Yield per Recruit Analysis of the Hawaiian Yellowfin Tuna Fishery

Is there evidence to support increasing the minimum size limit for Yellowfin in Hawaii?

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Yield Per Recruit

Simple analysis to provide advice to fishery management

Requires only measures of fishing and natural mortality and growth

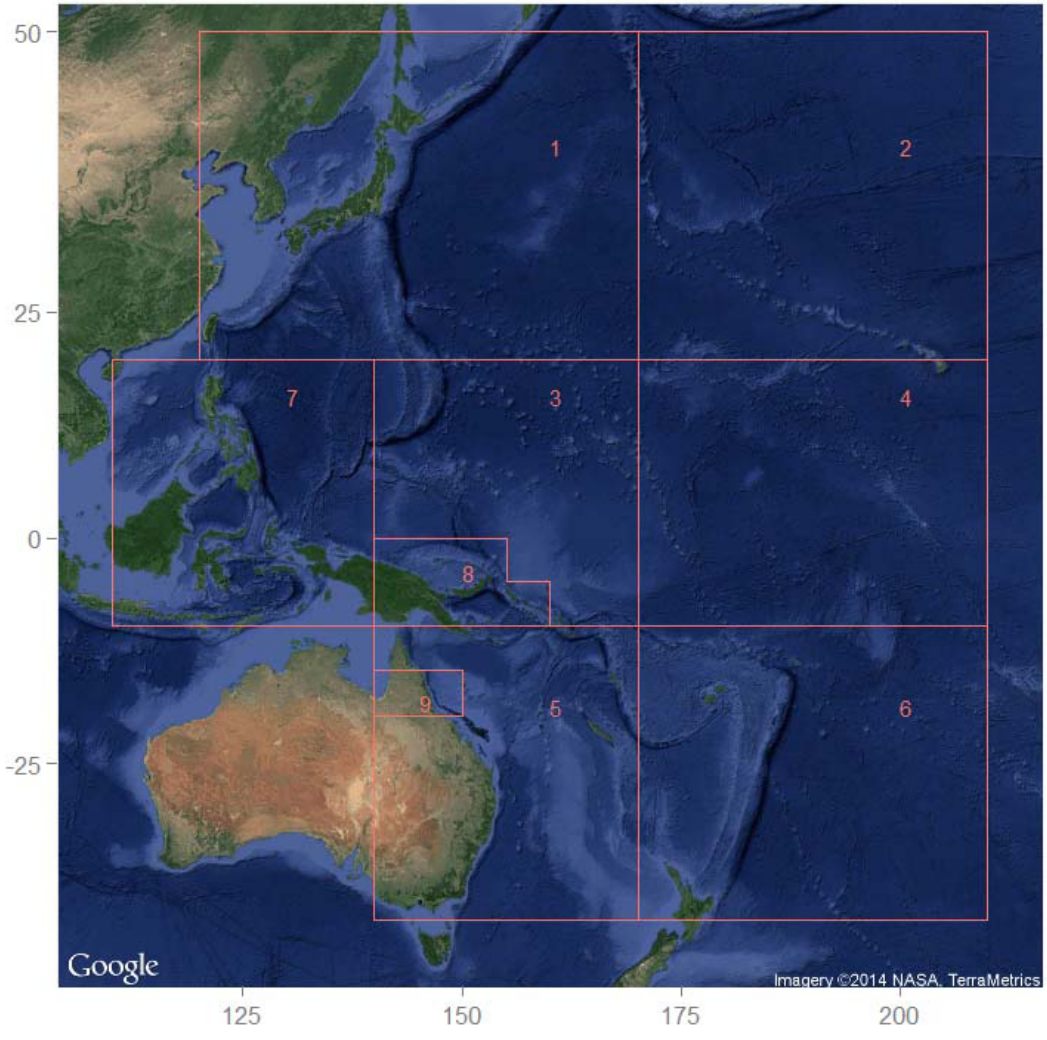
No advice about stock status

$$
\begin{aligned}
Z_a &= M_a + F_a && (1)\\
N_a &= N_{a-\Delta a} e^{-\Delta a Z_{a-\Delta a}} && (2)\\
N_0 &= 1 = R && (3)\\
Y_a &= F_a N_a W_a && (4)\\
\frac{Y}{R} &= \sum_a Y_a. && (5)
\end{aligned}
$$

