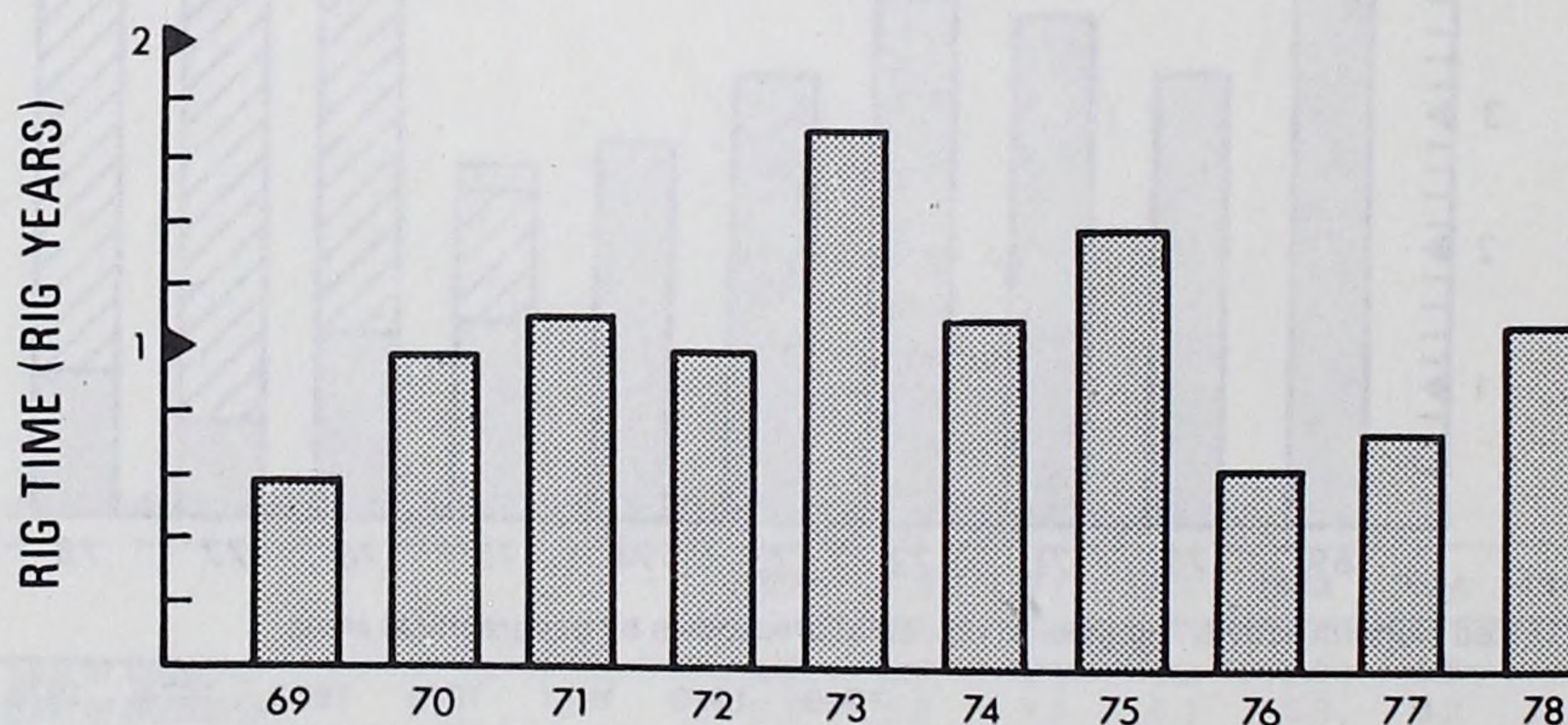


(F) Onshore drilling: number of wells drilled

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Exploration wells	6	8	10	10	14	6	4	4	2	1
Appraisal/Development wells	½*	1	½*	½*	5	4	15	1	2½*	8½*

* Note: Where a well was started in one year and completed in the next it has been shown as a half in each year.

