

Expert Elicitation and Consultation Protocols

A structured expert elicitation was undertaken to define and agree upon the parameters used in calculating the kelp forest conservation finance target. We convened three virtual workshops (January–March 2025) with 30 registered participants who were invited from professional social media posts (LinkedIn) and the Kelp Forest Alliance mailing list (845 people). Participants represented academic, NGO, and government expertise in kelp forest conservation.

The workshops followed a modified Delphi-style process designed to balance transparency with iterative refinement:

1. **Presentation of background materials** – all participants were presented with a powerpoint summarizing the Kelp Forest Challenge goals, existing area-based targets, and benchmarks from analogous ecosystems.
2. **Intervention Costs:** - participants were presented a range of costs for both restoration and protection. These costs were based on both kelp and other marine ecosystems (e.g., Eger et al. 2020, 2022; Balmford et al. 2004, Mangrove Breakthrough, Coral Reef Breakthrough) and were sourced from the literature and the Kelp Forest Alliance database.
3. **First-round discussion** – participants were asked to reflect on the appropriateness of candidate values for restoration and protection costs per hectare, drawing from their own experience, literature knowledge, or project databases. Inputs were recorded and a summary was shared with all participants.
4. **Synthesis of inputs** – A facilitator collated responses into three scenario bands (low, medium, high) for both restoration and protection.
5. **Second-round feedback** – the draft scenario bands were circulated to participants between workshops for written comment and revision. We then reviewed these updates during the next workshop. This step allowed clarification, correction, and adjustment of the references.
6. **Third-round consensus** – the final workshop presented the consolidated values and walked through their implications. Participants were invited to indicate agreement or concern. No objections were raised, and the medium-cost scenario was adopted by consensus.

This structured elicitation ensured broad agreement on the final target and reflected the pooled judgment of multiple experts, with opportunities for iteration and review.

Calculation of Area Gaps

Area needs were based on the difference between current conservation progress and the Kelp Forest Challenge targets. Using published global assessments, we adopted:

- **Protection:** ~1.4 M ha requiring additional coverage.
- **Restoration:** ~0.98 M ha requiring active intervention.

These figures were presented to workshop participants as fixed inputs for cost calculations.

Restoration Cost Calculations

Participants were presented with three cost bands for restoration:

- Low = USD \$1,000/ha
- Medium = USD \$10,000/ha
- High = USD \$100,000/ha

The total restoration cost was calculated by multiplying per-hectare estimates by the 0.98 M ha restoration need. For example:

$$0.98 \times 10^6 \text{ ha} \times 10,000\text{USD/ha} = 9.8\text{B USD}$$

Protection Cost Calculations

Participants were presented with three scenarios for annual MPA management costs per hectare:

- Low = USD \$125
- Medium = USD \$650
- High = USD \$1,300

The total protection cost was multiplied by five years to represent an initial implementation period. These costs were indexed in inflation from 2004 to 2024. These values were then multiplied by the 1.4 M ha protection need. For example:

$$1.4 \times 10^6 \text{ ha} \times (650 \times 5) \text{ USD/ha} = 4.6\text{B USD}$$

Combining Scenarios

The restoration and protection estimates were then combined in a 3 × 3 matrix (low, medium, high for each). Totals ranged from ~USD \$1.9 B (low–low) to ~USD \$58.2 B (high–high). The medium–medium case equalled ~USD \$14.4 B, which can be rounded to USD \$14 B for communication purposes.

Total Cost Estimate (\$USD B)

Restoration

		Low	Med	High
Protection	Low	1.9	10.7	50.0
	Med	5.5	14.4	53.6
	High	10.1	18.9	58.2

Discussion Comments

Participants noted that adjustments for purchasing power, currency exchange, and diminishing returns at large scale were desirable but given the wide range of options and general nature of the target, they were not incorporated as to compounding assumptions and achieve a simplicity of communication. Localized funding targets may wish to make these adjustments. Similarly, protection costs were calculated for an initial five-year period; achieving the 2040 goals will require longer-term sustained investment.

Participants also raised several criteria and principles which were included in the discussion of the paper.

For example:

- Uncertainty of the global kelp distribution
- How to frame the benefits of achieving the target
- Costs of failed restoration
- How to prioritize areas for restoration
- How to track and monitor the target

References

Balmford, A., Gravestock, P., Hockley, N., McClean, C. J. & Roberts, C. M. The worldwide costs of marine protected areas. *Proceedings of the National Academy of Sciences* **101**, 9694–9697 (2004).

Eger, A. M. *et al.* Financial and institutional support are important for large-scale kelp forest restoration. *Frontiers in Marine Science* **7:535277**, (2020).

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