

Supplementary material

Table S1: Osmose species' parameters. Highlighted in gray: parameters estimated by the calibration algorithm. More information on the parameters can be found on <http://www.osmose-model.org>

[illegible]

Table S1 Continued:

	Anchovy	Krill	Shallow water hake	Deep water hake	Horse mackerel	Meso-pelagics	Redeye	Sardine	Large pelagics	Snoek
Max ingestion rate ($g.g^{-1}.yr^{-1}$)	3.5	3.5	3.22	3.15	3.5	3.5	3.5	3.5	2.7	3.15
Pred-prey size ratio max	10	15	3.5	3.5	10	2.5	10	100	3.5	3.5
(before/after threshold)	5	5	1.8	1.8	5	-	-	200	-	-
Pred-prey size ratio min	100	300	50	50	100	100	100	200	70	70
(before/after threshold)	500	100	50	50	100	-	-	400	-	-
Pred-prey size threshold (cm)	8	0.6	27	29	10	-	-	10	-	-
Mortality starvation rate (yr^{-1})	3	3	3	3	3	3	3	3	3	3
Current fishing mortality rate (yr^{-1})	0.142	0	0.334	0.357	0.050	0.001	0.050	0.190	0.138	0.229
Recruitment age to the fishery (yr)	0.62	1	2.5	1.9	2	1	1	1	1	3
Nb of schools	24	100	24	24	24	100	24	24	24	24

	Dinoflagellates	Diatoms	Ciliates	Copepods
Accessibility to fish	0.0269	0.0030	0.0142	0.1854
Conversion factor ($mmol N.m^{-2}$ to $ton.km^{-2}$)	0.72	0.72	0.675	1
Maximal size (cm)	0.002	0.02	0.02	0.3
Minimal size (cm)	0.0002	0.002	0.002	0.02
TL	1	1	2	2.5

Table S2: Indicators' species parameters

	Anchovy	Krill	Shallow water hake	Deep water hake	Horse mack- erel	Meso- pelagics	Redeye	Sardine	Large pelag- ics	Snoek
Predator	No	No	Yes	Yes	No	No	No	No	Yes	Yes
Surveyed	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Harvested	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Vulnerability	44	1	59	59	44	31	46	54	60	61

Surveyed species:

These are species sampled by researchers during routine surveys (as opposed to species sampled in catches by fishing vessels), and should include species of demersal and pelagic fish (bony and cartilaginous, small and large), as well as commercially important invertebrates (squids, crabs, shrimps...). Intertidal and subtidal crustaceans and molluscs such as abalones and mussels, mammalian and avian top predators, and turtles, should be excluded.

Predatory fish species:

Predatory fish are considered to be all surveyed fish species that are not largely planktivorous (i.e. phytoplankton and zooplankton feeders should be excluded). A fish species is classified as predatory if it is piscivorous, or if it feeds on invertebrates that are larger than the macrozooplankton category ($> 2cm$). Detritivores should not be classified as predatory fish.

Intrinsic Vulnerability:

The intrinsic vulnerability index of a species (IVIs) is based on life history traits and ecological characteristics, ranges from 0 to 100, with 100 being the most vulnerable. For more details, see Cheung et al. (2007).

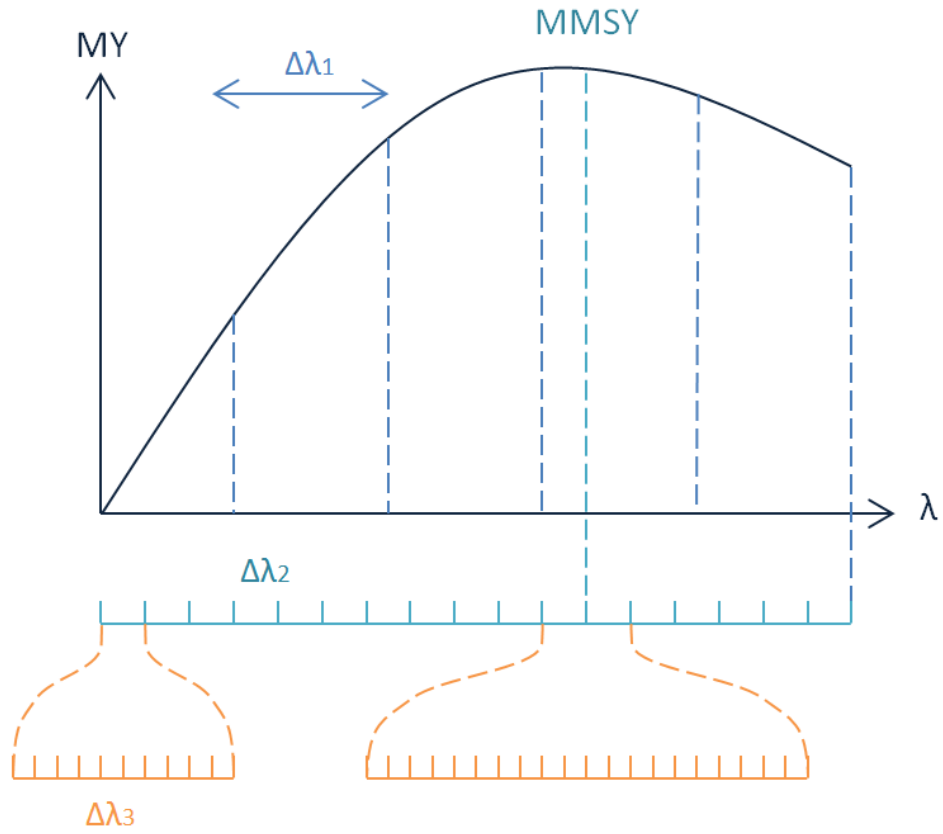


Figure S1: Illustration of the different phases of the algorithm for reaching the multispecies maximum sustainable yield (MMSY). For each fishing strategy, the step of the fishing mortality multiplier λ is progressively refined from a coarse step ($\Delta\lambda_1$) to the finest step ($\Delta\lambda_3$)

