



# BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record 1985/14

## RECORD

An estimate of Australian production of  
crude oil during 1985 to 1994

by

D. J. Forman

(Paper presented at Petroleum and Minerals  
Review Conference, March 1985).



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AN ESTIMATE OF AUSTRALIAN PRODUCTION OF CRUDE OIL DURING 1985 TO  
1994

by  
David J. Forman

At last years Petroleum and Minerals Review Conference I presented an estimate of possible future production of crude oil to the year 2000. That estimate suggested a good chance that Australian production of crude oil would rise about 30 percent between 1984 and 1989 and would plateau at this level before beginning to decline in 1996. The estimate was based on the information available at that time. For instance we assumed that there was a 200 million barrel discovery at Jabiru in the Bonaparte Basin and had revised our assessment of undiscovered potential in the region accordingly.

This years estimate of future crude oil production, which I will show you in a moment, is lower than was estimated last year, mainly because further work has shown that the Jabiru field is much smaller than 200 million barrels and this has implications in terms of the number and size of possible future discoveries in the region and also in terms of the time and rate at which the discoveries might be brought into production.

Slides 1 and 2

In these two slides, last years estimate is shown on the left and this years on the right. In each slide the vertical axis shows amounts of oil in millions of barrels per year and the horizontal axis shows the time period. You will notice that last years estimate showed information for the years 1960 to 2000, whereas this years estimate shows information from 1974 to 1994.

There has been little change either in the estimate of demand, which is shown by the uppermost line in each slide, or in the estimate of production from identified fields, which is shown by the bottom line.

The main difference between the two slides is the estimate of production from undiscovered fields. This years estimate is shown as a range of values for each year with the range of uncertainty increasing throughout the period. When viewed together with the production from identified fields, the new estimate suggests production of crude oil and condensate is likely to fall from about 185 million barrels in 1985 to a narrow range close to about 160 million barrels per annum in 1988. Production levels in 1994 are considered to be much more uncertain, with possible future levels lying between 130 and 200 million barrels per annum.

For the remainder of this talk I propose to give you an outline of the methods that we have used to prepare this years estimate of production from undiscovered fields and to show you how we have handled the uncertainty involved.

This years estimate has been produced by a combination of two methods. One, called the projection method, calculates the amount of oil that may be produced if future oil exploration follows past exploration trends. The other called the subjective probability method, calculates the additional amount of oil that may be produced if the historic trends are broken by the discovery of a string of medium to large fields. The total estimate of production from undiscovered fields is then obtained by adding these two estimates together.

The main causes of uncertainty in the estimate are doubts about the size and number of the undiscovered oil fields and the timing of their discovery. Additional uncertainty arises because of doubts about future exploration levels, success rates, the lead times from discovery to production, and field production rates, but only some of this uncertainty has been taken into account.

#### Slides 3 and 4

Onshore Australia and offshore Australia have been assessed separately by the projection method and these two slides show the historic field size trends that have been used. The vertical axis shows log field size, although the scale has been left off because the actual field sizes are confidential. The horizontal axis shows new-field wildcat number.

The slides show the field size of every oil discovery in Australia plotted against the new-field wildcat number of the well that made the discovery. Hence the early discoveries appear on the left of each slide and the later discoveries appear on the right. A straight line has been fitted to the data and projections of this line are used to help indicate the sizes of future oil discoveries.

The offshore field sizes, which are show in the left hand slide, have a strong declining trend. In fact, we have not found a field larger than about 50 million barrels since the early 1970's.

The onshore field sizes, in the right hand slide, have a weak, nearly horizontal trend; and, if valid, a projection would indicate that future onshore discoveries could be about the same size as some of the earlier discoveries, such as Mereenie and Moonie. The most probable location for good-sized discoveries in the near future is the Eromanga Basin, but other onshore areas such as the Canning Basin could also contain fields of about this size.

### Slides 5 and 6

In order to make the projections, we also need to know how many new-field wildcat wells are likely to be drilled in each year of the estimate. This slide shows the number of onshore and offshore new-field wildcat wells that have been drilled from 1960 to 1984, and the number of new-field wildcat wells that we assumed would be drilled in the period 1985 to 1994. The actual rate of drilling may turn out to be higher or lower than this, but as you will see later the amount of oil that may be produced, more or less, is small. Unfortunately, our present method does not allow us to calculate how much oil is produced using a range of values for the number of wells drilled

### Slides 7 and 8

Next we need to know the success rate of the onshore and offshore drilling. These slides show the number of fields discovered on the vertical axis plotted against the sequential new-field wildcat number on the horizontal axis, and the slope of the graph is the success rate. We have assumed that future success rates will lie within the same range and we have selected high, low, and most likely success rates from these graphs for use in the projections.

### Slides 9 and 10

The top part of this slide shows how we have handled the doubt about the time it may take to bring an offshore field into production. The triangular distribution shows that a field above the cut-off size should be brought into production in some time between two and seven years, most probably in four years. A different cut-off and a different distribution of lead time were used for onshore fields.

