

Outcomes of NEFMC SSC Workshop on Dynamic Reference Points*

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August 11-12, 2026, SSC meeting

* Based on slides presented by Willy Goldsmith to the Climate and Ecosystem Steering Committee



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Terms of Reference

- A. Consider the outcomes of the SSC workshop on dynamic reference points, and make any refinements to the recommendations for indicators, candidate stocks, and other recommendations for next steps.

Discussion Plan

- Recap workshop report: key outcomes, next steps
- SSC questions
- Discussion: develop and refine recommendations, next steps
 - Concept mapping (Figure 35, Slide 11)
 - Indicators (Figure 11, Slide 13)
 - Evaluation approaches (p. 20-23, Slide 14)
 - Candidate stocks (Section 6.1, Slide 12)
 - Other recommendations for uptake (p. 39, Slides 15-16)

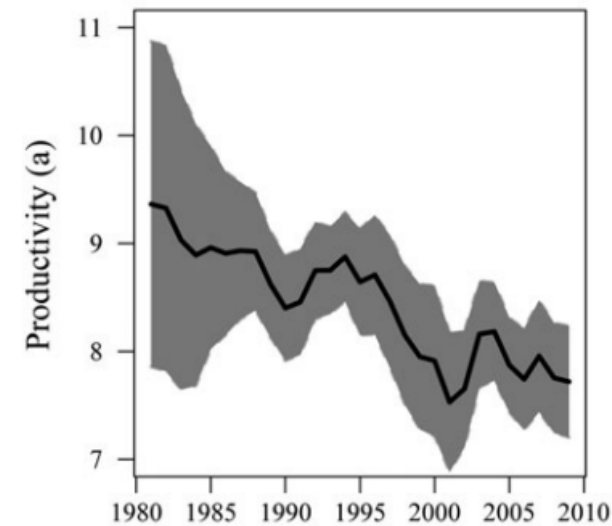


The Challenge

- Ocean conditions are changing
- For some stocks, changes in productivity have resulted
- Stationarity assumptions → unrealistic reference points and rebuilding timelines
- ***How can management adapt?***



On The Water



Bell et al. 2014



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What are Biological Reference Points?

Biological Reference Points (BRPs) are the benchmarks used to:

- Determine stock status
- Inform management action (e.g., ABCs)
- Define rebuilding targets (SSB_{MSY} or proxies)