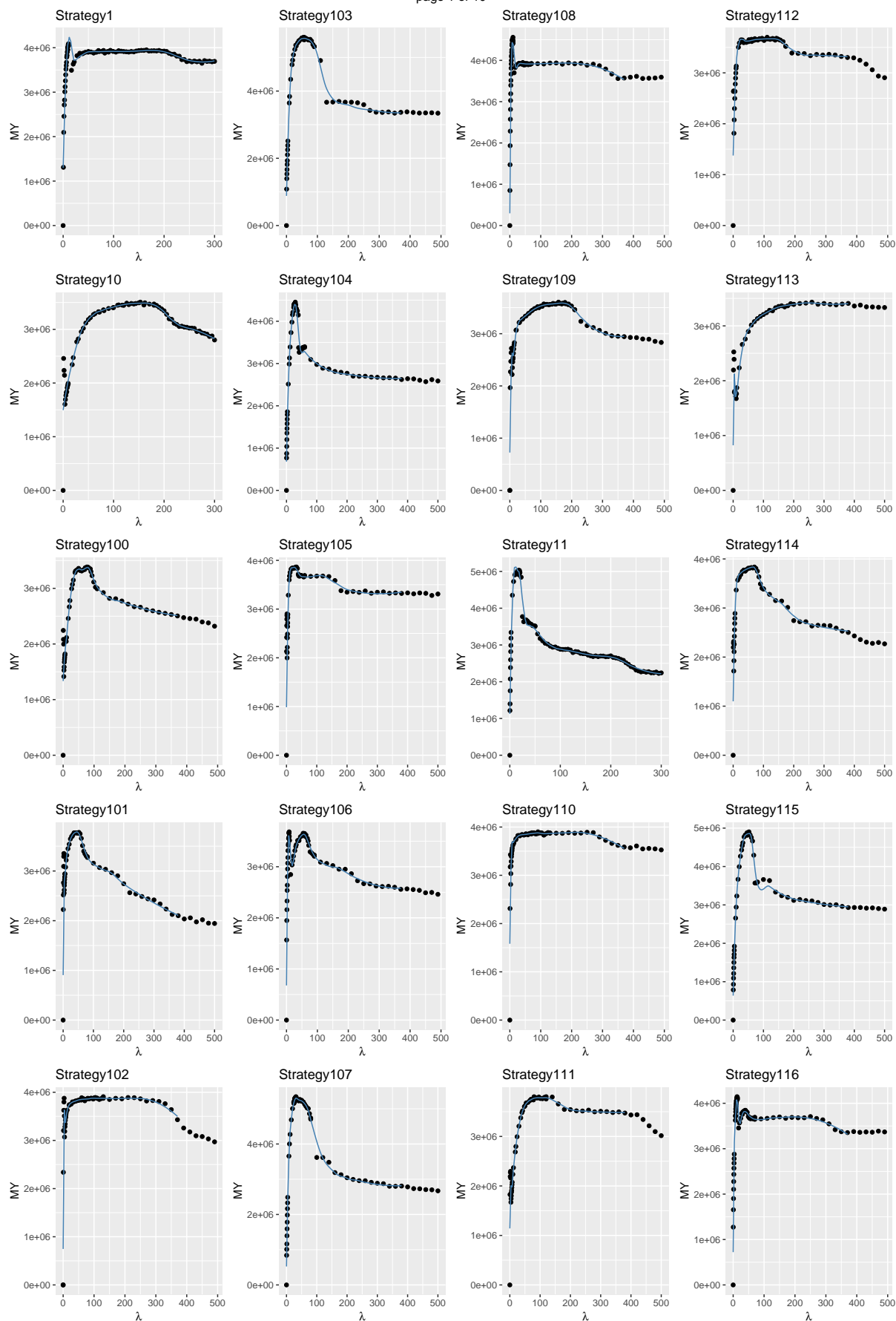


Figure S2: Evolution of multispecies yield with fishing pressure across all simulated fishing strategies. In many cases, the multispecies yield curve does not display the typical bell-shaped curve often presented (Worm et al., 2009) but rather decreases very slowly once MMSY has been reached or level off to a plateau.