The lower part of the slide shows the production profile that we use for all undiscovered offshore fields. Actual field production rates could be higher or lower than this, but our present method does not allow us to calculate how much oil is produced using a range of values for the production rates.

### Slides 11 and 12

This slide shows the main types of data that have to be determined in the subjective probability method. You will remember that this method is used to calculate the additional amount of oil that may be produced if the historic trends are broken by the discovery of a string of medium to large fields.

We used a panel of BMR experts to determine the number of areas within which these larger fields are likely to occur. Then, as summarised in the slide, the experts decided the range of possible field sizes in each area, the numbers of fields, and the timing of their discovery. A range of values was given to each factor in order to quantify our uncertainty.

Lead time from discovery to production and annual production rates for each field are handled the same way in this method as they are in the projection method.

Slides 13 and 14

These two slides show the probabilistic estimates of future crude oil production from undiscovered fields. The slide on the left shows the projection estimate and the slide on the right shows the subjective probability estimate. The scale on each slide is the same with the vertical axis showing the possible production levels in millions of barrels per year. As you can see the possible production levels derived by the subjective probability method are much higher than the production levels derived by the projection method. This of course indicates that when the two estimates are added together, the range of values between the high and low estimates results largely from variation in the number of large fields that may be discovered.

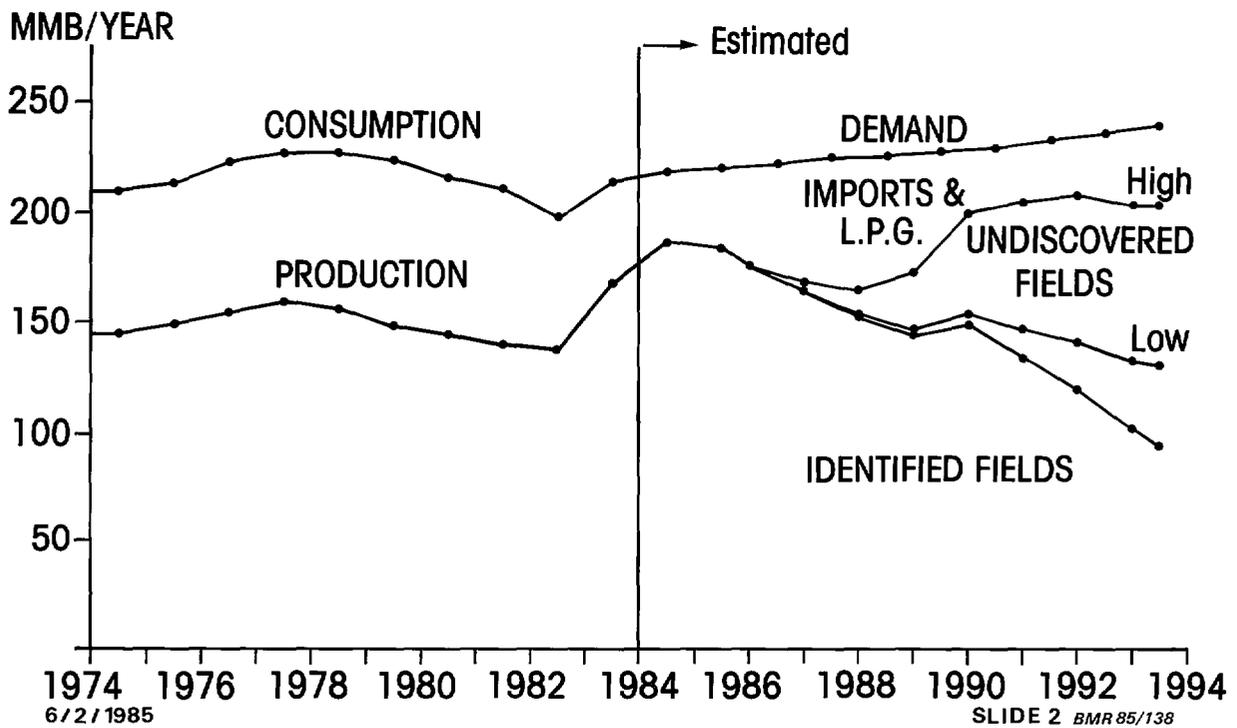
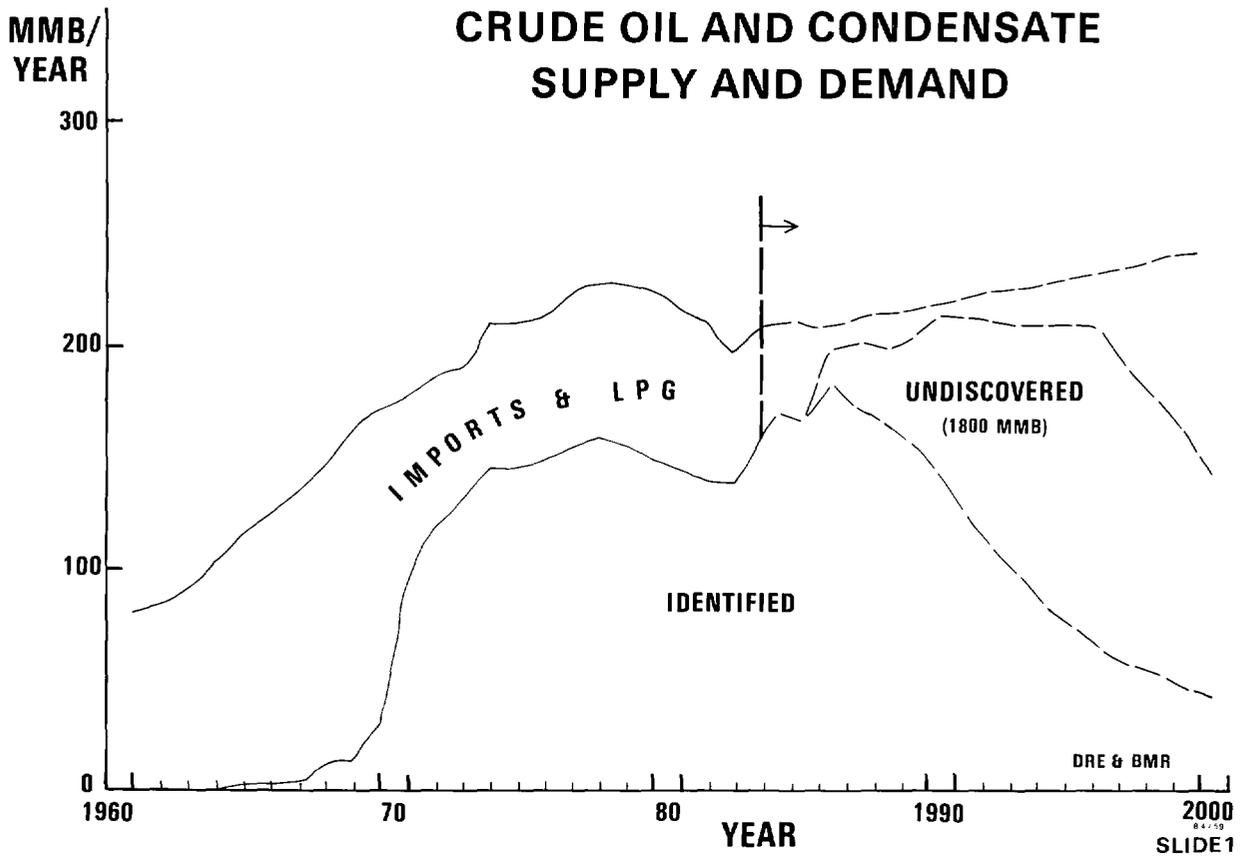
Slides 15 and 16