BRPs can be derived either analytically (model-based) or empirically

Traditional (“static”) BRPs ***assume stationarity in stock productivity***

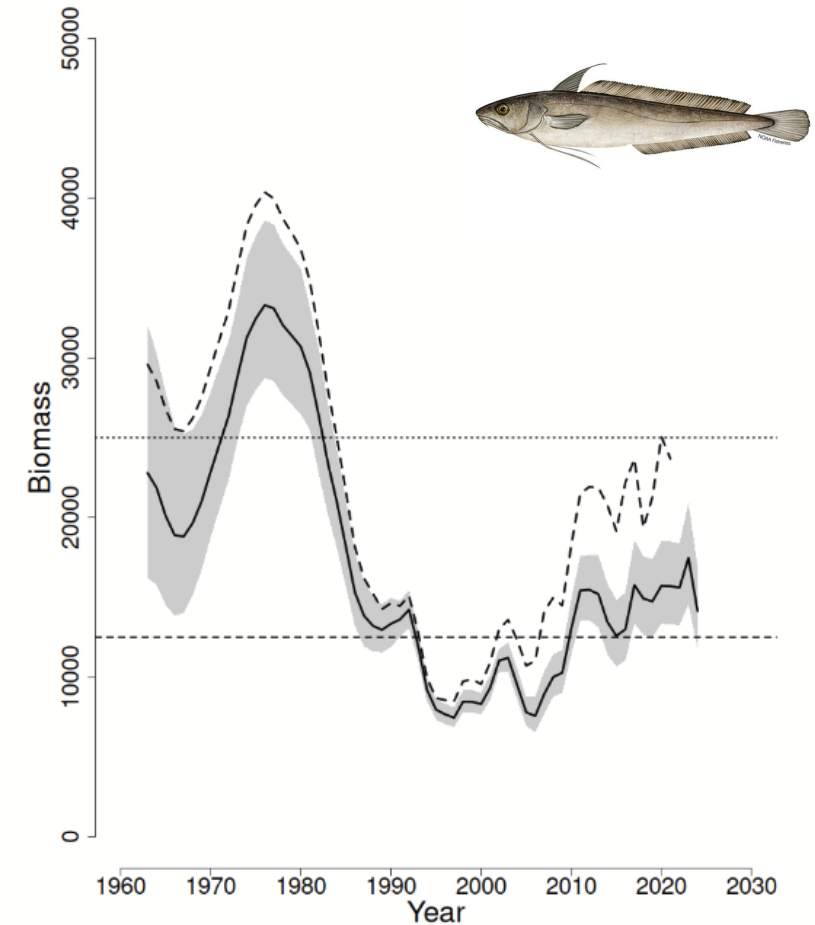


Figure 1: Trends in spawning stock biomass (SSB) of White Hake between 1963 and 2024 from the current (solid line) and previous (dashed line) assessment and the corresponding $SSB_{Threshold}$ ($\frac{1}{2} SSB_{MSY}$ proxy; horizontal dashed line) as well as SSB_{Target} (SSB_{MSY} proxy; horizontal dotted line) based on the 2025 assessment. The approximate 90% lognormal confidence intervals are shown.

2025 Management Track Assessment White Hake *draft working paper for peer review only*



What are *Dynamic* Reference Points?*

MSY: The largest long-term average catch/yield that can be taken “*under prevailing ecological, environmental conditions and fishery technological characteristics (e.g., gear selectivity), and the distribution of catch among fleets.*”

But what if those conditions change?

Dynamic Reference Points (DRPs) are time-varying BRPs that adjust for changes in stock productivity

- Account for the impacts of broad and persistent ecosystem change or regime shifts → enable more responsive management.

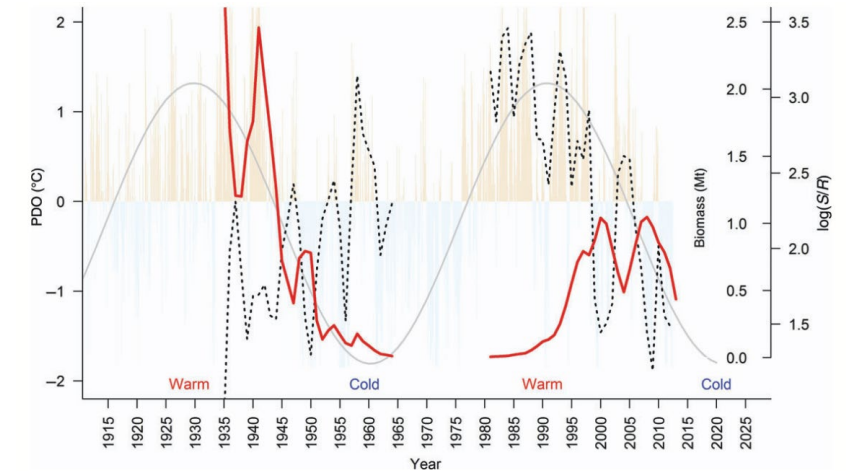


Figure 4. The PDO index indicating positive (pink) and negative (light blue) monthly values; the 60-year periodic component of the PDO projected to 2020 (grey line; Zwolinski and Demer, 2012); the assessment estimated sardine biomass (red); and the predicted logarithmic stock – recruitment ratio (dashed line).

Zwolinski, J. P., et al. (2014). *Environmental and parental control of Pacific sardine recruitment in the California Current ecosystem*. *ICES Journal of Marine Science*, 71(8), 2198–2207. <https://doi.org/10.1093/icesjms/fst173>

*Definition refined during workshop planning and the workshop itself



Workshop Goals

1. Establish a **shared understanding** of current approaches and recommendations from regional and national workshops on defining dynamic biological reference points, including the challenges of implementation and human dimensions.
2. Recommend ways to evaluate the effectiveness of existing reference points for NEFMC stocks to **determine when it may be more appropriate** to use dynamic reference points.
3. **Evaluate alternative approaches to defining reference points** that can account for non-stationarity, appropriateness of methods for NEFMC stocks (given data), and potential challenges in application.
4. **Identify tradeoffs, pathways and potential stocks** for implementing dynamic reference points within the current scientific process to inform management.



