Namibian hake model update, 2026

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Executive summary

Summary of changes in assessment inputs

The accepted 2025 model configuration was extended through 2026 without changing the base-model assumptions. The update adds the 2026 catch, CPUE, survey biomass, and composition rows provided in `namhakdata26.dat`. The species-specific survey series in `CapeHakes.csv` was extended through 2026 for *Merluccius paradoxus* and *M. capensis*.

Automated checks confirmed continuous annual ADMB matrices from 1964 through 2026, the expected dimensions of all weight, catch, composition, CPUE, and survey blocks, agreement among all terminal-year controls, and valid `54321` and `12345` end-of-file sentinels.

Summary of results

The 2026 base model converged with an objective function of -44.977, a maximum gradient of 4e-05, and a positive-definite Hessian. Estimated terminal spawning biomass was 467 and terminal spawning biomass relative to BMSY was 0.497.

Four of six sensitivity configurations met the same convergence criteria as the base model. The dome-shaped selectivity case had parameters on their lower bounds and a singular Hessian. The model with steepness fixed at 0.5 had a maximum gradient above 0.001 after an extended optimization. Results from those two configurations are not used for inference.

No TAC, ABC, or OFL recommendation is made in this document. Those quantities require the agreed Namibian management procedure and management inputs.

Table 1: Comparison of 2025 values from the previous assessment with 2026 values from the updated assessment.

Quantity	Previous assessment (2025 value)	Updated assessment (2026 value)	Change (2026 minus 2025)
SSB	490.867	466.951	-23.916
Depletion	0.172	0.165	-0.008
B_Bmsy	0.521	0.497	-0.024
Catch	140.001	133.001	-7.000
RY	104.865	98.766	-6.099
Catch_RY	1.335	1.347	0.012

Introduction

This operational update applies the 2025 base-model structure to information available through 2026. Stable model methods are not repeated in full; the emphasis is on new inputs, bridge results, model diagnostics, and sensitivity to the principal structural assumptions considered in the previous assessment.

Fishery and management history

The assessment input contains annual catches from 1964 through 2026. Management-history text and the final 2026 management decision should be inserted following review by MFMR.

`TODO: add the final 2026 TAC decision and any in-season management changes.`

Data

Table 2: Automated validation of the 2026 model inputs.

Check	Result
Annual model years	1964–2026
Weight-at-age dimensions	63 × 10
Fishery composition dimensions	63 × 11
CPUE dimensions	63 × 7
Survey dimensions	63 × 5
Control EOF sentinel	54321
Data EOF sentinel	12345

Survey data

Other data

No additional external data series were introduced in this update. Missing survey observations remain represented as missing or zero according to the existing model input convention; no values were imputed to create artificial annual continuity.

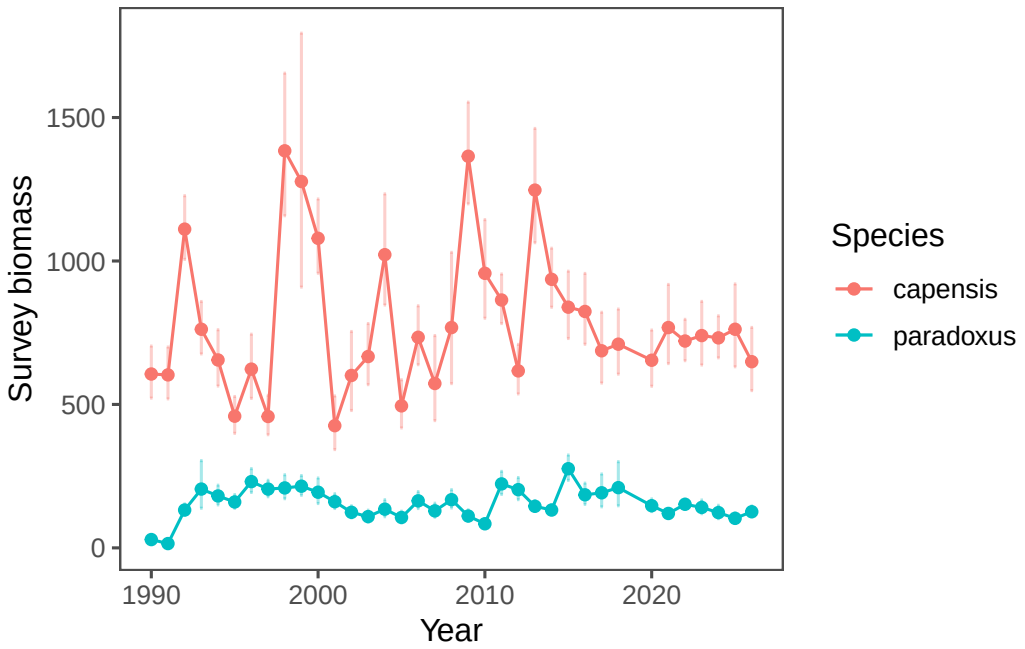

Figure 1: Species-specific survey biomass observations through 2026.