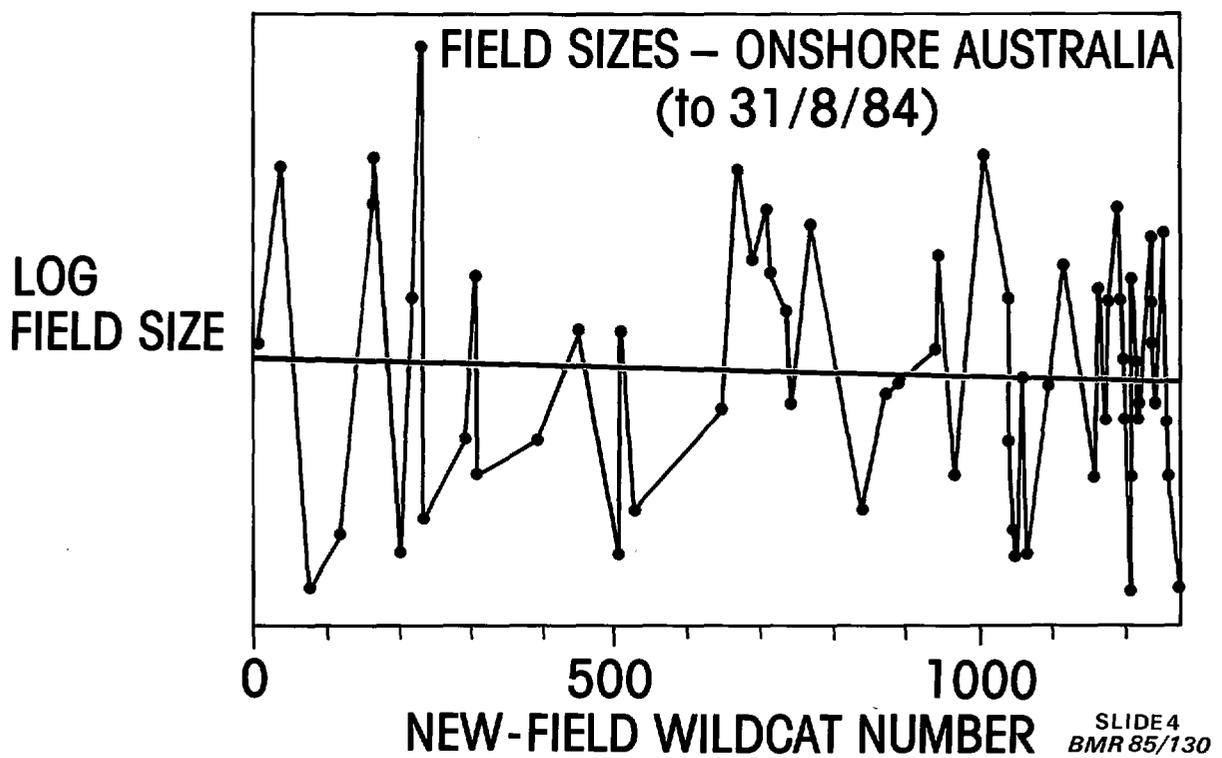
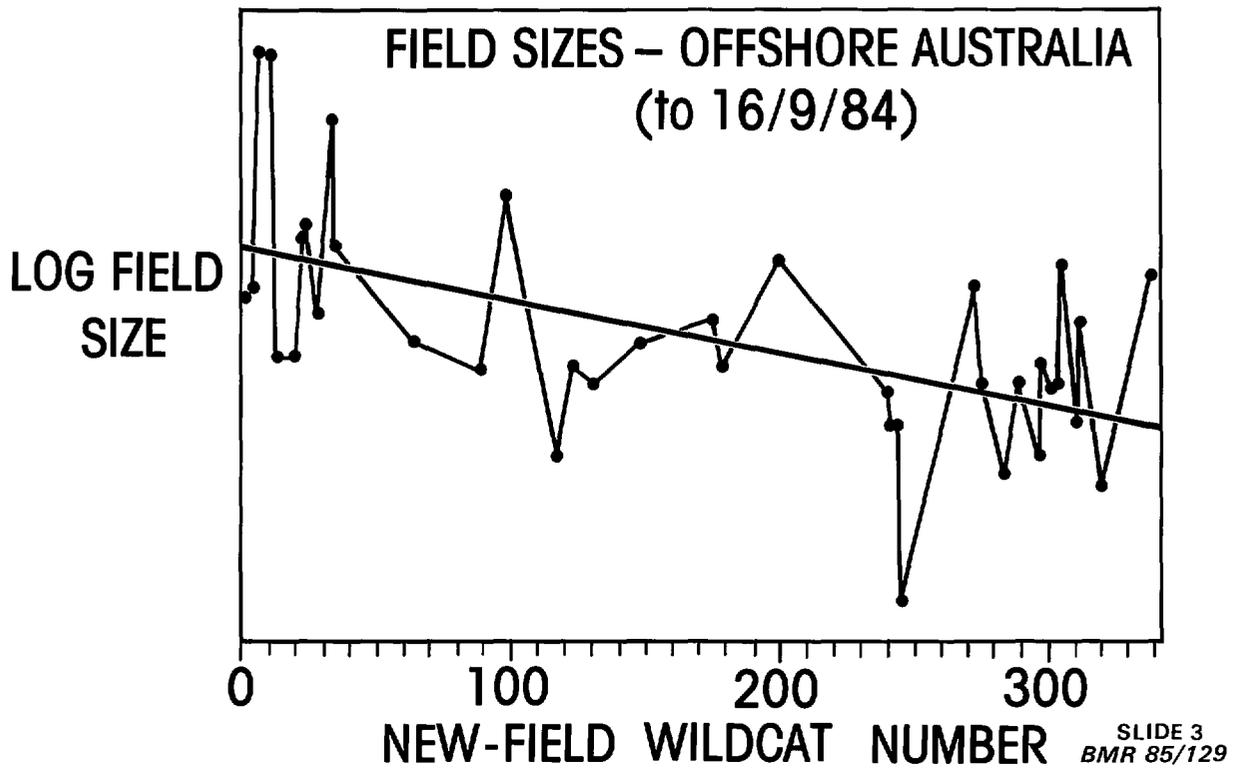
In conclusion, we have produced a new estimate of production from undiscovered fields for the period 1985 to 1994. Because of uncertainty in many of the factors involved, the estimate is presented as a range of values for each year, with the range of uncertainty increasing throughout the period.