Estimates M_a and F_a available from two sources: WCPFC and HTTP

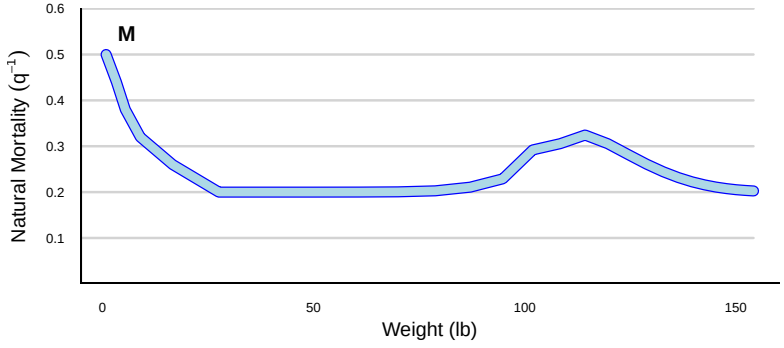
WCPFC Multifan-CL Yellowfin Stock Assessment

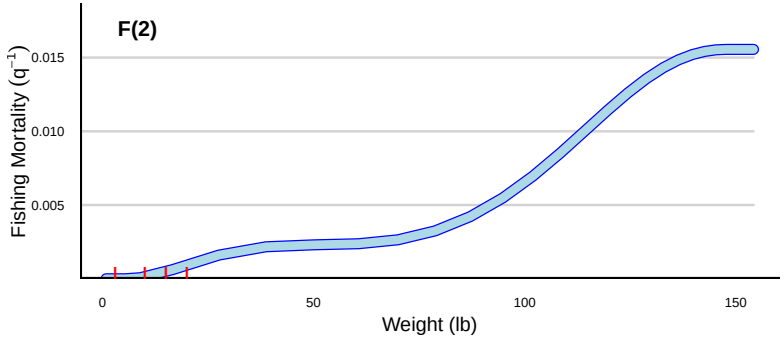
(A "worked" example)

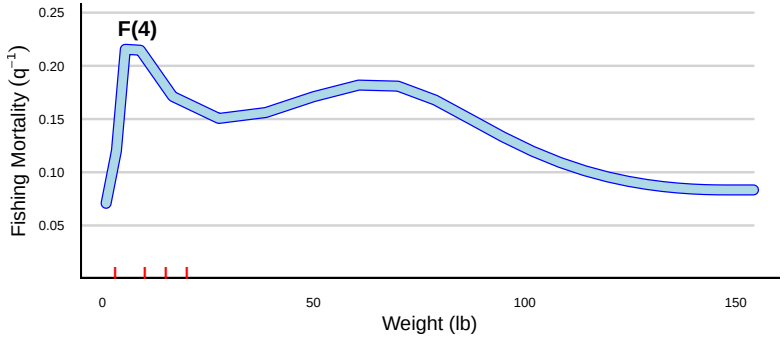


MFCL Mortality Values

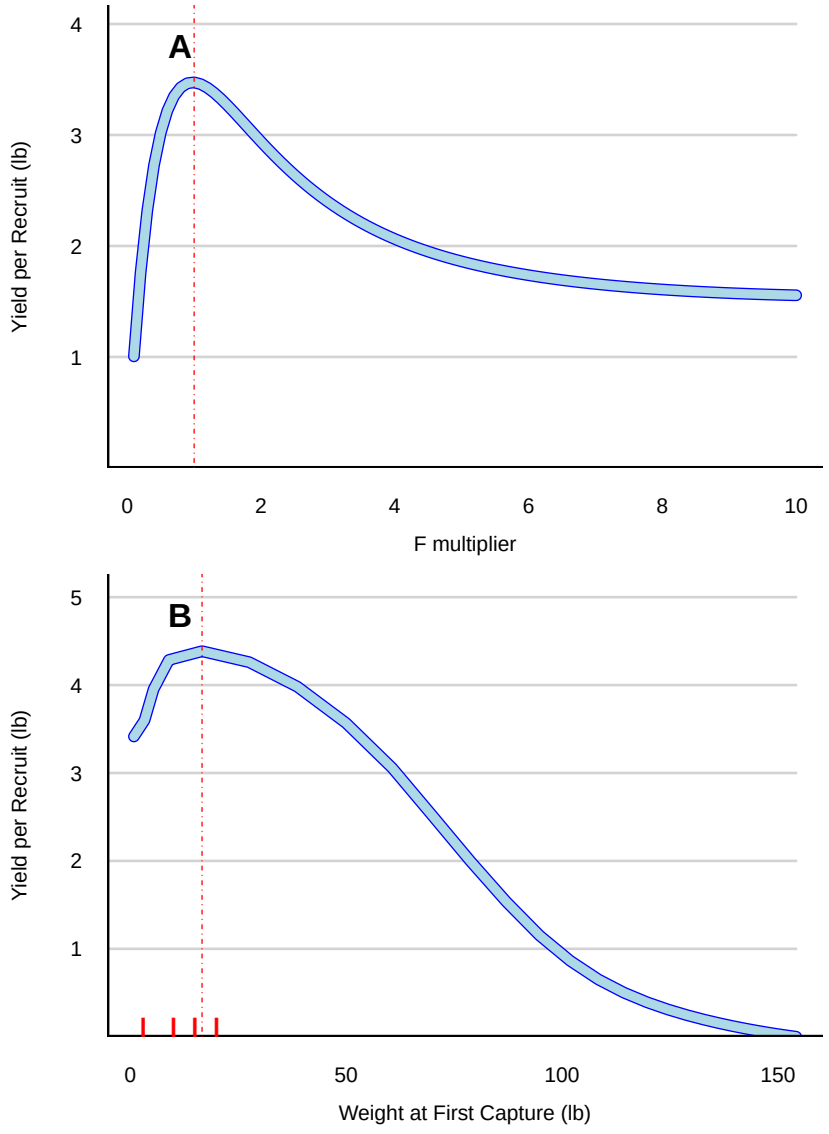
(M specified "reference case"; F estimates averaged 2008 - 2012)