Rig activity



(G) Onshore drilling: rig activity in rig years

	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Activity (rig years)	0.6	1.0	1.1	1.0	1.7	1.1	1.4	0.6	0.7	1.1

Appendix 7

Oil production platforms

Field	Operator	Platform contractor	Site	Platform type	Installation Date
PLATFORMS INSTALLED					
Argyll	Hamilton	Converted by Wilson-Walton	Teesside	Converted Drilling Rig	March 1975
Auk	Shell	Redpath Dorman Long	Methil	Steel	July 1974
Beryl	Mobil	Norwegian Contractors	Stavanger, Norway	Concrete	July 1975
Brent	Shell	Redpath Dorman Long	Methil	Steel	May 1976
A		Norwegian Contractors	Stavanger, Norway	Concrete	August 1975
B		McAlpine/Sea Tank	Ardyne Point	Concrete	June 1978
C		Norwegian Contractors	Stavanger, Norway	Concrete	July 1976
D		Union Industrielle et d'Entreprise	Cherbourg, France	Steel	July 1976
Claymore	Occidental	McAlpine/Sea Tank	Ardyne Point	Concrete	May 1978
South Cormorant	Shell	Andoc	Rotterdam, Holland	Concrete	July 1977
Dunlin	Shell	Laing Offshore	Teesside	Steel	June 1974
Forties	BP	Laing Offshore	Teesside	Steel	June 1975
FA		Highlands Fabricators	Nigg Bay	Steel	August 1974
FB		Highlands Fabricators	Nigg Bay	Steel	June 1975
FC		McDermott Scotland	Ardersier	Steel	May 1977
FD		Union Industrielle et d'Entreprise	Le Havre, France	Steel	August 1975
Heather	Unocal	Howard Doris	Loch Kishorn	Concrete	May 1978
Montrose	Amoco	Highlands Fabricators	Nigg Bay	Steel	July 1978
Ninian Central	Chevron	Highlands Fabricators	Nigg Bay	Steel	June 1977
North		(McDermott Scotland	Ardersier	Steel	June 1975
South		(Union Industrielle et d'Entreprise	Le Havre, France		
Piper	Occidental	Laing Offshore	Teesside	Steel	August 1976
Thistle	BNOC				
PLATFORMS UNDER CONSTRUCTION					
Beatrice	Mesa	Dragados Y Construcciones	Almeria, Spain	Steel	June 1979
	Mesa	Dragados Y Construcciones	Almeria, Spain	Steel	April 1980
Buchan	BP	Conversion by Lewis Offshore	Stornoway	Converted Drilling Rig	August 1979
Fulmar	Shell	Highlands Fabricators	Nigg Bay	Steel	June 1980
	Shell	Redpath De Groot Caledonian	Methil	Steel	June 1979
Murchison	Conoco	McDermott Scotland	Ardersier	Steel	July 1979
Tartan	Texaco	Redpath De Groot Caledonian	Methil	Steel	June 1979
		Union Industrielle et d'Entreprise	Cherbourg, France	Steel	April 1981
North Cormorant	Shell	Redpath DeGroot Caledonian	Methil		
		Union Industrielle et d'Entreprise	Cherbourg, France		

Appendix 8

Major North Sea pipelines

Pipelines, from — to	Length (miles)	Diameter (inches)	Material conveyed	Operator	Year commissioned
<i>Operating</i>					
West Sole — Easington	42	16	Natural Gas	BP	1967
Leman Bank — Bacton	35	30	Natural Gas	Shell/Esso	1968
Hewett — Bacton	20	30	Natural Gas	Phillips/Arpet	1969
Leman Bank — Bacton	38	30	Natural Gas	Amoco	1969
Leman Bank — Bacton	40	30	Natural Gas	Amoco/Shell/Esso	1970
Leman Bank — Leman Bank	5	30	Natural Gas	Amoco/Shell/Esso	1970
Indefatigable — Leman Bank	25	30	Natural Gas	Amoco/Shell/Esso	1971
Viking — Theddlethorpe	86	28	Natural Gas	Conoco	1972
Hewett — Bacton	20	30	Natural Gas	Phillips/Arpet	1973
Leman Bank — Bacton	36	30	Natural Gas	Amoco/Shell/Esso	1973
Rough — Easington	18	16	Natural Gas	Amoco	1975
Ekofisk — Teesside	220	34	Crude Oil	Phillips	1975
Forties — Cruden Bay	111	32	Crude Oil	BP	1975
Piper — Flotta	124	30	Crude Oil	Occidental	1976
Frigg — St Fergus No 1	220	32	Natural Gas	Total	1977
Claymore — Piper	8	30	Crude Oil	Occidental	1977
South Cormorant — Sullom Voe	93	36	Crude Oil	Shell/Esso	1978
Piper — Claymore	22	16	Associated Gas	Occidental	1978
Thistle — Dunlin	7	16	Crude Oil	BODL Ltd	1978
Heather — Ninian	22	16	Crude Oil	Union Oil	1978
Piper — Frigg (MCP-01)	33	18	Associated Gas	Occidental	1978
Frigg — St Fergus No 2	220	32	Natural Gas	Total	1978
Ninian — Sullom Voe	105	36	Crude Oil	BP	1978
Dunlin — South Cormorant	17	24	Crude Oil	Shell	1978
<i>Awaiting commissioning/under construction</i>					
Tartan — Piper	11	18	Associated Gas	Texaco	
Brent — St Fergus	281	36	Associated Gas	Shell	
Brent — South Cormorant	22	30	Crude Oil	Shell	

