Thoughts on developing a trigger consequence bycatch rate that is linked to PBR

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Introduction

In preparation for the Feb 13-14 HPTRT webinar meeting, we developed a method to estimate a trigger consequence bycatch rate linked to a pre-specified target level, such as PBR, a percentage of PBR, or ZMRG.

This method calculates a bycatch rate for pre-defined regions that would, under past fishing effort scenarios, keep total past harbor porpoise takes below the pre-specified target level. These regional bycatch rates could be used as trigger consequence bycatch rates so long as the average future landings are similar to the last couple of years. Consequences could be triggered if these regional trigger consequence bycatch rates were exceeded.

The trigger consequence bycatch rates were calculated using the following process: 1) for each of the three pre-defined regions, determine its regional portion of the target level so that the sum of the individual regional target levels is the overall target; 2) given each regional target level, use recent levels of landings within the region to calculate the corresponding regional trigger consequence bycatch rate.

In this example, three regions were pre-defined which encompass the entire fishing times and areas that interact with harbor porpoises: the Mid-Atlantic, Southern New England, and Gulf of Maine regions. The target level is PBR, though other target levels and other issues to consider are discussed later. To complete the first step, the total estimated annual bycatch for each region for the last eight years was collated, and the average percentage of historical annual takes for each region was then calculated (Table 1). The last eight years were chosen for this analysis to encompass a wide degree of variability over time, and because the estimates since 2004 were well documented, allowing the estimates to be easily divided into regions. The pre-specified target level was then divided by these percentages to yield individual regional portions of the target level. The data used are in several NOAA Lab Reference Reports from 2004 through 2011 (see http://www.nefsc.noaa.gov/publications/crd/). These data are the same as those used to calculate the annual estimates found in the Stock Assessment Reports (SARs). Bycatch was assigned to regions based on the same management areas and port groups used to calculated the annual SAR estimates. The East of Cape Cod port group was assigned to the Southern New England region based on the extent of the current Southern New England management area and observed fishing locations largely within this management area.

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Table 1. Annual Estimated Harbor Porpoise Takes by Region

Calendar Year	Mid-Atlantic	SNE (annual)	GOM (annual)	TOTALS	MidAtl %	SNE %	GOM %
2004	135	483	172	790	17.09%	61.14%	21.77%
2005	470	345	285	1100	42.73%	31.36%	25.91%
2006	512	332	182	1026	49.90%	32.36%	17.74%
2007	58	281	115	454	12.78%	61.89%	25.33%
2008	350	264	403	1017	34.41%	25.96%	39.63%
2009	201	232	359	792	25.38%	29.29%	45.33%
2010	257	274	113	644	39.91%	42.55%	17.55%
2011	123	164	159	446	27.58%	36.77%	35.65%
AVG	263.25	296.875	223.5	783.625	33.59%	37.88%	28.52%
CV					0.22	0.23	0.19

Bycatch shown in Table 1 is based on fishing location if within a management area, and by port group if the fishing did not occur within a designated management area (which is the same process used to calculate the annual SAR bycatch estimates). So, under this method, it would be possible for a fishermen based out of a New England port to fish in a Mid-Atlantic management area and have any harbor porpoise caught counted towards the Mid-Atlantic portion of the target level.

Next, the historical percentage of annual takes (Table 1) was used to apportion the target level to each region by multiplying the percentage of takes for each region by the current target thus resulting in a regional target for each region (Table 2).

To complete the second step, the regional allocation was divided by the average total metric tons landed in the corresponding time/area to result in the trigger consequence bycatch rate for each region (e.g., for the Mid-Atlantic (row 1 in Table 2), the calculations are 706*33.59% = 237 (the regional target), and 237/4647.85 = 0.051 (the regional trigger consequence bycatch rate).

Table 2. Trigger consequence bycatch rates for three regions and seasons that is linked to PBR, based on historical regional takes and 3-years of recent landings. The three regions are the Mid-Atlantic (Mid-Atl), Southern New England (SNE) and the Gulf of Maine (GOM).

Region	Season	Target level = PBR	%	Regional Target	Avg 3-yr Landings	Regional Trigger Bycatch Rate
Mid-Atl	Jan-Apr	706	33.59%	237	4647.85	0.051
SNE	Nov-June	706	37.88%	267	5806.32	0.046
GOM	all	706	28.52%	201	8179.43	0.025

In Table 2 above, the 3-year average metric tons landed was calculated using the most recent three years of landings, in this case 2009-2011. The recent three year time period was chosen because of the

team's preference for using recent landings when assessing bycatch options. These landings also corresponded to those used in the SAR estimates. The landings used in these calculations are for the entire season when harbor porpoise were caught in those regions.

Using this same general process, trigger consequence bycatch rates could be calculated for individual seasons instead of annually. Similarly, the target level could be some percentage of PBR, to provide a cushion between PBR and the trigger consequence bycatch rates, or to allow for bycatch occurring in other areas (such as Canada) or in other gears (such as trawls). Alternatively, the target level could be set to 10% of PBR (i.e., the "insignificance threshold" or "ZMRG"), as done below in Table 3. Another option is to not create regions or seasons, but instead set the trigger level for the entire New England and Mid-Atlantic gillnet fisheries, as done below in Table 4.

Other possible variations could also be considered. Such as, a confidence of variation (CV) or 95% confidence interval could be calculated and reported for the regional target levels and perhaps somehow be used to compare to the actual bycatch rate for a region. Also, other years could be used in steps 1 or 2.

Table 3. Trigger consequence bycatch rates for three regions and seasons that is linked to a target bycatch level of ZMRG, based on historical regional takes and 3-years of recent landings. The three regions are the Mid-Atlantic (Mid-Atl), Southern New England (SNE) and the Gulf of Maine (GOM).

Region	Season	Target Level = ZMRG	%	Allocation	Avg 3-yr Landings	Trigger Bycatch Rate
Mid-Atl	Jan-Apr	70.6	33.59%	24	4647.85	0.005
SNE	Nov-June	70.6	37.88%	27	5806.32	0.005
GOM	All	70.6	28.52%	20	8179.43	0.002

Table 4. Trigger bycatch rates for the entire New England and Mid-Atlantic gillnet fishing region during all seasons that is linked to a target bycatch level of PBR and ZMRG, based on historical regional takes and 3-years of recent landings.

Region	Season	Target Level	Target	%	Allocation	Avg 3-yr Landings	Trigger Bycatch Rate
All	All	PBR	706	100%	706	18633.6	0.0379
All	All	ZMRG	70.6	100%	70.6	18633.6	0.0038