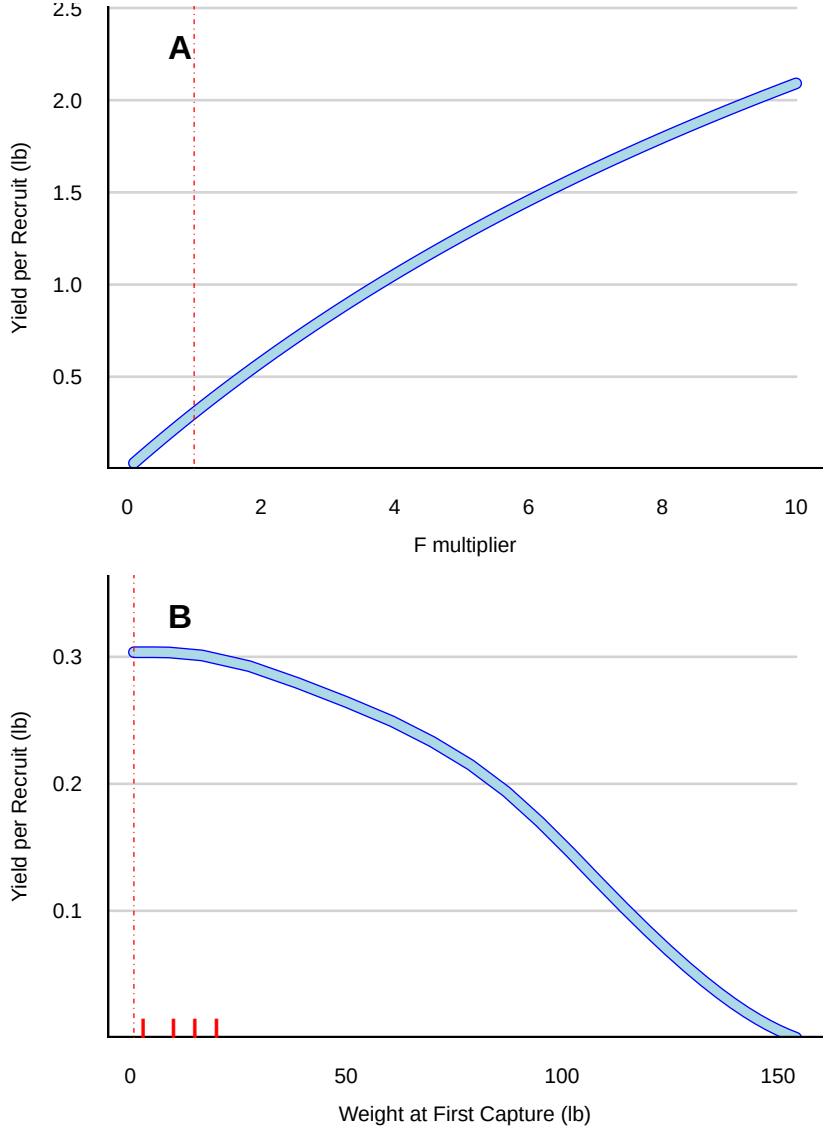




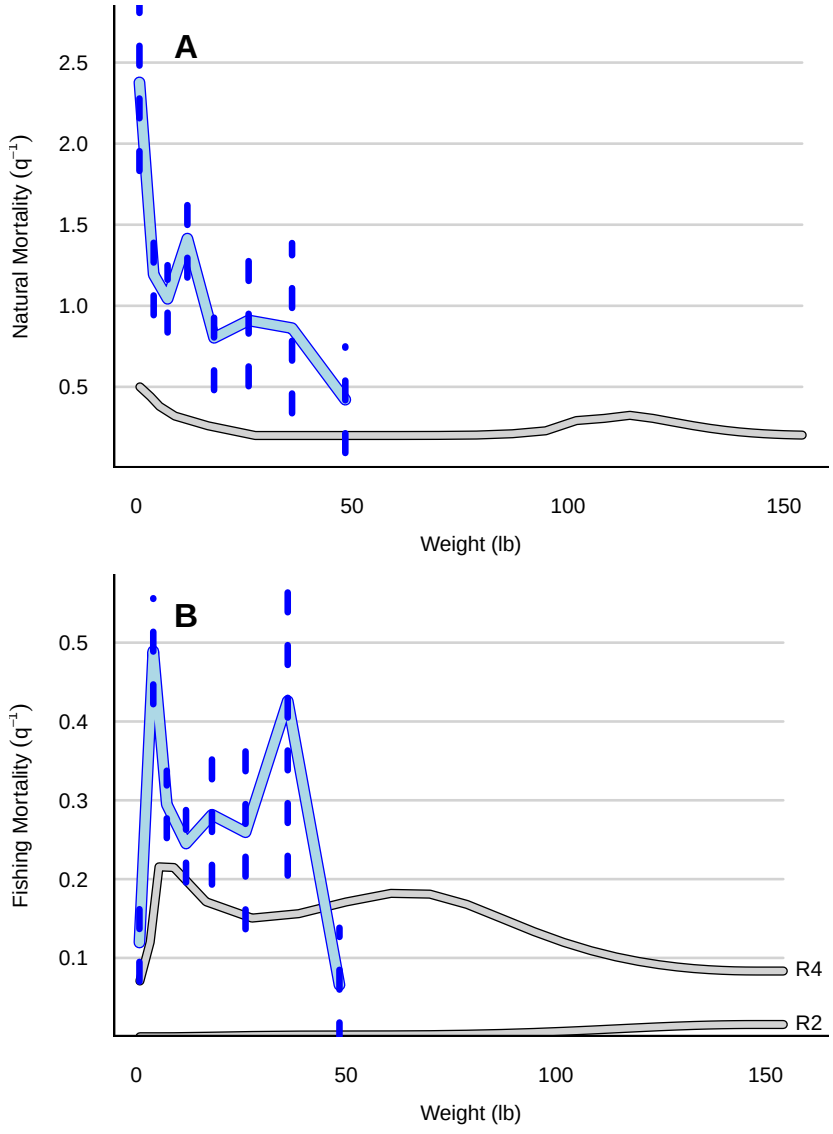
