

Science, Service, Stewardship



Data inputs for Age structured catch-free model applied to dusky shark

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Why catch-free?

Landings deemed untrustworthy:

- Poor species identification (can be confused with other species, particularly silky sharks, especially immature individuals). This is particularly problematic for recreational fishery, which may produce expanded estimates based on mis-identification
- Magnitude of dead discards in pelagic fishery prior to 1992 (when PLLOP began) unknown
- Possible under-reporting in commercial fisheries after 1999, when species became prohibited



Data inputs

- Fishery inputs (CPUEs, some length composition, some effort)
- Biology

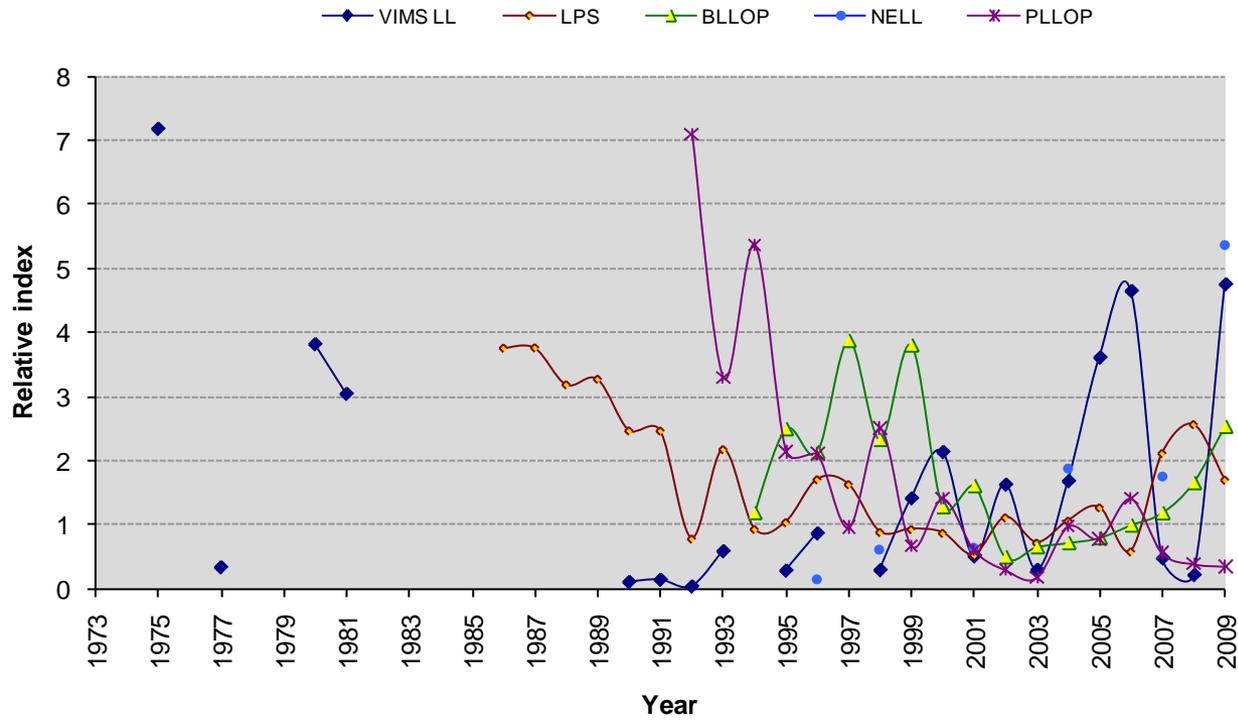


Fishery inputs: indices of relative abundance

- Five series (+ 1 depletion index)
 - VIMS
 - LPS
 - BLLOP
 - NELL
 - PLLOP

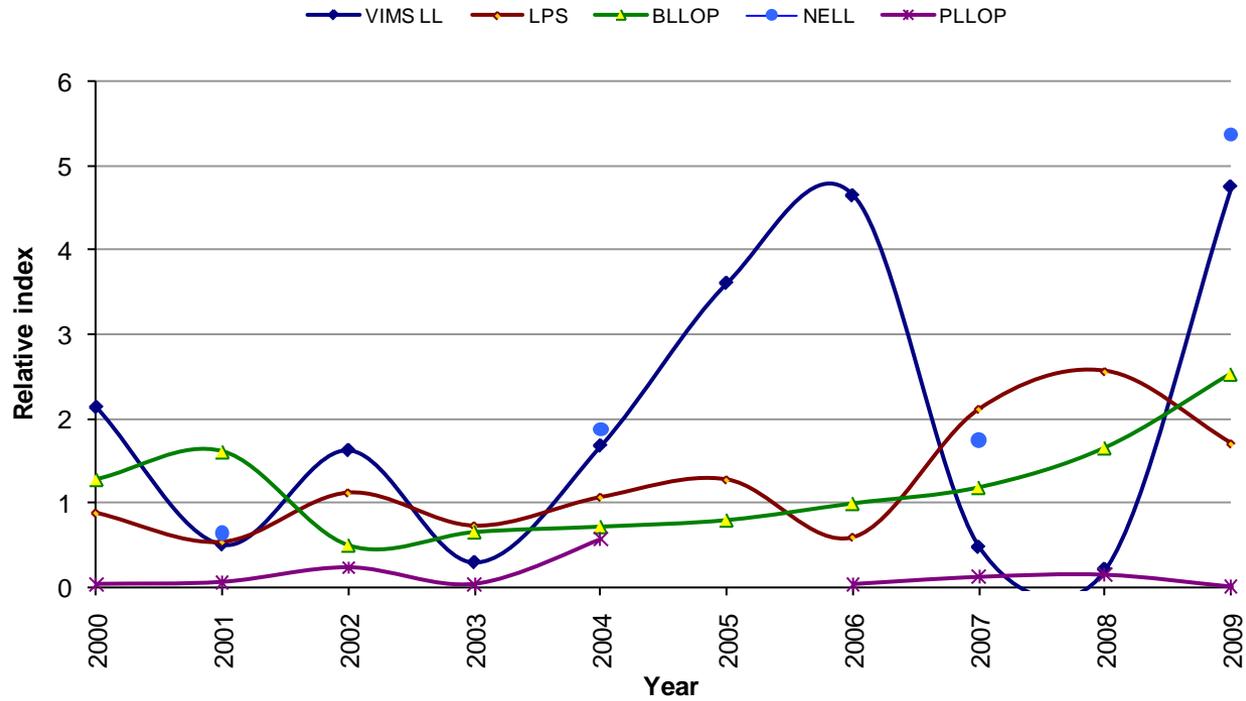


INDICES (baseline)



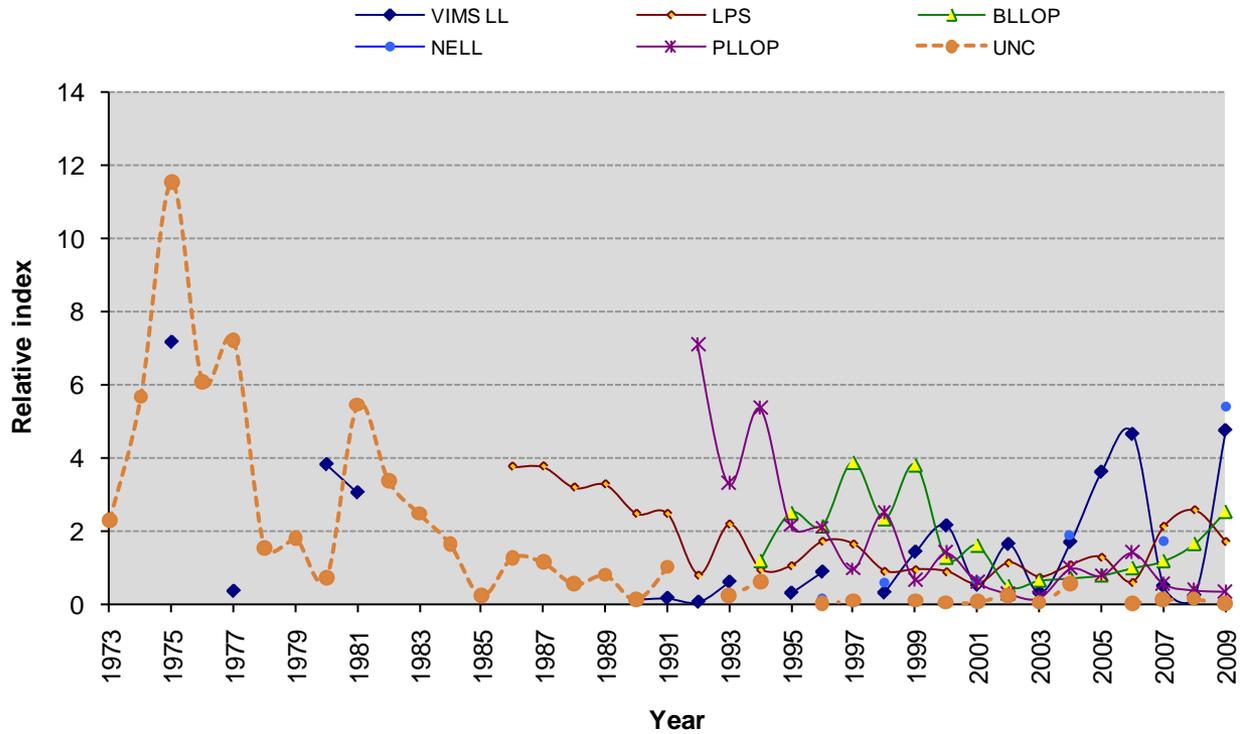


INDICES (baseline)



