CHAPTER 1

1.1 Prologue

This book is the product of a sabbatical year during which I was cast into a state of social isolation by the COVID-19 pandemic. My intended itinerary through the Universities of Northern Europe did not materialize and I was left with the time on my hands and bounteous opportunity to contemplate the rise and fall of human populations; this book is the result. It is a projected future with all of the uncertainties that prediction brings. It is a journey that has taken me to unfamiliar landscapes beyond my traditional biological homelands and into new territories, particularly social science, demography and economics. Determining the fate of human populations is clearly a multidisciplinary task requiring input from many different quarters and I am grateful to colleagues who traditionally occupy these strange domains for their forbearance and thoughtful contributions to the argument that threads its way through this book. I hope that the logic that I have laid out is sufficiently grounded in fact and reason to be plausible and that the conclusions are valid. If correct, this analysis suggests that the world's population is about to take a sudden, unexpected turn, generating a demographic collapse that will have ramifications for Governments, national health services, economists and society at large for years to come.

Unfortunately our species seems to have the attention span of a goldfish. The political cycle is generally around 3 to 5 years and that seems to be all that we mere mortals can handle. Anything beyond that duration tends to be classified under science fiction or fantasy. This is why the global warming debate has had so much difficulty getting traction; trying to

convince people to think beyond their normal 3–5-year horizon has been too much of a challenge. The fundamental point I am trying to make in this book, is that there are global changes happening around us at this very moment that are going to have a profound effect on the human condition, not now, not next week or even next year, but in the decades to come.

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All over the world we are seeing a dramatic fall in human fertility rates. Natural selection works by selecting those genotypes that favour our capacity to reproduce. When human societies started out on the rocky road to civilization, they were characterized by large family sizes. This was partly by desire – in an unmechanized society many hands make light work – but it was also partly by necessity. Such need arises because societies in the early throes of socioeconomic development, are characterized by high rates of infant (<1 year of age) and childhood (<5 years of age) mortality. Under these conditions, you must be capable of having six or seven children for one or two to survive, reach sexual maturity, find a partner and have children of their own, thereby ensuring the transgenerational inheritance of your precious, selfish genes. As a result, fertility is strongly selected for because only the most fecund individuals will be capable of ensuring the continuation of their genetic lineage. Some of my learned colleagues have used this biological principle to predict a sudden recovery of the world population from its current downward spiral. According to this argument, the descent of human fertility to subreplacement levels will be followed by a period of population recovery due to the natural selection of fertile individuals (Collins and Page, 2019). This is very comforting; if it is true, we can all go home, sit in front of a roaring log fire, have a nice cup of tea and listen to Nat King Cole. However, the comfort we gain from such assertions may not be sustainable. As I shall explain in later sections of this book, we left natural selection behind a long time ago under the

guiding hand of rising affluence; reality is actually much more stark.

As societies become more advanced, infant mortality rates invariably come down and so does the desire, and the need, to have large families. Large numbers of children are not required when labour has become mechanized, if not automated, and the guaranteed survival of your brothers and sisters will only serve to place limitations on the per capita distribution of resources within the family. In response to such factors, by the time we reach the levels of socioeconomic development typical of most twenty-first-century industrialized societies, the total fertility rate (average number of children a woman would have if she survived all her childbearing years) has declined to below replacement level (around 2.1–2.3, depending on how conservative you want to be) and, in the absence of significant immigration, population decline has become inevitable.

This socioeconomically driven shift of demographic from one with a high birth rate in the face of high levels of infant/childhood mortality to one characterized by low birth rates and low levels of infant/childhood mortality is known as *the demographic transition* and has been consistently observed throughout history as societies become more technically sophisticated and primary healthcare standards improve. The existence of a demographic transition has been widely acknowledged and discussed; however, the long-term consequences of such changes have not received widespread consideration. As a result of this transition, the pressure that natural selection places on fertility is massively reduced, such that the high-fertility genotypes that dominated the genetic landscape when life was nasty, brutish and short, no longer prevail. The result of this change is a progressive reduction in the fundamental fertility of advanced industrialized societies.

Added to this, the advance of civilization has not only reduced family sizes but also given women the freedom, opportunity and time to become educated. An inadvertent consequence of this progressive social change is that fertility rates

are falling faster and further than anticipated because more women are choosing to become educated and pursue their own career ambitions rather than have a family or, in denial of their biological makeup, are leaving the quest to have a family so late in life, that procreation is no longer possible.