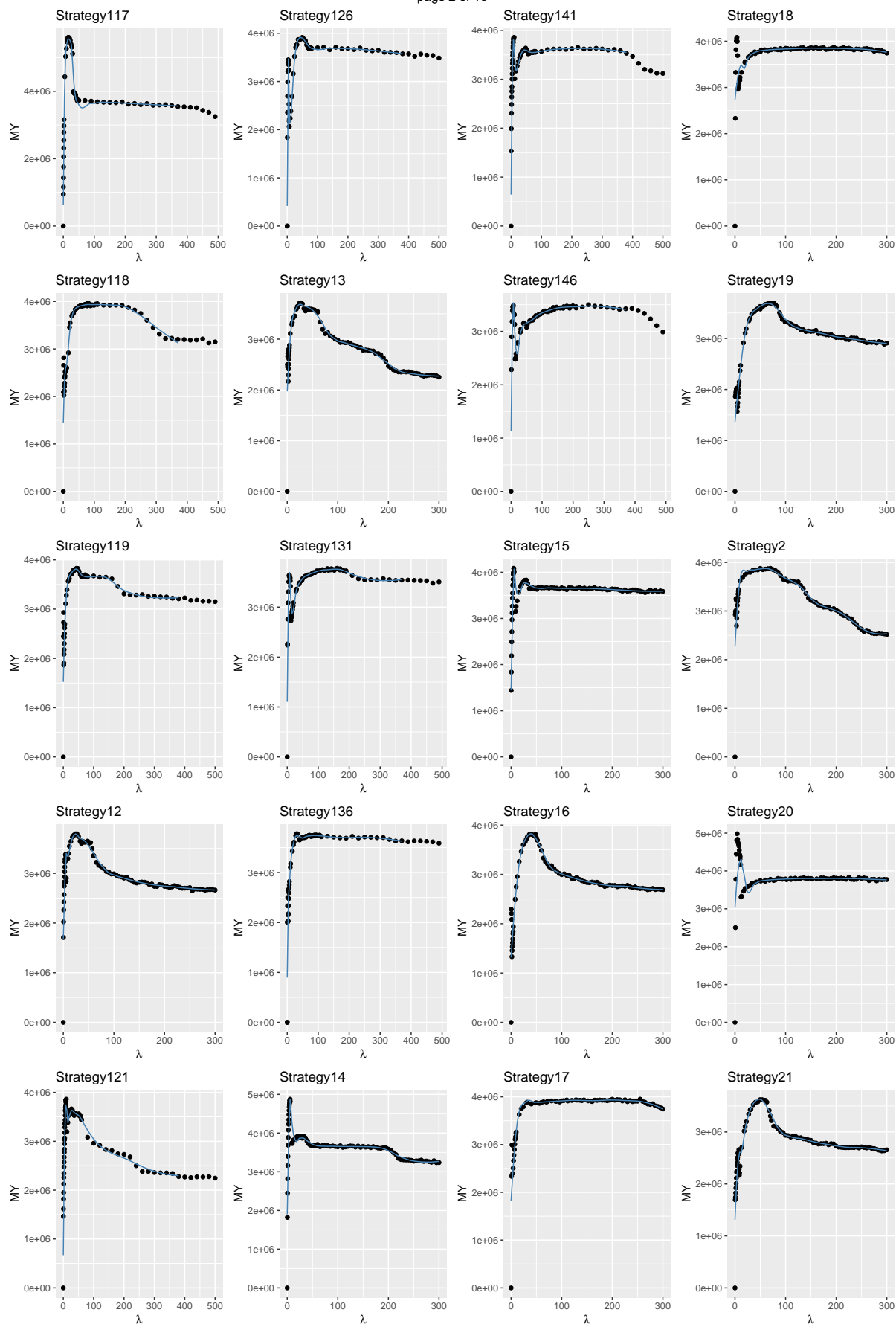


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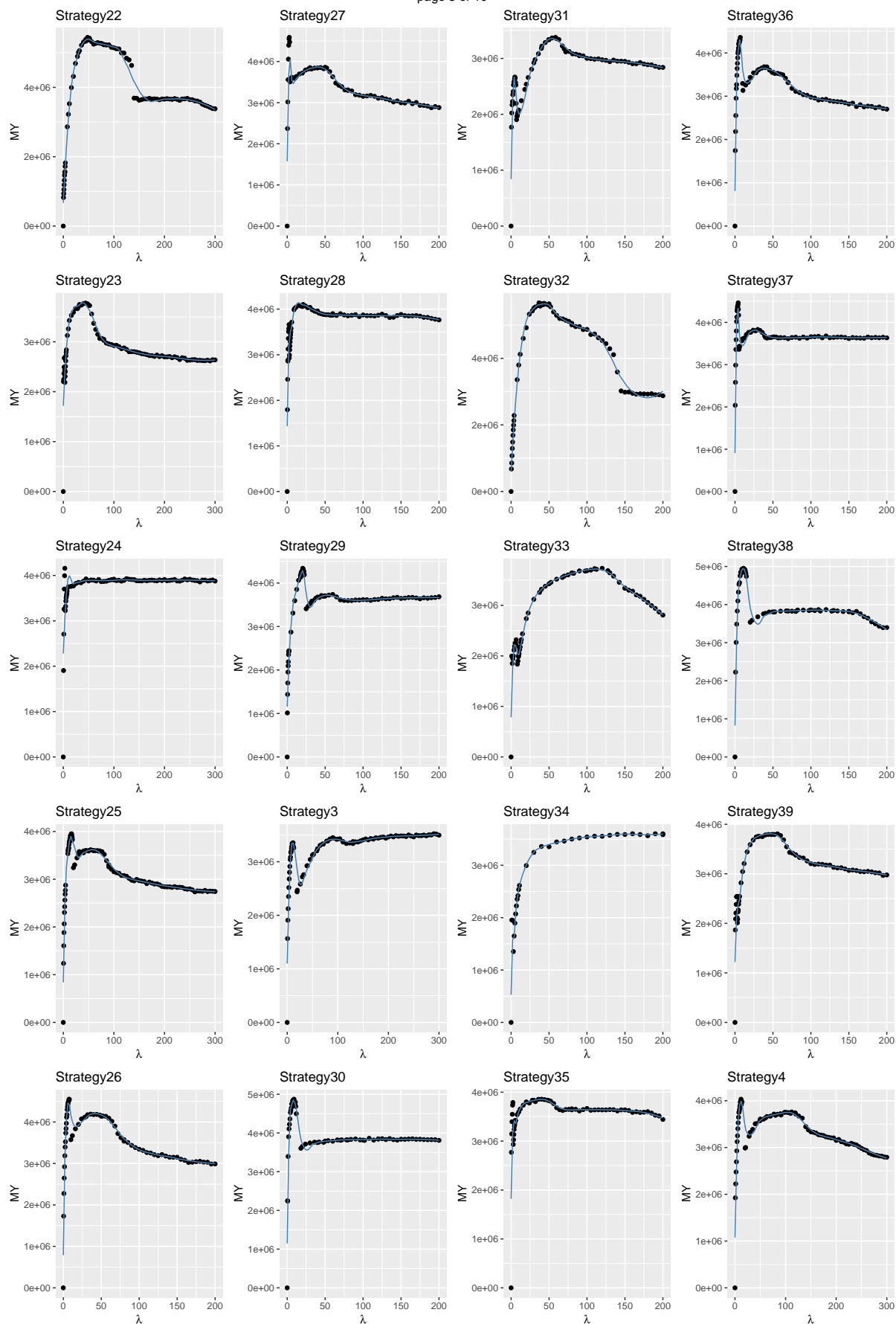


