



ISC 2024 Pacific Bluefin Tuna Stock Assessment

Peer Review Summary

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External Review Panel · 20–23 March 2026 · Hokkaido University, Sapporo

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Overall Conclusions

Assessment is well-constructed with significantly improved retrospective patterns and defensible characterization of recent stock trends. The 2022 SSB is estimated at 23.2% SSB₀ — above the 20% SSB₀ second rebuilding target is highly defensible.

Strengths

- Benchmark methodological advanced
- Shortened 1983–2022 time series
- Improved CPUE treatment
- Good convergence & hindcast skill
- Transparent documentation

Improvement Areas

- The growth curve now serves as the primary translation key between observed lengths and internal age structure. A high-priority is improving its characterization.
- The Japanese troll index was truncated in 2010. For over a decade the model has estimated year-class strength without a direct juvenile abundance index. Filling this gap is the most consequential data need.

No Major Deficiencies

- No major concerns in input data
- No major methodology flaws
- Outputs are management-ready
- Recommendations reflect improvements, not corrections

TOR 1 — Biological Assumptions

⚠️ GROWTH (Highest Priority)

- VBGF now primary length→age translation key
- Coherent residual misfit across 5 juvenile fleets: shared systematic error
- Inter-annual growth variability collapsed into fixed curve
- EPO samples absent from growth estimation
- Influence on possible SSB bias currently unquantified

Steepness & Recruitment

- $h = 0.999$: flat SRR consistent with literature
- $\sigma_R = 0.6$ via empirical tuning — best available
- Resampling ignores potential regime structure (shifts in 1994, 2009)
- Terminal recruitment CV up to 53% — index gap effect

Natural Mortality

- Age-specific M accepted as reasonable
- Short-term: present plausible range, develop prior distribution
- Consider Lorenzen-type alternatives

Maturity

- Fixed ogive from histological studies
- EPO immature fraction creates structural uncertainty
- Overestimating mature age-3–5 inflates SSB
- Continue sensitivity analyses on EPO proportions

Weight-Length

- Last updated 2007 (Kai)
- Gilled & gutted conversion may bias estimates
- Short-term: compile full 1983–2022 dataset
- Long-term: examine time & space variation

TOR 2 — Fisheries & Data

⚠ CRITICAL: Abundance indices are the most significant data concern — management-induced catchability changes threaten both the Japanese LL (S1, ended 2019) and Taiwanese LL (S5) indices.

Japanese LL Index (S1) — Terminated 2019

- IQ system in 2020 altered fishing behavior — correctly omitted post-2019
- Creates 4-year window (2019–2022) with only Taiwanese index for adults
- SSB recovery narrative rests on single index in terminal period
- Catchability uncertainty from distribution shifts not fully propagated

Taiwanese LL Index (S5) — Urgent Risk

- Only adult index for 2019–2022 terminal period
- 2024: first early closure due to quota exhaustion — same mechanism that ended S1
- Quota-driven truncation structurally biases CPUE downward as stock grows
- PBFWG must investigate catchability corrections urgently before 2027

Japanese Troll Index (S3) — Truncated 2010

- Catchability change from farming ops justified truncation
- No direct juvenile index for 2011–2022 — 12+ year gap
- CV up to 53%; reestablishing juvenile index is top priority

Fleet Structure & Data Quality

- Panel encouraged consolidation fleets where appropriate
- New troll monitoring (S4) promising but not yet assessment-ready
- Maintain high-quality Taiwanese sampling; consider EPO fleet merges

TOR 3 — Model Configuration

1983 Start Year

- Panel concurs with the decision — paucity of pre-1983 data
- Improved stability and reduced strain from historically difficult data
- Some historical perspective on long-term dynamics is lost
- Investigate effects of start year as a source of structural uncertainty
- Prior selectivity sensitivities not re-tested under 1983 framework

Cohort Slicing (Multi-Settlement) — Priority

- July 1 birthday conflates: individual growth variance, spawning season spread, inter-annual growth variation
- May–Aug spawning season generates ~4 cm length difference at sampling — larger than true σ_L
- SS multi-settlement framework: 3-event parameterization is tractable
- PBFWG should test cohort slicing as priority analytical task for 2027

Selectivity

- Consider time-varying length selectivity
- Examine dome-shaped length-based alternatives
- Fleet-by-fleet table linking blocks to fishery changes

Data Weighting

- Effective N approach reasonable as first-order correction
- ESS ~16% of nominal N — consistent with literature
- Update 2012 composition analysis
- Consider Hulson & Williams (2024) methods
- Apply Francis (2011)

Uncertainty

- Switched bootstrap → Hessian CIs between 2022 and 2024
- Local minima found in jitter analysis
- Hessian may understate uncertainty — skewed distribution possible
- Compare Hessian vs bootstrap CIs in 2027
- MCMC posterior would be ideal