Agenda

Monday, June 1

- Morning: Setting the Stage – Where we are in 2026
- Afternoon: Evaluating Reference Points and Considering Potential Guidelines

Tuesday, June 2

- Morning: Management Applications, Challenges, and Opportunities of Implementation
- Afternoon: Toward Operational Guidance and Next Steps



Where We Are: Considering productivity shifts

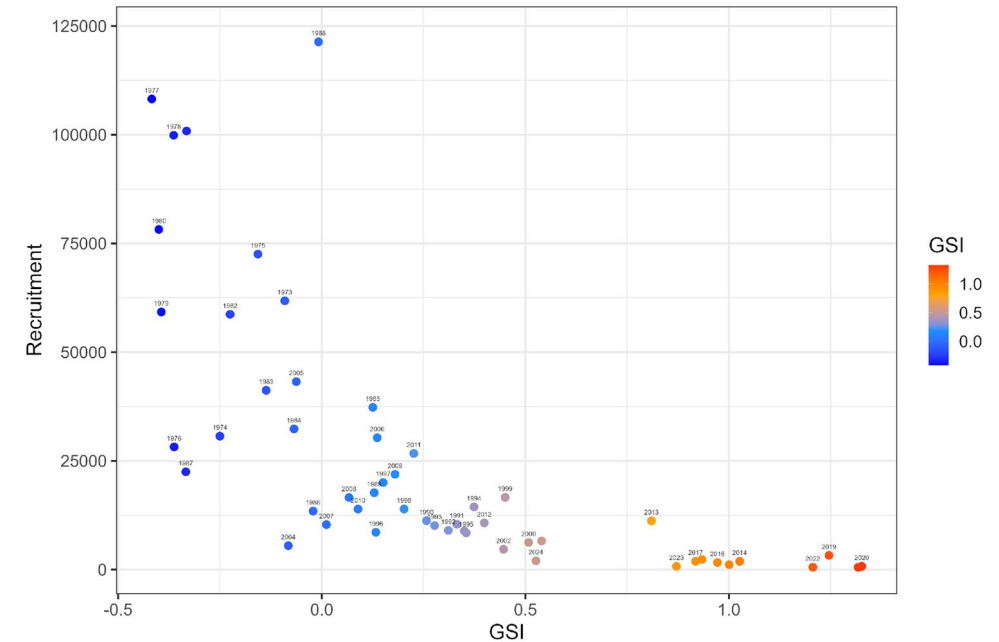
Species/Stock	What Changed?	Approach
Atlantic Herring 	Low recruitment despite low fishing pressure	WHAM with recruitment process random effects
GB and SNE/MA Yellowtail Flounder 	Low recruitment linked to environmental conditions	Inclusion of environmental covariates in WHAM to identify recruitment stanzas
SNE/MA Winter Flounder 	Warm conditions negatively impacting stock-recruitment relationship	Moving 20-year window of recent recruitment to reflect contemporary conditions
White Hake 	Low recruitment despite historically low harvest	Autocorrelated recruitment for short-term projections (reference points unchanged for now)



Where We Are in 2026

- It has been challenging to account for changes in productivity in the assessment and management processes.
- There have been efforts to revise reference points to reflect changing productivity for some stocks.
- No consistent framework for revising reference points as conditions shift.