Appendix 9

Offshore employment

Offshore employment

The workforce employed on offshore installations on the UK Continental Shelf is estimated to have numbered 12,500 in July 1978. The figure was obtained from a Department of Energy survey which was carried out on two dates in July, separated by about a fortnight, to cover all shifts on the installations.

The two tables below present some of the results of the survey and are based

on 10,600 returns. The difference between this figure and the final estimate of 12,500 is due to the fact that the survey did not cover fields stretching across the median line (separate estimates of the numbers employed, 1,100, have been included in the total), some returns were too late to be included in the analysis of the results, and an allowance has been made for 'missing' returns. Figures have been rounded.

1 FUNCTION	NUMBER	PER CENT
construction	4300	41
maintenance	1400	13
production	800	7
drilling and ancillary drilling activities	1900	18
diving	200	2
domestic including cleaning, catering, wireless operation and general ship's crew	2000	19
TOTAL	10600	100

2 USUAL PLACE OF RESIDENCE	NUMBER	PER CENT
Aberdeen	1560	14.7
Banff and Buchan	90	0.8
Gordon	180	1.7
Kincardine and Deeside	150	1.4
Moray	130	1.2
Borders and Dumfries and Galloway	30	0.3
Central	170	1.6
Fife	270	2.5
Highland	190	1.8
Lothian	330	3.1
Strathclyde	1260	11.9
Tayside	560	5.3
Orkney, Shetland and Western Isles	40	0.4
England	4870	45.9
Wales and Northern Ireland	170	1.6
outside UK	610	5.8
TOTAL	10 600	100

Appendix 10

Accident statistics

Year	Mobile drilling activity (rig years)	Fixed platform drilling activity (rig years)	Fixed platforms (2)	Estimated numbers employed on installations	Number of fatal accidents (approximate rate per 1000 in brackets)		Number of serious accidents (approximate rate per 1000 in brackets)	
					Installations	Vessels	Installations	Vessels
1968	6.0	5.3	1	1210	3 (2.5)	5	21 (17.5)	0
1969	7.7	4.5	4	1450	2 (1.5)	1	19 (13.0)	0
1970	5.3	3.3	9	1150	1 (1.0)	0	12 (10.5)	0
1971	5.2	3.7	11	1260	4 (3.0)	0	15 (12.0)	2
1972	8.8	3.8	16	1850	3 (1.5)	0	17 (9.0)	0
1973	13.3	3.2	19	2430	2 (1.0)	1	22 (9.0)	0
1974	24.5	2.8	23	4030	9 (2.0)	3	19 (4.5)	6
1975	27.7	2.6	29	6300	9 (1.5)	1	46 (7.5)	4
1976	21.2	9.4	39	9200	16 (1.5)	1	50 (5.5)	7
1977	23.6	14.9	50	12100	10 (0.8)	1	35 (2.9)	5
1978	18.1	18.6	55	12500	0	4	33 (2.6)	7

Notes:

1 The above accident statistics are based on data reportable under S.I. No. 1842 1973, the Offshore Installations (Inspectors and Casualties) Regulations 1973. This does not include pipe laying barges. Accident rates are therefore only calculable for installations.

2 For the purposes of this table, "Fixed Platforms" refers to Oil and Gas Platforms which are on location either drilling, producing or under construction.

