

Simple back-calculation techniques

fish5104vpa Assessment methods based on back-calculations

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Backcalculating assessment methods background

Several back-calculation methods are available

For example:

- VPA (virtual population analysis): Gives (historical) stock size in numbers
- Cohort analysis and other variations: Different approximations
- "Tuning" with survey indices: Gives current abundance

Exceedingly simple stock assessments

VPA = Virtual Population Analysis

Start with simplified VPA

- no differential equations
- fishing not concurrent with natural mortality

Assumptions:

- 18% natural mortality
- Entire cohort caught in the last year

Simple back-calculation: one year

1987 = previous year

- catch = 46 thousand fish
- stock (cohort) size before catch in last year = catch = 46 thousand fish
- stock (cohort) size at beginning of year = stock (cohort) size before catch $\div 0.82$
- $N = 46 \div 0.82 = 56$ thousand fish

Simple backcalculation - full cohort

Year	Age	Catch	p	Cohort size
1987	13	46	100	56
1986	12	103	64	194
1985	11	217	52	501
1984	10	512	50	1235
1983	9	2054	62	4011
1982	8	7666	65	14241
1981	7	12710	47	32867
1980	6	15119	31	58519
1979	5	13772	19	88160
1978	4	16286	15	127375
1977	3	2614	2	158523

Example: Simple back-calculations for a cohort of cod in Icelandic waters, starting at age 13 and going backwards to the start of the fishery. The assumption of catching the entire cohort in the last year can easily be remedied.

Simple backcalculation - revised assumptions

- Revise the assumption of catching everything in the last year
- More reasonable to assume 50%

Example: Revised assumptions: Final catch is 50% of the cohort:

Year	Age	Catch	p	Cohort size
1987	13	46	50	112
1986	12	103	47	262
1985	11	217	45	584
1984	10	512	46	1337
1983	9	2054	60	4135
1982	8	7666	64	14392
1981	7	12710	46	33051
1980	6	15119	31	58744
1979	5	13772	18	88435
1978	4	16286	15	127710
1977	3	2614	2	158931

Note: Get almost same yearclass size... But: natural mortality and fishing mortality are assumed to occur at separate times of year ...