HIGHLY MIGRATORY SPECIES MANAGEMENT TEAM
REPORT ON DRIFT GILLNET PERFORMANCE METRICS

The Highly Migratory Species Management Team (HMSMT) compared drift gillnet (DGN) protected species bycatch estimates resulting from the ratio estimator method and the regression tree analysis (Caretta et al., 2018, unpubl.).

As mentioned in Agenda Item G.3.a, HMSMT Report 1, the HMSMT supports revising the DGN bycatch performance metrics using the regression tree methodology as it is currently the best available science. This approach reduces extreme bycatch values (both zeros and large over-estimations) and provides a more consistent and realistic estimation of protected species bycatch in the DGN fishery.

The Council should consider revisiting the existing performance metrics to modify the species, and corresponding metric, based on the biological considerations and the Council's objective to encourage the fishery to improve bycatch performance moving forward. Additionally, some performance metrics, such as the one for Northern elephant seal, may be impractical because as populations increase, higher encounter rates are possible and there is an increasing likelihood of reaching or exceeding the performance metric. Therefore, there is a tendency for performance metrics to become more stringent as populations increase, relative to their initial level, which may be contrary to the Council's intent.

A comparison of DGN fishery performance during the 2016/2017 and 2017/2018 fishing seasons using the ratio estimator method is presented in Table 1. These are the species for which the Council established performance metrics and proposed hard caps. This table is similar to Table 1 in Agenda Item G.3.a, HMSMT Report 1, but includes estimates of the 2017/2018 season, proposed hard caps species, and PBR. Yellow highlighting indicates metrics that were exceeded.

Table 1. PBR and DGN ratio estimator performance metrics of fishery performance for the 2016/2017 and 2017/2018 seasons.

Species	PBR	Ratio Estimator Performance Metric	2016/2017 Fishing Season Ratio Estimator Results	2017/2018 Fishing Season Ratio Estimator Results
Finfish Retention Rate		70%	88%	82%
Minke whale	3.5	5	0	0
Short-beaked common dolphin	8,393	66	44.6	54.3
Long-beaked common dolphin	657	24	4.5	0
Risso's dolphin	46	7	0	0
California sea lion	9,200	97	4.5	5.4
Northern elephant seal	4,882	6	0	16.3
Northern right whale dolphin	179	11	26.8	5.4
Gray whale	624	5	0	5.4
Pacific white-sided dolphin	191	22	0	0
Billfish (other than swordfish)	NA	26	17.9	16.3
Prohibited sharks (megamouth, basking, white)	NA	2	0	0
Hammerhead sharks	NA	4	0	21.7
Manta ray	NA	2	0	0
Sperm Whale	2.7	16	0	0
Humpback Whale	11	5	0	0
Fin Whale	81	0	0	0
Short-finned pilot whale	4.5	6	0	0
Bottlenose dolphin (coastal & offshore)	2.7 & 11	0	0	0
Leatherback sea turtle	NA	8	0	0
Loggerhead sea turtle	NA	5	0	0
Olive ridley sea turtle	NA	0	0	0
Green sea turtle	NA	0	0	0

Table 2 provides performance metrics for protected species derived using the regression tree methodology presented in Carretta et. al (2018, unpublished) which estimates bycatch, as well as estimates for the 2016 calendar year. The metric for each species is equal to the highest annual estimated catch of that species from 2004 through 2013, the same years that were considered when the Council originally adopted performance metrics based on a ratio estimator method.

Table 2. PBR, DGN performance metrics using the regression tree method, and DGN fishery performance in the 2016 calendar year for species which the Council established performance metrics. Yellow highlight indicates metrics that were exceeded.

Species	PBR	Regression Tree Performance Metric*	2016 Calendar Year Results
Minke whale	4	2.3	0.3
Short-beaked common dolphin	8,393	57.7	28.3
Long-beaked common dolphin	657	5.6	5.5
Risso's dolphin	46	2.9	1.4
California sea lion	9,200	46.3	17.3
Northern elephant seal	4,882	4.2	2.4
Northern right whale dolphin	179	8.1	8.4
Gray whale	624	2.1	0.5
Pacific white-sided dolphin	191	9.2	2.1
Sperm Whale	2.7	2.1	0
Humpback Whale	11	1.5	0.1
Fin Whale	81	0.3	0
Short-finned pilot whale	4.5	1.3	0.1
Bottlenose dolphin (coastal & offshore)	2.7 & 11	4.2	0
Leatherback sea turtle	NA	2.8	0
Loggerhead sea turtle	NA	4.5	1.7
Olive ridley sea turtle	NA	0.2	0
Green sea turtle	NA	0.3	0

*based on highest 2004 - 2013 calendar year estimate in Carretta et al. 2018

Table 3 compares the adopted performance metrics calculated using the ratio expansion method to performance metrics calculated with the same parameters using the regression tree analysis. The regression tree performance metrics are considerably lower than the ratio estimator performance metric for most species. This may reflect the larger variance that results from using the ratio estimator, which translates into a larger maximum value over the period used to compute the performance metrics. The exception is for rare event bycatch species, where zeros may result with the ratio estimator, in cases where no observed interactions occurred during the window over which performance metrics were calculated.