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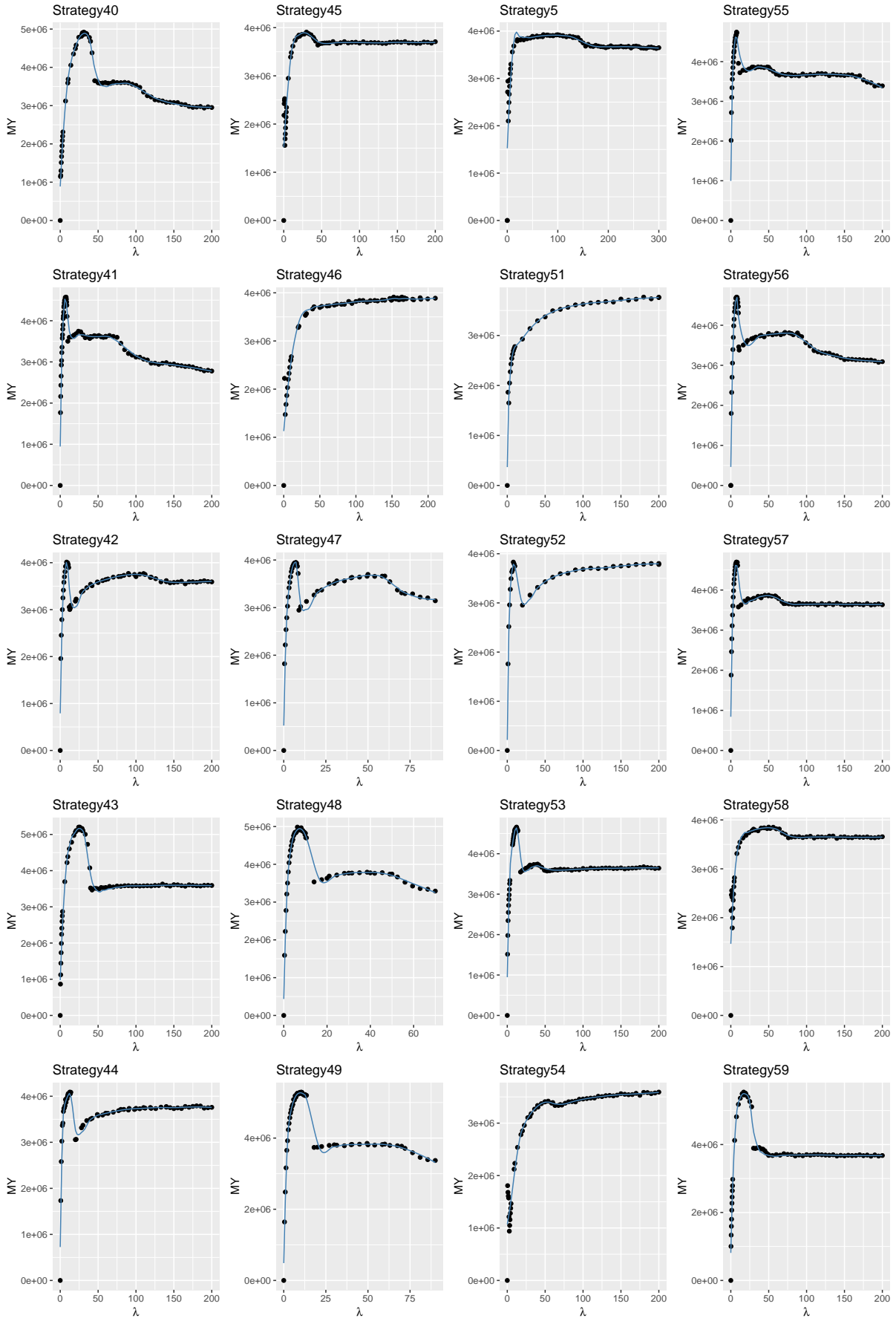


