

Limit reference point examples – MarinTrust approved whole fish fisheries

Approaches to limit reference point:

- % unfished biomass: 27.5%, 25%, 20%, 15%, 8%
- stock-recruit: lowest biomass producing a good recruitment, or applying a break-point regression or Beverton-Holt SR model
- Biomass time series: lowest biomass in time series, or other low fixed value defined by time series

Country	species / stock	Target / trigger ref points	Limit ref points	General type of approach to setting ref points
Chile	anchoveta, Araucaria herring (several stocks)	F 55% or 60% SPR 55/60% SPR or 55% SB_0	25% SB_0 or 27.5% SB_0	% unfished biomass ($F=0$)
Chile	horse mackerel	Bmsy	Lowest historic SB relative to recent estimate of $SB_{F=0}$ – 8%	% unfished biomass
Denmark, Estonia, Finland, Latvia	Gulf of Riga herring	Fmsy, Bpa (average SB from $SBs \leq \text{median}$ but resulting in recruitment $\geq \text{median}$)	Bpa / 1.4	stock-recruit (empirical)
Denmark, Estonia, Finland, Latvia	sprat (several stocks)	Fmsy	SB resulting in 50% recruitment when BH stock-rec function is applied	stock-recruit (model)
Denmark	herring (several stocks)	Fmsy	15% B_0	% unfished biomass
Denmark, Norway	Norway pout, North Sea	B (prob. $B < B_{lim} < 5\%$); also max F (F_{cap}) = 0.7	Bloss (lowest point in time series – 2005)	biomass time series
Denmark	sandeel, North Sea	F_{cap} – maximum F resulting in $B > B_{lim}$ with 95% probability	B_{lim} – mean of two lowest SB estimates which resulted in recruitment $>$ median	stock-recruit (empirical)
Denmark	sprat (several stocks)	F_{cap} – maximum F resulting in $B > B_{lim}$ with 95% probability (long-term)	B_{lim} – breakpoint of hockey stick SR curve	stock-recruit (empirical)
Denmark	herring, North Sea	Fmsy	breakpoint of segmented regression of SR curve	stock-recruit (empirical)
Norway	capelin, Barents Sea	none	$SB = 200$ kt (Bescapement); lowest SB to produce a good year	stock-recruit (empirical)

			class (SB 1989). TAC set such that $SB > B_{lim}$ with 95% prob	
Panama	anchoveta, thread herring	60% B_0	20% B_0	% unfished biomass
Peru	anchoveta (south)	B_{msy} , F_{msy} (TAC fixed at 80% MSY)	?	
Peru	anchoveta (north)	5 million t, $E < 0.35$	4 million t (empirical)	biomass time series
South Africa	sardine, anchovy	none per se	'critical biomass' (fixed quantity, based on acoustic survey)	biomass time series