Table 3. Comparison of DGN performance metric values calculated by the ratio estimator and regression tree methods corresponding to species for which the Council established performance metrics and proposed hard caps.

Species	PBR	Ratio Estimator Performance Metric	Regression Tree Performance Metric*
Minke whale	3.5	5	2.3
Short-beaked common dolphin	8,393	66	57.7
Long-beaked common dolphin	657	24	5.6
Risso's dolphin	46	7	2.9
California sea lion	9,200	97	46.3
Northern elephant seal	4,882	6	4.2
Northern right whale dolphin	179	11	8.1
Gray whale	624	5	2.1
Pacific white-sided dolphin	191	22	9.2
Sperm Whale	2.7	16	2.1
Humpback Whale	11	5	1.5
Fin Whale	81	0	0.3
Short-finned pilot whale	4.5	6	1.3
Bottlenose dolphin (coastal & offshore)	2.7 & 11	0	4.2
Leatherback sea turtle	NA	8	2.8
Loggerhead sea turtle	NA	5	4.5
Olive ridley sea turtle	NA	0	0.2
Green sea turtle	NA	0	0.3

*based on highest 2004 - 2013 calendar year estimate in Carretta et al. 2018

The HMSMT highlights several considerations pertaining to Table 4:

- Northern right whale dolphin interactions exceeded the performance metric during the 2016/2017 season using the ratio estimator; the regression tree based estimate for calendar year 2016 also exceeded the regression tree based performance metric, although by a lesser degree.
- With the regression tree method, there are fewer zeros in the fleet's interactions with marine mammals.
- Using the ratio estimator method, a single observed gray whale interaction during the 2017/2018 season expands to 5.4 animals. This exceeds the performance metric of five animals, which was based on a single observed gray whale interaction during the 2004/2005 fishing season. The difference in values is due to differences in observer coverage rates. This illustrates some of the issues and the inherent uncertainty in the ratio estimator method.

Table 4. Comparison of DGN performance results calculated using the ratio estimator and regression tree methods for species for which the Council established performance metrics and proposed hard caps.

Species	PBR	Ratio Estimator 2016-2017 results	Regression Tree* 2016 results
Minke whale	3.5	0	0.3
Short-beaked common dolphin	8,393	44.6	28.3
Long-beaked common dolphin	657	4.5	5.5
Risso's dolphin	46	0	1.4
California sea lion	9,200	4.5	17.3
Northern elephant seal	4,882	0	2.4
Northern right whale dolphin	179	26.8	8.4
Gray whale	624	0	0.5
Pacific white-sided dolphin	191	0	2.1
Sperm Whale	2.7	0	0
Humpback Whale	11	0	0.1
Fin Whale	81	0	0
Short-finned pilot whale	4.5	0	0.1
Bottlenose dolphin (coastal & offshore)	2.7 & 11	0	0
Leatherback sea turtle	NA	0	0
Loggerhead sea turtle	NA	0	1.7
Olive ridley sea turtle	NA	0	0
Green sea turtle	NA	0	0

*based on highest 2004 - 2013 calendar year estimate in Carretta et al. 2018

The HMSMT recommends the Council transition to DGN performance metrics based on the regression tree method to stay current with the best available science. Should the Council wish to also explore modifying the finfish performance metrics using the regression tree methodology to maintain consistency, the HMSMT can explore this possibility. There is uncertainty as to the time required to perform these analyses, as well as who would perform this work given the frequency this information needs to be updated.

While the performance metrics are currently determined using the highest annual catch of each species from 2004 - 2013, if the Council decides to move to the regression tree methodology, the values might change each year due to the use of new observer data collected yearly to recalculate the entire time series of bycatch estimates.

The HMSMT notes in the case of species with increasing abundance, performance metrics will appear to show negative performance due the simple fact of increased interactions with increasing populations. The Northern elephant seal example provided in HMSAS Report 1 illustrates this situation. In these cases, the Council may choose to determine a management measure to reduce interactions or make a change in the performance metrics that reflects the change in population.

The HMSMT recommends the Council consider the following:

- Consider adopting the regression tree approach to computing performance metrics.
- Work with NMFS to revise the list of species for which performance metrics are specified based on best available science.
- Periodically update the performance metrics in the future based on changing fishery performance or population statuses of species subject to interactions with DGN.

PFMC
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