The main causes of uncertainty in the estimate of production from undiscovered fields are doubts about the size and number of the fields and the timing of their discovery. Secondary causes of uncertainty are doubts about exploration levels, success rates, the lead times from discovery to production, and field production rates, but only some of these have been taken into account in preparing this years estimate. We propose to make further improvements to our methodology at BMR so that in the future we may be able to take account of all the significant sources of uncertainty.

When viewed together with production from identified fields, the estimate suggests that production of crude oil and condensate could fall from estimated levels of about 185 million barrels per annum in 1985 to a narrow range close to 160 million barrels per annum in 1988. Production levels in 1994 are much more uncertain, with possible production ranging between 130 and 200 million barrels per annum.

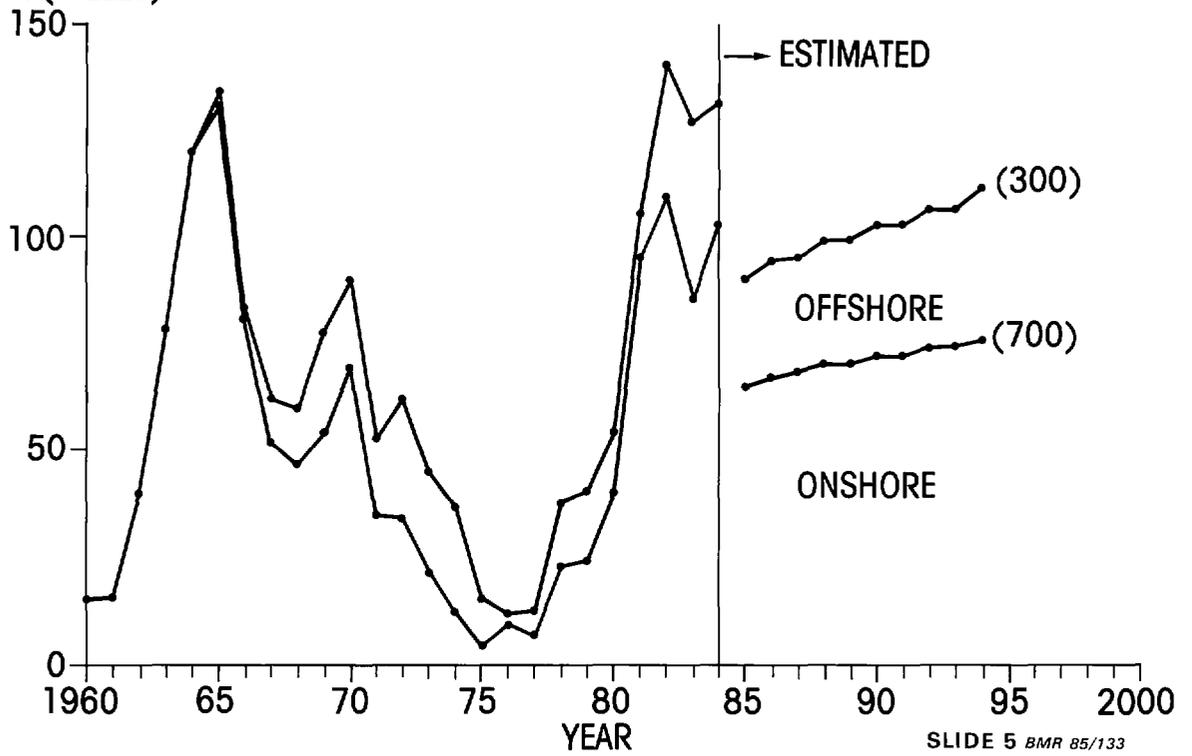
I thank my colleagues in the Petroleum Branch of BMR who also contributed to this project.