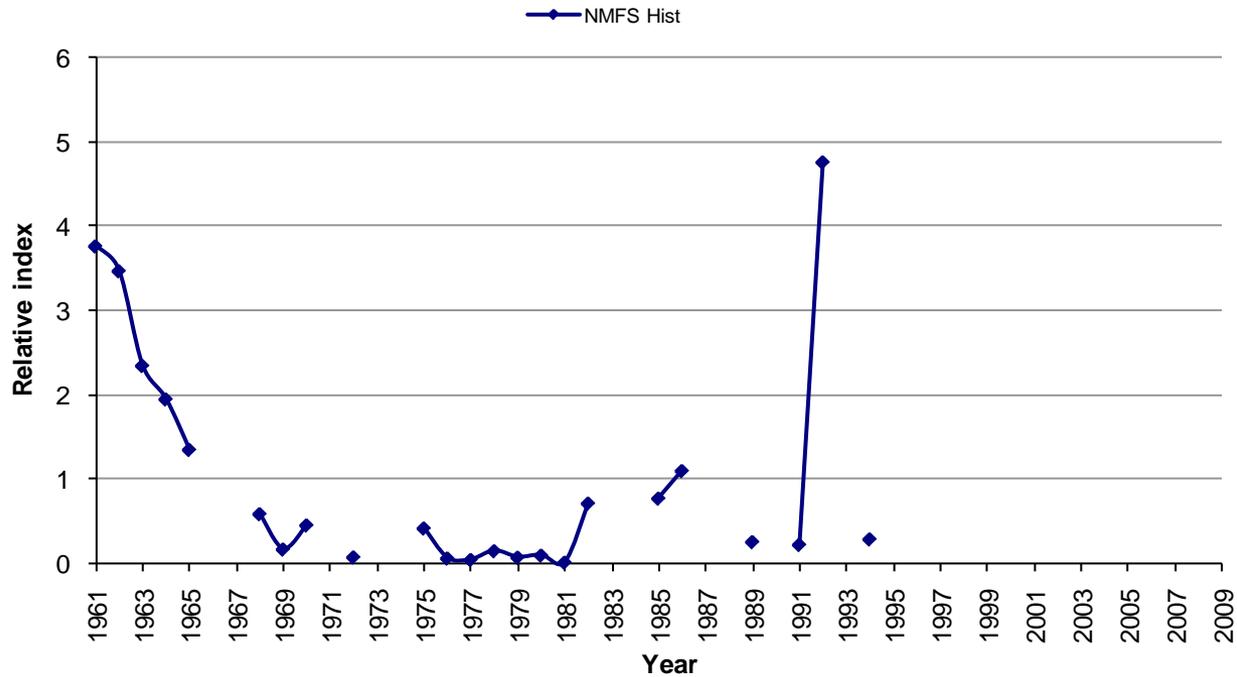


INDICES (baseline +UNC LL sensitivity index)



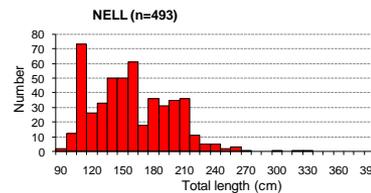
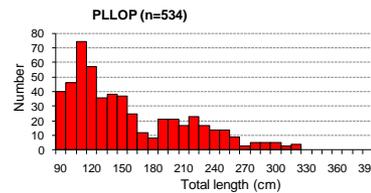
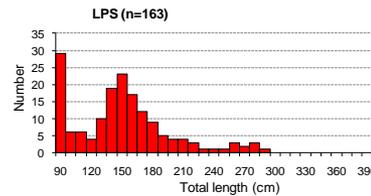
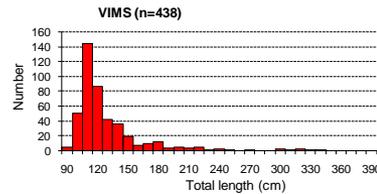
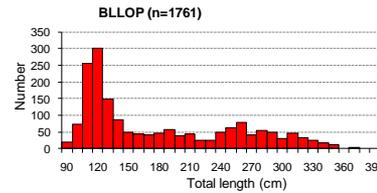


INDICES (NMFS Historic LL index)