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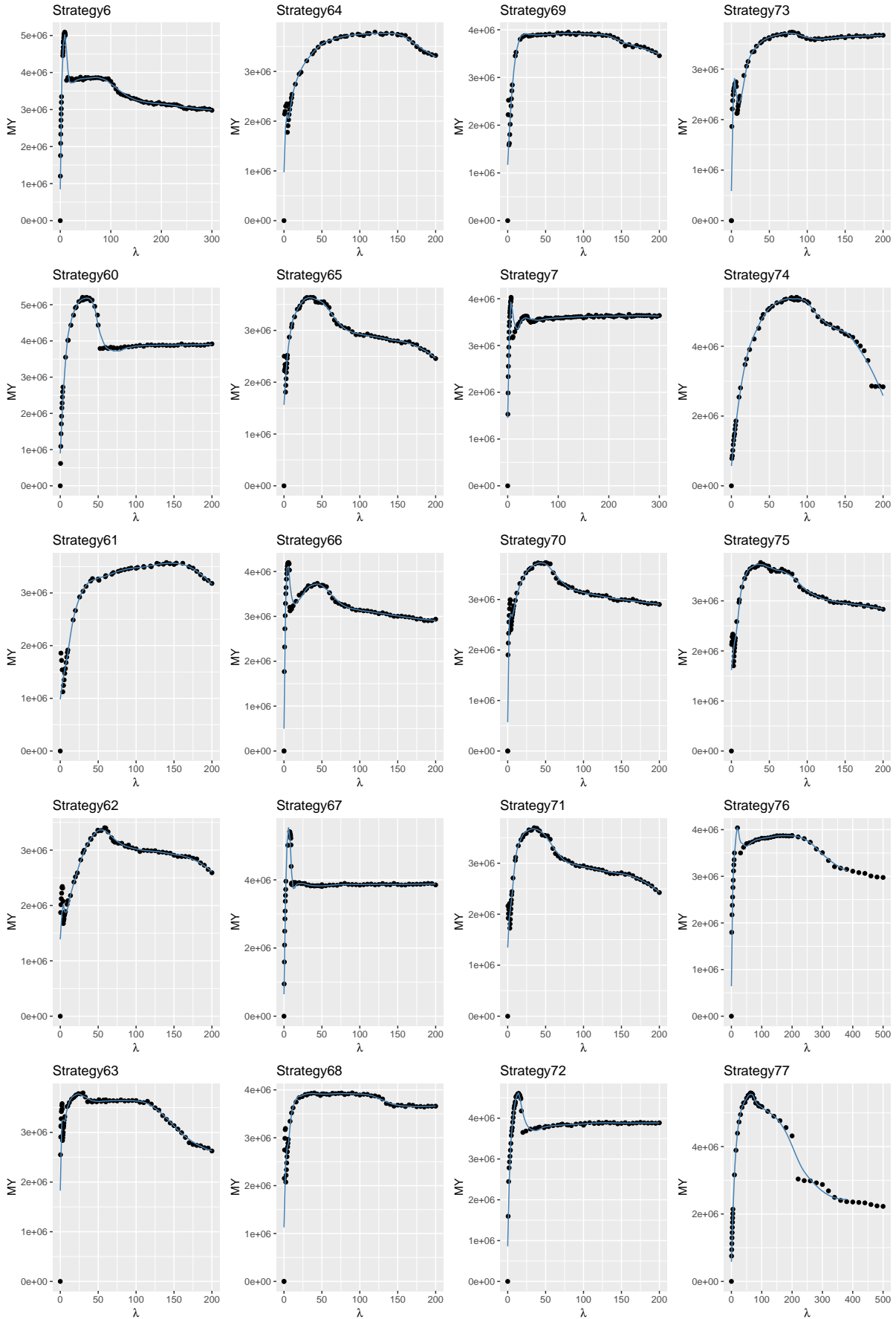


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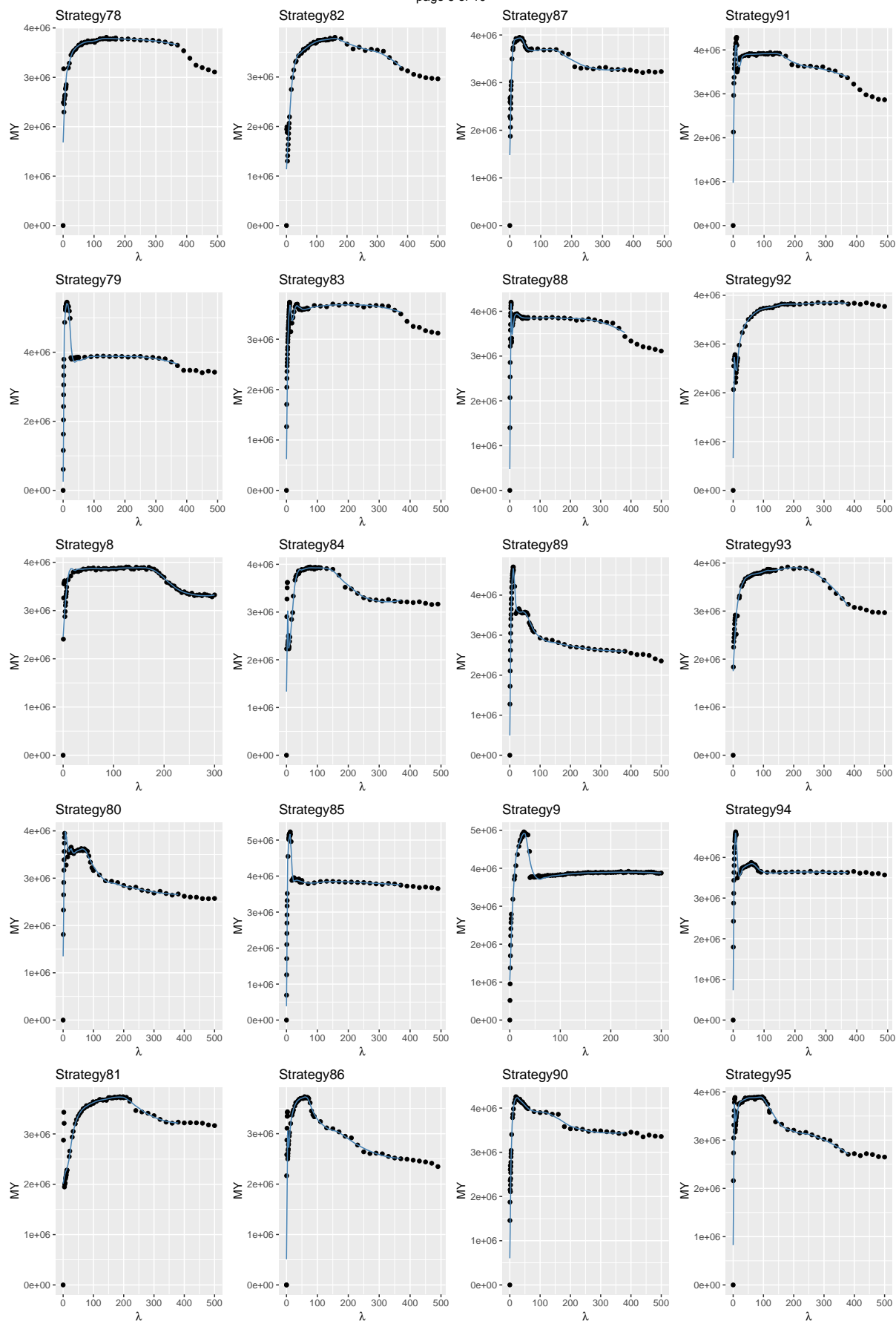