The chemical and electromagnetic pollution that characterizes industrialized societies also contributes to the loss of fertility because several of these toxicants and pervasive radiation sources are also known to compromise our capacity for reproduction. Moreover, the lifestyle choices associated with twenty-first-century living in modern industrialized societies including recreational drug abuse, alcohol and tobacco consumption, and dietary changes leading to obesity are also not good for our reproductive health – or the health of our offspring.

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Faced with a catastrophe of monumental proportions, we are placing more and more reliance on two possible solutions to dig us out of the trap into which we have fallen – immigration and the assisted conception industry. As far as immigration is concerned, many of the world's most advanced economies (North America, Europe, Australia) depend heavily on the prospect of future prosperity to attract economic migrants to their shores. This strategy has helped buffer these advanced economies against the adverse consequences of low fertility rates for several decades. We may have struggled to maintain some level of control over the raging torrent of economic migrants and political refugees flowing to the wealthier nations on Earth. However, in truth, we should have welcomed these victims of circumstance with open arms because this is a river that will ultimately dry up, as

those traditional wellsprings of humanity, China and India, suffer their own version of a fertility collapse.

The assisted conception industry also has its part to play in the coming population crisis. In the short term, assisted reproductive technology (ART) clearly benefits its patients by providing an opportunity to have children that they would have otherwise been denied. If this technology had been confined to the patient population for which it was originally designed (i.e. women with blocked Fallopian tubes) there would be no problem with this approach to treatment at all. Problems arise however, when ART is used indiscriminately as the default form of treatment for many different forms of subfertility, including genetically induced conditions, and when it is conducted at scale. In some countries up to 10% of all newborn babies are the result of such reproductive intervention and in all countries the trend is sharply upwards. The meteoric rise of assisted conception is clearly meeting an unmet clinical need, but it is also leaving a vapour trail of social injustice and despair in its wake as successive Governments abandon their social responsibility to subsidize such treatment and costs rise in order to provide dividends to shareholders in, what has become, a lucrative industry. Nevertheless, the legions of couples willing to pay for assisted conception services has created an insatiable demand. If the uptake of this form of treatment continues on its current trajectory, it will ultimately have a significant impact on the fertility of our species. The simple fact is that the more we use ART in one generation, the more we are likely to need it in the next. The major reason for this assertion is that if ART is practiced indiscriminately at scale, it will simply serve to maintain poor fertility genes in the population and thereby exacerbate the reduced selection pressure on high fecundity genes that invariably accompanies the demographic transition.

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Altogether, we now have a perfect storm of factors conspiring to reduce the fertility of our species. This may seem counterintuitive because the global population is still expanding and we are constantly surrounded by the myriad legacies of overpopulation in the form of global warming, widespread pollution, unprecedented species extinctions, precarious food security, resource depletion and the savage spread of diseases such as the corona virus, COVID-19. In light of such factors, we might conclude that there are too many humans on this planet already and that a gentle correction would not come amiss. The trouble is that when the correction comes it will not be gentle and, if we are not prepared, will not be reversible. We are currently faced with the prospect of creating an 'infertility trap' from which it might be very difficult to extricate ourselves. This is like being in your lounge on a sweltering 40-degree day in regional Australia, trying to imagine what it will be like when winter comes, and we are all gathered within a 3-foot radius of the wood burner. It would be hard to convince yourself that this is actually what is going to happen and that the appropriate response is to rise from the comfort of your armchair, switch off the TV, go outside and start chopping wood. The ultimate purpose of this book is to alert the world that winter is coming.

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I shall no doubt receive many a broadside from the lumbering galleons of denial; the sceptics who have sought to trash the climate change argument and generally fail to grasp the dynamic flux that underpins the apparent stability of the world around us. It might be helpful if they would just open

their eyes and see beyond the immediate economic horizon. I may also receive more deserved criticism from specialists in disciplines such as sociology and demography that are not within my area of expertise. However, in my defence, none of us can be an expert in the entire range of subjects responsible for driving social and demographic change. Indeed, it may be precisely because we rarely venture outside our citadels of specialized knowledge that projections of global population numbers have been so difficult to resolve. Outside the castle walls of our specialities is open ground where we are vulnerable to attack from other disciplines speaking in strange tongues with different cultures, different types of knowledge and distinctly different perspectives on the world. Nevertheless, we can only really advance intellectually if we take that risk, take that leap of faith and walk out into the open grounds of controversy and treat our colleagues and the information they generate, with interest and respect. If we are to really understand what is happening to us as a species, we need to work together on a multidisciplinary front to achieve a synthesis that might more accurately predict our fate than any single specialty working in isolation.

