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Estimating Recreational Abalone Harvest Using Length-Weight Data from Commercial Catch Sampling

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By

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1 Background

Effort in the recreational abalone fishery is managed by daily limits, and until the 2019/2020 recreational fishing season the daily bag limit was set at a maximum of 10 abalone/licence/day, with a possession limit of 20 at any point in time. From 2010 to 2019 persistent declines in the commercial abalone fishery catch and catch rate were observed despite multiple decreases in the commercial TACC. Commercial CPUE is used as the sole proxy for biomass of the abalone resource, on the basis that the recreational catch is both small and difficult to accurately quantify. In 2019, a recommendation for closure of five key areas of the Tasmanian East Coast commercial blacklip abalone fishery was accepted. Similarly a reduction (but not closure) of the recreational bag limit to five abalone/licence/day was recommended and accepted to assist with recovery, and minimizing further risk of depletion of the abalone in key recreational fishing regions along the East Coast.

In November 2021, the Tasmanian Legislative Council rescinded the five-bag limit regulation, with an immediate return to the 2018/2019 recreational abalone fishery regulations and limits. As part of the motivation for the reversal of the bag limit reduction, it was argued that size limits were the most important management lever available, and that no efforts had been made to consider and/or implement increases in the size limit governing the recreational abalone fishery.

Here we explore the consequences of increases in the recreational abalone size limit on Tasmania's East Coast on the magnitude of the recreational abalone harvest.

2 Estimate Recreational harvest for by mean weight

Recreational abalone harvest has been routinely estimated by a phone-diary survey involving a random sample of license-holders since 1996. Participants record details of their fishing activity including date, location, method used, target species, start and finish times, and the number of abalone kept (harvested) for the survey period 1st November to 30th April the following year and thus only provide a partial season estimate. Data from respondents are then expanded to estimate the catch (number of abalone harvested) and effort of the entire recreational licensed population using a 'bootstrapping' method to estimate 95% confidence limits using the percentile method. Estimated harvest weight (kg) is then estimated by multiplying the harvest number by the average weight of an individual abalone for each area based on commercial catch sampling data collected prior to 2018 (area 1 = 522 g, area 2 = 517 g, area 3 = 520 g) (Lyle et al. 2021).

The estimated combined east coast (areas 1-3) blacklip abalone recreational harvest number for 2020-21 was n = 22882 (95% CI 12774-34777) (area 1 = 11756, area 2 = 9919, area 3 = 1207) (Lyle et al. 2021). In 2020-21 this equates to 11916 kg (11.9 t) (see Table 6 in Lyle et al. 2021).

The estimated combined east coast (areas 1-3) blacklip abalone recreational harvest number for 2018-19 was n = 25671 (95% CI 13728-37139) (area 1 = 20339, area 2 = 2365, area 3 = 2967) (Lyle et al. 2019). In 2018-19 this equates to 13167 kg (13.2 t) (see Table 6 in Lyle et al. 2019).

The following code have been developed to utilise the most recent data collected from the commercial abalone catch sampling program between 2019-2022.

Table 1: Average weight of individual abalone from commerical abalone catch sampling data for all zones collected between 2019-2022.

Zone	Av.weight(g)	n	Catches
BS	390.1429	770	8

Zone	Av.weight(g)	n	Catches
E	558.2148	20565	214
G	662.9899	296	3
N	486.2810	630	6
W	690.5580	20972	218

Table 2: Average weight of individual abalone from commerical abalone catch sampling data for all recreational harvest regions collected between 2019-2022.

RecRegion	Av.weight(g)	n	Catches
1	574.0975	22872	239
3	517.4343	594	6
4	395.7644	348	4
5	441.2958	649	6
6	741.5011	457	5
7	662.4153	1245	13
8	686.5202	14901	154

3 Estimate recreational harvest weight for east coast based on mean weight of individual abalone from commerical catch sampling for the eastern zone

Table 3: Estimated Recreational harvest based on average weight of individual abalone from commerical catch sampling for the eastern zone collected between 2019-2022.

Av.weight(g)	Harvest 18/19(kg)	Harvest 20/21(kg)
558.2148	14329.93	12773.07

4 Estimate Recreational harvest based on length-weight relationship

Table 4: Estimated length-weight model parameters from commerical abalone catch sampling data for all zones collected between 2019-2022.