YPR Region 4: 10°S to 20°N



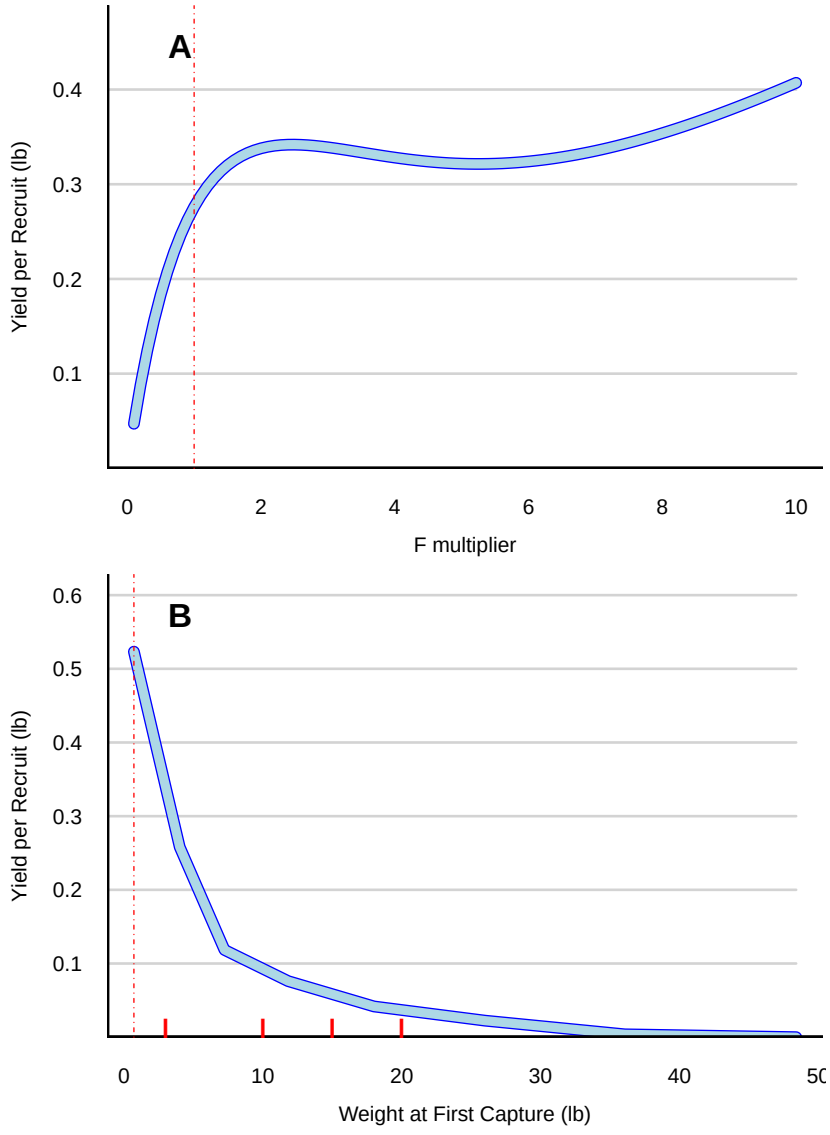
YPR Region 2: 20°N to 50°N



