A New Proposed Method for Analyzing Bag and Size Limits

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Background

- The Council decided to consider a bag limit increase for Black Sea Bass.
- Bag limit decrease straight forward: Any trip landing above the proposed bag limit has landings reduced to the new bag limit.
- How have we handled bag limit increases?
  - Only a problem very recently.
  - Assume any trip that reached the current bag limit will reach the new bag limit.
  - Refinement: Increase catch of trips reaching current bag up to the number of reported discards.

Background

- Assumption of current refined method: All discards on trips that reach the bag limit are discarded due to reaching the bag limit.

- Looking at Black Sea Bass data, ~89% trips encountering BSB had no landings of BSB, <1% trips reached bag limit, and discards made up over 93% of the total catch.

- These data suggested the size limit was the driving force of the discards.
  - So, it's probable that most of the discards, even on trips reaching the bag limit, are from size limit.
  - The Council is now considering decreasing the size limit, for which there is no established analysis.

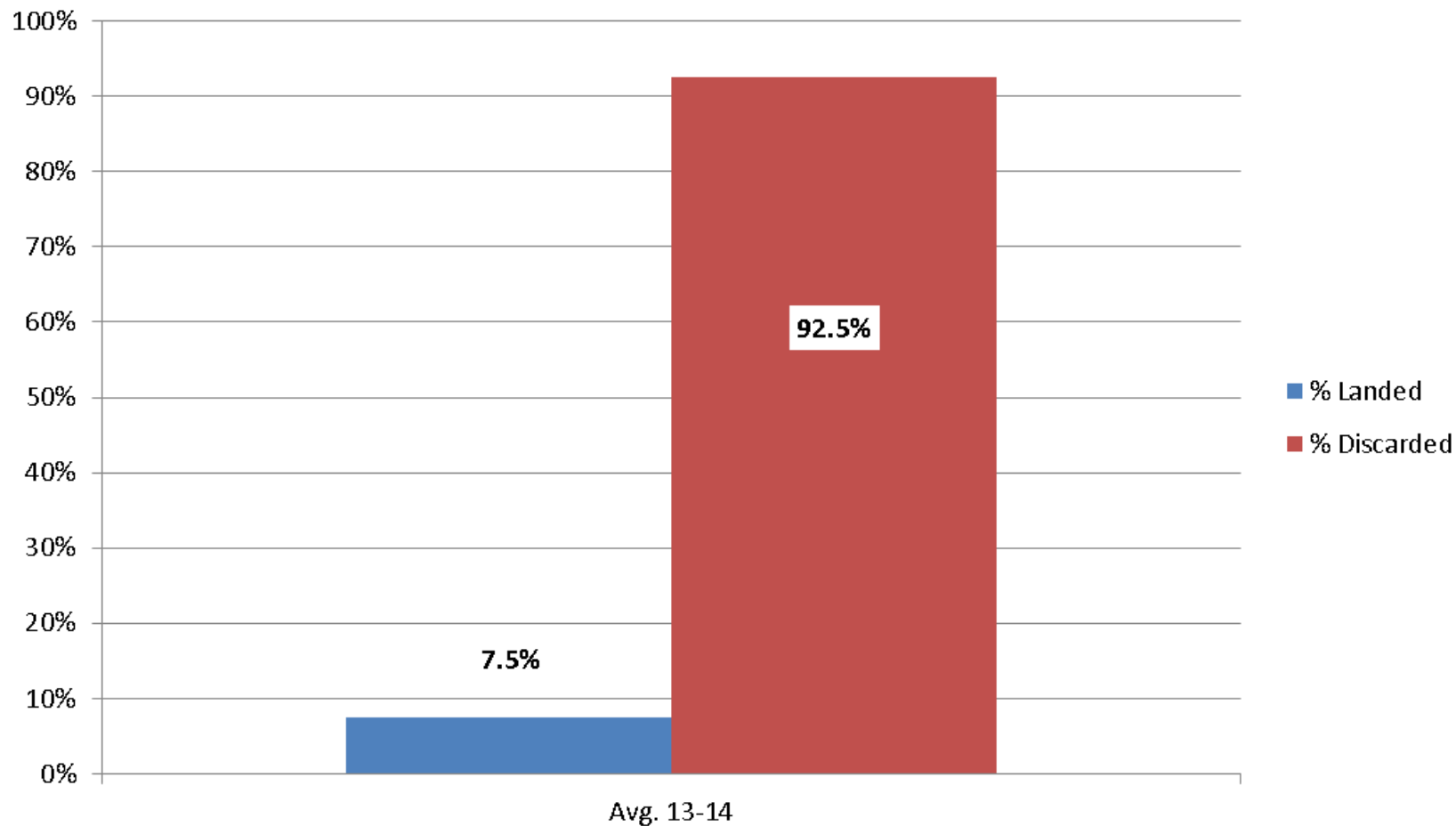# % Trips that Did and Did Not meet the Bag Limit 2013-2014
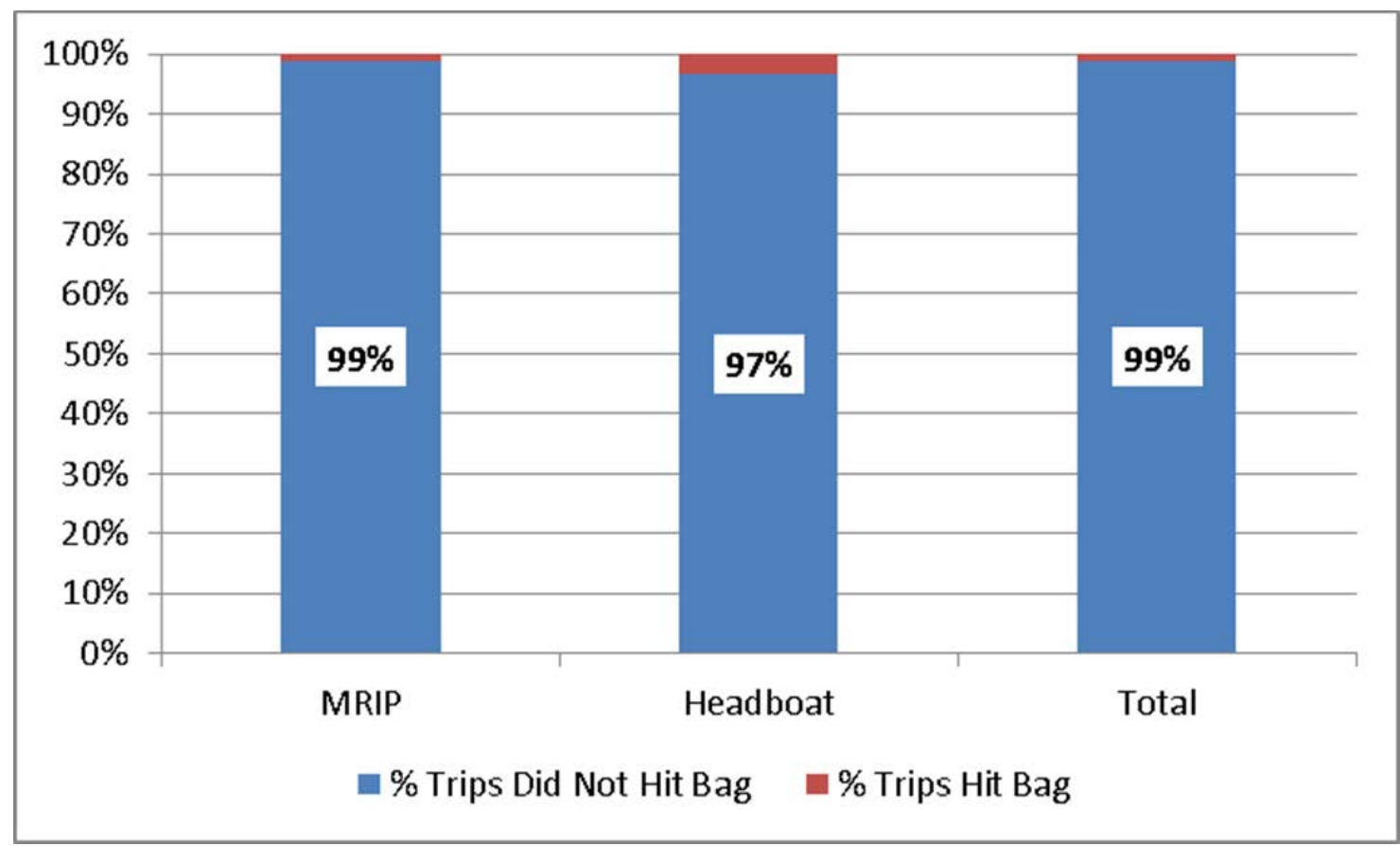
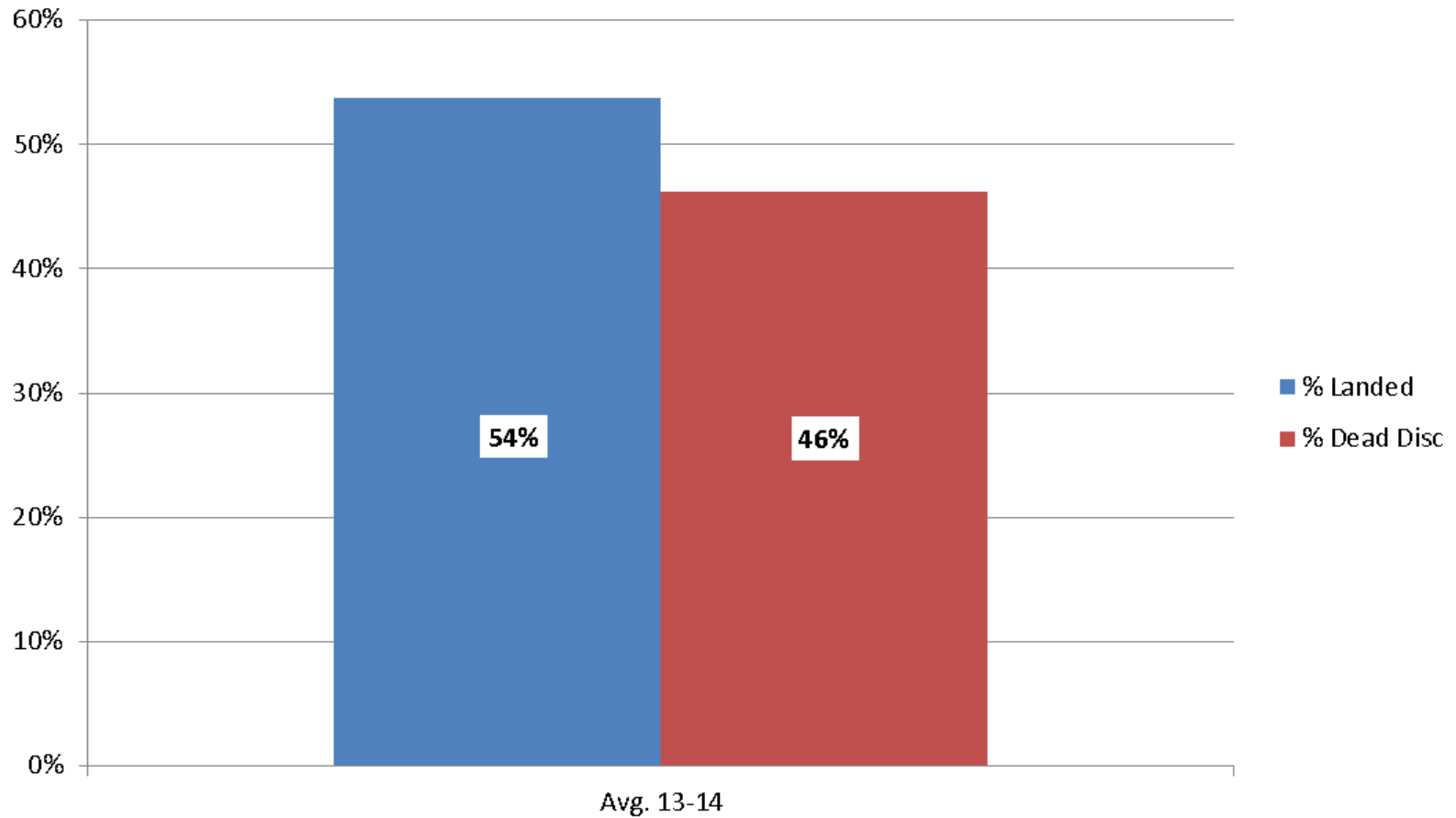# % Trips within Landings/Angler Bins (Landings of BSB)
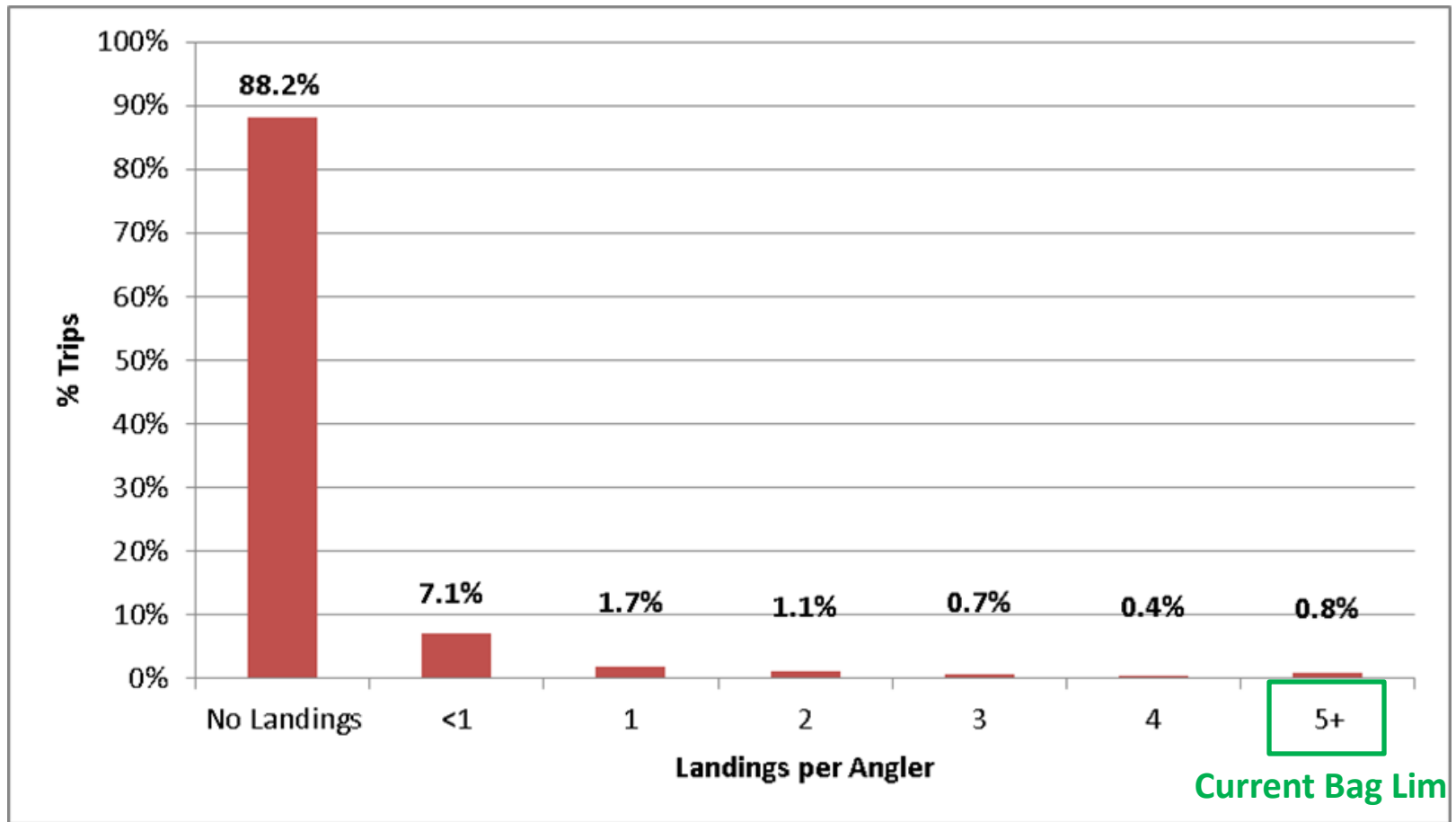
% Landings and Total Discards of BSB on All Rec Trips