Zone	a	b
BS	0.0011043	2.609012
E	0.0065332	2.267080
G	0.0000692	3.162481
N	0.0013457	2.585293
W	0.0019023	2.525828

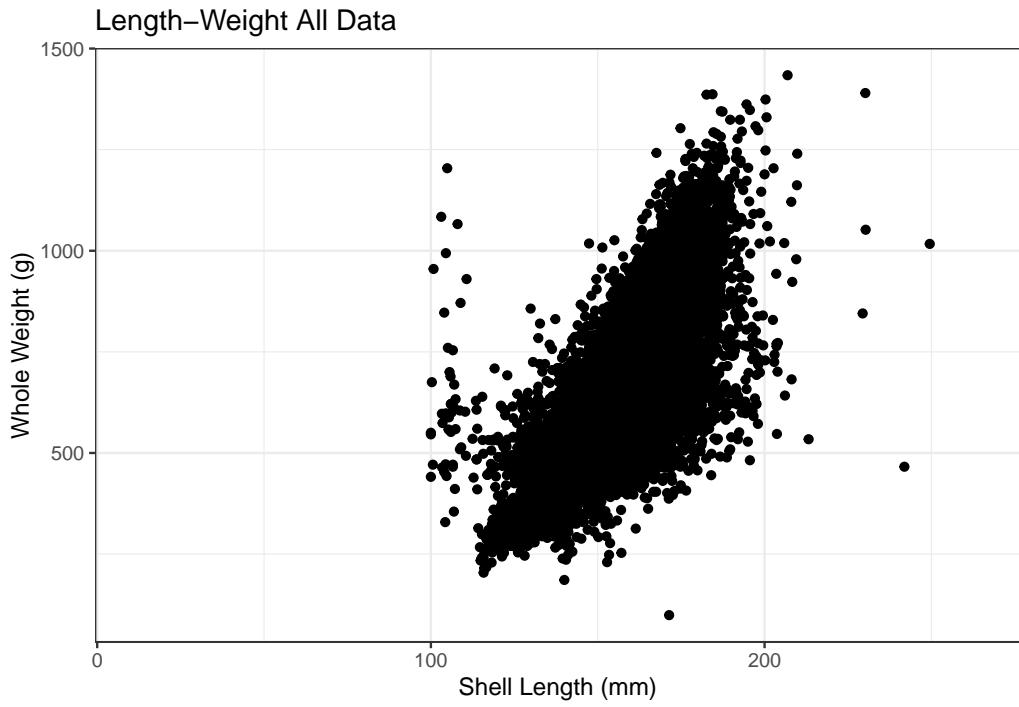


Figure 1: Length-weight relationship of commercial abalone catch sampling data for all zones collected between 2019-2022.

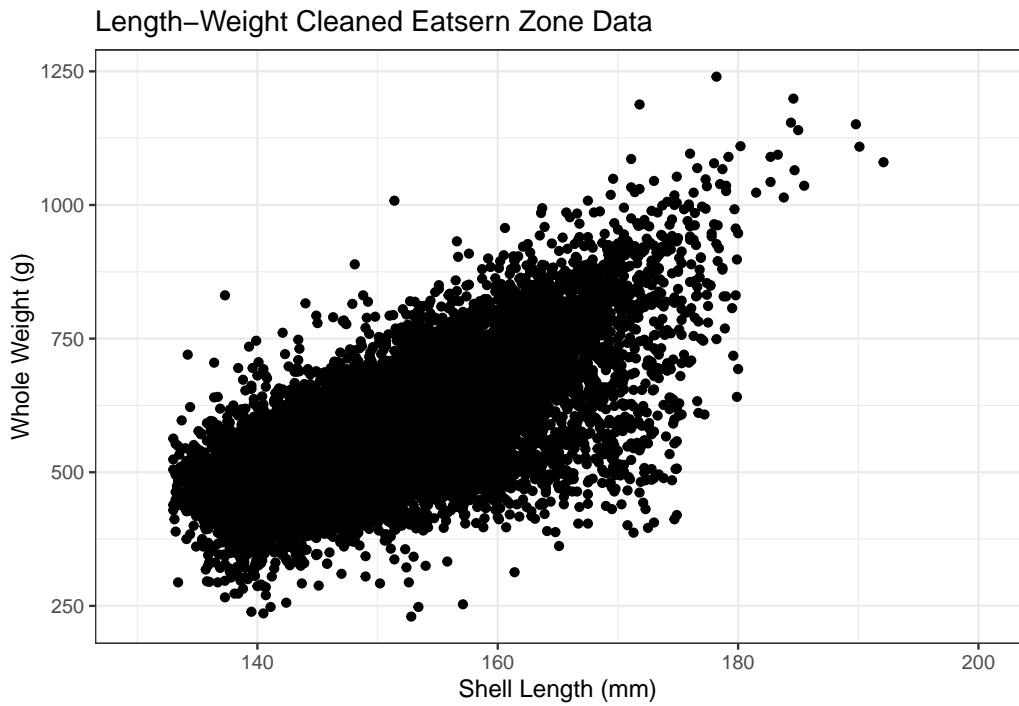


Figure 2: Length-weight relationship of cleaned commercial abalone catch sampling data for the eastern zone collected between 2019-2022.