Fatalities and serious accidents by activity

	Fatalities											Serious accidents											Dangerous occurrences		
	Pre 69	69	70	71	72	73	74	75	76	77	78	Pre 69	69	70	71	72	73	74	75	76	77	78	76	77	78
Construction								2	4			1			1			5	12	4	5		6	7	9
Drilling	16*			2	2		5	2	2	2		38*	10	4	5	7	10	13	26	21	20	10	13	6	9
Production															2			1	2	4	2	4	9	14	15
Maintenance		1		1					1	4		2		1		2	1	3	6	4	1	5	5	6	7
Diving	1			1	1	1	3	3†	6	2	2	3	2		1	1	1		2	5	5		3	1	3
Helicopters									1										4				1	2	1
Boats	5	1				1	3	1	1	1	2				2		2	4	7	5	7	12	12	13	
Cranes	2	1	1			1	1	2	2	2		4	6	3	2	5	5	6	7	3	3	4	21	18	30
Domestic																							1	2	2
Unallocated +												15	1	4	4	2	5								
	24	3	1	4	3	3	12	10	17	11	4	63	19	12	17	17	22	25	50	57	40	40	71	68	89

* Sea Gem accounts for 13 of the Pre 1969 fatal accidents and 6 serious accidents.

† One further diver died from natural causes while diving from an offshore installation.

+ 1965-1973 had an allocated group to slips, falls etc unassociated with working operations. Only the fatal accidents have been re-classified.

Appendix 11

Expenditure by operators and other production licensees on exploration, development and operating activities

TOTAL EXPLORATION EXPENDITURE

	£ million				
	Q1	Q2	Q3	Q4	Year
1976	69.7	70.5	70.8	90.4	301.4
1977	70.4	96.5	103.4	104.5	374.8
1978	63.3	63.5	58.8	71.3P	256.9P

DEVELOPMENT EXPENDITURE

DEVELOPMENT EXPENDITURE										£ million
		Total	Platform structures	Modules and equipment	Offshore loading systems	Pipelines	Terminals	Production wells	Appraisal wells	Other expenditure
Oil fields										
1976	Q1	288.3	115.5	117.4	2.5	17.4	12.1	15.6	6.3	1.5
	Q2	400.8	155.2	127.2	5.1	64.7	17.0	21.5	7.9	2.2
	Q3	440.4	195.2	151.0	7.6	38.4	22.7	22.5	1.0	2.0
	Q4	393.4	100.5	173.9	23.3	32.0	24.7	35.9	2.5	0.6
	Year	1522.9	566.4	569.5	38.5	152.5	76.5	95.5	17.7	6.3
1977	Q1	280.1	99.5	125.8	2.5	7.1	17.8	23.6	0.2	3.6
	Q2	389.8	129.4	149.7	1.4	25.5	32.9	40.8	0.5	9.6
	Q3	441.0	128.3	204.8	4.1	16.4	40.6	43.4	0.3	3.1
	Q4	444.7	104.8	211.6	2.7	15.8	48.6	48.1	7.3	5.8
	Year	1555.6	462.0	691.9	10.7	64.8	139.9	155.9	8.3	22.1
1978	Q1	371.8	82.5	183.5	8.0	4.3	48.0	41.2	2.1	2.2
	Q2	433.2	84.5	211.7	2.6	17.8	56.5	53.6	1.1	5.4
	Q3	451.3	44.8	218.0	2.7	29.6	74.7	71.5	4.2	5.8
	Q4P	475.5	52.8	214.0	1.5	41.4	81.7	76.1	5.4	2.6
	Year P	1731.8	264.6	827.2	14.8	93.1	260.9	242.4	12.8	16.0
								Production and appraisal wells		
Gas fields										
1976	Q1	45.4	22.3	11.9	—	3.0	4.8	3.4		—
	Q2	66.8	26.9	8.6	—	21.3	4.4	5.6		—
	Q3	130.8	59.3	16.9	—	45.3	4.9	4.4		—
	Q4	144.7	90.5	19.6	—	19.3	8.1	7.2		—
	Year	387.7	199.0	57.0	—	88.9	22.2	20.6		—
1977	Q1	48.4	5.7	11.4	—	25.1	3.7	2.5		—
	Q2	91.2	8.5	16.4	—	60.7	3.4	2.2		—
	Q3 ⁽²⁾	89.9	9.7	16.6	—	50.0	6.5	7.1		—
	Q4	104.4	29.0	22.6	—	29.1	13.4	10.3		—
	Year	333.9	52.9	67.0	—	164.9	27.0	22.1		—
1978	Q1	37.7	(0.7) (credit)	2.9	—	18.5	10.9	6.1		—
	Q2	85.2	2.0	12.9	—	52.9	11.3	6.1		—
	Q3	91.9	3.8	20.4	—	49.7	11.9	6.1		—
	Q4P	68.1	7.9	19.0	—	21.9	13.1	6.2		—
	Year P	282.9	13.0	55.2	—	143.0	47.2	24.5		—