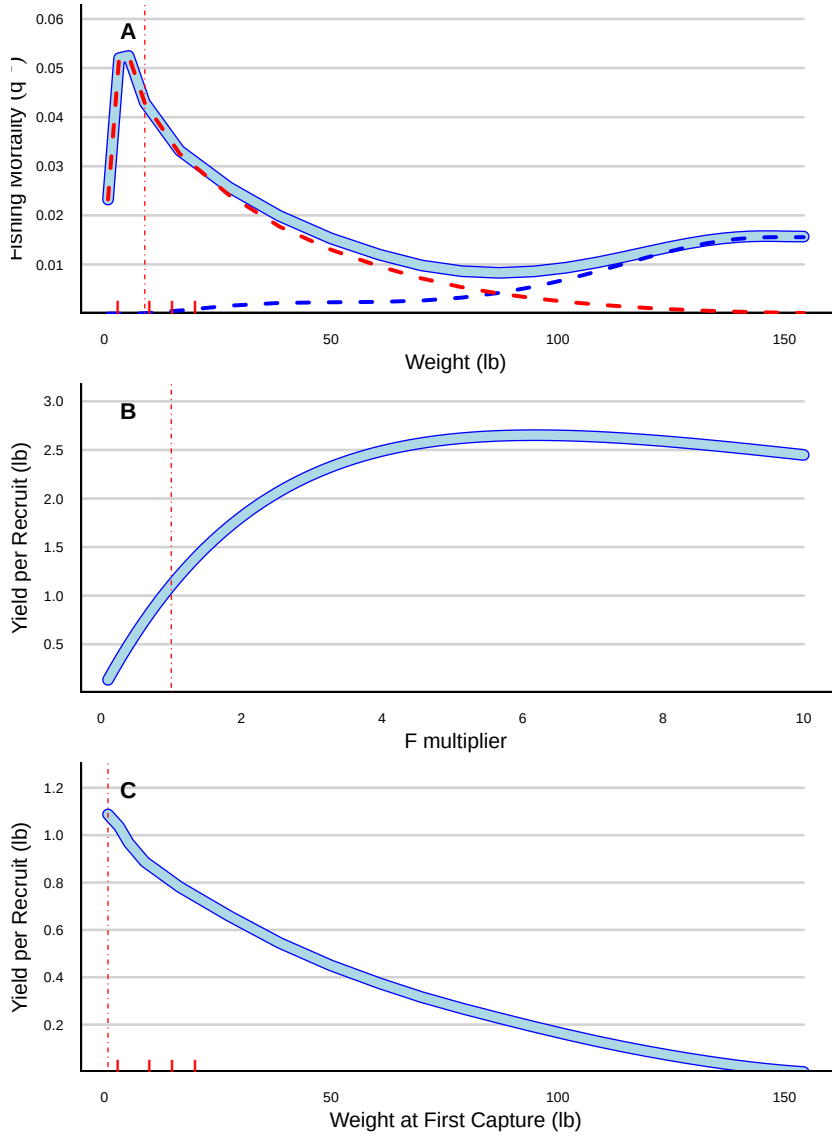
HTTP Mortality Estimates; 1995 – 2000