% Landings and Dead Discards of BSB on All Rec Trips

New Proposed Method

- Goal: Find a way to estimate the proportion of discards above and below the minimum size.

- Assumptions
  - All discards on trips not reaching bag limit are due to size limit.
  - Discards on trips reaching bag limit can be either from bag or size limit.
  - On headboats not reaching the total bag limit (add bag of all anglers), some of the anglers did reach the bag limit and some of the discards from those anglers may be due to the bag limit rather than the size limit.

Selectivity

- Discard selectivity from SEDAR 25 and 2013 update
  - Assumed most discards are due to the size limit.
  - Applies to those fish selected to be discarded at age.
  - Dome shaped with age 3 being age at full selection, meaning 100% of age 3 fish that were selected by the fishery were discarded.
  - Ages 0-2 were estimated directly in the model.
  - Ages 4+ were calculated as the probability at age of being below the size limit, assuming a normal distribution of size at age.
    - Allows changes to descending limb with changes in min size.
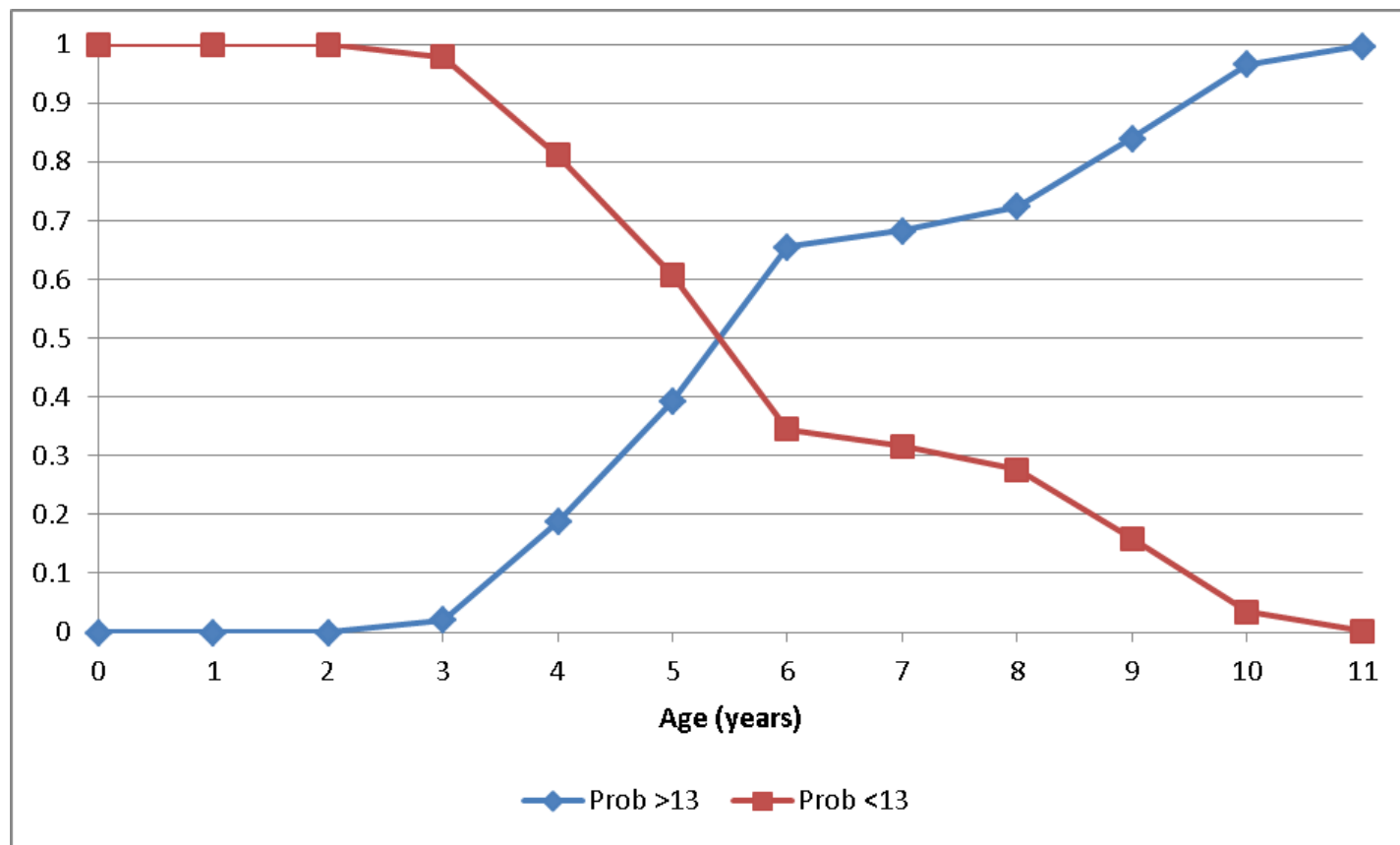
New Proposed Analysis