TOTAL OPERATING EXPENDITURE

£ million

	Q1	Q2	Q3	Q4	Year
<i>Oil fields</i>					
1976	11.6	16.5	22.5	30.7	81.3
1977	35.9	38.7	41.2	43.1	158.9
1978	45.9	56.1	65.1	87.9P	255.0P
<i>Gas fields</i>					
1976	7.5	15.5	12.2	13.3	48.5
1977	8.5	10.7	12.7	15.8	47.7
1978	15.0	18.3	22.8	31.6P	87.7P

P Indicates Provisional Figures.

(1) Expenditure on the development of gas fields includes that on the Brent field associated gas system (FLAGS) and other associated gas gathering pipelines.

(2) The Frigg gas fields reserves were subject to an adjustment of the UK and Norwegian shares effective from 15 April 1977, resulting in a reimbursement of the UK licensees by the Norwegian licensees of a proportion of the expenditure incurred for the development of the field prior to this date. This settlement has been treated as a sale of fixed assets to Norway in the Balance of Payments and in the capital formation item of the National Accounts, but it has not been deducted from the expenditure figure here.

Appendix 12

Licensing

Offshore Production and exploration licences are issued under the Petroleum (Production) Act 1934, as extended offshore by the Continental Shelf Act 1964. To date there have been six rounds of production licensing in 1964, 1965, 1970, 1971/1972, 1976/1977 and 1978/1979. Details of each round are given below.

Round	Area under offer	No. of blocks on offer	No. of applications	No. of companies in consortia	No. of blocks applied for	Licences		
						No. of blocks	No. awarded	No. of companies
First (1964)	North Sea	960	31	61	394	348	53	51
Second (1965)	North Sea Irish Sea English Channel	1102	21	54	127	127	37	44
Third (1970)	North Sea Irish Sea Orkney/ Shetland Basin	157	34	54	117	106	37	61
Fourth (1971/ 1972)	North Sea Irish Sea Celtic Sea Orkney/ Shetland Basin	421 for Discretionary award;	92	228	271	282	118	213
		15 for tender bid	31	73	15			
Fifth (1976/ 1977)	North Sea Irish Sea Celtic Sea Orkney/ Shetland Basin English Channel/ South Western Approaches West of Scotland	71	53	133	51	44	28	64
Sixth (1978/ 1979)	North Sea West Shetland Basin Southern North Sea Cardigan Bay/ Bristol Channel South Western Approaches	46	55	94	46	42	(conditional awards)	59

(continued overleaf)