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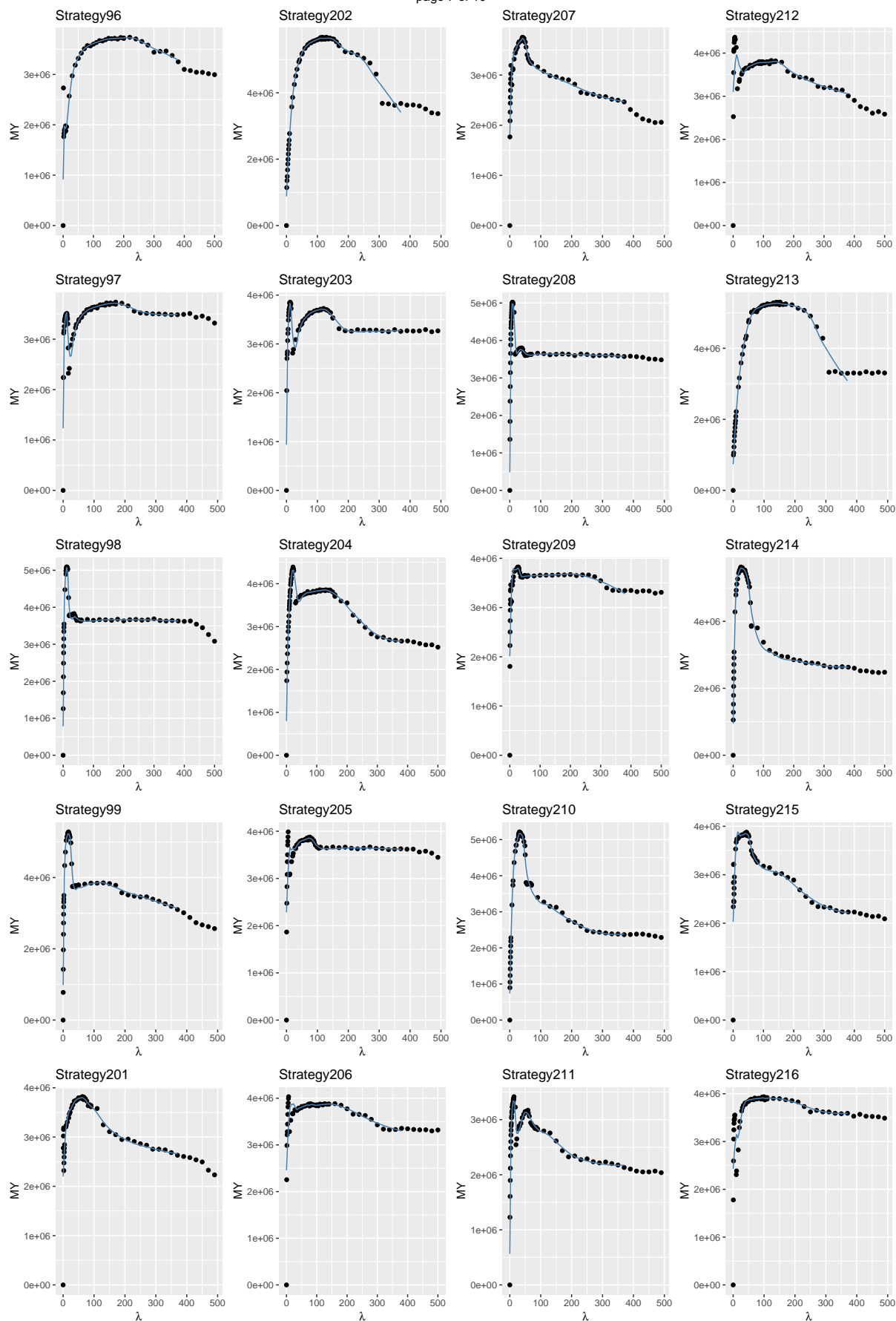