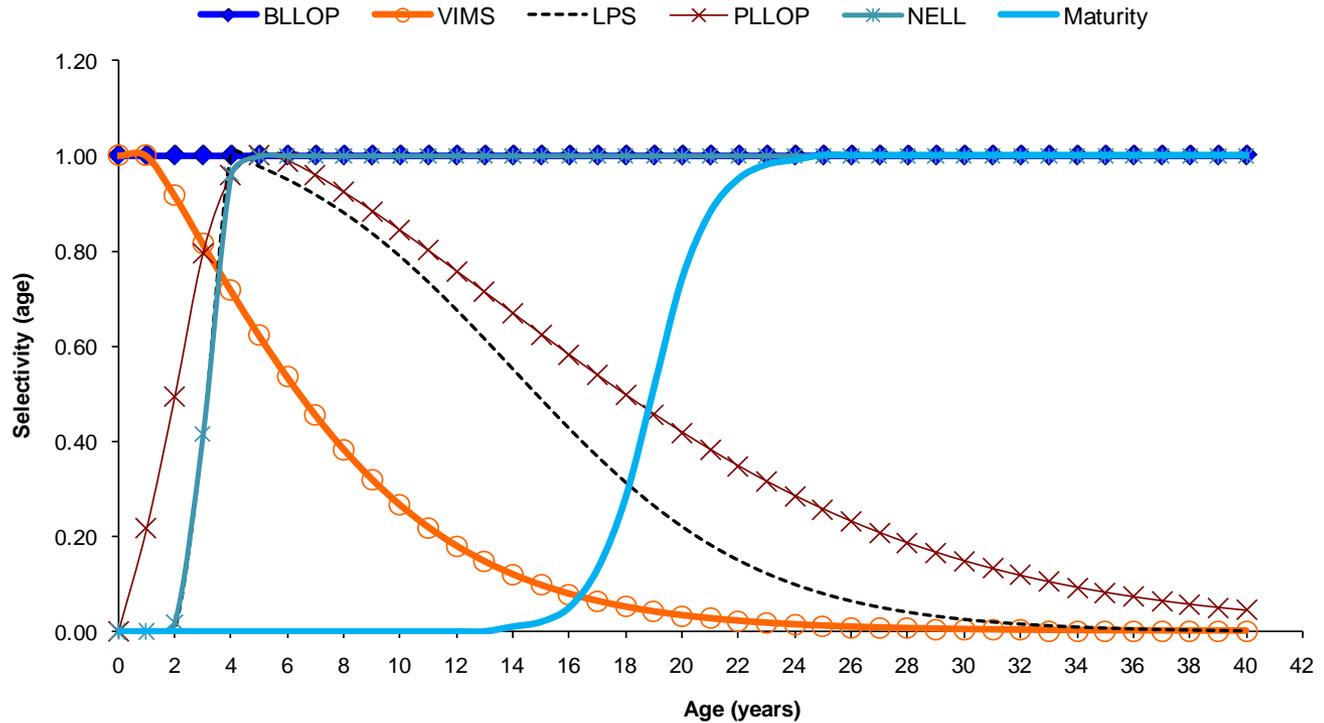


Fishery inputs: length compositions





Fishery inputs: selectivities for indices of relative abundance





Fishery inputs: fleets

- Three fleets:
 - Bottom longline
 - Recreational
 - Pelagic longline

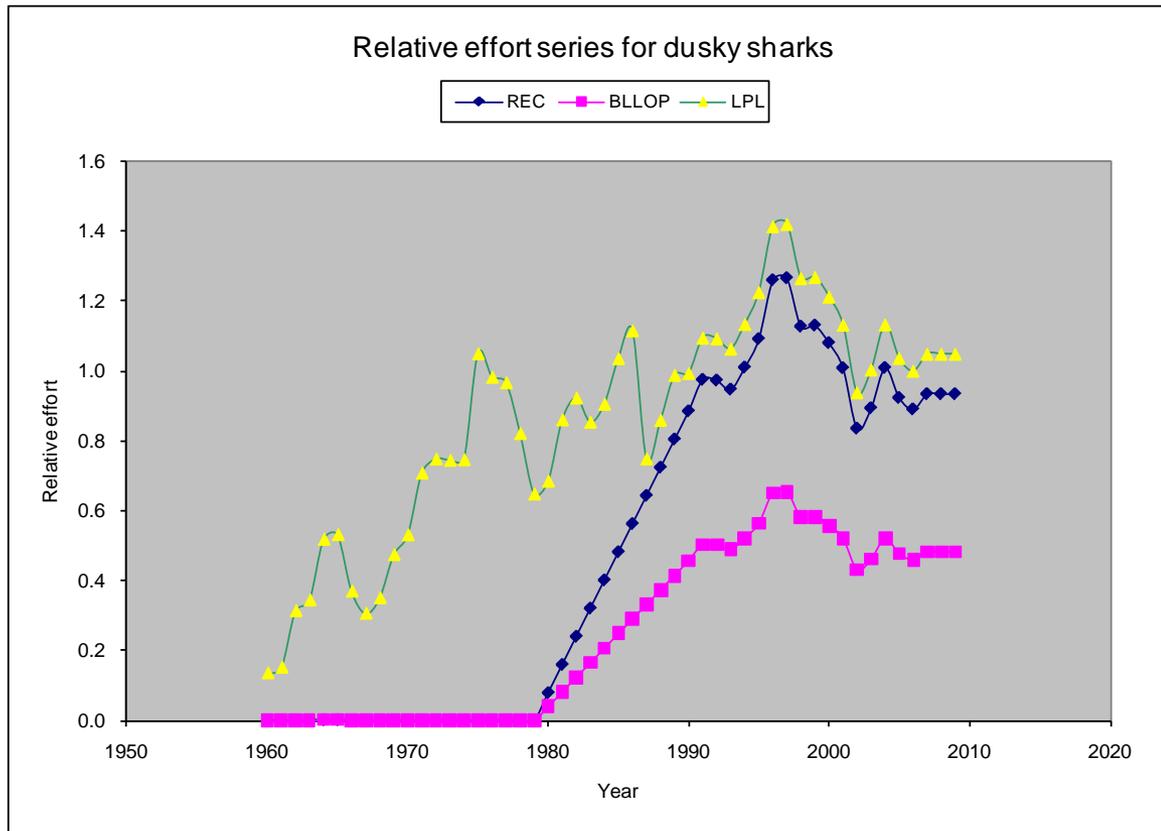


Fishery inputs: relative fishing effort series (derived at DW)

- 1) Obtained relative effort series from ICCAT (Task II, total estimated number of hooks for all fleets in the NWA) and scaled to last year of data (2006). For 2007-2009, took average for 2001-2005. This is the relative effort series for the PL fleet
- 2) Computed annual ratios of REC:PL and BLL:PL based on reported catches (landings + discards) for these 3 sectors. Used average of 2002-2007 (years for which differences in catches were more moderate) to calculate the ratios. Ratios obtained were REC:PL=0.89 and BLL:PL=0.46
- 3) For 1990-2009, computed relative effort for REC and BLL by multiplying PL effort by respective ratio
- 4) For 1980-1989, computed relative effort for REC and BLL by assuming linear decrease from 1990 to 1980
- 5) For 1960-1979, assumed relative effort for REC and BLL was negligible (for 1970-1979 assumed 1969 value; for 1960-1969, assumed values from 2006 assessment [very small])