Analytic approach

The age-structured ADMB model and 2025 base assumptions were retained. The control file specifies the terminal year in four locations: the model terminal year, final selectivity period, final recruitment-estimation year, and final Ksp period. All four are set to 2026.

The bridge comparison changes only the data and terminal year. Sensitivities fix survey catchability at 1.0 and 0.5, estimate natural mortality, allow dome-shaped fishery selectivity, and fix stock-recruit steepness at 0.5 and 0.9. Convergence requires a finite objective, maximum gradient no greater than 0.001, and a positive-definite ADMB Hessian.

Results

Bridge comparison

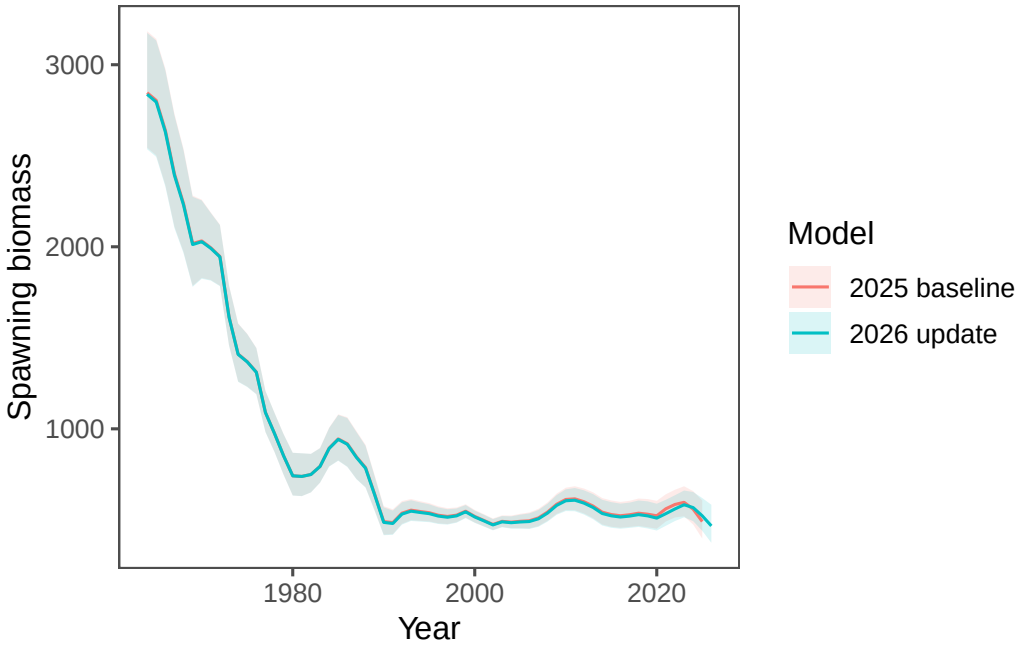

Figure 2: Spawning biomass from the unchanged 2025 model and the 2026 data update.

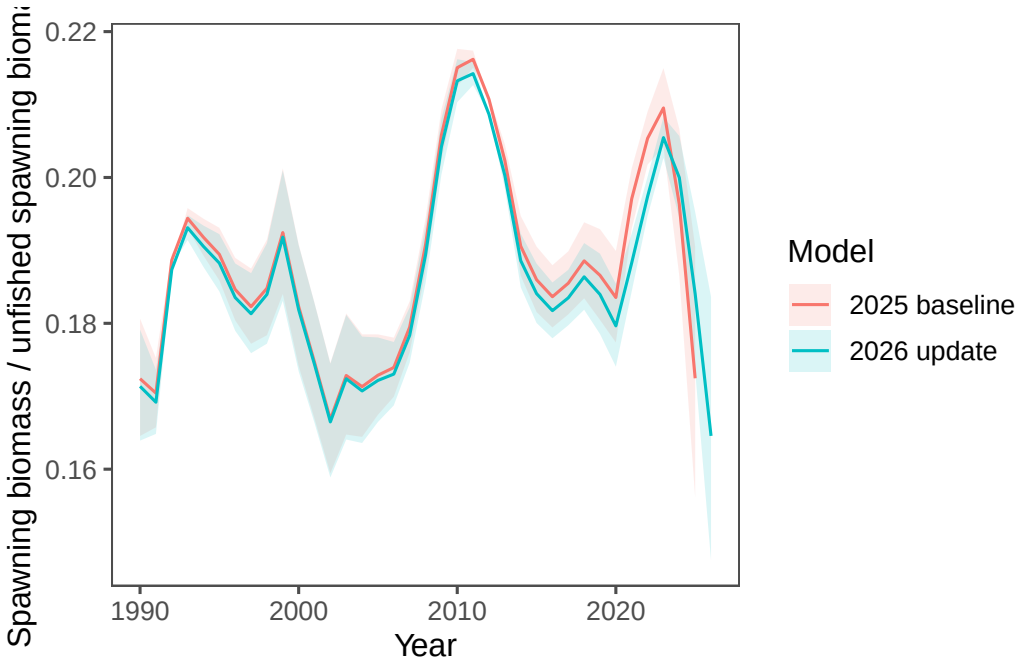

Figure 3: Estimated depletion from the 2025 baseline and 2026 update.