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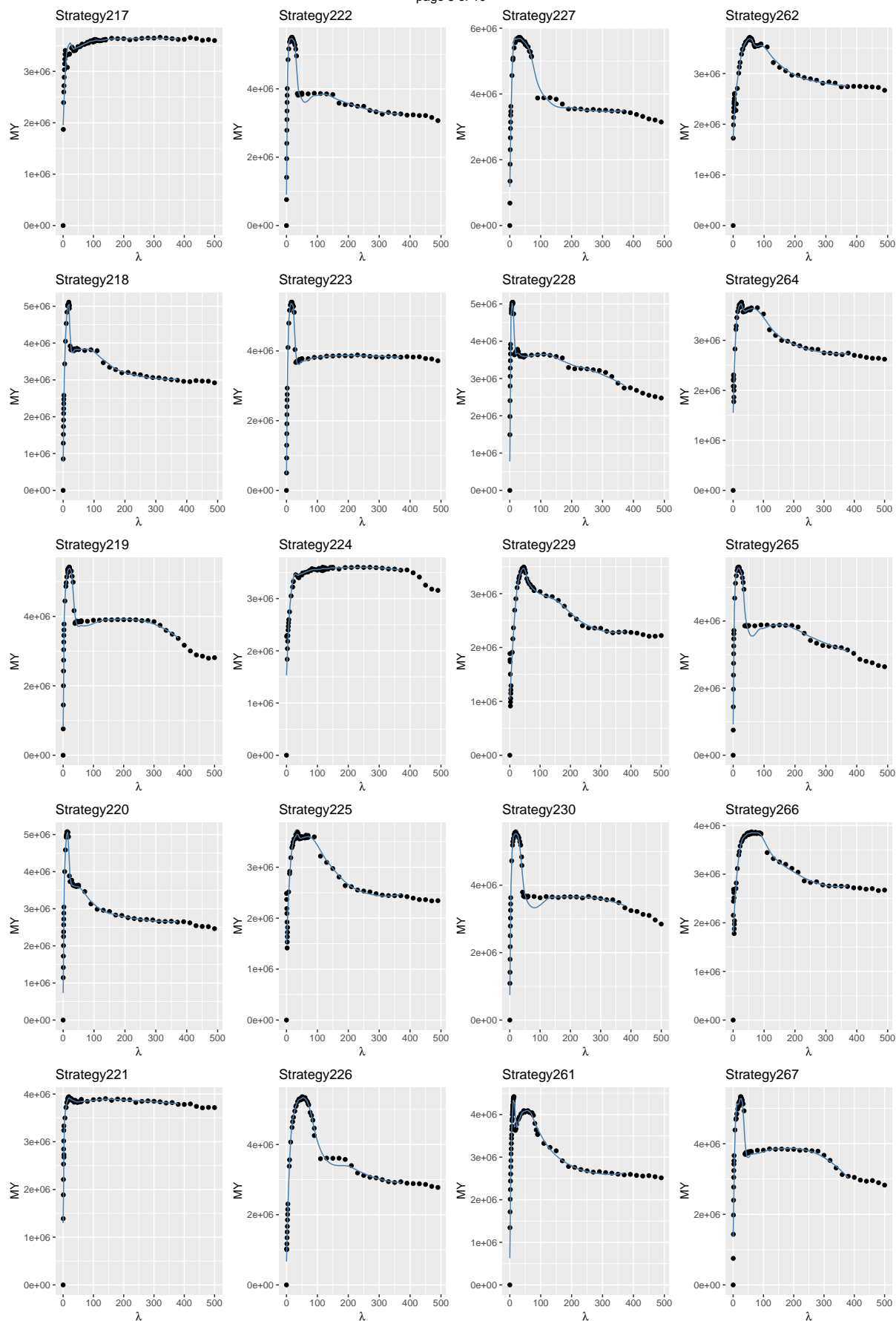


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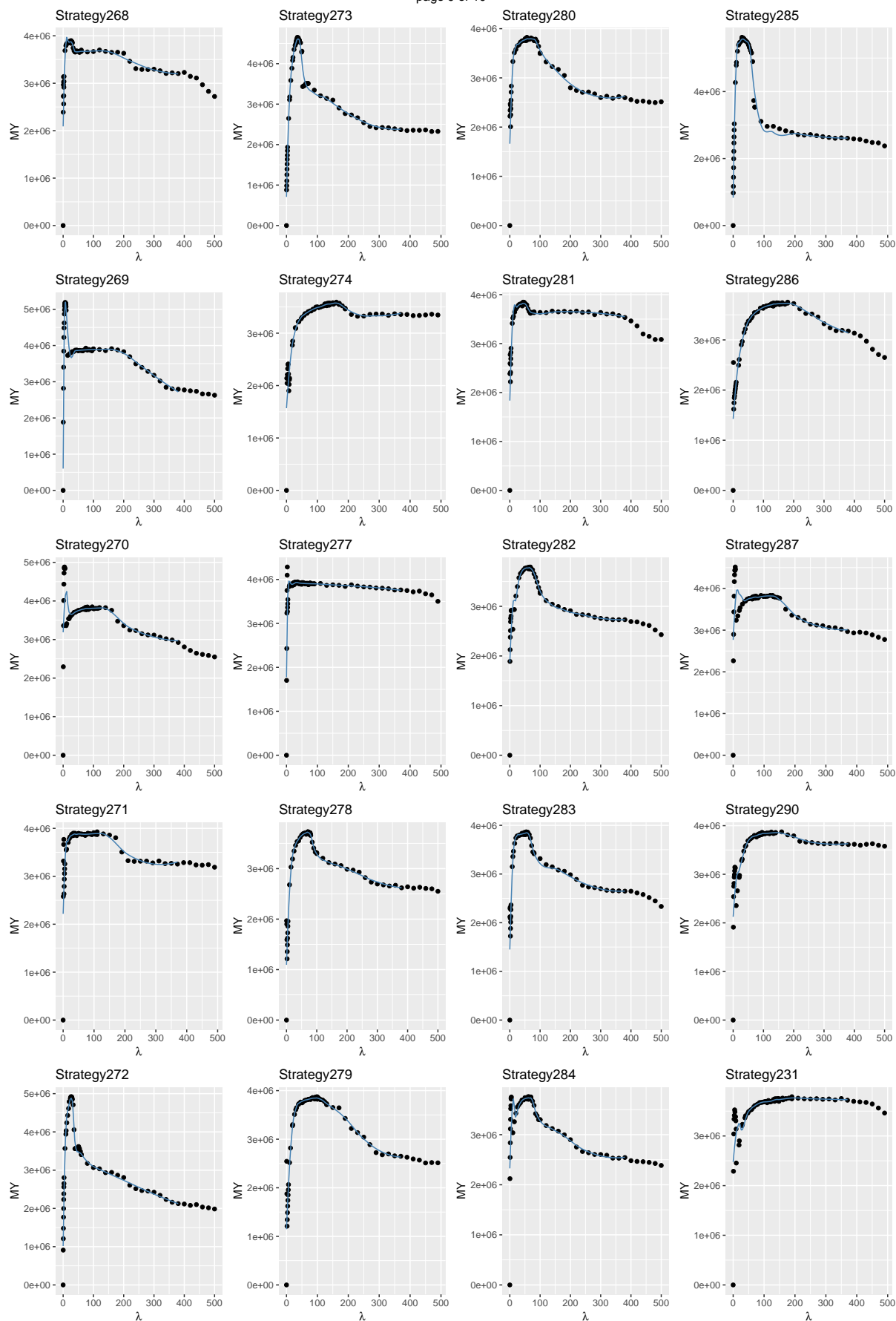