Appendix 12 continued

Sixth Round Allocation — Conditional Awards

Group	Block(s)	Group	Block(s)
BNOC & Phillips Petroleum Exploration UK Ltd. Hispanoil UK Ltd. Century Power & Light Ltd.	73/7	BNOC & Amoco UK Petroleum Ltd. BGC Mobil North Sea Ltd.	85/28,72/20 73/16,85/23 85/24 & 87/11
BNOC & Phillips Petroleum Exploration Ltd. Fina Exploration Ltd. Agip (UK) Ltd. Century Power & Light Ltd. Ultramar Exploration Ltd The British Electric Traction Company	13/30	BNOC & BP Petroleum Development Ltd.	208/15
BNOC & Occidental of Britain Inc. Getty Oil (Britain) Ltd. Allied Chemical (GB) Ltd. Thomson Scottish Petroleum Ltd.	13/28	BNOC & Gulf Oil Corporation	209/6
BNOC & Monsanto Ltd. Amerada Exploration Ltd. Charterhall Oil Ltd.	73/9	BNOC & Placid Oil (GB) Ltd. Enserch International Exploration Inc.	74/2, 73/11 & 73/12
BNOC & Tenneco GB Ltd. Albright and Wilson Ltd.	20/6	BGC Amerada Exploration Ltd. Texas Eastern (UK) Ltd.	42/27,47/3c 47/4b & 47/9b
BNOC & Ultramar Exploration Ltd. Houston Data Venture (UK) Ltd. Canadian Pacific Oil & Gas of Canada Ltd. (UK)	13/29	BNOC & BGC Amoco UK Petroleum Ltd.	208/19, 206/3 & 208/24
BNOC & Mobil North Sea Ltd.	209/3, 209/13, 16/18	BGC BGC	214/30 74/1
BNOC & Unocal Exploration & Production Co. Ltd.	13/12	BNOC & Cluff Oil Ltd. CCP North Sea Associates Ltd. Stratton Oil Exploration	20/8
BNOC & Arpet Petroleum Ltd.	20/1, 14/26	BNOC & Total Oil Marine Ltd. Deminex Oil and Gas (UK) Ltd. Pict Petroleum Ltd.	208/26
BNOC & Pan Ocean Oil (UK) Ltd. Bow Valley Exploration (UK) Kerr McGee Oil (UK) Ltd. LL & E (GB) Ltd. Siebens Oil & Gas (UK) Ltd. Canadian Ashland (UK) Ltd.	16/3b	BNOC & Shell (UK) Ltd.	209/7 & 206/2
BNOC & Swedish Petroleum Ltd.	73/1	BNOC & BP Petroleum Development Ltd. Total Oil Marine Ltd. Elf Oil Exploration & Production Ltd. Aquitaine Oil (UK) Ltd.	85/29
BNOC & Chevron Petroleum Co. Ltd. ICI Petroleum Ltd.	73/8		
BNOC & Tricentral North Sea Ltd. Blackfriars Oil Co Ltd Hamilton Bros. Oil Co. (GB) Ltd. Hamilton Bros. Petroleum (UK) Ltd. Hamilton Bros. Exploration (UK) Ltd. Hispanoil (UK) Ltd. Oil Exploration (Scotland) Ltd. Swedish Petroleum Ltd.	208/23		
BNOC & Burmah Oil Exploration Ltd. Charterhouse Petroleum Development Ltd. Petroswede (UK) Ltd. Canadian Industrial Gas (UK) Ltd. DSM Hydrocarbons Ltd. Norsk Hydro Oil & Gas Ltd.	20/2		

Appendix 13

Companies with whom participation agreements have been signed

AGIP (UK) Ltd	London & Scottish Marine Oil Co Ltd
Allied Chemical (Great Britain) Ltd	Mesa (UK) Ltd
Amerada Exploration Ltd	Mobil Producing North Sea Ltd
Amoco UK Petroleum Ltd	Murphy Petroleum Ltd
Ashland Oil (GB) Ltd	Norwegian Oil Co DNO (UK) Ltd
Blackfriars Oil Co Ltd	Occidental Petroleum (UK) Ltd
Bow Valley Exploration (UK) Ltd	Ocean Exploration Co Ltd
British Electric Traction Co Ltd	Oil Exploration Ltd
British Petroleum Co Ltd	Pan Ocean Oil (UK) Ltd
Canadian Ashland Oil (UK) Ltd	P & O Petroleum Ltd
CanDel Oil (UK) Ltd	Phillips Petroleum Exploration UK Ltd
CCP North Sea Associates Ltd	Plascom Ltd
Century Power and Light Ltd	Ranger Oil (UK) Ltd
Charterhall Oil Ltd	RTZ Oil & Gas Ltd
Chevron Petroleum Co Ltd	Saga Petroleum A/s & Co
City Petroleum Co	St Joe Petroleum (UK) Corp
Conoco North Sea Ltd	Santa Fe (UK) Ltd
Creslenn (UK) Ltd	Scottish Canadian Oil & Transportation Co Ltd
Deminex Oil and Gas (UK) Ltd	Shell UK Ltd
Esso Petroleum Co Ltd	Siebens Oil and Gas (UK) Ltd
Fina Exploration Ltd	Skelly Oil Exploration (UK) Ltd
Gas & Oil Acreage Ltd	Sunningdale Oils (UK) Ltd
Getty Oil International (UK) Ltd	Tenneco Great Britain Ltd
Gulf Oil GB Ltd	Texaco North Sea UK Ltd
Halkyn District United Mines Ltd	Texas Eastern (UK) Ltd
Hamilton Brothers Oil (GB) Ltd	Thomson North Sea Ltd
Hunt Oil (UK) Ltd	Trans-European Co Ltd
ICI Petroleum Ltd	Transworld Petroleum (UK) Ltd
Kerr-McGee Oil (UK) Ltd	Tricentrol Thistle Development Ltd
Lochiel Exploration (UK) Ltd	Ultramar Exploration Ltd
LL & E (GB) Ltd	Unocal Exploration & Production Co (UK) Ltd