Table 5: Estimated Recreational harvest for each LML based on estimated harvest for 2020-21 season and abalone length-weight relationship from commerical catch sampling for the eastern zone collected between 2019-2022.

LML	Est. weight(g)	Harvest(kg)	Harvest 95%(kg)	Harvest 90%(kg)
138	463.8792	10614.48	10083.76	9553.035
140	479.2606	10966.44	10418.12	9869.797
145	518.9458	11874.52	11280.79	10687.065
150	560.4034	12823.15	12181.99	11540.836
155	603.6497	13812.71	13122.08	12431.441
160	648.7003	14843.56	14101.38	13359.205

Table 6: Estimated Recreational harvest for each LML based on estimated harvest for 2018-19 season and abalone length-weight relationship from commerical catch sampling for the eastern zone collected between 2019-2022.

LML	Est. weight(g)	Harvest(kg)	Harvest 95%(kg)	Harvest 90%(kg)
138	463.8792	11908.24	11312.83	10717.42
140	479.2606	12303.10	11687.94	11072.79
145	518.9458	13321.86	12655.76	11989.67
150	560.4034	14386.12	13666.81	12947.50
155	603.6497	15496.29	14721.48	13946.66
160	648.7003	16652.79	15820.15	14987.51

4.1 Determine relative change in Recreational harvest from initial LML

Table 7: Relative change in estimated Recreational harvest for an increase in LML based on estimated harvest for 2020-21 season and abalone length-weight relationship from commerical catch sampling for the eastern zone collected between 2019-2022.

LML	Est. weight (g)	Harvest (kg)	Harvest Change
138	463.8792	10614.48	1.000000
140	479.2606	10966.44	1.033158
145	518.9458	11874.52	1.118709
150	560.4034	12823.15	1.208080
155	603.6497	13812.71	1.301308
160	648.7003	14843.56	1.398425

Table 8: Relative change in estimated Recreational harvest for an increase in LML based on estimated harvest for 2018-19 season and abalone length-weight relationship from commercial catch sampling for the eastern zone collected between 2019-2022.

LML	Est. weight (g)	Harvest (kg)	Harvest Change
138	463.8792	11908.24	1.121886
140	479.2606	12303.10	1.159086
145	518.9458	13321.86	1.255064
150	560.4034	14386.12	1.355329
155	603.6497	15496.29	1.459920
160	648.7003	16652.79	1.568874

5 Estimate Recreational harvest based on commercial catch sampling size frequencies

Table 9: Estimated Recreational harvest for each LML based on estimated harvest for 2020-21 season and abalone length-weight relationship and size frequencies from commerical catch sampling for the eastern zone collected between 2019-2022.

LML	Est. Harvest(kg)	Harvest 95%(kg)	Harvest 90%(kg)
138	12738.26	12101.35	11464.43
140	12905.47	12260.20	11614.92
145	13566.78	12888.44	12210.10
150	14345.50	13628.23	12910.95
155	15178.65	14419.71	13660.78
160	16088.46	15284.04	14479.62

Table 10: Estimated Recreational harvest for each LML based on estimated harvest for 2018-19 season and abalone length-weight relationship and size frequencies from commerical catch sampling for the eastern zone collected between 2019-2022.

LML	Est. Harvest(kg)	Harvest 95%(kg)	Harvest 90%(kg)
138	14290.88	13576.33	12861.79
140	14478.47	13754.54	13030.62
145	15220.39	14459.37	13698.35
150	16094.02	15289.32	14484.62
155	17028.71	16177.28	15325.84
160	18049.43	17146.95	16244.48