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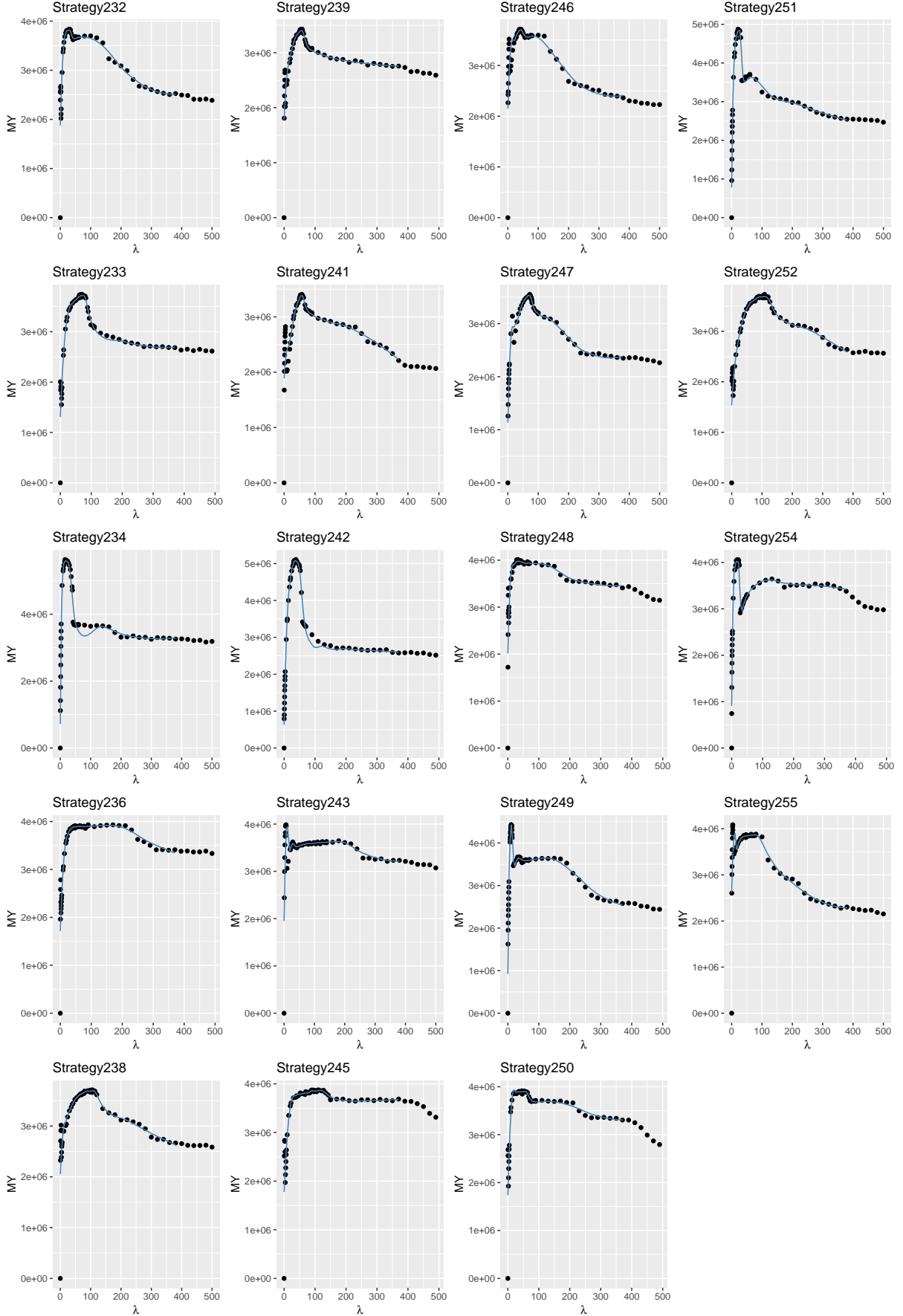


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References

- Cheung, W., Watson, R., Morato, T., Pitcher, T., Pauly, D., 2007. Intrinsic vulnerability in the global fish catch. *Marine Ecology Progress Series* 333, 1–12. URL: <http://www.int-res.com/abstracts/meps/v333/p1-12/>, doi:10.3354/meps333001.
- Worm, B., Hilborn, R., Baum, J.K., Branch, T.A., Collie, J.S., Costello, C., Fogarty, M.J., Fulton, E.A., Hutchings, J.A., Jennings, S., Jensen, O.P., Lotze, H.K., Mace, P.M., McClanahan, T.R., Minto, C., Palumbi, S.R., Parma, A.M., Ricard, D., Rosenberg, A.A., Watson, R., Zeller, D., 2009. Rebuilding Global Fisheries. *Science* 325, 578–585. URL: <http://www.sciencemag.org/cgi/doi/10.1126/science.1173146>, doi:10.1126/science.1173146.