2024 Research Track Assessment: SNE/MA Yellowtail Flounder

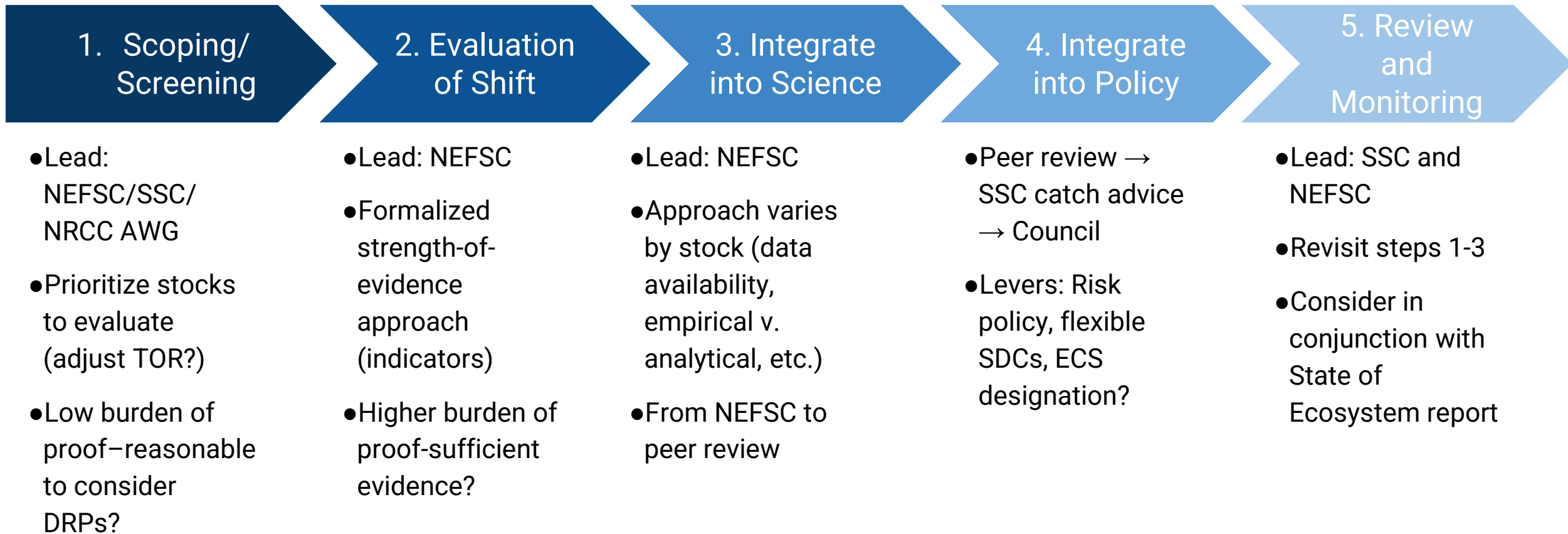


Workshop Outcomes

Intended Outcomes	Actual Outcomes
A preliminary suite of indicators and guidelines for evaluating whether to use dynamic BRPs and potentially candidate stocks.	Identified 21 indicators related to environment/biology, fishery, environmental, and management with guidelines for evaluation (p. 37).
Consensus on recommendations for developing, reviewing, and maintaining DRPs, building on existing CINAR, SSC8, and NS1 guidance (e.g., evaluation standards, evidence thresholds).	Developed a concept map describing five key steps: 1) scoping/screening; 2) evaluation of evidence; 3) integration into science; 4) integration into management; and 5) ongoing monitoring.
A stepwise implementation roadmap that aligns scientific advances with management, legal, and capacity constraints and identifies potential risks.	Discussed potential priority stocks: white hake, Georges Bank haddock, witch flounder.
A prioritized list of research recommendations that could advance our understanding of DRPs and future development of best practices for implementation.	Identified 14 recommendations for researching detecting productivity shifts, DRP approaches, and management implementation (p. 38-39).



Concept Mapping: From screening to implementation



Initial Discussion of STEP 1

Scoping/Screening to identify priority stocks



Tim Tower



NOAA Fisheries



NOAA Fisheries

White Hake

- Assessed with ASAP model
- Subject of previous analyses re. changing productivity
- Best poised for adoption of DRPs
- **Fall 2027 peer review***

Georges Bank Atlantic Cod

- Assessed with WHAM model
- Data-rich; in low-recruitment stanza
- **Spring 2027 peer review***

Witch Flounder

- Empirically assessed
- Biomass reference point not used to determine stock status
- **Fall 2027 peer review***

*Schedule set after workshop.



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Initial Discussion of STEP 2 Evaluation

Preliminary Indicators

- Refinements?
- Other stock-specific indicators could be identified.