Appendix 14

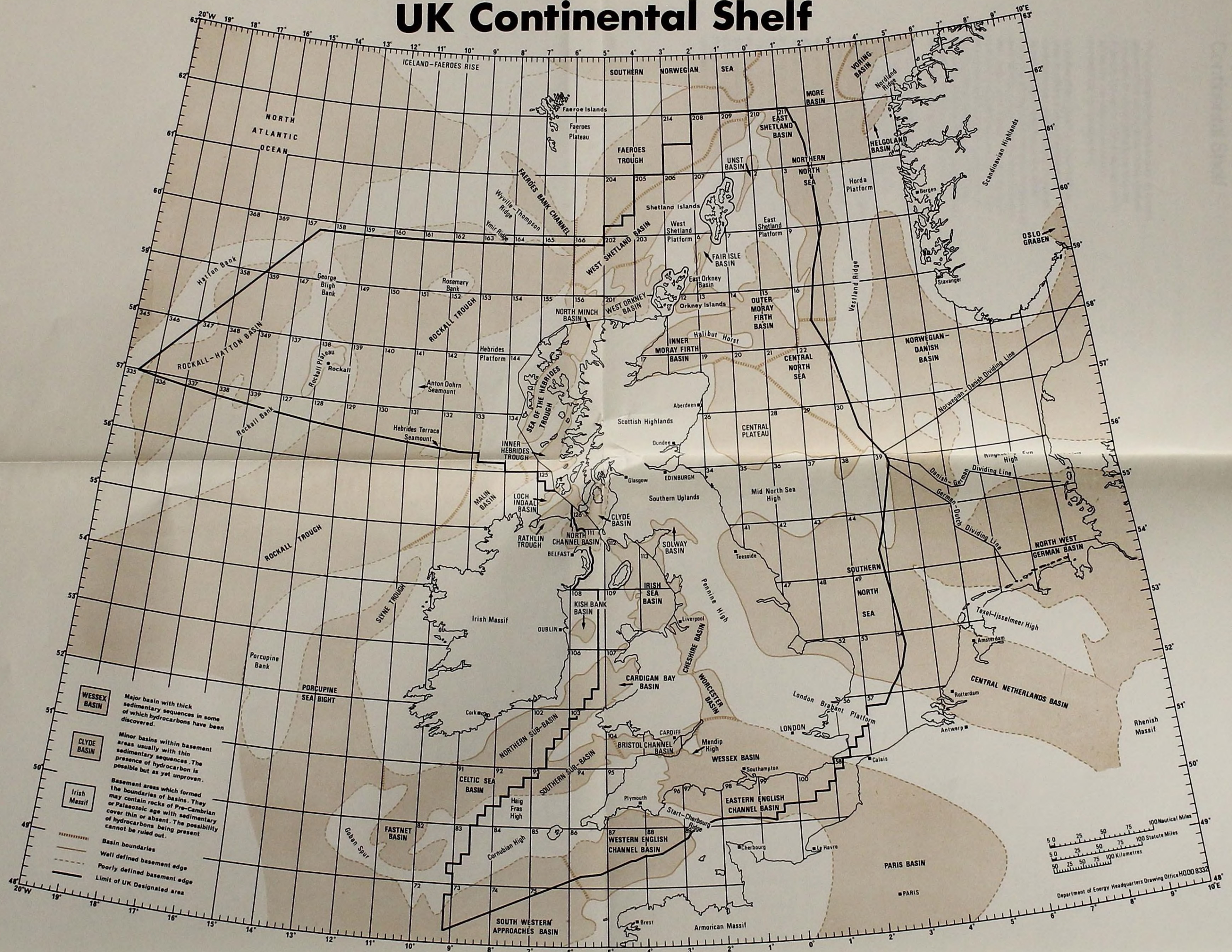
Map of sedimentary basins, UK Continental Shelf

The accompanying map shows, in brown, sedimentary basins around the United Kingdom in which petroleum may be expected to occur. The areas shown in white are, on present evidence, considered non-prospective.

A sedimentary basin is essentially an area in which a large thickness of sediments has accumulated. Generally speaking, as a basin becomes filled it subsides allowing further accumulation of sediment to occur. The division of basins into 'major' and 'minor' on the map is an indication of both their size and of their depositional history. As a general rule, hydrocarbons tend to occur in larger rather than smaller basins because their greater thickness tends to favour hydrocarbon generation.