Relative fishing effort series



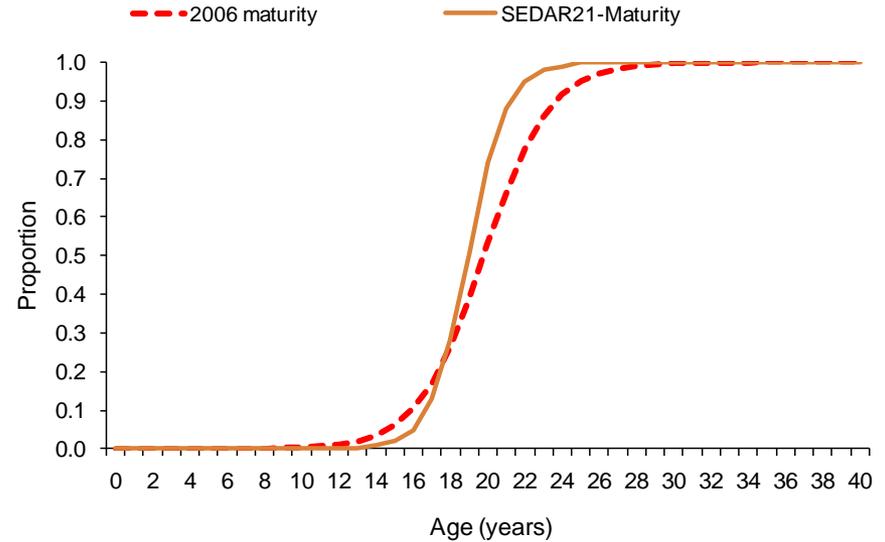
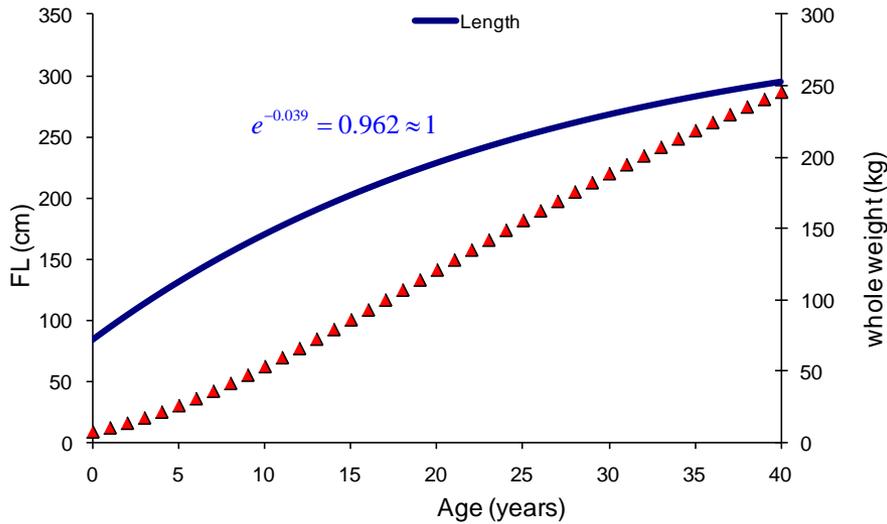


Biological inputs: reproduction

- Fecundity: 7.13 pups/female
- Sex ratio at birth: 1:1
- Pupping frequency: triennial