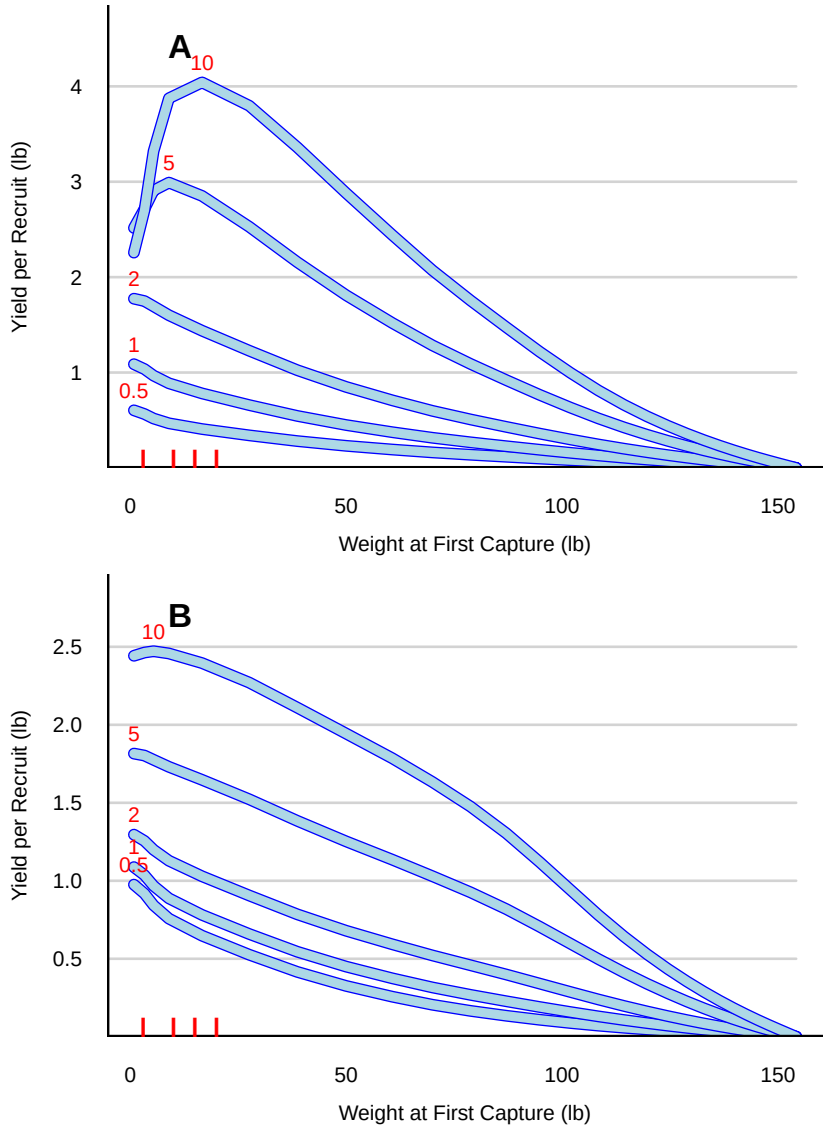
YPR Main Hawaiian Islands (HTTP estimates)



