The damping ratio, d, is the ratio of lambda 2 to lambda 1 which are the first and second eigenvalues of the Leslie matrix and is the rate of convergence to asymptotic behavior.

Add eq

The actual rate of convergence may deviate slightly from the damping ratio due to the effect of remaining eigenvalues, but d a good approximation since the first two eigenvalues are the largest. Larger values of d result in longer transients because the oscillatory behavior of the Leslie matrix, represented by lambda 2, are large relative to the exponential growth component represented by lambda 1. And conversely, small values of d result in shorter transients and faster rate of convergence.

In the Atlantic cod populations, rate of convergence decreases with larger CV about the age of peak spawning biomass. At first this may seem counter-intuitive since we expect age structure populations with wide spawning biomass distributions to take longer to converge, and narrow spawning biomass distributions to return relatively quickly to the SAD (see individual panels in Table 4 / Fig 4).

Variation in CV among the cod populations is completely explained by differences in peak spawning age, and not differences in the width, or standard deviation, of the spawning biomass distribution (Table 5). As we see in Fig 4, populations with older peak spawning ages (lighter blue dots) have longer transients. This makes intuitive sense, since populations with late-maturing individuals have slower rates of convergence to asymptotic behavior.

Position on the stock-recruit curve influences a population’s exponential growth, but peak spawning age does not have a strong effect except when population is on the far right side of the curve (closer to an unfished state). In general, as the population’s equilibrium state moves down the stock-recruit curve (high biomass depletion), exponential growth increases (Table 2). Each a single equilibrium point on the stock-curve (where the line of 1/LEP intersects the stock-recruit curve), [rephrase]