- Use model predicted numbers at age and discard selectivity curves to estimate the size composition of discarded fish on trips that reached the bag limit.
- For BSB, discard selectivity needed to be adjusted due to implementation of a new size limit after the assessment was conducted.
  - This is also true when analyzing changes in the size limit.
- Use data from SERFS to calculate the probability at age that a fish is above or below the minimum size.
  - Independent sampling data used due to fishery dependent samples being skewed from having a min size.
  - Assume distribution of size at age is Normal (SEDAR 25 and 2013 update).
 - Pooled all available years of data as in SEDAR 25 and 2013 update.

New Proposed Analysis

- Set selectivity for ages 4+ equal to the probability of being below the min size to get the new discard selectivity at age for fish **below** the minimum size.
  - o For ages 3 and younger use model estimated discard selectivity.
- For fish **above** the min size, need to multiply the probability at age of being above the min size by the proportion of trips that reached the bag limit to obtain the discard selectivity.
  - o Due to assumption of only trips reaching bag limit will discard fish above the min size.
  - o Assumed to be zero for ages 0-3, supported by SERFS data.

Prob at Age of being >13" and <13" Min Size from SERFS Data

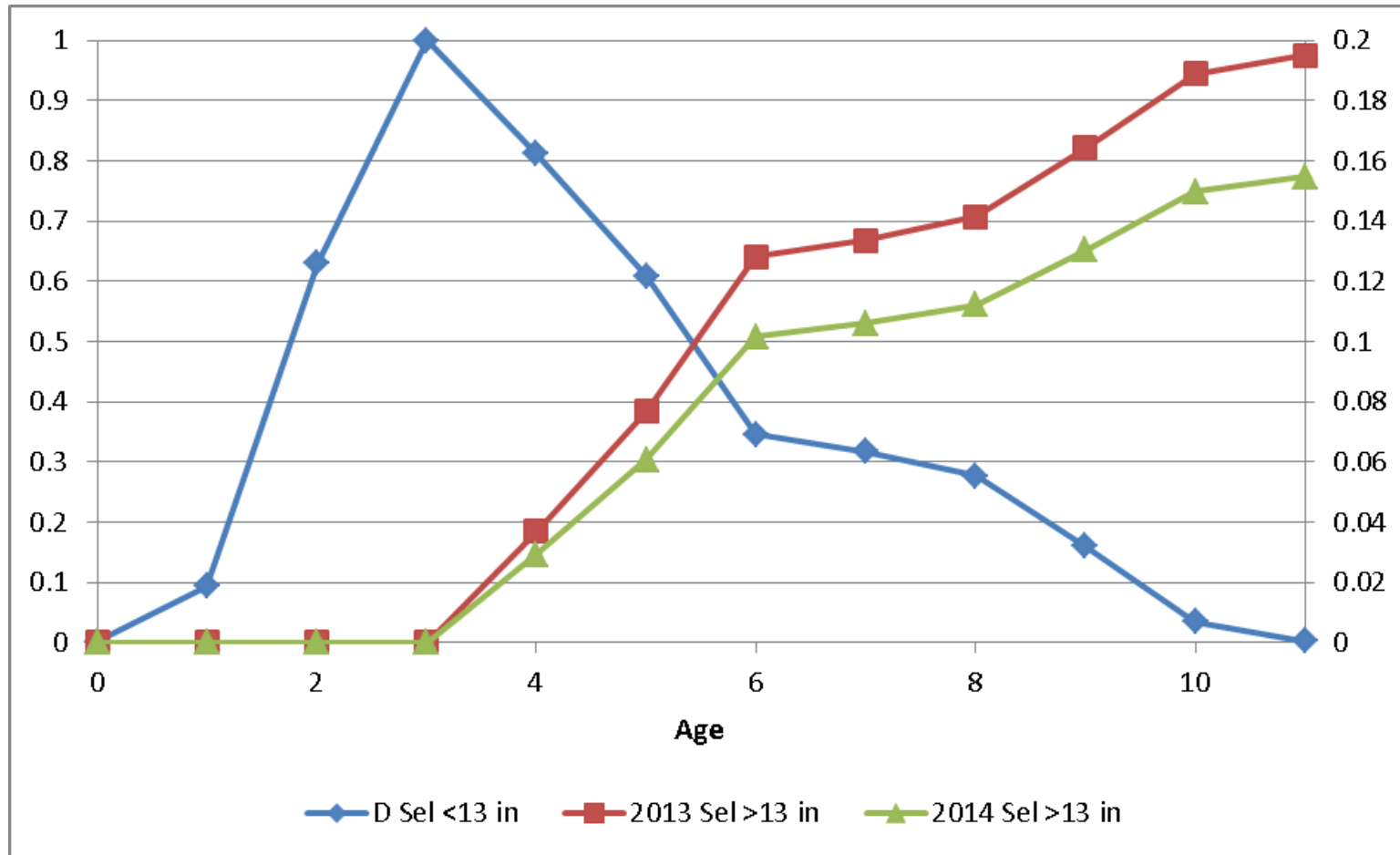# Calculated MRIP Discard Selectivities
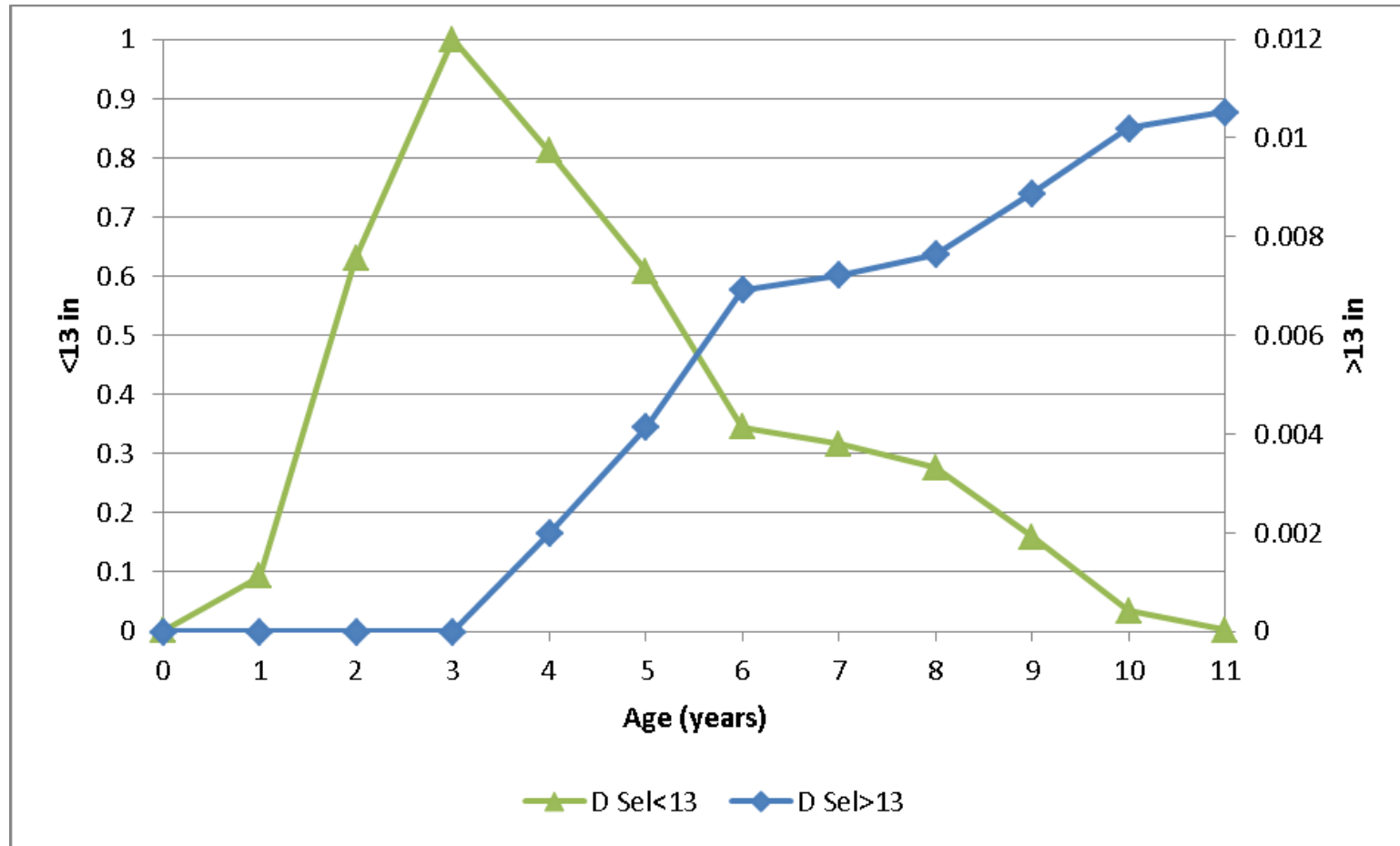
New Proposed Analysis

- For calculating discard sel of headboat trips not reaching the bag, also need to multiply by proportion of anglers that reached the bag on those trips.
  - o Done for each year separately, but can combine years.
  - o Estimated by dividing the total number of fish landed by the total trip bag limit (num angs * bag lim).
  - o This gives an estimate of the maximum number of anglers on that trip that could have reached the bag limit.
  - o Ex. 5 fish bag limit, 100 fish landed, 50 anglers on board would lead to an estimated 20 anglers maximum that reached their bag limit.