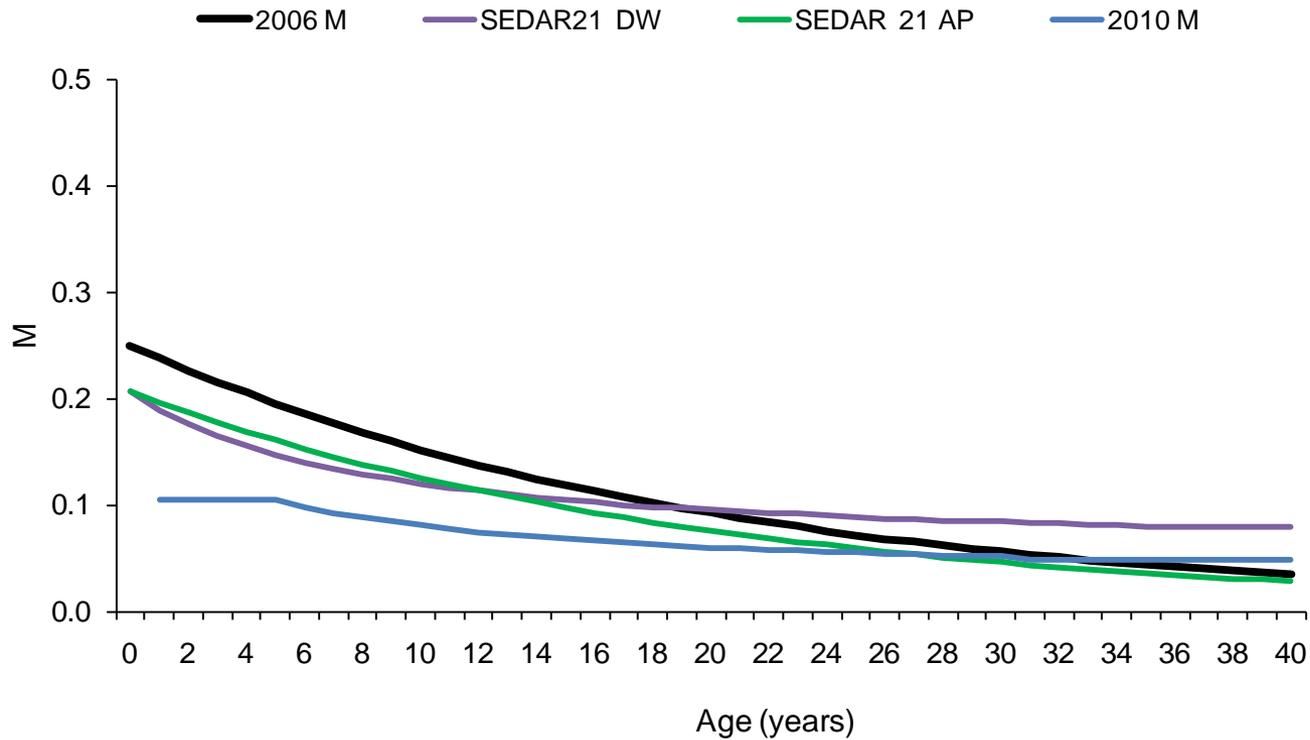


Biological inputs: growth and maturity



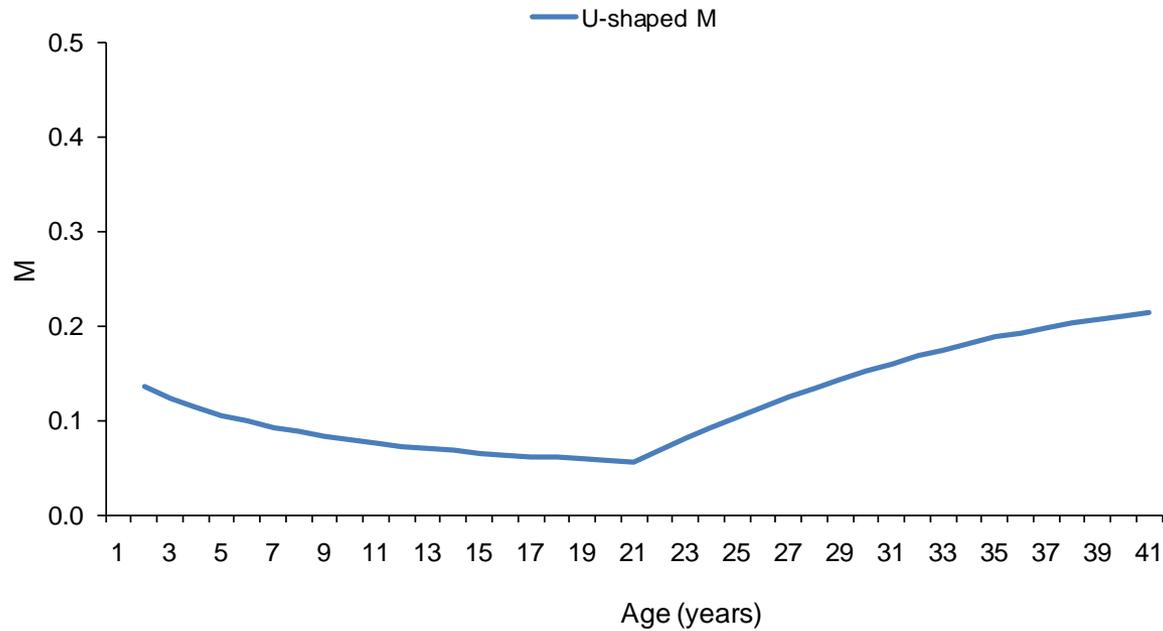


Biological inputs: natural mortality



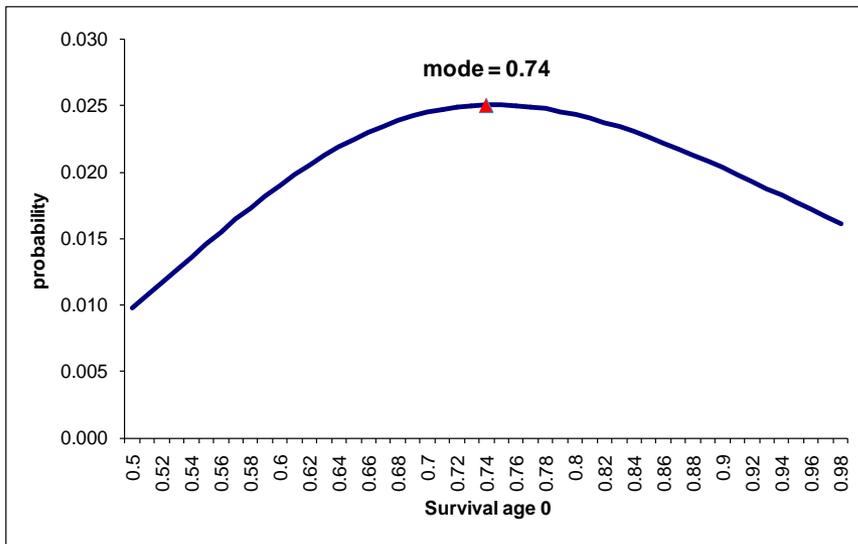


U-shaped natural mortality

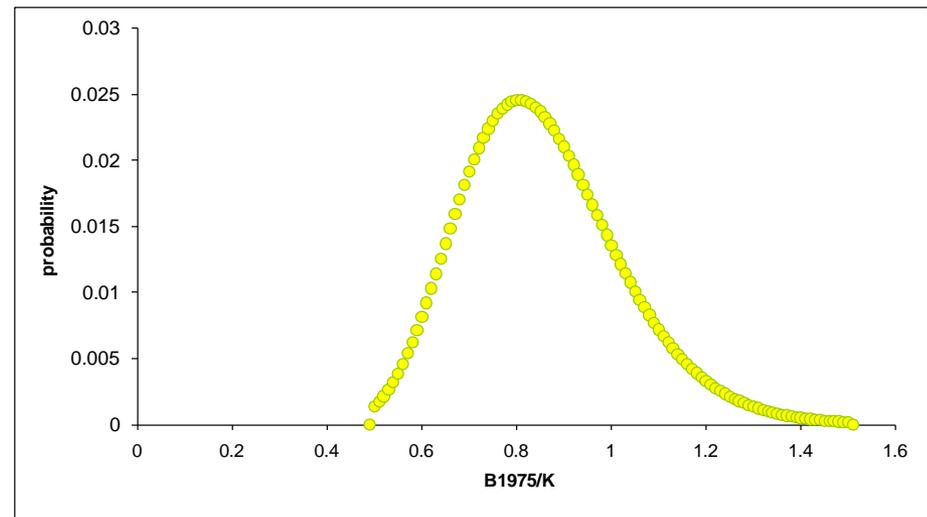




Prior distributions: pup survival and depletion at the start of modern period



Prior for S0:
Lognormal with median 0.81, CV = 0.3
 (mean = 0.84; mode = 0.74)
 bounds: [0.5 , 0.98]



Only 18% of distribution > 1 :
B1975/K ~ Lognormal w/ median = 0.83 , CV = 0.202
 (mean = 0.85 , mode = 0.80)

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Catch-free assessment model

Recruitment – parameterization for sharks

- Beverton-Holt spawner-recruit curve parameterized in terms of maximum reproductive rate at low density (Myers et al. 1999)
- Myers' α equivalent to slope of the spawner-recruit curve at the origin times unexploited numbers of spawners per recruit
- Slope of spawner-recruit function at origin equivalent to density independent pup survival (Brooks et al. 2009)



Steepness – Max. lifetime reprod. rate (α)