 A. Ecology/Biology	 B. Fishery	 C. Environmental	 D. Management
1 Change in stock recruitment (or recruitment/SSB) 2 Spatiotemporal distribution of stock 3 Observed changes in a stock's recruitment 4 Increased stock variability 5 Ecosystem and Socioeconomic Profiles 6 State of the Ecosystem Report 7 Ecosystem indicators (generally and stock-specific) 8 Changing growth/maturity schedules (signs that stock under stress) 9 Ruling out alternative hypotheses	1 Quota usage (or CPUE?) 2 Landings and lack of response in biology 3 Persistent non-responsiveness to decreases in F 4 Market-driven changes 5 Effort location (stat area, VMS, port of landing) 6 Industry-provided info (FEK)	1 Temperature 2 Anomaly analysis 3 Environmental linkage desired but not required	1 Management implications (choke sp., etc.) 2 Management history 3 Decoupling of F and SSB



Initial Discussion of STEP 2 Evaluation

Table 1
Scoring guidelines.

Score	Observed change in a productivity indicator	Understanding of assessment model input data	Understanding of assessment model structural assumptions	Explanatory hypothesis
0	Short period less than one generation	Model input uncertainties are unknown	Key population parameters affected have not been identified	The mechanism is unknown
1	More than one generation	A number of model inputs are uncertain and the extent of uncertainty has not been characterised	Modeled changes in one or more key population parameters have fitted with observed biomass changes	A plausible mechanism for productivity shift has been developed from general knowledge of biophysical processes
2	Multiple generations and across several assessment/management cycles	Uncertain model inputs have been characterised and plausible ranges for those uncertainties have been investigated	Modeled changes in key production parameters have been somewhat validated by investigation of alternative model structures and/or improved model behaviour such as the removal of retrospective patterns	Output from a limited biophysical or multispecies model is consistent with observed patterns of change in productivity
3	Multiple generations and across many regular assessment/management cycles in the same timeframe	The character of model inputs is well understood and uncertainty has largely been eliminated or well estimated statistically	Validated modeled changes are consistent with output from a biophysical or multispecies model	Output from a comprehensive biophysical multispecies model is consistent with observed patterns of change in productivity

- Identified strength- of-evidence approach (e.g., Klaer et al. 2015) based on stock indicators (some weighted more heavily than others)
- Refinements? Other approaches?



Recommendations for Research and Implementation

Detecting Productivity Shifts	Specific DRP Approaches	Management Implementation
• Develop guidance for which metrics to use to assess productivity • Identify indicators of an imminent regime shift→proactive approach • Investigate analytical approaches for using fishery and socioeconomic indicators to infer productivity shifts • Explore/analyze potential synchrony in stock dynamics) → enable proxies for data-poor stocks • Examine strategies to quantify whether fishing is a driver of stock health/decline	• Explore appropriate DRP approaches for empirical stocks • For data-limited stocks, consider applying economic reference points • Evaluate assumptions in models that are used for projections (e.g., numbers at age random effects) • Examine strategies for adjusting fishing mortality proxies (e.g. $F_{40\%}$) to ensure that they align with changes to biomass proxies • Conduct retrospective on how reference point have changed over time for certain stocks to lend context to current efforts • Investigate how to appropriately account for age composition in developing DRPs	• NOAA Fisheries to clarify whether transitioning to DRPs differs markedly from “routine” reference point changes for the purpose of setting SDCs • Examine management implications of revising BRPs for the ABC control rule process to foresee and address potential SSC/NEFMC implementation challenges • Investigate effect of different DRP methods on stability of catch (e.g., through simulation testing); explore strategies to coordinate DRPs with ABC control rules to avoid large interannual shifts in catch advice and resulting industry impacts



Next Steps (from report)

- At August SSC meeting (**today!**)
 - Review indicators developed. Any to add, subtract, modify?
 - Apply indicators to the three DRP candidate stocks (white hake, GB cod, witch flounder) to determine whether pursuit of DRPs is warranted.
 - If so, make recommendations to inform 2027 assessments.
- At next Social Sciences Subcommittee meeting: continue discussion of appropriate socioeconomic indicators for DRPs.
- Recommend other priority actions for DRP pathways:
 - Develop omnibus FMP amendment to implement flexible SDCs, informed by workgroup to review current FMPs and SDCs.
 - Add evaluating applicability of DRPs as a Term of Reference for the SSC across stocks to ensure ongoing consideration.
 - Plan NEFSC-SSC meeting to discuss coordination on indicator development and screening.



Questions?



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