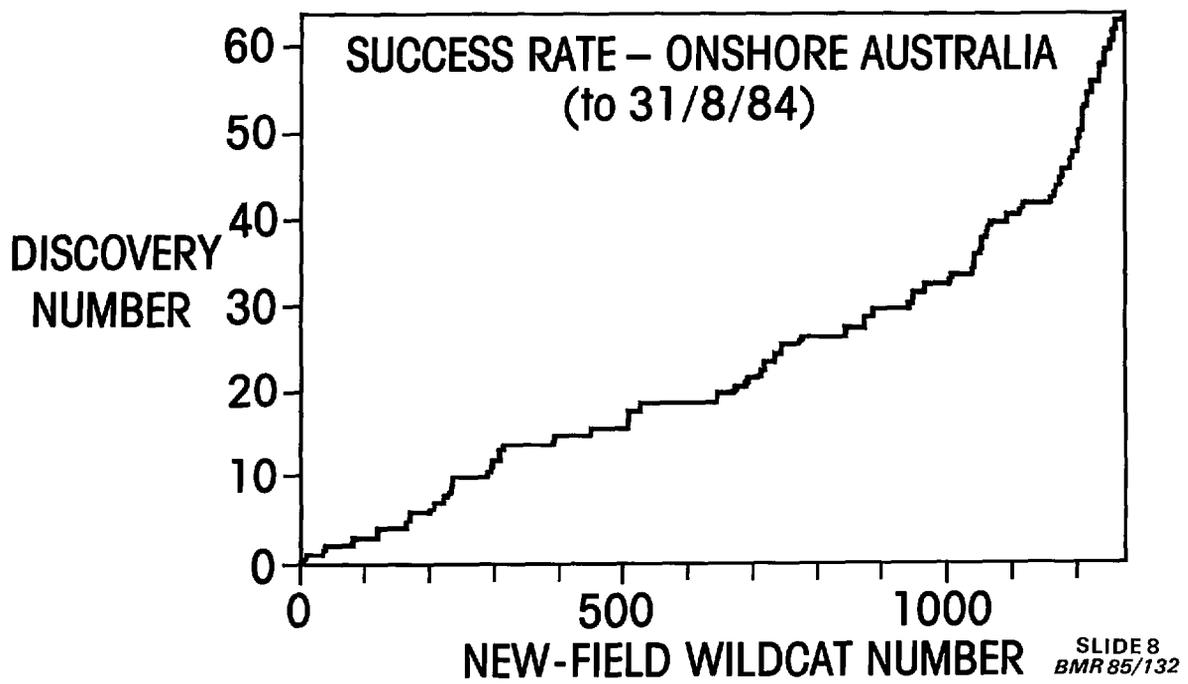
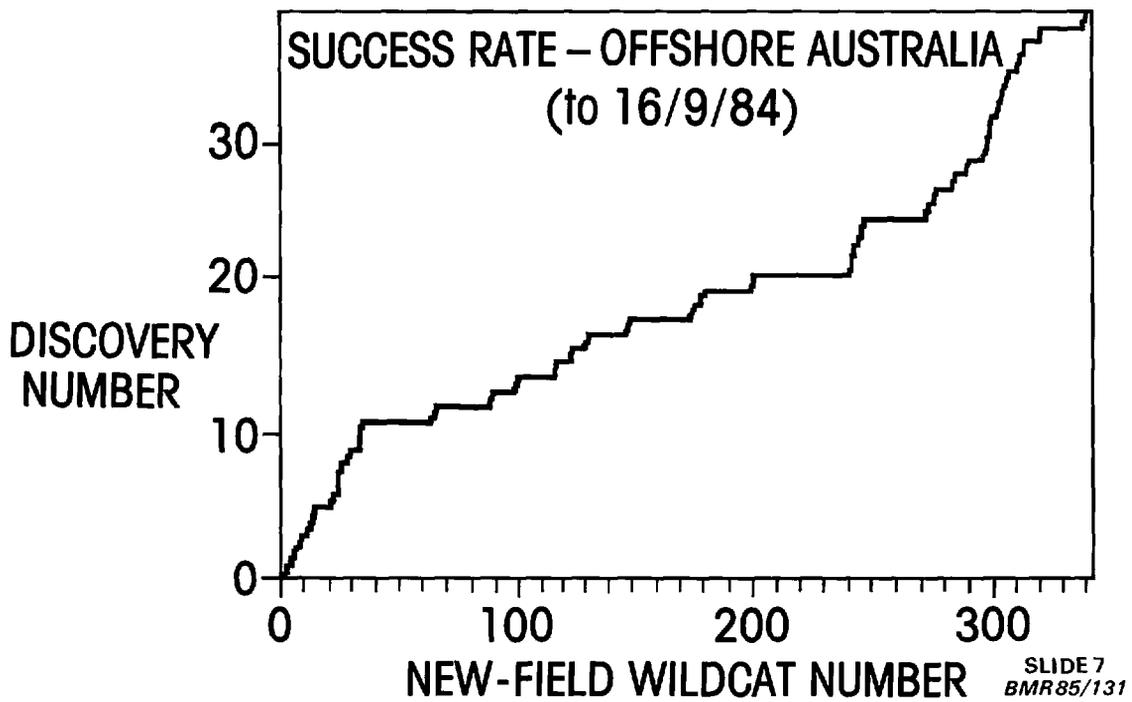


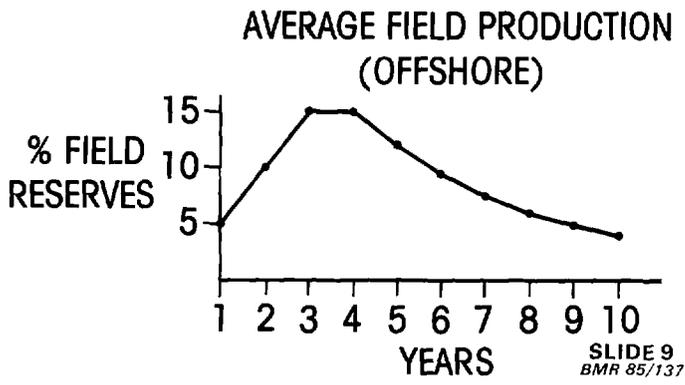
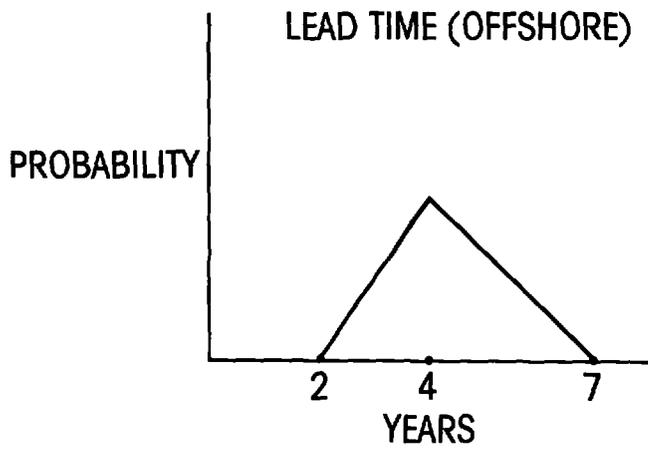
NUMBER OF  
NFW (WELLS)