α = pup.survival X virgin.spawners.per.recruit

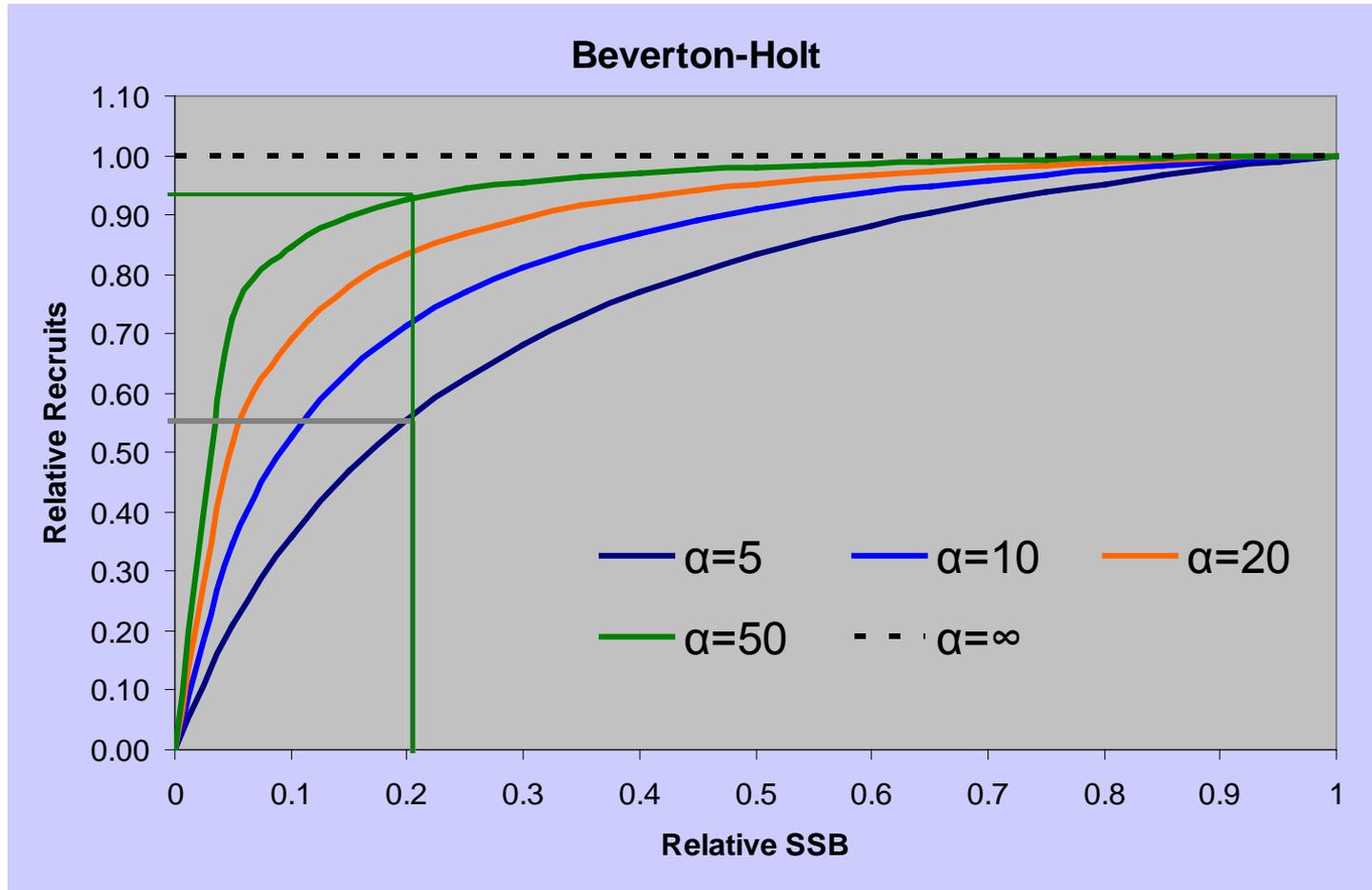
α = pup.survival X

$$\varphi_0 = \sum_{age} fec_{age} \cdot mat_{age} \prod_{j=1}^{age-1} e^{-M_j}$$

Steepness = $\alpha / (\alpha+4)$

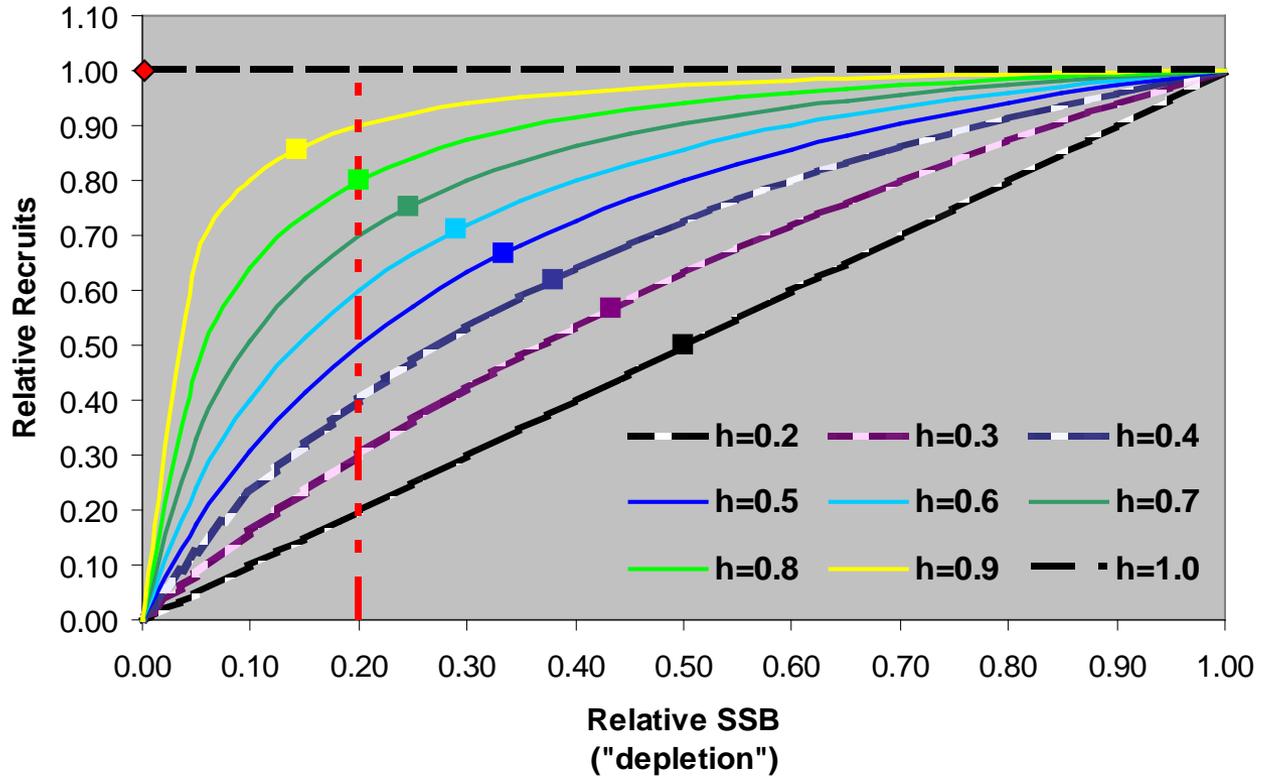


alpha	5	10	20	50	500000
(steepness)	0.56	0.71	0.83	0.93	1.00





Beverton-Holt





Selectivity Derivations

- Selectivity reflects both vulnerability to gear as well as availability to fishery
- Limited length-frequency data converted to age-frequency data through an age-length key
- Age-frequency data fitted statistically or by eye and considering collective knowledge of fisheries of AP participants (see “[ALK and selectivity computation_SEDAR 21_Sept162010_revised.pptx](#)” for details)