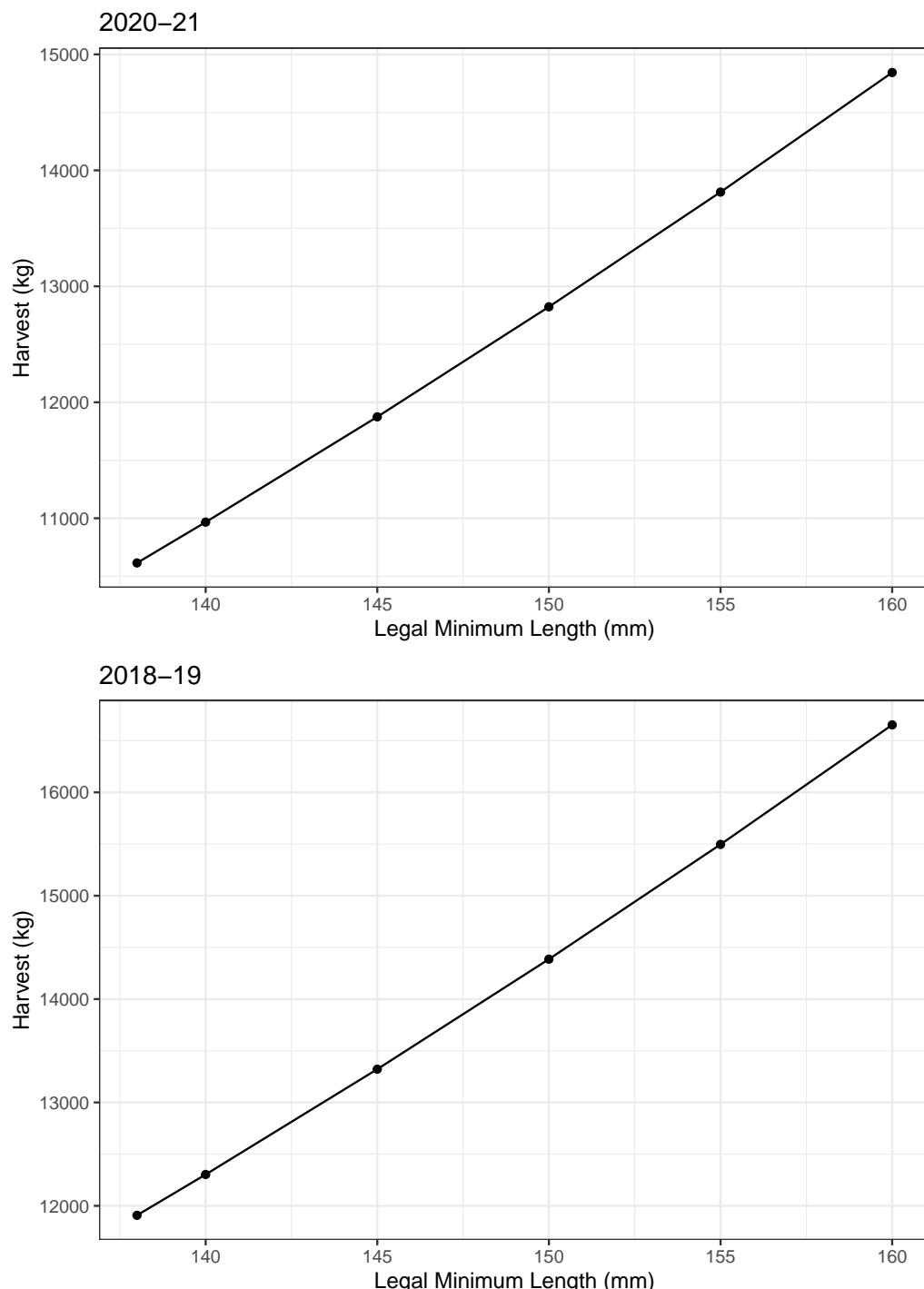


Figure 3: Estimated Recreational harvest in 2020-21 and 2018-19 for each LML based on abalone length-weight relationship from commerical catch sampling for the eastern zone collected between 2019-2021.

Table 11: Relative change in estimated Recreational harvest for an increase in LML based on estimated harvest for 2020-21 season and abalone length-weight relationship and size frequencies from commerical catch sampling for the eastern zone collected between 2019-2022.

LML	Harvest(kg)	HarvestChange
138	12738.26	1.000000
140	12905.47	1.013127
145	13566.78	1.065042
150	14345.50	1.126175
155	15178.65	1.191579
160	16088.46	1.263003

Table 12: Relative change in estimated Recreational harvest for an increase in LML based on estimated harvest for 2018-19 season and abalone length-weight relationship and size frequencies from commerical catch sampling for the eastern zone collected between 2019-2022.