### AUSTRALIA – NEW-FIELD WILDCAT WELLS



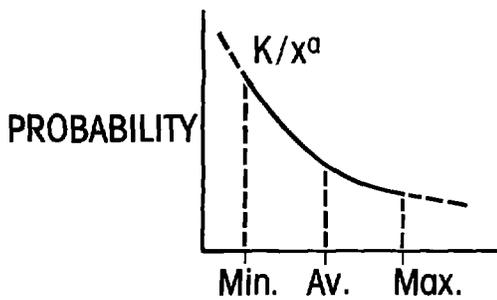
SLIDE 5 BMR 85/133



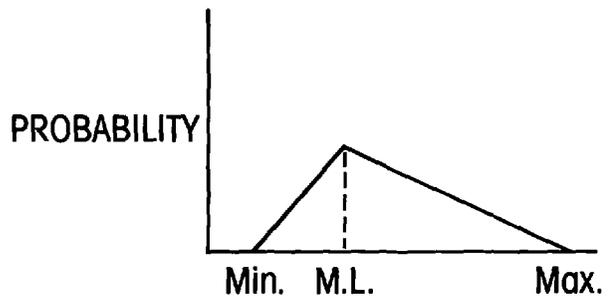


### SUBJECTIVE PROBABILITY METHOD

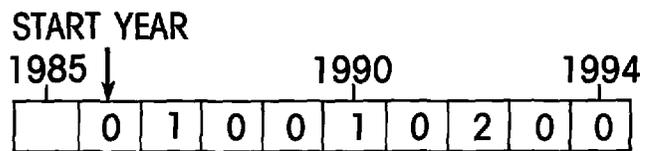
(a) FIELD SIZE DISTRIBUTION



(b) NUMBER OF FIELDS

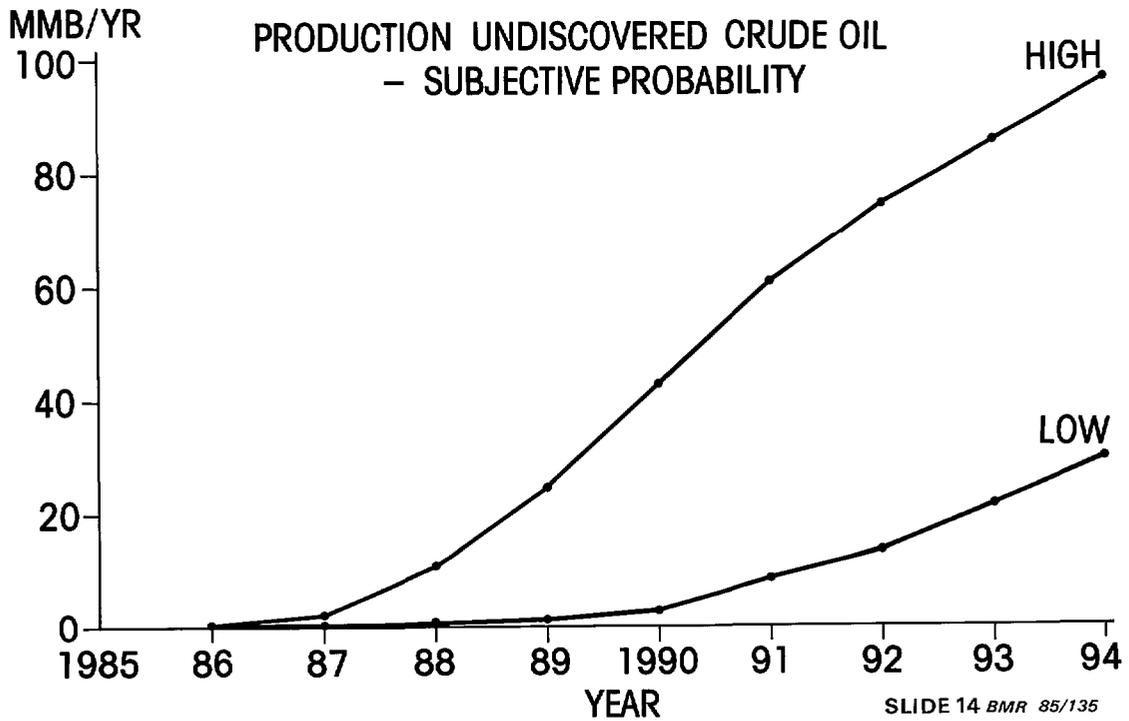
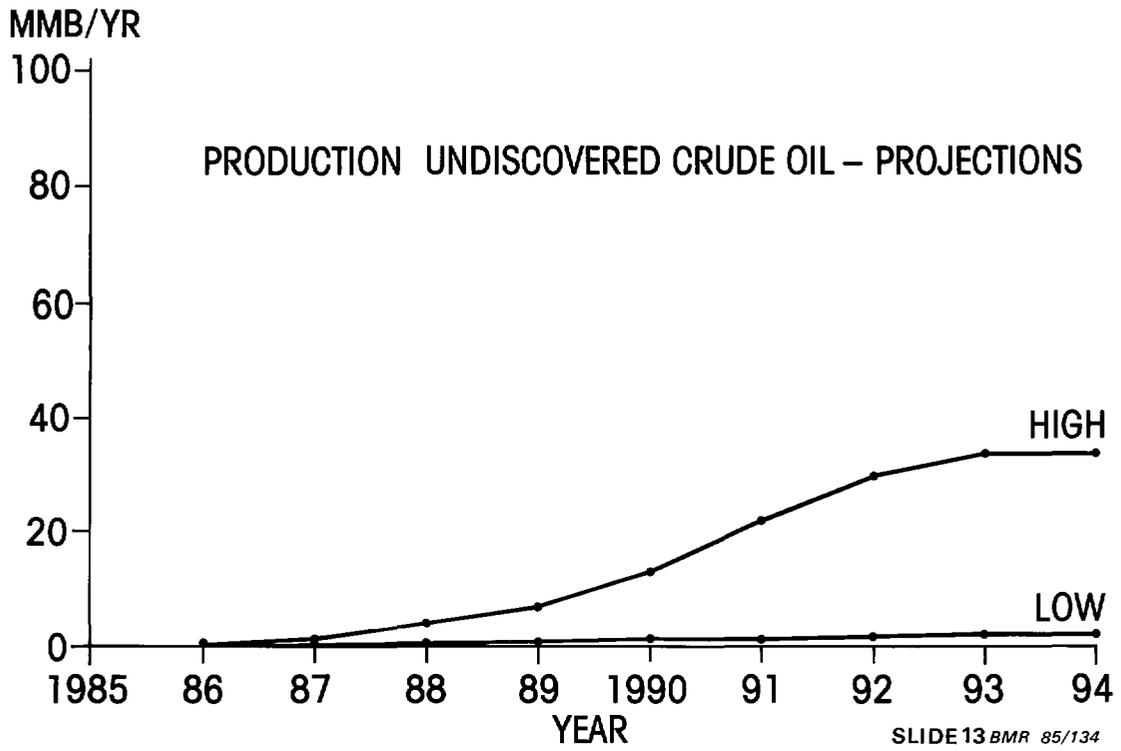