Previous attempts to predict the fate of human populations have been mired in controversy. Initially, demographers completely underestimated how rapidly the human population was going to rise. More recently, the same demographic authorities have repeatedly underestimated how rapidly and how far the human population will fall. Global population projections have been produced by the Population Division of the Department of Economic and Social Affairs of the UN Secretariat (UNPD) since the 1950s. Even in the short term, the assumptions underpinning their models have generated inaccurate results. For example, in 1951 the world population for 1980 was projected to be 3.0–3.6 billion whereas it actually increased to 4.4 billion (Warren, 2015). The UN projections for the future assume that all nations ultimately converge and stabilize their populations at around replacement level. The total fertility rate at which the population stabilizes has varied with the passage of time, but

current UN projections are based on an assumed stabilization of fertility rates just below replacement levels at 1.9. The assumption underpinning this model is that with increasing socioeconomic development we shall see a reduction of fertility in all nations as a function of the concomitant reduction in infant and childhood mortality as well as the powerful, social, environmental and lifestyle drivers briefly referred to above. Once these factors have forced the total fertility rate to below replacement level, this downward vector will, according to the UN, miraculously reverse to stabilize the fertility rate at a level that all the donor nations would be happy with. The wisdom that generates this stabilization is held to involve a range of social and political factors, invoked by society and Government, and designed to provide levels of social security, gender equality, market flexibility and financial reward needed to restoke the fertility fire and stabilize the population (Myrskylä et al., 2009). This is a very reassuring view of the future. Whether it is an accurate view of how the human population will fare in the coming years is a key question that we shall explore.

Uncertainties around the fertility rate at which population stabilization is supposed to occur, and the mechanisms that might deliver this outcome, have haunted this model since its inception. A detailed analysis of population data reveals that once the demographic transition has triggered a decline in fertility rates then a range of social, demographic, economic and biological factors are brought into play that actually reinforce the reduction in fertility rather than stabilize it. As a result, fertility tends to drop beneath our wisdom like a stone. Furthermore, if we take a long-term view of the situation facing *Homo sapiens,* there may well be an evolutionary cost to these changes that will permanently alter our population dynamics. If we fail to take such factors into account and act upon them, we shall have mortgaged the prospects for future generations, just to realize trivial economic gains in the present.

In the chapters that follow we shall take a detailed look at the various elements that are contributing to the global

decline of human fertility and ask whether it is remotely possible to reverse this process – or are we being caught in an irreversible trap. To begin this journey, we shall look at the historical record of human fertility and see whether things really are as bad as I am making out. We shall then look at the causes and consequences of this infertility decline, beginning with a consideration of how affluence and age have wreaked havoc with female reproduction. This will then be followed by an examination of the male side of the equation and a consideration of why sperm counts are falling, why testicular cancer rates are rising and why the infertile male is making such an important contribution to the aetiology of human infertility. Having dealt with the factors impairing both female and male infertility, we shall then take a close look at assisted conception therapy and consider whether this technological miracle has the capacity to resolve our infertility crisis or simply make matters worse by perpetuating the spread of poor fertility genes in the population. This will then lead us into a discussion of how the factors driving the downward spiral of human fertility may be difficult to reverse and the extent to which we, as a species, have been lured into a trap. In the final chapter I propose that the only way in which we can prevent ourselves becoming ensnared in this trap is for sociologists, economists, politicians, demographers, geneticists, toxicologists, clinicians and reproductive biologists to come together to generate a multidimensional, multidisciplinary view of the problem and fashion an appropriate range of measures for its resolution. As we march along the road of socioeconomic development, we are already seeing the strains that Governments and institutions across the globe are under to provide adequate eldercare facilities to support our ageing communities, to resource the swelling ranks of single-parent families, to provide adequate parental leave schemes and childcare facilities for working mums and dads and, increasingly, to enable equitable access to infertility services. These are all symptoms of the changes that society is going through that are contributing to, and reflective of, the global decline in

human fertility. To paraphrase the legendary Bill Shankley's thoughts on a life in soccer – this is not a matter of life and death – it is much more serious than that.

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1.2 Summary

Many different factors, social, political, environmental and biological, are conspiring to suppress fertility rates in our species. In this book, we shall explore the fundamental nature of human population dynamics and the wide range of factors responsible for the change that is about to come. We shall examine the extent to which the above factors will have an irretrievable impact on the dominance of our species or whether the observed fertility decline can be controlled to the point of bringing the world's population to a new, sustainable, stable equilibrium. We should hope for one, anticipate the other and hold on for a bumpy ride.

1.3 References

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