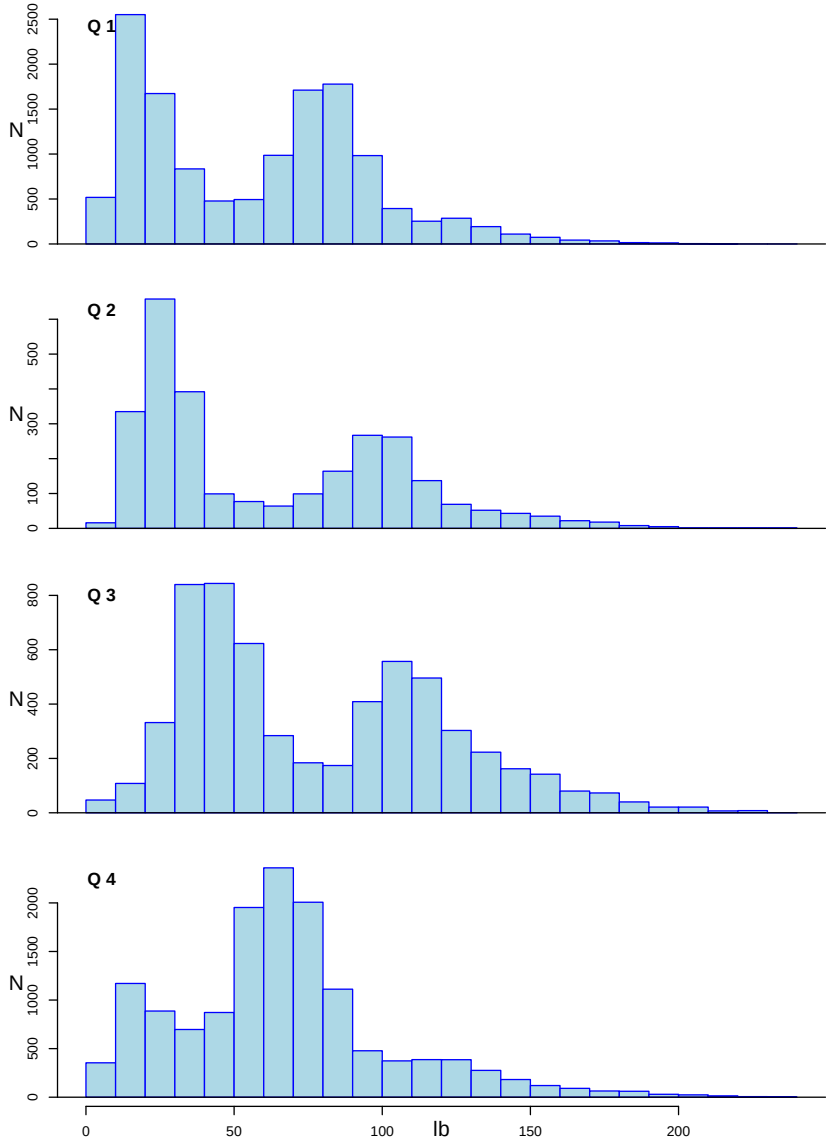
Hypothetical Region 2 Fishing Mortality



Hypothetical Region 2 Fishing Mortality



NOAA Weight-Frequency Data, 2000 – 2013



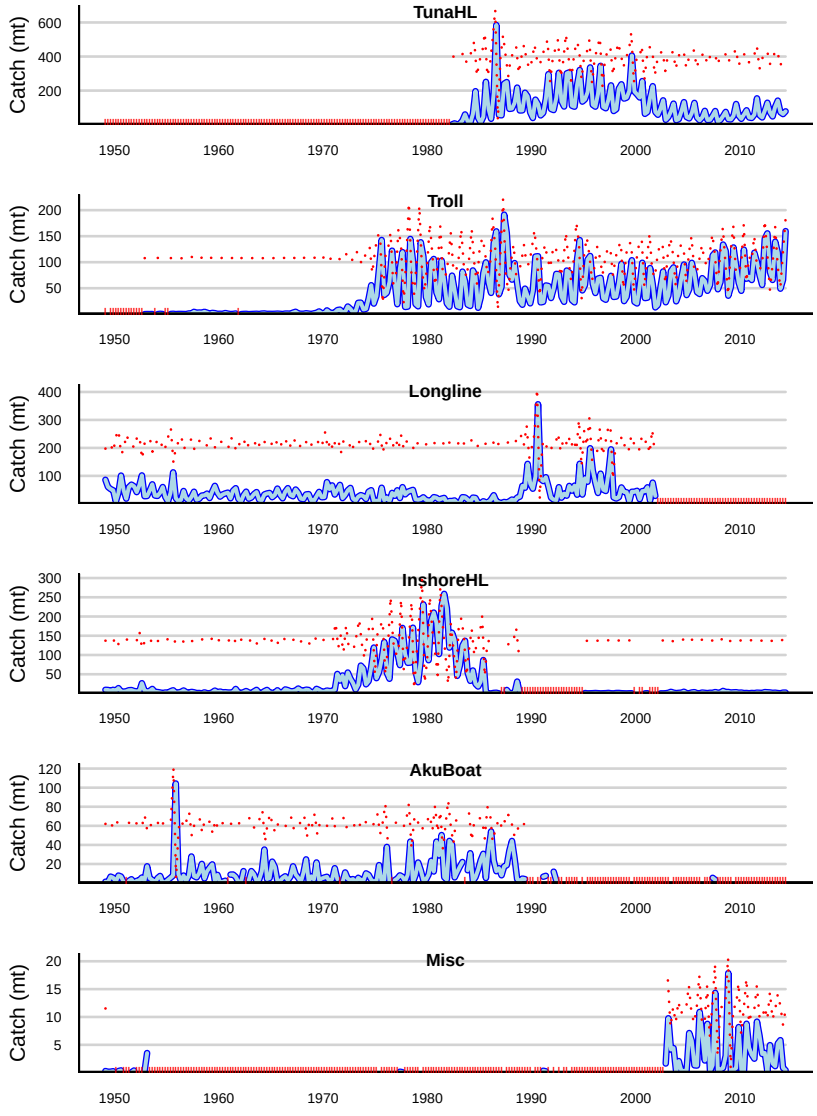
Conclusions

1. The YPR analysis for MFCL Region 4 shows clearly that increasing the size at first capture would increase the yield to the entire fishery. Whether such a change in minimum size in Region 4 would benefit the MHI yellowfin fishery is unknown.
2. The YPR analysis for MFCL Region 2 is inconclusive because only longline catches from Region 2 are included in the assessment.
3. The YPR analysis using mortality estimates from tagging data is also inconclusive because few tags from large fish fish were returned.
4. Total yield to the fishery is insensitive to age at first capture for hypothetical fishing mortality profiles less than five times current fishing mortality levels.