Model diagnostics and sensitivities

Table 3: Convergence diagnostics for the bridge and sensitivity models.

Model	Objective	Maximum gradient	Status
2025 baseline	-44.15933	0.00023	Converged
2026 update	-44.97733	0.00004	Converged
q = 1.0	-25.52259	0.00006	Converged
q = 0.5	32.89469	0.00003	Converged
Estimated M	-45.62760	0.00007	Converged
Dome selectivity	-46.56746	2.49472	Failed diagnostic criteria
h = 0.5	-53.76517	0.00302	Failed diagnostic criteria
h = 0.9	-33.47065	0.00008	Converged

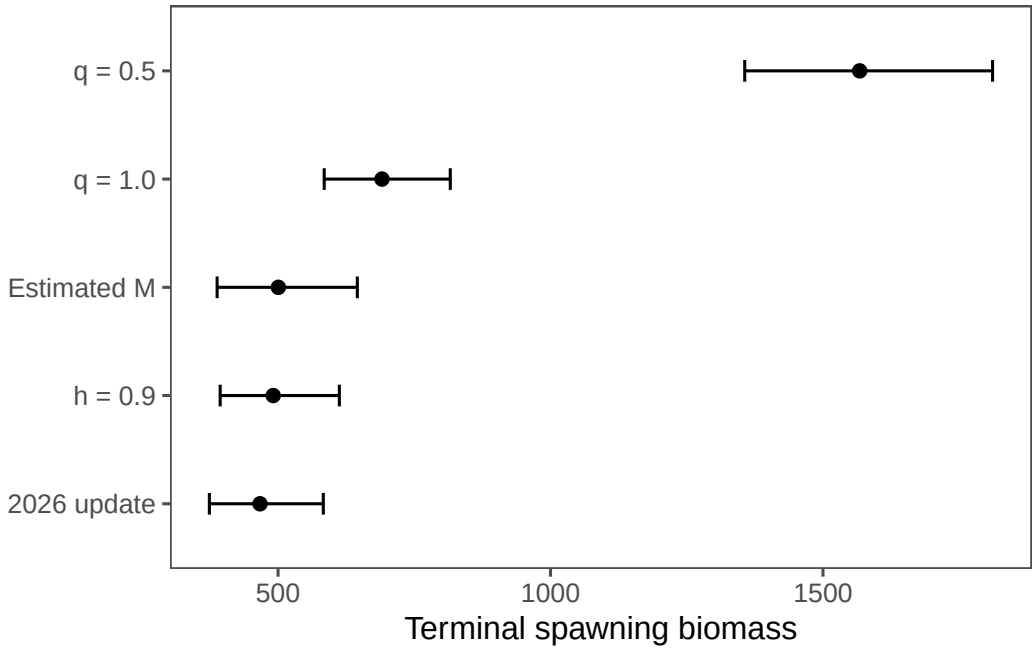

Figure 4: Terminal spawning biomass for the converged 2026 models.

Projections and harvest recommendations

The ADMB model produced replacement-yield and long-term reference-point outputs for each converged configuration. A management recommendation is not presented because the final control-rule inputs and decision framework were not supplied as part of this update.

TODO: insert the agreed harvest-control-rule calculation and resulting TAC advice after management review.

Risk table and recommendation

The 2026 base model passed the declared numerical diagnostics. Structural uncertainty remains material: estimated natural mortality and fixed survey catchability change the inferred scale of the stock, while the dome-shaped selectivity case is not estimable under the current parameterization. The non-converged `h = 0.5` and dome-selectivity results should not be assigned inferential weight.

Status determination

The base-model estimate of spawning biomass relative to BMSY is reported in Table 1. Formal legal or management status terminology should be supplied by MFMR using the applicable Namibian framework.

Ecosystem considerations

No new ecosystem covariates were incorporated in the assessment likelihood. The species-specific survey series is retained for evaluating the relative signals for *M. paradoxus* and *M. capensis*.

Data gaps and research priorities

1. Resolve the non-identifiability of dome-shaped selectivity before using that alternative for management inference.
2. Profile or otherwise investigate the `h = 0.5` optimization surface.
3. Document the provenance and preprocessing of each annual input block.
4. Add retrospective analyses and likelihood profiles to the operational workflow.
5. Archive the final management-procedure inputs alongside the accepted assessment.

Acknowledgements

The assessment update was prepared by John Kathena and Jim Ianelli with data provided by the Namibian Ministry of Fisheries and Marine Resources.

Auxiliary files

The assessment source, annual controls, automated validation tests, ADMB template, and model outputs are maintained in the `NamibianHake` repository.