Calculated HB Discard Selectivities for Trips Not Reaching the Bag

Calculated HB Discard Selectivities for Trips Reaching the Bag
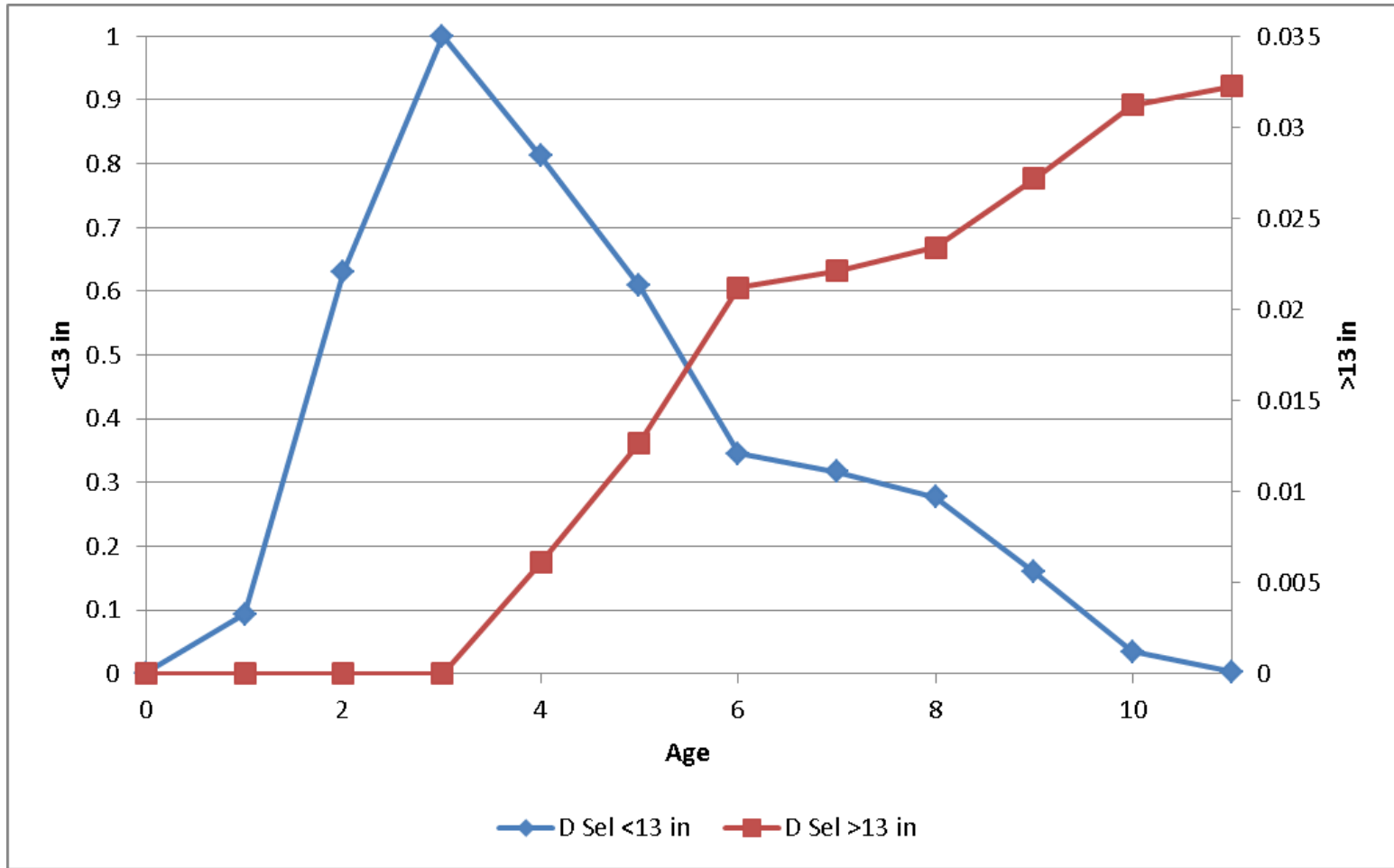
New Proposed Analysis

- Multiply each discard selectivity at age by the estimated numbers at age, for the year interested in, to get the predicted number of discards above and below the min size.
  - o For BSB, only had numbers at age up to 2012 but analyses were done using intercept data from 2013 and 2014. Assumed 2012 was representative of 2013 and 2014.
  - o In future, SEFSC will produce estimated numbers at age for each projection year as well, eliminating need for previous assumption (SEDAR 41).

New Proposed Analysis

- Divide total number of discards above and below min size by the total number of discards to get the proportion of discards above and below the min size, respectively.

- Multiply the proportion of discards above the min size by the total discards reported on trips that reached the bag to get the number of discards that would have been retained under a larger bag limit.

- Do not need to account for discard F rates or discard mortality rate since these quantities cancel out when the proportion of discards above and below the min size is calculated.

Formula for Calc Prop Disc >Min Sz

$$\frac{\sum_a\left(S_a^{D,>min}\cancel{F^D}N_a\right)\Big/\cancel{M^D}}{\left(\sum_a\left(S_a^{D,<min}\cancel{F^D}N_a\right)\Big/\cancel{M^D}\right) + \left(\sum_a\left(S_a^{D,>min}\cancel{F^D}N_a\right)\Big/\cancel{M^D}\right)}$$

$S_a^{D,>min}$ – Discard selectivity for fish greater than the minimum size at age a

N_a – Total abundance at age a

$S_a^{D,<min}$ – Discard selectivity for fish less than the minimum size at age a

M^D – Discard mortality rate

F^D – Fishing mortality rate for dead discards

Discard Sel for MRIP Data

Age	Discard Selectivity		2012 Abundance (numbers)
	Size Limit	Bag Limit	
0	0.001	0	33,042,170
1	0.093	0	13,459,560
2	0.63	0	8,842,770
3	1	0	4,277,590
4	0.812	0.002	1,542,900
5	0.608	0.004	516,580
6	0.345	0.007	145,210
7	0.317	0.007	33,720
8	0.276	0.008	8,310
9	0.160	0.009	3,840
10	0.034	0.010	1,490
11	0.003	0.011	900