TOR 4 — Diagnostics & Results

2022 SSB

23.2% SSB₀

Exceeds 20% SSB₀ second rebuilding target

Terminal Recruitment CV

Up to 53%

Due to absent juvenile index 2011–2022

Composition Fit Diagnostics

- Add one-step-ahead (OSA) residuals — Stewart & Monnahan (2025)
- Reduce reliance on year-aggregated compositions; examine individual years
- Coherent residual misfit at 60–100 cm across 5 juvenile fleets
- Consistent underfitting at >270 cm in LL fleets

ASPM Diagnostics

- ASPM and ASPM-R are useful consistency checks
- Clarify independence from base case — ASPM-R uses base-case recruitment deviations
- Describe as consistency check, not independent validation
- Explore combined structural sensitivity scenarios

Key Results — Robust Findings vs. Caveats

- ROBUST: Directional rebuilding trend since ~2010, stock substantially recovered from 2010 lows
- CONDITIONAL: Precise terminal SSB and probability of exceeding 20% SSB₀ — dependent on single adult index (S5) in terminal period
- CAVEAT: Near-term projections dependent on terminal recruitment assumptions with CV up to 53%

TOR 5 — Research Priorities

1

Juvenile Abundance Index

Reestablishing a robust, independent juvenile index is among the most important data collection priorities for 2027. The Real-Time Troll Monitoring (RTM) program is promising but requires more validation before formal assessment inclusion.

2

Growth Characterization

Growth uncertainty is the most consequential biological parameter issue for near-term improvement. Temporal/spatial growth variability analysis, cohort slicing, and inter-laboratory age comparison are high-priority.

3

Adult Abundance Index — Taiwanese LL

Development of alternative adult indices is the highest-priority data collection need given S1 termination and S5 quota vulnerability. Formal catchability break-point analysis required before 2027.

4

Larval Survey (TAWA)

Conceptually important; not yet ready for assessment inclusion. Post-2020 TAWA–SSB divergence must be explained. Larval transport/retention analysis needed. Continue development.

5

CKMR

Strategically important medium-to-long-term priority. Currently insufficient pair counts for standalone estimation. Near-term role: external consistency check against assessment trajectory.

TOR 6 — Communication & Reporting

Recommended Three-Tier Communication Framework

ROBUST

Use with confidence

Directional rebuilding trend since ~2010. Stock substantially recovered from historical lows. Hindcast skill is commendable.

CONDITIONAL

Dependent on assumptions

Precise terminal SSB estimate (23.2% SSB₀). Probability statements for management targets. Single adult index (S5) in terminal period.

CAVEAT

Explicit caution required

Near-term projections: terminal recruitment CV up to 53%. Results under changing distribution and quota-affected indices.

Short-Term Reporting Recommendations

- State clearly that adult abundance in terminal period rests on S5 alone
- Document that S3 (troll) truncated 2010; recruitment uncertainty grows thereafter
- Report recent recruitment quality in plain language for managers
- Distinguish model-structure improvement vs. data-driven improvement
- Link parameter uncertainty to SSB interpretation and rebuilding conclusions

Structural Uncertainty & Documentation

- Selectivity sensitivities tested in earlier cycles not re-tested under 1983-start framework
- Flag explicitly in report so reviewers can assess adequacy
- Future reports: include fleet-by-fleet table linking selectivity blocks to documented fishery changes
- Explain basis for data weighting (statistical, historical, or expert judgment)

Key Priorities for the 2027 Assessment Cycle

MAJOR AREA 1

Growth & Length-at-Age

- Cohort slicing (multi-settlement) framework — priority analytical task
- Temporal & spatial growth variability analysis
- Investigate sex-specific growth
- Formal inter-laboratory age comparison (Japan, Taiwan, U.S.)
- Test correlation of growth with SST and density
- Reorganize fleet residuals by cohort rather than calendar year

MAJOR AREA 2

Recruitment & Abundance Indices

- Reestablish robust juvenile abundance index (equal urgency to adult index problem)
- Continue RTM development — target viable time series before 2027
- Investigate S5 catchability under quota constraints — urgent
- Develop alternative adult abundance indices
- Formal catchability break-point analysis for S5
- Advance larval survey (TAWA) — resolve post-2020 divergence

The Panel recommends that member countries consider allocating additional staffing beyond what is currently provided to support PBF research and assessments. Additional resources would create an enormous boost to research and assessment progress for PBF and other stocks.

Summary

An Exceptional Assessment of a Recovering Stock

No major deficiencies identified — recommendations reflect improvement, not correction

- 2022 SSB at 23.2% SSB₀ — above second rebuilding target of 20% SSB₀
- Two overarching priorities: (1) growth & length-at-age; (2) recruitment index gap 2011–2022
- Abundance index vulnerability: S1 ended, S5 faces quota-induced catchability risk — develop alternatives urgently
- Near-term projections carry high uncertainty due to uninformed terminal recruitment (CV up to 53%)
- RTM, larval survey, and CKMR are promising research lines requiring continued investment
- Panel recommends member countries provide additional staffing to support PBF assessment capacity