The basins of the North Sea tend to fall into the major category with accumulation of sediments of up to around 30,000 ft, and the same is probably true of the Rockall Trough area. Around the periphery of the UK, however, and even extending on to land, there are a number of minor basins which are small and do not appear to have accumulated a great deal of sediment. This does not necessarily mean that they are less prospective, but it is usually the case. The areas shown in white are 'high' areas which controlled the deposition of sedimentation in the 'brown' areas. In strict geological terms the map may be an over-simplification, but it is important to be able to see discoveries in their correct basinal context.

LOCATION OF SEDIMENTARY BASINS UK Continental Shelf



Appendix 15

Map of the UK Continental Shelf

(as at March 1979)

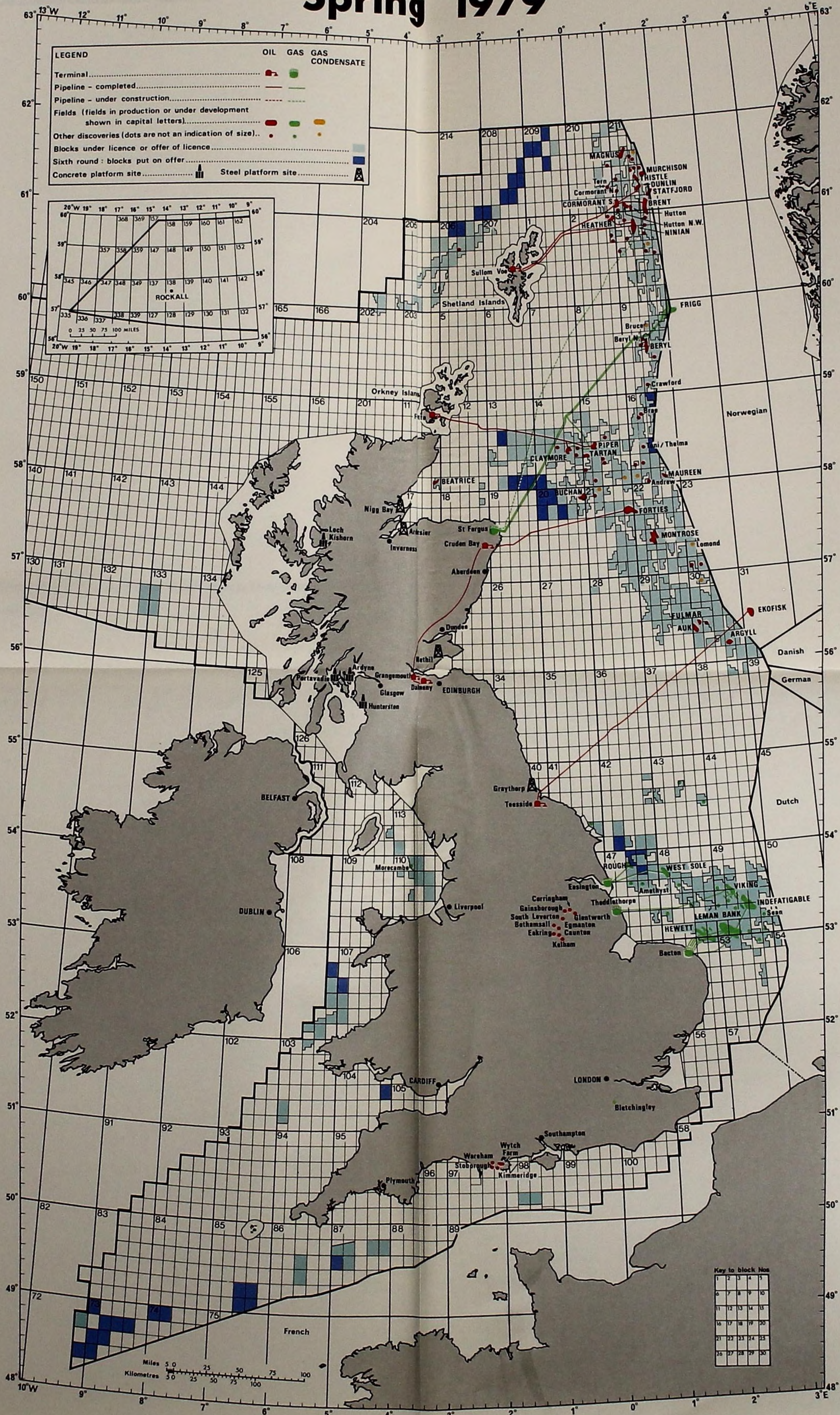
Sixth Round conditional awards are listed in Appendix 12

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