Discard Sel for Headboat Data

Age	Trips Hit Bag		Trips Did Not Hit Bag				2012 Abundance (num)
	Size Limit Sel	Bag Limit Sel	Size Limit Sel	Base Bag Limit Sel	2013 Bag Lim Sel	2014 Bag Lim Sel	
0	0.001	0	0.001	0	0	0	33,042,170
1	0.093	0	0.093	0	0	0	13,459,560
2	0.63	0	0.63	0	0	0	8,842,770
3	1	0	1	0	0	0	4,277,590
4	0.812	0.006	0.812	0.188	0.037	0.029	1,542,900
5	0.608	0.013	0.608	0.392	0.077	0.061	516,580
6	0.345	0.021	0.345	0.655	0.128	0.102	145,210
7	0.317	0.022	0.317	0.683	0.134	0.106	33,720
8	0.276	0.023	0.276	0.724	0.141	0.112	8,310
9	0.160	0.027	0.160	0.840	0.164	0.130	3,840
10	0.034	0.031	0.034	0.966	0.189	0.150	1,490
11	0.003	0.032	0.003	0.997	0.195	0.155	900

Est % Discarded BSB Above and Below 13" Min Size
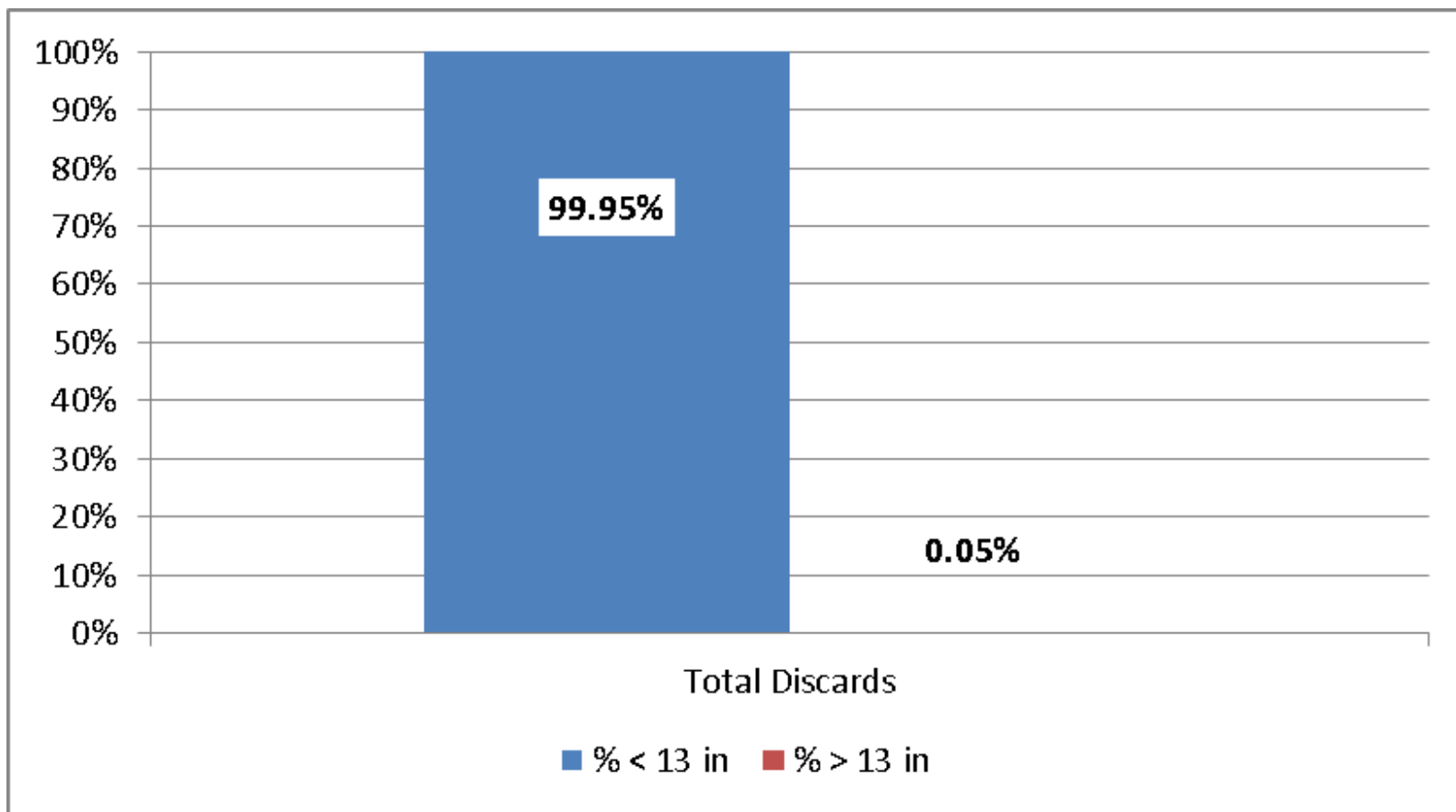
Conclusions

- Allows estimation of proportion discards due to the bag limit as opposed to the size limit.

- Allows analysis of bag limit increases by basing assumptions on observed/reported data.

- Can also be used for size limit decrease analyses.
  - o Calculating a discard selectivity for each proposed size limit.
  - o Using these selectivities to estimate what proportion of the discards can be added to the catch with each of the proposed size limits.

Questions?