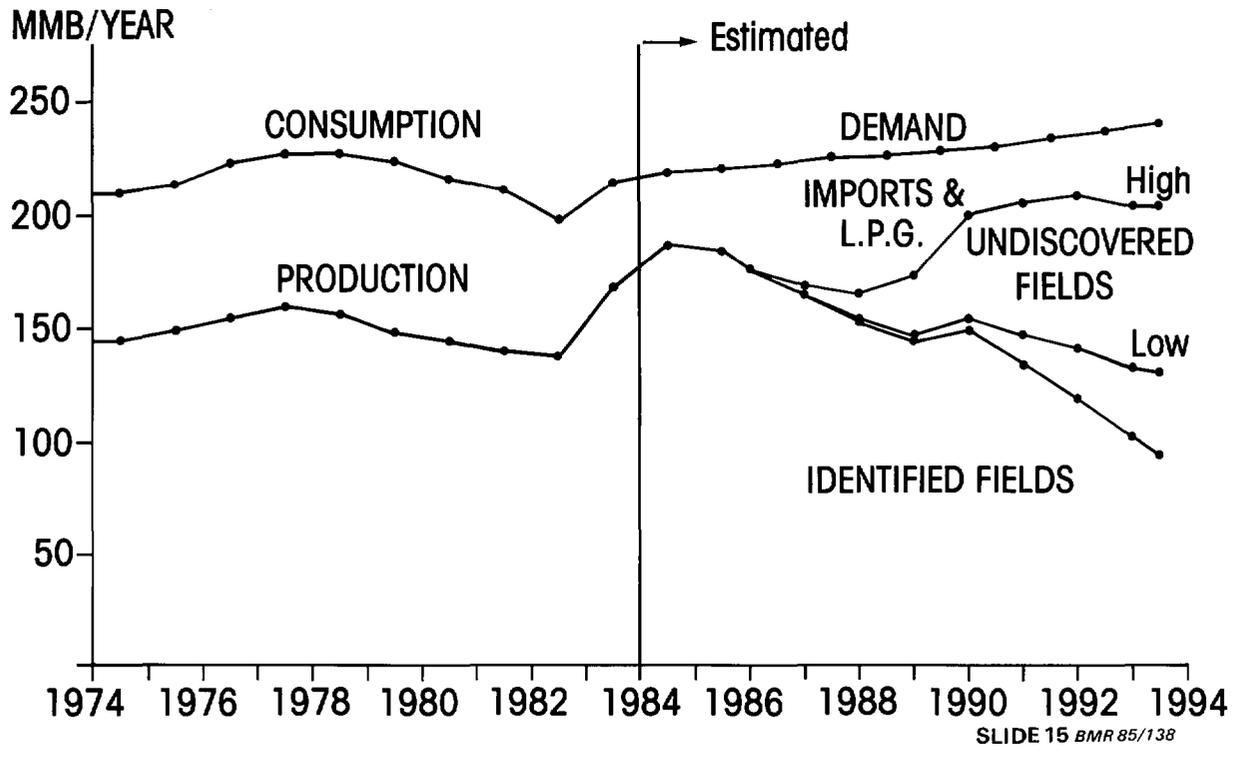
(c) NUMBER OF ANNUAL DISCOVERIES



etc

SLIDE 11  
BMR 85/136





SLIDE 15 BMR 85/138

12X