LML	Harvest(kg)	HarvestChange
138	14290.88	1.000000
140	14478.47	1.013127
145	15220.39	1.065042
150	16094.02	1.126175
155	17028.71	1.191579
160	18049.43	1.263003

6 References

- Lyle, J.M., Ewing, F., Ewing, G. and Tracey, S.R. (2021). Tasmanian recreational Rock Lobster and Abalone fisheries: 2020-21 fishing season. Institute for Marine and Antarctic Studies Report, 38p.
- Lyle, J.M., Ewing, F., Ewing, G. and Tracey, S.R. (2019). Tasmanian recreational Rock Lobster and Abalone fisheries: 2018-19 fishing season. Institute for Marine and Antarctic Studies Report, 36p.

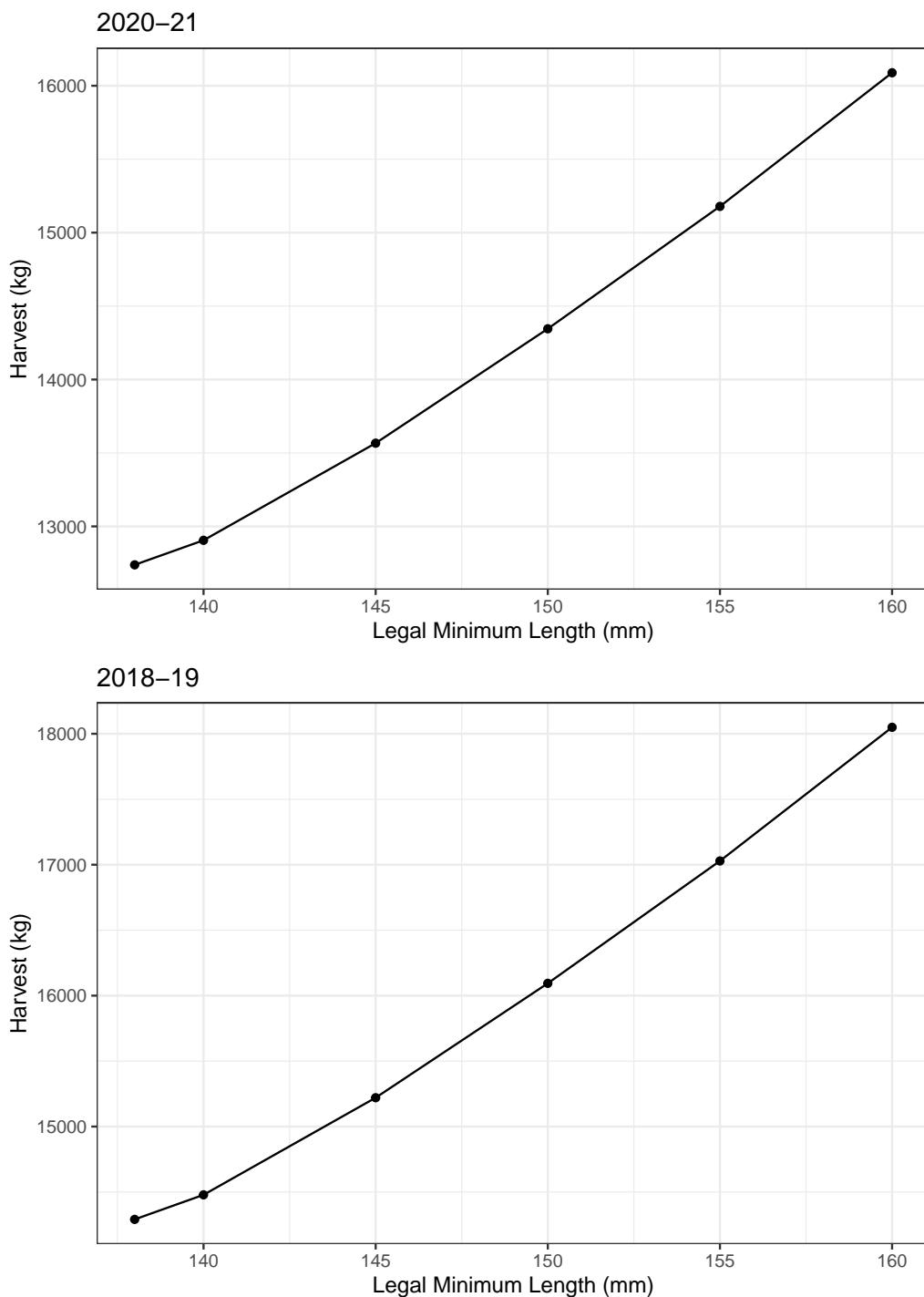


Figure 4: Estimated Recreational harvest in 2020-21 and 2018-19 for each LML based on abalone length-weight relationship and size frequencies from commerical catch sampling for the eastern zone collected between 2019-2022.