5. Available data on size distribution of commercial catch does not show a large catch of small fish.
6. There is no clear benefit to the fishery of increasing the minimum size restriction.

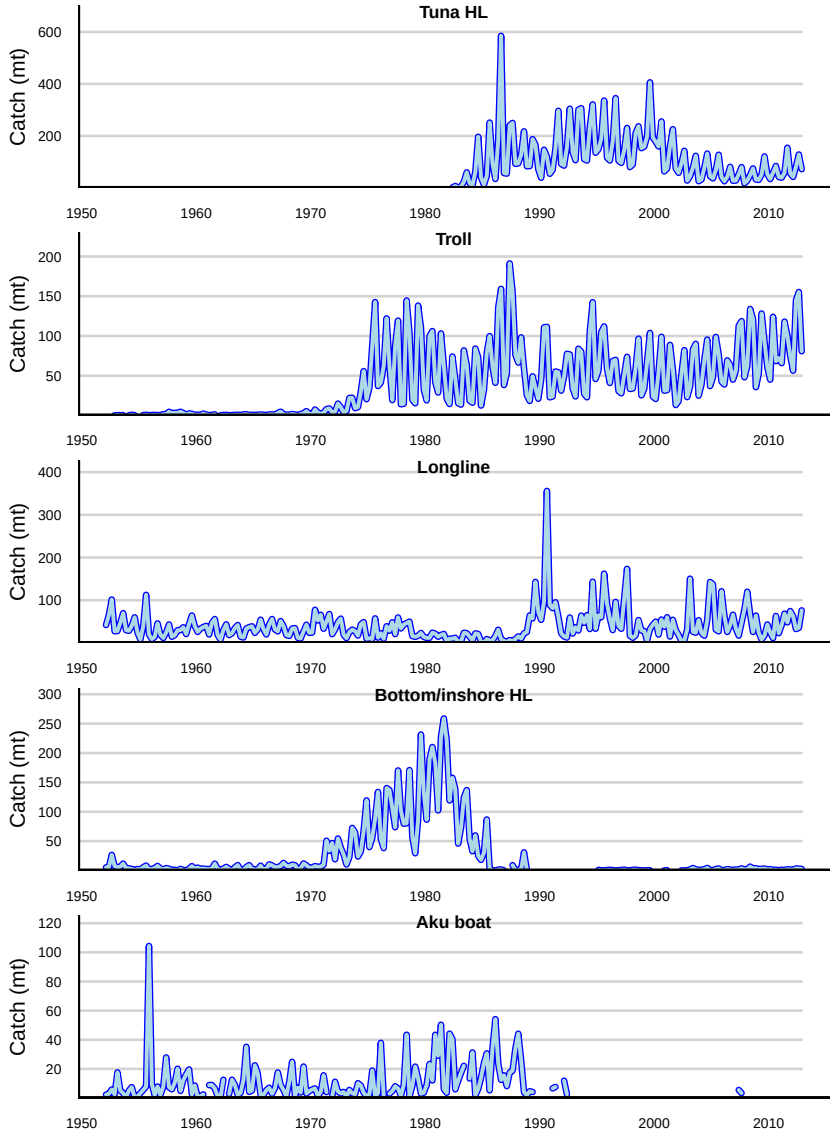
Next Steps?

1. Further YPR analysis on existing information base unlikely to change conclusions.
2. HTTP tag recapture data base should be updated and reanalyzed to improve mortality estimates.
3. The WCPFC convention area stock assessments could potentially to assist in addressing management issues in Hawaii, but MFCL regions need realignment, and mortality of non-longline fleets should be accommodated.
4. MHI stock assessment and fishery management software should be developed.
5. Collect relevant catch and size data that represent the fishery.

HDAR Yellowfin Landings, 1949 – 2014



Yellowfin landings in Hawaii, 1952 – 2012



NOAA Weight-Frequency Data, 2000 – 2013