POPULATION & IMMIGRATION MATHS.

If P =Population at time t
I =Net immigration rate per annum.
b = breeding rate per female per lifetime
T = average Life Expectancy
Then in a short time-interval Δt population increases by:

$$\Delta P = births - deaths + net\ immigration$$

$$\Delta P = \frac{P}{2}\ .\frac{\Delta t}{T}.b\ - P\frac{\Delta t}{T} + I.\Delta t \qquad (1)$$

$$Therefore \qquad \frac{dP}{dt} = \left(\frac{b}{2} - 1\right) + \left(\frac{IT}{P}\right).P \qquad (2)$$

where, in the usual way, we have taken the $\Delta\,'s$ to the infinitesimal limit 'd'. It is a first order Differential Equation with general solution:

$$p(\tau) = \left[1 + \frac{B/2}{\left(\frac{b}{2} - 1\right)}\right] \times exp\left[\left(\frac{b}{2} - 1\right)\tau\right] - \frac{B/2}{\left(\frac{b}{2} - 1\right)} \qquad (3)$$

Where $p \equiv P/P(0)\ ,\ \tau \equiv\ t/T; \quad and\ B \equiv 2IT/P(0)$. It is far too clumsy to give much insight.

But if we make the natural assumption that I/P ~ constant = I_0/P_0 (4) where the subscripts refer to today's values [We are assuming that unless controlled, immigration and population tend to rise or fall in proportion] then. we can rewrite (2) as:

$$\frac{dP}{dt} = \left(\frac{b}{2} - 1\right).P + \left(\frac{TI_0}{P_0}\right).P$$

a straightforward exponential equation which simplifies to:

$$\frac{dP}{dt} = \left(\left(\frac{b+B}{2}\right) - 1\right).P \qquad (5)$$

$$\text{Where } B \equiv \frac{2I_0T}{P_0} \approx \frac{160I_0}{P_0} \qquad (6)$$

plays, for immigration, exactly the same role as b, the breeding rate, does for natural population growth [as we can see in Eqn. (5) without even having to solve it !]. We can now appreciate where the 160 comes from: it is 2T. Now an

I_0 of 300,000/y corresponds to an increase of B (which is the same thing) of $(2\times 300{,}000 \times 80)/64M.$ which is 0.75 or 3/4. It is equivalent to each British mother having an extra ¾ of a baby or 3 mothers out of 4 having an extra baby. In other words: COMPARATIVELY SMALL AMOUNTS OF IMMIGRATION CORRESPOND TO APOCALYPTIC CHANGES IN THE NATURAL BIRTH RATE.

Qualifications:

This is a model designed to yield insight rather than strict precision. It involves two approximations: Eqn. (2) implicitly assumes that T and b are time-independent, or roughly so, while Eqn. (4), as we have argued, is natural. In our context all 3 approximations probably underestimate population growth.

SUMMARY

When immigration of I/year is happening the Population multiplies itself exponentially from generation to generation roughly by the factor

$$X = \frac{b+B}{2} \quad where\ B = 2IT/P.$$

The 2 arises because only the female half of the existing population breeds, so the fair ratio of immigration to breeding has to be I/(P/2) = 2I/P. The factor T arises because immigrants arrive every year while people breed or die only once or twice during the course of their lives: thus 2IT/P.

NUMERACY We see here the sometimes revelatory power of Mathematics. Without it we would never have understood that Immigration, if not controlled, will absolutely swamp natural breeding rates. I wouldn't and indeed didn't. Should not this simple Calculus, which used to be taught at O-Level (age 15-16) in Britain be a part of every numerate citizen's tool-bag? It could be taught, if done Inductively.