# Stock and catch equations

## fish5102stockcatch The development of a year-class

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# Deriving the catch equation

Need to derive an equation describing the catch in numbers in relation to stock size.

# Development of catch from a cohort

Constant fishing intensity within a year or during short time interval needs to be assumed to determine the amount of catch from a cohort.

Catch in proportion to stock and length of timestep:

$$\Delta C = FN\Delta t$$

# Development of catch from a cohort

As before this leads to a simple differential equation:

$$\frac{dC}{dt} = FN = Fe^{-Zt}N_0$$

where the previous results concerning the development of a stock within a year have been used.

# Deriving the catch equation

Integrating gives the annual catch in numbers from that cohort

$$C = \int_0^1 F e^{-Zt} N_0 \, dt = \frac{F}{Z}(1 - e^{-Z}) N_0$$

# The catch equation

$$C = \frac{F}{Z}(1 - e^{-Z})N_0$$

Surviving proportion

The catch equation:

$$C = \frac{F}{Z}(1 - e^{-Z})N_0$$

Proportion that dies

$$C = \frac{F}{Z}(1 - e^{-Z})N_0$$

Proportion which gets caught

# Change in yearclass size during a year

$$N_1 = e^{-Z} N_0$$

# The catch equation for many age groups and years

Catch equation for many yearclasses

$$C_{ay} = \frac{F_{ay}}{Z_{ay}}(1 - e^{-Z_{ay}})N_{ay}$$

The catch equation can be indexed with age and year to indicate the intent to compute catch in numbers by age and year.